The Habibie Center

SRE

CLIMATE ACTION 101

Indonesia's Guide for Newbies

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Indonesia's Guide for Newbies

Written by:

The Habibie Center

SRE

Supported by:

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Climate Action *101*:
Indonesia's Guide for Newbies

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About The Habibie Center (THC)

The Habibie Center (THC) is an independent think tank non-proft organization founded by the 3rd President of Indonesia, Bacharuddin Jusuf Habibie, and his family, with a mission to promote democracy and human rights. One of core programs is to advocate democratization in just energy transition sector including raising public awareness on climate crisis.

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About Society of Renewable Energy (SRE) Indonesia

The Society of Renewable Energy (SRE) Indonesia is a non-profit organization dedicated to promoting and supporting Indonesia's goal of achieving net-zero emissions. This is accomplished through the empowerment of young people and multi-institutions collaboration. SRE has currently has over 4,000 members spread across 50 universities across Indonesia.

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We also extend our appreciation to our SRE colleagues for their significant contributions to the marketing and publication of this work: Muhammad Fachmi Kurniawan – Vice Chairperson of Special Projects at SRE Indonesia, alongside I Gusti Ngurah Rae Arjun Arisara and Muhammad Zuvisco Sauqi from the Marketing Team.

Our deepest thanks go to all the anonymous individuals who played a role in shaping this book, particularly those who contributed to Chapters 1 and 2. Their expertise, insights, and dedication were crucial to our success. We would like to give special recognition to FED for leading and mobilizing the Chapter 2 team, AFR for their insights into decarbonizing the industry, KA and AC for their contributions to agriculture, BB for their work on building, FS for transportation, MP for the introduction to climate change, WA for waste management, HP for Chapter 1, FG for FOLU, and NA for electricity.

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Foreword

Nadia Habibie
Board Secretary at The Habibie Center

As the Secretary of The Habibie Center's Executive Board, I am deeply committed to promoting democracy in all its facets, including addressing the critical issue of climate change. At The Habibie Center, we believe that solving climate change must be approached democratically, ensuring that the interests of all citizens are protected.

Recognizing the urgency of this crisis, I, along with other writers, have crafted this book specifically for the youth eager to combat a crisis of planetary scale, wondering how we, as individuals, can make an impact. I wrote this book for my younger self, who wanted to make a difference in something so immense but was unsure how to begin.

This book is essential for several reasons. **Climate change affects everyone, and understanding its unique impact on Indonesia is crucial.** For a developing nation, *finding a balance between sustainability and economic growth is vital*. Unfortunately, much of the knowledge surrounding climate change remains exclusive and technical, making it difficult for the average reader to grasp. Yet, it is imperative for the youth to understand these issues because the future lies in our hands, and we will bear the brunt of climate change more than older generations. The youth have a significant role in shaping the future, and our understanding and action are critical.

I aim to help equip and inspire the youth by providing practical actions we can take and guidance on what to advocate for a better life. It is essential that we recognize our power to influence positive change and work towards a sustainable and prosperous future.

Now is the time to act. Together, we can forge a sustainable future for our beloved country, Indonesia.

Aufar Satria
Commissioner at SRE Indonesia
President Director & Co-Founder at Akartha Kapital
Director & Co-Founder at Akartha Energy

From years of experience pushing the boundaries of climate solutions—whether through concrete renewable energy projects, regulatory reforms, or company-wide transformations—one thing becomes clear: **we cannot solve the monstrous climate problem alone.** We need as much firepower as possible to fight it, and that includes you. Whether you are a national leader, a savvy business executive, a renowned non-profit founder, or an everyday person who wants to do good for the world, your involvement is crucial.

This book contains essential climate concepts that will be invaluable in your fight against climate change. From the fundamentals (which I still need to brush up on occasionally!) to the latest developments in the climate sector, there is something here for everyone. No matter your level of expertise, I believe you will learn something new from reading this book. However, learning is perpetual. Finishing this book does not mean that you stop learning about climate change. As we know, climate knowledge is ever-changing and continuously updating, so please view this book as your initial step, not the final one.

I am a proud Indonesian with a burning passion for my country. **This book is tailored to Indonesia, addressing its unique challenges and opportunities in the fight against climate change.** While we respect and regard international trends, our primary focus is on solutions that work within the Indonesian context. We explore how global strategies can be adapted to our local environment, culture, and economy, ensuring that our approach is both relevant and sharp.

Lastly, we have designed this book to be fun. Accompanied by our characters, Susi, Nabil, and Lily, we hope that you will not be bored. Enjoy!

Rachmat Kaimuddin
Deputy Coordinating Minister in Infrastructure
and Transportation, Coordinating Ministry of Maritime
Affairs and Investment of the Republic of Indonesia

The experience over the past few years in handling energy transitions through the provision of green electricity and transportation electrification to mitigate climate change and improve air quality has been one of the biggest challenges in my professional life at the Coordinating Ministry for Maritime Affairs and Investment (CMMAI).

Climate change is a significant issue that requires the involvement of every organization and individual, including the younger generation.

This is why this book was written. The authors have skillfully simplified complex scientific concepts related to climate change into topics that are easy for everyone to understand. They also present real-life examples and practical insights that can motivate the younger generation to become advocates for climate justice and contribute to global efforts against climate change.

The delightful illustrations and practical steps that can be taken by the younger generation make this book an excellent read for anyone who wants to increase environmental awareness and take the first steps toward a more sustainable lifestyle. I am very excited about this book and its potential to inspire a new generation that will lead Indonesia to become a greener and more sustainable country. Together, we can make a significant impact on the health of our planet and ensure a better future for generations to come.

Jap Hartono
CEO of PT Sawit Sumbermas Sarana Tbk (SSMS)

Sawit Sumbermas Sarana
Karya Nyata untuk Negeri

PT Sawit Sumbermas Sarana Tbk. (SSMS), based in Pangkalan Bun, Central Kalimantan, Indonesia, is a palm oil company with a vision to become a world-class plantation business. Our mission includes maximizing the potential of palm oil, building a professional business, adding value for stakeholders, implementing best governance practices, utilizing environmentally friendly technology, and developing human resources and local potential.

SSMS is the only company in Indonesia with 100% RSPO certification, and it develops its plantations in line with RSPO, ISPO standards, and government regulations. The company has also set time-bound commitments to certify all operations under these standards. SSMS believes palm oil is vital to meeting the growing demand for vegetable oil, driving national development, and benefiting society and the environment.

Sustainability is key in our operations, especially in the face of climate change, which poses significant challenges to humanity. We are committed to socializing the importance of sustainable practices and climate action.

We believe that this book is present as an effort to provide a deeper understanding of climate change and inspire concrete actions at the local, national and even international levels.

In this book, we can describe various efforts that have been and are being made in Indonesia to address climate change. Starting from government policies, sustainable corporate practices and community initiatives to technological innovations and best practices that can be adopted by various sectors. Each material in this book is carefully compiled in order to provide comprehensive and applicable insights for readers.

Fifi Pangestu
Executive Director of Bakti Barito Foundation

As the Executive Director of the Bakti Barito Foundation, the philanthropic arm of Barito Pacific, I am honored to support "Indonesia's Climate Action Crash Course for Newbies." This book provides an insightful exploration into the challenges and opportunities of climate action, particularly for Indonesian youth, which strongly aligns with our foundation's priorities. This book is an essential read for anyone looking to contribute to a sustainable future for Indonesia. I encourage you to explore its pages and be inspired to take action.

Yani Panigoro
President Commissioner at Medco Energi
Board of Trustees at Medco Foundation

Medco has long been at the forefront of energy exploration and production, power generation, and mining. Today, our journey extends beyond these core businesses, as we embrace sustainability and energy transition. Indonesia has big potential to become green economy powerhouse while we realize "Indonesia Emas 2045". We believe that this book provides invaluable insights for the young generation, to better understand the complexities of the importance of climate action, preparing for the upcoming green boom. It is our hope that through education and awareness, we can inspire the next wave of leaders to champion a sustainable future.

Dicky Yordan
President Director at TBS Energi Utama Tbk

As Indonesia's foremost innovator, TBS Energi Utama is dedicated to fostering a safe and equitable world. Our mission—transforming our futures together—drives our shift towards sustainability. We are transitioning from coal mining to renewable energy, electric vehicles, and waste management. Our TBS2030 commitment is a clear roadmap toward carbon neutrality and a fair transition by 2030, aligned with Indonesia's Net Zero goals for 2060. This book is an essential guide to climate change, highlighting the synergy between sustainable and economic development and the importance of climate justice. Together, we explore boundless possibilities, driving progress that supports the nation's social and economic goals.

About the Book

Welcome to ***Indonesia's Climate Action Crash Course for Newbies***, your essential guide to understanding climate change and why it matters to you, a curious and bright Indonesian. This book will unravel the mystery of climate change, with **easy-to-grasp, exciting-to-explore, and practical ways**.

We'll begin with the basics, such as distinguishing weather from climate and understanding the concepts of carbon, emissions, and its buzzwords like 'Net Zero'. When you can visualize and understand these seemingly complex concepts, you will start to grasp the world and science of sustainability. This foundational knowledge will empower you to grasp the broader picture of our climate problem.

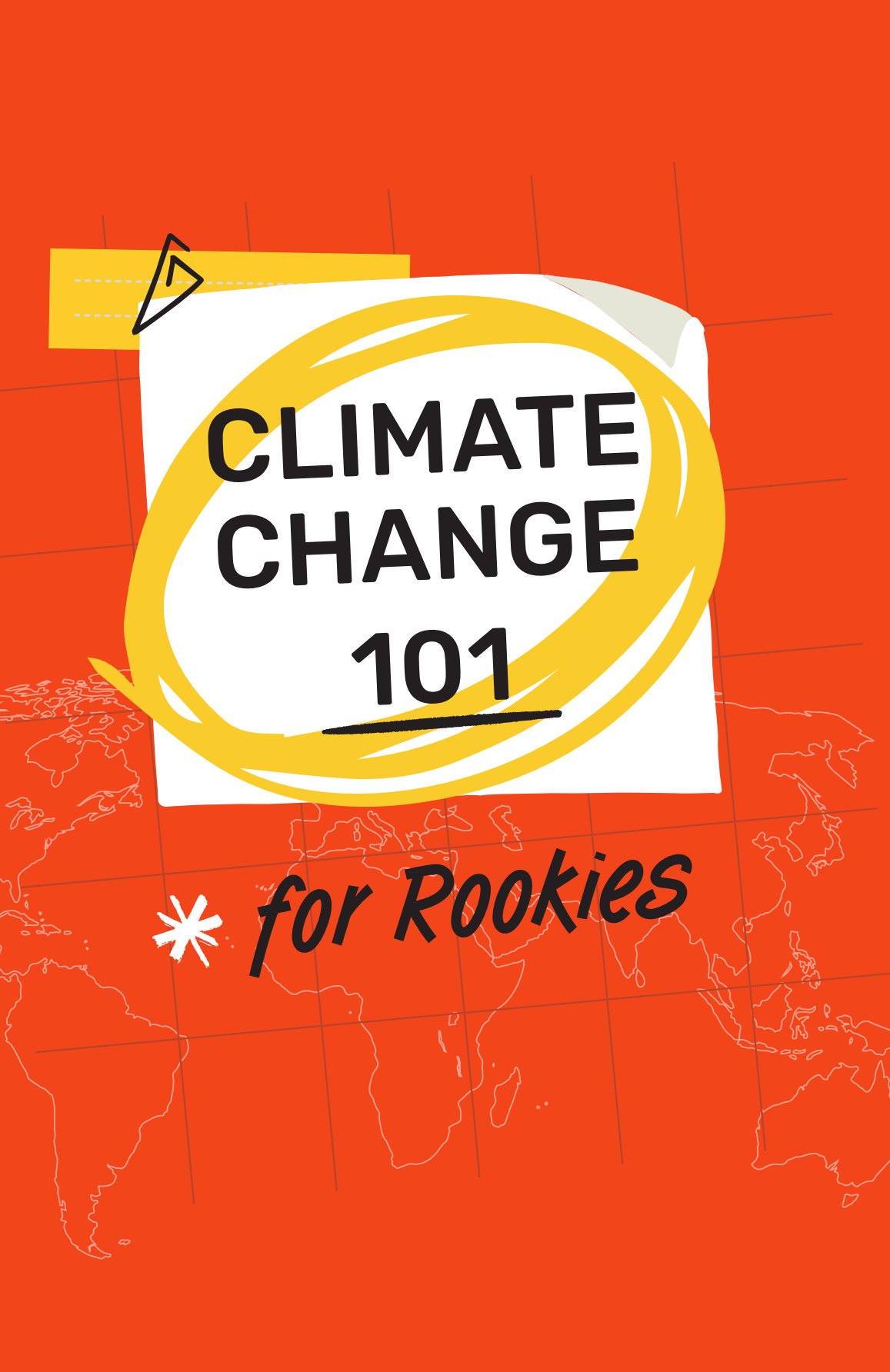
Then, we'll remind you of the importance of climate change and solving it. Climate change is already heavily affecting Indonesia, around us every day. Picture our stunning coastlines slowly being swallowed by rising sea levels or think about the times when unpredictable weather has disrupted Indonesia's food production. Understanding these changes not only raises awareness but also empowers you to act and protect our nation's future. Plus, you'll learn to debunk myths and misconceptions, grounding your knowledge in scientific facts and clearing up common misunderstandings you might hear.

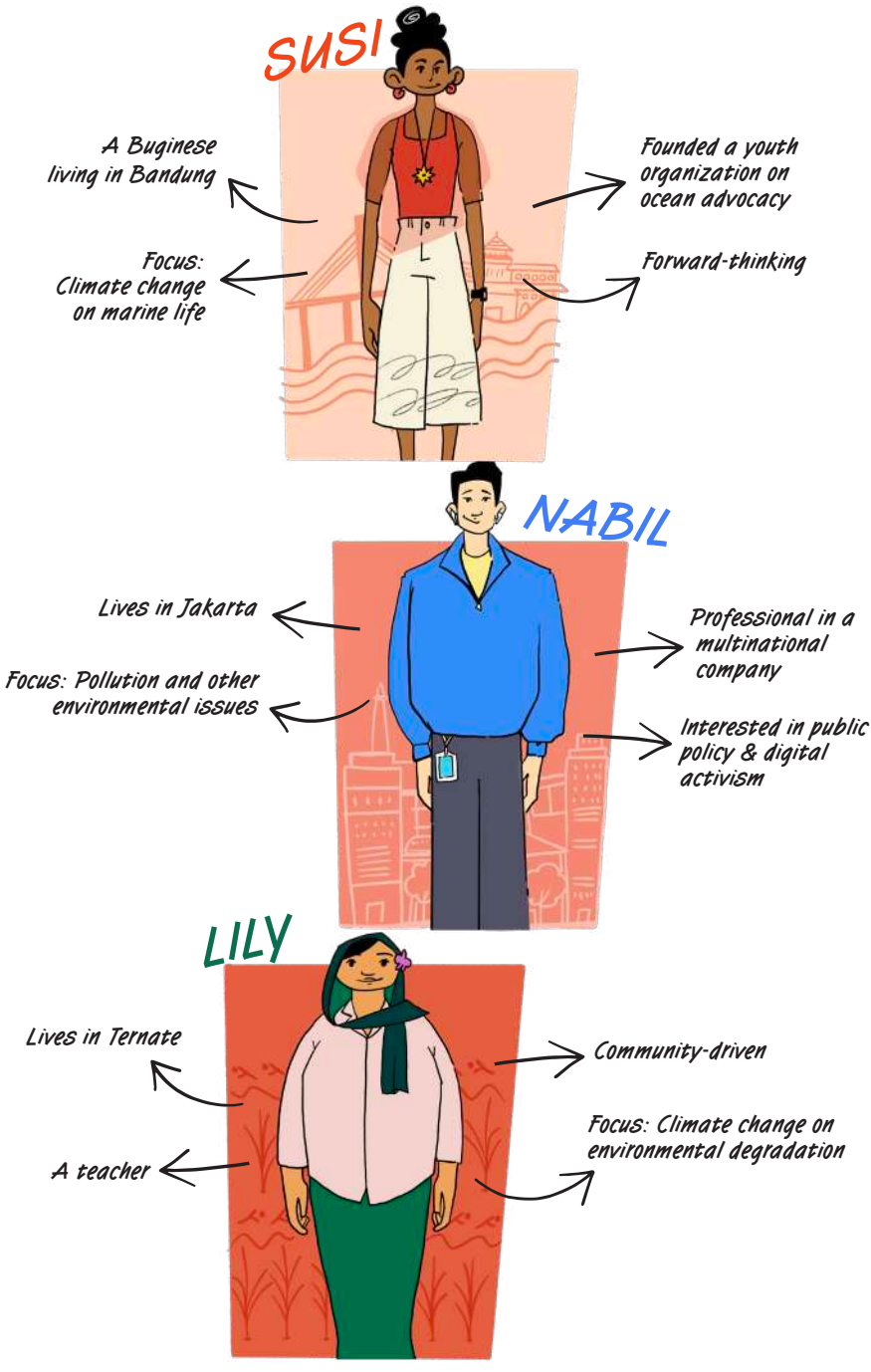
The core of this book: we'll talk about the solutions—on how to implement climate solutions and achieve **Net Zero Emissions**. Through local anecdotes and stories, this book will show you how transitioning to renewable energy, adopting sustainable transportation, managing waste effectively, preserving nature, practicing sustainable agriculture, innovating industrial processes, and designing energy-efficient buildings can help us escape climate crisis.

Finally, we'll turn knowledge into action. Reflect on lifestyle changes, engage in activism, foster innovation, and how you can contribute in climate change regardless of your formal education and career path. We need all the hands-on deck to fight climate change, and that includes you. By the end of this book, you'll be ready to make a difference.

With Susi, Nabil, and Lily by your side, start your first page to embark on this journey to a greener, more sustainable Indonesia!

CHAPTER 1


CLIMATE CHANGE 101
* for Rookies


SUSI
A Buginese living in Bandung
Founded a youth organization on ocean advocacy
Focus: Climate change on marine life
Forward-thinking
NABIL
Lives in Jakarta
Professional in a multinational company
Focus: Pollution and other environmental issues
Interested in public policy & digital activism
LILY
Lives in Ternate
Community-driven
A teacher
Focus: Climate change on environmental degradation

1.1 WHAT IS CLIMATE CHANGE

INTRODUCING SUSI, NABIL, AND LILY

If you're a rookie, you might be delving into this book with a lot of burning questions, like what is climate anyway? What do we mean when we say the climate is changing? Well, before we get into that, let us introduce three characters to help guide you through this book: **Susi, Nabil, and Lily**.

Meet **Susi**. Growing up as Buginese (Suku Bugis) from South Sulawesi, Susi has always had a deep connection to the sea. She saw how important the sea is for her people's livelihood, but over the years, she observed the adverse effects of climate change on marine life. Warmer seas are bleaching the corals in the beloved waters she holds dearly, making it harder for her people to catch fish. She moved to Bandung to study marine science, broadening her understanding of the global impact of ocean degradation. Now, at 19 years old, she founded a youth organization focusing on ocean advocacy, and she believes that we need to start doing something about the climate **now.**

Unlike Susi, **Nabil** has always been a metropolitan guy through and through. He's lived all his life comfortably in Jakarta, mostly blinded to the effects of climate change. However, he has recently noticed that air pollution has been making him cough while he's doing his hobby running outdoor – it's difficult to breathe properly amidst the hazy Jakarta air. The heat has also been scorching, most days are getting unbearably hot for Nabil. His air conditioner has been hard at work, racking up his electricity bill. This isn't like the Jakarta he remembers from his childhood. But Nabil wonders if he can even do anything about this. He often finds himself reflecting on these changes during his commute through Jakarta's congested streets. His daily routine at the multinational company keeps him busy, but the nagging concern about environmental issues continues to grow.

Lily, a recent university graduate from Ternate, is the first in her family to achieve this milestone. Now a teacher, she is determined to make a difference in her community. For as long as she remembers, Lily has always cherished her tight-knit community. The community always has each other's backs. For instance, they built their own communal garden, a symbol of their self-reliance. However, in recent years, Lily has witnessed the harsh effects of climate change firsthand – the destruction of coastal areas and rising sea levels are threatening their way of life. With her limited resources, Lily feels increasingly vulnerable to these changes, yet she remains committed to protecting her community's livelihood.

Throughout various parts of this book, we'll be looking at Susi's, Nabil's, and Lily's lives – how they're being impacted by climate change and what they can do to act. At a later part in this chapter, we'll explore how their day-to-day lives are directly impacting the climate, but we'll go back to your burning questions for now.

UNDERSTANDING WEATHER VS. CLIMATE

Let's take a step back and explore the meaning of the core word of this book "climate". What really is climate, though? How is it different from weather?

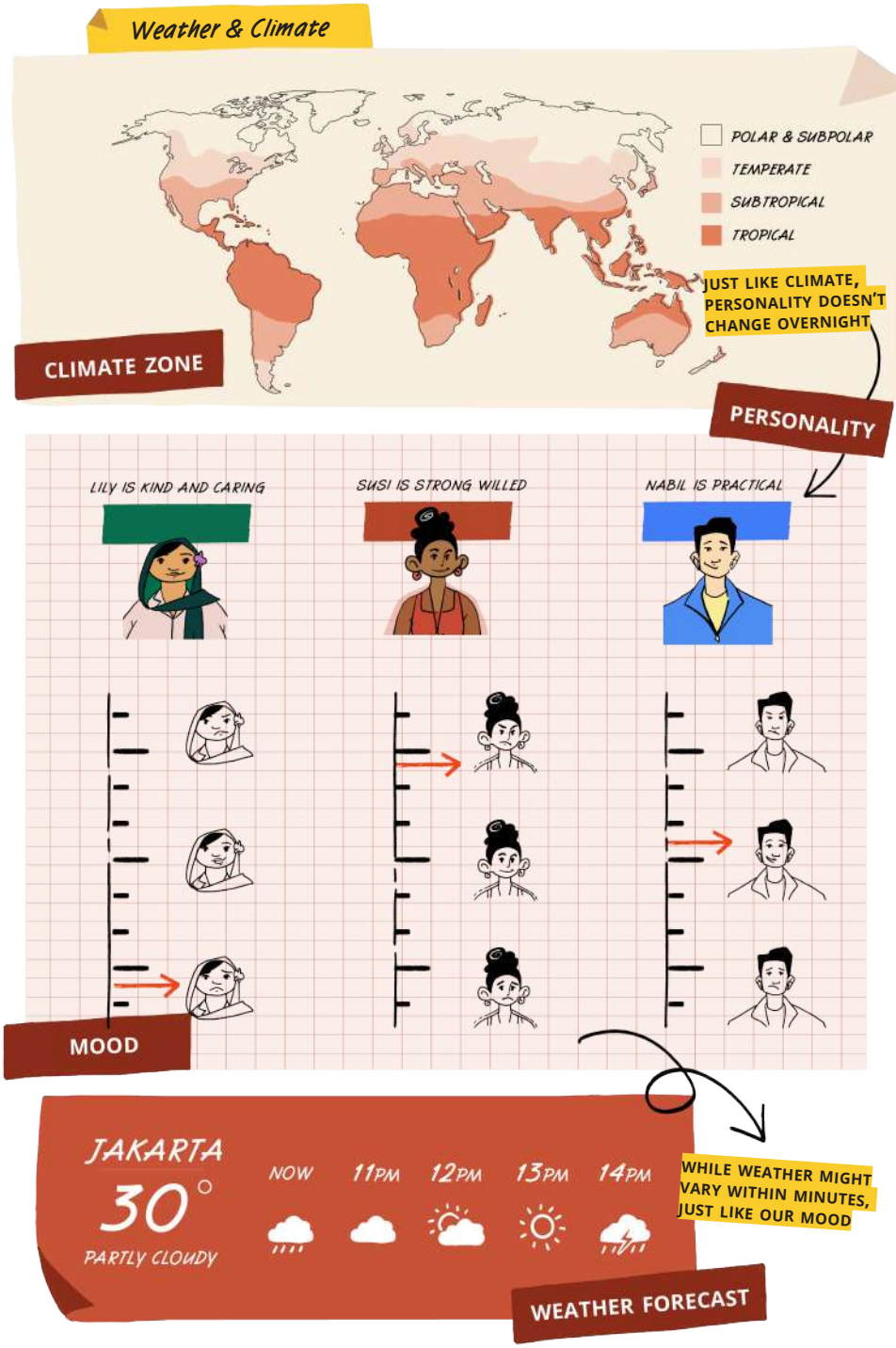
Imagine how your friends perceive you as a person. Do they think you have a cheerful personality? Let's say they do. However, you would definitely have some days when you're quieter, for example when you're facing a difficult personal problem.

Climate is like your personality, whereas weather is like your moods. Just like how you might be generally cheerful or quiet, there are some days where your mood is the opposite of your personality. Moods typically change, within minutes or hours. But if you average your moods over a long period of time, it forms your perceived personality.

Imagine weather as your fluctuating moods. Some days are cooler, while others are warmer. One moment it's rainy, the next it's sunny. Over time, these fluctuations form a general pattern. So it becomes your personality, and this is what we call climate. Unlike daily weather, which can change in just a few hours, climate is the average weather we expect over many years. To be specific, climate refers to the long-term patterns of temperature, humidity, wind, precipitation, and other atmospheric conditions in a particular region.

You must have realized that today, it's kind of hard to predict the weather in your area. **Jakarta** is one of the most vulnerable cities to these changes. The city is experiencing unpredictable rainy seasons that also leads to frequent flooding. Not to mention there's ongoing poor air quality and the threat of sea-level rise. In other cities, such as **Semarang**, there's extended drought periods, causing headaches for the local farmers. One day Semarang experiences severe flooding, and another day the locals face drought. It seems like the weather is wild and unpredictable, right?

It's almost like our Earth has a fever – the temperature gets hotter and everything goes haywire, making the whole ***personality of the planet*** **feels lousy.**


Weather & Climate
POLAR & SUBPOLAR
TEMPERATE
SUBTROPICAL
TROPICAL
CLIMATE ZONE
JUST LIKE CLIMATE, PERSONALITY DOESN'T CHANGE OVERNIGHT
PERSONALITY
LILY IS KIND AND CARING
SUSI IS STRONG WILLED
NABIL IS PRACTICAL
MOOD
JAKARTA
30°
PARTLY CLOUDY
NOW
11PM
12PM
13PM
14PM
WHILE WEATHER MIGHT VARY WITHIN MINUTES, JUST LIKE OUR MOOD
WEATHER FORECAST

When we say **"climate change"**, this is what we mean. The Earth's temperature gets too hot, too fast, and this triggers wild and unpredictable weather.

The climate is changing. In fact, the climate has been changing along the lifespan of Earth itself. These changes are caused by a multitude of factors. But right now, human influence has sped up this process considerably and rapidly because all of the coal, oil, and gas that we burn release **greenhouse gases** which makes the planet hotter.

We will explore and break down the important aspects of climate change within this chapter, where you will learn the basics of climate change such as **carbon, emissions, & why it matters.**

Climate Lingo 101

Completely new to this whole climate change thing?

Here's an overview of the most common lingos used in conversations surrounding climate change.

Climate Change:

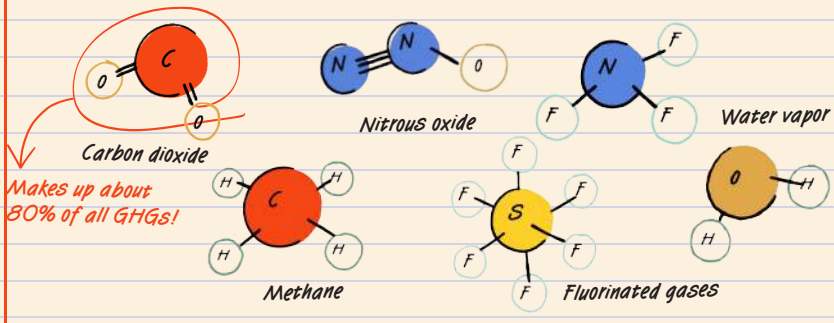
Long-term changes in temperature, precipitation, wind patterns, and other aspects of the Earth's climate system. Experts agree that the climate change that we're experiencing now is **accelerated due to human activity** as the Earth's temperature has spiked since the industrial revolution – this was when we started burning more fossil fuels.

Example: Increased frequency and intensity of extreme weather events like storms and droughts are signs of climate change.

Greenhouse Gases (GHGs):

These are gases that trap heat in the atmosphere, contributing to the greenhouse effect. Key GHGs include carbon dioxide (mainly from fossil fuel combustion), methane (which can come from cow farts!), nitrous oxide (from industrial processes), and fluorinated gases (like from your air conditioner).

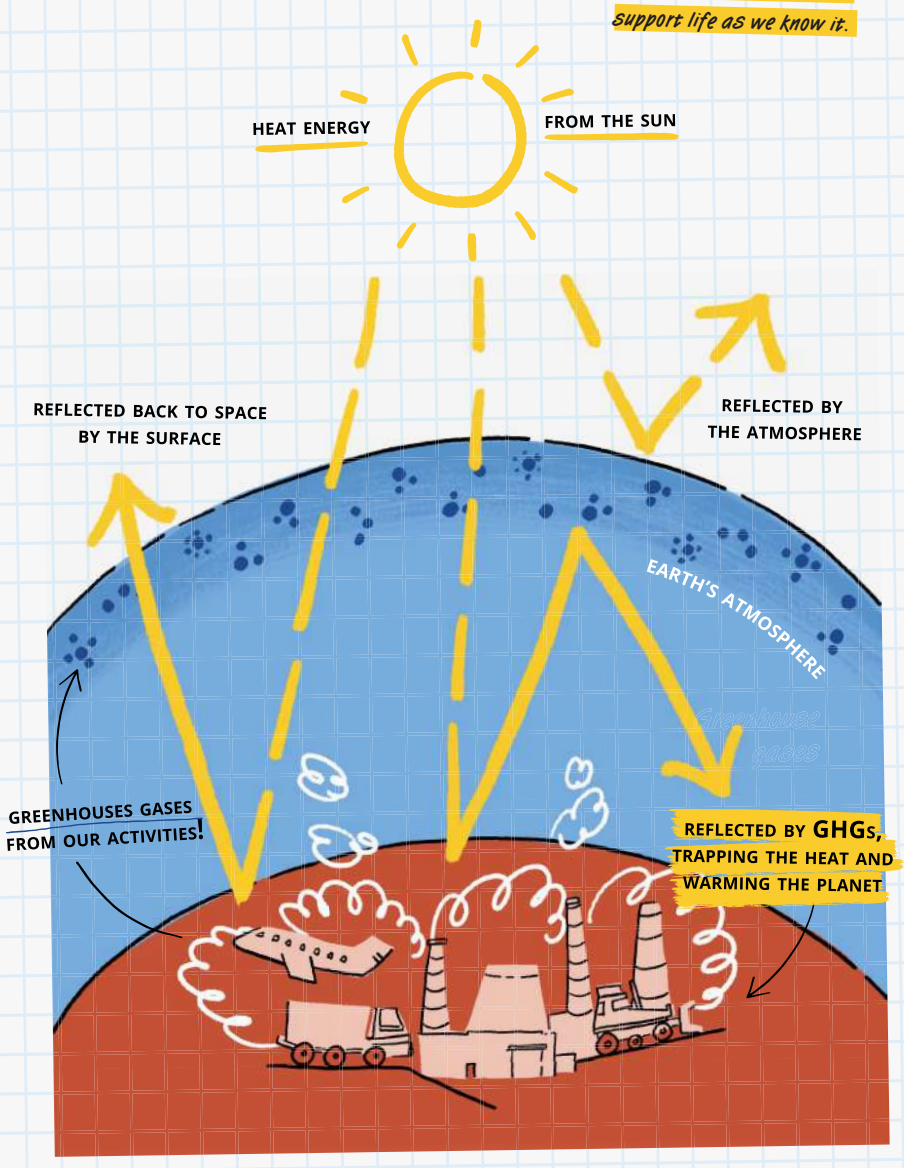
Example: Believe it or not, when cows fart, they release a lot of methane into the air. A single cow can produce between 70 to 120 kilograms of methane in a year.



Greenhouse Effect:

The process by which greenhouse gases trap heat in the Earth's atmosphere. In other words, the effect is like wrapping Earth in a blanket that traps heat from the sun. Naturally, it's helpful for us. The greenhouse effect is not bad. But when the heat trapped is excessive, it can lead to global warming.

Without the greenhouse effect, Earth would be too cold to support life as we know it.



WHAT IS CARBON?

By now you must have heard the word "**carbon**". This element, denoted by "C" in the periodic table (yes, please recall your chemistry class in school), is everywhere. Despite its infamous connotation these days, it is a fundamental element found in all living and non-living things. It is everywhere around us and plays a crucial role in the natural world.

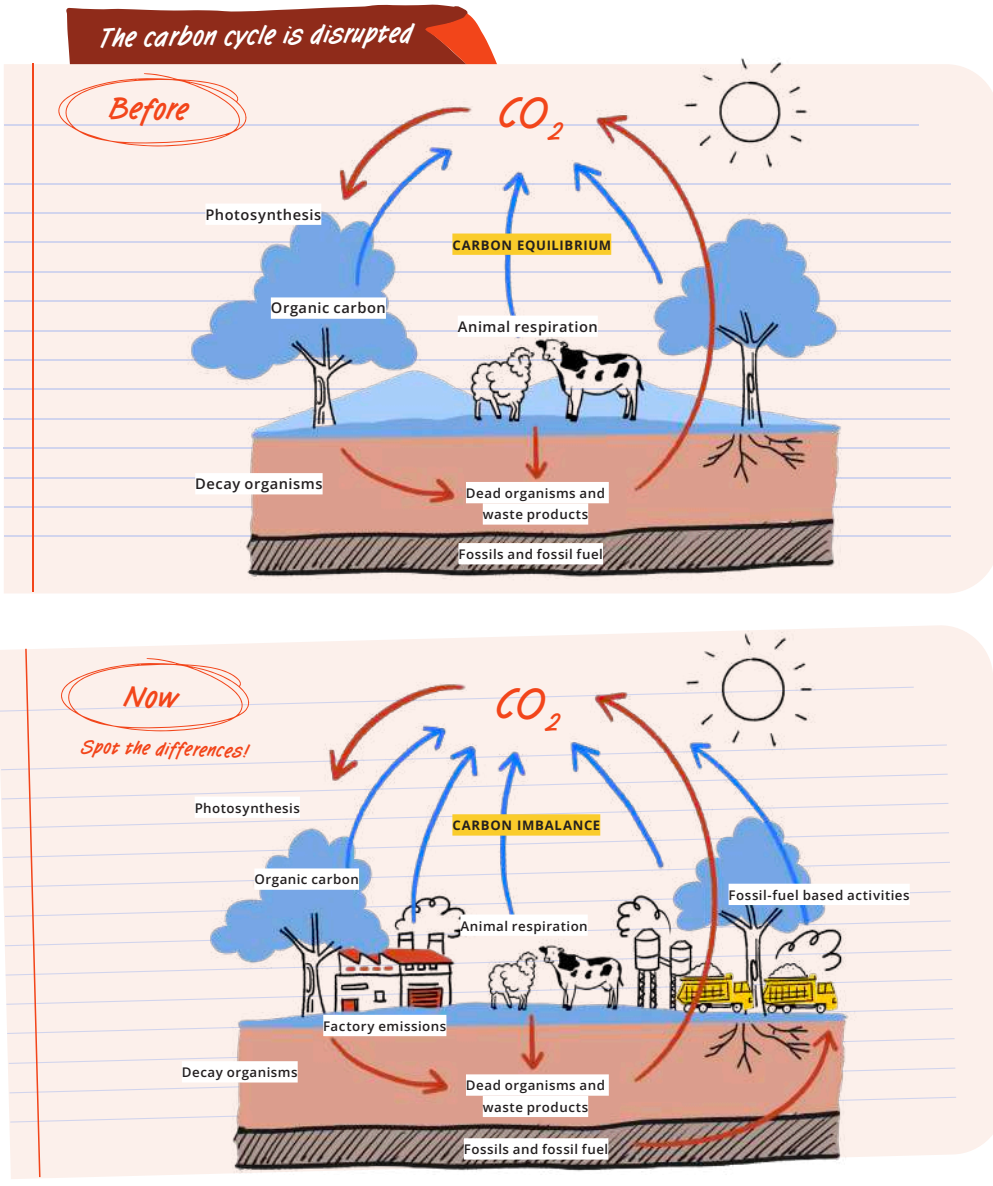
You can find carbon in:

- Your food which contains carbohydrates and sugars – these are all made up of carbon
- The rubber sole of your shoe, derived from natural or synthetic polymers (a carbon-based element)
- This book (assuming you're reading on print), as paper contains cellulose, a carbon-rich substance from trees
- Plastic bags, clothing... and even yourself!

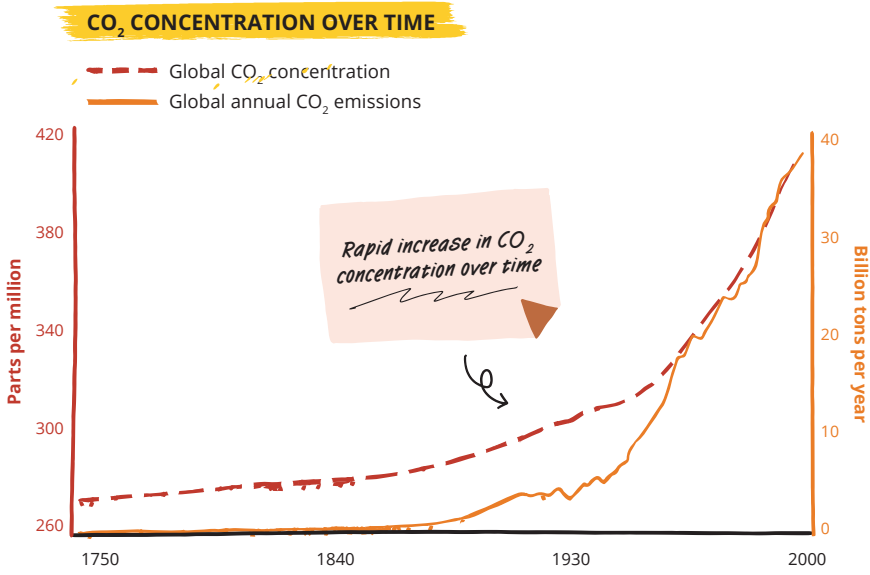
> You are made up of proteins and fats, both are carbon-based – in total, you are about 18% carbon
>
> You breathe in oxygen (O_2), and breathe out CO_2 – yes, short for **carbon dioxide**

So, carbon itself is not the issue. It's when carbon mixes with oxygen, forming carbon dioxide (CO_2) – the same stuff we exhale when we breathe. CO_2, along with other greenhouse gases, builds up in the atmosphere. Naturally, CO_2 produced by life forms are offset by the green wonders we call plants. They perform a process called photosynthesis where they suck in CO_2 from the air around them and turn them into food (glucose) and release O_2 back into the air – and the cycle continues. This is called **the Carbon Cycle**

However, the balance of this cycle is being disrupted. Human activities, such as burning fossil fuels (like coal, oil, and natural gas) for energy and deforestation, are adding more CO_2 to the atmosphere than plants and oceans can absorb. This excess CO_2 is a major driver of climate change, as it traps heat in the atmosphere and leads to a warming planet. This warming effect can result in more extreme weather patterns, rising sea levels, and various impacts on ecosystems and biodiversity. We must take action to reduce our carbon emissions and enhance the natural processes that absorb CO_2 to mitigate these effects and protect our planet.



The disruption of this carbon cycle is also evident in the increasing concentration of CO_2 over time... Meaning, in every cubic meter of air, there are more molecules of CO_2 than there used to be! The unit we use to measure this is parts per million (ppm).



Now, let's delve deeper into the sources of these emissions and explore how they contribute to the overall increase of greenhouse gases in our atmosphere.

WHAT ARE EMISSIONS?

As we've mentioned before, the release of CO_2 – which we typically call carbon emissions – has been rising due to several factors such as:

INDUSTRIAL ACTIVITIES — which emit about 238 million metric tons of CO_2 per year

FOSSIL-FUELLED TRANSPORTATION — which contributes 57 million metric tons of CO_2 per year

HEAVY DEFORESTATION — That totals 3.8 million hectares since 2001, releasing emissions equivalent to 22.2 gigatons of CO_2 per year

Let's pause for a bit.
We mentioned carbon emissions – but what do we mean by **emissions** anyway?

Climate Lingo 101

Emissions:

Emissions refer to the release of greenhouse substances (gases, particles) into the atmosphere from various sources, both natural and human-made. Emissions can be measured, with a unit called Carbon Dioxide Equivalent (CO_2e).

Pollution is what happens when those emissions mix with the environment.

See page 6 for a refresher about greenhouse gases.

Wait – so how do emissions differ from pollution?

Not all emissions pollute. For instance, plants release oxygen through photosynthesis, which does not negatively impact the environment. There are though emissions that lead to pollution. Air pollution, in particular, is one visible consequence of these emissions. Think of the times when you look at the sky and it's grey and hazy. This haze is called smog. Smog is made up of smoke and chemicals (like greenhouse gases) from cars, factories, and power plants. It can make the air look dirty and is harmful to breathe.

Key differences of Emissions vs. Pollution:

1. SCOPE

Emissions are about what we release, while pollution is about how it affects the environment.

2. IMPACT

Emissions can lead to pollution, which can have big and widespread effects on the environment and our health.

Now, let's get back to carbon emissions and why they matter. Carbon dioxide (CO_2) is the main greenhouse gas causing climate change. Compared to other greenhouse gases, CO_2 is the most abundant gas emitted by human activities, and it stays in the atmosphere for a long time.

Let's Measure Up!

To track our carbon emissions, we measure them using a unit called **CO_2e,** which stands for **Carbon Dioxide Equivalent**. This unit allows us to compare the effects of different greenhouse gases based on how much they warm the earth over a certain period, usually 100 years. We call this measure the **Global Warming Potential (GWP)**.

Think of it like using a single scale to measure different things: CO_2e lets us add up the warming effects of gases like methane (CH_4) and nitrous oxide (N_2O) along with CO_2. This way, we get a clear picture of our total impact on the climate, as everything is converted to the equivalent amount of carbon dioxide.

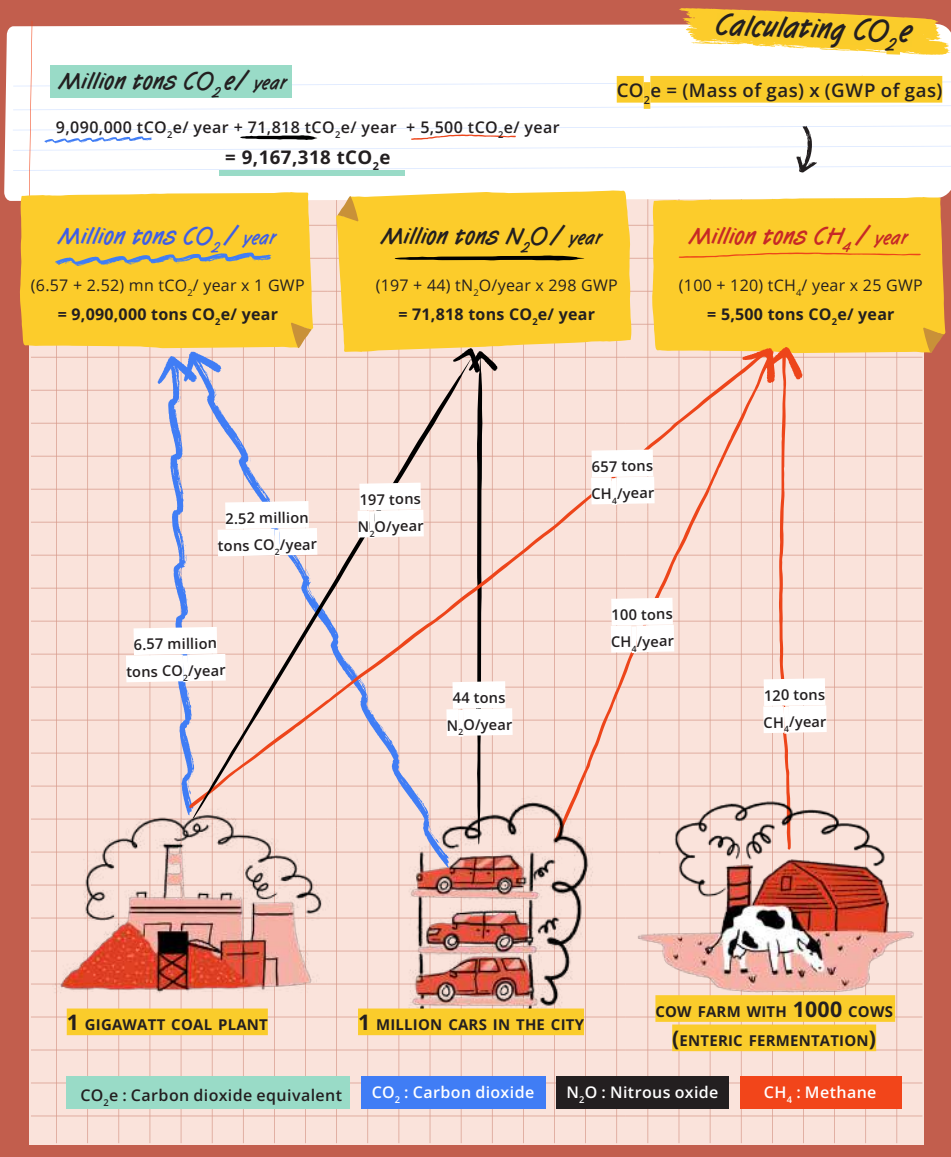
Now let's do the fun part, let's have a quick calculation to understand emissions better.

Glossarium

CO_2	: Carbon Dioxide
CO_2e	: Carbon Dioxide Equivalent
$MtCO_2$	: Metric Ton Carbon Dioxide
$MtCO_2e$	: Metric Ton Carbon Dioxide Equivalent
tCO_2	: Ton Carbon Dioxide
GHG	: Greenhouse gas emission
GWP	: Global Warming Potential
GW	: Giga Watt

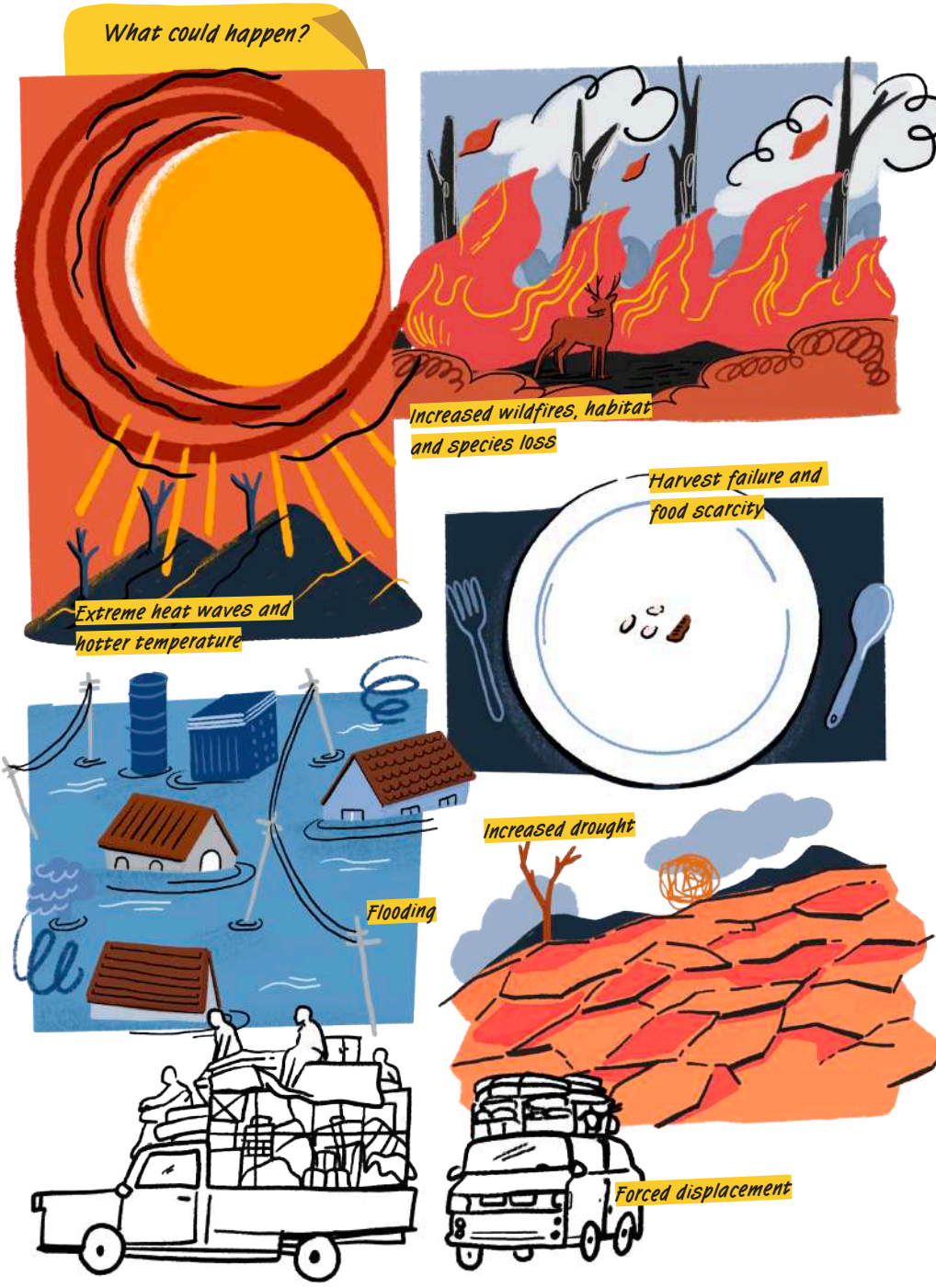
Common GHGs and their GWPs:

GHGs	GWP	YEARS IN THE ATMOSPHERE
Carbon Dioxide	1 (baseline)	Hundred to thousand years
Methane	25	Less than 100 years
Nitrous Oxide	298	Over 100 years
Fluorinated Gases	GWP varies significantly, ranging from a few hundred to over 10,000.	-



From this, **carbon footprint** is the total amount of greenhouse gases, measured in CO_2e, that are emitted directly or indirectly by any kind of activity. It measures the overall impact on climate change caused by human activities, including emissions from energy use, transportation, food production, and waste.

Knowing those facts above, now the important question would be: why should we as a young Indonesian care about the climate anyway? Does it really matter to us? To you, your friends, and your family at home?


What could happen?
Increased wildfires, habitat and species loss
Harvest failure and food scarcity
Extreme heat waves and hotter temperature
Increased drought
Flooding
Forced displacement

WHY SHOULD YOU AS A YOUNG INDONESIAN CARE?

Climate change isn't just happening somewhere else; it's affecting our beloved Indonesia right now.

INDONESIA'S CLIMATE IMPACT

Jakarta is sinking due to excessive groundwater use and rising sea levels.

Prolonged dry seasons and more frequent extreme weather events are severely impacting agriculture across Indonesia, especially in Java and Sumatra. Farmers face unpredictable planting and harvesting times, reducing crop yields and threatening our food supply.

Coastal communities are losing fertile land to saltwater, affecting farming and drinking water. The Thousand Islands (Kepulauan Seribu) are eroding faster, putting homes and livelihoods at risk.

Indonesia's incredible biodiversity is also in danger. Our rainforests, crucial for absorbing CO_2, are increasingly threatened by wildfires, often worsened by drought. These fires destroy habitats and release large amounts of greenhouse gases.

You might think these issues won't affect you, but they will. Climate change will impact your daily life. Imagine your coffee doubling in price due to reduced crops, enduring hotter days and nights, and unpredictable rain disrupting your football games, park dates, and commutes.

Yes, our day-to-day lives will be impacted. But have you considered that your daily activities are, in turn, contributing to climate change as well?

As we've talked about before, a carbon footprint is the total amount of greenhouse gases (GHG) emitted directly or indirectly by our actions. Everything from the electricity we use, the food we eat, to the way we travel adds up to our carbon footprint. Calculating your carbon footprint provides a clear picture of where your emissions come from and helps identify areas for improvement.

Let's return to our friends Susi, Nabil, and Lily. They each have different carbon footprints based on the lifestyles that they lead – let's take a look:

SUSI

Daily total: ~8.8kg CO_2e/day

Lives in a student dorm with a roommate, turns on AC from 10pm - 6am

2kg CO_2e/day

Wakes up at 6am and takes daily showers with hot water

~0,2kg CO_2e/day

Takes ride-hailing ojek to and from campus

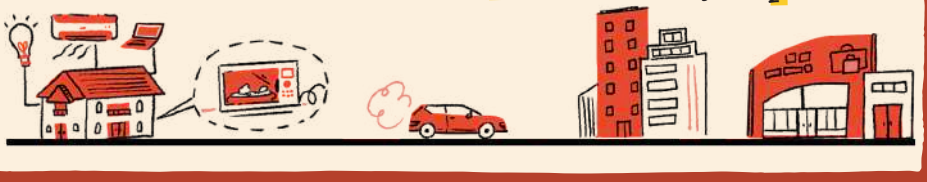
~0,5kg CO_2e/day

Goes out on weekends with friends, most time using ojek but occasionally taking cars from ride-hailing apps for longer distances

~0,51 - 1.25kg CO_2e/day

NABIL

Daily total: ~41.2kg CO_2e/day



Lives in a large, air-conditioned house. His home consumes a lot of electricity due to extensive use of air conditioning, lighting, and electronic devices

~34kg CO_2e/day

Microwaves leftover food for breakfast

~0,07kg CO_2e/day

Travels 15km to work daily in a private SUV or a vespa (when the traffic's really bad!)

~3.75kg CO_2e/day

Goes to the mall on weekends, and buys ~1 clothing item in fast fashion brands

Smokes cigarettes, a pack a day

(0.14 + ~0.5)kg CO_2e/

LILY

Daily total: ~2.1kg CO_2e/day

Relies on fans instead of air conditioning

~1.3kg CO_2e/day

Makes breakfast using a gas stove from plants harvested from her community garden and eggs from the chickens that she keeps

~0,3kg CO_2e/day

Bikes everywhere

~0kg CO_2e/day

Walks to her local market, occasionally buys secondhand items or artisan goods

0,02kg CO_2e/day

True or False

The myths and facts about climate change

MYTH: Scientists haven't reached an agreement on climate change.

FACT: More than 99% of climate scientists have reached a consensus that the climate is changing because of human activities.[1]

MYTH: There has always been changes in the climate – climate change is natural!

FACT: Yes, there are natural causes that trigger changes in the climate, such as fluctuations in the intensity of sunlight that hits the Earth because of changes to the Earth's orbit (the ice ages were caused by this). However, according to NASA, the Earth is currently warming at a rate that is 10 times faster than average, and carbon dioxide in the air is increasing 250 times faster than it did naturally after the last Ice Age.[2]

MYTH: Carbon dioxide only makes up a fraction of the Earth's atmosphere – only 0.04%. It can't possibly be warming up the planet.

FACT: It's true that carbon dioxide makes up only 0.04% of the atmosphere. But carbon dioxide is potent! It's amazing how much heat carbon dioxide can absorb and keep in our atmosphere. This is the greenhouse effect we talked about previously. Even in small amounts, it has a big impact on the Earth's temperature.

MYTH: More carbon dioxide is good because plants need CO_2 to grow!

FACT: Plants do need carbon dioxide as part of their photosynthesis process. But there's only so much that they can absorb. What's making this worse is that more and more forests are getting chopped down, which means less plants to absorb the CO_2 in the atmosphere. Additionally, rising temperatures from excess carbon dioxide can actually stress plants and reduce their ability to grow.

MYTH: Darwin said animals and plants can adapt to their environment. They can adapt to climate change.

FACT: Yes, some animals and plants will adapt to rapidly rising temperatures. Coral reefs that are used to fluctuating heat conditions, for example, are better at resisting bleaching caused by rising temperatures.[3] But not all species have this flexibility. If they can't adapt, they only have one other option: move to cooler areas. But this is increasingly getting difficult as more and more habitats get destroyed. Unfortunately, those that can't adapt or move are threatened to face extinction as the climate keeps on changing.

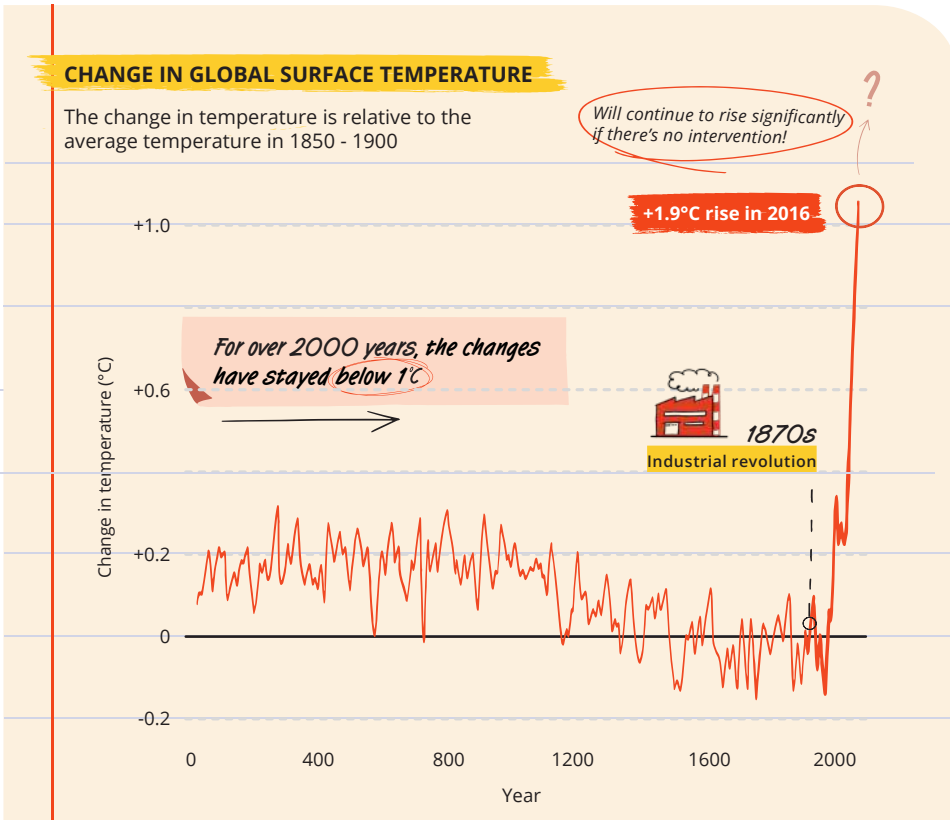
1.2 WHY IS THE CLIMATE CRISIS URGENT TO SOLVE?

CLIMATE CHANGE IS HARMING US AT AN ALARMING PACE

Climate change is causing some serious, long-lasting problems for our planet that we won't be able to easily undo. This crisis is happening all around us every day, and its impacts affect our well-being now and in the future. Understanding these impacts can help us see why it's such a big deal.

So, what are the real dangers of climate change?
Hasn't our climate changed since the Ice Age, and even before that?

Yes, our climate has been changing ever since then. But because of Industrial Revolution (ehm! **cough** Human activities!), the average change in temperature of our planet has been rising **rapidly**.



Source: https://time.com/6328017/climate-change-hockey-stick/

In 2020, the global average temperature was about 1.2°C higher than it was before the Industrial Revolution. Back in the 1960s, it was only 0.5°C higher—that's 2.4x higher! That kind of rise happened in a span of around 60 years. Previously, it took thousands or even millions of years to experience the amount of change we are facing right now.

The danger is that our current pace in changing is way too fast, and that's a big challenge for us because we might not have sufficient time to adapt.

Look at the previous graph. Since the industrial revolution in the 1800s, Earth's temperature has risen to extremes. While this might seem like a small change, scientists agree that we should limit this rise to 1.5°C by 2100. Even a 0.1°C increase beyond this can worsen climate impacts. Staying within this limit can help reduce the most damaging effects of climate change.

What if we do nothing?

Indonesia's temperatures could rise by 1.6°C by 2050 and 3.9°C by 2100. Considering the heat that you experience day to day and the extreme, unpredictable weather events right now, can you imagine that scenario? Heatwave frequency in Indonesia could increase by 98%.

How the heat influences the extreme weather events?

- A warmer atmosphere acts like a bigger sponge, holding and releasing more moisture, leading to heavier rainfall.
- As temperatures rise, ice sheets and glaciers melt, adding water to the oceans and causing sea levels to rise. This could shrink or even submerge islands.

In 2019, about 90% of Indonesia's 3,622 natural disasters were water-related events like tornadoes, floods, and landslides, which are expected to worsen with climate change.[4]

Recent research shows that **92 of Indonesia's outermost islands could sink as sea levels rise**.[5] According to Indonesia's National Research and Innovation Agency, at least 115 islands could be underwater by 2100.[6]

CLIMATE CHANGE CAN LEAD TO ANIMALS AND PLANTS DYING — EVEN TO EXTINCTION!

The climate crisis is currently the second biggest cause of biodiversity loss in the ocean due to **ocean acidification** and warmer temperatures. On land, it ranks as the fourth biggest cause due to heat waves, wildfires, and natural disasters. But why should we care about biodiversity?

The loss of **biodiversity** disrupts the ecosystem and the entire system can go haywire. Animals and plants that rely on each other for food and survival can get out of sync, and changes in the environment can make it easier for diseases to spread. This can affect the things we get from the ecosystem – which we call **ecosystem services** – including things like food supplies, natural pest control, and fresh water. The whole system struggles to function properly, which can have serious impacts on our daily lives.

Climate Lingo 101

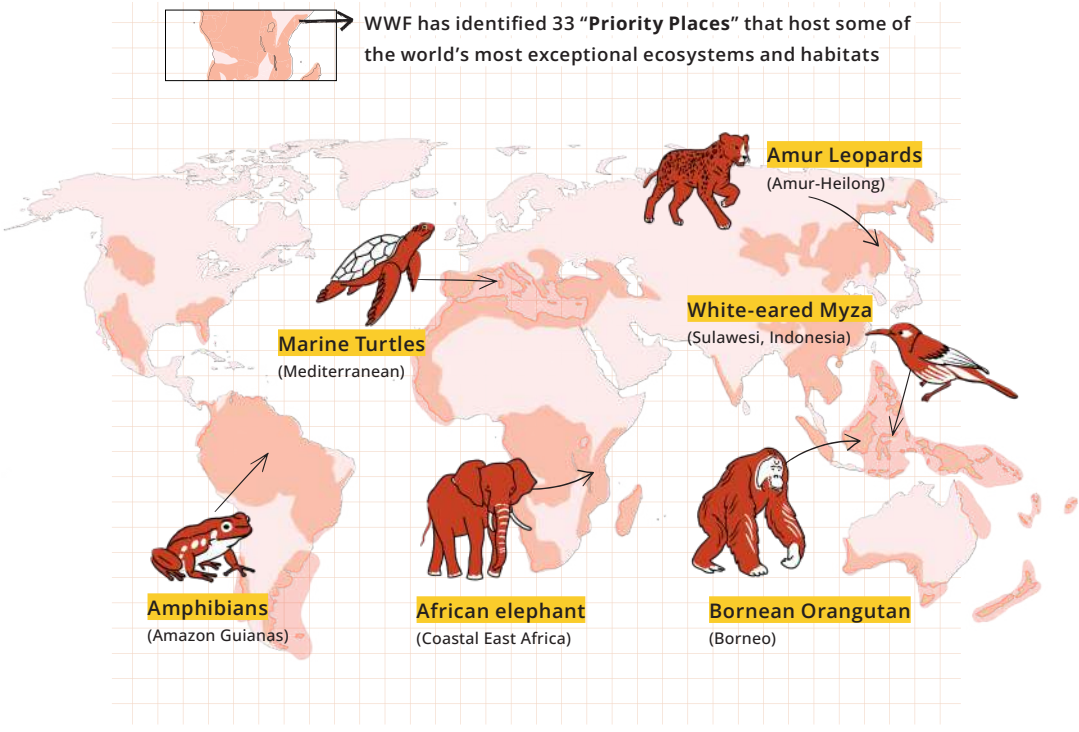
Ocean acidification refers to the reduction of the ocean's pH level (in other words, oceans are becoming more acidic). This is caused by excess carbon dioxide in the air getting dissolved in the oceans.

Biodiversity, short for biological diversity, refers to the wide array of life forms in a particular area, from plants and animals to tiny microorganisms. These life forms work together in an ecosystem, where each species contributes in their own unique way.

Ecosystem services are the amazing gifts that nature gives us for free, such as food and clean water. We depend on them to survive – think of industries like agriculture and forestry, how would they fare without these free gifts of nature? Plus, ecosystem services benefit plants and animals as well by giving them healthy habitats.

Indonesia is an archipelago with one of the longest coastlines in the world, which supports an extraordinary marine ecosystem. However, climate change is causing the ocean to become hotter and more acidic, which can lead to coral bleaching and coral death. These conditions disrupt the habitat for many marine species. In 2017, Indonesia was the world's second-largest producer of wild-capture fish and the third-largest producer of fish from aquaculture.[7] Coral reefs are critical habitats for many fish species, and their degradation due to climate change can significantly reduce fish populations. This decline not only impacts biodiversity but also threatens Indonesia's fishing industry and the communities that rely on the sea for food and economic stability.

GLOBAL WARMING THREAT ON BIODIVERSITY



Source: World Wildlife Fund (WWF)

Climate change threatens our land animals as well, like orangutans, komodo dragons, tigers, rhinos, and elephants. Many of these species are already vulnerable due to small populations and limited habitats. Climate change adds extra stress, increasing the risk of extinction. A study in Sulawesi found that highland birds could lose up to 60% of their population by 2050 due to climate change.[8] Similarly, research on Borneo mammals indicates that up to 36% of species could lose 30% of their habitat by 2080.[9] This threat of biodiversity loss can increase the prevalence of infectious diseases, and essentially make us more vulnerable to sickness.

How climate change causes pandemics

Do you remember the pandemic a few years ago? Turns out, climate change and pandemics are linked! Our interference of natural habitats can unleash unexpected diseases that can spread from animals to humans. This will get worse with climate change. As the Earth warms, animals migrate to cooler areas, potentially encroaching to human settlements. This heightens the risk of infectious diseases spreading to us.

CLIMATE CHANGE CAN MAKE US SICK

Did you know that our warming planet can affect your health in many ways? Heatwaves can cause heat stroke, especially for vulnerable people such as the elderly and those who don't have access to air conditioning. Hotter weather can also worsen heart and lung problems. Wildfires and dusty droughts pollute the air, making it harder to breathe, especially for those with asthma.

Rising temperatures lead to more foodborne illnesses, bacterial outbreaks, and the spread of **zoonotic diseases**, which are diseases spread from animals to humans (like COVID-19!). Droughts and floods threaten clean water and food supplies, leading to malnutrition and waterborne diseases.

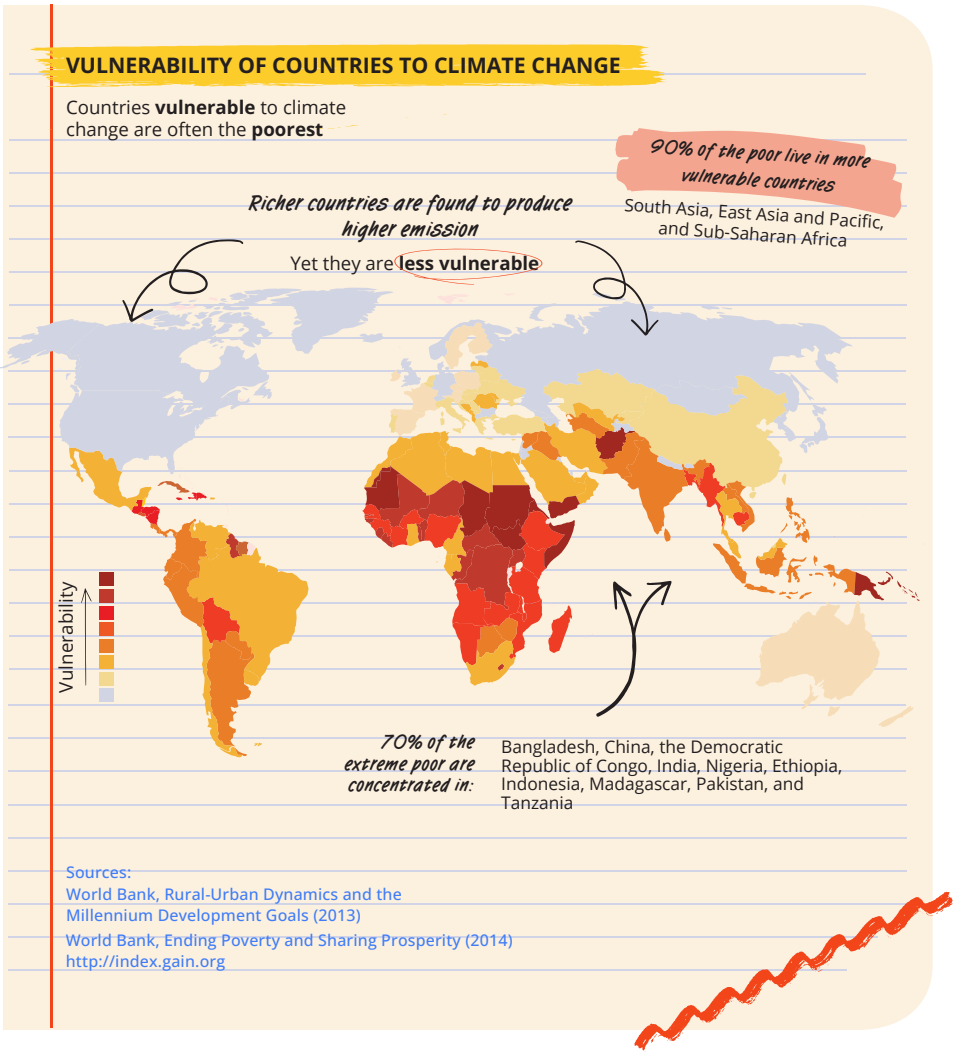
Climate change also impacts our mental health. Over two-thirds of young people (18-24 years old) experience climate anxiety.[10] This anxiety stems from uncertainty about the future and frustration over the lack of climate action. It's a sense of worry, sadness, or fear about climate change and its impact on the planet. Climate anxiety can lead to symptoms like panic attacks, loss of appetite, irritability, weakness, and sleeplessness.

If you've been feeling like this, remember that these feelings are valid, but there are ways to cope. Taking breaks from social media, practicing meditation, seeing a therapist, or doing small acts to help the environment can make a difference.

As we have seen, climate change is a complex issue affecting both our physical and mental health. By understanding these impacts, we can better prepare and take action to protect our well-being and the planet.

CLIMATE CHANGE CAN HIT CERTAIN NATIONS HARDER

Unfortunately, climate change will also take a hit on Indonesia's overall economic growth, whether we do nothing or take action without considering the wellbeing of our economy. We've mentioned earlier about the extreme weather, and it will affect farmers' crop yields, reducing their income and impacting the local economy. On the other hand, if we adopt all the green technologies at once without factoring in the country's economy, we also run the risk of increasing the prices of food, transportation, and basically life (we'll discuss this more in sub-chapter 1.4)! This is why it's crucial to balance combating climate change with economic growth to avoid these ripple effects and protect the country's economic stability.



Without immediate action, Indonesia could lose 4.4% of its GDP by 2050, potentially worsening to 13.27% by 2100.[11]

Gross Domestic Product (GDP) measures a country's economic health. A rising GDP indicates growth, while a falling GDP signals trouble. Climate change threatens Indonesia's GDP in both low- and high-emission scenarios, impacting agriculture, fisheries, infrastructure, and tourism.

Developing and least-developed countries are most affected by climate change despite contributing the least to emissions. **The 74 lowest-income countries produce only one-tenth of global greenhouse gases** but face the worst impacts.[12] Indonesia, where 70% of the population earns below-average incomes, is particularly vulnerable.

Let's look at how Indonesia is doing. Every year, each person in Indonesia produces about 2.3 tons of CO_2. This might sound like a lot, but it's actually lower than the global average of 4.5 tons per person.

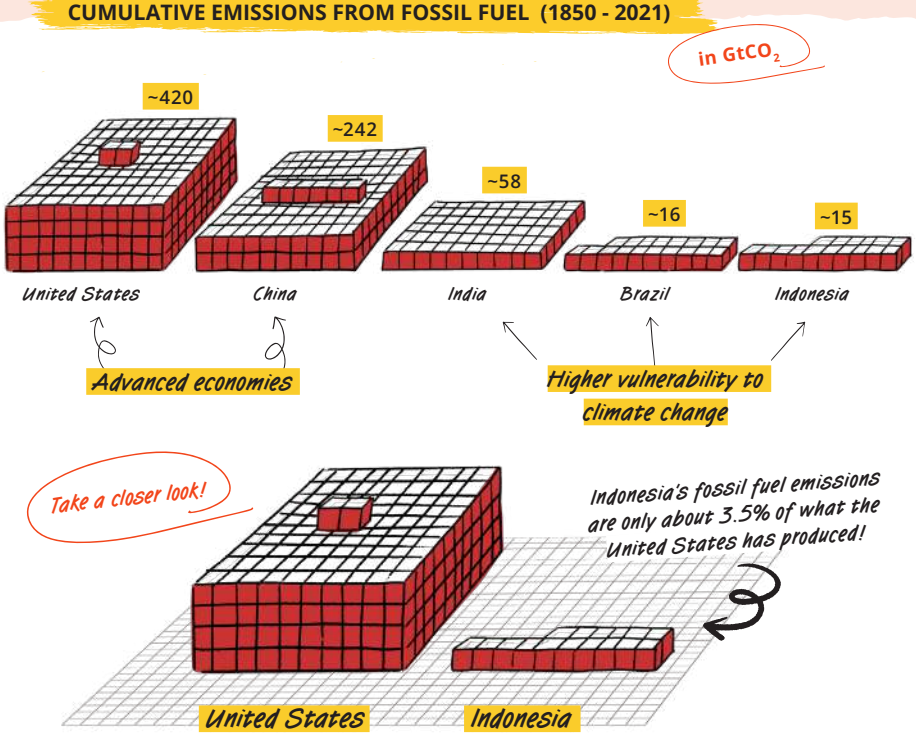
When we add up all the CO_2 emissions from Indonesia, they make up about 2% of the total CO_2 emissions from the G20 countries. The G20 is a group of 20 major economies, including both developed and developing countries. To put this in perspective, developed countries in the G20 contribute a whopping 82% of the total CO_2 emissions. So, Indonesia's share is much smaller compared to these countries.

Different countries around the world have different starting points and face different challenges when it comes to climate change. But we all need to work together to reach a common goal: a healthier planet. One important idea to keep in mind is called "Common but Differentiated Responsibility" (CBDR). This means that while every country should help fight climate change, some countries might need to do more based on their abilities and how much they have contributed to the problem in the past.

One way for countries to do "more" is by helping developing countries like Indonesia with advancing their sustainability agendas while pursuing economic growth.

We'll talk about this more in the next sub-chapter!

CUMULATIVE EMISSIONS FROM FOSSIL FUEL (1850 - 2021)



$GtCO_2$: One billion tonnes or gigatonne of CO_2
1 $GtCO_2$ = 1,000 $MtCO_2$

Source: Carbon Brief analysis of figures from the Global Carbon Project, CDIAC, Our World in Data, Carbon Monitor, Houghton and Nassikas (2017) and Hansis et al (2015)
https://www.carbonbrief.org/analysis-which-countries-are-historically-responsible-for-climate-change/
*Exclude cumulative emissions from Land Use, Forestry, Cement and Others

Climate change can also worsen global geopolitics

Did you know climate change can cause wars? If not addressed, it threatens global security with long-lasting economic, human, and political consequences, especially in environmentally unstable regions.

Climate change increases social and political tensions, such as human migration, political instability, conflict, and global rivalry. It worsens resource scarcity, leading to competition over food, water, and energy, potentially fuelling conflict. Moreover, climate adaptation efforts often overlook peacebuilding or conflict prevention, leaving vulnerable communities poorer and less resilient to these intertwined crises.

CLIMATE CHANGE HAS DISPROPORTIONATE IMPACTS ON EXTREME POVERTY

Climate change impacts are unequal. Addressing it justly means supporting the most affected and vulnerable communities, giving them a voice in finding solutions. Indigenous people, often marginalized in land use and climate adaptation decisions, possess valuable knowledge for sustainable solutions.

Vulnerable communities with limited resources and infrastructure are more exposed to extreme weather events like floods, droughts, and heatwaves.

Their ability to adapt and recover is limited.

These groups include low-income households, indigenous populations, people with disabilities, children, older adults, and blue-collar workers. For example, Indonesia's coastal communities are particularly at risk from the climate crisis. As mentioned before, sea levels in Indonesia are rising by 0.8-1.2 cm per year[13]. Around 1.3 million people, or 12.5% of the nation's poorer population, live in coastal areas and are at risk of losing their homes[14]

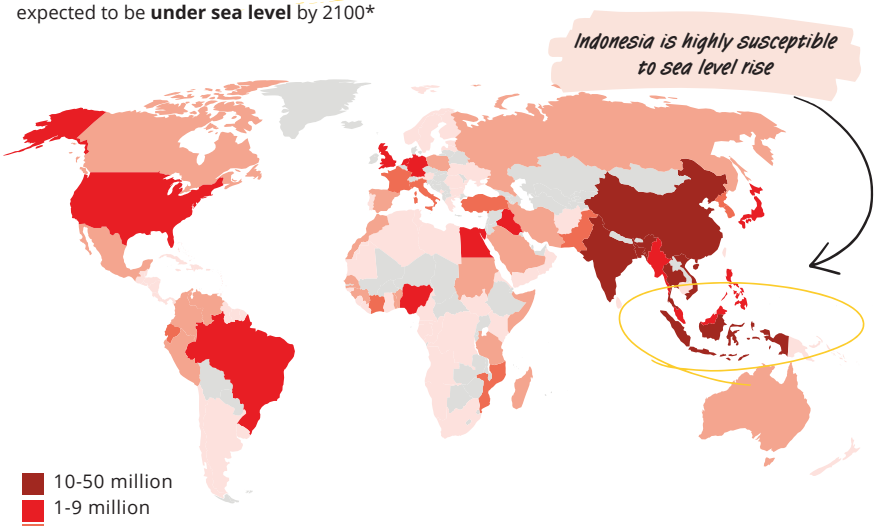
According to climate and environmental justice principles, those most affected should be central to the discussion, and their needs and rights should guide climate action. Climate justice involves addressing climate change with fairness and ensuring basic human rights for everyone, a concept known as **distributive justice**. The aim is to ensure that all individuals have an equal opportunity to protect their life rights.

Future generations deserve a healthy planet. Climate justice emphasizes the importance of intergenerational equity, ensuring that the actions taken today do not compromise the ability of future generations to meet their own needs. This involves stopping climate change and helping communities adapt to ongoing changes by investing in resilience-building measures.

Climate change cannot be solved with a single solution. Inclusive climate action ensures justice and equity for all, especially for vulnerable and voiceless groups. We will discuss what we can do further in the next chapters.

WHERE MOST PEOPLE ARE AFFECTED BY RISING SEA LEVELS

Number of people per country living on land expected to be **under sea level** by 2100*



*Assuming a rise in sea levels of 50 - 70 cm

Sources:
Scott A. Kulp & Benjamin H. Strauss: New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding, Nature Communications

Now that we have discussed why it is urgent to address climate change, the global community has set an ambitious goal to prevent catastrophic and irreversible consequences. Let's introduce you to a concept called Net Zero, which means balancing the amount of greenhouse gases produced with the amount removed from the atmosphere. By achieving net-zero emissions, we can stabilize global temperatures, mitigate the worst impacts of climate change, and safeguard our planet for future generations.

Women and girls face disproportionate impacts from climate change.

Did you know that women face more climate change impacts than men? This is due to various social, economic and cultural factors. Disparities in access to resources, income, health, education, and the burden of unpaid domestic work, make it more difficult for women to adapt to climate change. In addition, strong gender norms often limit women's participation in climate-related decision-making. As a result, women are more likely to experience negative impacts such as food shortages, lack of clean water, and higher health risks.

1.3 WHAT IS 'NET ZERO'?

DEFINITION OF NET ZERO

Remember how we talked about carbon emissions in sub-chapter 1.1?

Reminder: Human activities, like burning fossil fuels and deforestation, have disrupted our earth's delicate balance by releasing excessive carbon emissions into the atmosphere.

This is where the concept of "net zero" comes in. So, what does net zero actually mean?

Net Zero refers to **the zero balance** between the amount of human-made greenhouse gases we emit (carbon emissions) and the amount we remove from the atmosphere.

Essentially, it's about reaching a point where our carbon emissions are **cancelled out** by the carbon we absorb or offset. That's why the term "net" is used before "zero"—it's about achieving a zero balance.

How do we achieve it, then?

To reach net zero, we must significantly do two basic, crucial things:

1. REDUCE OUR EMISSIONS

Which come from various human activities, such as driving cars, generating electricity from coal, and manufacturing goods. The problem that we should solve is that we have to be able to reduce emissions **at the source.**

2. ABSORB MORE CARBON

Enhance our efforts to absorb carbon, like increasing the capacity of natural systems to do so (re: planting trees) and using technology to capture carbon from the air.

Reaching net zero is crucial for combating climate change. Think of it like a very huge project involving everyone in the world, from individuals, businesses, and governments worldwide. This collective effort will help stabilize global temperatures and reduce the adverse effects of climate change.

For Indonesia, achieving Net Zero involves a huge effort, with the primary focus being reducing carbon emissions. This means making significant changes in various sectors like factories, transportation, and power generation. Factories need to adopt cleaner, more efficient technologies.

Cars and other vehicles should transition to electric or other low-emission alternatives. Power plants must shift from burning fossil fuels to using renewable energy sources like solar, wind, and hydro power.

In addition to reducing emissions, it is also essential to increase and create areas to "offset" carbon emissions, such as forests that absorb CO_2. These natural areas are called carbon sinks because they soak up more carbon dioxide than they release, acting like sponges for greenhouse gases. However, relying solely on carbon sinks is not enough.

To truly achieve Net Zero, it is crucial to focus on both reducing emissions and enhancing carbon absorption. Simple actions by individuals, like using energy-efficient appliances, reducing waste, and supporting eco-friendly policies, can contribute to this goal. These are called **mitigation strategies**.

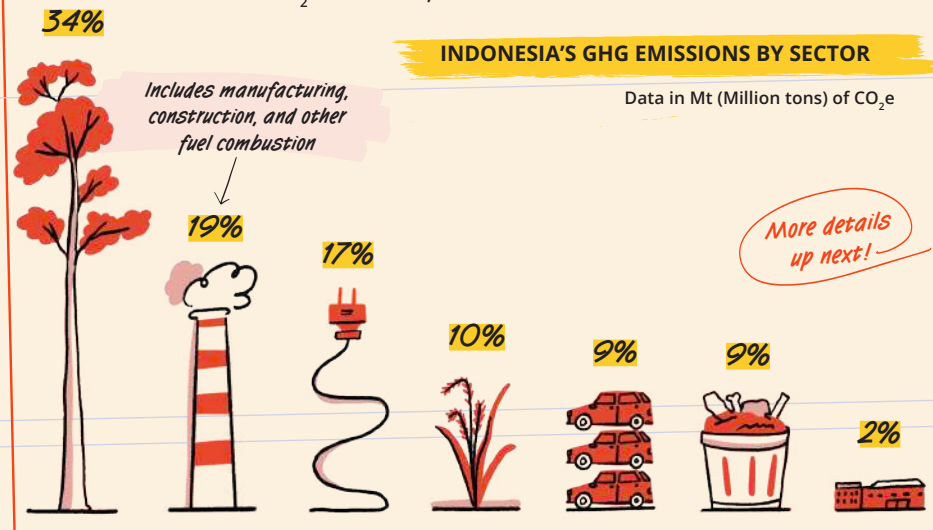
INDONESIA'S PATH TO NET ZERO

Globally, the world is planning to achieve Net Zero by 2050. Indonesia has committed to Net Zero by 2060.

Indonesia's Net Zero strategy by 2060 is about making sure that we lower our CO_2 emissions, as shown in the chart below.

INDONESIA'S GHG EMISSIONS BY SECTOR

Data in Mt (Million tons) of CO_2e



Source: https://ourworldindata.org/co2/country/indonesia (2020)

NATURE

Compared to global emissions, Indonesia is unique because our biggest emission contributor is Nature, or in the climate world, it's called FOLU (Forestry and Other Land Use. As you know, almost half of our land is covered in greenery! Peatlands, mangroves, tropical forests, you name it. However, when these lands are cleared for agriculture or other uses, they release massive amounts of GHGs.

ELECTRICITY

While our nation's persistent problem lies in electricity inequality, a significant portion of Indonesia's electricity comes from our most accessible natural resources—burning coal and oil, which releases a lot of GHGs.

INDUSTRY

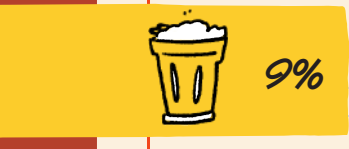
Our industrial boom has boosted our economy, exports, and job opportunities, but there's a catch—it contributes 274.74 million tons of CO_2. The biggest culprit? Energy use, largely due to heavy reliance on fossil fuels to keep everything running.

FOOD/ AGRICULTURE

Our agricultural practices, especially rice farming, contribute notably to greenhouse gas emissions. Rice paddies, when flooded, produce methane, a potent greenhouse gas.

TRANSPORTATION

Transportation is another big source of emissions in Indonesia. Many people rely on fossil fuel-powered vehicles, which release a lot of carbon dioxide.



WASTE

Improper disposal and burning of waste release a significant amount of methane and carbon dioxide.

BUILDING

Buildings also play a role in our emissions through energy use and construction practices. This sector heavily interconnected with electricity and industry. Many buildings are not energy-efficient and use a lot of electricity for heating, cooling, and lighting.

Indonesia is working hard to balance how much carbon we release with how much we can absorb, aiming for Net Zero to help fight climate change. We'll dive into all this exciting stuff in Chapter 2!

Remember, as a developing country, **we still need to grow our economy**, and that often means more emissions because growing industries usually need affordable and reliable energy, which is currently provided by fossil fuels. Luckily, we've got a treasure trove of natural resources and a huge potential for renewable energy that can help support both economic growth and sustainability! We'll explain this more in the next chapter.

Other than mitigating climate change, and balancing that with our economy's need to grow, we also need to adapt. Adaptation involves making adjustments in our lifestyles, infrastructure, and policies to better cope with the impacts of climate change. It's about preparing for and managing the effects that are already occurring and those that are expected in the future.

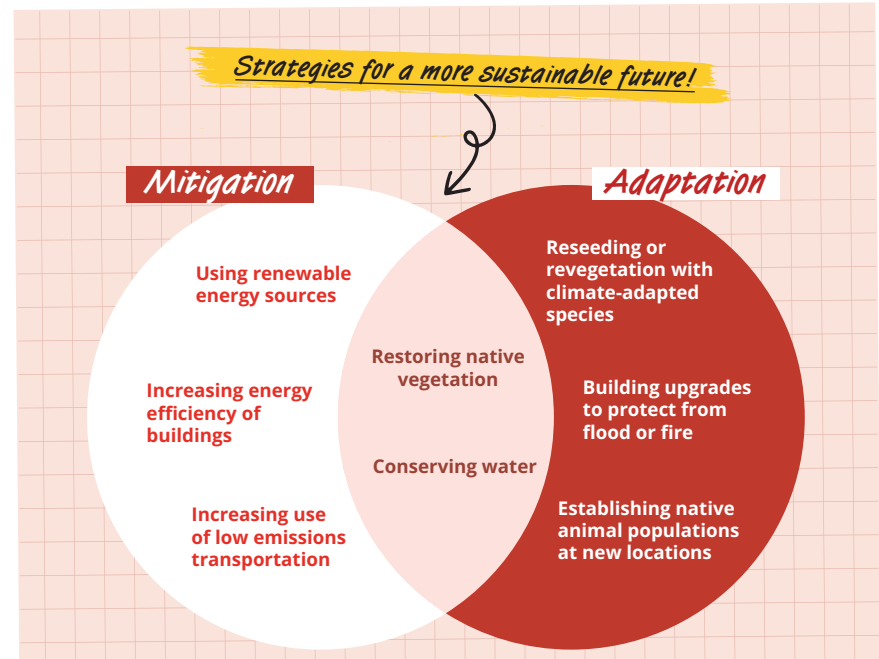
Examples of adaptation strategies:

1. **BUILDING RESILIENT INFRASTRUCTURE** for Indonesia like sea walls and improved drainage systems to withstand extreme weather, with Jakarta investing heavily in flood control measures.

2. **MANAGING WATER RESOURCES** by constructing reservoirs, improving irrigation, and promoting water-saving practices ensures a stable water supply, especially in scarce areas.

3. **STRENGTHENING HEALTHCARE SYSTEMS** in all aspects, starting from **yourself**. Improve public health system with better infrastructure, better protection and medical access is crucial to combat the health impacts of climate change, like the spread of diseases.

By combining mitigation and adaptation strategies, we can work towards a more sustainable and resilient future, ensuring that communities are better prepared to face the ongoing and future impacts of climate change as Indonesians.



Climate Lingo 101

Carbon offsets: A carbon offset is a way to compensate for your carbon emissions. This can be done by funding or supporting projects that reduce, avoid, or remove emissions elsewhere.

Carbon sinks: Natural systems that absorb and store more CO_2, like a giant sponge that soak up CO2 from the air. These can be forests, oceans, or soil.

Mitigation: Mitigation refers to actions taken to reduce or prevent the emission of greenhouse gases. This can involve using renewable energy sources, improving energy efficiency, and adopting cleaner technologies to lessen our impact on the environment.

Adaptation: Adaptation involves making adjustments in our lifestyles, infrastructure, and policies to cope with the effects of climate change. This can include building flood defences, creating heat-resistant crops, and planning for more resilient cities to better withstand climate impacts.

1.4 WHY IS NET ZERO GOING TO BE CHALLENGING?

We briefly covered Indonesia's pathway toward Net Zero. But why is it so challenging to achieve? Let's break it down into four main reasons.

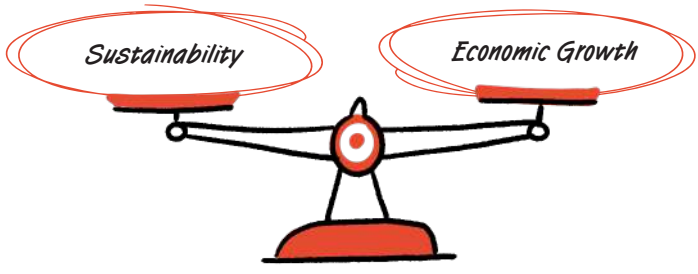
FIRST REASON: NET ZERO NEEDS TO BE BALANCED WITH THE COUNTRY'S ECONOMIC GROWTH!

Indonesia is a developing country, which means we face some pretty big economic challenges. Our GDP per capita is only about 10% of what you'd find in developed countries,[15] and about 25.9 million people are living in poverty.[16] Our stunting rates are around 22%, compared to just 4% in more developed nations.[17,18] And that's not all – we've also got some serious sustainability issues, as mentioned in previous sub-chapters.

So, how do we tackle these twin challenges? We need to find the sweet spot between boosting our economy and going green. We can't just focus on sustainability and forget about economic growth – that could undo all the hard work we've done to improve our economic development, like reducing stunting and poverty.

Plus, if we only go green, we might end up compromising the convenience that our fossil-fuel based lifestyles give. This is because eco-friendly options that give the same kind of convenience may not be available or affordable yet

(we'll explain this part a little more in the next few pages under "Green Premium").



Indonesia to strike the right balance between environmental sustainability and economic growth

But here's the exciting part: Indonesia is sitting on a goldmine of natural resources and has massive renewable energy potential. This means we can power eco-friendly industries and support both economic growth and sustainability, breaking the link between economic growth and emissions! Our potential is unique to Indonesia. For example, we have a whopping 3,600+ gigawatts of renewable energy potential! We're also rich in critical minerals like nickel, tin, and copper, which are essential for building green technologies for modern lifestyles. Plus, we've got the second-largest forest and biggest ocean biodiversity in the world, which means we have massive carbon sinks right here at home.

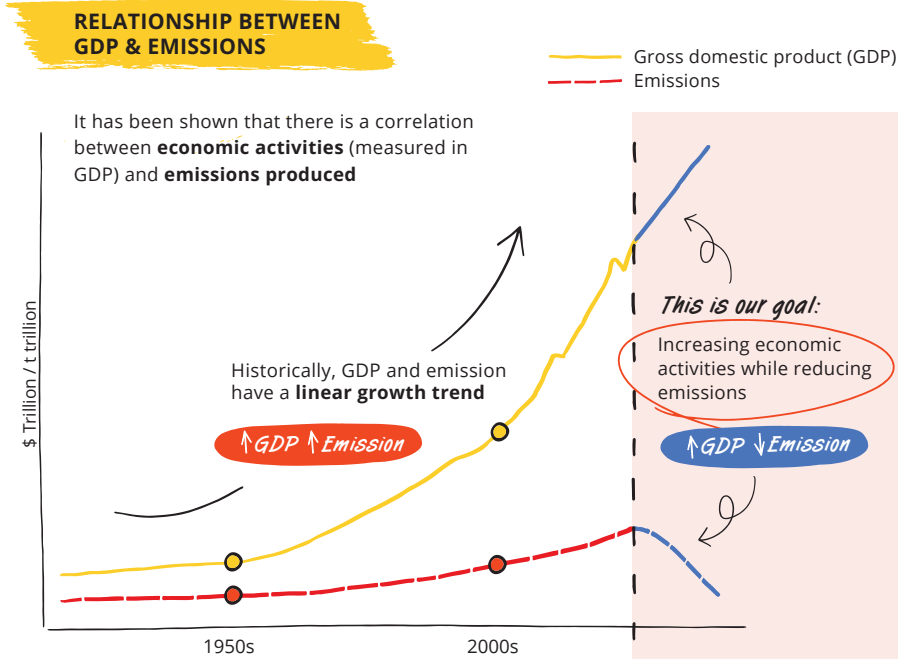
GOVERNMENT, CIVIL SOCIETIES, ACADEMICS, PRIVATE SECTOR, AND CITIZENS JOIN HANDS TOGETHER

But **we can't do it alone**. We need the collective effort of the government, private sector, civil society, academics, and all of us citizens to find sustainability solutions that also boost economic growth. We can't settle for solutions that only address one side of the problem. Additionally, we need help from other countries, especially those that have contributed a ton of greenhouse gases to the atmosphere. International support in the form of financing, technology, and human resources is crucial for us to go green and achieve our sustainability goals.

Balancing Net Zero with economic development might be tricky, but Indonesia's unique strengths give us a fantastic shot at making it happen. Let's tap into our natural resources and renewable energy potential, and put in the hard work and time needed to create a sustainable and prosperous future!

SECOND REASON: IT REQUIRES MASSIVE CHANGE IN LIFESTYLE AND 'HOW WE DO THINGS'

For the past 150 years, we have been emitting CO_2 to meet our everyday needs, often without a second thought. This period has seen unprecedented industrial growth and technological advancement, all fuelled by burning fossil fuels like coal, oil, and natural gas. These activities have become deeply embedded in our daily routines, powering our homes, cars, and industries.



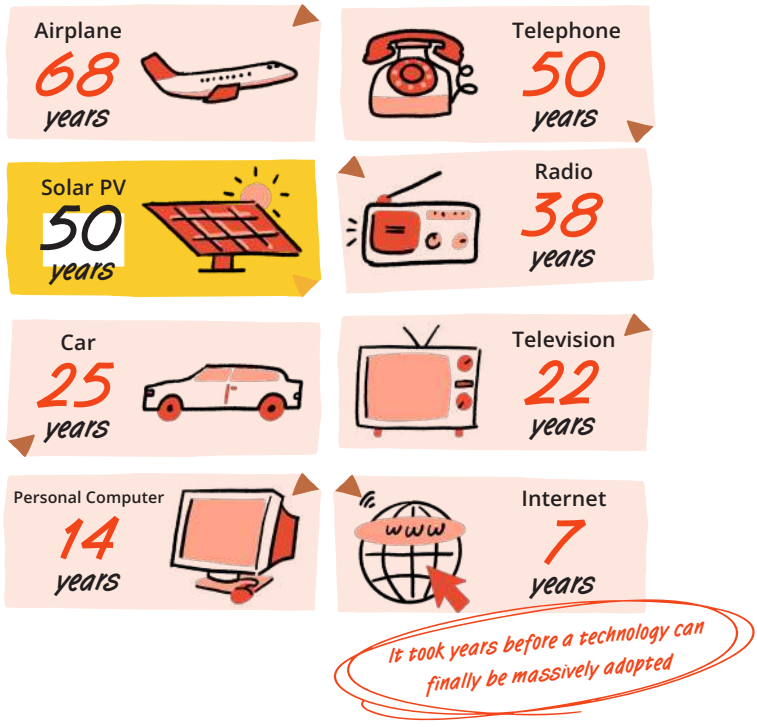
This reliance on carbon-intensive energy sources has led to significant environmental consequences, including climate change and global warming. As we strive for a net zero future, we must recognize the profound changes required to break free from these long-standing habits and move towards more sustainable practices.

Solving the net zero challenge requires **breakthroughs** in two critical areas of our daily lives:

CONSUMPTION OR 'HOW WE USE THINGS' — We must transform how we consume resources to reduce our reliance on carbon-emitting activities. We'll cover this more in Chapter 3.

PRODUCTION OR 'HOW WE MAKE THINGS' — We need to revolutionize how we produce goods and services by utilizing low-carbon technologies and processes. This involves shifting to renewable energy sources, implementing circular economy principles, and improving energy efficiency in manufacturing. Innovations in green technology, such as carbon capture and storage, renewable energy infrastructure, and sustainable agriculture, are essential to produce goods with minimal environmental impact. In terms of technology, we'll cover this more in Chapter 2.

Addressing the production side alone can help reduce significant portion of CO_2 emission by developing and implementing new technologies across various natural resources sectors. However, it's not just flipping a light switch, it will take years and years of development. For example, it took quite a long time for these technologies to be widely adopted...



We can see that even our beloved technology (re: the internet) needs 7 years to be finally used globally, while it took 50 years for Solar PV to be adopted globally. It is not easy to adopt net-zero technologies. There are three common challenges we face when trying to adopt new low-emission technologies:

1. DEVELOPING THE TECHNOLOGY

Creating net-zero technologies is tough and takes time. To be used widely, these technologies need to be affordable and practical. People will only switch to them if they are better and cheaper than the old, carbon-heavy ones we're used to.

2. FINDING THE RIGHT PEOPLE

Even when we have the tech, we need skilled people to operate it. Technology evolves quickly, and only a few people may know how to use the new stuff. Training enough people to handle and maintain these technologies is crucial.

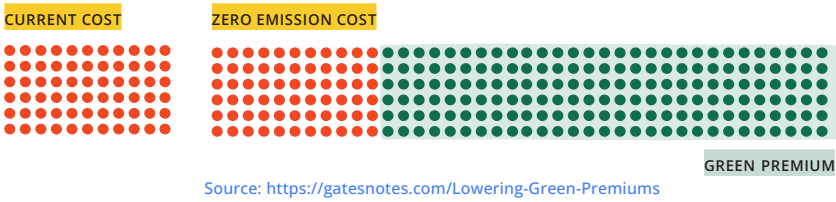
3. COST ISSUES

Even if everything is in place, new technologies can be expensive. Being an early adopter means facing high costs and risks, including potential failures. Making these technologies more affordable is key to achieving a low-emission future.

By addressing these challenges, we can make the transition to low-emission technologies smoother and more accessible for everyone.

THIRD REASON: SOMETIMES, 'GREENER' IS MORE EXPENSIVE

Going green can be costly at first. Adopting new, eco-friendly technologies often comes with a high price tag, which is a significant challenge on our journey to net zero emissions, and also balancing this with economic growth.



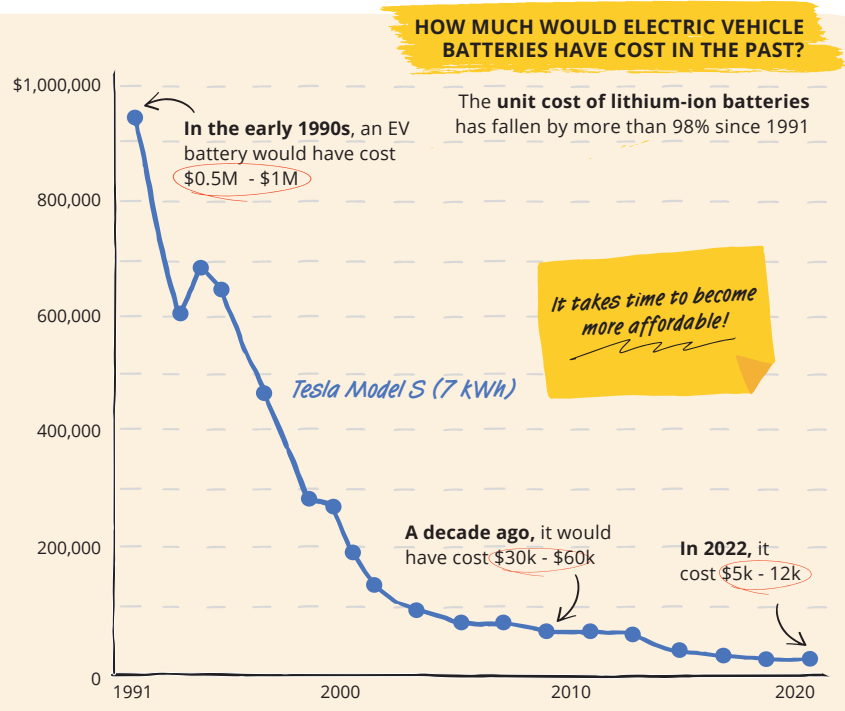
Source: https://gatesnotes.com/Lowering-Green-Premiums

The figure before from one of Bill Gates notes, captures it very well. New low-carbon technologies are often expensive at first. **This high initial cost is known as the "green premium."** New technologies tend to be pricey because we haven't produced enough of them yet to bring the costs down.

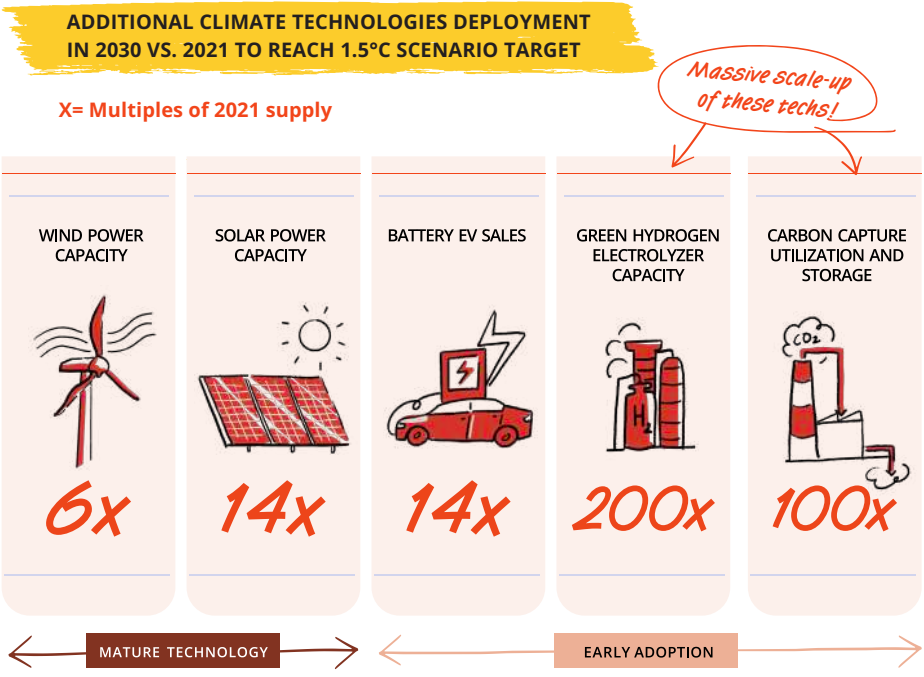
Historically, it takes time for green technologies to become affordable and widely used. For example, it took over 20 years for electric vehicles (EVs) to become affordable compared to traditional gasoline cars. As shown in the exhibit below, the cost of EV batteries has decreased over time as more people started using the technology.

As more people adopt a technology, the cost decreases. The question now is: ***"Can we find a way to make things cheaper quickly so we can reach our goals faster?"*** With tight deadlines to address climate change, we can't rely on the same slow process we used for traditional technologies.

However, if we force to adopt all green technologies without careful economic planning, it could have a serious impact on our economy. We need to find ways to make it more affordable without tipping the economic scales too much.



Crude estimates based on battery unit costs and the size of modern-day EV batteries.
Inflation-adjusted and give in 2022 prices
Source: https://www.sustainabilitybynumbers.com/p/ev-battery-costs



Source: EV-Volumes; IEA; International Renewable Energy Agency; McKinsey Analysis

To meet the crucial 1.5-degree climate goal, we need to add our solar power capacity by at least 14 times by 2030! This means adding over 1,400-1,500 gigawatts (GW) of solar energy. Big enough? The space it requires to install 1,400 - 1,500GW is like having over 3 million FIFA football fields covered in solar panels! Sounds like a very big task!

So, how do we tackle this challenge?

Imagine a group of students with loads of homework. To get it all done on time, they split the work and collaborate. This method, known as **"ecosystem parallelization"** is what we need for green technology to make it cheaper and more accessible.

Take the **Electric Vehicle (EV) ecosystem** as an example. To make EVs more affordable and widespread, we need several key elements:

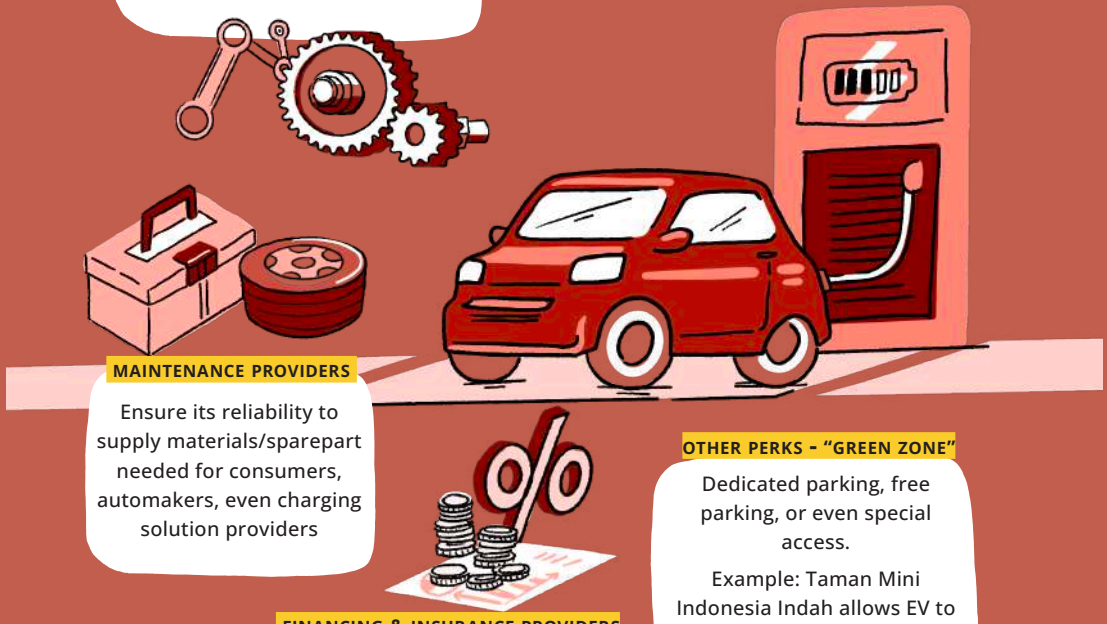
MANUFACTURER

Manufacture the whole component of EV (battery, charger, motor/powertrain, chassis!

Need to achieve **"economies of scale"!**

CHARGING SOLUTION PROVIDERS

Ensure accessible and adequate charging points across cities, especially to support multi-city trip.



MAINTENANCE PROVIDERS

Ensure its reliability to supply materials/sparepart needed for consumers, automakers, even charging solution providers

OTHER PERKS - "GREEN ZONE"

Dedicated parking, free parking, or even special access.

Example: Taman Mini Indonesia Indah allows EV to enter the main area, while regular cars are not allowed.

FINANCING & INSURANCE PROVIDERS

Accessible financing, government incentives to discount EV purchase

Provide safety for EV drivers in case of accidents.

By providing these supports, EV drivers can afford and will feel more comfortable using EVs. As more people use EVs, the demand grows, leading to increased production. This results in **"economies of scale"** where the cost to produce each vehicle drops, making EVs cheaper for everyone.

This concept applies to all types of climate or green technologies. But no single player can do it alone. Creating an ecosystem requires collaboration from multiple stakeholders, including the government and private sectors. We'll cover the financing part to scale green technologies next.

FOURTH REASON: WHERE WILL THE MONEY COME FROM TO PAY FOR THE 'GREEN' TECHNOLOGIES?

Realizing new green technologies, building the infrastructure, and enabling ecosystem changes require a significant financial commitment. The global funding needed for green projects is estimated at trillions of dollars per year, but **only about $150 billion is available** annually from government and development aid. To close this gap, we need to involve the cash cow a.k.a the private sector—businesses and investors outside of the government.

RISKS OF GREEN INVESTMENT

Long Time to See Returns

It takes a while for new technologies to be adopted and start generating financial returns.

Huge Investment until Economies of Scale are Achieved

Significant upfront investment is needed, and large-scale adoption is necessary to make these technologies cost-effective.

High Uncertainty

The green tech industry is new, with uncertainties in technology advancements and potential policy changes.

As we mentioned the importance of "ecosystem parallelization" previously, a key support for building the green tech ecosystem is **blended financing**.

BLENDED FINANCING is where the public sector takes on more risk and accepts lower returns to make private investment more appealing.

By using blended financing, we can make green investments more attractive to businesses and investors, encouraging them to invest more and help us achieve our sustainability goals faster. While greener technologies may be trickier to finance at first, through collaboration and innovative financing strategies, we can make them affordable and speed up our progress toward a sustainable future. Plus, blended financing can attract investments that support both sustainability and economic growth, creating a win-win situation for our planet and our economy.

Indonesia government has initiated the blended financing scheme through Just Energy Transition Partnership (JETP). The goal of this partnership is to reach the 1.5°C commitment using $20 billion fund from 10 developed countries.

FIFTH REASON: WE NEED TO GET TO NET ZERO—NOT HALF-ZERO OR QUARTER ZERO!

As we covered briefly in sub-chapter 1.3, achieving net zero emissions is a big challenge that requires everyone to work together. Emissions come from all over the world. Every country needs to pitch in because pollution in one place affects the whole planet. In other words, everyone must get to net-zero!

Achieving net zero emissions is a **team effort** where every country needs to reduce their emissions to zero.

If certain countries do not reach this goal; the whole planet will not achieve net zero. International cooperation is crucial to effectively tackle global warming and achieve net zero emissions.

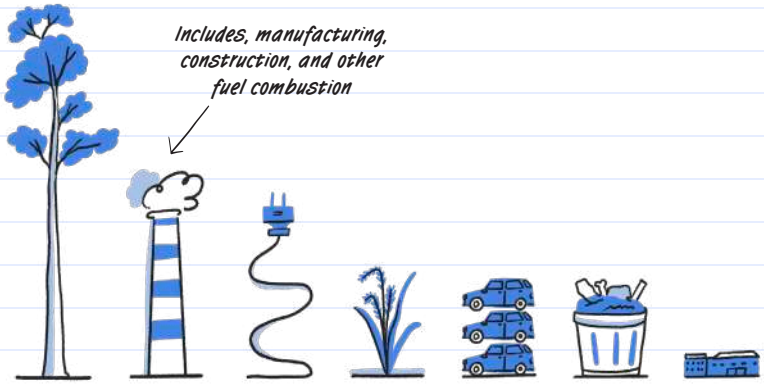
To do so, we have kickstarted several good initiatives in committing to reducing emissions through global cooperation. Agreements like the **Paris Agreement** and international meetings like **United Nations Climate Change conference (COP)** have brought countries together to pledge reductions and take action against climate change. These agreements are a great start, but there's still a lot of work to be done.

As we have mentioned in sub-chapter 1.2, countries like the United States, the EU, and China have been responsible for a big chunk of emissions since the Industrial Revolution, so they have a special role to play. They also have the knowledge and resources to understand where emissions are coming from and how to reduce them effectively. Developing countries like Indonesia and Brazil have lots of talent and resources.

By investing in green technologies, combining the financial resources and technological know-how of industrialized nations with the talent and resources of developing countries, we can speed up global efforts to reduce emissions and move towards a sustainable future. It's not about getting to half-zero or quarter-zero; we need to aim for net zero to effectively combat climate change and protect our planet for future generations.


ZERO
OUT
EMISSIONS

In sub-chapter 1.3 “What is Net Zero,” we briefly discussed Indonesia’s big problem with emissions and which sectors contribute the most. Here’s a quick recap:



In this section, we’ll deep dive on how to decarbonize them and achieve Net Zero for each sectors

First part, we’ll discuss about the sectors that are closely related to our daily activities: **Electricity, Transportation, and Waste.**

Second part, we’ll talk about sectors that emit a lot in Indonesia in the green space: **Nature** (or in professional world – they call it FOLU, Forestry and Other Land Use) and **Food/Agriculture**.

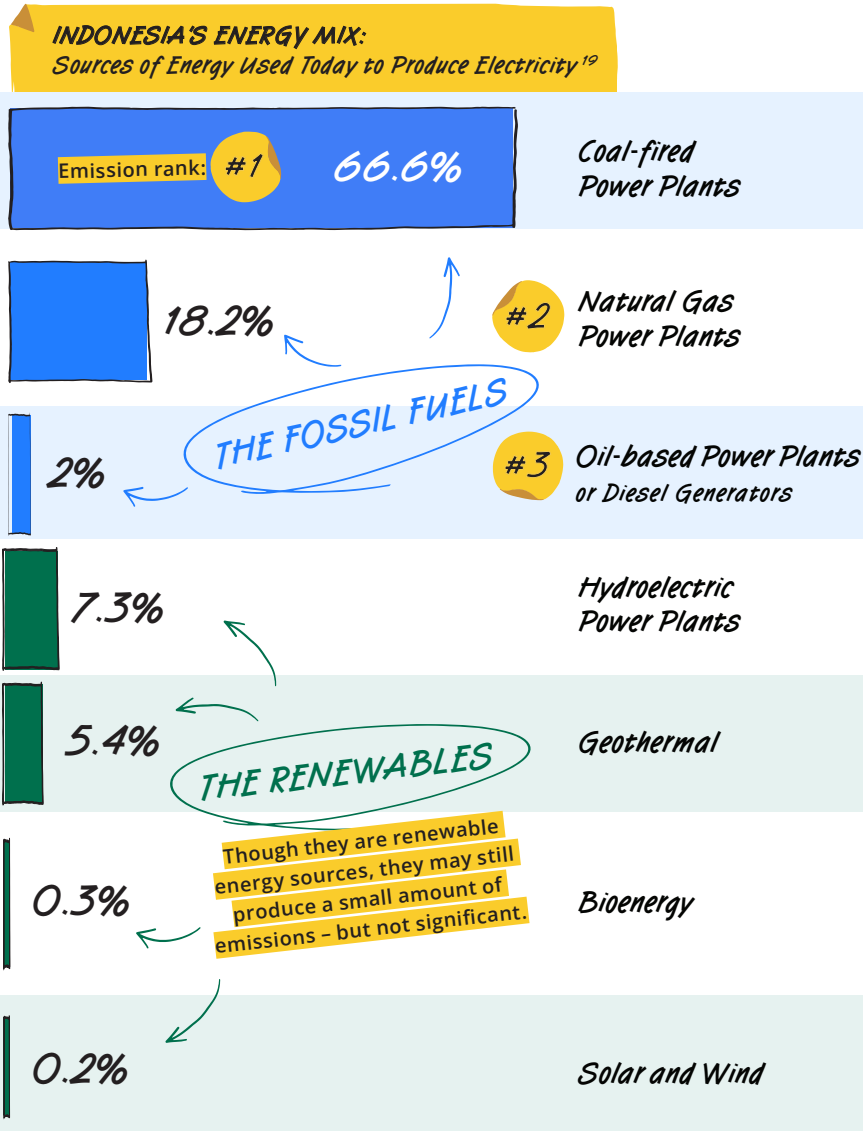
Lastly, we’ll cover **Industry** and **Building**. These two sectors are closely connected with other sectors, especially Electricity

By breaking it down this way, we can better understand and address each sector’s role in achieving Net Zero.

2.1 ZERO OUT ELECTRICITY

CONTEXT: WHAT DRIVES EMISSIONS IN ELECTRICITY?

Electricity generation is a major source of emissions in Indonesia. The country relies heavily on coal, natural gas, and oil for its power, which contributes significantly to greenhouse gas emissions.



Note: The energy mix is expressed in terms of the percentage of total electricity generated. Total energy generated is usually expressed in Gigawatt Hours (GWh).

Solar and wind are intermittent renewable energy sources, which needs to be coupled with battery in order to be reliable and highly dispatchable.

Indonesia relies on coal fired power plant for electricity. It is still the **cheapest**, highly dispatchable and reliable electricity source due to abundance of coal in Indonesia.

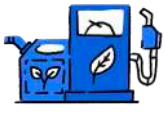
Significant emissions but less than coal. Indonesia operates gas-fired power plants that acts as **one of the most stable electricity sources**. Indonesia also has extensive gas reserves; so, it is reliable and relatively cheap.

Used in remote areas (usually for industry operations) and used in the city during peak demand – as it is flexible and **serves as decentralized solution**. High emissions.

High potential in Indonesia as we have a lot of moving water to be leveraged as hydroelectric power from dams and rivers, especially in regions like **Sumatra** and **Sulawesi**.

Geothermal energy, sourced from heat of Indonesia's volcanic activity, particularly in areas like **Java and Bali**. Indonesia has the 2nd highest geothermal potential of the world.

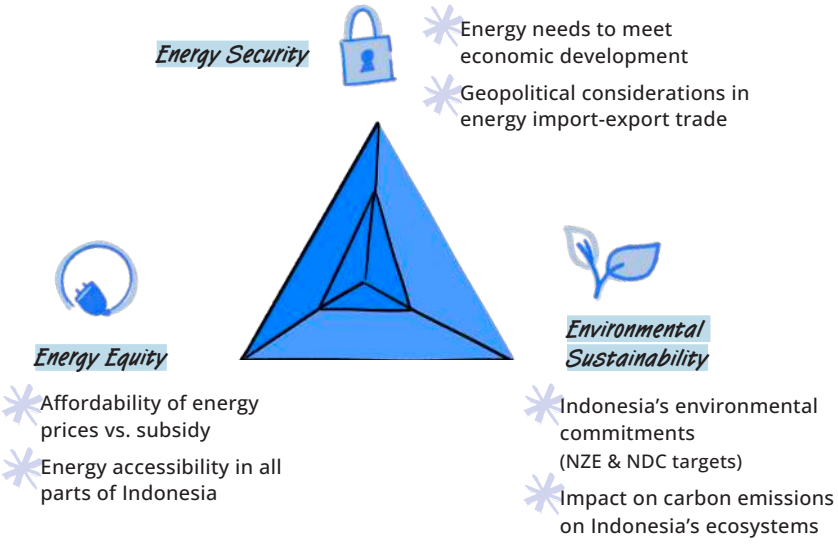
Efforts to use bioenergy are increasing in Indonesia. Biomass, including agricultural residues and municipal waste, is increasingly used for co-firing in coal power plants. Biodiesel, primarily derived from palm oil, is mandated by the Indonesian government to be blended at 30% with diesel fuel to produce B30.



Solar photovoltaic (PV) panels are being increasingly deployed in Indonesia. Indonesia has a decent irradiation potential as we are located at the equator of earth. Wind is also a potential source especially in high wind speed areas.

INDONESIA'S CHALLENGE: ENERGY TRILEMMA

Indonesia faces three-pronged challenges when it comes to its electricity needs, we call it energy trilemma. Balancing the energy trilemma had proven to be difficult, even in developed countries.



ENERGY SECURITY: Keeping the lights on and the economy running smoothly. Think about how important it is to have electricity at school for computers and lights, or at home for cooking and heating. It is so fundamental to our everyday life.

Did you know?

#1 Indonesia's challenge: High population, spread across its 17,000 islands. The interconnectedness between the main islands is critical to strengthen the resilience and reliability of the national electricity grid, ensuring more consistent and secure power distribution across the archipelago. Alas, we also need diverse energy solutions to ensure everyone is served.

#2 The System Average Interruption Duration Index (SAIDI) measures how long we experience power outages annually. In 2019, Indonesia's SAIDI was 2.8 hours, higher than Malaysia (0.5 hours) and Singapore (0.06 hours). Compared to neighboring countries, our electricity reliability needs improvement.

ENERGY EQUITY: Making sure everyone can afford and access energy. Consider how challenging it would be for families in remote areas without reliable electricity to study at night or keep food fresh.

Did you know? Indonesia's cost of electricity is considered to be relatively cheap (rank #91) compared to other countries around the world, and we currently have a negative carbon price! (It subsidizes fossil fuels more than it supports renewable solutions) when the world is moving towards a high positive carbon price.

ENVIRONMENTAL SUSTAINABILITY: Protecting our environment by reducing pollution and carbon emissions. Indonesia is committed to growing the economy with environmental sustainability in mind by taking it into the heart of electricity planning, committing to achieve Net Zero by 2060.

Solutions: What's the fix?

So what do we do about it? Players in the electricity sector are committed to support Indonesia's government commitment to achieve Net Zero in 2060 considering four key enablers, and they are: technology, financing, people, and policy. In this section, we will be zooming in on technology part!

Method	Solutions	Indonesia's Edge
Changing of technology sources of electricity generation	Geothermal, Solar and Wind (+battery), Bioenergy, and Nuclear (long-term)	**Abundance of renewable energy potential** Indonesia has ~3,686 GW (we currently only use 81 GW, so we have 45x the size of our needs!) of renewable energy potential spread across the archipelago.
Still using fossil fuels but netted off by Carbon Capture technologies	Carbon Capture, Utilization, and Storage (CCUS)	**Huge storage capacity** Indonesia has abundant of reservoir from oil and gas to put and inject our carbon emissions into. We'll deep dive this in sub chapter Zero Out Industry.
Policy Support	Renewable energy incentives, carbon tax, reduction of fossil fuel subsidy	**Government support** The government has supported the transition with policies that incentivize renewable energy adoption and disincentivize the usage of fossil fuels.

A DIFFERENT RENEWABLE ENERGY PATHWAY FOR INDONESIA

Indonesia has only unlocked **2.2%** of its total potential energy capacity!

UNDERUTILIZED RENEWABLE POTENTIAL

Geothermal	*Hydropower*	*Solar*
Current: 2.3 GW Potential: 22 GW	Current: 5.2 GW Potential: 65 GW	Current: 0.1 GW Potential: 265 GW
Biomass	***Wind***	**Current overall capacity is only 2.2% of potential capacity**
Current: 0.1 GW Potential: 34 GW	Current: 1.9 GW Potential: 44 GW	

GET TO KNOW GEOTHERMAL ENERGY

Indonesia has a lot of volcanoes, which means there's a lot of heat beneath the ground. Indonesia is the 2nd highest geothermal potential of the world. Geothermal power plants tap into this heat to produce steam, which then drives turbines to generate electricity. This method is especially useful in volcanic regions. Unlike solar and wind power, geothermal energy can produce constant electricity because it's not affected by weather or time of day.

INDONESIA'S FLAGSHIP PROJECT:
SARULLA GEOTHERMAL POWER PLANT 330 MW

This power plant in North Sumatra is **one of the largest in the world**. It uses the Earth's natural heat to produce electricity, making use of Indonesia's volcanic activity.

PLANT TYPE: Geothermal powerplant
LOCATION: North Sumatra
OUTPUT: 330MW
EST. INVESTMENT: $1.7bn

Image courtesy of INPEX Corporation

POTENTIAL GEOTHERMAL LOCATION IN INDONESIA

Source: Geology Department of Indonesia, MEMR Publications

+ ADVANTAGES

- Renewable
- Uninterrupted power generation
- Small footprint
- Clean

– DISADVANTAGES

- High installation cost — Finding the best spots to tap into geothermal energy and drilling down to access the heat is very expensive
- Not all sites are suitable, there are environmental concerns: might trigger earthquakes or land sinking, release toxic gases, so it needs to be **managed carefully**

Your turn to act: What can you do?

Turn off lights and appliances when not in use.

Reduces electricity consumption and lowers carbon emissions.

Advocate for renewable energy policies and incentives.

Supporting policies leads to systemic changes.

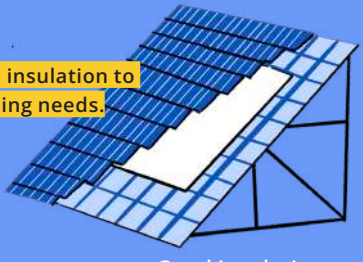
Use LED lights, smart appliances, and water-saving showerheads/ faucets.

Encouraging energy-saving habits and using efficient technologies (e.g., LED bulb instead of filament) can significantly reduce emissions. Conserving water reduces energy needed for water supply.

Choose energy-efficient appliances and avoid leaving them on standby.

Energy-efficient appliances use less power.

Improve home insulation to reduce cooling needs.



Good insulation reduces the need for heating and cooling.

Support renewable energy by installing solar panels if possible.

Solar panels generate clean energy.

Once upon a time in the past...

THE FIRST POWER PLANT

Did you know the story of electricity in Indonesia began way back in 1897 during the Dutch colonial era? Imagine this: the first power plant was built in Gambir, Jakarta, which was then called Batavia. This plant could generate 7,500 kilowatts (kW) of electricity, mostly used for street lights and the homes of important colonial officials.

The power plant used coal to generate steam, which then drove turbines to produce electricity. This was common back then because coal was abundant and could produce a lot of energy. But Indonesia didn't just stick with coal for long. By 1908, we had our first renewable power plant, the Rasak Bungo Hydro-electric Power Plant, which used the power of strong river flows to generate electricity. Pretty cool, right?

THE FIRST FACTORY TO USE ELECTRICITY

Here's a fun fact: After the first power plant was up and running, factories quickly started to use electricity too. The very first one was a sugar factory in East Java, established in 1900. Imagine how much faster and more efficient production became with electric power running the machines. It was a game-changer!

Soon, other factories like textile mills, rubber processing plants, and oil refineries adopted electricity. This allowed them to operate continuously and produce goods on a larger scale, which was great for both local and international markets. The efficiency brought by electric machinery boosted industrial growth and innovation.

THE ESTABLISHMENT OF PLN

Let's talk about how our national electricity company, Perusahaan Listrik Negara (PLN), came to be. During the Dutch colonial era, the Nederlandsch-Indische Electriciteits Maatschappij (N.V. N.I.E.M.) was the main player in introducing and expanding electricity services in urban centers like Batavia (now Jakarta).

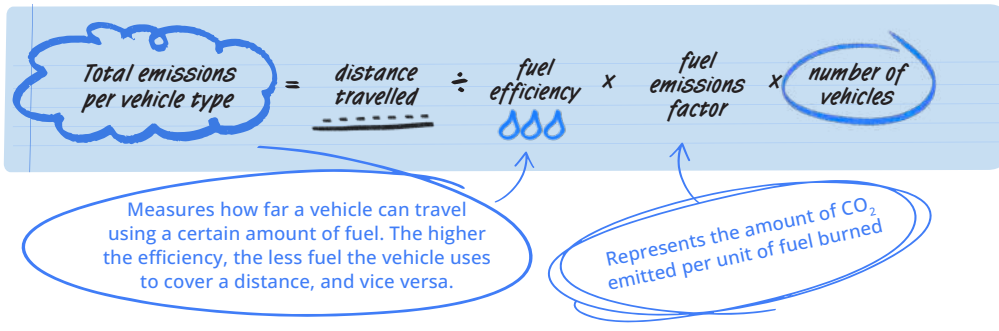
After Indonesia declared independence on August 17, 1945, we needed a way to manage our electricity infrastructure. So, on October 27, 1945, PLN was established. In the beginning, PLN faced many challenges, like limited resources and damaged infrastructure from the war for independence. But despite these difficulties, they worked hard to rebuild and expand the electricity network.

Today, PLN supplies power to over 89 million customers across Indonesia. Thanks to their efforts, nearly every household in the country now has access to electricity, a huge leap from just 40% in the 1970s.

2.2 ZERO OUT TRANSPORTATION

CONTEXT: WHAT DRIVES EMISSIONS IN TRANSPORTATION?

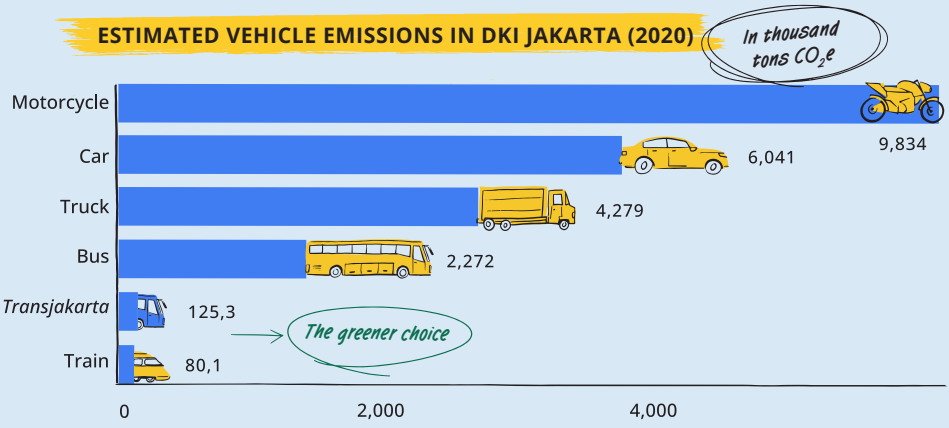
Indonesia, being the largest archipelago in the world, relies on all kinds of transportation: planes, ships, cars, and motorcycles. To understand which type of vehicle is most emissive in Indonesia, check out the equation below.



The large number of people in Indonesia contributes to the large number of private vehicles (cars and motorcycles). This is why these vehicle types produce most of the CO_2 emissions in the transport sector.

This is aligned with a study conducted by Greenpeace in 2022[20] on transportation emissions in Jakarta, where cars and motorcycles are the main culprits, followed by trucks, buses, leaving train as the "greenest' mode of transport.

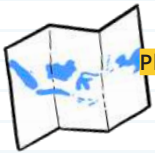
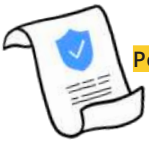
In this section, we will focus mainly on road transportation for passengers.



Emission rank:		Stats to back this up:
#1	**Cars and motorcycles**	Indonesia has highest passenger car and motorcycle consumption in Southeast Asia[21] - predominantly gasoline cars and motorcycles.	20 million cars[22] and 125 million motorcycles in Indonesia[23]
#2	**Trucks and buses**	In Indonesia, the majority of buses and trucks are still powered by diesel, a more emissive fuel than gasoline, despite the gradual integration of electric vehicles. Conventional buses and trucks can carry more passengers and cargo than cars and motorcycles, making them useful in busy areas.	5 million trucks registered with the Indonesian police[24] ~260,000 buses all over the country[25]
#3	**Trains**	Trains usually produce fewer emissions than other types of transport, even when they use coal. This is because trains are very efficient at moving lots of people or heavy goods in one trip, which means they use less fuel per passenger or ton of cargo. This makes trains a cleaner option overall, even if they run on coal[26]	Jakarta-Bandung high-speed railway, known as Whoosh, serves approximately 31,000 passengers per day with 68 trips, which translates to about 456 passengers per trip on average[27]

We have been rolling with our usual cars and bikes for as long as we can remember, but it's time to switch things up for a greener future. Gas-guzzling vehicles are major pollution culprits. **By going for other alternative travel choices, we can help save the planet.** But before we look into the solutions for Indonesia, that let's share some transportation in Indonesia facts to get you to understand the landscape.

Indonesia's Landscape: Setting the Stage for Solutions

Category	Hard Facts Revealed
 Place	• Indonesia is the biggest archipelago in the world, with a total land area of ~1.9 million km. Different modes of transportation are always needed
 People	• Indonesia has the biggest private vehicle population in SEA, due to consumer behavior (that is also strengthened by a lack of public transportation)
 Policy	• Indonesia's public transportation options are limited compared to other countries • Most transportation fuels are imported and subsidized

Solutions: What's the fix?

First, let's talk about the most common technologies aimed to zero out transportation we see around the world.

Method	Solutions	Indonesia's Edge
Changing technology of transportation mode	EVs	**Nickel and government support** Indonesia has a significant advantage in electric vehicle production due to its large nickel reserves, essential for battery manufacturing[28]. This advantage can be further maximized with sustainable mining practices and proper disposal of batteries. Additionally, the Indonesian government is offering tax breaks and cash incentives to make EV cars and motorcycles more affordable. This is to help with speeding up their adoption.
	Hybrid	**Manufacturing footprint** Indonesia's established automotive manufacturing footprint supports the production of hybrid vehicles efficiently.
	Hydrogen vehicles	**Piped gas infra** The existing piped gas infrastructure in Indonesia provides a foundation for hydrogen vehicle development, especially for vehicles located around industrial areas and refineries.
Changing fuel	Biofuel	**Waste** Indonesia can leverage its abundant source of agricultural waste and other biomass for biofuel production
Changing transportation mode altogether	Public transportation (As an alternative to private vehicles)	**Government policy push** The Indonesian government is actively pushing for improved public transportation systems, with recent push is implemented in the new capital city (IKN) where officials are required to use public transportation instead of receiving official cars.[29]
	Trains (as an alternative to planes)	**Government policy push** Government policies in Indonesia promote trains as a lower-emission alternative to domestic flights through providing subsidy for selected routes.

ZOOM IN ON ELECTRIC VEHICLES

An ICE, or Internal Combustion Engine, is the type of engine used in most cars we see on the road — These typical cars run on gasoline or diesel fuel. When you fill up the tank with gas, the fuel gets burned inside the engine to create energy, which makes the car move. However, burning fuel produces exhaust gases, like carbon dioxide, which can be harmful to the environment.

In contrast, EVs (electric vehicles) and hydrogen vehicles are much cleaner options — An EV runs on electricity stored in a big battery that you charge by plugging it into an outlet, so it doesn't produce any harmful exhaust gases. Hydrogen vehicles use hydrogen gas as fuel. Inside the car, a special engine called a fuel cell mixes hydrogen with oxygen from the air to create electricity, powering the car with only water vapor as the byproduct. Both EVs and hydrogen vehicles are much better for the environment compared to traditional ICE cars.

However, EVs have seen much faster global growth compared to hydrogen vehicles — In 2023, global sales of electric cars nearly reached 14 million, a 35% increase from the previous year, driven by strong policy support, falling battery prices, and increased consumer demand, particularly in China, Europe, and the United States.[30] Conversely, hydrogen vehicles face challenges such as high production costs and the need for extensive new infrastructure, which have slowed their market uptake compared to EVs.[31]

HOW THE GOVERNMENT AND PRIVATE SECTOR COLLABORATE TO DOUBLE DOWN ON EVs

How Chinese EV companies have flourished[32]

On aggregate, Chinese EV companies produce the most EV companies, with BYD leading the way (surprising, given Tesla is a bigger headliner). This is because the Chinese government has supported the EV technology by generous policies to boost both supply and demand so that it becomes more affordable for the consumer to buy, and therefore become mainstream.

How has Thailand government done this?

Different from China, Thailand doesn't try to reinvent the wheel by trying to create local EV manufacturers to provide supply. Instead, Thailand attracts existing Chinese EV manufacturers to build factories in the country to provide supply. If they have built factories, or have a plan to, the EV product is then eligible for financial incentives that make it cheaper for the consumer to buy.

Electric vehicles (EVs) are great for the environment, but there are some challenges. Most of Indonesia's electricity still comes from fossil fuels, which reduces the benefits of EVs. Despite this, EVs still produce fewer emissions than regular cars. For example, in Indonesia, electric cars and motorcycles emit about 47% and 26% less,[33] respectively, compared to gasoline ones. As Indonesia switches to cleaner energy sources, these emission reductions will get even better.

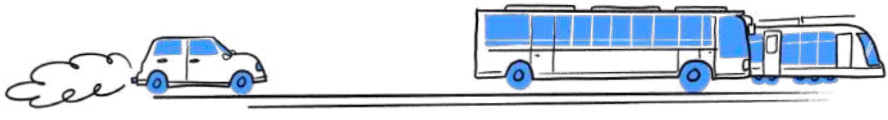
Another challenge is that there aren't enough charging stations yet, especially outside Java. This makes it hard for people to charge their EVs, leading to range anxiety (the worry that your EV might run out of battery power before you can find a charging station). But as more people start using EVs, more charging stations will be set up.

The Indonesian government is encouraging more people to use EV cars and motorcycles by offering financial incentives, similar to what China and Thailand have done. This has led to a steady increase in EV car sales, which were over 25% higher compared to last year, as of May 2024.[34] Many major car companies are also planning to build EVs in Indonesia, providing more options, boosting local production, and help develop the EV ecosystem.

TRANSPORTATION MODE CHANGE

In Indonesia, shifting from private cars to public transport is key to managing growing travel needs, especially since many people lack access to biofuels or electric vehicles. Public transit like buses is more affordable and eco-friendly compared to private cars.

Countries like Thailand, Hong Kong, and India are improving their public transport systems by investing in buses and trains. Indonesia is facing challenges like limited infrastructure and a preference for private cars, but efforts are underway with new projects and fare subsidies. **Learning from these global examples and involving private companies could make public transport a better option for everyone.**

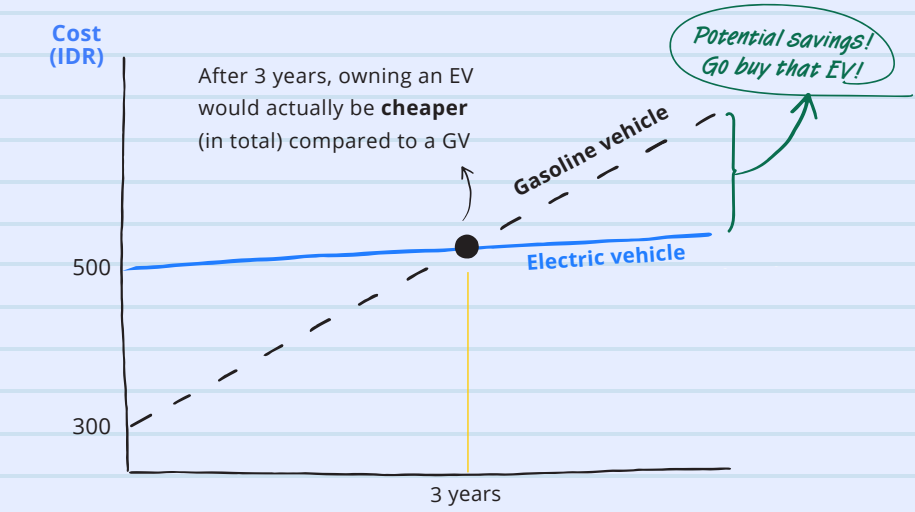


Your turn to act: What can you do?

Switching to electric vehicles (EVs) can save you money over time, even though they might cost more upfront. Government incentives can help cover some of the initial costs, and you'll save on things like gasoline, maintenance, and taxes. The graph shows that you can start saving money within 3 years of owning an EV compared to a regular gasoline car.

GASOLINE VEHICLE VS ELECTRIC VEHICLE

Which one is cheaper in the long run?



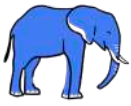
Actions	Why
Use more public transportation, whenever possible, wherever available	Using public transportation! When we share rides with others, there are fewer cars on the road, which means less pollution and cleaner air. Plus, **using public transportation can be fun and help you meet new people!** If there aren't enough buses or trains where you live, you can talk to your community leaders. Tell them why it's important to have more public transportation. Your voice can help make a difference!
Use trains vs airplanes, whenever possible	Trains are better for the environment than airplanes because they **move more people or goods with less fuel** and often use cleaner electricity, while airplanes burn a lot of fuel and are less efficient. Train rides can also be more comfortable and convenient: you can enjoy the scenery outside your window and train stations are usually closer to home than airports.
Offset the emissions you can't avoid	Carbon offsetting means **balancing out your pollution by supporting environmental projects**. For example, if you need to fly, you can use frequent flyer miles to fund activities like mangrove planting. Garuda Indonesia offers this option through a partnership with Jejakin, allowing you to use your miles to help reduce carbon emissions.

2.3 ZERO OUT WASTE

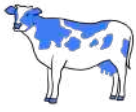
CONTEXT: WHAT DRIVES EMISSIONS IN WASTE?

Improper waste treatment accounts for **9%** in Indonesia in 2020. Here are some realities that give you a sense of the scale of waste management challenges we are facing in Indonesia:

• Municipal waste (coming from household and industries) in urban areas is seeing growth 9% every year



• Every day, Jakarta province alone sent 7,000 tons of waste (equivalent to 2,000-3,000 *Sumateran elephants*!) to the Bantargebang landfill



• 8.3 billion tonnes (1 tonne equals to 2 to 3 cows, now imagine 16 to 25 billions cows worth of plastics...) is the total amount of plastic ever made, half of which has been produced in the last 13 years

• Indonesia is dubbed as the 2nd biggest plastic polluter[35] to the ocean after China, given its long coastal lines and waterways which are the main sources of plastics getting into the ocean

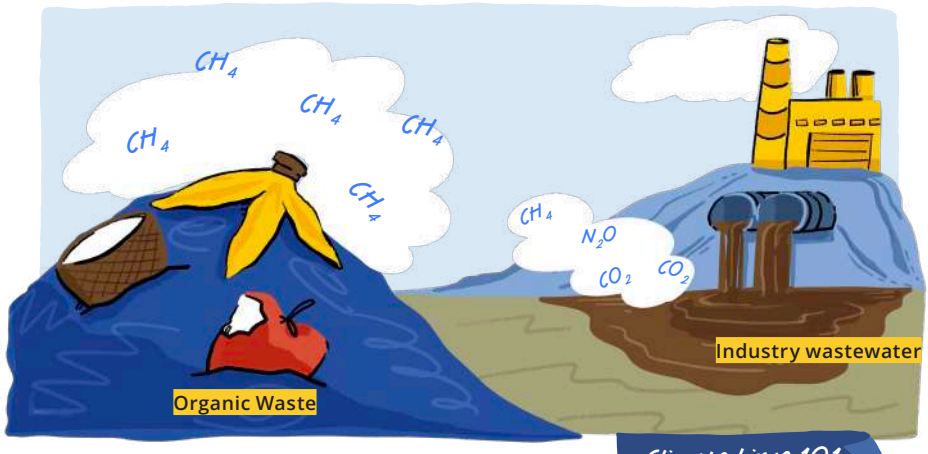
In Indonesia, we classify the emissions from waste as emissions from solid waste and wastewater.

Category	Total GHG Emission (million ton CO_2/year)	Portion of Total Waste Emission (%)
Industrial Waste - Wastewater from Factories	60	46
Household Waste - Unmanaged Garbage Dumps	39	30
Household Waste - Wastewater from Homes	25	19
Burning Trash! - Open Burning of Waste	5	4
Small Emissions (< 0.1%)	1	1
Total	130	100

Note: Small emissions include Industrial Solid Waste Handling, Managed Industrial Garbage Dumps, Composting Industrial and Domestic Waste Source: GHG Inventory Report, KLHK, 2024

But how? How does waste generate emissions in the first place?

If solid organic waste is managed improperly, it generates methane when it decomposes. In liquid waste like wastewater, it produces methane and nitrous oxide when organic waste breaks down without oxygen, and carbon dioxide from the energy used in treatment.



Climate Lingo 101

Waste is often grouped into two main categories

Waste

Most waste come in this form

Liquid

e.g. wastewater, sewage, industrial effluents, and oil spills

Solid

e.g. household trash, packaging materials, and electronics

Based on the origin of material

Organic

e.g. food scraps and garden clippings, produces methane

Releases methane, a potent greenhouse gas, when organic waste breaks down in open landfills. Without proper management, this methane can lead to significant harmful emissions.

Inorganic

e.g. plastics, metals, and electronics

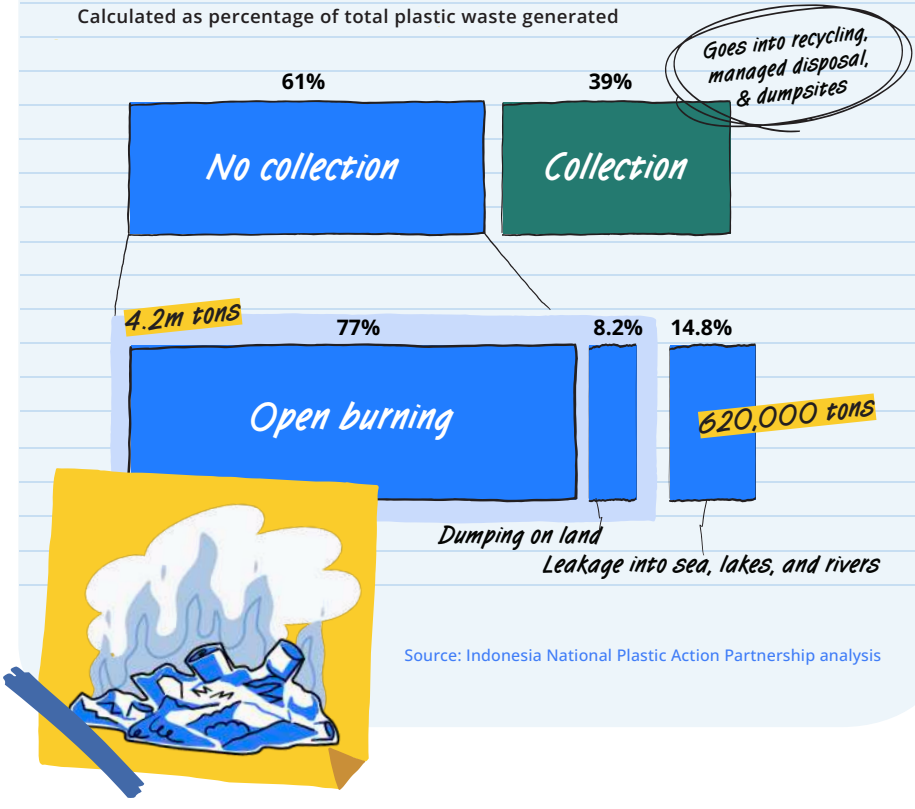
Can last over 500 years and can contain toxic chemicals. While not emitting gases directly, it occupies landfill space, leading to more landfills and associated emissions. Burning inorganic waste also emits CO_2, N_2O, and methane

ZOOM IN ON PLASTIC WASTE

Based on World Economic Forum report, Indonesia generates 6.8 million tonnes of plastic wastes (equivalent to ~14-21 million cows) each year, growing by 5% each year. However, only 39% of plastic waste is collected, while the remaining 61% is not. Most of this uncollected plastic waste ends up being openly burned or dumped on land and in waterways.

WHERE INDONESIA'S PLASTIC WASTE ENDS UP TODAY?

Calculated as percentage of total plastic waste generated



Source: Indonesia National Plastic Action Partnership analysis

WHY IS IT CHALLENGING TO IMPLEMENT A PROPER WASTE MANAGEMENT SYSTEM IN INDONESIA?

In Indonesia, we face several challenges in properly managing our waste. Here are some of the key issues:

1. IN INDONESIA, WE HAVE A BIG PROBLEM WITH COLLECTING AND SEPARATING OUR TRASH

Even though there are rules that tell people to sort their waste, these rules are not enforced. So, people still mix all their waste together, making it hard and expensive to process.

2. OUR WASTE MANAGEMENT SYSTEM IS VERY SCATTERED AND NOT WELL-ORGANIZED

Because of this, very little of our recyclable waste actually gets recycled. For example, in Bali, only about 4% of waste is recycled. The rest ends up in landfills, pollutes the environment, or is burned.

Case in point: Bali's Waste Management Stats

(Managed) *(Unmanaged)*

RECYCLABLES	RESIDUAL WASTE	MIXED WASTE		
Only 4% is managed, sorted in Bali's village waste center	44% Sent to landfills	22% Open dumping	19% Open air burning	11% Dumped in waterways

Source: Bali Partnership Study (2019)

3. MANAGING WASTE IN INDONESIA HAS BEEN REALLY TOUGH

More than 70% of TPS3R centers (small village-level waste centers) and 40% of TPST centers (larger waste centers) are abandoned or not working because they don't have enough funding. Most of our trash is collected and processed by informal workers, not official services.

4. OUR LANDFILLS ARE OVERFLOWING AND IN BAD SHAPE

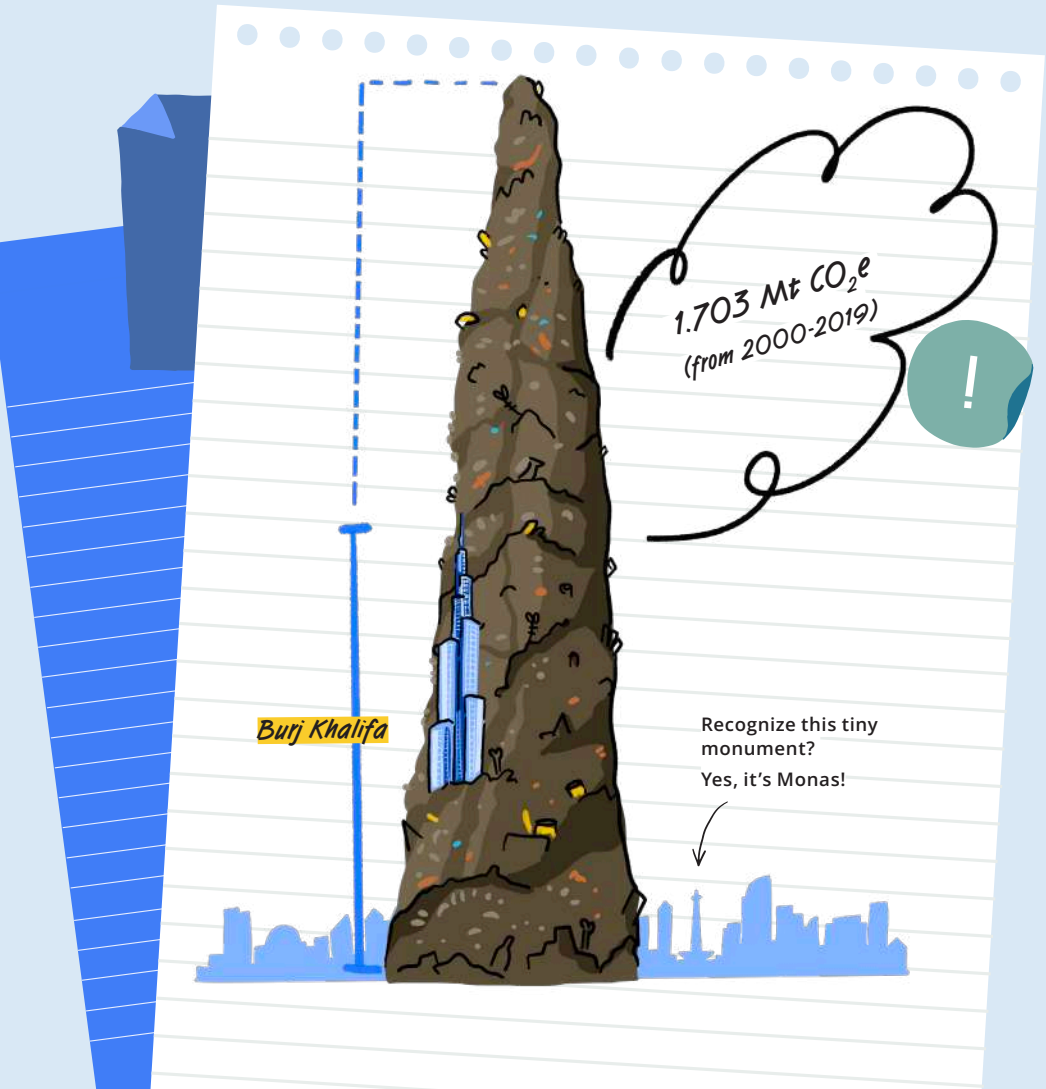
It causes pollution in the groundwater and releases methane gas. In 2018, there were still 167 open dumps, even though the goal was to close them by 2013. By 2023, around 1.2 million informal waste pickers were still scavenging at these dumps, often in unsafe conditions with no protection.

TRASH TALK:
Food Edition!

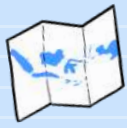
Let's talk about **food loss and food waste**. Food loss occurs before it reaches us, while food waste is what we throw away. According to Kompas, if all food waste in Jakarta were stacked, it would be 14 times taller than Monas and even exceed the Burj Khalifa![36]

This results in huge methane emissions—**1.703 Mt CO_2e** from 2000-2019, as noted by BAPPENAS.[37]

Food waste not only harms the environment but also contributes to the food crisis by squandering resources like water, energy, and labor. Nationally, food waste costs Indonesia up to IDR 551 trillion annually, affecting both the environment and the economy.



Indonesia's Landscape: Setting the Stage for Solutions

Category	Hard Facts Revealed
 Place	Because Indonesia has plenty of natural resources, there might not be as much pressure to recycle or reuse materials. This is because getting new resources is often easier and cheaper.
 People	Waste from cities is increasing by 9% each year, driven by rapid economic growth
 Policy	In 2023, Indonesia has over 400 waste processing centers installed all over the country, with the capacity to handle 15.2 million tonnes of trash annually[38]

Although Indonesia faces significant challenges in its waste sector, the government is actively working on solutions. We can support these efforts by changing our lifestyles and advocating for better policies to help accelerate progress.

Solutions: What's the fix?

To tackle Indonesia's waste and environmental challenges, twofold methods are used: **Minimize Waste Generation** and **Better Waste Management.** The first part can be directly done by you and your community. By using our strengths and opportunities, we can reduce waste, boost recycling, and explore new ways to manage and use waste effectively.

Minimize Waste Generation

Solution	Indonesia's Edge
Encourage Recycling and Reuse	**Government support** Indonesia's Extended Producer Responsibility makes companies responsible for their products' entire life, from creation to recycling or disposal. The country also has national policy for integrating environmental education, including waste management, into the national education system. These policies can be continued and expanded to further recycling and reusing
Reduce consumption	**Young population** Indonesia has a potential to adopt new, sustainable lifestyles and practices more rapidly, given its large youth population.

Recycling is crucial for effective waste management, but it relies on a well-organized system that handles waste through its entire value chain. This is because waste management involves multiple steps from the moment waste is created until it is processed.

For instance, with municipal waste, the process starts with individuals **sorting their trash** at home. Next, the waste needs to be **separated during collection**, often using scheduled pickups for different types of waste. When the waste reaches processing centers, **organic materials are composted** and used as fertilizer for farmers, while **inorganic materials are recycled**. The complexity of this process highlights the importance of a fully integrated system to manage waste effectively.

Your role is to start by properly separating waste at the source and then help advocate for improvements in the entire waste management process!

Better Waste Management

Solution	Indonesia's Edge
Integrated Waste Systems	**International collaboration** Indonesia can leverage its strong relationships with countries that have advanced waste management systems, like Japan, through training programs and joint projects. Additionally, these countries can invest in building more integrated waste facilities in Indonesia.
Waste to Energy	**Growing economy** As Indonesia's economy grows, so does its energy demand. This increasing need makes it logical to convert waste materials into valuable resources like energy and fuel.
Composting	**Mature agriculture sector** Agriculture accounts for ~13% of Indonesia's GDP, underscoring its significance.[39] With high demand for natural fertilizers, composting—turning organic waste into nutrient-rich soil—can enhance soil fertility and reduce the need for synthetic fertilizers.

Learning time

LEARNING TIME:
INTEGRATED WASTE MANAGEMENT IN JAPAN

In the 1990s, Japan had a big problem with running out of space for landfills, so they completely changed how they handle waste. The government made local areas responsible for all their waste, from picking it up to getting rid of it, and told everyone to start sorting their trash. They also introduced a "pay-as-you-throw" system, where people paid based on how much waste they produced, and gave money to help with composting and recycling.

This new approach got communities to follow the rules and the government made sure everyone did their part by enforcing strict penalties for improper disposal. Now, Japan sorts its waste into three main categories: burnable, non-burnable, and recyclable, with over 40 specific types. Because of these changes, **Japan now burns about 80% of its waste to create energy, recycles a lot, and only 1% ends up in landfills, making their system a great example of effective waste management**.

Your turn to act: What can you do?

Understanding that our resources—whether material or energy—are limited is key to using them wisely. When we use materials carefully, we also reduce the energy and resources needed to make them in the first place, which helps cut down on emissions throughout the production and supply chain.

On a personal level, we should choose products with less environmental impact, make the most of what we buy before throwing it away, and sort our waste properly to ensure it can be recycled or disposed of correctly. This means really practicing the "reduce, reuse, and recycle" principles in our daily lives.

As consumers, we have the power to choose products with better life cycles, meaning those that are designed to be reused, recycled, or disposed of responsibly. Waste management is also influenced by how manufacturers design their products. So if you work in a company where you have the power to redesign products to create less waste, that would be very impactful!

Details up next!

As consumers:

Reduce

Reduce consumption by planning meals to avoid food waste

Buying items in bulk to cut down on packaging

Using digital documents instead of printed ones,

Adopting a minimalist lifestyle focusing on quality over quantity.

Reuse

Use items multiple times before discarding them, e.g. include using a water tumbler instead of single-use plastic cups, replacing single-use plastic bags with reusable ones, and fixing broken items to extend their life.

Recycle

Compost food waste at home to create nutrient-rich soil

Collect recyclable materials like paper, plastic, and glass to send to recycling centers or go to waste banks for bottles!

Repurpose items like glass jars and old clothing.

As producers:

Reduce

Design products with minimal or no packaging that can be composted or recycled – e.g. some foods now use edible packaging made from seaweed, which reduces waste by being consumable along with the food

Reuse

Design products with packaging that can be reused

Recycle

Decompose organic waste in closed tanks to produce methane and compost, which can be used for power generation and fertilization, respectively.

Set up collection centres for consumers to drop off used packaging for recycling into new products.

As we discussed in the opening of Section 2, let's dive into the second part of this section. The elephant in the room is that Agriculture, Forestry, and Other Land Use (FOLU) make up **almost half (~44%)** of Indonesia's carbon emissions. We'll explore this topic in two sub-chapters: **"Double Down on Nature"** and **"Zero Out Agriculture."**

See the next page!

2.4 DOUBLE DOWN ON NATURE

CONTEXT: WHAT DRIVES EMISSIONS IN NATURE?

Our home is the **second** most biologically diverse country in the world, right after Brazil. We have almost 40% of the world's **tropical peatlands** (*lahan gambut*), which are crucial for storing carbon. Plus, we boast the largest **mangrove forests** globally, covering about 23% of the world's mangrove areas. These natural resources play a huge role in fighting climate change and protecting our environment.

Unfortunately, when we fail to protect these natural wonders, we face a double impact on climate change: the immediate release of stored CO_2 emissions and the loss of future carbon storage.

SUMATRAN PEAT SWAMP FOREST (PEATLANDS)

Image Courtesy of James Maiden, CIFOR

MANGROVES IN RAJA AMPAT, INDONESIA

Image Courtesy of The Ocean Agency / Ocean Image Bank

When a hectare of carbon-rich peatland is drained, it has roughly the same climate-warming effect of burning 6,000 gallons of gasoline.

Much of this biodiversity is under threat because of land use change.

These ecosystems are mainly destroyed for agriculture. When they are destroyed, we release the carbon they stored, increasing emissions, especially during dry years known as El Nino years.

Climate Lingo 101

Deforestation:

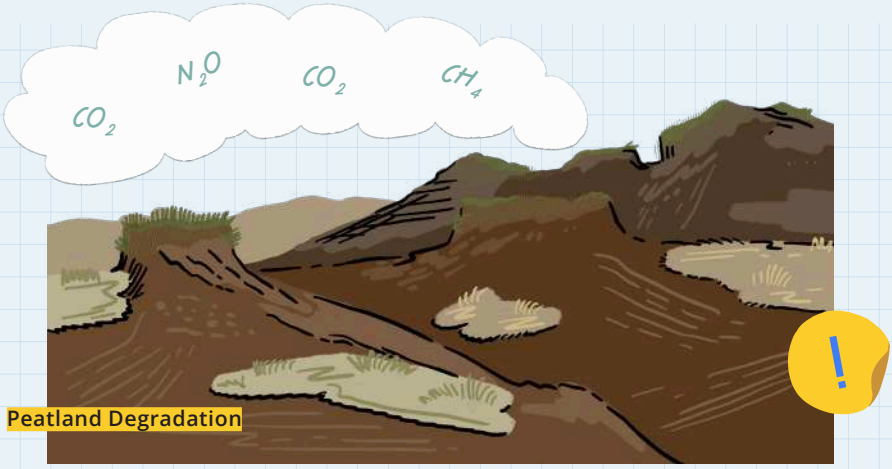
Forests are cleared entirely through multiple ways (e.g. cutting down all the trees) so the land can be used for other purposes like farming or raising animals.

Degradation:

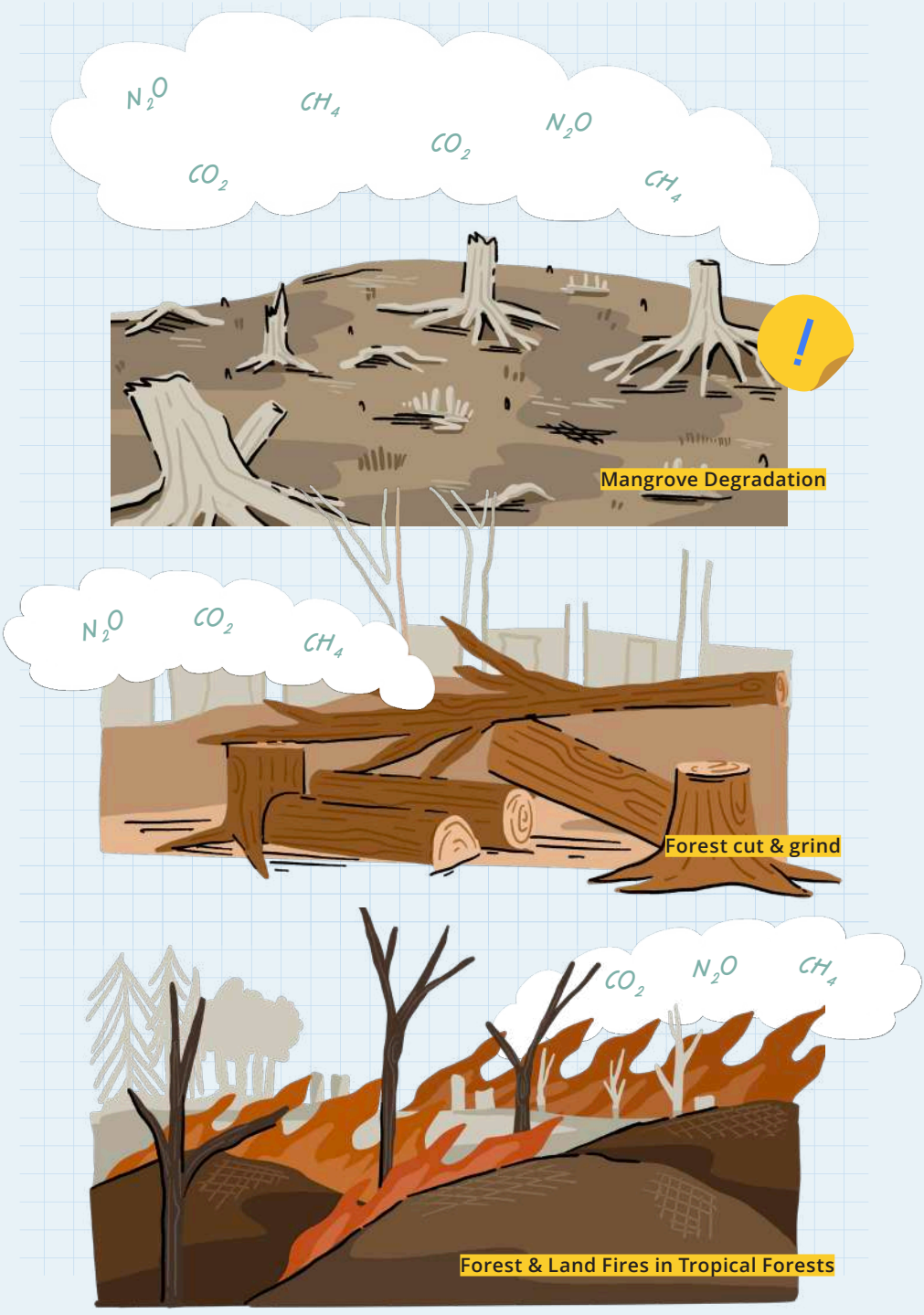
Damaging a forest by illegal or improper logging, which harms the trees, plants, and soil, leaving the area in poor condition.

Natural ecosystems, like forests and oceans, are key to absorbing and storing carbon, soaking up about 50% of the carbon emissions we produce. That's why they are called carbon sinks.

Some lands, especially peatlands and mangrove – when degraded, release even more greenhouse gases because they stored more carbon. Let's examine the types of deforestation that are the major contributors of forestry emissions.



Peatland Degradation


N_2O
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Mangrove Degradation
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Forest cut & grind
CO_2
N_2O
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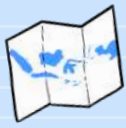
Forest & Land Fires in Tropical Forests

Main contributors of Indonesia's forestry emissions

Major Contributor to Forestry Emissions	Description	Stats to back this up
Degradation and fires of peatlands	Draining and turning peatlands for farmland releases a lot of greenhouse gases because these wetlands store lots of carbon in their waterlogged soil It also increases the risk of fires that release even more emissions	Around 5.65 million hectares of peatland, an area nearly twice the size of Belgium, are located outside protected areas. This degradation contributes to approximately 50% of Indonesia's forestry emissions[40]
Forest and Land Fires	Using fire to clear land and letting it spread releases a lot of greenhouse gases. The burning itself releases gases, and it also releases carbon stored in the trees. And again, without the trees, there's nothing to absorb carbon from the air in the future	During the intense fire seasons of 2015 and 2019, vast areas were burned due to land clearing practices. In 2015, around 2.6 million hectares were affected, and in 2019, the area burnt was about 1.65 million hectares. More than 100,000 people prematurely died (many from acute respiratory infections).[41] The economy suffered a loss of $16 billion.[42]
Forest Cut and Grind 	Cutting down all the trees in a forest to make space for plantations releases the carbon that was stored in the trees and means that the forest can't absorb carbon from the air in the future	Based on data from Global Forest Watch, non-fire related loss contributes majorly to Indonesia's primary forest loss, accounting for almost 75% compared to fire-related loss.[43]

Many people don't realize that protecting and restoring damaged ecosystems isn't just about reducing our vulnerability to climate change – it's also about using nature as our greatest ally in fighting it. Forestry sector is targeted to be the largest contribution to GHG emission reduction until 2030.

Indonesia's Landscape: Setting the Stage for Solutions

Category	Hard Facts Revealed
 Place	• Largest area of tropical peatlands and mangrove forests in the world • Third-largest tropical rainforests behind Brazil and Congo, Indonesia has 96 million hectares of natural forest remaining, representing 51.2% of the country's land mass. • Approximately 45.5% of the total peatlands area in Indonesia should be conserved. Only 15.6% of the peatlands in need of conservation measures are currently protected.[44]
 People	• 3rd highest per capita CO_2 emissions from deforestation for food production over the period from 2010 to 2014.
 Policy	• President Jokowi's moratorium on new palm oil licenses from 2018 to 2021, which decreased deforestation by 82% from 2018 to 2020.[45] • Omnibus Law on Job Creation (UUCK) now specifies a 100,000 ha limit for a new palm oil plantation

Indonesia is home to a huge forestry. Unfortunately, a lot of deforestation has damaged this rich nature. While the government has taken steps to address the problem and is continuing to work on it, there's still a lot more to be done to protect these valuable ecosystems.

Being blessed with natural wonders means we have a huge responsibility. As Spiderman's Uncle Ben said, "with great power comes great responsibility".

Protecting our vast tropical rainforests from threats such as deforestation, land use change is no easy task. Imagine trying to protect 120 million hectares of state forest – an area twice the size of France!

SOLUTIONS: WHAT'S THE FIX?

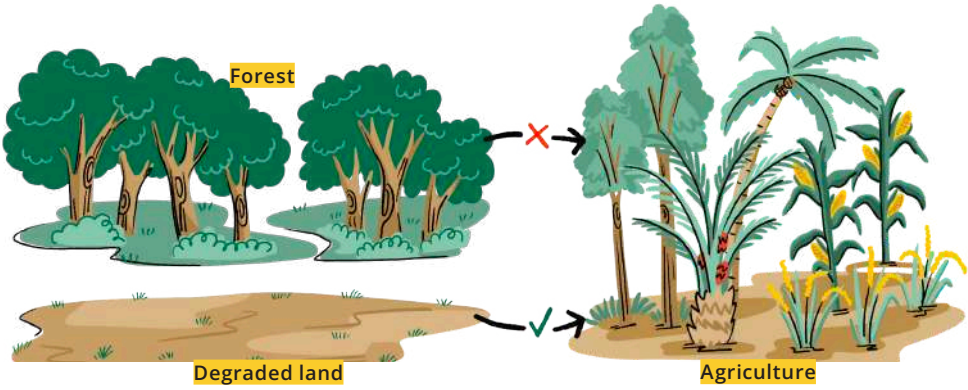
Considering the vastness of the Indonesian forest that needs protection to achieve its net-zero target (we call it *FOLU Net Sink 2030*), the solution must be large and systemic. Strong policies and their implementation are the best ways to make a big difference. We've made it simple for you by categorizing the methods into two main chunks: **Increasing natural carbon sinks & avoiding deforestation.** Let's uncover them!

Increasing natural carbon sinks

Solutions	Indonesia's edge
Restoration of degraded peatland and mangroves	**Government support** There's already an existing goal to restore 600,000 hectares by 2024. While setting this target helps drive government action, achieving it will require more effort. Therefore, extending the deadline may be necessary to ensure the goal is met effectively.
Strengthening of social forestry and indigenous forests (Hutan Adat): Communities participation	**Vast traditional forests** In Indonesia, there are 244 thousands hectares of Hutan Adat (traditional forests in Indonesia managed by local communities based on their cultural practices and heritage). These communities posses traditional knowledge and practices that are invaluable for sustainable resource management.
More Blue Carbon strategies: Ocean alkalinity enhancement	Ocean alkalinity enhancement is a **technique to help the ocean absorb more carbon dioxide** (CO_2) from the air. It involves adding substances like crushed limestone to the ocean, which makes the water more alkaline. This increased alkalinity allows the ocean to take in more CO_2 and helps combat the harmful effects of ocean acidification.

Avoiding deforestation

Solutions	Indonesia's edge
Expand Forest Protections (Especially peatlands and mangrove)	**Strong Basis for Collaboration** Indonesia have already had policies in place such as OneMap. This policy will help local governments, forest managers, policymakers, and even local citizens on forest watch in monitoring and improving data on deforestation. Couple of ways the laws and policies can be improved: • Protect more peatland areas that aren't already covered. • Include mangrove protection in local plans (provincial and district level) and ensure local government officers recognize mangroves as important ecosystems.
Improve better monitoring on site	**Digitalization** Important to strengthen policies with good implementation, in other words better monitoring and enforcement. The Indonesian government can use digital tools to track deforestation more effectively. By focusing on areas with high deforestation, these tools can provide detailed insights into what's changing and why. Regular updates on land and forest data each year will help monitor and understand these changes.
Alternative Land for Agriculture Activities	We'll cover this more in the next sub-chapter "Zero out Agriculture", but one idea is to **shift to degraded land**. The goal is to prevent deforestation by diverting agriculture activities (such as oil palm plantations) **away from forests** and on to already degraded areas.
Sustainable urbanization	**Rapid urban growth** Urban growth is fast, make sure that you implement good sustainable practices like removing trees completely from the ground, including its roots, and replant it elsewhere and increase the % of green space in urban development.



Your turn to act: What can you do?

FOOD FOR THOUGHT

Let's get more interactive here. Think about these questions below and jot down your ideas. Discuss with your friends, coworkers, and even advocate these issues through your platform!

What policies do we need?

1. Do your research, and think of this: Should there be new laws to protect our forests better?
2. How can we ensure transparency in giving out land concessions?

Cooperation Between Central and Local Government (Pemerintah Pusat & Pemda)

3. How can the central government work better with local governments to manage forests and land use?
4. What kind of support do local governments need from the central government?

Partnerships with Businesses and Communities

5. How can businesses help in the fight against deforestation and land degradation?
6. How to increase the participation of communities in protecting forests and their local environment?

2.5 ZERO OUT AGRICULTURE

In the previous section, we tackled the big issue of deforestation. We learnt that we're cutting down forests to grow more crops and raise more animals. As we dive deeper into agriculture, let's remember this link. Our challenge is to find ways to farm smarter and more sustainably so we don't have to keep chopping down our forests. This approach not only helps preserve our forests but also reduces carbon emissions, tackling climate change from multiple angles.

CONTEXT: WHAT DRIVES EMISSIONS IN AGRICULTURE?

Ever wondered about the impact of agriculture in Indonesia?

Interestingly, agriculture activities contribute to 10% of Indonesia's greenhouse gases, pumping out a whopping 2.31 billion tons of CO_2e from 2015 to 2021![46]

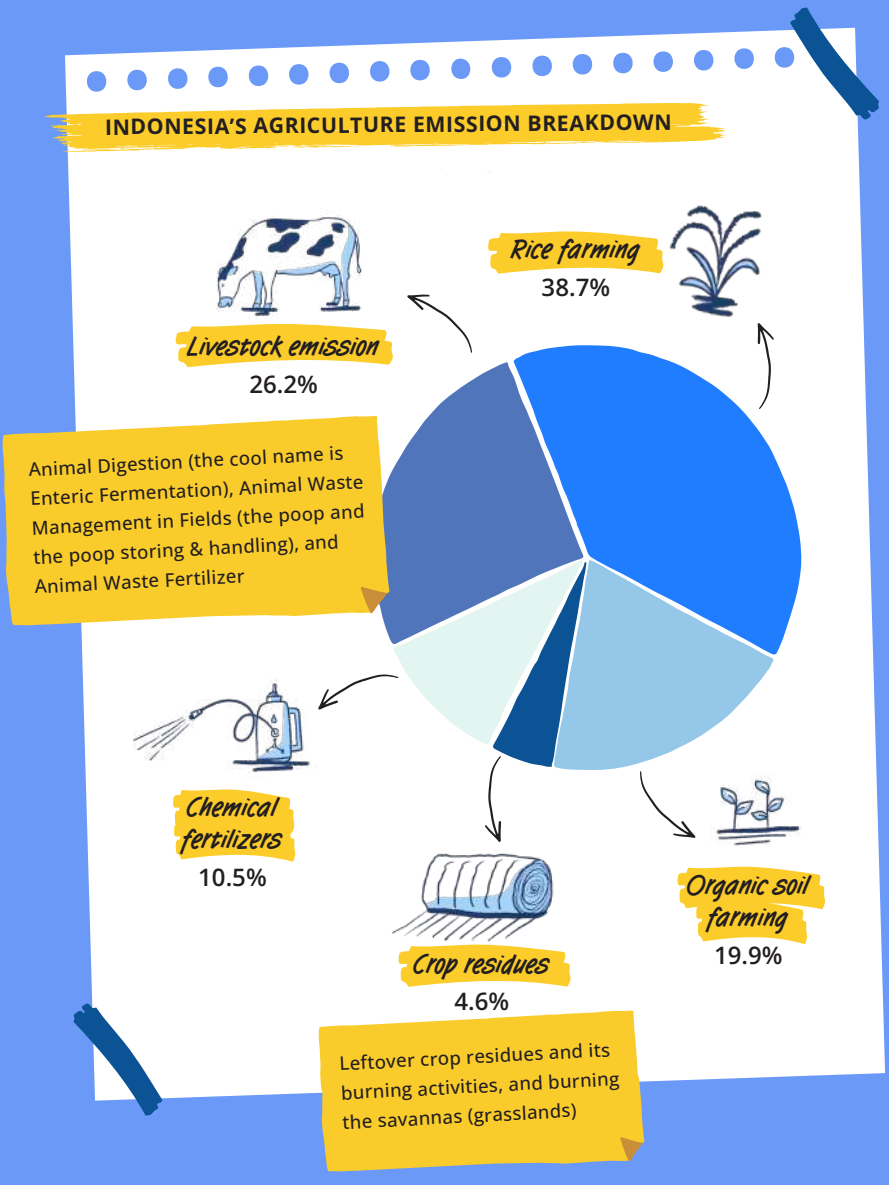
While it helps our economic development, our farms contribute 2.4% to the world's agricultural emissions.[47] That's a lot. We see that achieving net zero in the agricultural sector won't be an easy feat. While it's crucial to cut down emissions, we also have to make sure that everyone has enough to eat.

Undernutrition is still a big problem in the country. Though the stunting rates among children has decreased over the years, it still stood at 21.6% in 2022, which remains as a chronic public health problem for Indonesia.[48] Meanwhile, almost 70% of Indonesians can't afford to buy healthy food.[49] The agricultural sector also currently accounts for one-third of all employment in the country,[50] making it essential to support the livelihoods of those working in the industry.

In essence, finding a balance between reducing our carbon footprint and maintaining food security and job stability is key.

Balancing these needs makes it essential to pinpoint where emissions are coming from within the agricultural sector. Rice cultivation has the largest impact and share of 38.7%, followed by livestock emissions at 26.2%.[51]

INDONESIA'S AGRICULTURE EMISSION BREAKDOWN



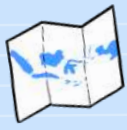
Source: Savelli, A.; Atieno, M.; Giles, J.; Santos, J.; Leyte, J.; Nguyen, N.V.B.; Koostanto, H.; Sulaeman, Y.; Doux-champs, S.; Grosjean, G. (2021) Climate-Smart Agriculture in Indonesia. CSA Country Profiles for Asia Series. Hanoi (Vietnam): The Alliance of Bioversity and CIAT; The World Bank Group 88 p. https://hdl.handle.net/10568/114898

We've compiled the top contributors to GHG emissions in this sector.

Contributor	Description	Stats to back this up
#1 Rice Farming - Cultivation	When rice fields are flooded, microbes break down organic matter in the waterlogged soil, producing methane, a potent greenhouse gas.	In Southeast Asia, including Indonesia, rice cultivation contributes 25-33% of methane emissions, compared to the global average of 10%, due to continuous flooding irrigation methods.
#2 Livestock Emissions	Farm animals like cows and goats release methane during digestion (enteric fermentation). Additionally, animal manure left on pastures releases methane and nitrous oxide as it decomposes.	Beef cattle are the top emitters, accounting for 66-71% of emissions from livestock. Most cows are raised by farmers without resources for proper feed management, leading to higher emissions.
#3 Organic Soil Farming	Farming practices disturb soils rich in organic matter. When these soils are plowed or tilled, the organic material decomposes faster, releasing greenhouse gases.	In 2019, Indonesia had the highest annual emissions from drained organic soils in the world, amounting to 343 million tons of CO_2 equivalent, 41% of the global total. These emissions came from about 5 million hectares of drained tropical peatlands, mainly used for oil palm cultivation.
#4 Chemical Fertilizers	Using synthetic fertilizers releases greenhouse gases because these fertilizers contain nitrogen compounds that can break down into nitrous oxide	Over 86.4% of all fertilizers used in Indonesia are synthetic. Despite government regulations encouraging organic fertilizer use, many farmers believe synthetic fertilizers produce better crop yields (i.e. how much crop you get from a field).
#5 Crop Residues	Decomposing crop residues release methane and carbon dioxide. Often, these residues are burned to clear fields for the next planting season, releasing more CO_2	Indonesia produces 121 million tonnes of crops annually, with 20-30% (36 million tonnes) as crop waste. Around 45 million tonnes of these residues are burned each year, releasing massive pollutants into the air!

Many factors contribute to emissions in agriculture, and understanding Indonesia's geography, population, and policies is key. These unique aspects shape the country's agricultural emissions and guide us in finding effective solutions.

Indonesia's Landscape: Setting the Stage for Solutions

Category	Hard Facts Revealed
 Place	Indonesia has 187.8 million hectares of land, but much is being cleared for agriculture. By 2018, rice and palm oil crops used 80% of the farmed land, causing deforestation.
 People	With over 270 million people mostly eating rice, high food demand leads to intensive farming and heavy use of fertilizers and pesticides, which increase greenhouse gas emissions.
 Policy	The Indonesian government can invest more in training farmers to handle climate change, which would help them better protect their crops and livelihoods

Solutions: What's the fix?

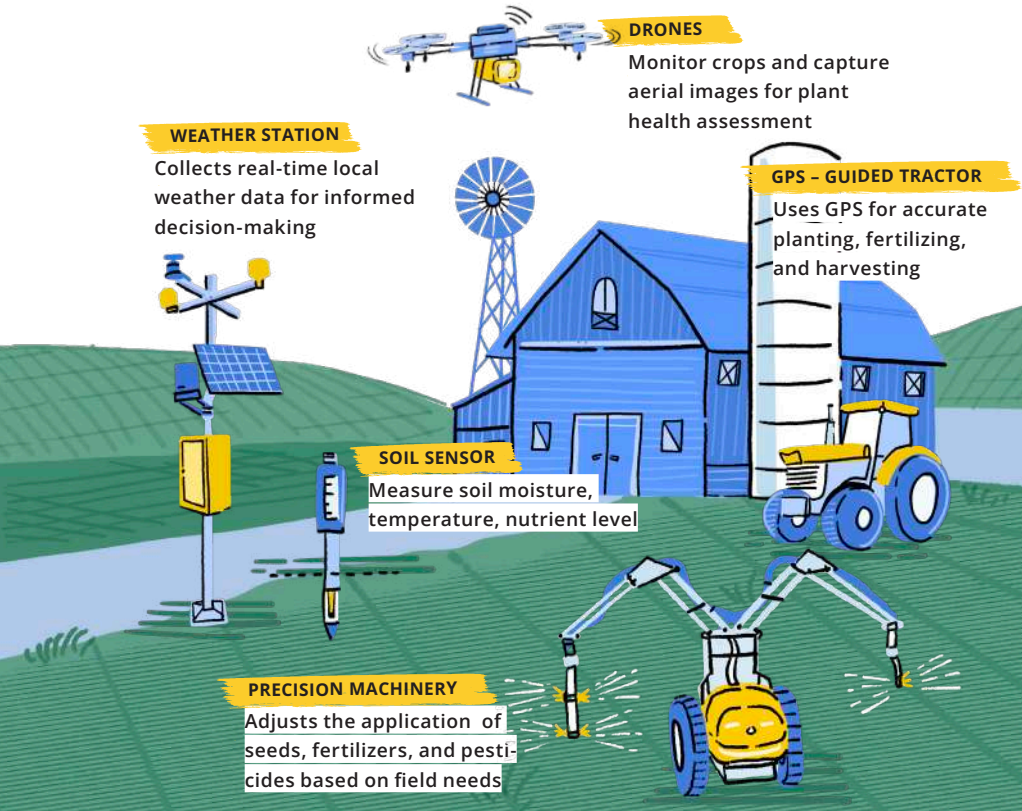
Method	Solutions	Indonesia's Edge
Technology	Artificial intelligence	**Government's focus on tech** The agricultural sector is evolving with technology, and artificial intelligence (AI) is now driving Indonesia's farming revolution. The National Research and Innovation Agency (BRIN) is deploying AI in drones and sensors to supercharge precision farming
Sustainable farming practices	Agroforestry	**Strong local knowledge** Agroforestry, which mixes trees with crops or livestock, creates a healthier ecosystem. In Indonesia, communities have used this method for centuries, and we can build on their knowledge to improve modern practices.
	Switching to organic fertilizers	**Institutional support** UPPO (Organic Fertilizer Management Unit), established in 2015, plays a key role in helping farmers in Indonesia produce and use organic fertilizers. This program reduces the need for chemical fertilizers, improving soil health and supporting sustainable agriculture.
	System of Rice Intensification (SRI)	**Rich agricultural knowledge** Indonesia has a lot of agricultural knowledge, including rice farming. The System of Rice Intensification (SRI) improves rice growing by managing soil, plants, and water, and has been used successfully across the country.
Supportive frameworks	Policy for sustainable agriculture	**Existing agricultural policies** Indonesia has embraced sustainable agriculture through a variety of national level strategies, such as the National Agenda 21, National Development Programs, and Revitalization Strategy for Agriculture, Fisheries and Forestry. These strategies have been implemented by The Central Planning Agency (BAPPENAS), the Ministry of Agriculture, and the Ministry of Environment.

About one-third of Indonesia's land is used for farming, and the government plans to expand this further, which could lead to more deforestation and emissions. How do we feed more people without clearing more forests? The answer lies in farming more efficiently and improving our methods.

ZOOM IN ON SUSTAINABLE INTENSIFICATION

Sustainable intensification is all about getting more crops from the same land while using fewer chemicals and being kind to the environment. It's like upgrading your farm with cool new tech and better seeds while still sticking to eco-friendly practices.

Did you know that the Netherlands, despite its tiny size, is a huge player in agriculture? They grow more tomatoes per square mile than anyone else, thanks to high-tech gadgets like drones and sensors. Imagine farmers here using smartphone apps to check soil, weather, and crop health in real-time—it's like having a farm assistant in your pocket! Training and teamwork are essential to help our farmers get the hang of these awesome tools.



In Indonesia, we can kick-start better farming by investing in top-notch crop varieties. Picture seeds that yield more, resist diseases, and thrive in tough conditions—like superhero seeds for our farms.

Organic fertilizers are like the perfect diet for plants. They make them stronger and healthier, reduce runoff into our rivers, and keep our soil in great shape.

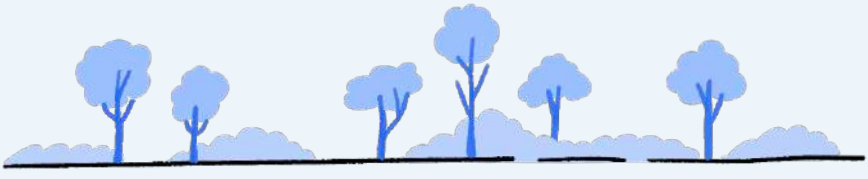
For rice, the System of Rice Intensification (SRI) is like giving our fields a smart workout. Instead of keeping them always flooded, SRI uses a mix of wet and dry periods to cut down on methane. With better plant spacing and organic fertilizers, SRI boosts rice production and slashes greenhouse gases. Pair this with cutting-edge tech and climate-smart seeds, and we've got a winning recipe for amazing farming!

ZOOM IN ON AGROFORESTRY

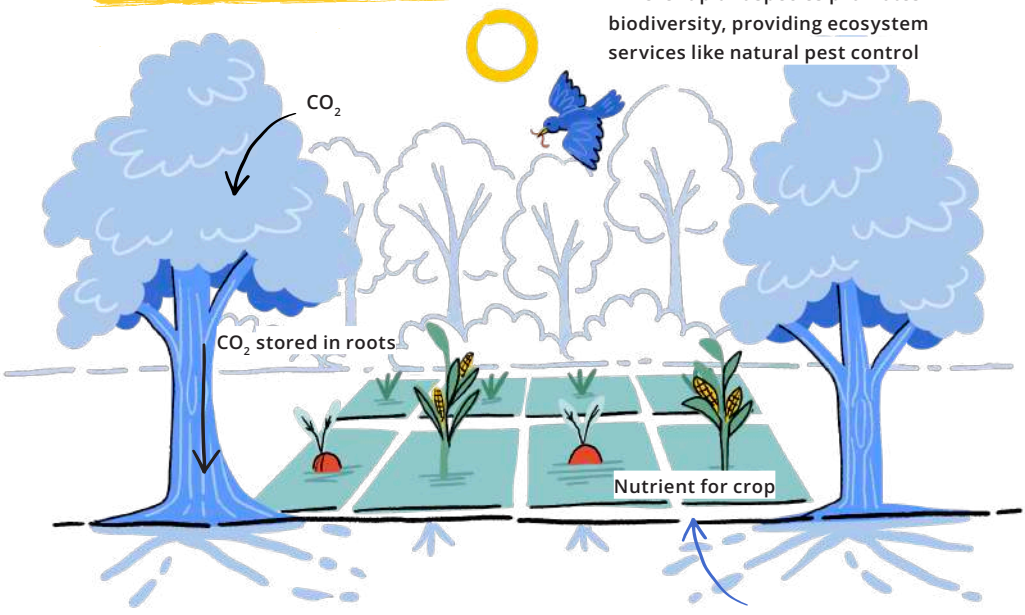
In Indonesia, agroforestry can really transform farming by mixing crops with fruit trees, timber, and grazing animals. This setup boosts biodiversity, improves soil health, and makes farms more resilient to climate change. It helps prevent soil erosion—where soil is washed or blown away, leading to land degradation—by 50% and enriches the soil with nutrients.

Trees in agroforestry systems also capture carbon by storing it in their leaves, trunks, branches, and roots. When the trees die and their roots decompose, the carbon stays in the soil, improving its fertility and benefiting the crops.

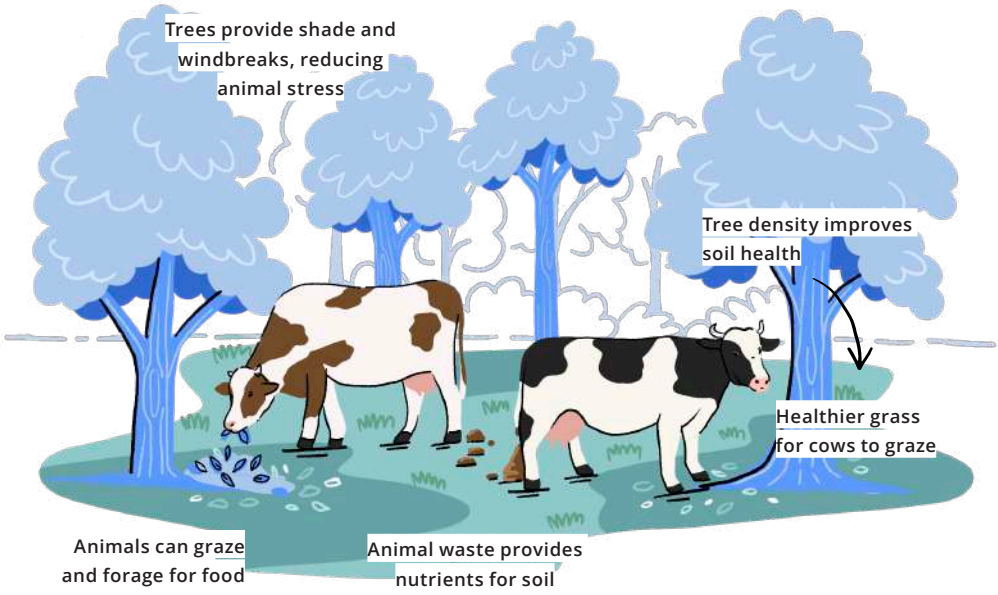
Combining livestock with trees is a great farming method. Animals graze on grass and eat leaves or nuts from the trees, which also provide shade and keep them healthy. Their waste helps fertilize the soil, and their movement breaks up hard soil so air and water can reach plant roots. This approach has worked well globally, like in Latin America, where dairy farmers increased their production by 75% per hectare by adding trees to their farms.[52]



CROP – TREE INTEGRATION



LIVESTOCK – TREE INTEGRATION



Your turn to act: What can you do?

FOOD FOR THOUGHT

Let's get more interactive here. Think about these questions below and jot down your ideas. Discuss with your friends, coworkers, and even advocate these issues through your platform!

Case-in-point: Indonesia aims to accelerate the smart farming adoption.

How can we improve infrastructure for smart farming?

- Do your research, and think of this: Should there be new laws to protect our forests better?

How can we enhance the agricultural supply chain?

- What innovative methods can improve the transportation and storage of farm inputs and outputs?

What steps can we take to strengthen human resources in agriculture?

- How can we empower our farmers better? Research about the latest climate-smart agricultural knowledge out there.

In New Zealand, the government has come up with a program called He Waka Eke Noa (meaning "we're all in this together!") that focuses on helping farmers measure, manage, and cut down on GHG emissions from their farms while also adapting to climate change. It involves creating a system to estimate and benchmark GHG emissions at the farm level, helping farmers understand their emissions footprint, including both sources and sinks.

How can we design an incentive program for farmers that protect the nature?

Imagine getting paid for planting trees on your cropland, or for penning your flocks in degraded grasslands, thereby allowing the land to rehabilitate. That's what China is doing through their eco-compensation program. The government provides direct incentives to rural households to protect the environment in their effort to curb deforestation and land degradation due to agricultural activities.

What strategies can support institutions in the smart farming ecosystem?

- How can we improve access to capital for small farmers to invest in smart farming technologies?

2.6 ZERO OUT INDUSTRY

CONTEXT: WHAT DRIVES EMISSIONS IN INDUSTRY?

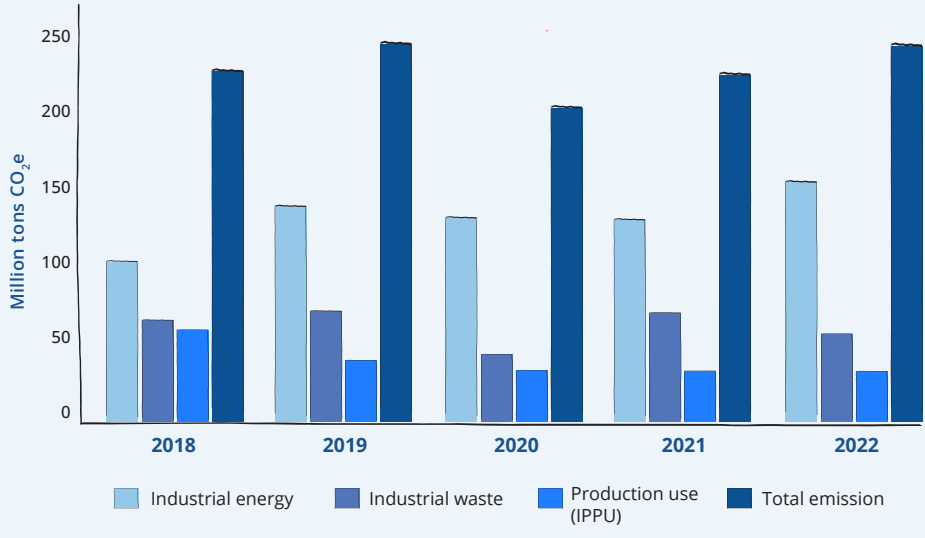
Fun fact: did you know that Indonesia is one of the top 10 manufacturing countries in the world? That's right! In 2022, our factories generated about USD 240 million in output and attracted investments of around USD 460 million. This industrial boom has been great for our economy, exports, and job opportunities. But there's a catch—our industrial sector also contributes 274.74 million tons of CO_2. Yikes!

The biggest culprit? Energy use, thanks to the **heavy reliance on fossil fuels to keep everything running**. Industrial processes and product use weren't far behind, with emissions coming from chemical reactions and high-emission materials. And while waste management played a smaller role, it still contributed to the overall emissions. This highlights the urgent need for Indonesia to go green and adopt more sustainable practices in these areas to fight climate change.

As we have already covered energy in 2.1 and waste in 2.3, for this section we'll focus solely on **industrial process and production use (IPPU).**

GREEN HOUSE GAS EMISSION FROM INDUSTRIAL SECTOR

Volume of gas emission based on industrial components (2019 – 2022)



Source: https://databoks.katadata.co.id/datapublish/2023/10/12/emisi-gas-rumah-kaca-industri-ri-naik-pada-2022-ini-komponennya

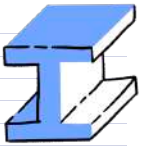
When people around the world talk about industry emissions, they often focus on steel, cement, and chemical industries. Why? These materials are key to economic growth, and their production generates a lot of emissions. The same goes in Indonesia – these are the heavy hitters in the industry emissions. There are various sectors within the chemical industry, but for simplicity, let's go with the ammonia industry, since it's produced in large quantities in Indonesia.

Material	Main Uses	Production and Use Stats
Steel 	Construction, Transportation, Kitchenware, Computers, Factory Machines	• 2nd largest producer of stainless steel[53] • Top 20 producer of crude steel • Steel production emits 1.85 tons of CO_2 per ton[54]
Cement 	Mostly Construction, Infrastructure	• 8th largest producer[55] • Produced 62 million tons of cement in 2023[56] • Emitting ~40-59 million tons of CO_2[57]
Ammonia 	Fertilizers, Refrigeration, Water Treatment, Pharmaceuticals, Textiles, Cleaning Products	• 5th largest producer[58] • Produced 6 million tons of CO_2 in 2023[59] • Ammonia production emits 1.9-2.6 tons of CO_2 per ton[60]

Let's dive in to the production of these 3 materials!

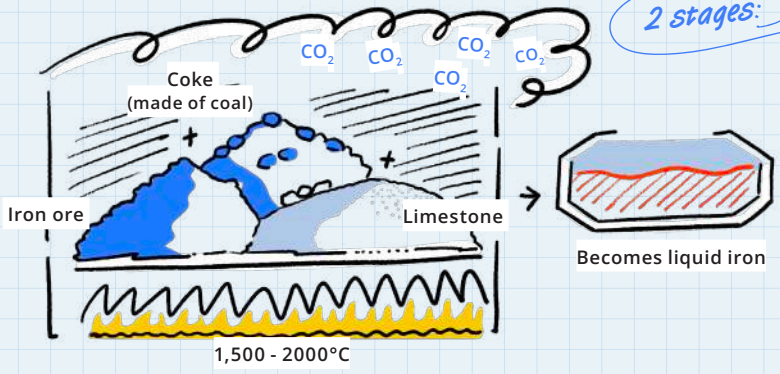
STEEL PRODUCTION

We start by making liquid iron, then mix it with other materials to make it stronger, and finally shape it into steel that can be used for building and making stuff. When producing liquid iron, CO_2 is exerted from chemical reactions.



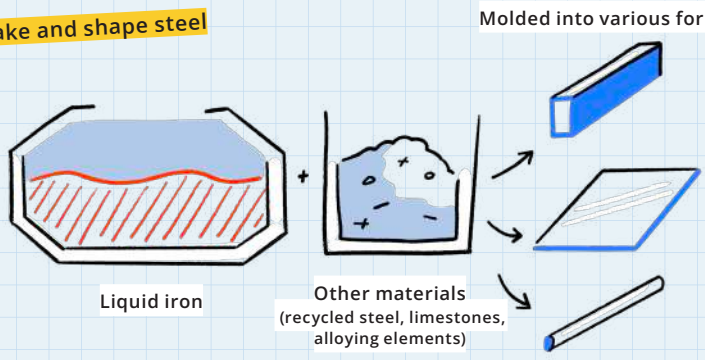
1. Make liquid iron in blast furnace *(like a hot oven)*

2 stages:



STEEL PRODUCTION *Continued...*

2. Make and shape steel

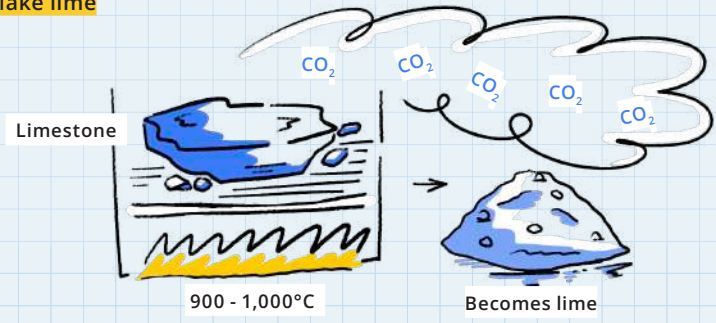


CEMENT PRODUCTION

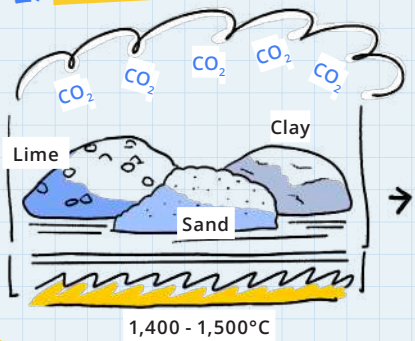
Cement Production: Lime and clinker are two important steps in making cement. We make lime by heating limestone, and clinker is made by mixing lime and other ingredients in a very hot oven. Heating these things induce chemical reactions that produce CO_2.

3 stages:

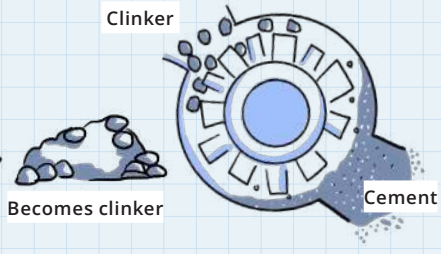
1. Make lime



2. Make clinker

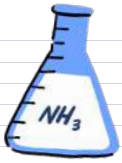


3. Grind



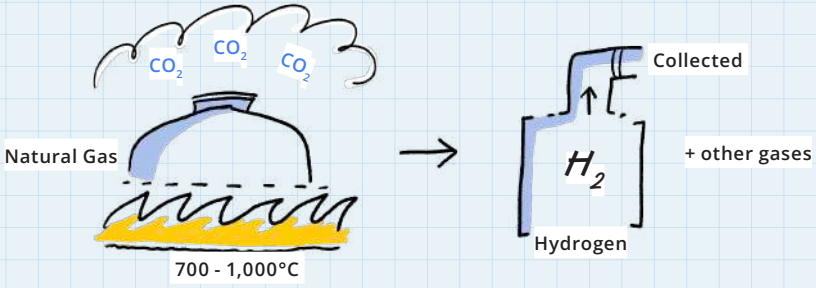
AMMONIA PRODUCTION

We mix hydrogen and nitrogen gases together in a special machine that heats and squeezes them to create ammonia. Hydrogen production exerts CO_2.

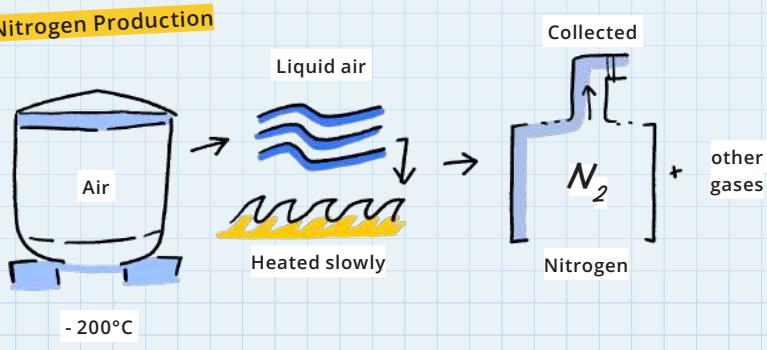


3 stages:

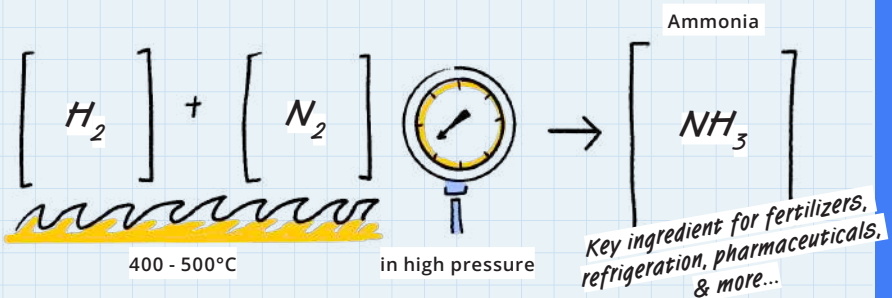
1. Hydrogen Production



2. Nitrogen Production



3. Ammonia Production



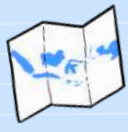
Industry has some of the most stubborn emissions to decarbonize, known as "hard-to-abate" sectors. Here's why these emissions are so persistent:

1. Almost half of the CO_2 emissions come from the raw materials used. You can change the raw materials, but you'd have to consider changing the whole process too.
2. About 35% of emissions are from burning fossil fuels to create super high heat – we're talking temps from 700°C to over 1,600°C! Switching to green energy, like zero-carbon electricity, is tough because it means redesigning the equipment from scratch.
3. Everything in these processes is tightly linked. Changing one part means you have to adjust everything else too.
4. These production facilities have been around for a long time, often over 50 years. Making changes involves expensive overhauls or retrofits.

Additionally, there are economic challenges to reducing emissions. Steel, cement, and ammonia are basic materials where price is key for buyers. If companies raise their prices by using low-emission methods, they could be at a disadvantage compared to competitors who don't. Also, if the prices for these materials go up, it could lead to higher inflation in those countries.

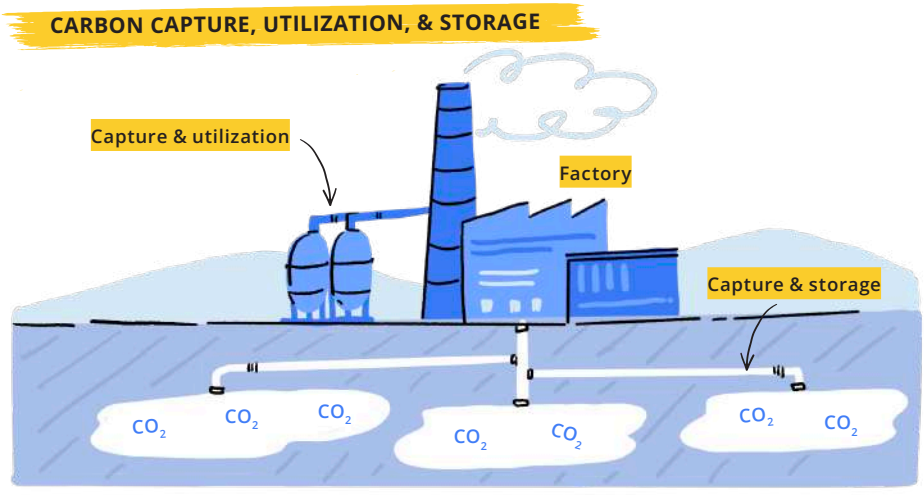
This means that the industry is expected to keep expanding in the future, so instead of stopping production, we need to focus on finding ways to reduce emissions while still allowing the industry to grow.

Indonesia's Landscape: Setting the Stage for Solutions

Category	Hard Facts Revealed
 Place	Within the top 10 producers in the world for steel, cement, and ammonia
 People	The consumption of steel, cement, and ammonia is high and increasing because of the growing population and the growing urbanization.
 Policy	President Jokowi's focus on infra-structure will also further increased demands for steel and cement

Solutions: What's the fix?

Industry	Solution	Indonesia's Edge
New technology		
All	CCS/CCUS (Carbon Capture Storage/ Carbon Capture Utilization Storage)	**Abundant Storage Sites** There are many old oil and gas fields as well as deep, salty water layers in Indonesia that can be used to store captured CO_2 underground. Stubborn emissions from manufacturing processed could be captured and then stored to keep them away from atmosphere
Steel	Electric Arc Furnaces	**Lots of electricity in Java** Most steel factories are in Java, where lots of electricity are available. Electric Arc Furnaces are like hot ovens that use electricity to melt and refine steel, which can reduce emissions compared to traditional methods that burn fossil fuels
Change raw materials		
Steel	Charcoal or Biomass Char	**Abundant Agriculture and Forestry Waste** The country's large waste can help create charcoal or biomass char, which can replace coking coal in steelmaking, and thus reduce CO_2 emissions
Cement	Natural Pozzolans	**Large Volcanic Activity** Indonesia's many volcanoes provide natural materials like pumice and volcanic ash that can be mixed into cement. This means we use less lime, which cuts down on CO_2 emissions
Steel	Hydrogen	**Rich renewable energy and natural resources** Indonesia has lots of renewable energy, land, and water, making it easy to produce green hydrogen. For Steel: Hydrogen can replace coking coal used in steelmaking, reducing emissions as only water vapor is produced For Ammonia: Hydrogen from renewable sources can be used instead of natural gas to make ammonia without producing CO_2
Recycling & circular economy		
Steel	Increase the use of recycled steel	**Abundant Steel** Indonesia has a significant amount of steel mostly due to its big focus on construction. As structures age and are dismantled, there is a steady supply of steel scrap available for recycling. In 2023 alone, consumption reached 17.9 million tonnes, 5% growth compared to 2022



ZOOM IN ON CCS/CCUS

How it works in Indonesia: CCS/CCUS technology is like catching and saving greenhouse gases from things like factories and power plants. We can either use these gases as fuel to produce new things or put them safely underground where they won't hurt the air. In Indonesia, we can use old oil and gas places or hot underground rocks to keep these gases out of the sky.

Indonesia's Flagship Project: The **Gundih Pilot Project** in Central Java is capturing CO_2 from the Gundih gas field and inject it into underground rock layers instead of letting it escape into the atmosphere. This project aims to see if this method is effective and if it can be used on a larger scale CCS applications in Indonesia

Challenges in Indonesia:

1. **INITIAL HIGH COSTS:**
   Setting up CCS/CCUS infrastructure requires significant investment and requires effective fiscal management so that it will not increase public electricity tariffs.

2. **GEOGRAPHICAL BARRIERS:**
   Can be tough to find and reach good places to store CO_2 especially if these places are in far-off or hard-to-reach areas, like remote islands.

3. **LEAKAGE RISK:**
   Indonesia's frequent earthquakes increase the risk of leakage and impact on local communities, requiring better planning.

Your turn to act: What can you do?

While individuals may not directly influence large industrial processes, there are several ways they can contribute to decarbonizing the steel, cement, and ammonia manufacturing industries:

1. Advocate for Policy Changes:

A) CARBON TAX — A penalty fee imposed on companies that burn fossil fuels to reduce greenhouse gas emissions. South Korea has successfully implemented a carbon tax, leading to reductions in emissions while supporting economic growth.

B) DIRECT INCENTIVES FOR GREEN INVESTMENTS — Imagine the government giving out rewards for companies that go green. They can offer tax breaks, grants, and subsidies to businesses that invest in technologies to cut down their carbon emissions. In fact, Germany is already doing this! They have budgeted 4 billion euros this year to subsidize energy-intensive industries, like cement manufacturers. All these manufacturers have to do is come up with a proposal for green technology projects that would help them reduce their emissions.

C) REUSE AND RECYCLE — Governments like the US have Extended Producer Responsibility laws that require manufacturers to take responsibility for the end-of-life disposal of their products, encouraging the reuse and recycling of materials like steel. Maybe Indonesia can consider replicating this approach?

2. Support Research and Innovation:

Advancing sustainable technologies requires strong research and innovation. Organizations like ECADIN, which conduct valuable research in hydrogen and carbon capture specific to Indonesia, need increased support. Companies can benefit from training with these organizations to stay updated on the latest advancements. Additionally, appointing research organizations to explore decarbonization methods can drive progress.

3. Purchase decisions:

Individuals to opt for greener alternatives to cement, steel, and urea-based fertilizers. These are further discussed in the **Zero Out Agriculture and Building** sections.

2.7 ZERO OUT BUILDING

CONTEXT: WHAT DRIVES EMISSIONS IN BUILDING?

Building life cycle stages

Building Design

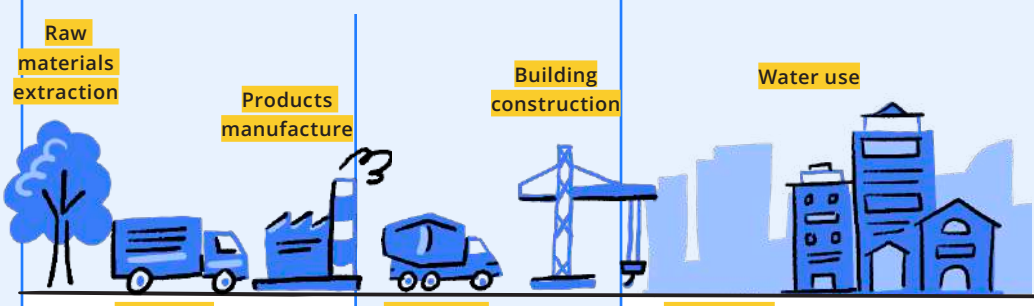
Buildings that aren't designed to be energy-efficient use more energy for lighting, heating, and cooling, which increases emissions, especially in hot places like Indonesia. Also, using materials like concrete and steel that require a lot of energy to produce (remember what we learned in Zero Out Industry?) adds to the building's carbon footprint.

Energy Use in Buildings

Buildings use a lot of electricity, and in Indonesia, much of this electricity comes from coal, which produces a lot of CO_2. Air conditioners consume a lot of energy, contributing significantly to electricity use and emissions. Additionally, inefficient lighting, traditional water heaters, and constantly running appliances like refrigerators and computers all add to the high energy consumption and emissions.

Construction and Materials

As mentioned, making cement and steel produces a lot of CO_2 because the processes need a lot of energy and release emissive gases. Other materials like bricks and glass also add to emissions through their production.



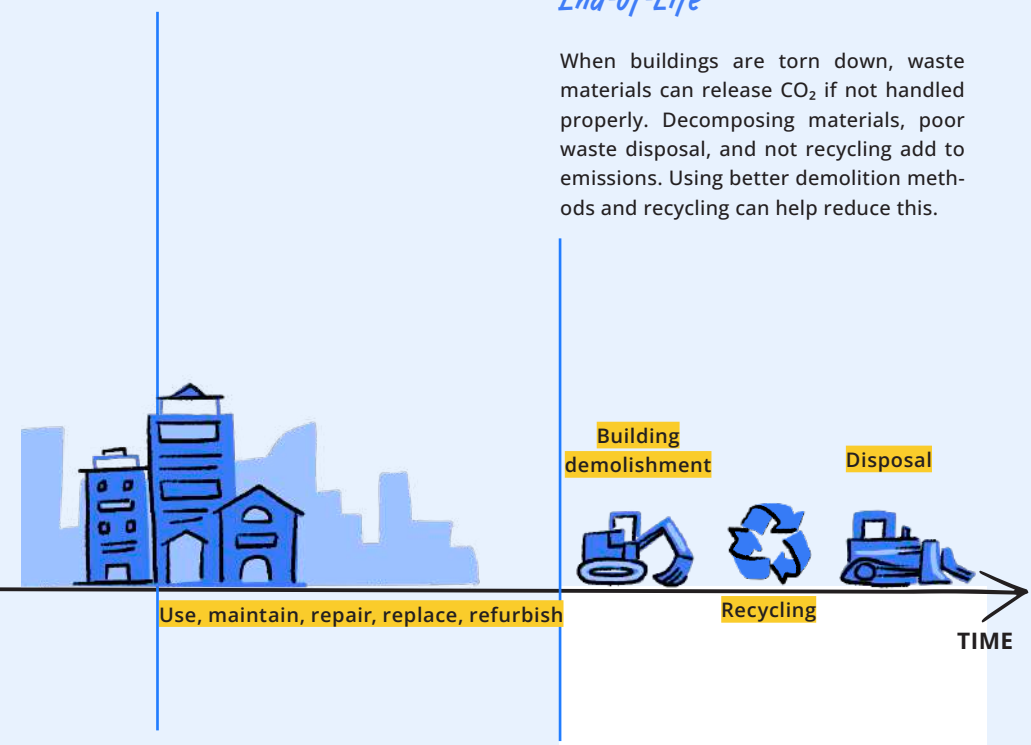
Buildings are all around us – our homes, schools, malls, and offices. Buildings play a significant role in greenhouse gas emissions in Indonesia. In 2022, direct emissions and indirect emissions from the buildings sector in Indonesia account for 4.6% and 24.5% of total energy-related CO_2 emissions, respectively.[61] Although Indonesia's building sector emissions per capita are 0.6 tCO_2/capita, still below the G20 average of 1.5 tCO_2/capita, the country has experienced a significant increase of 52% from 2016 to 2021. Understanding where these emissions come from can help us find ways to reduce them.

Building Operations and Maintenance

How we manage buildings every day, like how we run heating, cooling, and lighting, impacts energy use. Good maintenance and smart practices can save energy and cut emissions. However, wasteful habits like leaving appliances on, overusing heating and cooling, and skipping maintenance can increase energy use and emissions.

End-of-Life

When buildings are torn down, waste materials can release CO_2 if not handled properly. Decomposing materials, poor waste disposal, and not recycling add to emissions. Using better demolition methods and recycling can help reduce this.

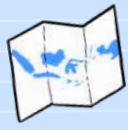


Let's look at some numbers to understand how this trend might play out in Indonesia.

CONTRIBUTOR	DESCRIPTION	STATS TO BACK THIS UP
#1 **Building Design**	Poor design increases energy needs for lighting, heating, and cooling.	According to multiple studies, efficient green buildings can reduce energy consumption from 30% up to 70%.[62]
#2 **Construction Materials**	Cement and steel production is energy-intensive and releases significant CO_2.	Indonesia produced 62 million tons of cement in 2023,[63] emitting approximately ~40-59 million tons of CO_2.[64] Steel production emits 1.85 tons of CO_2 per ton.[65]
#3 **Energy Use**	Emission electricity consumption for lighting, heating, cooling, and appliances	Buildings account for 30% of Indonesia's total electricity consumption;[66] ~66% of this electricity is from coal. Air conditioning accounts for 50% of a building's energy use in tropical regions like Indonesia.[67]
#4 **Building Operations & Maintenance**	Inefficient ways of running buildings and poor habits	Leaving appliances on when not needed and lack of regular maintenance can increase energy use by 20-30%.[68]
#5 **End-of-Life**	Improper waste management during demolition releases CO_2.	Construction and demolition waste management is critical due to rapid urbanization and infrastructure development. In 2023, 58.6% of Indonesia's total population lived in urban areas and cities, up from 52% in 2013.[69]

As we can see, various factors contribute to the high emissions from buildings in Indonesia, from the design and construction materials to the way buildings are used and maintained. To address these issues effectively, it's essential to consider Indonesia's unique context.

Indonesia's Landscape: Setting the Stage for Solutions

Category	Hard Facts Revealed
 Place	Indonesia is the **largest archipelago** in the world with diverse climates and geographies, requiring tailored building designs/solutions.
 People	Indonesia has a **growing population** and economy with increasing demand for housing and commercial spaces, leading to higher emissions.
	The country is also **home to diverse tribes** with different traditions, which may require varied and culturally appropriate building solutions.
 Policy	The government has **implemented green building codes** but still faces **challenges in enforcement** and widespread adoption.

SOLUTIONS: WHAT'S THE FIX?

First, let's talk about the most common technologies aimed to zero out buildings we see around the world.

Details up next!

Solutions: What's the fix?

Method	Solutions	Indonesia's Edge
Energy Efficiency Upgrades	LED lighting or leverage natural light (as much as possible)	**Mature LED lighting market & warm tropical climate** • High availability of LED lighting in the market due to increased adoption • Indonesia has abundant sunlight, making natural lighting a viable option year-round
	Energy-efficient appliances	**Existing government regulation** Boosting market options by supporting government rules (GR 33/2023) on implementation of energy conservation, providing rewards and penalties, and sharing data
Renewable Energy Integration	Solar panels & water heaters	**Tropical zone** Indonesia gets a lot of sunlight all year because it's near the equator
Sustainable Building Materials	Green cement & steel	**Access to technology and raw materials** Indonesia has access to innovative building material technologies and abundant raw materials for green cement and steel
	Recycled materials	**Expanding recycling sector** Growing recycling industry and availability of recyclable materials in urban areas
Improved building design	Smart design	**Eco-friendly architecture** Traditional architecture principles that promote natural ventilation can be integrated with modern energy-efficient designs
	Environmental policies and incentives	**Government support** • Indonesia has introduced rules for green building codes, which encourage using energy-saving methods, saving water, and using eco-friendly materials • The government is dedicated to boosting renewable energy and provides financial support for things like installing solar panels on rooftops

Enforcing green building code:

Green building codes are like the superhero guide for making buildings energy- efficient and eco-friendly. They set good rules for saving energy, using less water, and picking sustainable materials. But getting these codes to work smoothly in Indonesia can be a bit tricky.

Challenges:

A lot of builders and local officials might not know about these green codes or why they're beneficial, which can lead to less following of the rules. Plus, enforcing these codes needs trained inspectors and good systems, which aren't always available in less developed areas. Sometimes, enforcing the rules can be uneven because not all local governments are fully on board or have the right tools.

Steps to improve:

To turn things around, we need to get builders and officials to commit to workshops and training. Raising public awareness can boost demand for green buildings, so let's spread the word about why green buildings are great, and make sure local governments have what they need to enforce the rules. Giving rewards like tax breaks or grants to those who follow the codes can also make green building practices more popular.

Optimizing Home Design:

Making your home design smarter can cut down on emissions and save energy. It's all about using natural light and cool design tricks to keep your home bright and breezy while staying eco-friendly.

Maximizing natural light

Imagine having big windows, skylights, and open spaces that let in lots of sunshine. This means you won't need to flip on the lights during the day. Add some light shelves and mirrors, and you've got a home that's bright and energy-efficient. In sunny Indonesia, using natural light is a no-brainer!

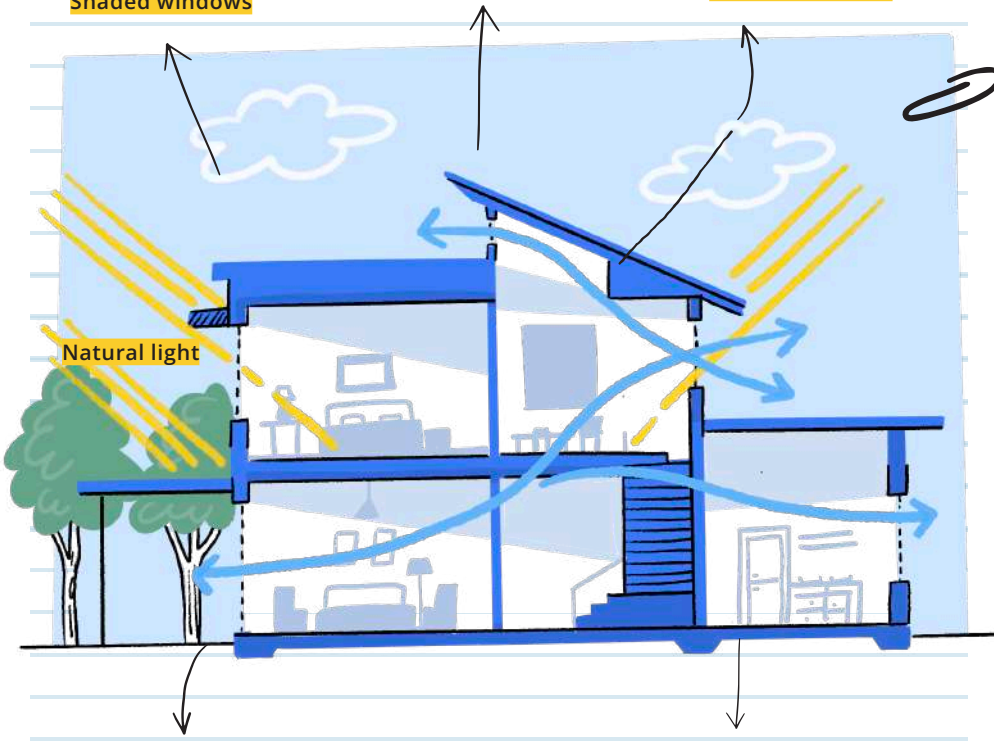
Cooling and smart design:

To keep your home cool without cranking up the AC, design for natural airflow with features like wide eaves and shaded courtyards. Light-colored roofs and walls help bounce away heat. Combine these with modern tech, like smart shading and thermostats, and you'll have a comfy, energy-saving home. Blending traditional Indonesian design with today's smart technology makes for a perfect, cool, and eco-friendly living space!

Steps to improve:

To improve home design, blend traditional Indonesian methods that promote natural airflow with modern, energy-saving features for the best results. Get local communities involved to ensure designs fit their needs and culture. Plus, offer rewards for using smart design features to encourage more energy-efficient buildings.

Passive design scheme



Your turn to act: What can you do?

Actions for Individuals: 5 simple things you can do to make a difference

Switch to Energy-Efficient Lighting and Appliances

Why? Saves electricity and lowers your carbon footprint

- Cuts down on electricity use and reduces emissions
- For example, LED bulbs use up to 75% less energy and last much longer than old-fashioned bulbs.

Install Solar Panels if Possible

Why? Produces clean energy and reduces reliance on fossil fuels

- Generate cleaner, renewable energy from sunlight
- While initial cost can be high, government incentives can help, and over time, you'll save on electricity bills
- If your panels produce extra energy, you can even sell it back to the grid

Apply Smart Home Technology

Why? Reduces energy use and cuts down on emissions

- Use energy more efficiently.
- For example, a smart thermostat can adjust the temperature based on your schedule, and smart lights can turn off when rooms are empty

Use Water-Saving Fixtures

Why? Saves water and energy

- Use less hot water, so use less energy to heat it

Don't forget to advocate for green building policies by supporting local environmental groups and campaigns. Your involvement helps push for better building standards and renewable energy incentives, which contribute to a healthier environment and fight climate change.

The Path to Balanced Climate Activism

As we conclude this chapter, we hope you're feeling inspired and empowered to take action as climate activists. We hope you're fired up and ready to jump into action as climate warriors! We've shared a bunch of eco-friendly tips and tricks, and now it's your turn to bring them to life. Whether you're cutting down your carbon footprint, cheering for renewable energy, or pushing for change, your efforts are vital. However, **remember that our journey toward sustainability must be balanced with economic growth**.

Indonesia is unique. Our country faces **a unique mix of economic and environmental challenges that other countries might not experience**. Our GDP per capita is only a fraction of that in developed nations, and millions of Indonesians live in poverty. At the same time, we are among the most vulnerable to the impacts of climate change. **This unique mix means we can't tackle sustainability with a one-size-fits-all approach**.

As you champion green policies and make eco-friendly choices, keep an eye on their economic impacts. **We need solutions that boost both the environment and the economy**. Work with everyone—government officials, business leaders, your community—highlighting that sustainable growth is not just cool but crucial.

✳ Every little bit helps.

By finding the sweet spot between going green and economic growth, we can set up a future where Indonesia shines sustainably. Your role as a climate activist is key to this balancing act. Doing nothing will cost us more in the long run, so let's take action now and make things better! Ready for more? Let's dive into the next chapter!

CHAPTER 3


what can I do?
TURNING
INTO
ACTION

3.1 REFLECTION FOR LIFESTYLE CHANGES

HOW MUCH CARBON DO I EMIT IN A DAY?

Understanding how everyday activities affect the environment is crucial for making informed decisions. In this section, you can see practical examples on how to reduce your **carbon footprint** and contribute to a healthier planet. To start reflecting on how carbon-heavy your lifestyle is, you can fill in the questionnaire below.

My Carbon Journal

How do I use electricity?

1. How do I cool my home? Do I use fans or air conditioners? How often do I turn them on, and for how long?
2. To what extent would reducing my cooling appliances usage impact my comfort?
3. Have I considered switching to energy-efficient appliances or lighting? Would switching to sustainable alternatives be feasible for me?
4. To what extent would reducing my energy consumption impact my comfort or daily routine?

How do I protect the nature around me?

1. How do I stay connected to the natural world? Do I have a garden or keep indoor plants?
2. How have I contributed to protecting local ecosystems beyond my home? Have I joined any nature protection efforts?
3. How can I learn from local or indigenous practices to protect nature?

What do I eat?

1. How often do I eat meat and dairy on a weekly basis?
2. Would changing my diet to be more plant-based affect my nutrition? How would it affect my satisfaction?
3. How much food do I throw out in a week? Have I implemented any measures to reduce food waste?

What products do I buy and use?

1. How often do I buy new items, and what types of products are they?
2. Am I mindful of the environmental impact of the products I choose?

How do I get around?

1. How do I get around? Do I drive a car, use public transportation, walk, or cycle? How often do I use these modes of transportation?
2. Would changing my commuting habits to more sustainable options affect my productivity? How so?
3. How do I travel long distances? How frequently do I travel by air?
4. Do I consider alternatives such as trains or buses for longer trips?

How do I manage my waste?

1. How often do I recycle or compost? Would recycling and composting be more of a hassle for me?
2. Do I bring reusable bags, bottles, and containers when I shop and eat out? Why or why not?
3. What percentage of my waste goes to landfill?

Have I been involved in advocacy and community projects?

1. Do I participate in or support local environmental initiatives?
2. Have I considered advocating for larger systemic changes (e.g. support ing policies, joining environmental movements? Why or why not?
3. Do I feel like my individual actions can inspire others to make more sustainable choices? How so?

We've met **Susi**, **Nabil**, and **Lily** in the first chapter. Recall that they lead very different lifestyles, and thus they contribute to climate change in differing ways. If we were to compare their footprints, Nabil's extensive use of air conditioning, him driving an SUV for daily travels, and frequent shopping at fast fashion stores, Nabil's footprint ends up being the highest of the three. On the other hand, Lily, by walking to and from classes and living in a student dorm, has the lowest footprint. These examples highlight the diverse ways individuals can impact the environment. Based on your carbon journal, how carbon-intensive do you think your lifestyle is?

SMALL CHANGES, BIG IMPACT

Susi, Nabil, and Lily have taken steps to make more sustainable changes into their own lives. If you're unsure where to begin, their experiences could offer you some inspiration:

	WHAT THEY DID BEFORE	WHAT THEY DO NOW
ENERGY 	Nabil used to turn his air conditioner on 24/7, in every room in his house.	Nabil finds it hard to stop his use of cooling appliances completely. He still uses the air conditioner, but only on very hot days. When it's cooler, he switches to fans.
	Lily's community doesn't have access to a constant electricity supply.	Lily is pushing for better sustainable electricity from the government to safeguard her and her community's future.
NATURE 	Susi's connection to nature was more casual. In her hometown, she participated in traditional fishing practices.	Now, as an active advocate for ocean conservation, Susi has expanded her efforts significantly. Through her youth organization, she focuses on marine advocacy, collaborates with local communities and environmental groups to promote sustainable fishing practices, and campaigns for policies that protect marine habitats and species.

	WHAT THEY DID BEFORE	WHAT THEY DO NOW
DIET	 Susi didn't pay much attention to her diet, though she's always eaten more plant-based meals to be cost efficient.	Susi **adjusts her diet** to be even more sustainable, which often means opting for black coffee instead of her usual kopi susu. Additionally, she advocates for government support in reducing food waste on a national level.
TRANSPORTATION	 Nabil used to drive his SUV to get around.	Nabil has the means to retire his fuel-inefficient SUV – he now **uses an EV**. He is also organizing awareness campaigns with his HR department to encourage colleagues at his company to consider EVs and public transportation.
CONSUMPTION HABITS	 Nabil used to buy clothes from fast-fashion brands at least once a week	Nabil now **prioritizes quality over quantity** to reduce waste. He realized that he owns a lot of clothes, and he has decided that he doesn't need to buy any more. In the future, if he does need to buy more clothes, he will be investing in durable, timeless clothing from more sustainable brands.
WASTE	 Lily's community has always practiced composting to provide rich soil for their community garden. But beyond that, they didn't pay much attention to waste separation or minimizing plastic use.	Lily now focuses on **cutting down plastic** waste by using reusable bags, bottles, and containers, and encourages others to do the same. She also advocates for better waste management policies from her local government, such as establishing more recycling facilities.

Remember!

The journey toward a sustainable future is built on small choices that contribute to a larger, global movement.

Even though Susi, Nabil, and Lily only made small changes to their lifestyles, they added up to make a big difference! Wondering what else you can do to help Indonesia reach net zero? We've laid out some actions that you can do below to decarbonize Indonesia's key sectors:

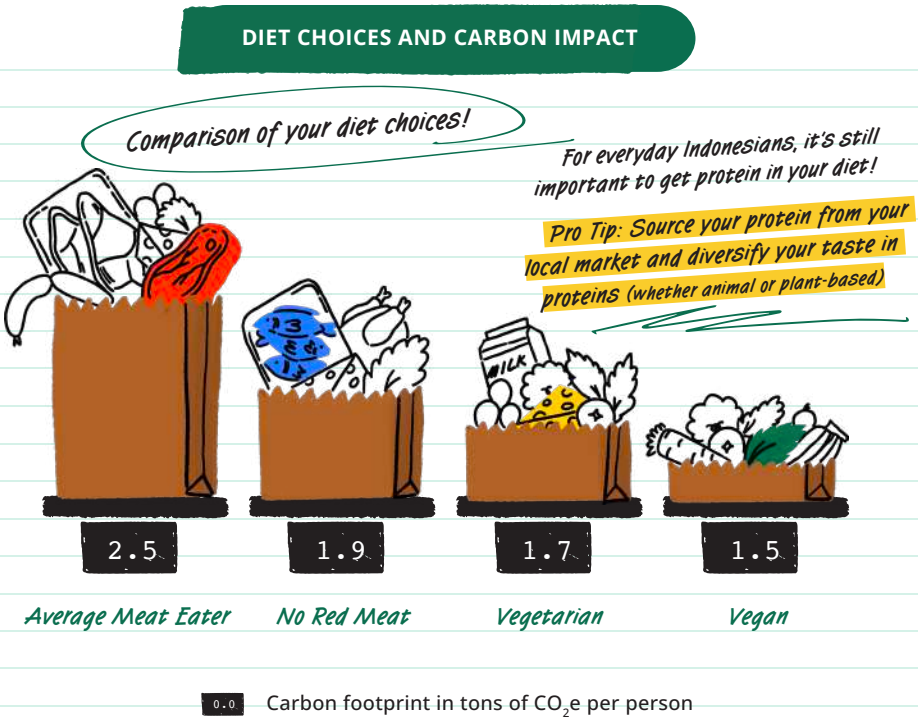
Small changes Big impact!

(Reuse, Reduce, Recycle!)

	ELECTRICITY	TRANSPORT	WASTE	NATURE	AGRICULTURE	INDUSTRY	BUILDING
Be mindful of your consumption habits			✓	✓	✓	✓	
Choose sustainable food products				✓	✓		
Use energy-saving appliances & vehicles	✓	✓					✓
Switch to renewable energy sources	✓	✓				✓	✓
Improve home insulation to reduce cooling needs	✓						✓
Offset emissions you can't avoid	✓	✓	✓	✓	✓	✓	✓
Advocate for better policies	✓	✓	✓	✓	✓	✓	✓
Promote sustainable practices	✓	✓	✓	✓	✓	✓	✓

Now is a good time to start!

Susi, Nabil, and Lily's journeys show us that individual actions, no matter how small, can build up to create substantial impacts. By taking responsibility for our carbon footprint and making conscious decisions, we not only help the planet but also set an example for others. This ripple effect is powerful. When people see the changes in our lives, they are inspired to make their own changes. The next step is to move beyond personal lifestyle adjustments and think about how we can influence those around us.



Source: A comprehensive review on carbon footprint of regular diet and ways to improving lowered emissions, Results in Engineering, Volume 18, 2023

This brings us to the next crucial step in our journey: activism. It's about taking the passion and knowledge we've gained from our personal changes and using it to advocate for broader societal shifts.

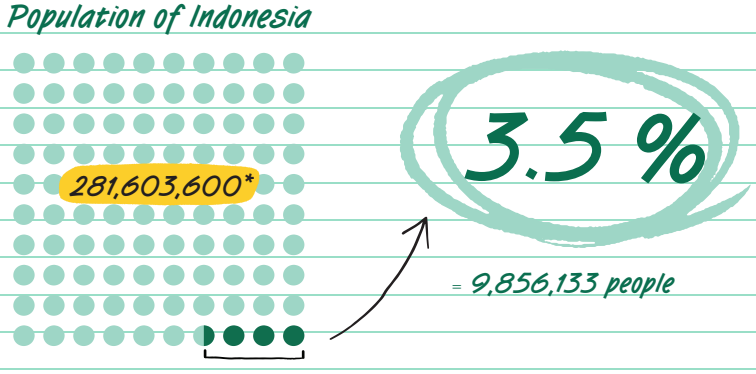
Activism might sound intimidating, but in the next section, we'll show you that it doesn't have to be.

3.2 ACTIVISM — PASS IT FORWARD

WHAT IS ACTIVISM

We define activism as working collectively to create change, whether it's leading an organization or advocating for a change inside your company. While individual actions like adopting a sustainable diet and taking public transportation (the things we described in section 3.1) can be considered activism, we are primarily concerned with collective action here, where lots of people coordinate together to bring about change.

Some of you might be skeptical about this whole activism thing. You might be thinking to yourself – the scale of this issue is so beyond us, does anything I do matter? Well, this is where we introduce **the 3.5% rule**.



*Source: Mid-year population (June 2024), www.bps.go.id

This rule was popularized by Erica Chenoweth and Maria J Stephan, whose research shows that just 3.5% of the population can drive significant change. Hence, if we can get this small but active minority to actively engage in environmental efforts, we can achieve serious progress.[70] You might be thinking, what happens if we don't reach the 3.5% threshold? Well, if you find that you're one of the early pioneers in climate activism, don't feel helpless. Taking the first step is often the hardest – keep on advocating for what you believe in. Remember, one of humanity's most common traits is the Fear of Missing Out (FOMO). People tend to follow trends, whether they're good or bad, and this can be your tool to influence others to join your cause. Evaluate and re-strategize your approach until you find one that resonates with others. Before you know it, you could have a whole army ready to fight for your cause.

We know that most of you imagine an activist as someone who's holding a megaphone, demonstrating in front of the parliament building. But if that's not what you're into, that's completely okay. According to Bill Moyer, there are four roles in social activism[71] – you can adopt the role that suits your personality and preferences best:

1 REFORMER

This is what the Indonesian folks typically say "*ubah dari dalam*", meaning change from within. You want to change the system? Then become the system! You can be the next aspiring politician, lobbying the parliament with the climate agenda.

2 REBEL

This is your '98 student activist archetype. Idealistic and ready to face the police with your megaphone.

3 CHANGE AGENT

This is what you would commonly think of as a peaceful activist. You work from the outside and exert pressure on the government in peaceful ways, maybe by helping the local farmers and advocating their rights to the local government.

4 CITIZEN

Or, you can be the good old citizen, where you mostly do day-to-day stuff but still raising your voice and being politically active when it matters. An example is choosing a pro-climate president or regional representative.

ACTIVISM CORNER

A success story

Let's travel back to 2013, when two young sisters, Melati and Isabel Wijsen, started the Bye Bye Plastic Bags (BBPB) movement in Bali. Getting concerned about the widened plastic pollution, they launched peaceful campaigns to ditch plastic and promote sustainable alternatives. They engaged in beach clean-ups, educational workshops, social media campaigns, engagement with government officials, and an online petition gathering over 100,000 signatures. And guess what? Bali's governor went on to issue a regulation that bans single-use plastic bags, straws, and styrofoam. It came into effect on July 1st, 2019, forcing businesses to switch to eco-friendly alternatives. BBPB's strategic actions created a powerful domino effect across Indonesia. Similar initiatives have been witnessed at big cities, including some environmentally conscious stores in Jakarta. This shows that dedicated grassroots activism can influence the government to act, leading to impactful change.

Okay, at this point, we hope we've convinced you that activism can lead to systemic changes. But you might be concerned with the potential risks involved. There are two main risks we often encounter:

1. **YOU ARE BURDENED WITH HIGHER STANDARDS FROM EVERYONE AROUND YOU —** As we mentioned before, being an activist makes people look at you differently. You are held to a higher standard, where you CANNOT make any mistake or do anything that even slightly deviates from your belief. Once you've made this mistake, you and your activism lose credibility.

2. **INCONVENIENCE ON YOUR LIFESTYLE FROM MAKING MORE SUSTAINABLE CHOICES —** We get it, being sustainable can be tough sometimes. Sustainable products are often pricey because they're made in ways that protect the environment and ensure that the workers are treated fairly. Don't forget, companies and their workers still need to make money! Beyond the cost, being sustainable can also require more effort. For example, rather than just buying cheap plastic water bottles, you need to carry a reusable water bottle with you.

It sucks but worry not. Instead of striving to be the perfect activist, we should acknowledge that we're still continuously learning and may make mistakes along the way. We should embrace the idea of being **imperfect environmentalists**.[72] Being an imperfect environmentalist means exactly that – it's okay to screw up sometimes. And sometimes, we need to understand that our choices are often influenced by factors such as our socioeconomic background and other daily realities. So, it's alright if we can't always choose the most sustainable option. Instead of judging each other (which can be counterproductive), let's support one another with constructive reminders and recognize that we are all still learning.

FIGHTING FOR JUSTICE

As we've discussed in Chapter 1, climate change can hurt everyone, but some people are affected much more severely, even if they were not the ones who caused the problem in the first place. We've also talked about how fighting for a better climate future should include (and center) those who will suffer the most from the impacts of climate change. Their needs, rights, ideas and hopes should guide our journey in tackling climate change and building a sustainable future for all.

People living in poverty, indigenous groups, and other vulnerable populations usually have fewer resources to adapt to changes like extreme weather or rising sea levels. However, they also have less power to advocate for their rights and influence policies that affect their lives. They are also often left out in the decision-making process to tackle climate change. This is why **it's so important for those of us in a more privileged position to stand in solidarity with them** and ensure that their voices are heard – activism serves as a powerful tool for this.

When engaging in activism for climate justice, it is important to **recognize your rights** and empower others to do the same. Activism allows us to actively champion these rights in the face of climate challenges, ensuring justice not only for ourselves but also for vulnerable communities.

For instance, if a factory is polluting your neighborhood, you have a right to take legal action to stop it – this is what we call **access to justice**. You also have the right to **access information** – you have the right to know what the factory is emitting and how it's affecting your health. Lastly, you have a right to **public participation** – you and your neighbors should have a say when decisions are being made about the factory and its impacts.

Voicing the rights of the vulnerable is crucial in the pursuit of climate justice

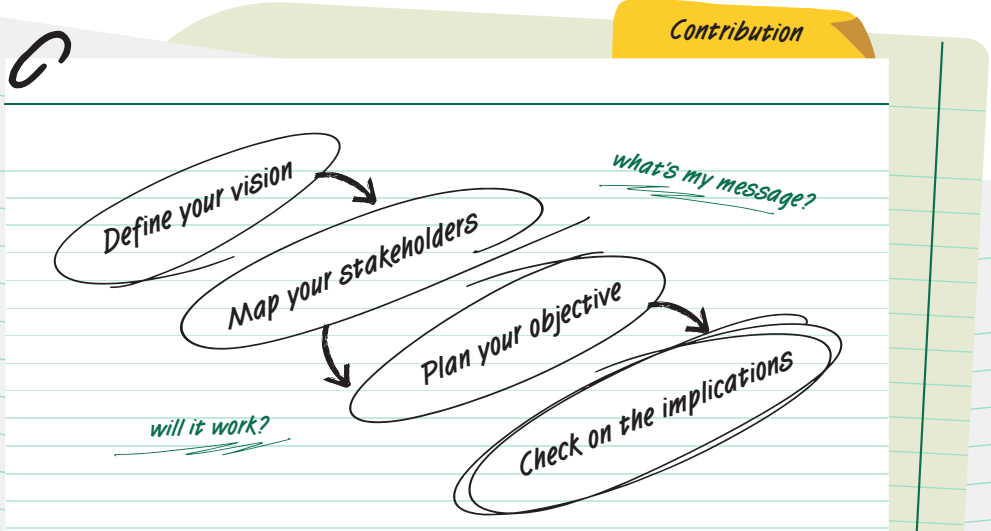
More fundamentally, you must remember that everyone has a right to a healthy environment with clean air, clean water, healthy ecosystems and biodiversity. These are the basic environmental conditions that we all deserve, now and in the future. Hence, it is within our rights to demand that these conditions are met.

HOW YOU CAN CONTRIBUTE

If you've made it this far, then you must be really into the whole activism thing. So, let's see how you can translate your will into real actions. There are only two things you need to do to get started. First, you need to find your **message**, and second, you need to find the **platform** you can use to spread your message.

— SHARPEN UP YOUR MESSAGE

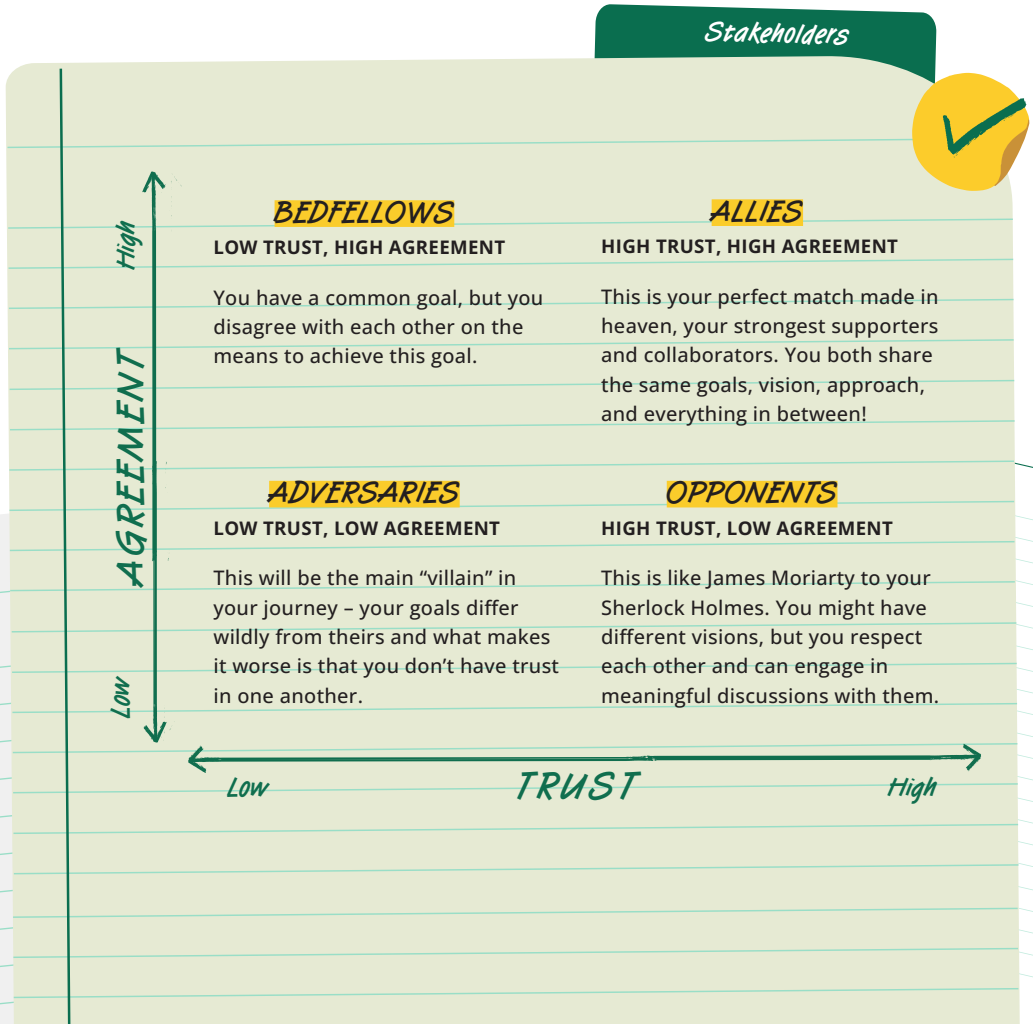
First things first, you need to know what cause you want to champion, and what message you want to spread. If you don't have a clear stance on the issue, then it's going to be hard for you to influence others. So, to sharpen up your message, you can follow these steps:



1. **DEFINE YOUR VISION —** First, you need to pick a long-term vision – what is it specifically that you want to achieve? You need to make it specific, catchy and relatable for others. This would make it easier for them to buy into your vision. The more relatable, the better.

2. **MAP YOUR STAKEHOLDERS —** After defining your vision, it's time to map out your friends and foes. You can't get everyone in the world to agree 100% with your vision – some groups will share your vision, while some won't. The trust-agreement matrix can help you assess where others stand in relation to your vision and how to engage with them productively.

As mentioned, this matrix plots trust on the x-axis and agreement on the y-axis. Trust reflects your willingness to have a discussion with others. If there's no trust, meaningful discussion will be difficult to have even if your goals align. Agreement relates to how much your visions align with one another – higher agreement suggests shared goals and easier collaboration.



Mapping stakeholders with Susi

Susi is a BEM (Badan Eksekutif Mahasiswa/Student Union) member at her university. She was tasked to create a campaign to stop illegal logging. While brainstorming on her campaign, she tried to identify and map the stakeholders she needed to engage.

She investigated cases of illegal logging by following local news and talking with the residents near affected sites. Through her research, she identified the companies and groups involved in these illegal activities. Meanwhile, the local communities are actively trying to combat these activities and protect their environment.

Through her investigation, she discovered that the companies and small groups involved ignore environmental concerns and cut down trees irresponsibly. She considers them as **Adversaries**.

On the other hand, she's happy to see the local government also opposes illegal logging. However, she remains frustrated with their implementation efforts, believing they could do a lot better. Hence, she considers the local government as **Opponents**.

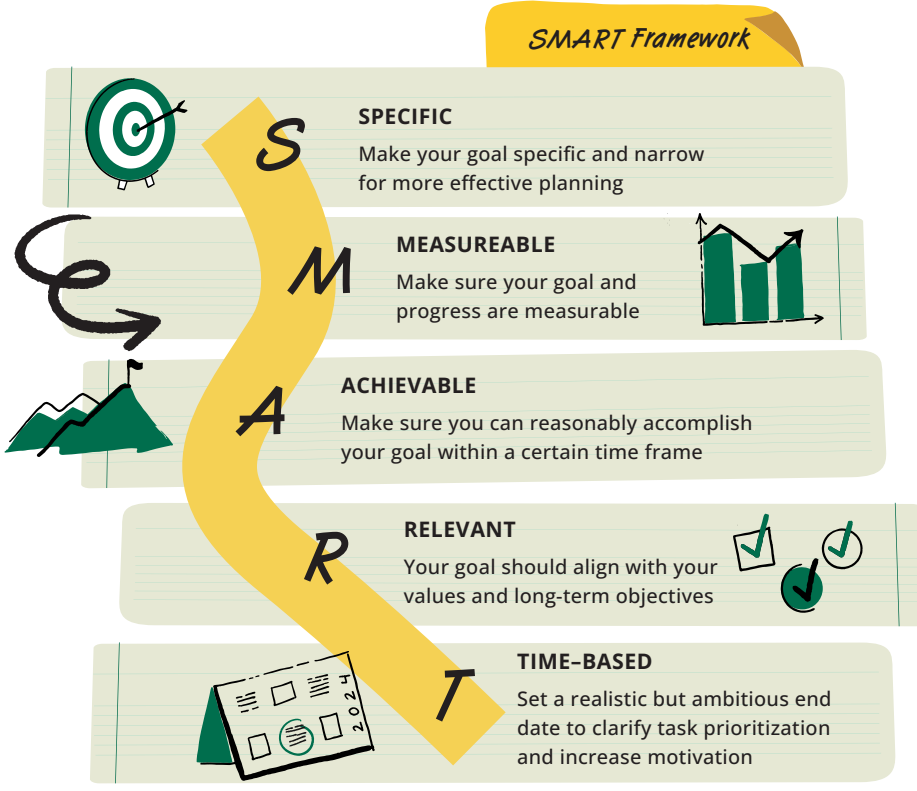
While having the same vision as the locals, she gradually realizes that their deep frustration has led them to plan radical actions against the illegal loggers. She understands the severe impacts these activities have on their lives, but she still believes in using strategic engagement to advocate for and influence stronger policy implementation. Therefore, she considers the locals **Bedfellows**.

On her way back home, she encountered local researchers who share her vision for stopping illegal logging and are also working to conduct strategic engagement in the campaign. She invited them to collaborate since she considers them to be her **Ally**.

3. PLAN YOUR OBJECTIVE — Now is the time to put your plan into motion. You need to specifically define what you want to do to support your vision. This is usually a program, campaign, or anything that you see activists do. To ensure your objectives are clear and aligned, you need to follow the **SMART** framework.

4. CHECK ON THE IMPLICATIONS — After defining your vision and objectives, it's crucial to reflect, unlearn, relearn, and iterate as you go. When it comes to activism, there are two common pitfalls. Firstly, we sometimes fail to grasp the full implication of our vision. It's easy to view those on the other side as villains, and hence sometimes we fail to understand the motives behind their actions. For example, we often demonize the use of fossil fuels. But has it occurred to you that the fossil fuel industry provides millions of jobs for people all around the country? If someday the fossil fuel industry ceases to exist, they will be jobless – unless we also help them to transition out of their old jobs.

Secondly, it's vital to ensure that our actions align with our vision. There are many examples of activists falling from grace just because they were seduced by opportunities that conflict their original goals. This is why it's important to be rock-solid with your vision – without a strong anchor, you will be drifted away from your journey of climate activism.



WAYS OF INFLUENCING OTHERS

Now that you've sharpened up your vision, you might think to yourself: but what specific actions can I take to communicate our message and influence others? To give you some ideas, we've categorized these actions into two main types: offline and online activism.

More on this next!

Offline Activism

GROUP DISCUSSIONS

Group discussions allow a diverse range of stakeholders to sit together and engage in meaningful conversations so they can collaboratively reach consensus on how to support effective on-the-ground climate action initiatives.

Stronger together

POLITICAL MARCHES

Marching is a non-violent public activity where you and like-minded others can express your ideas and opinions. Marching can be very effective for attracting media and public visibility, thereby increasing pressure on policymakers.

COMMUNITY EVENTS

Community events bring like-minded people to execute climate actions together. This can include things like tree planting campaigns or beach clean-ups.

RESEARCH GROUPS (FOR SCIENTISTS-ALIKE!)

Research groups play a crucial role in activism. Though it can be resource and time intensive, they provide evidence-based support for advocacy efforts that aim to influence policy.

Power of knowledge

EDUCATIONAL OUTREACH

Educational outreach is crucial for empowering people with knowledge and raising public awareness. You can do this by organizing seminars at your local townhall, workshops on campuses, and more.

Online Activism

CONTENT CREATION

This is the most common method where people will generate content, in the hopes that others will share it to create virality. This can be social media posts, articles on blogs, videos, memes, and more.

Broaden the reach!

ONLINE PETITIONS

There are plenty of petition platforms out there – one of the most widely used in Indonesia is change.org. You can then share these petitions on your social media platforms to amplify their reach.

FUNDRAISING

Gathering donations for a cause you care about through online crowdfunding platforms like Kitabisa is another effective method. These platforms enable you to reach out to a wide audience, rallying financial contributions that you can use to fund your initiatives.

Note

Not all Indonesians have access to the internet, so when engaging in online activism, we must be mindful to amplify their voices and advocate for their rights.

OFFLINE ACTIVISM

Though offline activism can be very effective, it can be quite demanding – it requires substantial resources in terms of money and man-hour. Because of this, you should be prepared to conduct thorough planning to secure funding, manage logistics, coordinate participants, and address legal considerations. But the good news is you don't always need to start from scratch! You can find local communities, organizations, or even workplaces that share your vision, as these places can provide valuable support and resources. In Indonesia, there are several well-established communities that you can potentially collaborate with. We've compiled some in the table below, but this is not an exhaustive list.

Field	Communities
Agriculture	✳ Aliansi Organis Indonesia
Construction	✳ Green Building Council Indonesia (GBCI)
Economy	✳ Global Green Growth Institute (GGGI)
Energy	✳ Society of Renewable Energy (SRE) ✳ Rumah Energi
Marine	✳ Yayasan Konservasi Laut (YKL) Indonesia
Nature Conservation	✳ World Wildlife Fund (WWF) Indonesia ✳ Greenpeace Indonesia ✳ Wahana Lingkungan Hidup Indonesia (WALHI)
Policy	✳ Think Policy Indonesia
Research	✳ World Resources Institute (WRI) Indonesia
Climate Justice	✳ The Habibie Center

ONLINE ACTIVISM

Digital activism is not a magic genie that can instantly achieve your goal. There are pros and cons of doing online activism.

Pros

- Easy to organize (you can do it from the comfort of your own bed!)
- Message can spread to a wider range of audiences, crossing geographic and demographic boundaries

Cons

- Opponents can use buzzers to spread false messages and attack your efforts
- Success heavily depends on virality

1. FACT-CHECK YOUR SOURCES

Since there is a plethora of unverified information on the internet, it is easy to be misguided. The bad thing about hoaxes is that they're designed to manipulate your emotions and thus often receive higher engagement than real news. To prevent this, always remember these three guidelines:

Check the source — is it credible? *Remember!*

Check the content — don't fall for misleading headlines

Get a second opinion — check for another credible source

2. PLAN FOR RESPONSES.

Typically, you will encounter three types of responses from netizens – you can read about them below. It's important to be ready to face all three types of responses and prepare your reply accordingly.

Supporters — Agree with your stance, your besties on the web. Reply with a thank you!

Opponents — Disagree with you but give clear counter arguments. Respectfully debate them when you can.

Trolls — Disagree with you without any substantial arguments. Don't feed the trolls!

3.3 INNOVATE — AREAS OF INNOVATION FOR INDONESIA'S NET ZERO PATHWAY

Wondering where to start?

We've simplified the process for you – take a look below

Innovation is a key driver in the fight against climate change. From renewable energy solutions to sustainable agriculture practices, innovative ideas can help us reduce emissions, conserve resources, and create a healthier planet.

• **Observe your surroundings and listen!** What are the most pressing environmental issues that they're facing? Conduct surveys, interviews, and research to gather data. This data-driven approach will help you understand the scope and impact of the problem, setting a strong foundation for developing innovative solutions.

• **Choose specific and impactful problem:** This could be anything from reducing plastic waste to improving energy efficiency in buildings. For example, Indonesia's plastic waste problem is significant, with the country being one of the largest contributors to ocean plastic pollution. Identifying such a pressing issue can provide a clear focus for your innovative efforts.

GREEN INNOVATION PROCESS

This might involve **tweaking the design, changing materials** (if it's a product) or **experience** (if it's a service or other non-product solutions), or **adjusting your approach** with continuous improvement in mind. **Iteration is key** in this stage, as each refinement brings you closer to a viable innovation. Refining your idea also involves **considering scalability and sustainability**. How can your solution be scaled up to benefit more people? Is it sustainable in the long term?

Address these questions during the refinement stage to enhance the impact and longevity of your innovation. Document each iteration to track progress and make informed decisions about future changes.

What should ideal brainstorming look like?

• **Open and inclusive process, encouraging diverse perspectives and innovative thinking.** Ask your grandparents, friends with disabilities, indigenous communities, and other vulnerable communities around you. Innovations need to be just and inclusive to ensure that they benefit everyone equitably.

• **Use techniques such as mind mapping, role-playing, and "what-if" scenarios to spark creativity.** Document all ideas without judgment; the focus should be on quantity over quality at this stage. Later, you can sift through these ideas to find the most promising ones.

Case-in-point: To tackle plastic waste, ideas might include developing biodegradable plastics or creating community recycling programs.

Important principles:

• **Prototypes don't have to be perfect;** they are meant to test the feasibility of your ideas.

• **Expect for failures and learn from them.** Testing helps identify potential issues and areas for improvement. This iterative process is essential for refining the solution and ensuring it can work in real-world scenarios.

Case-in-point: For instance, if you're working on biodegradable plastics, you might create a small batch to test its durability and decomposition rate.

Use feedback from tests to make necessary adjustments. Engage potential users in the testing phase to gather insights on usability and effectiveness. This user-centered approach ensures that the innovation meets the needs and expectations of those it is designed to help.

UNDERSTANDING THE INNOVATION PROCESS

SUCCESS STORIES

Innovation is happening all around us, and there are countless examples – big and small – of successful innovations making a real impact. These success stories provide inspiration and practical insights into how innovative ideas can be transformed into tangible solutions that address environmental challenges.

These stories are not only about technological advancements but also about people and communities coming together to solve pressing issues. They demonstrate how innovation can be inclusive, engaging, and deeply rooted in the local context.

While innovation presents many opportunities, it also comes with challenges. These include high initial costs, resistance to change, and the need for ongoing research and development. However, the benefits of sustainable innovation far outweigh these challenges, offering long-term environmental and economic gains. By addressing these challenges head-on, we can unlock the full potential of innovative solutions.

As we move forward, let's commit to supporting and fostering innovation in all its forms. Celebrate successes, learn from failures, and continuously seek new ways to address environmental challenges. By embracing innovation, we can create a brighter, more sustainable future for Indonesia and the world.

Renewable Energy

Innovation Case-in-Point

Kopernik is an Indonesian NGO that focuses on bringing affordable, sustainable technology to rural areas. They developed low-cost solar lamps that replace kerosene lamps. Not only does kerosene emit GHGs, but the fumes can also cause respiratory illnesses. These solar lamps have improved the quality of life for many families and reduced greenhouse gas emissions significantly.

The Cirata Floating Solar Project in West Java is set to become Southeast Asia's largest floating solar power plant. By placing solar panels on water, this project minimizes the use of land, which is a scarce resource in densely populated areas. It also reduces water evaporation from reservoirs, contributing to better water management.

Agriculture

In Indonesia, projects like **"GoTani"** use apps to connect farmers with buyers directly, reducing waste and increasing farmers' income. These innovations help create more resilient agricultural systems that can withstand the challenges posed by climate change.

Globally, there are already a few examples of sustainable innovations in agriculture, such as precision farming, which uses technology to monitor and optimize crop growth can significantly reduce water usage and increase yields.

Waste Management

Companies like **"Waste4Change"** are leading the way by providing waste management services that follow circular economy principles, ensuring that materials are reused and recycled instead of being sent to landfills. This approach not only conserves resources but also creates new economic opportunities.

PLN (Perusahaan Listrik Negara) has collaborated with Jakarta's government in a waste-to-energy program. Burning trash can provide energy for electricity, providing renewable energy while simultaneously tackling Jakarta's waste problem.

Collaborations in Innovations

Engaging young people in the innovation process is crucial. Programs like **"Youth Climate Action Network"** provide platforms for young Indonesians to develop and implement their own climate solutions. These initiatives empower the next generation to take an active role in combating climate change.

Innovation is often most effective when it involves collaboration between governments, businesses, and communities. For example, the **"Jakarta Clean-Up Day"** is a collaborative effort that brings together volunteers, companies, and local authorities to tackle waste in the city. Such collaborations leverage the strengths of diverse stakeholders, making it easier to address complex environmental issues.

3.4 WORK — APPLY YOUR EXPERTISE TO THE INDUSTRY

Most of us will a spend a big chunk of our lives working, with nearly a quarter of our time dedicated to our jobs. Because of this, the workplace can be a great place to start if you want to contribute to climate action. You can make a difference in two ways:

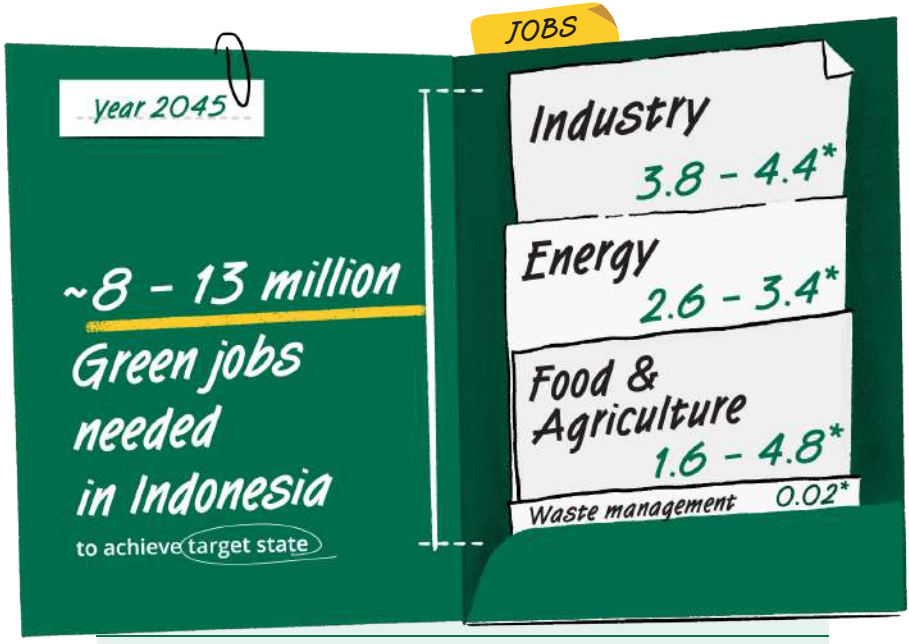
1. **You can pursue green jobs**; these are positions that are directly related to sustainability

2. If your job isn't directly related to sustainability, you can **push for internal changes** within your organization to steer them towards more environmentally friendly practices

GOING TO GREEN JOBS

"Green jobs" is a catchall term for any job that directly relates to climate change or the creation of climate initiatives. This covers a wide range of roles, such as engineering at a renewable energy power plant, marketing for a climate startup, being an environmental lawyer, and more! It's estimated that by 2045, there will be 8-13 million green jobs in Indonesia alone.[73] These jobs span four main sectors: Energy, Waste Management, Green Industry, and Food and Agriculture.

The good thing about green jobs is that they span beyond STEM (Science, Technology, Engineering, and Mathematics) to include fields like the social sciences, business, and more. To find your fit in the Green Jobs sector, check out the illustrations up next.



Industry

- Intensive carbon commodity transformation
- Downstream green technology

Energy

- Modern electricity
- Biofuel
- Hydrogen fuels

Food & Agriculture

- Digitalization and precision farming

Waste Management

- Organic, recycling, and toxic waste processing

Find your fit up next!

*Predicted number of jobs in millions
Source: Green Jobs Outlook Menuju Indonesia Emas 2045

In a typical climate initiative, there are four steps to follow:

to turn your idea into reality!

STEP 1

Ideate

This step is typically where you brainstorm what project or initiative that you want to pursue. Usually, this can be initiated by:

***a.* SCIENTISTS OR RESEARCHERS,**

who drive climate initiatives based on data and scientific trends. For example, with global warming, actions must be taken to mitigate rising temperatures, regardless of whether it's profitable or not.

***b.* ENTREPRENEURS,**

who drive climate initiatives based on business potential and market demand. For example, entrepreneurs are developing the latest tech for low emission fertilizers to fulfil the ESG targets of agricultural companies.

STEP 2

Plan

At this stage, you've already decided on the project you want to pursue and are ready to move forward with building it. Ofcourse, you need to design and plan the project beforehand. This is why the following functions are needed:

***a.* ENGINEERS,**

who can design the technical aspects of the project you're pursuing

***b.* PROJECT MANAGERS,**

who will prepare the timeline, create budgets, and manage stakeholders to keep the project on track

STEP 3

Implement

In this step, you bring your plan to life. Typically, two important roles are involved:

***a.* ENGINEERS,**

who build what has been designed

***b.* PROCUREMENT SPECIALISTS,**

who provide the items or services necessary for the project

STEP 4

Monitor & maintain

This is a crucial phase where you need to maintain and monitor the project to be long-lasting and working optimally. This is typically where you need:

***a.* ENGINEERS (AGAIN),**

who perform regular checkups and maintenance

***b.* SCIENTISTS/RESEARCHERS,**

who generate reports on the project's positive impact on the climate

We know that the jobs above are related to STEM sectors, but supporting roles are crucial for the success of the project as well. This includes:

1. POLICYMAKERS

Who help get the **necessary permits** and set up the legal grounds to conduct projects. With the right policies, climate initiatives can be conducted faster and have a bigger impact!

2. LAWYERS

Who **handle the legal agreements** and documents, and deal with any disputes that come up with other stakeholders during the project.

3. FINANCIAL SERVICES

Who assist the **financial modelling** during ideation to assess profitability, create budgets during planning, and conduct financial audits to ensure transparency throughout the project.

4. EDUCATORS

Who **teach younger generations** to understand the importance of climate initiatives and guide them towards green jobs.

5. CREATIVE WORKERS AND MARKETING

Who **educate the masses** informally through social media, publications, and other channels.

These are just some of the examples, but there are even more roles and functions needed to run climate projects that we can't list one by one. So don't be disappointed if your role isn't mentioned! If you're interested in learning more, there are several platforms that specialize in compiling green jobs opportunities – you can check these out on **https://renewableenergy.id/** and **https://www.sre-hireidn.com/**.

PUSH FOR INTERNAL CHANGES IN YOUR ORGANIZATION

If you're not working in the green jobs sector, does that mean you can't contribute to climate action? Of course not! You can still push for changes in your organization to make your workplace better for the planet.

Here's how you can make a difference – We've split it up according to your level of influence:

1. As a new joiner

You might be thinking, "I just joined two months ago, and you expect me to drive my multi-billion-rupiah company to be more sustainable. Are you serious?" Yes, we are! We understand that your level of influence might be limited, but you still have the power to make changes.

For example, if you're organizing internal company events like town halls or company outings, you can influence the team to choose environmentally friendly decorations and merchandise, collaborate with local organizations to recycle waste, and promote other sustainable practices. You can also make suggestions for sustainable initiatives to HR or other relevant teams to push a more sustainable practice in the company, such as a Bike to Work campaign, encouraging the use of reusable tumblers, and other creative ideas!

2. As management

If you're in management, you have the authority to change company procedures and ways of working. This allows you to drive more systemic changes. But how can you do so? Here are some ideas.

First, you can implement sustainability strategies within your organization. One way to do this is by adopting ESG principles. ESG stands for Environment, Social, and Governance – it's a framework that focused on three main areas: environmental impact, social responsibility, and corporate governance. By putting ESG principles in place, you're not just helping the planet, you can also drive business growth.

Take Bank Rakyat Indonesia (BRI) for example. They set up an ESG committee in 2021, and since then they've consistently increased their lending portfolio in sustainable projects. These efforts have resulted in a 12% profit increase compared to 2022.[74] The implementation of ESG is agreed upon by Indonesian business leaders to become the future best practice for companies.

Our ESG initiatives are crucial for risk management and long-term visibility. By investing in renewable energy and environmental conservation, we are not only complying with regulations but also ensuring the sustainability of our operations for future generations.

— NICKE WIDYAWATI, PRESIDENT DIRECTOR OF PT PERTAMINA

Second, be an early adopter. Companies have the scale and the cash to slash the extra cost – or green premium – of new green tech (not familiar with the term? Go back to Chapter 1.4!). Even if it seems pricey upfront, it sends a strong signal to the market that you're serious about pushing green technology innovation.

Third, you can influence your peers in the industry to go greener. We know that you're probably a member of industry associations. These forums can be an opportunity for you to showcase the best practices in sustainability and encourage others to follow suit. Additionally, you can also push your suppliers and everyone in your company's value chain to get on board with sustainable practices.

3.5 STUDY — EXPAND YOUR HORIZON

Are you feeling unsure that you are equipped with the necessary skills to contribute? Well, there is always an option to study. Given the rapid growth of green technology, the need for constant competency development is crucial for Indonesia to reach our decarbonization target.

We understand that university education can be expensive, and not everyone has the privilege to pursue it. Fortunately, we have scholarships offered locally and internationally. Most of them are merit-based, but some also aim to create and prioritize opportunities for marginalized people. Generally, you, as Indonesian citizens, can check scholarships from

1. INDONESIA ENDOWMENT FUND FOR EDUCATION (LPDP),
2. FULLBRIGHT (EXCLUSIVELY FOR AMERICAN UNIVERSITIES),
3. CHEVENING (EXCLUSIVELY FOR BRITISH UNIVERSITIES),
4. ERASMUS MUNDUS (EXCLUSIVELY FOR EU UNIVERSITIES), AND
5. AUSTRALIA AWARDS (EXCLUSIVELY FOR AUSTRALIAN UNIVERSITIES)

These scholarships generally cover tuition fees, living expenses, travel costs, and health insurance (how cool is that!). Other than that, you can always check on your chosen university if they offer direct scholarship or grants. So, feel free to check them out, expand your horizons, and come back to contribute here to our country.

Feeling unsure about furthering your academic studies? Not to worry, there are other avenues for non-academic study that you can explore. For instance, you can participate in online courses offered by environmental organizations or universities. These can also provide in-depth knowledge of topics such as renewable energy and environmental policy, just without the commitment of an academic program.

Another way to learn more is by attending conferences and seminars where experts discuss the latest developments in sustainability. These events can provide valuable learning opportunities and expose you to cutting-edge research and innovative solutions.

Lastly, reading books, scientific journals, and articles from environmental magazines can keep you informed on the latest studies and trends in sustainability. Continuously absorbing new information can help you stay updated on what's currently being discussed in the sustainability space.

Here is a list of university majors that might be the right fit for you (based on the jobs that we described in section 3.4)

ROLES	UNIVERSITY MAJOR
ENGINEERS	• Electrical Engineering • Mechanical Engineering • Civil Engineering • Environmental Engineering • Architects
ENTREPRENEURS	• Business • Management • Entrepreneurship
LAWYERS	• Law
PROJECT MANAGERS	• Industrial Engineering • Finance • Management
SCIENTISTS/ RESEARCHERS	• Oceanography • Earth science • Mathematics & Statistics • Agriculture & Forestry Science
EDUCATORS	• Education • Social Science
POLICY MAKERS	• Public Policy • Political Science
PROCUREMENT	• Industrial Engineering • Business • Finance
FINANCIAL SERVICES	• Finance • Accounting • Economics
CREATIVE WORKERS & MARKETING	• Communication • Graphic Design

Final thoughts

Throughout this book, we've laid out the basics of everything you need to know about the climate crisis (or at least we hope so!). What we're facing is a crisis of **planetary scale** – we need everyone on planet Earth, including you, to join forces in confronting this threat. And it's not just about tackling the climate crisis; we also need to balance it with Indonesia's need for economic growth. Finding this balance is crucial to ensuring a sustainable and prosperous future for all.

But we get it; it's easy to feel overwhelmed by the challenges ahead. You might be thinking: is it even possible for us to get everyone to work together?

To ease your worries, let's look at a recent example: the COVID-19 pandemic. When faced with a global health crisis, people worldwide came together, adapting quickly and working collectively to find solutions. Scientists, health-care workers, and ordinary people all played a part in slowing the spread of the virus and developing vaccines in record time. This shows that when we unite, we can overcome enormous challenges.

Today, we face another monumental challenge: **climate change**. The solutions won't be easy, but we must stay optimistic. By learning from past successes and working together with determination and innovation, we can create a sustainable future for generations to come.

As we move toward this future, we believe that young people like us need to take the helm. You've already taken the first step by learning about the climate crisis and its importance to be solved with the country's economic challenges. Now, let's do more. Be more environmentally conscious in your day-to-day choices, but also advocate for the rights of those who are marginalized and hold our leaders accountable for bolder action in sustainability and economic growth. This will guide us toward a future that is not only environmentally friendly but also socially and economically just.

The journey begins with us, and it begins now.

Are you ready to take the next step?

FURTHER READING

Eager to learn more?

Dive into our curated list of books and articles to expand your knowledge!

The Carbon Almanac **by Seth Godin, 2022 -** A reference book born out of the efforts of hundreds of collaborators, offering reliable, easily understandable facts on climate change and actionable steps for collective action.
Speed and Scale **by John Doerr, 2021 -** A detailed action plan for achieving net-zero by 2050, combining practical solutions such as electrifying energy, fixing the food supply chain, and capturing carbon, while harnessing politics, policy, and innovations to speed up the transition.

How to Avoid a Climate Disaster **by Bill Gates, 2021 -** The business tycoon's practical and comprehensive guide detailing the technology, policies, and innovations needed to achieve net-zero emissions and avoid a climate catastrophe by 2050.

Silent Spring **by Rachel Carson, 1962 -** Often thought of as a pivotal book in the modern environmental movement, this book explores the dangers of the synthetic pesticide DDT, widely used during and after the Second World War. This classic work is one of the early texts to connect human activities with environmental impacts.

The Man-Nature Relationship and Environmental Ethics by P Bordeau, 2004, from the Journal of Environmental Radioactivity, 72(1–2), pp.9–15 -
A journal article that offers a framework for evaluating human interactions with the environment, emphasizing the need for sustainable practices and respect for nature.

Doughnut Economics **by Kate Rasworth, 2017 -** This book provides a framework that emphasizes balancing human needs and planetary boundaries to address climate change effectively. Doughnut economy advocates for an economy that is equitable, regenerative, and sustainable, combating climate change by reducing resource depletion and waste.

Climate Justice: An Introduction **by Dominic Roser and Christian Seidel, 2016**
The relationship between justice and climate change is becoming more crucial in the discussion of climate issues. This book on climate justice discusses the hot topic of climate change as a moral challenge.

Climate Justice: A Man-Made Problem with a Feminist Solution **by Mary Robinson, 2018 -** This book explores the inspiring grassroots efforts of women and communities around the world in battling climate change, highlighting how their resilience and innovation offer hope and practical solutions to one of our era's greatest challenges.

A Life on Our Planet: My Witness Statement and A Vision for the Future **by David Attenborough, 2020 -** Written by the acclaimed nature documentarian, this book serves as Attenborough's "witness statement" detailing the environmental degradation he has observed throughout his life and proposes a few solutions to hinder biodiversity loss.

Re-envisioning Indonesia's Just Energy Transition: Toward a Regenerative and Democratic Ecosystem **by the Habibie Center, 2024 -** This book employs a systems thinking approach to explore key discourses in the energy sector, unravelling the complex energy landscape in Indonesia and highlighting critical aspects—environmental, social, and economic—of implementing the energy transition.

Transisi Energi Berbasis Komunitas di Kepulauan dan Wilayah Terpencil (Community Based Energy Transition in Islands and Remote Areas) **by Pusat Studi Energi (PSE) UGM, 2019** - This book enhances understanding of diverse perspectives on energy transition. It explores the fulfilment of renewable energy needs in local communities through a model of community empowerment.

A Vision for a Sustainable Battery Value Chain in 2030 **by World Economic Forum, 2019 -** A report outlining a sustainable battery value chain vision for 2030.

Transport Outlook 2023 **by International Transport Forum, 2023 -** A forward-looking report on global transport trends and forecasts.

Nature and Net Zero **by World Economic Forum and McKinsey & Company, 2021** This report details how natural climate solutions (NCS) are essential for combatting climate change, potentially providing up to one-third of the needed carbon mitigation by 2030 while also delivering significant benefits for ecosystems and communities.

Restoration Agriculture **by Mark Shepard, 2013 -** This book reveals a revolutionary approach to farming by emulating nature's own systems, promising sustainable food and resources while transforming our agricultural future.

The Green Building Revolution **by Jerry Yudelson, 2008 -** A practical guide that explores the history, principles, and future of green buildings, including case studies.

Designing Climate Solutions: A Policy Guide for Low-Carbon Energy **by Hal Harvey, Robbie Orvis, and Jeffrey Rissman, 2018 -** Provides actionable insights into policies that can drive decarbonization and energy efficiency in buildings.

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CHAPTER 3

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