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Climate Change, Paris Agreement and Global Action: A Way Forward

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The recent Climate Change Conference at Katowice, Poland, in December 2018 has been seen by many as leading to a minimal outcome in dealing with Climate Change. Faced with mounting scientific evidence and increasingly serious assessment of threats arising from global warming, the Conference barely could reach agreement even after extended sessions on the rule book for implementation of the Paris Agreement; this rule book has fallen far short of the expectations of many stakeholders. Important issues such as voluntary trading could not be covered owing to disagreements among member states.

Towards Tipping Point?

Meanwhile, the latest annual estimates of global emissions from the Global Carbon Project (GCP) have found that output from fossil fuels and industry would grow around 2.7% in 2018, the fastest increase in seven years (Carbon Brief, 2018a). The magnitude of the challenges can be gauged from the fact that global warming (average increase in Earth temperature since the pre industrial revolution base) has reached 1.17 degree Celsius. The latest IPCC report had warned of the grave consequences if the warming exceeded 1.5 degrees. When the Paris agreement was negotiated, the limit for global warming was set at 2 degree C, and total carbon dioxide equivalent levels in the atmosphere were to be kept below 450 parts per million volume (ppmv). The data of January 2019

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indicate that CO_2 level has already reached 413.9 ppmv; with an average rate of increase of 2.24 ppmv per year. At this rate, the "tipping point" of 450 ppmv would be reached by March 2035. Of concern is the sharp rise in methane (which has high global warming potential) to 1850 parts per billion (ppbv); growing at 6 per cent per year.

To stay within the limit of 1.5 degree, a sharp cut in greenhouse gas emissions or technology to remove greenhouse gases from the atmosphere would be essential. Relief can be provided if technology for removal of CO_2 either from the atmosphere or from the industries such as cement, power, petroleum and steel is applied.

Montreal Protocol and Climate Change

There was an unexpected slowdown in the reduction of CFC11 level, used in refrigeration and cooling industry, which has been phased out since 2004 under the Montreal Protocol. This has been traced to increased emissions of CFC-11 in eastern Asia by certain Chinese entities, mislabeling banned Chlorofluorocarbons (CFCs) as hydrochlorofluorocarbons (HCFCs). China has acknowledged this, and has pledged to take corrective action (Venkatesh, 2018)

Under the Montreal Protocol to save Ozone layer, CFCs and HCFCs called Ozone Depleting Substances (ODS) were to be phased out. They were replaced by HFCs. This resulted in the improvement of ozone layer. However, the very success of the Montreal Protocol increased HFCs levels in the atmosphere with very high global warming potential (150 to 11000 times that of Carbon Dioxide). This required adoption of the Kigali Amendment to the Montreal Protocol (which has been entered into force on 1 January 2019); under which HFCs are to be phased out. The goal is to achieve over 80% reduction in HFCs consumption by 2047. The impact of the amendment would reduce by up to 0.5 °C the increase in global temperature by the end of the century. Technically, this means that alternative technology, including use of refrigerant gases such as Ammonia, Hydrocarbons, Carbon Dioxide etc., would need to be used in refrigeration and air conditioning equipment. This would require management of problems of toxicity, flammability and lower system energy efficiency. This presents a technological challenge.

Increase in Warming of Oceans

Another study based on more accurate data on ocean temperatures measured directly through the Argo network of floating sensors has indicated that the oceans are warming much faster than was estimated using the earlier data (Cheng *et al.*, 2019); which were based on the indirect measurements and estimates. The oceans are the major reservoir of heat energy (over 90 per cent) in the global climate system, and are linked to circulation of water vapour in the atmosphere. The next IPCC report is expected to address this issue. Water vapour, present in the atmosphere, is a potent greenhouse gas, but owing to its rapid changes and ability to transform into clouds and rain, its global warming effects so far have not been quantified. Some experts, however, have warned of a possible feedback effect of water vapour amplifying global warming. Even the global cooling effect of clouds and aerosols has not been studied sufficiently. All this indicates for the need for greater effort

in global climate modeling to improve calculation of the effects of greenhouse gas emission levels, and to predict extreme climate events in time and location. The ability to do the latter would be highly beneficial for adaptation efforts.

The Need for More R&D in CCS technology

Much greater R & D efforts need to be made in the area of Carbon Capture and Sequestration (CCS)[1] technology and negative emission technologies (including direct air capture and sequestration). At present, natural CCS is being used mainly through planting of additional forest and green areas (Ni *et al.*, 2016). Breakthroughs in this would provide valuable carbon space and enable developing countries to meet needs of economic development. It would also reduce the pain of developed countries in meeting their emission reduction commitments. R & D efforts for CCS should especially be targeted on concentrated sources such as cement production, while continuing efforts in steel, power, and hydrocarbon processing sectors. Introduction of a realistic carbon pricing mechanism, for example, a carbon tax, may lead to an economic boost for these technologies. However it must be emphasized that CCS is not to be seen as a mere "technical fix" to the problem of emission reduction, but as a complement to vigorous efforts to move away to lower emission technologies.

Divisions Sharpen at COP24

The extent of the divide among member states could be judged from differences over the language regarding the IPCC report on 1.5 degree warming. As at IPCC 48, the pro-fossil fuel countries lobbied hard to dilute the importance of the report and refused to "welcome" the latest IPCC report (Carbon Brief, 2018b), insisting instead only to "note" it. The final text did not "welcome" the report, but did welcome its "timely completion" and "invited" countries to make use of the report in subsequent discussions at the United Nations Framework Convention on Climate Change (UNFCCC).

The most technical and challenging area of negotiations was on the rules for voluntary market mechanisms under Article 6 of the Paris agreement. This includes Article 6.2, under which countries can trade over achievement of their climate pledges, as well as Article 6.4, under which individual projects can generate carbon credits for sale. In the end, the whole section was deferred to COP25 to be in November 2019. The most contentious point was on basic accounting rules to prevent "double counting" of emissions reduction by the buyer and the seller of offsets, as well as on credits for legacy emission reductions prior to the Paris Agreement.

In other areas, there was a visible weakening of provisions relating to emissions accounting, climate finance reporting, and on transparency and flexibility. One potentially important detail commits countries to report emissions in "CO_2 equivalents", using Global Warming Potentials[2] over 100 years. The differentiated regime for developing and developed countries was further diluted. A global stocktaking process has been agreed and the first such one would be in 2023. COP24 has agreed to set up an expert compliance committee that is "facilitative in nature…non-adversarial and non-punitive" (UNFCCC, 2015).

Countries are set to re-submit or update their climate pledges (known as "nationally determined contributions", or NDCs) in 2020. The Paris Agreement would come into effect in 2020, but countries had agreed in 2015 to take stock in 2018 of the progress on the climate action to date. This Talanoa dialogue began in January 2018, and concluded in a political phase during the second week at Katowice. The Paris Agreement says that successive pledges should "represent a progression" on the previous one – and "reflect its highest possible ambition", while also acknowledging different national circumstances. Going by the present trends, the total of all NDCs is likely to be far short of what is needed to keep global warming below 1.5 degree C

Progress Made at COP 24

During the COP, several countries including India, Canada, Ukraine and Jamaica, indicated willingness to submit increased climate pledges in 2020. Several dozen countries from the "High Ambition Coalition" – including the EU, UK, Germany, France, Argentina, Mexico and Canada – pledged to step -up their ambition by 2020. This would be done through enhanced climate pledges, low-emission development strategies and increased short-term action. The special efforts, made by large developing countries, such as India, China, Brazil, and South Africa, in the face of withdrawal of a few large advanced countries from the Paris Agreement deserve high praise.

On the setting of a new climate finance goal, the Paris Agreement says this should be set by 2025 and should go above the $100bn per year "floor" promised to developing countries by 2020. The COP 24 parties had agreed to start discussing this new goal at COP26 in November 2020. Meanwhile, rich countries' contributions remain well short of the $100bn target for 2020. Several announcements at the COP showed some scaling-up of finance for the Adaptation Fund; raising the total pledges to $129m – a record annual fund-raising. Germany also became the first country to announce a concrete amount for the Green Climate Fund (GCF)'s replenishment round, offering €1.5bn —double the amount of the previous contribution in 2014. Norway pledged $516m to the GCF, while Japan would consider more funding once the replenishment process officially starts in 2019. The GCF has so far received only $7bn of the $10bn promised to it in 2014 due to US backing out of its $3bn pledge as well as change in exchange rate for the US dollar.

The World Bank has announced $200bn for its 2021-2025 climate investment programme, which doubles the $100bn; given during previous five-year investment plan up to 2020. Half the total would come directly from the Bank, with equal shares of this going to mitigation and adaptation. The remaining $100bn will come from other parts of the World Bank group and "mobilised" private capital, the Bank said. The World Bank was also one of nine multilateral development banks who made a declaration at the COP to "align… their activities" with the goals of the Paris Agreement. Also, a combined loan book of €2.4tn has been committed by five Banks, namely Standard Chartered, ING, BNP Paribas, BBVA and Société Générale, in order to measure the climate alignment of their lending portfolios, to navigate them

towards "well below 2C" target (Climate Diplomacy, 2018).

Climate-Induced Migration

There is increasing recognition internationally about how climate change may affect migration of people; both within their own country and to different ones. The World Bank recently mentioned that up to 143 million people in Sub-Saharan Africa, South Asia and Latin America can be forced to migrate internally by 2050 due to climate change. The Warsaw International Mechanism (WIM), the formal mechanism, for addressing the loss and damage caused by climate change adopted a final text, which "invites" countries to consider recommendations of a task force set up by the Paris agreement, which touch on many issues related to both internal and cross-border migration. The WIM also decided to extend the mandate of the Task force – for exactly how long is yet to be decided.

The "Just Transition" Issue

A new issue was injected into the climate deliberations on the adverse impact on employment of energy transition away from fossil fuels. Some 50 countries have adopted a separate "Silesia declaration", which emphasize the need for emission-reducing policies to ensure "a just transition of the workforce" that creates "decent work and quality jobs". Earlier, in 2016, the ILO had developed guidelines on the concept of a "just transition" during the achievement of sustainable development goals. The presence of a large coal mining industry in Poland no doubt influenced this. If fossil fuel use is to continue, especially in power plants and steel production, the obvious solution is to use Carbon Capture and Sequestration (CCS) technology which enables Carbon Dioxide to be removed from emissions of plants and stored. This may cut down global warming impact of such industries. The other track is to use coal, oil and gas for transformation into other useful chemical products rather than for producing energy. In addition, technology for Direct Air Capture (DAC) of Carbon Dioxide is advancing, which would remove Carbon Dioxide from the air and convert it into useful fuel and chemicals.

The Next Steps – Global Climate Summit

A key event in 2019 would be a UN climate summit set to take place in September in New York. This is seen as a place where more stringent pledges may be announced. COP 25 is due to take place from 11-22 November 2019 in Chile, with Costa-Rica hosting the "pre-COP". The UK and Italy have both indicated their interest in hosting COP26 in 2020. This is considered a crucial COP as it is when countries have been asked to submit their next round of climate pledges for 2030. All countries need to prepare well for discussions. And holding wide ranging national stakeholders' consultations would be essential to enlist support of civil society.

Role of Science Diplomacy

Climate change is perhaps the defining challenge of the 21st century. It presents a conjunction of formidable challenges of multidisciplinary nature to scientists, policy makers, and civil society across the globe. Facing this challenge requires science diplomacy of a high order, where scientists must do more research about the science underlying climate change phenomena.

In turn, they must inform non-scientists including policy makers and civil society in clearly comprehensible terms about the scientific knowledge underlying climate change phenomena. Close cooperation between climate scientists and policy makers and civil society stakeholders is necessary for international negotiations to work. It is possible that new approaches to global governance may emerge as a result of climate change negotiations, especially the role of sub-national entities and transnational coalitions. The temptation to hammer out agreements behind closed doors and push them through should be avoided. Transparency in the negotiation process is important for success, as agreements must receive the widest possible support and cooperation to be effective.

A Strategy for Survival

Clearly a survival strategy for mankind in dealing with climate change should be based on (1) Continuing and widespread efforts to reduce greenhouse gas emissions, (2) Outreach to sub-national entities and private sector, especially of countries that have withdrawn from the Paris Agreement to adhere to the spirit of and implementation of the Paris Agreement objectives, (3) Massive global R & D effort to achieve breakthroughs in CCS technologies, (4) Massive R & D effort to evolve much more precise global climate models and predict extreme climate events, and (5) Intensify the current R & D efforts to achieve breakthroughs in solar energy capture and storage systems. There is a need to take up at least three of the "mega science "activities as mentioned above. It is ironic that the scientific community has deployed enormous resources on projects such as ITER and the Large Hadron Collider while making relatively lesser efforts in projects of relevance to climate change.

Integrated Approach to Address Major Global challenges

In another development, an academic group has issued a report on the multiple serious and coincident global challenges of the "anthropocene" or human era (Sterner, *et al*, 2019). This has been echoed in the World Economic Forum's Global Risk Report for 2019 (WEF, 2019). This stresses the importance of tackling multiple challenges such as climate change, biodiversity preservation, water, pollution, disease, etc and brings out their mutual inter-linkages. It calls for an integrated approach to managing these multiple challenges stating that "policy design needs to deal with a multitude of geographic levels, interconnected boundaries, and spatial, ecological and socio-political complexities".

Solutions designed to deal only with one global issue may impact on other global issues. This was the case with the Montreal Protocol, which led to HFC use having very high global warming potential. The WEF report (2019) notes that, "…the world is facing a growing number of complex and interconnected challenges—from slowing global growth and persistent economic inequality to climate change, geopolitical tensions and the accelerating pace of the Fourth Industrial Revolution. In isolation, these are daunting challenges; faced simultaneously, we will all struggle if we do not work together". However the divisions among nation states and the trends towards increasing polarization, nationalism and global conflict do not augur well for humanity.

Endnotes

[1] EPA (2019) defines CSS as 'a set of technologies that can greatly reduce CO2 emissions from new and existing coal- and gas-fired power plants and large industrial sources. It is a three-step process that includes (a) Capture of CO2 from power plants or industrial processes; (b) Transport of the captured and compressed CO2 (usually in pipelines); and (c) Underground injection and geologic sequestration (also referred to as storage) of the CO2 into deep underground rock formations.'

[2] The EIA (2019) defines Global Warming Potential (GWP) as 'an index used to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emission of one kilogram of a greenhouse gas to that from the emission of one kilogram of carbon dioxide over a fixed period of time, such as 100 years'.

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