IPCC REPORT ON CLIMATE CHANGE MITIGATION – "IT'S NOW OR NEVER"

The Russian invasion of Ukraine and soaring energy prices have prompted a rethink of energy policies, with potential increases in fossil fuel production. This however comes as a critical inflection point in the fight against the effects of climate change. The impact of increases in fossil fuel production was a central theme of the latest report from the Intergovernmental Panel on Climate Change (IPCC), Climate Change 2022: Mitigation of Climate Change.

This latest IPCC report (from Working Group III), which represents the third instalment of the IPCC's Sixth Assessment Report, provides an updated assessment of progress and pledges on climate change mitigation and examines sources of global emissions. The first instalment (issued by Working Group I) warned that the effects of human drivers of climate change were becoming irreversible, and the second (issued by Working Group II) addressed the impacts of climate change. (See my prior briefing note, available here.)

The full report is available here, the Summary for Policymakers is available here and the IPCC press release is available here.

Key Takeaways from the Report

Highlights of the report:

Headline items

- There is an implementation gap because projected GHG emissions are higher than those implied by pledges by governments under the Paris Agreement (known as nationally determined contributions, or NDCs). GHG emissions in 2030 associated with the NDCs announced prior to COP26 make it likely that warming will exceed 1.5˚C during the 21st century. Limiting warming to 2.0˚C would then need to rely on rapid acceleration of mitigation efforts after 2030.

  In other words, current climate pledges under the Paris Agreement will not be sufficient to keep global warming to 1.5˚C above pre-industrial levels. Without a strengthening of policies beyond those that are implemented by the end of 2020, GHG emissions are projected to rise beyond 2025, leading to median global warming of 3.2˚C by 2100.

- Limiting warming to around 1.5˚C requires global GHG emissions to peak before 2025 at the latest and be reduced by 43% by 2030; methane would have to be reduced by about one-third. Even so, it is "almost inevitable" that the planet will temporarily exceed this temperature threshold (referred to as an "overshoot"), but could return to below the threshold by the end of the century.

  Doing so will require technologies to remove CO_2 from the atmosphere (known as CDR) and store it in geological, terrestrial or ocean reservoirs, or in products. The processes by which CO_2 is removed from the atmosphere are categorised as biological, geochemical or chemical. Afforestation, reforestation, improved forest management, agroforestry and soil carbon sequestration currently are the only widely practiced CDR methods. Reforestation, improved forest management, soil carbon sequestration, peatland restoration and blue carbon management are examples of

methods that can enhance biodiversity and ecosystem functions. Ocean fertilisation, if implemented, could lead to nutrient redistribution, restructuring of ecosystems, enhanced oxygen consumption and acidification in deeper waters. The removal and storage of CO_2 through vegetation and soil management can be reversed by human or natural disturbances; it is also prone to climate change impacts. In comparison, CO_2 stored in geological and ocean reservoirs is less prone to reversal.

CDR efforts, however, are not a substitute for significant reductions, starting now, in emissions. (To stay below the 2.0˚C limit, GHG emissions still need to peak before 2025 at the latest, and be reduced by 25% by 2030.) The global temperature will stabilize when the planet reaches net zero. For 1.5˚C, it means achieving net zero in the early 2050s; for 2.0˚C, it is in the early 2070s.

- All global modelled pathways to limit warming to either 1.5˚C or 2.0˚C involve rapid and deep and, in most cases, immediate GHG emission reductions in all sectors. Modelled mitigation strategies to achieve these reductions include transitioning from fossil fuels without carbon capture and storage (CCS) to very low- or zero-carbon energy sources, such as renewables or fossil fuels with CCS, demand side measures and improving efficiency, reducing non-CO_2 emissions, and deploying CDR methods to counterbalance residual GHG emissions.

  To achieve the goal of 1.5˚C, the global use of gas must decline by 45%, the global use of oil must decline by 60% and the global use of coal must decline by 95%, compared to 2019 levels. To limit warming to 2.0˚C, the reductions would have to be 15%, 30% and 45%, respectively, by 2050.

  All mitigation strategies face implementation challenges, including technology risks, scaling and costs. Many challenges, such as dependence on CDR, pressure on land and biodiversity (*e.g.*, bioenergy) and reliance on technologies with high upfront investments (*e.g.*, nuclear), are significantly reduced in modelled pathways that assume using resources more efficiently or shift global development towards sustainability.

The trends

- In 2010-2019, annual net GHG emissions were at their highest levels in human history, and "without immediate and deep emissions reductions across all sectors, limiting global warming to 1.5˚C is beyond reach." However, there is increasing evidence of climate action, and the rate of increase in GHG emissions between 2010 and 2019 was lower than the rate between 2000 and 2009. By 2019, the largest growth in absolute GHG emissions was CO_2 from fossil fuels.
- An increasing share of emissions can be attributed to urban areas (increasing from 62% of the global share in 2015 to 67-72% in 2020). Globally, 10% of the households with the highest per capita emissions contribute 34-45% of global consumption-based household GHG emissions, while the bottom 50% contribute only 13-15%.
- We have already used up about four fifths of the *total* carbon budget for a 50% probability of limiting global warming to 1.5˚C and about two thirds of the carbon budget for a 67% probability of limiting global warming to 2.0˚C. Cumulative net

emissions between 2010-2019 compare to about four fifths of the size of the *remaining* carbon budget from 2020 onwards for a 50% probability of limiting global warming to 1.5°C, and about one third of the *remaining* carbon budget for a 67% probability to limit global warming to 2°C. The carbon budget is the maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given likelihood, taking into account the effect of other anthropogenic climate forces - referred to as the *total* carbon budget when expressed starting from the pre-industrial period, and as the *remaining* carbon budget when expressed from a recent specified date.

- Reductions in CO_2 emissions from fossil fuels and industrial processes (due to improvements in energy intensity of GDP and carbon intensity of energy) were offset by increased emissions from rising global activity levels in industry, energy supply, transport, agriculture and buildings. In 2019, approximately 34% of net GHG emissions came from the energy supply sector, 24% from industry, 22% from agriculture, forestry and land use, 15% from transport and 5% from buildings. If emissions from electricity and heat production are attributed to the sectors that use the final energy, 90% of these indirect emissions are allocated to the industry and buildings sectors, increasing their relative GHG emissions shares from 24% to 34%, and from 6% to 16%, respectively. After reallocating emissions from electricity and heat production, the energy supply sector accounts for 12% of global net anthropogenic GHG emissions.
- An increasing range of policies and legislation have improved energy efficiency, reduced rates of deforestation and accelerated the deployment of renewable sources of energy. Since 2010, there have been sustained decreased in the costs of solar, wind energy and batteries.

Investments in mitigation

- Progress on aligning the flows of capital to meet the Paris Agreement thresholds remains slow. Annual tracked total financial flows for climate mitigation and adaptation increased by up to 60% between 2013/14 and 2019/20, but average growth has slowed since 2018. These financial flows remained heavily focused on mitigation, are uneven and have developed heterogeneously across regions and sectors. Public and private finance flows for fossil fuels are still greater than those for climate adaptation and mitigation. Markets for green bonds, and ESG and sustainable finance products have expanded significantly. Challenges remain, and total mitigation investments at current levels will need to increase by a factor of six to limit warming to 1.5˚C.

The costs

- Efforts to stay within the 2.0˚C ceiling, assuming coordinated global action between now and 2025, could reduce global GDP by 1.3% to 2.7% by 2050, as compared with relying only on the NDCs implemented by 2020. This adverse impact is small compared to projected growth in global GDP in scenarios that quantify the macroeconomic implications of climate change mitigation, but do not take account of economic damages from climate change or adaptation costs. Regardless of the extent of mitigation action, global GDP is projected to double.

Solutions

- Carbon pricing instruments have incentivized low-cost emission reductions measures, but have been less effective to promote higher-cost measures necessary for further reductions. Removing fossil fuel subsidies would reduce emissions, improve public revenue and macroeconomic performance, and yield other environmental and sustainable development benefits. Removing fossil fuel subsidies is projected by various studies to reduce global CO_2 emissions by 1-4%, and GHG emissions by up to 10% by 2030, varying across regions.
- Working Group III introduced a new component in its report – social aspects of mitigation, which explores what drives consumption and GHG emissions (*i.e.*, the demand side). The demand side has three categories: socio-cultural, which includes individual choices and behavior; infrastructure use, which enables changes in choices and infrastructure; and end-of-use technology. Demand-side measures and new ways of end-use service provision could reduce global GHG emissions by 40-70% by 2050, compared to baseline scenarios, while some regions and socioeconomic groups require additional energy and resources.

  The key message is that demand management will be critical, and that the fight against the effects of climate change requires a whole-of-society response in reducing consumption and demand for energy-intensive goods and services. The report addresses necessary changes in food, industry, transport, buildings and energy.

	Food	**Industry**	**Land transport**	**Buildings**
Socio-Cultural	• Shifts in diet • Avoidance of food waste	• Sustainable consumption	• Teleworking	• Social practices that result in energy savings
Infrastructure	• Guidance and financial incentives	• Networks for recycling, repurposing and remanufacturing	• Public transportation • Shared mobility • Spatial planning	• Compact cities • Rationalisation of living floor space • Urban planning
End-use	• N/A at this time	• Green procurement to access material-efficient products and services	• Electric vehicles	• Energy efficient building envelopes and appliances • Shift to renewables

Additional electrification to enable end-use sectors to substitute electricity for fossil fuels (*e.g.*, via heat pumps and electric vehicles), and reduced emission through demand-side mitigation options across buildings, industry and land transport, as well as load management (*e.g.*, incentive design-like time of use pricing/monitoring by AI, diversification of storage facilities and the like).

Concluding Thoughts

There is bad news, but also some good news. Mitigation efforts are having a positive impact and the costs of renewable energy technology has fallen dramatically. The amount of energy needed to drive the global economy – known as global energy intensity (measured as primary energy per unit of GDP) – in a reversal of the negative trend observed between 2000 and 2009, dropped 2% annually between 2010 and 2019. Carbon intensity decreased 0.3% annually over the same period (also a trend reversal from the prior period) largely due to shifts from coal to gas, reduced expansion of coal capacity and increased use of renewables.

Accelerating mitigation efforts (policies and technology) and increasing sustainable finance are critical. As the report noted, deployment of CDR to counter-balance "hard-to-abate" residual emissions (*e.g.,* emissions from agriculture, aviation, shipping and industrial processes) is "unavoidable" if net zero is to be achieved. Many believe that, as the cost of undertaking CDR after the fact is higher than preventing emissions on the front end, the focus must be on cutting emissions.

The bottom line is that we risk "overshooting" the goal of 1.5˚C, and events of the past six weeks are heightening that risk. As governments prepare for the COP27 summit in November, it is critical that the warnings set forth in all three IPCC reports are nonetheless acted upon. This will be a particular challenge in light of fears of soaring inflation, soaring costs for energy and growing food insecurity, all exacerbated by the Russian invasion of Ukraine. The Joint European action plan for secure and sustainable energy, issued last month, highlights both the tensions between reducing overall use of fossil fuels and the more immediate steps needed to reduce Europe's dependence on Russian fossil fuels, as well as the longer term opportunities presented by renewables to offset that dependence.

Back to the good news – by treating energy independence as a matter of national security, the transition to clean energy can only benefit. The question then is the extent to which short-term reactions undermine the longer-term benefits. Hopefully this latest IPCC report will not be eclipsed by the understandable focus of so much of the world on the war in Ukraine and its immediate consequences.

* * * *

Mark S. Bergman
7Pillars Global Insights, LLC
Washington, D.C.
April 6, 2022