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Towards net zero carbon emissions: carbon pricing strategies and the role of innovative technologies

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ABSTRACT

Mitigating the “Emissions Gap” in the Path Towards Net Zero Carbon Emissions: Carbon Pricing Strategies and the Role of Innovative Technologies

The 2021 COP 26 Summit held in Glasgow, has resulted, not only in groundbreaking agreements, but also the involvement of private sector investment, the participation of formidable alliances such as the Global Energy Alliance – and for the first time, the engagement of indigenous communities. Whilst ongoing negotiations and outcomes from the Summit appear promising, there are still concerns in relation to the lack of enforceability of agreements. This paper, not only aims to highlight the rationales underlying such concerns, but also consider the merits and applicability of innovative techniques and technologies – as well as notable progress and developments made during the ongoing Summit. By way of reference to the concept of the “Emissions Gap”, this chapter highlights how bridging the “Emissions Gap” or mitigating it, could be achieved – and this principally through first, technological developments; the “synergies between climate action and economic growth and development objectives”, as well as other considerations which will be discussed in this paper.

The engagement of several economies in the asset purchasing programs and uncertainty in decision making by some in respect of when, how or whether to commence winding up activities, also bears several monetary policy implications. This could in turn, impact outcomes – both intended and unintended, in relation to carbon, and more specifically, oil pricing strategies – which are ideally targeted at mitigating carbon emissions, whilst fostering climate goals and objectives. Given the demands and pressures of governments and economies in deploying funds to households, businesses; central bank engagements in deciding how and when to wind down asset purchase programs, and the need by governments to focus on more urgent and pressing matters such as those related to health, education, in the light of ongoing global developments, how ready and willing are governments able to commit to environmental issues? Herein lies a role for the private sector and private sector investment.

Key words: COP 26, double counting, fossil fuels, renewable energy, oil pricing, monetary policy, inflation, innovative techniques, Article 6 of the Paris Agreement, transparency, disclosure, emissions gap, NDCs

Mitigating the “Emissions Gap” in the Path Towards Net Zero Carbon Emissions: Carbon Pricing Strategies and the Role of Innovative Technologies

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Section One - Introduction

There is a considerable and vital role to be played by G20 member countries in the path and efforts towards net zero carbon emissions. This is certainly undeniable. Even though this is the case, this paper will also highlight why other channels - such as innovative technologies, renewable energy, the de carbonization of certain forms of transport – particularly those related to land and the aviation sectors, will have an increasing role to play – particularly given challenges in other areas, namely decarbonization through reductions in the fossil fuel sectors – as this paper will also aim to illustrate.

Based on the United Nations Report, “Environmental Programme, Emissions Gap”, G20 members account for 78% of GHG emissions. It further adds that even though they are “collectively on track to meeting their limited 2020 Cancun Pledges, seven countries are currently not on track to meeting 2030 NDC commitments.” (see UN Environmental Programme, Emissions Gap Report 2019 at page xvi).

In respect of those major economies, heavily dependent and reliant on coal, the reduction of coal, even in the long term, appears impracticable and unfeasible. In the light of recent negotiations at the COP 26 Summit and with notable absences of engagements of several major contributing economies to carbon (coal, methane) emissions, how likely will efforts aimed at addressing fossil fuel emissions, be successful in fostering climate goals and initiatives?

The Joint Declaration between the United States and China, as announced on the 10th November 2021, during the Summit, a consolidation on statements made by both countries in April, highlights areas in which cooperative initiatives are to be undertaken – amongst which are:¹

- regulatory frameworks and environmental standards related to reducing emissions of greenhouse gases in the 2020s;
- maximizing the societal benefits of the clean energy transition;
- policies to encourage decarbonization and electrification of end-use sectors;

¹ See “U.S – China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s” <https://www.state.gov/u-s-china-joint-glasgow-declaration-on-enhancing-climate-action-in-the-2020s/>

- key areas related to the circular economy, such as green design and renewable resource utilization; and
- deployment and application of technology such as CCUS and direct air capture.

This paper is structured as follows: The ensuing section, which deals with the literature review and background to the topic will not only introduce important concepts and definitions such as the “emissions gap” but also introduce Article 6 of the Paris Agreement as the reference point for the ongoing COP 26 Summit, as well as a determining factor – in respect of the extent to which its goals and objectives are realized at the COP 26 Summit. This will consider also Article 6 of the Paris Agreement within the context of carbon pricing, as well as pricing strategies which it facilitates - through the concept of nationally determined contributions - that is NDCs, the importance of the entire Agreement in fostering a fair equitable process in ascertaining and measuring carbon emissions, averting double counting, all of which should eventually facilitate a global carbon price. The COP 26 Summit and some of its major highlights will then be discussed under section three - from the perspectives of “Forests and Land Use”, “Sustainable Markets Initiative”, “Supporting and Restoring Sustainable Ecosystem, its “Breakthrough Agenda” and Breakthrough Points – as well as in respect of Fossil Fuel Financing.

Section four then considers possible effects of oil price increases, its intended and unintended environmental impacts”, as well as inflationary impacts of energy prices and their impacts on monetary policy decisions. This will also incorporate current differing monetary policy responses from major central bank regulators.

The role of innovative techniques in the path towards net zero carbon emissions is then considered under section five as well as its role in facilitating consistency, transparency and disclosure of reporting instruments – particularly from the perspective of supply chain managements. This will then be followed by the conclusive section.

Source : United Nations Environmental Programme, Emissions Gap Report November 2019 pg xxiii

Table ES.3. Summary of five energy transition options

Option	Major components	Instruments	Co-benefits	Annual GHG emissions reduction potential of renewables, electrification, energy efficiency and other measures by 2050

Renewable energy electricity expansion	<ul style="list-style-type: none"> Plan for large shares of variable renewable energy Electricity becomes the main energy source by 2050, supplying at least 50 per cent of total final energy consumption (TFEC) Share of renewable energy in electricity up to 85 per cent by 2050 Transition 	<ul style="list-style-type: none"> Flexibility measures to take on larger shares of variable renewable energy Support for deployment of distributed energy Innovative measures: cost reflective tariff structures, targeted subsidies, reverse auctions, net metering 	<ul style="list-style-type: none"> Greater efficiency in end-use energy demand Health benefits Energy access and security Employment 	<ul style="list-style-type: none"> Power sector: 8.1 GtCO₂ Building sector: 2.1 GtCO₂ District heat and others: 1.9 GtCO₂
Coal phase-out	<ul style="list-style-type: none"> Plan and implement phase-out of coal Coal to renewable energy transition Expand carbon capture usage and storage systems Improve system-wide efficiency 	<ul style="list-style-type: none"> Regional support programmes Tax breaks, subsidies Carbon pricing Moratorium policies De-risking of clean energy investments Relocation of coal workers (mines and power plants) 	<ul style="list-style-type: none"> Lower health hazards (air, water, land pollution) Future skills and job creation 	Share of the power emissions reduction from a coal phase-out: 4 GtCO ₂ (range: 3.6–4.4 GtCO ₂), with 1 GtCO ₂ from the OECD and 3 GtCO ₂ from the rest of the world
Decarbonize transport	<ul style="list-style-type: none"> Reduce energy for transport Electrify transport Fuels substitution (bioenergy, hydrogen) Modal shift 	<ul style="list-style-type: none"> Pathways for non-motorized transport Standards for vehicle emissions Establishing of charging stations Eliminating of fossil-fuel subsidies Investments in public transport 	<ul style="list-style-type: none"> Increased public health from more physical activity, less air pollution Energy security Reduced fuel spending Less congestion 	Electrification of transport: 6.1 GtCO ₂
Decarbonize industry	<ul style="list-style-type: none"> Demand reduction (circular economy, modal shifts and logistics) Electrify heat processes Improve energy efficiency Direct use of biomass/biofuels 	<ul style="list-style-type: none"> Carbon pricing Standards and regulations, especially on materials demand reduction 	<ul style="list-style-type: none"> Energy security Savings and competitiveness 	<ul style="list-style-type: none"> Industry: 4.8 GtCO₂
Avoid future emissions and energy access	<ul style="list-style-type: none"> Link energy access with emission reductions for 3.5 billion energy-poor people 	<ul style="list-style-type: none"> Fit and auctions Standards and regulations Targeted subsidies Support for entrepreneurs 	<ul style="list-style-type: none"> Better access Meet basic needs and SDGs 	<ul style="list-style-type: none"> N/A

Section Two - Literature Review and Background to the Topic

Article 6 of the Paris Agreement

As well as defining Article 6 as a mechanism designed to contribute to the mitigation of greenhouse gas emissions and support sustainable development, the aims of Article 6 of the Paris Agreement are highlighted under paragraph 4, as follows (Article 6:4):

- a) To promote the mitigation of greenhouse gas emissions while fostering sustainable development;
- (b) To incentivize and facilitate participation in the mitigation of greenhouse gas emissions by public and private entities authorized by a Party;
- (c) To contribute to the reduction of emission levels in the host Party, which will benefit from mitigation activities resulting in emission reductions that can also be used by another Party to fulfil its nationally determined contribution; and
- (d) To deliver an overall mitigation in global emissions.

Article 6 of the Paris Agreement and Carbon Pricing

According to the ICC, Article 6 of the Paris Agreement and Carbon Pricing, is not only aimed at “promoting integrated, holistic and balanced approaches that will assist governments in implementing their NDCs through voluntary international cooperation, but also, through its role as a driver for carbon pricing whose successful implementation will serve in “creating new channels for climate finance and lead to technology transfer and capacity-building.” (ICC, 2019).

The “cooperative mechanism” through which it is intended to operate is also targeted to achieve the following:

- make it easier to achieve reduction targets and raise ambition
- Making it possible to establish a policy foundation for an emissions trading system, which could help lead to a global price on carbon.

Developments which have taken place since the commencement of the COP 26 Glasgow Summit will serve to determine how far missing aspects of Article 6 of the Paris Agreement have been, or are yet to be realized – particularly in respect of nationally determined contributions. Whilst commitments have been made by several major pollution contributing economies, these, against the background of previous commitments by the same countries, are considered to fall short of

current targets desired and required to meet those targets set out under the Paris Agreement on Climate Change.

In line with paragraph 8 of Article 6 of the Paris Agreement, which states that parties recognize the importance of integrated, holistic and balanced non-market approaches being available to Parties to assist in the implementation of their nationally determined contributions, in the context of sustainable development and poverty eradication, in a coordinated and effective manner, including through, inter alia, mitigation, adaptation, finance, technology transfer and capacity-building, as appropriate.

The aims of such “integrated, holistic and balanced non market” approaches to foster mitigation and adaptation ambition – as well as enhance public and private sector participation in the implementation of nationally determined contributions (NDCs), (pursuant to paragraphs 8(a) and (b), constituted focal points during the COP 26 Summit. The challenges involved in the adaptation process were also highlighted. It was therefore of major significance that the inclusion and participation of indigenous communities was incorporated as a path towards the achievement of goals yet to be realized.

In “Bridging the Emissions Gap” or mitigating it, the United Nations Report makes reference to the need for “Enhancing mitigation ambition and action at G20 level and globally” (UN, 2019: Page 28 (54 of 108).

It adds further, that changes within three main categories in particular could facilitate greater NDC ambition today - including climate change:

- First, technological and economic developments present opportunities to decarbonize the economy, especially the energy sector, at a cost that is lower than ever.
- Second, the synergies between climate action and economic growth and development objectives, including options for addressing distributional impacts, are better understood.
- Finally, policy momentum across various levels of government, as well as a surge in climate action commitments by non-state actors, is creating opportunities for countries to enhance the ambition of their NDCs.”

The following subsection now expands on – as well as illustrates the concept of the “emissions gap”.

The Emissions Gap

As well as being attributed as “the difference between the greenhouse gas emission levels consistent with a specific probability of limiting the mean global temperature rise to below 2°C or 1.5°C in 2100 above pre-industrial levels and the GHG emission levels consistent with the global

effect of the NDCs, assuming full implementation from 2020” (see UN 2019; page x), the “emissions gap” is also defined as “the difference between projected emissions under full implementation of the nationally determined contributions (NDCs) and emissions under least-cost pathways that are in line with the Paris Agreement goals of limiting global average temperature increase to well below 2°C and pursuing to limiting it to 1.5°C.” (see UN 2019: chapter 3 page 21, page 47 of 108). The United Nations Report on “Emissions Gap” also highlights the various scenarios used for the assessment of the emissions gap: the reference scenarios, NDC scenarios and scenarios consistent with limiting global warming to a specific temperature limit.

Scenarios considered for the 2030 gap assessment in the Report include reference scenarios, NDC scenarios and least-cost mitigation scenarios.

Further, the Report defines **the emissions gap for 2030** as “the difference between global total GHG emissions from least-cost scenarios that keep global warming to 2°C and 1.5°C with varying levels of likelihood and the estimated global total GHG emissions resulting from a full implementation of the NDCs” (see UN 2019:23, page 49 of 108).

Reference Scenarios

Two types of reference scenarios are identified in the United Nations Environmental Programme, Emissions Gap Report as follows (2019:21, page 47 of 108):

- the 2005 policies scenario and:
- the current policy scenario.

The 2005 policies scenario is considered to project “ global greenhouse gas (GHG) emissions assuming no new climate policies are put in place from around 2005 onwards” whilst the current policy scenario is considered to project “GHG emissions assuming all currently adopted and implemented policies (defined as legislative decisions, executive orders, or equivalent) are realized and that no additional measures are undertaken.”

NDC Scenarios

- “The NDC scenarios estimate the levels of global total GHG emissions that are projected as a result of the implementation of the mitigation actions pledged by countries in their NDCs. In line with previous gap reports, two NDC scenarios are considered: the unconditional and the conditional NDC scenario. The unconditional NDC scenario assumes countries only implement the mitigation actions specified in their NDCs that have no conditions attached. Parties that do not have an NDC or solely have a conditional target in their NDC are assumed to follow their current policy scenario. The conditional NDC scenario assumes full achievement of Parties’ mitigation pledges (both the conditional and unconditional actions listed as part of the mitigation contribution in their NDCs). Parties

that do not have conditional mitigation targets in their NDC follow their unconditional target.”

Section Three

Other Main Issues and Areas to Be Addressed: The COP 26 Summit

During the COP 26 “Forests and Land Use” Event, the British Prime Minister, in opening the event, not only made reference to climate change and biodiversity being “two sides of the same coin”, but also drew attention to the following points:

- The need to channel funds to securing the rights of indigenous people;
- Reengineering world’s economic system to disincentivize activities which contribute to, or increase deforestation – particularly targeted at those industries which should contribute in efforts aimed at restoring and maintaining those communities impacted by their activities – as well as restoring habitats whose demise they are contributing to;
- The need for private sector involvement.

In respect of the above, it is worth noting the engagement of the Global Energy Alliance, whose partnerships include those of Amazon Founder, Jeff Bezos’ Earth Fund, IKEA, and the Rocker Feller Foundation. However the need for greater involvement by other major well known polluting industries – such as the oil industry and sector – and ultimately, fossil fuel based industries, is evident.

During the COP 26 Summit, the Prince of Wales, also made reference to the following points under the “ Sustainable Markets Initiative”:

- The importance of mobilizing natural capital and funding to facilitate sustainable development;
- The need to “safeguard and honor the rights of indigenous peoples and communities”;
- The need for “systemic shifts”, that is, implementation of shifts of how goods are produced – “ shifting to new and more sustainable practices” – as well as a shift to renewable bio based solutions, whilst providing new jobs.

Supporting and Restoring Sustainable Ecosystems

Major economies as represented by the UK and US, during the COP26 Forests and Land Use Event, shared similar views in relation to the need to “support sustainable land use through supporting farmers, as well as communities who have to switch to more sustainable green

methods”. In addition, the UK prime Minister added that there was need to protect and restore the world’s forests.

The US president also highlighted the need to pursue sustainable supply chains – as well as supporting developing countries, in particular, in restoring carbon sinks.

Within the framework of Article 6 paragraph 8 of the Paris Agreement, such initiatives and efforts, would have to be implemented in a coordinated and effective manner, including through, inter alia, mitigation, adaptation, finance, technology transfer and capacity-building – with goals and objectives aimed at facilitating sustainable development – as well as poverty eradication. As well as drawing attention to the fact that there was need to assist vulnerable farmers to adapt to climate change, the Microsoft Founder highlighted that “mitigation is not the only challenge.”

The Breakthrough Agenda and Breakthrough Points

The “Build Back Better Event”, witnessed more than 80 countries committing towards cutting back on methane levels and emissions by 30% by 2030. This in addition to the pledge, by about 100 countries, to stop and reverse deforestation by 2030.

The first of five goals of the “Breakthrough Agenda” signed by 40 global leaders to cover over 50% of global emissions were announced by the UK Prime Minister as follows:

- New pledge with 40 world leaders to “make clean power a reliable and affordable option” – to be achieved by 2030;
- Sustainable agriculture suitable for farmers globally by 2030.
- New pledge with 40 world leaders to make zero emission vehicles efficient and affordable by 2030.

Fossil Fuel Financing

More than 20 countries also pledged to halt all funding for fossil fuel power abroad – a significant step, in respect of participating countries – even though concerns still revolved around the possibility of some countries being able to invest in fossil fuel domestically.

In respect of the Coal Agreement, to which 190 countries and organizations are parties, the following points are noteworthy:

- The phasing out of coal power and support for new coal plants;
- An end to all investment in coal power generation – both domestically and internationally;
- Rapid increase of the use of clean power;
- Phasing out of coal power in 2030 for major economies and by 2040 for others (the rest of the world and smaller countries).

Section Four

Possible Effects of Oil Price Increases: Intended and Unintended Environmental Impacts

It is argued (see FAZ:2021a) that even though high energy prices should serve towards climate goals and environmental protection – as well as a deterrent to high consumption levels, high oil prices also serve as an incentive for oil states and oil companies to invest more in oil demand. “When the price of oil rises, people consume less and think about more ways to save energy or produce less oil-intensive products - a lesson from the oil crisis of the 1970s.” Furthermore, it is stated that “in order to have a “directional” effect, a high price for energy is fundamentally desirable, since it creates an incentive for careful or economical use - however, high energy prices on the supply side naturally also create an incentive to expand the supply.”

Could the afore mentioned effects be really considered to be “the revenge of the old economy”, which understandably having lost out on investment to the digital economy, in recent years, can simply find alternative ways of triggering the need to invest in greater production? More importantly, how can technology be harnessed to ensure that those intended effects, through oil price increases, are realized? The inflationary impacts of high energy prices² and monetary policies will now be considered.

Energy prices: Inflationary Impacts and Monetary Policy Decisions

Meanwhile energy prices are at around nearly double their usual rates – when compared to their levels exactly a year before. Rising inflation, at the present, constitutes a challenge for many central banks - with differing views on the tightening or relaxation of monetary policy stances.

In a rather unusual turn of events, the Bank of England, initially chose not to follow the Federal Reserve’s position in increasing interest rates. However, on the 16th December 2021, following months of speculations and concerns regarding inflation risks, the Monetary Policy Committee (MPC) of the Bank of England, for the second consecutive month – voting 8-1 in favor of higher interest rates – as well as admitting that “inflation was heading in the direction of around 6%”, decided to raise interest rates from 0.1% to 0.25% - a first increase in more than three years

² “So far, the oil countries have showed some reluctance and hesitation and do not want to go beyond their slow monthly increase in oil production of 400,000 barrels a day. And that, although the industrialized countries are now even threatening them: Not only America's President Joe Biden has signaled that if the oil-producing countries do not help fight high energy prices and thus inflation by producing more oil, politics could also tap into the national emergency reserves of oil - and flood the market with it.” For further information see FAZ (2021). “Vor der Opec-Sitzung: Das Dilemma der teuren Energie” (faz.net)

(Financial Times: 2021). Even though it appeared that financial markets were surprised at the announcement, this follows growing and persistent increases in inflation, rising energy prices – as well as costs of living. Further, the MPC voted to end its quantitative easing program – on a unanimous basis – having created £895 billion to purchase mostly UK government bonds.

On the 16th March 2022, Federal Reserve officials voted to increase interest rates and signaled six more rate rises before the year's end – the most “aggressive” pace in 15 years – the first rate increase since 2018 – with a rise in the benchmark deferral funds rate by a quarter percentage points to a range between 0.25% and 0.5%.

Even though such a pace in the raise in interest rates by the Federal Reserve, had been anticipated – with a slower pace to be adopted by counterparts such as the European Central Bank, there are concerns about the intended effects of such a pace in the increase of interest rates – with already mounting concerns in respect of possible impending recessions and the loss of employment.

The following day, on the 17th March 2022, the Bank of England, for the third consecutive meeting, decided to raise the bank Rate, back to its pre pandemic level of 0.75%.

Meanwhile the European Central Bank, which had adopted a differing stance to the “hawkish” approach being adopted by its counterparts, particularly in relation to when and in what manner to wind down pandemic stimulus, agreed the week before to “stop pumping money into its markets this summer” paving the way for possible rate increase in 2022 – hence underlining its slower and more cautious approach.

In highlighting how differing stances from the position taken by the Federal Reserve could impact other monetary policy stances, it is added that “America's stance could place the ECB under pressure in two ways: argumentative and technical. From a purely technical point of view, the pressure on Europe's central bank could increase if the transatlantic interest rate differential widened and the exchange rate of the dollar against the euro became stronger and stronger..... Immediately after the Fed's decision, the dollar's exchange rate rose against the euro. “FAZ (2021b).

Differing Monetary Policy Responses

Further differences in monetary policy approaches are also illustrated by the timing and manner of winding up, in respect of the asset purchase programs.

As reported (FAZ :2021b):

- “Whilst the Fed announced its intention to stop its bond purchases by the end of June 2022 in eight even steps;

- The ECB, so far, has “only scaled back its crisis program”

The ECB meanwhile has signaled that since it is expecting inflation to fall in the coming months, there will be an eventual hike in interest rates - although this, it is expected, would follow at a much slower pace than is the case with the Fed Reserve or the Bank of England.

Given the current focus on cutting drastically on fossil fuels – on which certain economies appear to be significantly dependent, could efforts also be channeled to other sectors – which if not equally are as culpable for environmental impacts, do have some contributory impacts – and particularly those whose involvement and private sector expertise could potentially be harnessed towards achieving environmental goals and objectives? In this respect, the role of renewable energy also becomes highly relevant and important.

The unprecedentedly unique nature of inflation and the circumstances which have made it different from that which previously existed, are not only considered to have been triggered through a “drive by pandemic-related imbalances between policy supported demand, which is said to have remained robust, but also COVID disrupted supply, which on the other hand, is regarded as having been slow to recover.” Other factors which have contributed to its unique nature from that which existed previously, are considered to include the economy – considered different because of “weaker links between wage and price inflation, greater global price competition, longer term structural factors – including an aging population”. Of greater impact and significance is the difference in the approach and style adopted by central banks such as the Federal Reserve, according to Daly (2022:5), who is of the opinion that “one major evolution which separates today’s Federal Reserve from that of 50 years ago is a deep understanding that inflation expectations influence future inflation – namely, if people expect inflation to persist, then it does.”

In explaining the underlying causes behind inflation, D’Acunto and Weber (2022) add that whilst production stopped, following strict lockdown policies and COVID closures globally, with consumers accumulating savings – fueled by generous fiscal support through different fiscal measures, with a re start in production activities and supply chains, substantial demand pressure was placed on an already “stressed” supply side – resulting ultimately, to a sharp rise in prices.

Further, they add that in addition to demand pressures and supply-chain disruptions, labour market pressures, as well as the fact that a substantial share of the working population were retiring early, following months of inactivity, constituted part of the additional pressures on the recovery and restart of processes worldwide.

Even though D’Acunto and Weber are in agreement with the European Central Bank’s prediction that the causes of the post COVID 19 surge in inflation “are likely to be temporary and resolve in

the medium run as supply activities adjust”, they raise concerns about what in their opinion, constitutes an unresolved and unincorporated part of the puzzle, namely , the impact of consumers’ inflation expectations.

Hence will the Fed Reserve’s approach in engaging the public through greater transparency and communication over the years, a practice and understanding which Daly considers vital in managing actual inflation be key to restoring the commitment to price stability and combating inflation? – *“in order to manage actual inflation, policy makers also have to manage inflation psychology - through the help of households, businesses and market participants.”*

Uncertainty, however, it is still admitted, constitutes another piece of the puzzle, which needs to be addressed.

Section Five

The Role of Innovative Techniques in the Path Towards Net Zero Carbon Emissions

The following questions were raised during *The Economist’s* Climate Risk Europe Virtual Week, (2021):

- What key technologies will make a material difference to combating climate change?
- How can uncertainty around technological change fit into transition scenarios?
- If key technologies such as carbon capture and storage do not deliver as hoped, what will the impact be on future climate policies?

To which it must be added, in line with Article 6 paragraph 8 of the Paris Agreement, how can non market approaches ensure facilitation in a coordinated and effective manner, including through, inter alia, mitigation, adaptation, finance, technology transfer and capacity-building?

The engagement of private sectors, alliances and funding, on a greater scale than was previously the case, as evidenced during this Summit will not only help ensure that finance, technology transfer and capacity building are fostered, but also help address the challenges posed by mitigation and adaptation – particularly through cross border cooperation and the engagement of indigenous communities.

“Disruptive technological change can enable sustainable development with co-benefits for closing the emissions gap, but can also exacerbate unsustainable patterns of resource use. This is most clearly evidenced by the promises and risks of the digital revolution, constituted by ongoing advances in information and communication technologies, machine learning and artificial intelligence, connectivity, the Internet of Things (IoT), additive manufacturing (3D printing),

virtual and augmented reality, blockchain, robotics and synthetic biology.” (UN 2019, pg 68 of 108 (page 42).

The Role of Renewable Energy and Digital Technologies in Facilitating Sustainable Transport

“Renewables and energy efficiency, in combination with electrification of end uses, are key to a successful energy transition and to driving down energy-related CO₂ emissions.” (UN 2019: xxii).

The UN Environmental Programme Emissions Gap Report also concludes that (see page xxii):

- First, technological and economic developments present opportunities to decarbonize the economy, especially the energy sector, at a cost that is lower than ever.
- Second, the synergies between climate action and economic growth and development objectives, including options for addressing distributional impacts, are better understood.
- Finally, policy momentum across various levels of government, as well as a surge in climate action commitments by non-state actors, are creating opportunities for countries to engage in real transitions.

Examples and illustrations being given of technological and economic trends in relation to the cost of renewable energy, which it is stated (UN, 2019:xxii) as “declining more rapidly than was predicted just a few years ago - with renewables currently being the cheapest source of new power generation in most of the world.”

“Sustainable Transport” also constitutes a vital focal point in the global efforts aimed at tackling climate change. With road transport accounting for 17% of global carbon emissions, other sources of pollution, namely, the aviation sector have become increasingly subjected to scrutiny – particularly in respect of greater potential to address such a pollution source – which in contrast to road transport, is used by relatively fewer, and the more affluent in the society.

The role of digital technologies and renewable energy towards decarbonization in the aviation industry is highlighted as part of initiatives and ongoing efforts aimed at targeting carbon emissions generated by the aviation sector, hence paving the way for decarbonization, whereby the European Commission highlights the following main elements of its strategy in its report “A European Strategy for low-emission mobility” (European Commission: 2016:1):

- Increasing the efficiency of the transport system by making the most of digital technologies, smart pricing and further encouraging the shift to lower emission transport modes,

- Speeding up the deployment of low-emission alternative energy for transport, such as advanced biofuels, renewable electricity and renewable synthetic fuels and removing obstacles to the electrification of transport;

- Moving towards zero-emission vehicles. While further improvements to the internal combustion engine will be needed, Europe needs to accelerate the transition towards low- and zero emission vehicles.

Facilitating Consistency, Transparency and Disclosure of Reporting Instruments: Enabling Opportunities for Coordination Across Instruments

Article 9 of the Paris Agreement sets out various means whereby opportunities for coordination – as well as promoting mitigation and adaptation ambitions – as well as enhancing public and private sector participation in the implementation of nationally determined contributions, can be achieved.

Under paragraph 1, it states that developed country Parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention.

As well as biennial communication (paragraph 5), the importance of providing transparent and consistent information on support for developing country Parties provided and mobilized through public interventions biennially is also highlighted under paragraph 7. This should serve to promote consistency, transparency and disclosure of reporting instruments.

To the extent that COP 26 has taken huge steps and efforts to engage in the above mentioned points, even though challenges still persist in the areas of mitigation and particularly adaptation, a huge realization of the goals and objectives of the Paris Agreement could be considered to have been realized.

Within the framework of transparency and disclosure, innovative techniques could also be engaged in supply chains and their management in tracing their origins and pathways. However, global efforts and ongoing initiatives will not only require a focus – as well as the engagement of innovative technologies, but also a consideration of other channels.

The United Nations Emissions Gap Report also considers “six entry points for progressing towards closing the emissions gap, that is, the path towards net zero carbon emissions, through transformational change in the following areas”:

- (a) air pollution, air quality, health;
- (b) urbanization;
- (c) governance, education, employment;
- (d) digitalization;

- (e) energy- and material-efficient services for raising living standards; and
- (f) land use, food security, bioenergy.

In its roadmap towards achieving decarbonization within the aviation industry, the following elements are highlighted by the International Coalition for Sustainable Aviation (ICSA: page 1):

- Deploying near-term technology solutions (efficiency and operational measures and alternative fuels with lower lifecycle emissions than fossil jet fuel);
- • Addressing non-CO2 effects through mitigation measures;
- • Investing in transformative, breakthrough clean aviation technologies;
- Strengthening the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA);
- Strengthening the ICAO CO2 standard;
- Revisiting aviation subsidies;
- Developing new mobility solutions to support modal shift;
- Creating new business models for the aviation industry;
- Climate-proofing aviation against the effects of a changing climate; and
- Ensuring compatibility with the Paris Agreement

“Enhanced action by G20 members will be essential for the global mitigation efforts. Legitimacy for decarbonization therefore requires massive social mobilization and investments in social cohesion to avoid exclusion and resistance to change. Just and timely transitions towards sustainability need to be developed, taking into account the interests and rights of people vulnerable to the impacts of climate change, of people and regions where decarbonization requires structural adjustments, and of future generations.”

It is furthermore added that “Dramatic strengthening of the NDCs is needed in 2020 – with countries having to increase their NDC ambitions threefold to achieve the well below 2°C goal and more than fivefold to achieve the 1.5°C goal.” (UN, 2019: xxi)

The U.S. Methane Emissions Reduction Action Plan and the National Action Plan by China on methane, “aiming to achieve a significant effect on methane emissions control and reductions in the 2020s”, as well as other initiatives to cut down on CO2 emissions, including meetings to discuss progress, the exchange of information, are highlighted in their recent Joint Declaration.

In particular, a meeting in the first half of 2022 aimed at “focusing on the specifics of enhancing measurement and mitigation of methane , is envisaged - as well as working cooperatively to complete at COP 26 the implementing arrangements (“rulebook”) for Articles 6 and 13 of the Paris Agreement, and common time frames for NDCs”, as well as initiatives aimed at phasing

out coal consumption, the intent on establishing a “Working Group on Enhancing Climate Action in the 2020s”.

Conclusions

In assessing and evaluating the path towards net zero carbon emissions, it appears that given prevailing inflation levels, as well as unintended possible consequences of increased energy prices – and more particularly, oil prices, that greater focus will be required in respect of renewable energy – as well as the potential and need for innovative technologies to engage in the process. As highlighted in the paper, the engagement of private sectors, alliances and funding, on a greater scale than was previously the case, as evidenced during this Summit will not only help ensure that finance, technology transfer and capacity building are fostered, but also help address the challenges posed by mitigation and adaptation – particularly through cross border cooperation and the engagement of indigenous communities.

How far the Summit is considered to have achieved its intended goals and objectives also, particularly relate to certain sections and paragraphs of Articles 6, 7 and 9 of the Paris Agreement which are specifically committed to fostering greater transparency, communication and disclosure.

Engaging on a voluntary basis in cooperative approaches... that ensure environmental integrity and transparency, including in governance, .. seeking to apply robust accounting to ensure, the avoidance of double counting, pursuant to Article 6, paragraph 2, as well as engaging in biennial communications will facilitate greater consistency and coordination.

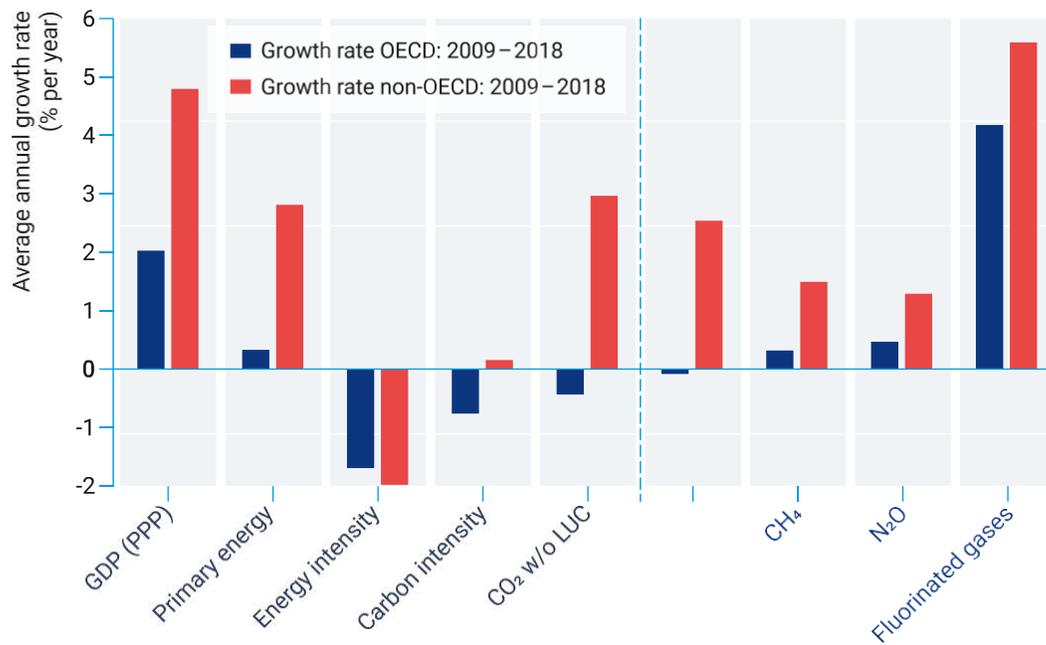
Concerns still persist owing to lack of enforceability of agreements which hence, render recently concluded agreements as non legally binding. It is hoped that in time, a formal rule book can be established which will not only ensure consistency and standardization in the enforcement of agreements, but also provide fairness in the manner in which emissions are measured – as well as incorporate standards aimed at avoiding possibilities of “double counting” which will pave the way for global carbon pricing, as well as the path to net zero carbon emissions.

As of the 10th November 2021, a first draft of agreement providing a guide to how countries will mitigate the “emissions gap” as a means of avoiding temperatures of above 1.5 C has been published. Given such progress during the COP 26 Summit, it is hopeful that innovative technologies – as well as the engagement of other areas such as those targeted at addressing deforestation (Forests and Land Use Events) – as well as addressing methane emissions attributed to land fills, Sustainable Transport, and other channels highlighted in this paper – whose focus and redress could considerably contribute towards mitigating the “emissions gap”, will eventually pave the way towards net zero carbon emissions.

Tables and Figures

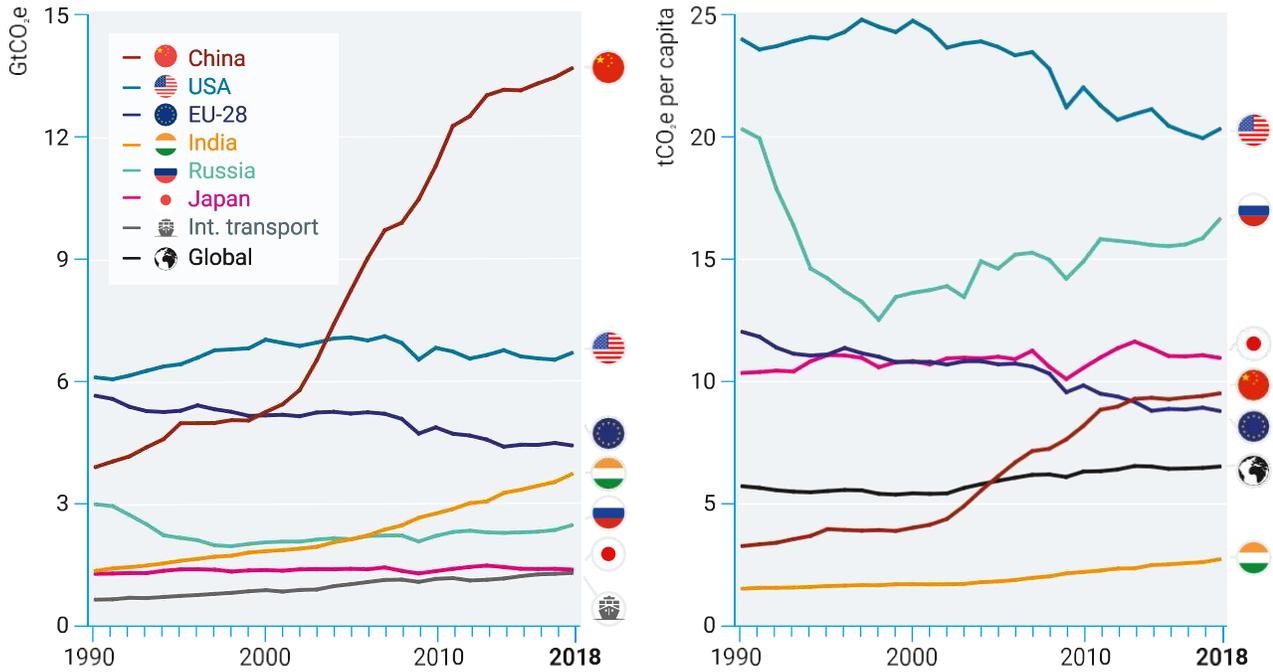
Source: UN Environmental Programme, Emissions Gap Report 2019 pg xv

Figure ES.1. Average annual growth rates of key drivers of global CO₂ emissions (left of dotted line) and components of greenhouse gas emissions (right of dotted line) for OECD and non-OECD members



Source: UN Environmental Programme, Emissions Gap Report 2019 pg xvi

Figure ES.2. Top greenhouse gas emitters, excluding land-use change emissions due to lack of reliable country-level data, on an absolute basis (left) and per capita basis (right)



Based on the United Nations Report, G20 members account for 78% of GHG emissions. It further adds that even though they are “collectively on track to meeting their limited 2020 Cancun Pledges, seven countries are currently not on track to meeting 2030 NDC commitments.” (see UN Environmental Programme, Emissions Gap Report 2019 at page xvi)

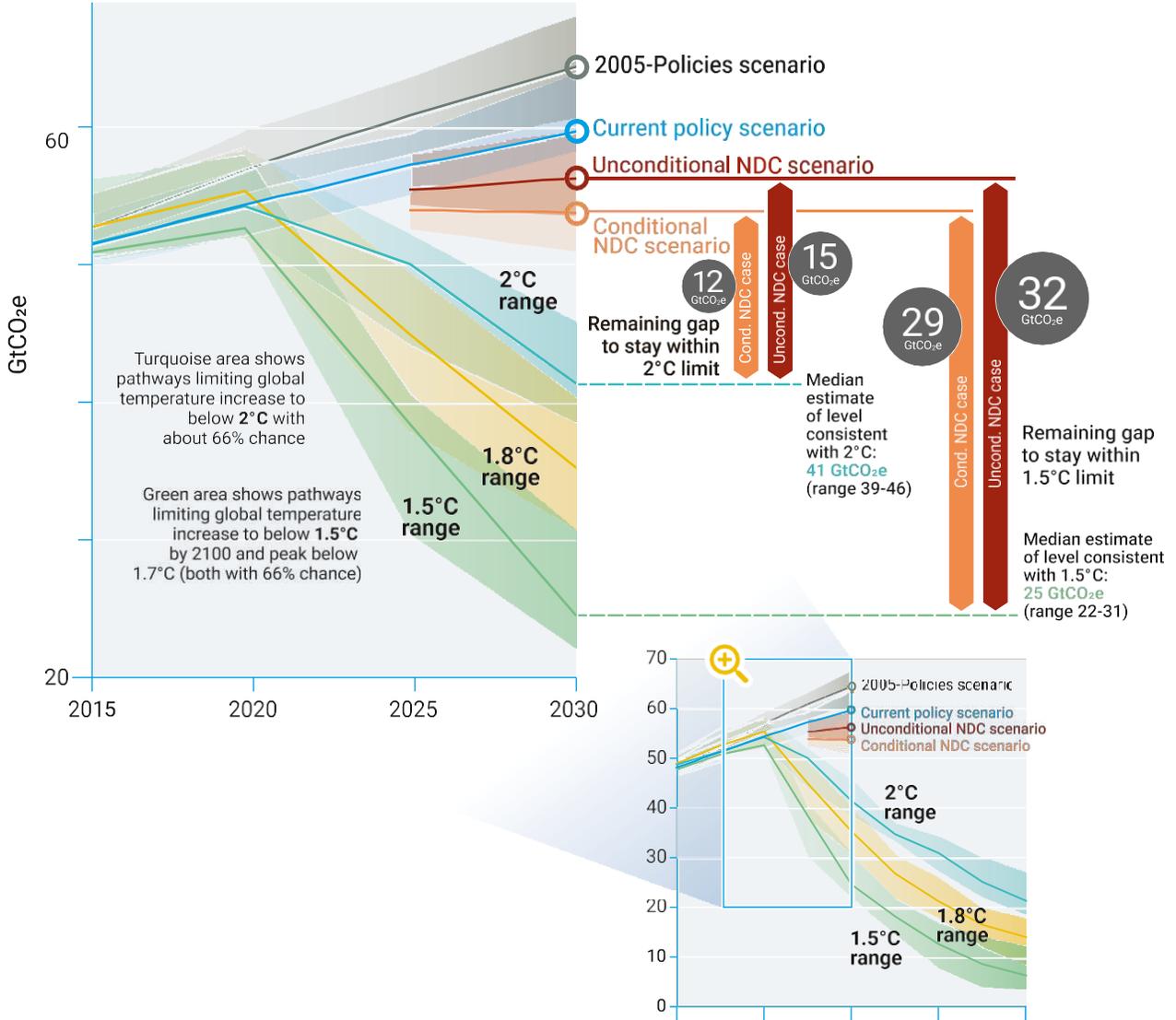
Source: UN Environmental Programme, Emissions Gap Report 2019 pg xvii: “Global total GHG emissions by 2030 under different scenarios (median and 10th to 90th percentile range), temperature implications and the resulting emissions gap”

Scenario (rounded to the nearest gigaton)	Number of scenarios in set	Global total emissions in 2030 [GtCO ₂ e]	Estimated temperature outcomes			Closest corresponding IPCC SR1.5 scenario class	Emissions Gap in 2030 [GtCO ₂ e]		
			50% probability	66% probability	90% probability		Below 2.0°C	Below 1.8°C	Below 1.5°C in 2100
2005-policies	6	64 (60–68)							
Current policy	8	60 (58–64)					18 (17–23)	24 (23–29)	35 (34–39)
Unconditional NDCs	11	56 (54–60)					15 (12–18)	21 (18–24)	32 (29–35)
Conditional NDCs	12	54 (51–56)					12 (9–14)	18 (15–21)	29 (26–31)
Below 2.0°C (66% probability)	29	41 (39–46)	Peak: 1.7-1.8°C In 2100: 1.6-1.7°C	Peak: 1.9-2.0°C In 2100: 1.8-1.9°C	Peak: 2.4-2.6°C In 2100: 2.3-2.5°C	Higher-2°C pathways			
Below 1.8°C (66% probability)	43	35 (31–41)	Peak: 1.6-1.7°C In 2100: 1.3-1.6°C	Peak: 1.7-1.8°C In 2100: 1.5-1.7°C	Peak: 2.1-2.3°C In 2100: 1.9-2.2°C	Lower-2°C pathways			
Below 1.5°C in 2100 and peak below 1.7°C (both with 66% probability)	13	25 (22–31)	Peak: 1.5-1.6°C In 2100: 1.2-1.3°C	Peak: 1.6-1.7°C In 2100: 1.4-1.5°C	Peak: 2.0-2.1°C In 2100: 1.8-1.9°C	1.5°C with no or limited overshoot			

Further, the United Nations adds that given the fact that the emissions gap is large, “in 2030, annual emissions need to be 15 GtCO₂e lower than current unconditional NDCs imply for the 2°Cgoal, and 32 GtCO₂e lower for the 1.5°C goal.”

Source: UN Environmental Programme, Emissions Gap Report 2019 pg xx

Figure ES.4. Global GHG emissions under different scenarios and the emissions gap by 2030



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