Supervisor: R. Glaser I University of Freiburg I Global Change

by Noah Burgert

The climate time bomb is ticking!
3 degrees of global warming and its consequences

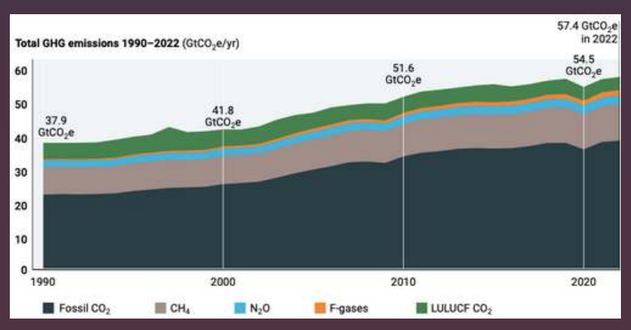
According to the U.N. Environment Program, if countries around the world fully implement their current climate commitments, the Earth will move towards nearly 3 degrees of warming by 2100, which will have tremendous consequences for life on earth as we know it! [1]

Glossary [3]

- **G20 countries**: The Group of 20 (G20) has been the central forum for international economic cooperation since 2009.[2]
- **Nationally Determined Contribution (NDC)**: Submissions by countries that have ratified the Paris Agreement which represent their national efforts to achieve the Paris Agreement's long-term temperature goal of limiting global warming to well below 2°C.
- **Emission gap**: The emissions gap is defined as the difference between the estimated global GHG emissions resulting from full implementation of the latest NDCs and those under least-cost pathways aligned with the long-term temperature goal of the Paris Agreement.

CAUSES [4]

Rising greenhouse gas emissions

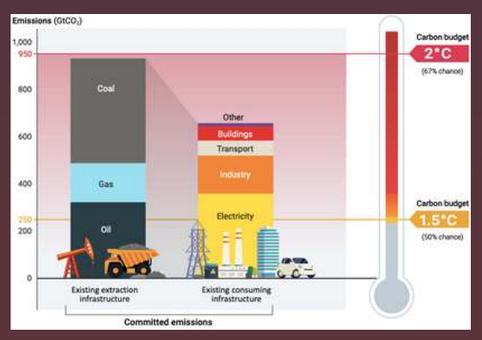


Low net zero commitments

Confidence in the implementation of net zero commitments is low

- Currently, none of the G20 members are reducing emissions at a pace consistent with achieving their net zero targets

Rising primary energy consumption



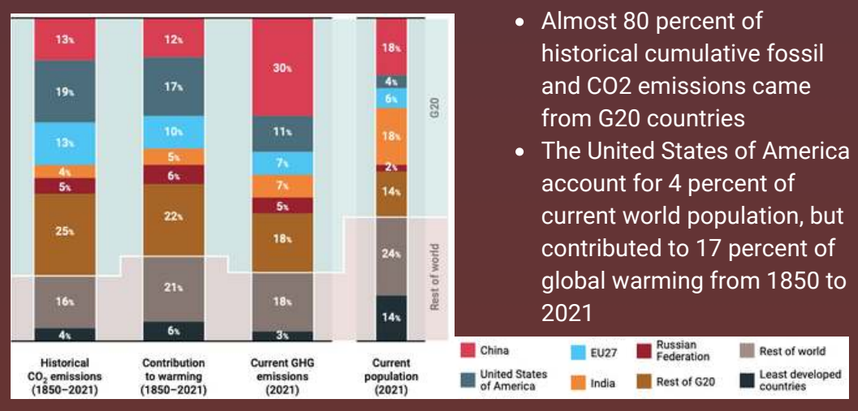
- Growth in coal, oil and renewable electricity supplies
- Investments in fossil fuel extraction
- Figure: Committed CO2 emissions from existing fossil fuel infrastructure, compared with carbon budgets reflecting the long-term temperature goal of the Paris Agreement

Overarching objective of pursuing development

Energy transitions in low- and middle-income countries are shaped by the overarching objective of pursuing development

- Fight poverty
- Expand industries
- Urbanize
- Moving away from fossil fuels

Unequal global distribution of emissions



- Almost 80 percent of historical cumulative fossil and CO2 emissions came from G20 countries
- The United States of America account for 4 percent of current world population, but contributed to 17 percent of global warming from 1850 to 2021

The emissions gap remains large

Current unconditional NDCs imply a 14 GtCO2e gap for a 2°C goal and a 22 GtCO2e gap for the 1.5°C goal

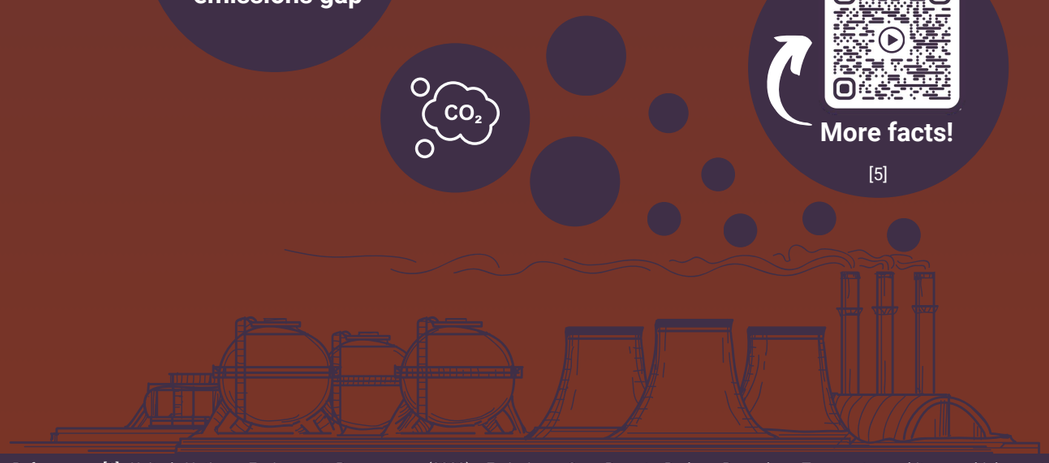
NDC progress is not enough to close the emissions gap

The failure to stringently reduce emissions in high-income countries and to prevent further emissions growth in low- and middle-income countries

CO_2

More facts!

[5]



CONSEQUENCES

Steam hunger
The atmosphere's ability to absorb water vapor increases with temperature

Extreme precipitation
Overall, precipitation worldwide is increasing with warming because the rate of evaporation from the oceans is increasing by around 3 percent per degree

Extreme heat
Expansion of deadly hot areas
--> Staying outdoors is more dangerous

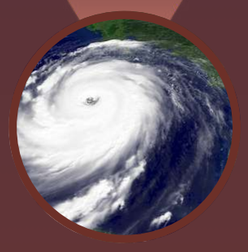
Extreme weather conditions

[6]

Drought
The drought causes loss of soil moisture and drying of vegetation, thereby affecting agriculture

Tropical cyclones
Global warming is charging tropical cyclones with additional energy - because these storms draw their destructive power from the heat energy stored in the upper ocean

[7]



Melting ice sheets

Rising sea level
Erosion of coastal zones and threatened infrastructure and coastal cities

[8]

Fluctuating jet stream
As the Arctic warms up, the jet stream becomes weaker
--> Bulges to the north and south
--> Persistent meanders cause extreme weather conditions

[10]

Permafrost
Thaws in large parts of the Arctic
--> Release of stored carbon dioxide and methane

[9]

WHAT NEEDS TO BE DONE

- Low-carbon development transformations with a focus on the energy transition.
- Countries with greater capacity and responsibility for emissions will need to take more ambitious action and provide financial and technical support to developing nations.
- Low- and middle-income countries, which already account for more than two thirds of global emissions, should meet their development needs with low-emissions growth, which would provide universal access to energy, lift millions out of poverty, and expand strategic industries.
- New emissions targets that bring greenhouse gas emissions in 2035 to levels consistent with the 2°C and 1.5°C pathways.
- CDR: anthropogenic activities that remove CO2 from the atmosphere and permanently store it in geological, terrestrial or ocean reservoirs, or in products. [11]

References: [1] United Nations Enviroment Programme (2023). Emissions Gap Report: Broken Record – Temperatures hit new highs, yet world fails to cut emissions (again). Nairobi. https://doi.org/10.59117/20.500.11822/43922. [2] Gruppe der Zwanzig (G20) - Bundesfinanzministerium – Themen (n.d.). Bundesministerium der Finanzen. https://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Internationales_Finanzmarkt/G7-G20/G20-7292.html. [3] See reference 1. [4] Content Causes see reference 1. Illustrations see reference 1. [5] UN Environment Programme. (2023, November 20). Broken record: UNEP's #EmissionsGAp Report 2023 [Video]. YouTube. https://www.youtube.com/watch?v=NvNjz1dnwqQ. [6] (1) Content: Wiegandt, K. (2022). 3 Grad mehr: Ein Blick in die drohende Heißzeit und wie uns die Natur helfen kann, sie zu verhindern. Springer. (2) Picture left: Maldonado, R. (2021, November 30). Die heimliche Katastrophe am Amazonas. WWF Blog. https://blog.wwf.de/wasser-amazonas/. (3) Picture right: Tropische Wirbelstürme. (n. d.). ESKP. https://www.eskp.de/grundlagen/naturgefahren/tropische-wirbelstuerme-935256/. [7] Picture: Gletscherschmelze wirkt sich sogar aufs Grundwasser aus (2021, 13. Oktober). DER SPIEGEL, Hamburg, Germany. https://www.spiegel.de/wissenschaft/natur/groenlaendischer-eisschild-gletscherschmelze-wirkt-sich-sogar-aufs-grundwasser-aus-a-41bb83e3-070d-4050-86b1-6f1ac86995e5. [8] (1) Content: IPCC, 2022: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press. Cambridge University Press, Cambridge, UK and New York, NY, USA, 3056 pp., doi:10.1017/9781009325844. (2) Content: Francis, J. A. (2019): Auf dünnem Eis. In F. Neukirchen (Ed.), Die Folgen des Klimawandels (pp. 97-107). Springer. (3) Picture: Erste Sturmflut der Saison überspült Hamburger Fischmarkt (2023, Oktober 14). DER SPIEGEL, Hamburg, Germany. https://www.spiegel.de/panorama/hamburg-erste-sturmflut-der-saison-ueberspuelt-fischmarkt-a-f6c3fef7-9668-455c-9788-3ee50e3e5a48. [9] (1) Content: Schuur, E. A. G. (2019): Tauende Tundra. In F. Neukirchen (Ed.), Die Folgen des Klimawandels (pp. 131-141). Springer. (2) Picture: Permafrost (n. d.). Hamburger Bildungsserver. https://bildungsserver.hamburg.de/themenschwerpunkte/klimawandel-und-klimafolgen/permafrost-254054. [10] Lingenöhl, D. (2019): Der Jetstream schlägt Wellen. In F. Neukirchen (Ed.), Die Folgen des Klimawandels (pp. 181-193). Springer. [11] See reference 1. [12] Pictograms are from Canva.