SYNTHESIS OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 6TH ASSESSMENT REPORT

GREENHOUSE GAS EMISSIONS: EVOLUTION AND MAIN SOURCES

Rising greenhouse gases (GHG). Carbon dioxide (CO2) concentrations have not been this high at least in the last 2 million years. Methane (CH4) and nitrous oxide (N2O) concentrations have not been this high at least in the last 800,000 years. In 2019, GHG emissions were about 12% higher than in 2010 and 54% higher than in 1990. All GHG have been increasing, but at different rates. CO2 from fossil fuels and industry (CO2-FFI) grew the most in absolute terms, by 2019, followed by CH4. Fluorinated gases had the highest relative growth (levels were low in 1990).

Evolution of CO2 emissions' growth. Between 1850 and 2019, humanity released a total of 2400 +/- 240 net Gigatons of CO2 (GtCO2). 58% was released between 1850 and 1989, 42% between 1990 and 2019. The different world regions contributed differently to historical emissions.

WHERE DO EMISSIONS COME FROM?

Since 2010, net anthropogenic GHG emissions have risen across all major sectors. In 2019, emissions came from the following sectors: energy supply, 34%; industry, 24%; agriculture, forestry and other land use (AFOLU), 22%; transport, 15%; buildings, 6%. Urban areas release an increasing share of emissions. There are regional and national differences in emissions, partly reflecting different development stages. There has been a rise in average global per capita net anthropogenic GHG emissions from 1990 to 2019 - from 7.7 to 7.8 tCO2-eq.

RISING EMISSIONS ARE LEADING TO:

Rising temperatures

The global surface temperature has been rising successively in the last four decades: each decade has been warmer than the previous one, and warmer than any decade since 1850. Human activities have led to an increase in global surface temperature of 1.07°C since 1850, a warming rate unprecedented in at least the last 2000 years.

Melting glaciers, ice caps and snow cover

Glaciers have been retreating since the 1990s, and the Arctic Sea ice area has decreased since the 1980s. Between 2011 and 2020, the annual average Arctic Sea ice area reached its lowest level at least since 1850. Northern hemisphere snow cover has decreased since 1950, and the Greenland Ice Sheet surface has been melting since 2000.

Warmer, acidified and rising oceans

The upper ocean (0-700 m) has been warming since the 1970s and the ocean surface has become more acidified. The global mean sea level has risen by 0.20 m between 1901 and 2018, faster than in any century in the last 3000 years at least.

Weather and climate extremes

Since the previous IPCC report (2014), there is stronger evidence that human-caused climate change is affecting weather and climate extremes all across the world. Hot extremes (including heatwaves) and heavy precipitation events have grown in frequency and intensity. Cold extremes (including cold waves) are less frequent and intense. Extreme events are increasingly occurring in a compound manner since the 1950s, e.g. concurrent heatwaves and droughts.

CLIMATE CHANGE IMPACTS

JESUIT EUROPEAN SOCIAL CENTRE

Urban infrastructure. Climate change has negatively impacted transportation, water, sanitation and energy systems, especially affecting marginalised urban dwellers, including those in informal settlements.

Damages and losses to ecosystems, including terrestrial, freshwater, coastal, and open marine ecosystems. Some species are either having to migrate in direction to the poles or to higher altitudes due to warming temperatures, or they are suffering due to ice loss, and/ or extreme weather events.

Negative effects on water and food security, due to impacted agricultural productivity, ocean warming and acidification. Food and water insecurity are mostly suffered in Africa, Asia, Central and South America, Small Islands and the Arctic. Several communities are increasingly experiencing malnutrition, especially Indigenous communities, small scale food producers and low-income populations.

Negative health impacts, including mental health. Main causes: weather and hot extremes; food, water and vector-borne diseases, animal and human diseases related to climate change.

Negative economic impacts to climate-exposed sectors: agriculture, forestry, fishery, energy and tourism.

Vulnerability to climate change. Ecosystems and human beings' vulnerability to climate change are interdependent, vary regionally, and are affected by socioeconomic development, ocean and land use, inequity, marginalisation, and governance. About 3.3 to 3.6 billion people live in highly vulnerable contexts. Likewise, a large share of species is vulnerable to climate change. When human beings destroy ecosystems, they increase their own vulnerability to climate change.

Climate hazards combined with high vulnerability contribute to humanitarian crises. Climate and weather extremes are causing displacement (Small Island Developing States are impacted disproportionately). Critical food insecurity and malnutrition related to floods and droughts have become more frequent in Africa, Central and South America.

OVERALL TRENDS

- Broader involvement. Non governmental and sub-national actors are playing increasingly important roles in the fight against climate change: cities, businesses, Indigenous Peoples, citizens (represented by local communities and youth), international initiatives and public-private initiatives.

- Climate change mitigation, adaptation and development pathways. Countries' economic development impacts their GHG emissions, as well as related mitigation challenges and opportunities. Climate mitigation is more "acceptable, durable and effective" (WG III, p. 3) when designed and implemented with a sustainable development, equity and poverty eradication approach.

- Carbon budget. Since 2014, the IPCC has improved carbon budget estimation. To limit global warming to 1.5 °C, the estimated remaining carbon budget from 2020 onwards is 500 Gt CO2, about 50% of what was emitted between 1990 and 2019. If we look at the total carbon budget to limit global warming to 1.5 °C, 4 / 5 of emissions were already emitted between 1850 and 2019.

- Change is possible, but not yet enough. At least 18 countries have been reducing their GHG emissions in the last 10 years, through decarbonisation of energy supply, energy efficiency, and energy demand reduction. Globally, a reduction in GDP energy intensity and energy carbon intensity have led to CO2-FFI emissions reductions. But these reductions have been less than emissions' increases.

- Reduced unit costs and increased deployment of low-emission technologies. There have been sustained decreases in the unit costs of solar energy (↓85%), wind energy (↓55%), and lithium-ion batteries (↓85%) (since 2010). And large increases in their deployment, varying widely across regions. These trends were made possible by innovation policy packages; demand pull instruments; and policy packages tailored to national contexts and technological characteristics.

- Social dimension of low-emission technologies' deployment. Policies and governance that were appropriately designed have helped deal with some of the environmental, social and distributional impacts potentially linked to the deployment of these technologies. However, many countries have suffered negative side-effects, like "low-value employment and dependency on foreign knowledge and suppliers" (WGIII p 12 & 13). Developing countries are lagging behind in the adoption of low-emission technologies, partly because of weaker enabling conditions, including "limited finance, technology development and transfer, and capacity" (WGIII p 12 & 13). Strengthening enabling conditions can invigorate development benefits and enhance public support for policies.

- Finance and climate action. Climate finance flowing from developed to developing countries is still slow and below the Paris Agreement goals. Climate finance flows are also unevenly distributed across regions and sectors. Sustainable finance has grown since 2014, but there is still more investment in fossil fuels than in climate adaptation and mitigation.

- Need to strengthen policies and ambitions. Compared to the IPCC's 5th Assessment Report (2014), the likelihood of limiting warming to 1.5°C has declined. To limit global warming to 1.5°, global GHG emissions should peak at the latest before 2025, and global CO2 emissions should reach net zero in the early 2050s. By 2030 and 2040, there should be deep reductions in GHG emissions, especially reductions in methane emissions. If policies are not strengthened beyond what was implemented toward the end of the year 2020, GHG emissions are projected to continue rising after 2025 and lead to 3.2 ° C of median global warming by the year 2100.