

# WHAT ARE THE SOLUTIONS TO CLIMATE CHANGE?

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## 1 INTRODUCTION

Climate change has garnered long-term attention and is considered a critical issue due to its unpredictability and wide-ranging consequences. Fundamentally, climate change refers to the warming of the Earth's climate, i.e., global temperature rise, primarily driven by anthropogenic greenhouse gas (GHG) emissions(World Meteorological Organization (2023)). This results in severe consequences such as biodiversity loss and unpredictable natural disasters. The causes of climate change are complex and multifaceted, leading current research to focus on several key areas. A major focus is to understand the interactions among the atmosphere, oceans, cryosphere, and land surface, and how these interactions influence global and regional climate patterns(Monerie & colleagues (2025)Qian & colleagues (2025)Chattopadhyay & colleagues (2024)).

Among the various approaches aimed at addressing climate change from different perspectives, policy and economic research investigates effective policy tools, such as carbon pricing and renewable energy incentives, while analyzing their economic and societal impacts. Studies on the carbon cycle and GHG management explore the processes of carbon cycling within the Earth system and technological methods to reduce atmospheric GHG concentrations. However, among the various solutions, transitioning to renewable energy is considered one of the most effective measures to reduce carbon emissions and achieve climate targets(International Renewable Energy Agency (2019)).

## 2 RENEWABLE ENERGY: A PRIMARY SOLUTION

One of the most effective solutions to climate change is the transition from fossil fuels to renewable energy sources such as solar, wind, and hydroelectric powerWorld Meteorological Organization (2025). As illustrated in the figure, renewable energy has been embraced worldwide and of which approaches have been widely adopted.

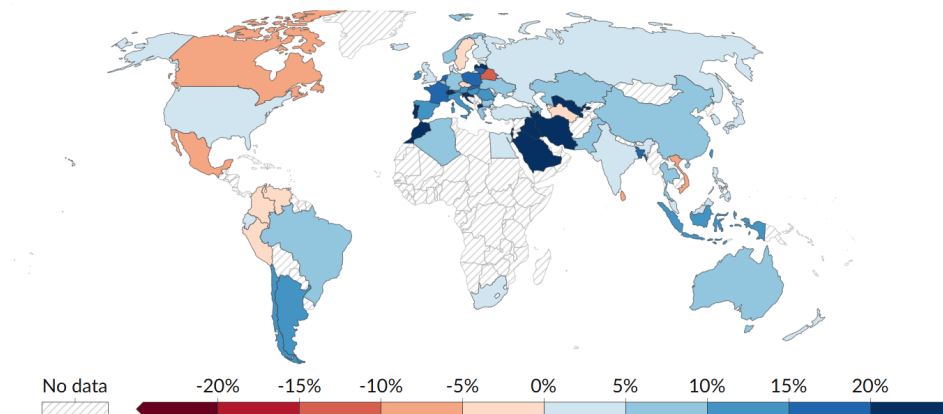


Figure 1: Renewable Energy change relative to 2023

### 2.1 ADVANTAGES OF RENEWABLE ENERGY

Renewable energy offers several benefits:

- **Zero Carbon Emissions:** Unlike fossil fuels, renewable energy sources do not release carbon dioxide (CO<sub>2</sub>) during energy generation.
- **Sustainability:** Resources like sunlight and wind are virtually inexhaustible, ensuring long-term energy security.
- **Economic Growth:** Investment in renewable technologies fosters job creation and stimulates technological innovation.

## 2.2 CHALLENGES AND SOLUTIONS

Despite its benefits, the transition to renewable energy faces technical and economic barriers.

- **Intermittency:** Solar and wind energy depend on weather conditions. Solutions include energy storage systems (e.g., lithium-ion batteries) and grid modernization.
- **High Initial Costs:** Although renewable energy infrastructure requires significant investment, long-term savings on fuel and maintenance make it cost-effective.

## 3 CARBON PRICING MECHANISMS

Carbon pricing is a market-based strategy designed to internalize the external costs of greenhouse gas emissions, providing economic incentives for emitters to reduce their carbon footprint. Two primary approaches are commonly employed:

Carbon taxes and cap-and-trade systems are two widely used policy tools for reducing greenhouse gas emissions. Carbon taxes involve governments imposing a direct tax on the carbon content of fossil fuels, effectively setting a price per ton of CO<sub>2</sub> emitted. This approach provides a clear financial cost for emissions, encouraging businesses and individuals to adopt cleaner energy sources and improve energy efficiency. On the other hand, cap-and-trade systems, also known as Emissions Trading Systems (ETS), establish a cap on total emissions and distribute or auction allowances to emitters. Companies that successfully reduce their emissions can sell excess allowances to others, creating a market-driven financial incentive for emission reductions.

### 3.1 POLICY INTERVENTIONS

Beyond carbon pricing, governments implement various policy interventions to promote renewable energy adoption.

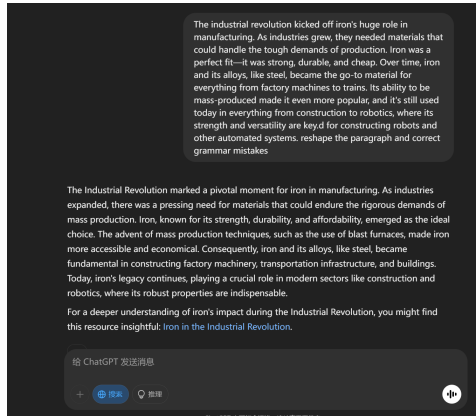
Subsidies and incentives, such as tax credits, grants, and rebates, provide financial support to lower the cost of renewable energy projects, making them more competitive with fossil fuel-based energy. These mechanisms encourage investment in clean energy and accelerate the transition to sustainable power sources. Additionally, Renewable Portfolio Standards (RPS) mandate that utilities source a specific percentage of their electricity from renewable energy, thereby driving demand for clean energy technologies and ensuring a steady market for renewable power development.

## 4 CONCLUSION

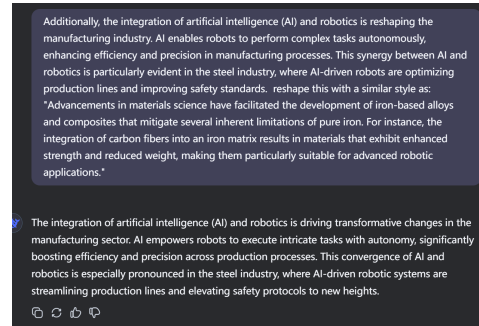
Addressing climate change necessitates an integrated approach that combines technological advancements, economic strategies, and policy interventions. The shift toward renewable energy, supported by mechanisms such as carbon pricing and carbon capture technologies, offers a viable and effective path toward sustainability. To drive meaningful progress, coordinated efforts among governments, industries, and individuals are essential in accelerating the adoption of these solutions and ensuring a sustainable future.

## 5 AI STATEMENT

ChatGPT is used for shaping the grammar mistakes and fine-tuning the language of the written paragraph. For example,



(a) AI usage example 1



(b) AI usage example 2

Figure 2: Examples of AI usage

## REFERENCES

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