Multi-pronged approach to combating climate change

1. Why is climate change?

With the development of society, climate change becomes a more and more popular topic in the international. So why does climate change occur?

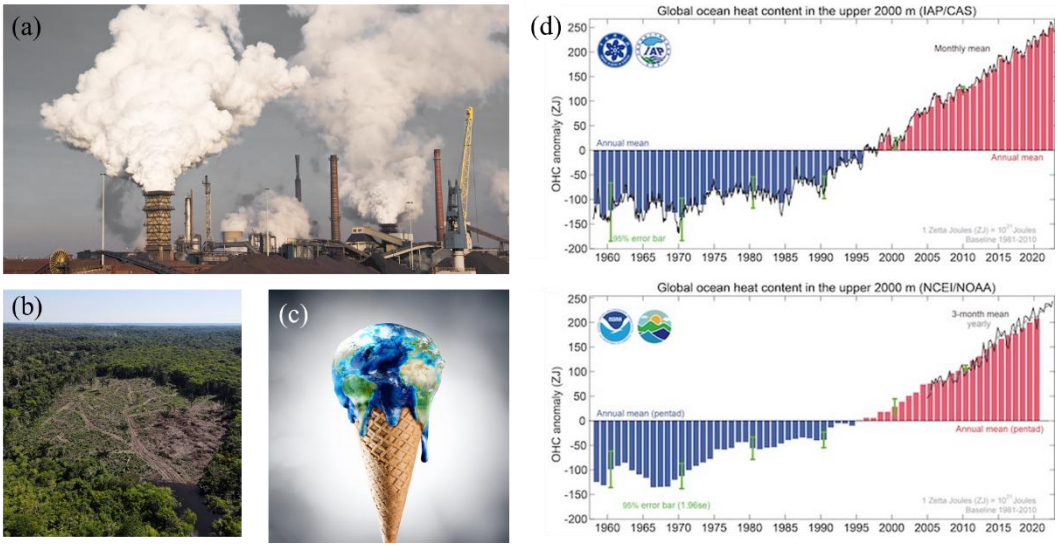

Fig. 1. (a) Chemical gas emissions; (b) Deforestation; (c) global warming; (d) Global upper 2000 m OHC from 1958 through 2022 according to (up) IAP/CAS and (down) NCEI/NOAA data. 1 ZJ = 10^{21} Joules. The line shows (up) monthly and (down) seasonal values, and the histogram presents (up) annual and (down) pentad anomalies relative to a 1981–2010 baseline [1].

Climate change is primarily driven by two key factors: natural processes and human activities. The former encompasses natural phenomena such as solar radiation variability, which contributes to Earth's climatic fluctuations. However, the latter, particularly anthropogenic activities—has exerted significantly more substantial and detrimental impacts on global climate

patterns.

These factors often interact synergistically to exacerbate climate change. For instance, industrial emissions and fossil fuel combustion substantially elevate atmospheric carbon dioxide (CO_2) concentrations, accelerating global warming. Concurrently, urbanization and widespread deforestation impair the biosphere's capacity to sequester CO_2, further diminishing the natural conversion of carbon dioxide into oxygen. Such interconnected mechanisms underscore the escalating severity of global warming in recent decades.

2. How to solve climate change?

It should be common knowledge that solving climate issues requires multiple efforts, such as researchers from university, individual and international governments. So, in the next content, methods will be proposed from three aspects.

2.1 What can researchers do?

Firstly, the academic committee should prioritize the development of structured courses on climate change. Such curricula would serve a dual purpose: (1) fostering student awareness of the underlying mechanisms driving climate change, and (2) cultivating a new generation of environmental specialists equipped to address sustainability challenges.

Fig. 2. Courses and lectures on climate change.

Secondly, concurrent with educational initiatives, substantial support should be directed toward research and development in renewable energy technologies. Key focus areas include:

- Optimization of photovoltaic conversion efficiency in solar cells.
- Enhancement of wind turbine performance and energy output scalability.
- Advancement of carbon capture and storage (CCS) systems to mitigate atmospheric CO_2 accumulation.

These technological innovations are critical for achieving meaningful reductions in global carbon emissions and counteracting the progression of climate change.

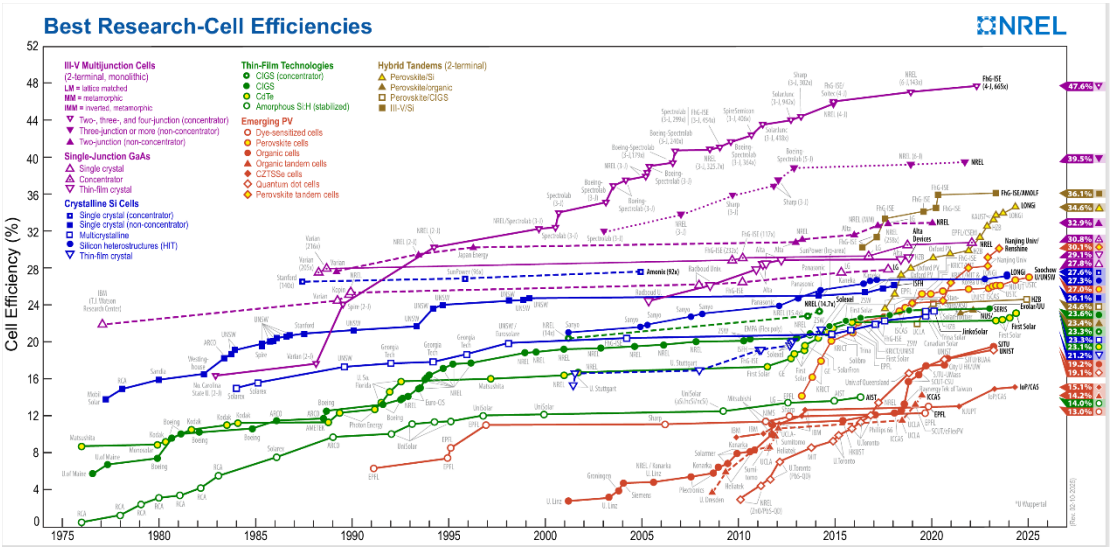

Fig. 3. The conversion efficiency of solar cells in recent decades [2].

Moreover, given the spatial heterogeneity of climatic conditions across regions, universities must establish strategic collaborations with international environmental organizations. Such partnerships facilitate:

- **Global knowledge integration**: Shared access to geographically diverse datasets and localized expertise.
- **Technology transfer**: Joint development and dissemination of regionally adaptable mitigation strategies.
- **Scientific diplomacy**: Creation of transnational research networks to harmonize climate action frameworks.

This multilateral cooperation paradigm not only accelerates breakthroughs in climate science through pooled intellectual resources but also operationalizes the Paris Agreement's principle of "common but differentiated responsibilities" at an institutional level.

Fig. 4. Cooperation and discussion on climate change between universities and international organizations.

2.2 What can an individual do?

The most important step individuals can take is to prioritize energy conservation and emission reduction in daily life. There are mountains of things waiting for individuals to do, for instance, reduce unnecessary electricity use by turning off lights when not in use and optimizing thermostat settings. For transportation, prioritizing public transport, walking, or cycling over private vehicles, thereby cutting carbon emissions. When making purchases, choose products with eco-certifications, recyclable materials, or low-energy production—such as energy-efficient appliances and eco-friendly household items. By aligning consumption with sustainability, consumers signal market demand for green products, driving businesses to adopt greener practices.

Besides, individuals can plant trees in their free time as trees have the

ability to absorb carbon dioxide.

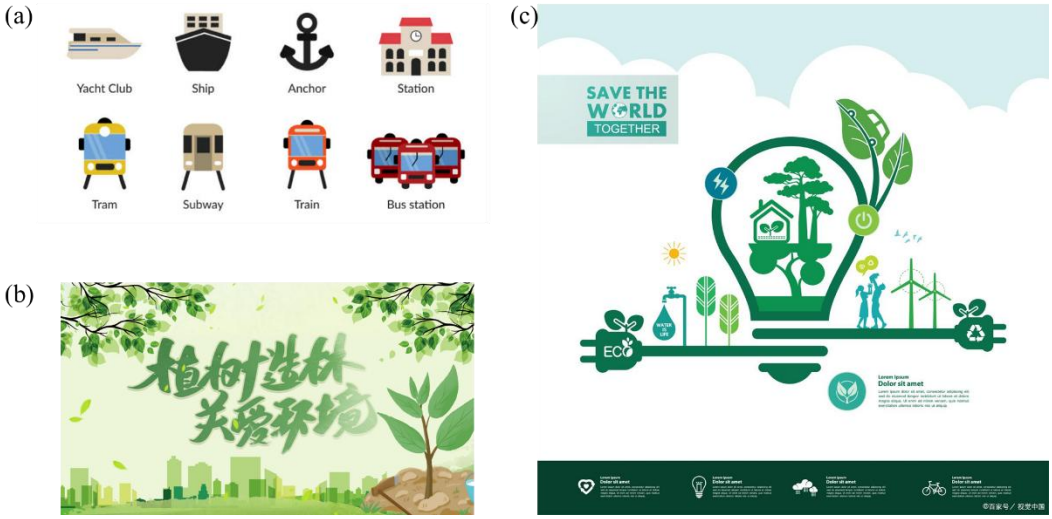

Fig. 5. (a) Some public transport; (b) Afforestation advocacy; (c) Propaganda to protect the planet.

In the meanwhile, individuals can make some posters or videos to public these environmentally friendly actions when they have done things mentioned before, which can raise climate literacy and catalyze a societal shift toward sustainable lifestyles through heightened environmental awareness.

2.3 What can governments and international organizations do?

It is known that the role of governments and international organizations is leader, rule maker and supervisor.

Therefore, the initial focus must be establishing and refining regulatory frameworks, like setting emission reduction targets, optimizing energy policy frameworks and developing comprehensive green building standards [3]. Governments may establish clear greenhouse gas (GHG)

emission reduction targets based on their national economic development levels, energy mix, and environmental carrying capacity. To incentivize renewable energy development, policy instruments such as subsidies and tax incentives can be deployed to accelerate the adoption of solar, wind, and hydropower technologies.

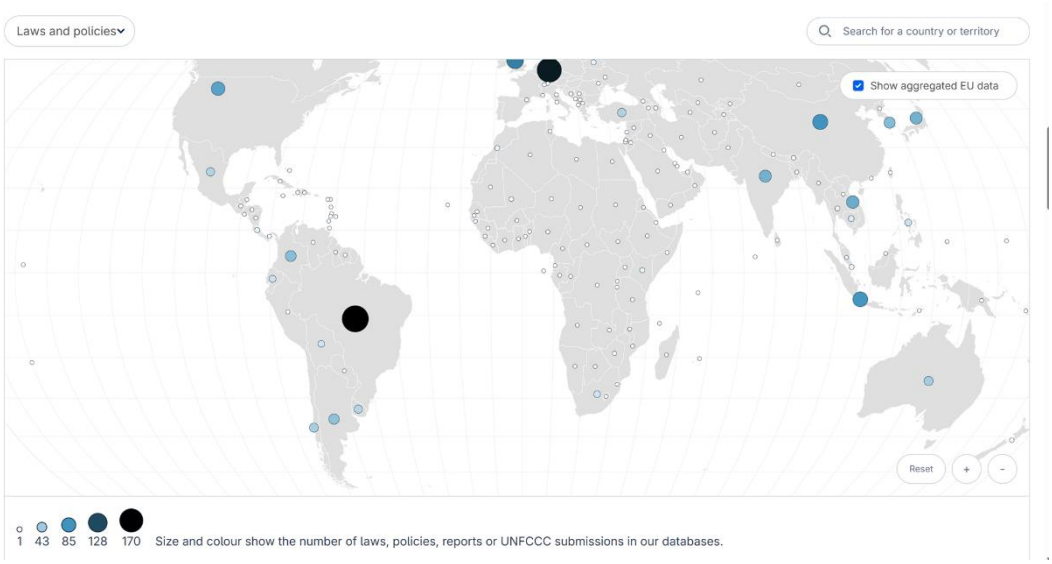

Fig. 6. A website where you can search for climate policies in different countries [4].

A case in point is Germany's Renewable Energy Sources Act (EEG), which implemented a feed-in tariff system guaranteeing long-term fixed-price payments for renewable energy producers. This mechanism has been instrumental in propelling Germany's installed solar PV capacity from 5 GW in 2008 to over 60 GW by 2023, while wind power generation increased by 52% between 2010 and 2022.

Meanwhile, international meteorological organizations must proactively monitor and assess climate change. For instance, the World Meteorological Organization (WMO) leverages its Global Observing System (GOS) to

collect and integrate meteorological data worldwide, establishing a scientific foundation for researchers to accurately evaluate climate trends and impacts, while informing evidence-based policymaking for national governments. Furthermore, under the Paris Agreement, countries are required to submit Nationally Determined Contributions (NDCs) reports periodically. International bodies can conduct technical reviews of these submissions through mechanisms like the Enhanced Transparency Framework (ETF), verifying alignment with pledged emission reduction targets. Should discrepancies or non-compliance be identified, multilateral institutions may initiate structured diplomatic consultations under Article 15 of the Paris Agreement, utilizing platforms such as the Facilitative Dialogue to urge corrective actions

3. Conclusion

Climate change represents a complex and pressing global challenge that demands coordinated efforts across academia, individual citizens, and governments. Academic institutions contribute through education, technological innovation, and international collaboration, providing critical knowledge and solutions. Individuals play a pivotal role by adopting sustainable habits, engaging in environmental advocacy, and reducing personal carbon footprints. Governments must lead by enacting robust policies, offering economic incentives, and fostering global partnerships. A synergistic approach integrating these three dimensions—

academic expertise, grassroots action, and policy frameworks—is essential to build a comprehensive, multi-tiered response system. Only through such collective action can humanity effectively mitigate climate impacts and achieve long-term sustainable development.

Reference

[1] Cheng, L., Abraham, J., Trenberth, K.E. *et al.* Another Year of Record Heat for the Oceans. *Adv. Atmos. Sci.* **40**, 963–974 (2023). https://doi.org/10.1007/s00376-023-2385-2.

[2] Arcipowska, Aleksandra, Perez Sara Blanco, Małgorzata Jakimów, Brian Baldassarre, Davide Polverini, and Miguel Cabrera. Role of solar PV in net-zero growth: An analysis of international manufacturers and policies. Progress in Photovoltaics: Research and Application, 2024. DOI: https://doi.org/10.1002/pip.3797.

[3] https://www.gov.cn/zhengce/2021-10/27/content_5646697.htm. 中国应对气候变化的政策与行动.

[4] Best Research-Cell Efficiency Chart | Photovoltaic Research | NREL.

AI statement: In this article, AI is used to collect some data and information as well as utterance morpheme checking.