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2050

2050 VISION

2 0 — 2 0 GREENHOUSE GAS MARKET REPORT ieta.org

"Perhaps 2020 gave us the ultimate reality check about the difficulty of planning for the future"

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About the **International Emissions Trading Association** (IETA): IETA is the voice of business on carbon markets around the world. Established in 1999, IETA's members include global leaders in the oil, electricity, cement, aluminium, chemical, technology, data verification, broking, trading, legal, finance and consulting industries. **www.ieta.org**

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Perhaps 2020 gave us the ultimate reality check about the difficulty of planning for the future. COVID-19 disrupted everyone's plans for the year – and likely for next year as well. Mega disruptions like this seem to come more frequently. September 11th. The global financial crisis. COVID-19. With each, it feels like someone has hit an enormous "reset" button in the sky, changing the way we do business in fundamental ways.

In response, some people just want to throw their hands up and say, what the heck? Why bother with setting a future plan when it can get blown off course by a mega-event in what seems like the blink of an eye?

IETA's GHG Market Report 2020 takes a different, more embracing approach.

- Christiana Figures sets the tone in looking at choices we make that help define a more positive future.
- Bill Winters offers a vision of how the scale of voluntary action can be raised – and how we can build on the markets of the past to lay a foundation for strong growth.
- The team at Baker McKenzie highlights how carbon markets may evolve between now and 2050.

A host of other market visionaries give views of how key market segments will change to meet net zero objectives.

Economic modelling: Article 6 potential in 2050

For the past two years, IETA has worked with economic modellers at the University of Maryland and the Pacific Northwest National Laboratory to explore the future of carbon markets in the coming decades. The economic modelling illustrates how policy design choices will impact future market performance.

The most dramatic results were for long-term impacts on the 2050 net-zero goals or end of century temperature objectives enshrined in the Paris Agreement. But the modellers were reluctant to start with these numbers, due to concerns that many would dismiss them as impossibly far away in time. We agreed to focus first on 2030. But we got reactions that a 2030 look was too short sighted.

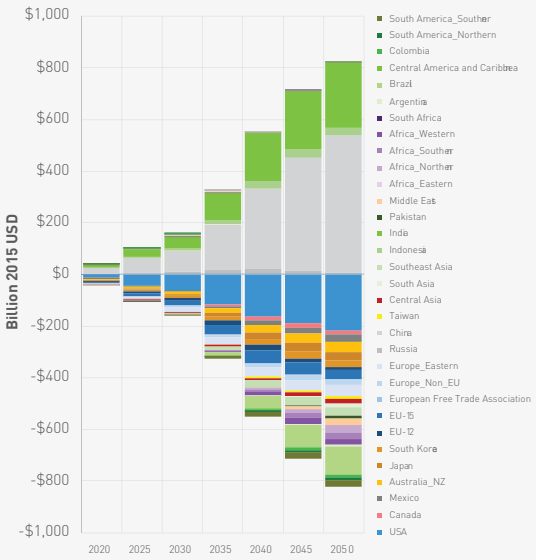
Since so many countries and companies are taking 2050 goals seriously, we saw that the information on possible long-term trends was important to share. To model the future to 2050, modelers needed to virtually strengthen NDCs to be on a "better than 2°C" pathway – which means they need to extend to 2100.

Take a look at how that future is depicted in the two charts below. The case on the left shows current ambition, where a trading system can bring 2050 prices from a wide range of $0 to $111 down to an average global price of $59, assuming that natural climate solutions are available. The case on the right shows an enhanced ambition case, where all regions would have stronger NDCs in line with "better than 2°C". The prices strengthen and converge. But a trading market would still offer significant value, as prices converge into a fairer global price through a functional Article 6 – as shown in the heavy red line shows.

The simple message in both scenarios: if Article 6 is allowed to work efficiently, it could lower costs and make targets more affordable.

Even if these models are only part right, the direction of travel should be crystal clear: a world with a well-functioning Article 6 would protect the climate more effectively than a world of isolated action.

Emissions Trading Market Size



Take a look at how the future is depicted

Dirk Forrister
IETA CEO & President

The models show that a "better than 2°C" world would mean the market would need to rise to a much grander scale. They show a size of over $800 billion per year by 2050 – where all regions of the world participate and receive benefits, either of attracting new investment for sellers or cost savings for buyers.

Numbers this big may seem crazy. But they simply reflect the amount of action, investment and cooperation required for the targets – and the need to enable trading to deliver a net-zero future.

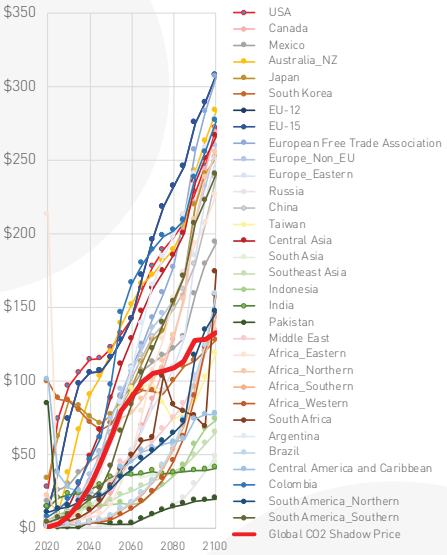
Looking to Glasgow

To any businessperson, the cooperative "Article 6" case should sell itself. Why would any political leader want to opt for a dysfunctional model that wastes money and makes targets less likely to chieve? Granted, the modelling assumes that trading is founded on strong accounting rules and quality standards. But observing the Article 6 negotiating sessions over recent years, one wonders whether some climate negotiators are serious about solving the climate crisis – or whether they've lost the plot entirely? COP26 in Glasgow will tell the tale on whether Article 6 can get moving and grow to its full potential.

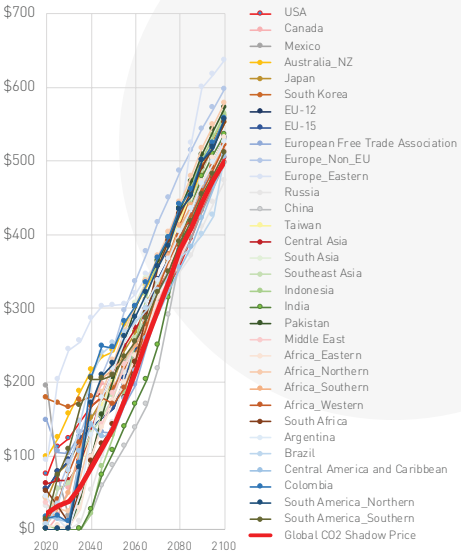
The fundamental facts come into clear view with the Article 6 modelling exercise. In Christiana's formulation, it's clear which future most businesses would want: one built on cooperation, integrity and quality. The work we've done together illustrates the future that WE would choose. It could help blaze the trail for governments to follow as Glasgow approaches – and as more and more governments and businesses commit to net-zero targets.

This year's report looks at the pledges made so far by governments and some of IETA's members, and the pathways to delivering on 2050 vision – from natural climate solutions to technological innovations, and how carbon pricing can drive these forward. While 2050 may seem far off, the decisions and choices we make now will determine the future. It's on us to make the right choices.

UCT Shadow Price of CO_2



Shadow Price of CO_2



Source: Jae Edmonds and Sha Yu, University of Maryland, Presentation to IETA Workshop (2020)

Article Two

Vision 2050: *Our Choice*

Our future will be determined by the choices we make now – we need to make sure these match up with our vision, says **Christiana Figueres**

We have 10 years to save the world. We've heard that said so many times that it can feel like it's lost all meaning, but reflect on this for a moment and how fast the previous 10 years have passed. Ten years go by in the blink of an eye. This decade is critical to the climate fight. These 10 years are our last best chance to avert calamitous climate change. The choices we make now will determine our collective future.

In our book *The Future We Choose*, Tom Rivett-Carnac and I laid out two different versions of 2050: one where we gave up on trying to reduce emissions after 2015 and one where managed to halve global emissions every decade since 2020. In the first, respiratory diseases are rampant, wildfires rage, sea levels are rising, food security is a lost ideal, and civil unrest and conflict are rife around the world. In the second, public transport has largely displaced private vehicle use, trees and flora are ubiquitous, the standard of living in the world's cities has never been better, people are healthier, fossil fuels are a thing of the past, and communities are working together to grow and procure food.

The determining factor in which of these comes to pass is the choices we make in the next decade.

We know from UNEP's 2019 emissions gap report[1] that we need to cut global GHG emissions by 7.6% each year until 2030 if we are to meet the goal to limit the increase in global average temperatures to 1.5°C. And this is a goal we need to meet – and we can meet. Leadership – in government, business, and our communities – is the key to securing the future we say we want.

This year will forever be remembered for the COVID-19 pandemic and its domino effect of global lockdowns and economic strife, bookended by a devastating hurricane season in the Americas and rampant wildfires in Australia and America, plus wetland fires in Brazil. These fires and storms are giant alarm bells ringing that the climate crisis isn't some far off problem for our kids or grandkids to solve. It's here, it's now, and it's on us to make good choices.

I remain optimistic that we will make the right choices to avert the worst effects of climate change

A good choice is one which moves you closer to your goal. Before making a firm choice, all options must be evaluated for how they help – or hinder – progress towards your goal. Net-zero emissions by 2050 pledge yet permitting more gas-fired power plants in 2020? Scrapping incentives for renewable energy yet continuing to subsidise fossil fuels? Turning fields into car parks? Cognitive dissonance, know thy name.

Despite these policy disconnects we see around the world, I remain optimistic that we will make the right choices to avert the worst effects of climate change. It is within our reach. We already see the transition happening in energy, with the cost of renewable technologies below those of fossil fuels in many countries. We see governments striving to be more ambitious in renewable energy goals, phasing out combustion-based vehicles, enhancing public transport, thinking about the industries, jobs and skills of the future. Many are using the severe economic disruption the coronavirus outbreak has wrought to reset, recalibrate and refocus their policy goals.

We need policies that recognise and incentivise decarbonisation. We need policies which value nature and public health above profit. We need policies which encourage cooperation and collaboration, not competition. We need to think about the climate crisis not as a problem on its own, but one which cuts across gender equality, social justice, mental health, food security, and jobs.

New Zealand's decision in 2018 to no longer issue permits for offshore oil and gas exploration could have been a blow to the Taranaki region. Instead, the government created a dedicated Just Transition unit which has drawn up a plan for the region in 2050 in consultation with the local community and Maori iwi. South Africa's government in September approved its Low Emissions Development Strategy and waste management strategy, with a focus on creating a circular economy. South Korea's COVID-19 recovery plan has an emphasis on hydrogen development. These are just a few examples of the kinds of policies we need.

(1) United Nations Environment Programme (2019). Emissions Gap Report 2019. UNEP, Nairobi

Carbon markets are a useful tool to drive the change we need. The more widespread carbon pricing is, the faster we can move towards our cleaner future. By assigning an external cost to emissions, business can make the right choices: faced with an ongoing cost which can be avoided, innovation increases. This eases the burden on the public purse to finance changes.

There is no one-size-fits-all blueprint for how we get to the clean, healthy, climate stabilised future we want. Everyone is coming from different starting points and with different challenges. Some, like Costa Rica, are already well on their way to decarbonisation and neutrality; some, like Australia, are blessed with ample renewable energy potential yet are far too slow in transitioning; while others still have their efforts stymied by ideological clashes.

What is universal is that there are more and more calls to act every day, from investors, from businesses, and from the public. It is encouraging to see so many youths engaging with this issue and putting pressure on politicians to act now to preserve their futures. These activists might be teenagers now, but it won't be long until they can vote. Climate change is their Vietnam, and they will not go gentle into the night. They know the most vulnerable will be, and are being, hit the hardest by climate change and that their quality of life will be very different from that of their parents and grandparents. This isn't the future they choose.

Much has been written about the parallels between the COVID-19 pandemic and the climate crisis. Both are devastating families, businesses, economies. Both are stressors to all our systems, from health to financial. Both disproportionately affect those who bear the least responsibility for them. And both require an urgent, rapid, and global response.

The Paris Agreement sets out a framework and our vision of the future we collectively want. But it is incumbent on governments, business and society to ensure that we make the right choices to fulfil its goals. Rather than slowing us down, the public health crisis this year should be the wake-up call that we can't keep doing the same things and expecting better results – we need to make positive changes to not just preserve but improve our futures. We can build back better and move faster towards our goals. That's the future I want.

We need to think about the climate crisis not as a problem on its own, but one which cuts across gender equality, social justice, mental health, food security, and jobs

Christiana Figueres - credit Jimena Mateo

Christiana Figueres is a founding partner of Global Optimism Ltd., a purpose driven enterprise focused on social and environmental change. Previously, she was the Executive Secretary of the United Nations Framework Convention on Climate Change from 2010 until 2016 and brought together national and sub-national governments, corporations and activists, financial institutions and NGOs to jointly deliver the Paris Agreement on climate change.

Article Three

Carbon Markets 2050: *Two Scenarios*

Carbon markets continue to evolve to adapt to new realities – how might they look by 2050? **Sharona Coutts**, **Sanjay Khanna**, **Ilona Millar** and **Peter Richardson** imagine how events over the coming decades could shape the carbon market of the future – and what lessons we can draw from the exercise

Recent months have seen a significant uptick in new state announcements of "net zero" emissions ambitions, including from China, Japan and South Korea.

The inauguration of Joe Biden in January is expected to see the US rejoin the Paris Agreement and issue a firm commitment to emissions reductions.

These new announcements coincide with proposals to strengthen emissions reductions targets from the EU, which in September published its new interim target of reducing emissions by at least 55% from 1990 levels by 2030, and from the UK, which, in 2019, enshrined its net-zero by 2050 commitment into law.

Collectively, these emissions reductions targets from recent and expected announcements comprise some two-thirds of global GDP.

In this context, IETA asked Baker McKenzie to use scenario planning, described below, to explore the long-term prospects for carbon markets. We have drawn on our experience in carbon markets, with support from Sanjay Khanna, a strategic foresight consultant, to consider two scenarios ending in 2050 — "Peak Performance" and "Globalisation Rewind".

Like the climate crisis, the COVID-19 pandemic affects everyone unevenly, often unfairly and disproportionately

These scenarios factor in real and imagined events (some more plausible than others), to identify two different outcomes for carbon markets: one resulting in the emergence of geographically broad and integrated markets, and the other resulting in a fractured system, with individualised markets, if any.

IETA's request was also informed by the COVID-19 pandemic. Like the climate crisis, the pandemic affects everyone unevenly, often unfairly and disproportionately. Given its planetary scale, the pandemic can be best addressed with cooperation and collaboration among wide-ranging private, public, NGO and social sector entities, and citizens, too. The same is true of the climate crisis. Scenario planning can help assess how varying degrees of cooperation could impact the success of climate action.

This type of scenario planning is intended to promote discussion, and, in doing so, we ask the reader to keep three things in mind:

- First, we have intentionally pushed boundaries. Some of the imagined events are loosely based on carbon markets history (and history often rhymes), but others are invented with unrestricted imagination, particularly as the narrative moves further into the future. Please forgive our indulgence in venturing into the unknown.
- Second, our scenarios of "Peak Performance" and "Globalisation Rewind" should not be seen as presupposing positive or negative endings. Our focus is on carbon markets, and it is plausible, if unlikely, that "Globalisation Rewind" may, notwithstanding the fragmentation or elimination of carbon markets, keep anthropogenic warming to around 1.5°C, which is a target that remains a constant in both scenarios.
- Finally, we should note that the imagined events, and the imagined market responses to those events, reflect outcomes of the scenario planning process rather than the views, thoughts and opinions of the authors. Nothing in this article should be construed as legal advice.

We hope our two scenarios, "Peak Performance" and "Globalisation Rewind", are interesting as IETA members and stakeholders consider their role in the pathway to 2050.

Our scenarios

Peak Performance

In Peak Performance, success at COP26 enables countries to cooperate to implement widespread carbon mitigation policies. Despite significant cooperation and progress, achieving Paris Agreement commitments remains elusive. Mounting social, economic and legal pressures, however, push public and private stakeholders to go further to drive emissions reductions and use market approaches not only for mitigation, but also to fund climate adaptation measures, primarily through investments in climate resilient infrastructure.

Globalisation Rewind
In Globalisation Rewind, multilateralism fractures, cooperation is limited, leaving costlier and more difficult pathways for countries and regions to attempt emissions reductions and climate mitigation. The elusiveness of meeting Paris Agreement pledges undermines the initial success of COP26. As a result, individual countries and communities must assemble their own mitigation and adaptation programmes.

Fictional context: 2021-40
Establishing a common set of events for the first years of our scenarios helps to distinguish the different market responses that are plausible under Peak Performance and Globalisation Rewind. A common set of events also reflects the likelihood that certain physical effects of climate change will occur, in the medium term, notwithstanding short-term geopolitical dynamics.

2021-24: The US re-entry to the Paris Agreement is influential. Rules allowing for international trading of carbon credits are agreed at COP26. The world's major emitters align on climate targets of net-zero emissions by 2050 (or 2060 at latest). Top performing companies compete to reduce emissions, develop net-zero technologies and build business resilience.

2025: Unprecedented wildfires erupt in several regions around the world. Smoke causes extensive respiratory challenges in commercial hubs, shutting down major global business centres. Some crop growing regions are affected. Simultaneously, regulators around the world discover a significant fraud in which carbon units are stolen after the security of some interlinked registries is compromised.

2030: Developments in sensor and satellite technology transform monitoring, reporting and verification processes (MRV), drastically cut the costs of forest and land carbon projects, and make credits truly fungible, as the new technology can assess with a high degree of accuracy the exact amounts of carbon emitted or sequestered. This technology also reveals significant errors in the previous calculations of some carbon projects.

Some of the imagined events are loosely based on carbon markets history, but others are invented with unrestricted imagination

2030-35: Jurisdictions around the world implement border tax adjustments aimed at goods and services with high GHG footprints. Others go further, banning importation of blacklisted goods.

2035: There is a particularly hot southern summer during which vegetation species that had previously been considered "drought proof" die, and large southern forests that had been part of REDD+ projects burn. This leads to the failure of large numbers of projects, which in turn, destroys the value of many bundled derivatives products. It also negatively affects the livelihood of communities that depend on the projects for their incomes.

2040: The ongoing physical impact of climate change makes life untenable in some of the world's most densely populated areas. Tens of millions of climate refugees commence mass migrations towards places they believe will provide a better chance of survival.

Peak Performance
The period to 2024 is foundational to the development of a number of global market systems. An early proliferation of individual markets rewards early arbitrage, before giving way to regional and then global derivatives markets, in which credits are traded on exchange, including through bundled products that draw credits from a large number of disparate projects. Top-performing companies compete to reduce emissions, develop net zero technologies and build business resilience, and to win clients and improved loan and corporate bond issuance terms based on climate credentials.

Global supply chains withstand the 2025 wildfires, thanks to resilience enhancements brought in after the COVID-19 pandemic and market fraud. For some time, suspicion of carbon markets dominates the news, but their positive impact in driving clean energy and sustainable development continues to win advocates. The widespread deployment of blockchain helps to improve both supply chain resilience and security.

The wildfires also prompt carbon market participants to move beyond mitigation and, for the first time, develop a comprehensive system of adaptation and resilient infrastructure credits – including projects that strengthen the resilience of food supply. Agricultural companies use revenues from these credits to develop more climate resilient food crops. In parallel, private sector support for the rapid deployment of sustainable finance, which started well before COP26, now commands a broad base of governmental support. Together, many jurisdictions establish long-term resilience plans, funded in part through carbon and sustainable finance revenues, which include measured responses to climate-induced migration and ecosystem disruption.

To thrive, carbon markets must adapt to address more issues, must be secure, and must proactively integrate with other climate responses

In 2030, carbon markets embrace the deployment of technology for MRV for land use, forestry and adaptation projects, and use it to support an even greater number of projects. The carbon market grows to an unprecedented size. Compliance markets continue to dominate in terms of market value, but the rapid expansion of fungible credits allows the voluntary market to continue to grow.

The introduction of border tax adjustments and import bans on blacklisted goods in the 2030s is seen as a further complement to carbon markets. Regulators and the private sector work hard to ensure that command-and-control measures (such as the prohibition on fossil-fuel powered passenger vehicles) integrate with carbon markets to ensure an efficient transition price for the private sector and citizens.

Droughts in 2035 result in the retroactive cancellation of a number of carbon credits, which again challenge confidence. However, resilience in carbon market infrastructure, designed in the 2020s and refined in response to the 2025 wildfires, mitigates the market impact of the crop failures. More importantly, the integration of carbon and sustainable finance markets permits the rapid and effective deployment of human, political and financial capital to assist affected communities.

In spite of the ongoing successes of the carbon markets (and other measures), climate-induced mass migrations place significant geopolitical pressure on many regions, leading to localised conflict. Comprehensive response plans, developed in the late 2020s, are now effectively deployed. Globally, the world remains on target to achieve net-zero by 2050, or even before then, and carbon markets are central to those efforts.

Eventually, a "race to the top" breaks out between the largest countries and companies, as the competitive advantage of achieving carbon neutrality becomes clear. Several claim to have "erased" all their historical emissions. Demand for credits remains strong but investments are geared much more strongly towards finding technological solutions to avoid any future emissions, and to remove CO2 directly from the atmosphere.

Globalisation Rewind

Early optimism from agreement at COP26 and organised and ad hoc grassroots efforts is rocked by the 2025 wildfires and carbon fraud. Carbon markets are labelled as ineffective tools to address climate change. Emerging international carbon market platforms see low trading volume as individual governments prioritise local action and command-and-control measures such as carbon taxes. Some countries also respond to supply chain impacts by imposing protectionist and restrictive measures to safeguard supplies of food, medicines and health supplies. In some regions, this sparks retaliatory trade measures.

Improved MRV is adopted by governments on a country-specific basis, principally in an effort to future-proof existing infrastructure and protect ecosystems.

The introduction of border tax adjustments and import bans on blacklisted goods in the 2030s, decoupled from carbon market integration, are broadly viewed with suspicion as protectionist, rather than environmental, measures. This leads to further trade conflict and geopolitical tensions. There is a widespread fragmentation of carbon markets, which are swept up in these trade conflicts. Voluntary markets continue to see growth, as companies and individuals respond to the effects of climate change, but compliance markets remain the preserve of a limited number of trading blocs.

The 2035 drought further erodes confidence in carbon markets. Sustainable finance, which many in the 2020s projected to be a key ally to a globally integrated system of carbon markets, refocuses on individual jurisdictions, and emerges alongside carbon taxes and border tax adjustments as the primary tools to fund mitigation and adaptation efforts.

As public support for carbon markets falls, the individualised country-cost of responding to climate events increases. Wealthy countries initially manage these increasing costs, at the expense of economic growth and global cooperation. However, all countries are ultimately impacted by climate-induced migration. Those worst affected face extreme adaption costs, and extreme shocks to daily life result in lasting generational impact on societies in the form of food scarcity, global conflict and public health shortfalls. There is no coordinated global response; individual countries must address these impacts alone. Carbon markets, as we now know them, end.

Discussion

In both scenarios, early indications suggest that Paris Agreement targets will not be met. In Peak Performance, however, this leads to global competition among countries and international institutions to reduce emissions, develop net zero technologies and build business resilience, and to engage stakeholders along the way. In contrast, the breakdown of multilateralism in Globalisation Rewind undercuts these efforts. The notion of social cohesion and resilient communities is never more relevant – or elusive.

For those involved in carbon markets, the message is clear: Peak Performance is the only one of these scenarios in which a globally integrated system of carbon markets can thrive. The more detailed message from Peak Performance is also clear: to thrive, carbon markets must adapt to address more issues (adaptation as well as mitigation), must be secure (and respond to inevitable security threats in a positive and systematic way), and must proactively integrate with other forms of climate responses, such as sustainable finance.

As noted above, we do not make conclusions about the impact of Peak Performance and Globalisation Rewind on societies and ecosystems. Our focus has been exclusively on carbon markets. That said, the COVID-19 pandemic illustrates benefits of cooperation and perils of fragmentation for societies and ecosystems alike.

Large-scale international cooperation on medical R&D enabled development of vaccine candidates in record time. On the other hand, the pandemic demonstrates that rapid and unmanaged change invariably sets back fragile economies and societies.

One lesson is that it is difficult to execute a unified global response to an all-encompassing crisis, particularly when a manageable start is followed by cascading impacts.

The aim of these scenarios is to facilitate a structured approach to test plans and strategies for carbon markets, identify potential blind spots (including both risks and opportunities), and begin to develop plans for how to manage them. Some suggested discussion questions include:

- How is technology likely to change carbon markets in the coming decades, both in terms of changing how the market functions, but also the role of emissions reduction technologies? What risks and opportunities does that present?
- How can carbon markets best operate in the absence of a fully integrated global market? What solutions could there be to ensure scale and profitability?
- Is there scope for adaptation or resilience credits as stand-alone offerings? What business models could support that?
- What actions are implied or suggested by your answers and thoughts in response to this exercise? How can you manage risk?

Sharona Coutts is an associate in the Environmental Markets team at Baker McKenzie, with a focus on climate change law and policy. Prior to joining Baker McKenzie, Sharona spent nearly two decades as an investigative reporter, editor and executive, based mostly in New York City and Los Angeles. She served as Associate to Justice Michael McHugh QC, AC at the High Court of Australia in 2005.

Sanjay Khanna is a strategic advisor and foresight expert. Previously the futurist at Baker McKenzie, today Sanjay works with organisations to illuminate risks and opportunities associated with the converging crises of geopolitical fragmentation, socioeconomic reordering, population health issues, technological acceleration, environmental and climate change. Sanjay has been interviewed by the Financial Times, the Globe and Mail, and the Canadian Broadcasting Corporation, among others.

Ilona Millar is a partner and the head of Baker McKenzie's Global Climate Law & Finance practice. She has worked for the last 20 years on climate change law, including the development of law and policy and its implementation by both governments and the private sector. This experience extends to complex multi-jurisdictional transactions as well as the development of innovative responses to climate change and sustainability problems.

Pete Richardson is a partner and head of the Major Projects Practice in Baker McKenzie's Toronto office. He is an energy and major projects specialist, advising clients on a variety of energy, infrastructure and environmental markets transactions. Pete worked in various Baker McKenzie offices around the world before settling in Toronto in 2013, including London, Chicago and Sydney.

The COVID-19 pandemic illustrates benefits of cooperation and perils of fragmentation for societies and ecosystems alike

Article Four

How to Scale the Voluntary Carbon Market

This year has seen a growing number of corporations set long-term net-zero targets – many including the use of offset credits to mitigate unavoidable emissions. To ensure that this increase in demand for volun-tary units is channelled to high-integrity voluntary projects, the Taskforce on Scaling Voluntary Carbon Markets has identified six areas for action. **Bill Winters** outlines the group's proposal

Limiting global warming to 1.5°C, in line with the Paris Agreement, requires deep, broad, and rapid action across all sectors of the economy.[1] An increasing number of firms are committing to net zero targets to support this goal. These firms will be expected to show how they plan to meet their targets, through an appropriate mix of direct emissions reductions and use of carbon credits.

While an important tool, offsetting should not be considered as a substitute for direct emissions reduc-tions by corporates, but as a complement. As for offset credits, it is essential that any purchases which form part of corporate climate commitments are from high-integrity carbon avoidance, reduction and removal projects.

For finance to flow to the right projects, a well-functioning voluntary carbon market (VCM) is needed.[2] Recognising this need, Former Bank of England Governor Mark Carney initiated a private-sector Task-force on Scaling Voluntary Carbon Markets to significantly scale up voluntary carbon markets and ensure they are transparent, liquid, verifiable and robust.

Voluntary markets have been operating for several years, with various standards and programmes found-ed to do very much the same as the Taskforce: drive a focus on quality and give oversight. However, with climate change now the most important global challenge we face, we must take these markets to the next level. Sponsored by the Institute for International Finance (IIF), the Taskforce convened in September, bringing together more than 50 experts from across the carbon markets value-chain, from over 20 sectors of the economy and across the world, with experience of the full history of these markets. We were further sup-ported by a consultation group of subject-matter experts from nearly 100 institutions, who helped to develop a blueprint for a voluntary carbon market.

The work of the Taskforce is guided by four key principles. First, the Taskforce will produce open-source solutions for private-sector organisations to take forward. Second, VCMs must have high environmental integrity and minimise any risks of negative consequences (ie, align to do-no-harm principles). Third, recognising the broad range of important work underway in this space, the Taskforce will amplify existing and ongoing work of parallel initiatives. Fourth, and perhaps most importantly, the Taskforce's work is predicated upon the principle that VCMs must not disincentivise companies' own emissions reduction efforts.

A blueprint for effective voluntary carbon markets

As the decarbonisation of the global economy accelerates in the coming years, demand for voluntary offsetting will naturally increase. That demand is more likely to be met if a large-scale, VCM takes shape, which is able to help companies achieve net-zero and net-negative goals. The scale up will need to be significant: our estimate is that VCMs need to grow by at least 15-fold by 2030 in order to support the investment required to deliver the 1.5°C pathway.

The voluntary market has made significant strides in both market functioning and credit integrity since its early days. However, in order to achieve another step-change in scale, there are structural challenges that remain to be solved. Today, buyers struggle to navigate various standards to find high-quality carbon credits at transparent prices. Co-benefits of those credits, while measured, reported, and verified, add another layer of complexity.[3] Understanding of what constitutes a high-quality credit changes as views on additionality, permanence, and leakage evolve. On the supply side, sellers face unpredictable demand, low prices, limited access to financing and long lead times to verify credits. As a consequence of these underlying pain-points, financial intermediaries and data players have not entered the market at scale, leading to the current state of low liquidity and limited data transparency.

To support the scale-up of the VCMs, the Taskforce has identified six key topics for action, spanning the entire value chain.

(1) The Paris Agreement, unlike the Kyoto Protocol, effectively covers nearly all greenhouse gas emissions and makes them the responsibility of national governments. (2) It is important to note that the advancement of regulated markets and regulations would also enable the private sector to play a full part in the transition to a net positive carbon economy. (3) Nevertheless there is clear evidence that co-benefits is a driver of buyers purchasing decisions.

I.Core carbon principles (CCPs) and attribute taxonomy

To enable contracts that assure buyers and the wider ecosystem that genuine emissions reductions are made with high environmental integrity, without any negative social or environmental side effects, we be-lieve that the market needs to align on a set of CCPs. These principles set out threshold quality criteria to which a carbon credit and the supporting standards and methodologies should adhere.

Currently, liquidity in VCMs is fragmented. Projects have a range of attributes (eg, project type, geogra-phy) that can influence their value, and buyers have different attribute preferences. In today's market, matching each individual buyer with a corresponding supplier is a time-consuming and inefficient pro-cess, transacted over-the-counter (OTC).

Reference contracts can bundle suppliers' products and buyers' preferences to allow for significantly more efficient matching of buyers and suppliers. Buyers could benefit from a simplified journey, in-creased price transparency and more effective price risk management. Suppliers benefit from improved access to financing and a clear price signal to inform their investment decisions as well as enable price risk management. The planet benefits due to increased climate action, financed by a scaled-up voluntary market. A set of CCPs is a critical enabler, as it can serve as the basis for a core carbon reference con-tract.

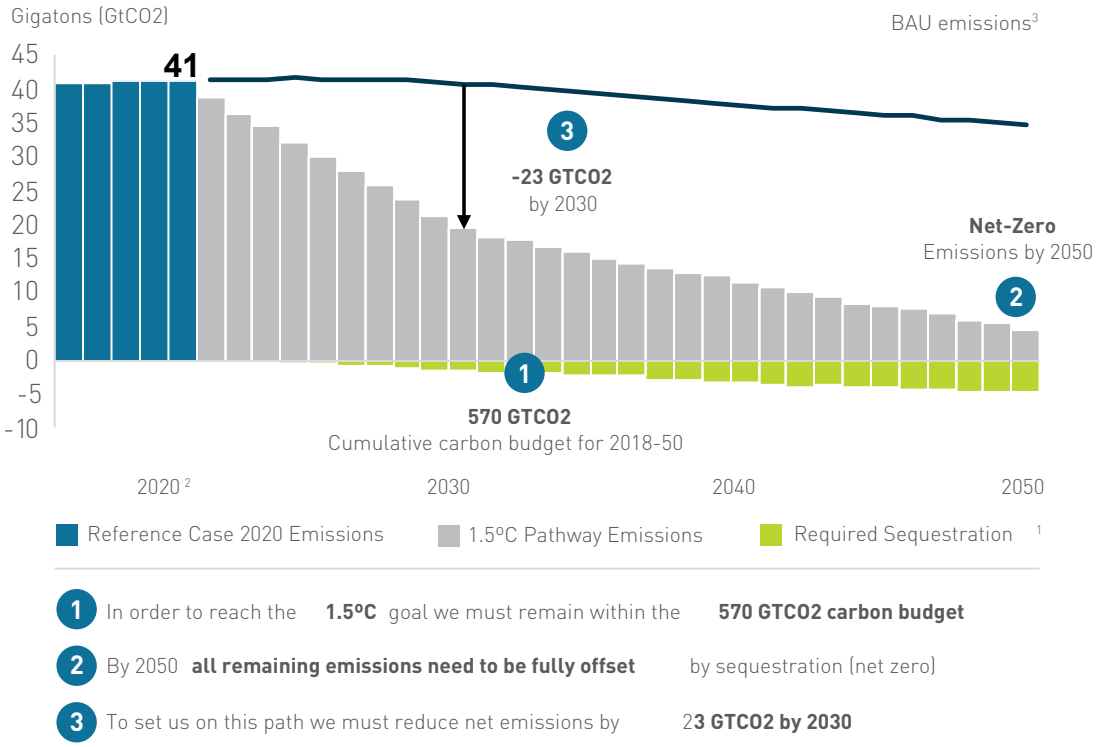
Limiting global warming to 1.5°C requires deep, broad, and rapid action across all sectors of the economy

II. Core carbon reference contracts

A key issue in today's VCM is that there are no "liquid" reference contracts (eg, spot and futures) with a daily, reliable price signal. This makes price risk management almost impossible and serves as an im-pediment to the growth of supplier financing. In order to concentrate liquidity and unlock the benefits that come with it, there is a need for core carbon reference contracts that can be traded on exchanges.

After these reference contracts are developed, there will still be a significant number of parties that pre-fer and continue to make trades OTC. These OTC contracts can also benefit as they could use the price of the core carbon contract as a starting point and then negotiate pricing for additional attributes.

Total CO_2 Net Emissions



1 In order to reach the **1.5ºC** goal we must remain within the **570 GTCO2 carbon budget**

2 By 2050 **all remaining emissions need to be fully offset** by sequestration (net zero)

3 To set us on this path we must reduce net emissions by **23 GTCO2 by 2030**

(1) 570GT of cumulative CO2 emissions from 2018 for a 66% chance of a 1.5°C increase in global mean surface temperature (GMST) (2) While emissions fell by a quarter at the peak of COVID-related lock-down, daily emission have rebounded to be only 5% lower than 2019 levels. Scenarios to 2050 still remain the same. From Nature: Current and future global climate impacts resulting from COVID-19 (3)Business-as-usual emissions. Source: McKinsey 1.5oC Scenario Analysis; IPCC; Le Quéré et al. 2018

Taskforce will issue its final report, including an updated blueprint for scaling voluntary carbon markets and an implementation road map.

III. Infrastructure: Trade, post-trade, financing, and data
A core set of infrastructure components need to be in place to make a market work. The components must work together in a way that is resilient, flexible, and able to handle large-scale trade volumes. The blueprint recommends further exchanges and clearinghouses enter the market to trade the CCP spot and futures contracts. Furthermore, the development of meta registries could provide custodian-like services for buyers and suppliers and enable the creation of standardised issuance numbers for individual projects across existing registries. Finally, banks and other supply chain financiers should catalyse structured fi-nance.

IV. Consensus on the legitimacy of offsetting
A key problem facing the development of VCMs arises from the lack of a shared vision for, and under-standing of, the role of offsetting in supporting the achievement of net-zero goals. Establishing principles for offsetting can help ensure that it does not disincentivise other climate action. The Taskforce recom-mends two sets of principles for companies. The first, Principles for Net-Zero Aligned Corporate Claims and Use of Offsets, sets out guidelines on the use of offsets for corporate buyers. The second, Principles for Credible Use of Offsets in Products or at Point of Sale, sets out high-level principles for the design of offset product or point-of-sale (POS) offerings to customers. Alignment across other ongoing initiatives will also be required regarding the use of offsetting in corporate claims.

V. Market integrity assurance
Integrity of VCMs should be further improved. Today the market lacks a strong governance body to decide on participant eligibility, tackle sub-optimal validation and verification processes, and combat fraud or money-laundering. As an example, the highly fragmented nature of supply creates potential for errors as well as for fraud or money laundering.

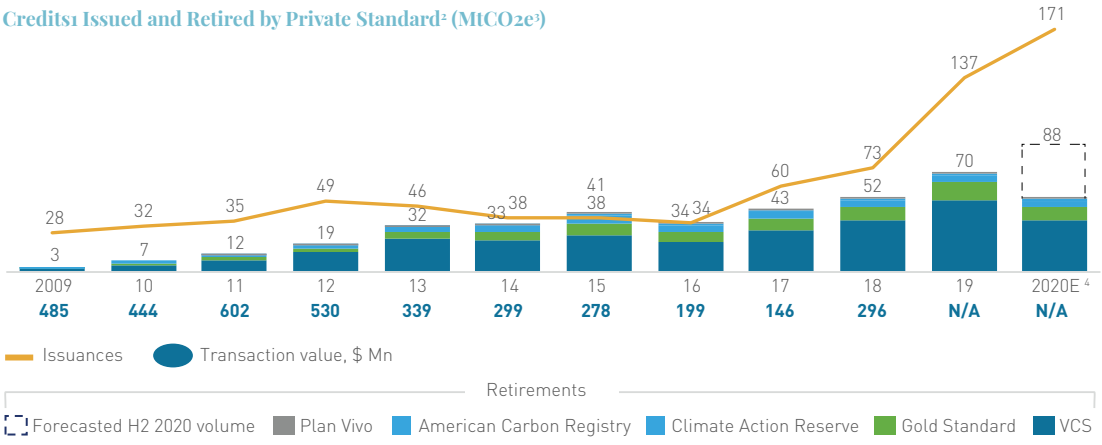
VI. Demand signals
The Taskforce believes that a clear demand signal could be one of the most important factors as it would provide the impetus to drive the development of liquid markets and scaled-up supply. To that end, the Taskforce proposes the following four recommendations:
i) Develop consistent investor guidance on off-setting, ii) Enhance consumer product offerings, including at Point-of-Sale iii) Increase industry collabora-tion and commitments and iv) Create mechanisms for demand signalling.

What's next?

The Taskforce initiated a public consultation to gather inputs from all interested stakeholders. The consultation period closed as this report went to press andin January 2021, the Taskforce will issue its final report, including an updated blueprint for scaling voluntary carbon markets and an implementation road map.

Bill Winters is the CEO of Standard Chartered. Throughout his career in banking, he has had significant frontline global banking experience and a proven track record of leadership and financial success. He has extensive experience of working in emerging markets and was a committee member of the Independent Commission on Banking, established in 2010, to recommend ways to improve competition and financial stability in banking.

Credits1 Issued and Retired by Private Standard2 (MtCO2e3)



(1) One carbon credit represents one ton of carbon dioxide equivalent (CO2e) avoided or sequestered. (2) Issuances and retirements based on registry data and McKinsey analysis; transaction value based on Ecosystem Marketplace 2019 report. (3) MtCO2e = metric tons of carbon dioxide equivalent. (4) Based on YTD volumes until end of September 2020 (ie, 114 million for issuances and 63 million for retirements); we project 2020 FY volumes based on extrapolation in line with historical seasonality (last 5 years); this does not reflect any potential impact related to Covid-19. Source: Ecosystem Marketplace; press search; data from VCS, GS, CAR, ACR and Plan Vivo market registries; McKinsey analysis

Article Five

The Year in Review

Carbon Pulse

The year may have been dominated by the COVID-19 pandemic, but climate policy and carbon market work didn't stop. The news team at Carbon Pulse wrap up the main developments of 2020 from around the world

International

The coronavirus pandemic forced a one-year delay to the annual UN climate negotiations, which have been rescheduled for next November in Glasgow. COP26 had been billed as a critical point for countries to ramp up their emissions pledged ahead of the Paris Agreement's 2021 formal start date.

The postponement also means nations will have to endure more uncertainty regarding the treaty's market-based Article 6. After two years of deadlock, experts had viewed this year's now-delayed talks as the last chance to forge detailed rules, or else face a looser system of multilateral and bilateral deals. In October, Switzerland struck the first Paris-era emissions trading agreements with Peru and Ghana.

The unresolved issue of what happens to the UN's Clean Development Mechanism has left officials in a precarious situation over whether to continue issuing credits beyond the end of Kyoto's second commitment period (2013-20). Some say doing so risks double counting emissions offsets from developing nations that will for the first time adopt emissions goals under Paris. Developers claim a halt in activity would cut off CER supplies, potentially raising costs for voluntary buyers or emitters under mandatory markets that allow the units for compliance.

The International Civil Aviation Organization (ICAO) Council in March approved six emissions unit programmes to supply credits under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). At the outset, offsets eligible for use in CORSIA's 2021-23 pilot phase will be limited to those generated from 2016-20 from the standards. However, due to the significant impact of the pandemic on global air travel, the Council in June voted to drop this year from CORSIA's 2019-20 average emissions baseline for the pilot phase. The move is expected to reduce carriers' demand for offsets over the next three years in all but the most optimistic recovery scenarios. ICAO's Council in November also approved two jurisdictional-scale REDD programmes to supply credits, the first time that international deforestation reduction units will be accepted in a compliance carbon market.

The coronavirus pandemic forced a one-year delay to the annual UN climate negotiations

Interest in voluntary offsetting also ballooned this year, prompting the private sector to assemble the Taskforce on Scaling Voluntary Carbon Markets (TSVCM). The body, steered by UN climate finance envoy Mark Carney, aims to bring more transparency, liquidity, and standardisation to the market. The panel proposed establishing a "core" voluntary offset contract based on a number of agreed criteria, which would be listed on exchanges and complemented by a taxonomy of additional attributes that brings additional value to buyers.

Asia Pacific

China is in the final stages of completing its long-awaited national ETS, releasing draft trading rules and an allocation plan for coal-fired power plants. It remains unclear whether the first trades will go through before the end of 2020, though the plans target compliance obligations dating back to Jan. 1, 2019.

New Zealand is finalising its five-year long ETS reform process, legislating measures that from 2021 will set an absolute emissions cap, introduce auctioning, ditch the fixed-price option, and bring in a cost containment reserve initially set at NZ$50. Some changes, relating to forestry and administration, were delayed to 2021 due to the pandemic.

Australia is also reforming its domestic carbon market after the government approved almost all recommendations put forward by a business-led panel. Many details are yet to be worked out, but the changes will include establishing a new type of carbon unit awarded to Safeguard Mechanism entities that voluntarily cut their emissions, and so-called "comprised crediting" – ie, awarding offsets before the emissions reductions have taken place – to some land-based schemes struggling with high upfront costs. The Clean Energy Regulator is also developing a method to allow CCS projects to earn carbon credits.

The election of former Vice President Joe Biden is likely to bring more attention to US climate and environmental policy and see the country rejoin the Paris Agreement after a brief exit under President Trump

However, the government still appears unwilling to impose CO2 restrictions on emitters, meaning the market will continue to rely on state-led purchases as well as growing voluntary demand.

In South Korea, the government this year finalised ETS allocation plans and trading rules for the 2020-25 period, which will for the first time allow investors and trading houses to buy and sell domestic carbon units. Officials have also tightened the allocation benchmark for coal plants to help bring down emissions from that sector. Crucially, state-owned KEPCO has indicated it might drop its practice of compensating regional power companies for the CO2 permits they have to buy, setting the stage for tougher conditions for the sector over the next five years.

Vietnam in November put in place legislation to establish a national ETS from 2022, while Indonesia and India are busy developing or considering voluntary markets for large GHG emitters in their respective countries.
Kazakhstan has re-started its domestic ETS after pausing it in 2016, though it is still struggling with overallocation and a lack of liquidity.

EMEA

Emissions from stationary installations covered by the EU ETS fell by 9.1% year-on-year to 1.53 billion tonnes in 2019.

The European Green Deal has taken centre stage across the EU, with the European Commission proposing to increase the bloc's 2030 emissions reduction target to at least 55% below 1990 levels, up from the current 40%. EU leaders are expected to back the upgraded target by year-end, but disagreements over burden-sharing across member states and the need for more financial support will not make it an easy task. Once the new target is endorsed, the Commission will put forward new proposals next June reviewing all legislation governing greenhouse gases, including the ETS Directive. The EU executive could potentially expand the bloc's cap-and-trade system to bring in other sectors such as vehicles and buildings, either into the existing ETS or through a separate system.
The European Commission also wants to bring "at least intra-EU" maritime emissions to the ETS, as progress at the global level under the International Maritime Organisation's (IMO) leadership remains slow. The European Parliament has proposed expanding the scope of the EU ETS to include emissions from all ships using EU ports as of 2022, as part of its negotiating mandate for the review of the bloc's maritime monitoring, reporting, and verification (MRV) system.

The EU is also laying groundwork for a proposal to introduce a carbon border adjustment mechanism (CBAM) to levy imports of selected products, with steel, cement, and power imports being the likeliest candidates. Its trading partners, however, have shown concerns and the measure risks retaliation if it is seen as incompatible with international trade rules.

The UK, on the verge of leaving the EU ETS at year's end, is set to replace its participation in the system with its own post-Brexit carbon pricing regime. However, as of the time of writing in early December, the government has yet to announce whether it will be a domestic carbon tax or a cap-and-trade scheme - either standalone or linked to the EU's market.
After years of negotiations, Switzerland finally linked its carbon market to that of the EU on Jan. 1. However, while the Linking Agreement came into force that day, a physical connection between the two systems was not opened until September, with transfers permitted only during a handful of one-day trading windows.

South Africa completed the first year under its carbon tax, delaying the compliance deadline due to the pandemic and setting up an offset registry that helped see the first credits turned in against the levy.

The Americas

The election of former Vice President Joe Biden (D) is likely to bring more attention to US climate and environmental policy and see the country rejoin the Paris Agreement after a brief exit under President Trump. Biden has appointed former Secretary of State John Kerry (D) as his 'climate czar', though the prospect for federal carbon pricing and clean energy legislation is unclear until Senate run-off elections for Georgia's two seats in January determine whether Republican or Democrats control the upper chamber.

California won summary judgements this summer in a US Department of Justice (DOJ) lawsuit challenging the legality of the state's WCI linkage with Quebec. The DOJ has appealed the case.

States in the Northeast US are working to finalise the Transportation and Climate Initiative (TCI) cap-and-trade framework to regulate on-road diesel and gasoline emissions. The programme is slated to release a final Memorandum of Understanding (MOU) by year-end. If the MOU receives support, the 13 member jurisdictions will work to finalise regulations and pass legislation or regulations to enact the carbon market by 2022.

Canadian Prime Minister Justin Trudeau's Liberal government in November put forth legislation to install five-year emissions reduction targets from 2030, en route to achieving net zero emissions by 2050. Despite the pandemic, the federal 'backstop' CO2 levy on fossil fuels increased to C$30/tonne in April, although British Columbia deferred the scheduled C$5/tonne increase in its own C$40 carbon tax until 2021. The federal environment ministry is also prioritising the development of eight protocols under the federal GHG offset system.

The first year of Mexico's pilot emissions trading scheme kicked off in January, with a transition year expected in 2022 before full compliance obligations begin in 2023. Colombia is also aiming to complete the design of its own carbon market by year-end, while Chile this year passed a reform of the country's carbon tax.

Article Six

Netting a Positive Change

Does the wave of net zero commitments now put the Paris Agreement goals within sight, asks **Simon Henry**

The last 18 months have seen an incredible surge in announcements, from both countries and companies, committing to achieve net zero emissions. As we stand on the cusp of the implementation of the Paris Agreement, there is now a genuine prospect of delivering its goals.

Five year ago, much of the climate community was celebrating the adoption of the Paris Agreement. This optimism was boosted by its entry into force less than a year later, leading to UNFCCC Executive Secretary Patricia Espinosa to comment: "The speed at which countries have made the Paris Agreement's entry into force possible is unprecedented in recent experience of international agreements." However, this optimism was dealt a huge blow just five days later, when Donald Trump won the 2016 US election; part of his election manifesto included a commitment to withdraw the US from the Paris Agreement.

Trump's electoral success, along with a surge in populism in many parts of the world, led to fears and rumours that other big emitting countries like Brazil could also pull out of the Agreement. At the other end of the scale, the Agreement also attracted criticism from a variety of commentators saying that it lacked the urgency necessary to tackle the climate crisis. Its implementation only starts in 2021 and the first global stocktake – the primary mechanism to evaluate progress in achieving the goals – won't occur until 2023.

It's fair to say the Agreement, and humanity's collective response to the climate crisis, was under threat with the real possibility of collapse. This would not be without precedent: six years prior to the Paris meeting, attempts to draft a global successor to the Kyoto Protocol collapsed at COP15 in Copenhagen. One prominent UK journalist commented that international summits like the COPs, "are a failed model. They are where good intentions go to die."

Yet despite this negativity, some urgency was injected into discussions at the end of 2018, courtesy of the IPCC's Special Report on the Impacts of 1.5°C of Global Warming. This led to a remarkable period in 2019, starting with a report from the UK's independent Committee on Climate Change saying that the cost of achieving net zero emissions by 2050 had fallen considerably, and could now be achieved for the same cost as the previous target of an 80% reduction. In June of that year, the UK became the first major economy to enshrine net zero by 2050 into law – one of the last acts of Theresa May's premiership before her resignation in July.

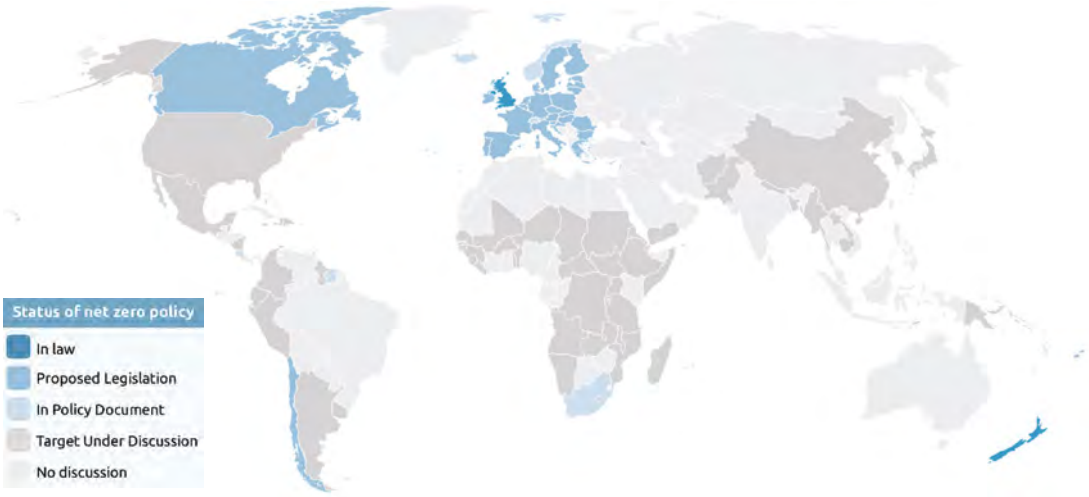
This development started a ball rolling and in the last 18 months we have seen similar announcements from some of the largest emitters in the world including China, the EU, South Korea, Japan, Canada and South Africa. As of the time of writing in early December 2020, 127 countries have set net zero goals, representing 63% of global emissions. A new report from Climate Action Tracker found that the cumulative effect of these pledges puts the 1.5°C goal within reach – while warning that more action is needed on interim goals.

Joe Biden's recent US election victory also provides cause for further optimism. On the same day the US officially left the Paris Agreement, President-elect Biden announced that the country would re-join it at the earliest date possible. In addition, his election manifesto included a commitment to achieve net zero emissions by no later than 2050.

From these recent developments, several important messages emerge:

- As we stand on the cusp of the implementation of the Paris Agreement, international commitment to its goals are stronger than ever.
- The narrative on long term ambition has changed – anything other than net zero is now seen as insufficient. The global end goal is slowly pulling into view.
- Carbon markets sit at the heart of the policy response of the most ambitious countries and regions, including Mexico, the EU, South Africa, China, South Korea and New Zealand.

Figure 1: Countries with net zero climate goals



Source: Paris Agreement turning point. Climate Action Tracker, December 2020

However, despite this significant progress, many challenges remain. While 126 countries may have gone on-the-record with a net zero goal, some big emitters remain silent, including Brazil, Indonesia and India. Despite this, carbon market developments are underway in these countries. Indonesia is working on regulations to introduce a domestic carbon market and India's Environment Ministry is considering an ETS to tackle both air pollution and GHG emissions.

The broad commitment to net zero in the long-term has also not been matched by ambition in near term NDCs. Parties are required to submit new or updated NDCs by the end of 2020 – five years after the adoption of the Paris Agreement. However, at present, only 18 countries have done this, though a further 154 have confirmed their intention to do so by the end of the year. December looks set to be a busy month!

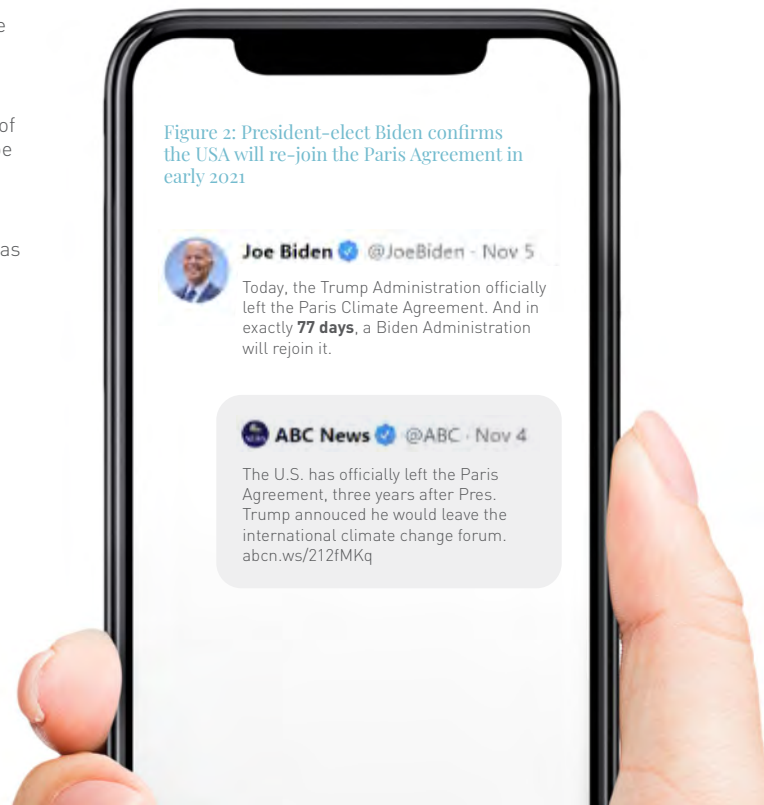
And finally, we should not forget that the Paris Agreement rulebook remains incomplete. While most of it was agreed at COP24 in Katowice, rules on Article 6 – international cooperation and market mechanisms – remain elusive. When it comes to raising ambition, Article 6 is perhaps the most important element of the Paris Agreement because it provides Parties with a tool to cooperate on meeting their NDCs. Completing this work and finalising the rulebook will be a top agenda item at COP26. And it will be a binary marker of success against which the UK's COP Presidency will be measured.

Prospects for agreement at Glasgow look promising though. The COVID-19 induced delay to proceedings has allowed time for reflection on national positions and consideration of potential areas of compromise – and presented an opportunity to build cleaner economies. The surge in net zero commitments should have also focused minds on the need for Article 6. A key climate policy advisor to the Chinese government indicated that China might need to sequester 800 million tonnes of CO2e per year to reach its net zero goal. It's inconceivable to think that this level of climate action, multiplied across numerous jurisdictions, can be delivered without international cooperation.

If we were to roll back the clock to the signing of the Paris Agreement, and tell the delegates at Le Bourget that within five years some of the biggest emitters on the planet would commit to ending their contribution to climate change within a generation, what would their reaction have been? Though perhaps the more interesting question is what will the next five years bring? If recent history is a good indicator, anything is possible.

Simon is Director of Carbon Market Development at IETA. He leads IETA's work to increase the role of natural climate solutions in carbon pricing systems. This work is focused through IETA's Markets for Natural Climate Solutions initiative, which aims to scale up private finance and help reduce emissions from deforestation and land use change.

Figure 2: President-elect Biden confirms the USA will re-join the Paris Agreement in early 2021



Article Seven

The Business of Net Zero

The past year has seen a surge in businesses adopting targets to achieve net-zero emissions by 2050 – at the latest – mirroring action seen by governments. Several IETA members have stepped up, from different sectors and from around the world. Here's a snapshot of pledges by some of IETA's members.
Compiled by **Katie Kouchakji**

Sector: Mining

COMPANY	BHP	Rio Tinto
SECTOR	Mining	Mining
HQ	Melbourne, Australia	London, UK
MARKET CAP (IF AVAIL)*	A$115bn	A$37.9bn
NET ZERO TARGET YEAR	2050^^	2050^^
OFFSETS/NCS USE?	Both, with NCS a priority	Yes, both
OTHER MEASURES (NON-EXHAUSTIVE LIST)	30% cut by 2030, compared to 2020; decarbonising power supply; increased electrification of operations; R&D for new low-emissions tech	Reduce carbon intensity by 30% and absolute emissions by 15% by 2030; $1bn investment in climate-related projects; carbon neutral growth to 2030
LATEST EMISSIONS DATA (IF AVAIL)	15.8 MtCO2e - FY2020^^	31.8 MtCO2e - 2018^^
TCFD ALIGNED?	Yes	Yes
KEY QUOTE	"Our updated portfolio analysis demonstrates that our business can continue to thrive over the next 30 years... even under a Paris Agreement-aligned 1.5°C trajectory"	"We do not have all the answers yet but I believe we are asking the right questions, especially of ourselves: what more can we do to contribute to climate action across our entire business ecosystem as we provide the essential materials used to deliver human progress?"

(*) Market capitalisation data taken from relevant exchanges on 28/29 November and 2 December 2020 (**) This encompasses all GHGs from production, processing and consumption of Shell products
(^) Scope 1 only (^^) Scope 1 and 2 (^^^) Scope 1, 2 and 3

Sector: Oil and Gas

COMPANY	BP	Total	Shell	Repsol
SECTOR	Oil & gas	Oil & gas	Oil & gas	Oil & gas
HQ	London, UK	Paris, France	The Hague, Nethelands	Madrid, Spain
MARKET CAP (IF AVAIL)*	£53.4bn	€100.3bn	€116.2bn	€13.6bn
NET ZERO TARGET YEAR	2050^^^	2050^^	2050^^	2050^^^
OFFSETS/NCS USE?	NCS	$100mn/year for NCS	NCS	NCS
OTHER MEASURES (NON-EXHAUSTIVE LIST)	50% cut in methane emissions; 50% minimum reduction in carbon intensity of products; $5bn/yr of investment in low-carbon business by 2030; new tech, such as CCUS and hydrogen	Net zero in global operations (scope 1 & 2) by 2050; net zero in Europe in Scope 3 as well by 2050, with 30% reduction by 2030; at least 60% cut in carbon intensity of energy products worldwide, with 15% by 2030 and 35% by 2040; increase capex investment in renewables and low-carbon electricity to 20% by 2030; cutting methane emissions	Energy efficiency measures; carbon intensity cut in products by 30% by 2035 and 65% by 2050; CCUS and hydrogen	Investing in renewables, 7.5 GW by 2025 and 15 GW by 2030; reducing carbon intensity 3% by 2020, 12% by 2025, 25% by 2030 and 50% by 2040; CCUS; energy efficiency; advanced biofuels; hydrogen
LATEST EMISSIONS DATA (IF AVAIL)	415 MtCO2e^^^	55 MtCO2e^	70 MtCO2e - 2019; estimated 1.7bn tCO2e using Shell's Net Carbon Footprint value**	25.2 MtCO2e - 2019^^
TCFD ALIGNED?	In progress	Yes	Yes	Yes
KEY QUOTE	"This coming decade is critical for the world in the fight against climate change, and to drive the necessary change in global energy systems will require action from everyone"	"We are determined to advance the energy transition while also growing shareholder value"	"It is going to take a lot of work. And, today, Shell's business plans will not get us to where we want to be. We are on a journey and recognise the need to change"	"We do it with the utmost confidence that we're investing in the future, and addressing the significant challenges that lie ahead with strategic clarity is what will enable us to turn them into opportunities"

(*) Market capitalisation data taken from relevant exchanges on 28/29 November and 2 December 2020 (**) This encompasses all GHGs from production, processing and consumption of Shell products (^) Scope 1 only (^^) Scope 1 and 2 (^^^) Scope 1, 2 and 3

Continued

Sector: Oil and Gas

COMPANY	Woodside	ENI	Equinor	Enbridge
SECTOR	Oil & gas	Oil & gas	Oil & gas	Oil & gas
HQ	Perth	Rome	Stavanger	Calgary
MARKET CAP (IF AVAIL)*	A$21.57bn	€30.23bn	$51.21bn	$84.17bn
NET ZERO TARGET YEAR	2050^^	2040^^	2050^^^	2050^^
OFFSETS/NCS USE?	NCS	NCS	NCS	NCS
OTHER MEASURES (NON-EXHAUSTIVE LIST)	Using renewables at offshore production sites; increasing efficiency; CCS and hydrogen	Aiming for net zero from upstream by 2030 - 2040 goal is global activities; eliminating flaring; reducing methane; energy efficiency; CCS	Carbon intensity target; absolute emission reduction target; carbon neutral in 2030; and investment in renewables, hydrogen and CCS	Investment in renewables; use of RECs; increasing operational efficiency; 35% cut in emissions intensity by 2030
LATEST EMISSIONS DATA (IF AVAIL)	12.1 MtCO2e - 2019^^	41.9 MtCO2e - 2019^^	261.9 MtCO2e - 2019^^^	13.47 MtCO2e^^ - 2019
TCFD ALIGNED?	Yes	Yes	Yes	Yes
KEY QUOTE	"We aim to be net zero by 2050, and we're challenging ourselves to do better in how we operate today's projects and develop tomorrow's opportunities"	"The Eni of the future will be even more sustainable, strengthening its role as a global player in the world of energy and boosted by the progressive development of the renewable energy business and new businesses based on circularity"	"Climate change is a shared challenge. The combined efforts of governments, industries, investors and consumers are crucial to reaching net-zero emissions"	"We are adapting to the energy transition over time - helping society transition to a lower-emissions economy, while reducing our own emissions"

(*) Market capitalisation data taken from relevant exchanges on 28/29 November and 2 December 2020 (**) This encompasses all GHGs from production, processing and consumption of Shell products
(^) Scope 1 only (^^) Scope 1 and 2 (^^^) Scope 1, 2 and 3

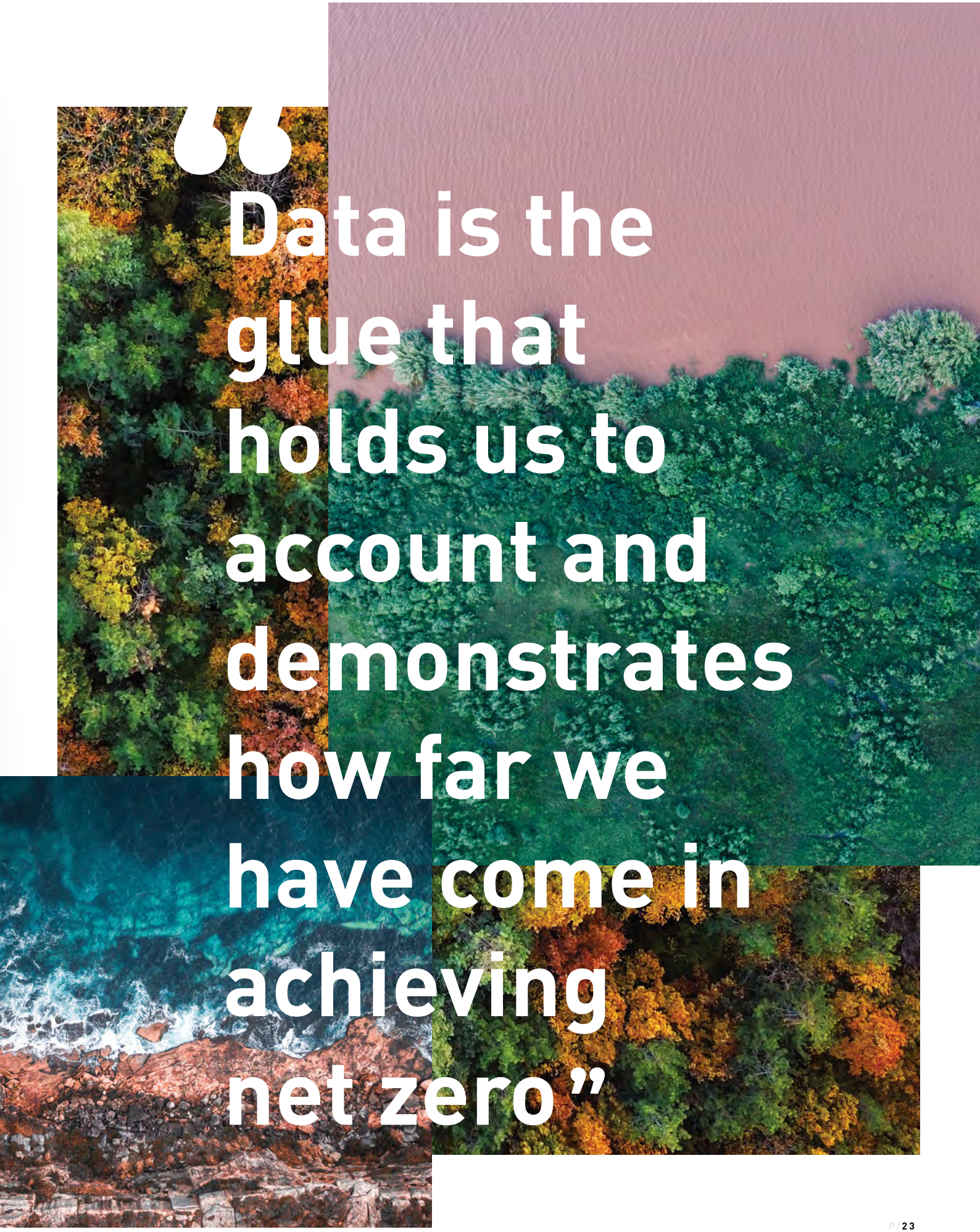
Sector: Electricity

COMPANY	Vattenfall	Ontario Power Generation
SECTOR	Electricity	Electricity
HQ	Solna, Sweden	Toronto, Canada
MARKET CAP (IF AVAIL)*	Government-owned	Government-owned
NET ZERO TARGET YEAR	2050^^^	2040^^^
OFFSETS/NCS USE?		NCS
OTHER MEASURES (NON-EXHAUSTIVE LIST)	Phasing out coal entirely by 2030; working with suppliers to cut Scope 3 emissions; customer programmes to adopt decentralised solutions; hydrogen; increase investment in renewables	Nuclear technology; carbon neutral suppliers mandate; reinvest in hydro fleet; solar and storage; CCS; convert fleet to Evs by 2030
LATEST EMISSIONS DAT (IF AVAIL)	37.5 MtCO2e - 2019^^^	0.5 MtCO2e - 2019^
TCFD ALIGNED?	Yes	No, but supports
KEY QUOTE	"To become fossil free within one generation, Vattenfall needs to reduce its carbon dioxide emissions throughout the entire value chain – and it's happening"	"Our goals won't be easy to achieve. The way forward won't always be clear. But we won't let that lack of perfect clarity stop us from taking action now"

Sector: Other

COMPANY	PwC	Dow	LafargeHolcim
SECTOR	Consultancy	Chemicals	Cement
HQ	London, UK	Midland, Michigan	Jona, Switzerland
MARKET CAP (IF AVAIL)*	Privately Owned	$41.1bn	CHF29.69bn
NET ZERO TARGET YEAR	2030^^^	2050^^^	2050^^
OFFSETS/NCS USE?	Both	NCS	
OTHER MEASURES (NON-EXHAUSTIVE LIST)	Outright GHG reduction of 50%; swap to 100% renewable energy globally; energy efficiency in offices; 50% cut in travel emissions	Renewable energy purchases; packaging to be reusable or recyclable by 2035; increasing efficiency in manufacturing	CCUS; renewable energy purchasing and investment; manufacturing efficiency improvements; alternative fuels; aiming to reduce Scope 3 intensity by at least 50%; development of green cement
LATEST EMISSIONS DATA (IF AVAIL)	662,299 tCO2e - FY2019^^^	93.6 MtCO2e - 2019^^^	148 MtCO2e - 2019^^^
TCFD ALIGNED?	No, but supports	Yes	Yes
KEY QUOTE	"The COVID-19 pandemic has accelerated the shift to remote working and demonstrated the feasibility of new client delivery models, as part of a longer-term transformation of our services"	"A sustainable future is attainable, but only if we continue to tackle these issues head-on, hold ourselves accountable, and work together to enable new science- and technology-based solutions that directly address both climate change and plastic waste"	"I will not stop pushing the boundaries on our net zero journey with rigorous science-based targets"

(*) Market capitalisation data taken from relevant exchanges on 28/29 November and 2 December 2020 (**) This encompasses all GHGs from production, processing and consumption of Shell products (^) Scope 1 only (^^) Scope 1 and 2 (^^^) Scope 1, 2 and 3



“Data is the glue that holds us to account and demonstrates how far we have come in achieving net zero”

Article Eight

Data: *The Glue Needed to Deliver Net Zero*

Being able to accurately measure and report emissions is vital for accountability and transparency of reduction pledges. But not all data is created equally and there is more to consider than just the numbers, warns **Anne-Marie Warris**

Achieving net zero is essential for us and our businesses, and data will play an essential part in getting us to net zero. Why? Because without reliable and credible data, there would be no baseline from which to measure our progress on the journey to net zero or to confirm when we have achieved it. It will also include data to demonstrate that societal and broader environmental impacts have been considered in the drive to net zero.

Data is the glue that holds us to account and demonstrates how far we have come in achieving net zero. But data despite being a short simple sounding word is anything but simple; it is a complex glue. It encompasses information not just numbers; machine learning, algorithms, analytics and models to help us determine GHG emission and removals, overcome challenges such as accuracy, uncertainty, validity and materiality, and help with tools such as conversion factors; software systems taking electrical signals and converting them into data and economic predictions; and to help us with issues such as collection, recording, manipulation, and presentations.

Critical focus needed in designing data collection systems

Often, people talk about the need for "good" data, or more correctly a "good outcome" from a data collection and analysis process, but what does that mean? To answer that, we need answers to a quite a lot of questions such as: does the outcome of the data collection and analysis phase answer the question we wish answered?; is the outcome comparable over time and with other data sets to tell us how we are progressing towards net zero?; is the outcome and collection without bias?; can the outcome be used for comparison over time?; is the outcome fair, accurate, correct?; and, what is the outcome uncertainty and accuracy?.

When reporting specific GHG emissions and removals, the challenge is the detail and the issue of commercial/national sensitive data. The challenge of commercially sensitive data or data that could be backward analysed to potentially indicate commercial sensitivities is a main challenge irrespective of if the data is national, regional, state, industrial or organisational. A data collection system design must grapple with this challenge and find a way of gathering relevant data and at a sufficiently detailed level while maintaining commercial sensitivity. Some of those issues can be overcome with consideration of things such as storage, retrieval and data integrity management.

Most of these questions come with complex and detailed answers, but the important point is that a "good outcome" is not achieved automatically or simplistically; it takes considerable effort in the design of data collection system, the use of the data in models/analytics, the validation of the data and the models to avoid bias, dealing conservatively with data errors or data gaps to derive the simple data outcome that answers the question 'are we on the right track to net zero?'.

How do you know if the data is 'good'?

The quality of the data depends on the answers to two main questions:

- How was "what data and how to collect the data" determined?
- What testing has been done to confirm the validity of the data and to assure it?

Typically, considerations in designing a date collection system include:

- How to collect and handle primary data (the original starting point for each outcome, so the temperature data, the activity data, the emission factors, etc);
- How to decide on estimation methods and their uncertainty and bias;
- How to validate software used to collect and translate remote data from electrical/electronical signals to mg/l, ppm, temperature, etc;
- How to avoid and manage, if it happens, disruption to the data flow – data is not normally a single point, but a stream of data collected remotely or developed from algorithms or via analysis or even machine learning;
- What integrity management is necessary to check processes used in the collection and analysis phase to avoid distortion (maliciously or unintentionally) or hacking/IT fraud;
- What controls are in place to check and control the integrity of equipment used to collect, transmit and analysis the data;
- How is data stored from the primary data stream to the analysis data and other support data;
- How is sharing of data/access controlled, etc.

The design of the data collection system also includes consideration of what additional data is needed to support effective and credible sensitive analysis, conversion, validation, and assurance processes.

The testing and assurance phase typically include elements such as:

- What is the critical data and has it been validated internally?
- What checks have been conducted to test assumptions to avoid bias, especially in mathematical models' algorithms/analysis/ machine learning/big data?
- What cross checks were made while the data was compiled?
- What sensitivity testing of primary data has been carried out?
- What sensitivity testing of results from machine learning/big data/mathematical manipulations have been carried out?
- What materiality review has been carried out of statements and modelling parameters/ assumptions and their impact on outcomes?
- What materiality testing of what is important, ie what information and data is needed to show the trajectory and where we are, understand the consequences of exclusions (recall debate on boundaries etc for lifecycle assessments) has been carried out?
- What external assurance process has been used to verify/assure the data and its results/ outcome or any peer reviews carried out in relation to projection/mathematical models?

Answering the above questions is complicated and a critical reminder that a "good outcome" is not achieved easily or rapidly; it takes significant effort in the validation, testing and assurance of the data generated to be able to determine if we on the right track to net zero.

A "good outcome" is not achieved automatically or simplistically

One of the major challenges is the combination or comparison of data that is derived from top down with data derived from actual measurement

Tackling data problems

There are two main challenges to overcome when crunching the numbers:

1. What do we do with old data and how do we make it useful for tomorrow and comparable?
2. What do we do when data is not available or, as we are seeing right now, there is an aberration in the data due to economic or other systemic shocks?

The first is the hardest because so much old data has been stored in systems which are no longer supported by software or stored as handwritten records. Thus, it cannot all be made available as making it all available means retrieving it and validating that the data retrieved is consistent with the original data. A critical question is, what is useful and what is nice to have? This raises the pertinent question of how do we avoid this challenge going forward? The best solution is to store both primary data and the outcome data in formats and systems that avoid specific software which may become obsolete for commercial reason, and to use open source and blockchain to avoid loss of data with global free access to avoid data secrets.

The second is somewhat easier, as we can use machine learning to fill data gaps due to failure in collection. The same approach can be used to deal with aberrations, so we have a data set based on data reflecting the aberration and sets reflecting the situation without the aberration.

Uncertainty – does that matter?

One of the major challenges is the combination or comparison of data that is derived from top down, such as IPCC data, IEA data or jurisdictional data, with data derived from actual measurement in the field of GHG emissions and reductions.

Perhaps the most important and most challenging to understand is the 'uncertainty' terminology used in the two approaches, which is different. Simplistically[1]:

- IPCC data typically uses uncertainty analysis as a means of driving methodological harmonisation (in the sense of acting similarly);
- While GHG bottom up data such as in the EU ETS, GHG protocol, and ISO standards uses uncertainty analysis as a means of improving accuracy (in the sense of getting nearer to the true physical value).

What this means is you cannot compare the two data sources just by adding number up from bottom up and expect to get the same outcome as from top down approach.

This raises the challenging question of, when it comes to declaring we have achieved net zero, do we have to take the uncertainty analysis into account? Yes, I believe we need to do that to have a realistic answer to the question and to be sure we have achieved net zero.

Dr Anne-Marie Warris has over 30 years' experience in sustainable matters and is a leading expert in climate change and environmental issues. She gave the Royal Academy of Engineering invited lecture on 'A low carbon world – is it realistic?' in April 2010. She is a board member and chair of the finance committee Verra, an IETA Fellow and Honorary Fellow of UK Emission Trading Group Ltd (ETG).

Anne-Marie has been involved in GHG accounting, monitoring, reporting and verification (MRV) since 2000, being UK expert to the ISO GHG standards, supporting ETG and IETA in the development of UK and EU MRV requirements for emission trading schemes and in 2010 acted as UK nominated expert to the IMO Expert Group on Market Based Measures. She convened the group which developed the IMO MEPC65/INF3./rev.1. 'Goal-based approach to fuel and CO_2 emissions monitoring and reporting' which became the foundation for IMO and EU requirements on reporting shipping GHG emissions.

Future-Proofing the EU ETS

The EU ETS has come a long way from its early "learning by doing" days. With an eye on the pathway to 2050, **Jos Delbeke** and **Peter Vis** lay out the challenges ahead in making the pioneering market fit for the future.

It is already 15 years since the EU Emissions Trading System (ETS) began. It is satisfying to see that it is working, first and foremost in delivering reduced emissions – in conjunction with other policies. By the end of 2019, emissions had been reduced by 35%, a remarkable achievement for an instrument that initially aroused much scepticism.

From a day-to-day perspective, emissions trading has worked well: the market is liquid and sophisticated; the registry performs to the highest standard and is now as secure as a bank vault; monitoring and verification has provided comparable data across the EU; and the level of compliance has been excellent. Application of the polluter pays principle has resulted in approaching Đ60bn of additional revenue for national treasuries since auctioning began, which has enabled the funding of innovative technologies and considerable extra spending on climate-related causes. Companies are familiar with the instrument and appreciate the flexibilities that enable them to hedge risks more than would be possible with carbon taxes, and the first linking agreement has come into effect with Switzerland.

There have been many challenges along the way, most notably the structural over-supply, the temporary suspension of the registry in 2011, and the 'stopping of the clock' on international aviation's inclusion in the system. Answers were found to each of these challenges, large and small, so that the integrity of the system was protected and left us stronger. Not only that, but the EU ETS has served as a template for others. Few would have predicted that so many other countries would consider using the instrument, least of all China, and the policy learning gained in Europe has been of global benefit.

Working on emissions trading is not for the faint-hearted

What lies ahead?

The next 30 years are likely to see many more challenges. Working on emissions trading is not for the faint-hearted; there is hard work ahead, but the benefits of carbon pricing combining cost-efficiency and the dividend of revenues with which to invest, are as compelling as ever.

The first challenge is to face is the departure of the UK from the EU ETS at the end of the transition period, and to negotiate with the UK a new linking agreement as rapidly as possible. The UK has always been at the heart of the EU ETS, having had a pre-existing national ETS and with London being the base for much of the trading. The UK appears to want to continue its link with the EU, and enabling the UK's smooth reintegration would be a vote of confidence in the instrument as a policy of choice.

The second challenge is the revision of the EU ETS in order to reflect the EU's higher than initially planned ambition to 2030 and the path towards climate neutrality by 2050. There does not need to be major design changes related to this increase of stringency. The likelihood is that adjustments will be made to the Market Stability Reserve and/or the Linear Reduction Factor. Greater flexibilities may be allowed between the three 'pillars' of EU climate policy, namely the EU ETS, the Effort Sharing Regulation, and the forestry and land use (or 'LULUCF') Regulation.

The more important changes to the design of the EU ETS will relate to the possible inclusion of new sectors. Maritime's inclusion will be along similar lines to aviation's inclusion a decade ago, but extending the EU ETS to buildings and road transport would be more challenging. It is almost certain that, if these sectors are brought into the scope, it will be via the inclusion of fuels that are not already covered by the EU ETS. Obligations will most likely be put on fuel suppliers in respect of these sectors, and the carbon pricing component will have to come on top of existing taxes – or the regulatory effort will not be increased as it must for these difficult to decarbonise sectors.

“Change is the only constant – even with respect to the EU ETS[1]”

(1) Apologies to Heraclitus (c. 535 BC–475 BC) for the adaptation of this famous quotation of his.

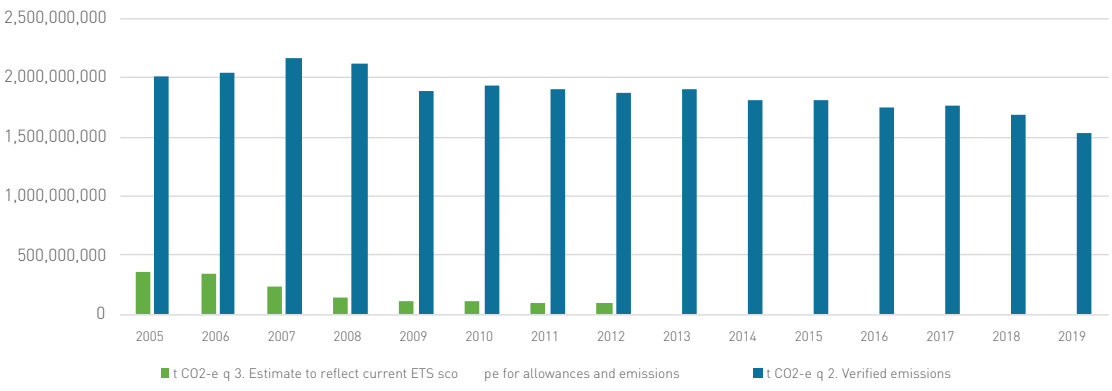
Furthermore, new issues arise by the inclusion of these ‘consumer-facing’ sectors, such as fuel poverty. Price elasticity of road transport use and energy for domestic heating is such that reductions will be hard to achieve through carbon pricing alone. The regulatory mix will therefore have to be maintained, and even strengthened, and auctioning revenues should be used judiciously to soften impacts on the poorest households. The overall EU ETS cap will have to be increased if its scope is widened, and agreement reached on the distribution of auctioning revenues between the Member States. So, the future co-decision process is likely to be as complicated as any so far.

There is no doubt that the CBAM will be difficult to implement, and may take longer than anticipated

What the Commission will do to implement the global market-based mechanism for international aviation (CORSIA) is also of great importance. Logically this will be done within the existing instrument that regulates emissions from aviation, which is the EU ETS. CORSIA is weaker than hoped, and adjustment of the base year to 2019 (instead of the average of 2019 and 2020) in light of the coronavirus pandemic means the start of CORSIA is, for all practical purposes, postponed for the next few years. This is a disappointment, even if it is the result of a tragic epidemic that no one would have wished for.

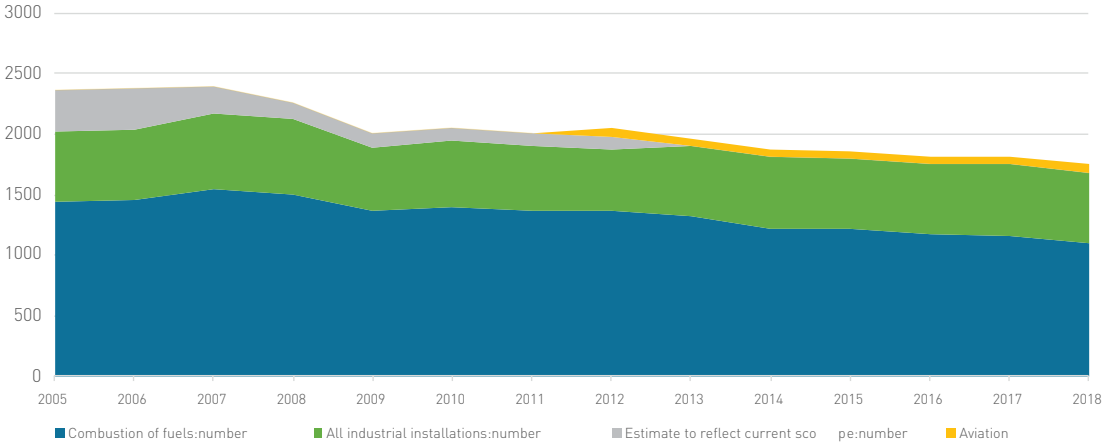
A third major challenge is the implementation by Europe, and possibly others, of a Carbon Border Adjustment Mechanism (CBAM). There is no doubt that the CBAM will be difficult to implement, and may take longer than anticipated. Given that the purpose of such a mechanism is to prevent carbon leakage in the face of higher climate ambition, it would be logical to start from Europe’s main climate policy instrument relating to energy-intensive sectors, the EU ETS. Some form of inclusion of imports into the scope of the EU ETS could be envisaged, with an obligation either to surrender EU Allowances (EUAs) or pay a charge based on the prevailing EUA price.

Figure 1: EU ETS emissions



Source: European Environment Agency. https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1

Figure 2: EU ETS emissions by activity



Source: European Environment Agency. https://www.eea.europa.eu/data-and-maps/daviz/eu-ets-emissions-by-activity-type#tab-chart_1

This is not the place to examine how this might be done, whether on a product-specific or country-specific basis, but there is clearly a close relation between the CBAM and the EU ETS. The European Commission acknowledged this by its statement that free allocation would have to be discontinued if the CBAM was introduced, given that the justification for the two instruments are the same. Whether the loss of free allocation could actually increase, rather than decrease, the risk of carbon leakage must be carefully considered. Finally, and in a longer time perspective, an important future evolution of the EU ETS will be in respect of CO2 removals. The Commission announced in its Circular Economy Action Plan the development of a regulatory framework for the certification of CO2 removals for 2023. Beyond 2030 there will be fewer and fewer allowances to allocate, and approaching 2050 there should be very few, if any, assuming that remaining emissions are from the most difficult to abate sectors, such as international aviation and some kinds of agriculture. Certified removals of CO2 should be made available through the EU ETS to emitters whose emissions still need to be balanced by removals. The latest Communication from the Commission on the 2030 Climate Plan – and its accompanying Impact Assessment – highlighted that, without additional effort, sinks by forests in the EU are expected to decrease, due to increased harvesting, climatic change and the spread of pests.

Countering this expected decrease will need further efforts, and it is going to be essential for technology be deployed to remove emissions, such as can be done by waste-to-energy plants burning sustainable biomass and then capturing and storing the CO2 emissions, or by the Direct Air Capture of CO2 and its permanent storage. Supporting the development and deployment of removal and storage technologies would not be more costly or less deserving than what has been done for renewable energy. It is easier to see that renewable energy is useful for producing electricity or hot water, but the removal of CO2 from the atmosphere is, in the long term, as useful in ensuring a liveable planet without the dangerous effects of climate change.

Climate neutrality in Europe by 2050 is certainly a ‘stretch target’, but we need to do this

The challenge for the ‘next generation EU’

Climate neutrality in Europe by 2050 is certainly a ‘stretch target’, but we need to do this if the goals of the Paris Agreement are to be met. The EU ETS is one of the key instruments in the European policy mix that will ensure we meet this goal at an affordable cost. It is a policy measure that was inspired by the Kyoto Protocol’s Article 17, and taken up by a Europe that found itself unable – for lack of unanimous agreement – to introduce a CO2-energy tax. The ETS was the EU’s second attempt at pricing carbon, and it has worked even better than expected. Emissions trading needs to go on giving in the coming decades; its continuing contribution to addressing the climate crisis is more essential than ever.

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Article Ten

Carbon Pricing Readiness to Action: *The PMR Story*

After 10 years, the World Bank's platform to develop carbon pricing readiness in developing countries is transitioning to the next stage: implementation. **Venkata Ramana Putti** and **Harikumar Gadde** reflect on the lessons learned from the PMR and its legacy for the future of climate policy

The Partnership for Market Readiness (PMR), the World Bank's flagship technical assistance programme on carbon pricing and markets, is scheduled to end by June 2021. Over its 10 years, the initiative has supported a number of countries to build their institutional and human capacities to institute and implement explicit carbon pricing instruments; produced a vast body of knowledge; and provided a platform for sharing experiences and mutual learning. Building on the PMR's foundation, the World Bank will launch a new initiative – Partnership for Market Implementation (PMI) –in early 2021 that will aim to take countries to the next level of implementation. As this transition of 'readiness to implementation' occurs, this article looks at the PMR's achievements, the key lessons and insights, and the legacy it leaves for the future.

Rationale for PMR

The failure of the Copenhagen climate talks in 2009 to reach a global agreement on a successor to Kyoto Protocol was a major setback to climate action, and the consequent lack of a clear policy signal had a deleterious impact on international carbon markets. In response, the PMR was conceived as a programme that could help large developing countries and emerging economies with substantial emissions profiles develop and promote domestic carbon pricing programmes for mitigation. With capacity building and technical assistance as the main goal, the PMR formally launched in mid-2011, and a total of $125 million was mobilised in funding from 13 contributing partners[1].

The PMR is perhaps the most consequential global programme supporting emerging economies and developing countries

Programme highlights

The overall focus of the PMR has been on explicit carbon pricing instruments: emissions trading schemes; carbon taxes; and offset mechanisms. The programme has operated with three windows: i) country readiness support; ii) technical work; and iii) policy analysis. Under the first, the PMR supported 19 countries in developing their readiness maps with funding ranging from $3 million to $10 million. Another four countries were given limited support as technical partners ($500,000 to $1.5 million). The scope, size and coverage of these readiness programmes varied across countries (Figure 1); some countries pursued the design of a particular instrument, others focused feasibility studies, and some invested in creating the institutional framework (eg, MRV systems, registry, etc.). The achievements and progress in select countries (Box 1) demonstrates their political commitment on moving forward with carbon pricing.

PMR's technical work stream has generated and disseminated multiple knowledge products: influential guidebooks on emissions trading, MRV, carbon taxes and Communicating Carbon Price; 40 analytical reports; and the annual report on State and Trends of Carbon Pricing. PMR's annual assemblies, technical workshops, training programmes, online courses and South-South exchanges have resulted in capacity building of over 4000 professionals. Under its policy analysis stream, the PMR supported the development of Paris pledges in five countries.

Features contributing to success

As concluded by two independent evaluations, the PMR is perhaps the most consequential global programme supporting emerging economies and developing countries, and is acknowledged by participating countries for its contribution to their mitigation actions. Some of the critical factors that have contributed to the positive results are:

(1) Australia, Denmark, Finland, Germany, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, United Kingdom, United States and the European Commission.

Figure 1: Scope of country readiness programmes

Non-prescriptive and non-political stance
The PMR has maintained a strictly instrument-neutral approach and facilitated a process to let countries determine the type and scope of the activities for themselves. Also, by keeping the focus on technical and operational aspects of carbon pricing, the work could be carried out with minimum disruption regardless of political and institutional changes. It has also become a platform for fair and frank discussions on technical and practical aspects, away from the intensity of global negotiations.

Adapting to evolving conditions
The PMR's objectives, participants, and activities have evolved since inception from an initial emphasis on "market readiness" to a broader scope; particularly after the Paris Agreement, the programme evolved extensively to support countries with their nationally determined contributions (NDCs), policy analyses to assess the role of carbon pricing to meet NDC targets, and analysis on structuring markets. This necessitated altering the programme scope in some countries. The technical work programme also made necessary accommodation to reorient the knowledge generation to include the emerging priorities.

A true partnership model
The PMR has recognised the role of partnerships and collaboration from the beginning and leveraged this strength to inform all its activities. In addition to the implementing countries and contributing donors (Figure 2), the PMR brought in technical partner countries, other multilateral and UN agencies, academia, etc. as members and observers of the assembly, and these interactions and exchanges have substantially benefited the overall programme and enriched the country experiences. Adoption of a participatory approach to decision making has helped created a sense of ownership among various stakeholders, which was recognised by the independent evaluation as perhaps the single most important strength of the programme. PMR worked with IETA to establish a Business Partnership for Market Readiness (B-PMR) to enhance the potential for developing international carbon trading models and to support the private sector's readiness. This facilitated industry to industry emissions trading dialogues in the PMR jurisdictions. The PMR also partnered with agencies such as ICAP and IEA. Internally, the PMR has worked closely with other World Bank initiatives such as the Carbon Pricing Leadership Coalition, NDC Support Facility and Climate Warehouse to ensure complementarity.

Contributing to broader policy dialogue
In addition to carbon pricing readiness, PMR country programmes have generated robust analytical and technical outputs, which have contributed to advancing climate policy and relevant mitigation policy instruments. In countries such as Jordan, Costa Rica and Côte d'Ivoire, other WB policy-based activities (eg, Development Policy Financing operations) are building upon PMR outcomes to support the implementation of climate-related policy reforms and enhance their effectiveness.

Key challenges and lessons

Given that the PMR was the first of its kind, there has been a lot of 'learning by doing', which has influenced the individual programmes' scope and implementation. Lack of domestic capacity has been a major challenge in decision-making, and along with evolving domestic and international policy environments has led to substantive delays in operationalising some programmes, which in turn necessitated a change of scope in response to changed priorities. Thus, overall, it has been an evolutionary process with major challenges and some important lessons have emerged from the experience:

- A clear political mandate, together with inter and intra-ministerial coordination is key.
- Carbon pricing initiatives should be part of a broader policy framework, and not done in isolation.
- Stakeholder engagement is critical for confidence building, data collection, and design and implementation. Clear communication of the benefits and impacts of carbon pricing is critical to achieve buy-in (eg, use of carbon revenues, improvements in productivity, technological shifts, competitiveness issues, etc.).
- Extensive international exchanges and peer-to-peer learning can act as a catalyst for successful design of carbon pricing. A built-in mechanism for regular sharing of experience and progress across activity components should be instituted at the programme level.
- Right selection of counterpart agency and targeted activities is the key contributing factor to the achievement of project outcomes. Further, cross-sectoral cooperation enhances the capacity of the implementing agencies. This is particularly vital as countries adopt a whole-of-government approach towards decarbonisation.

Box 1. Highlights in Select Countries

China implemented ETS in five cities and two provinces, before launching the simulation phase of the national ETS.

Kazakhstan is the first Central Asian country to have an ETS.

Argentina, Colombia, Chile, Mexico and South Africa have active carbon tax programmes.

Costa Rica has a National Carbon Neutrality programme and is poised to introduce an emissions levy.

India has an approved feasibility study for a market-based instrument in the small and medium enterprises (MSE) sector.

Jordan developed an MRV system, which has become a template for other countries to adopt (eg, Sri Lanka).

Mexico has a firm schedule for piloting an ETS, in addition to its carbon tax. Colombia is also working on an ETS roadmap.

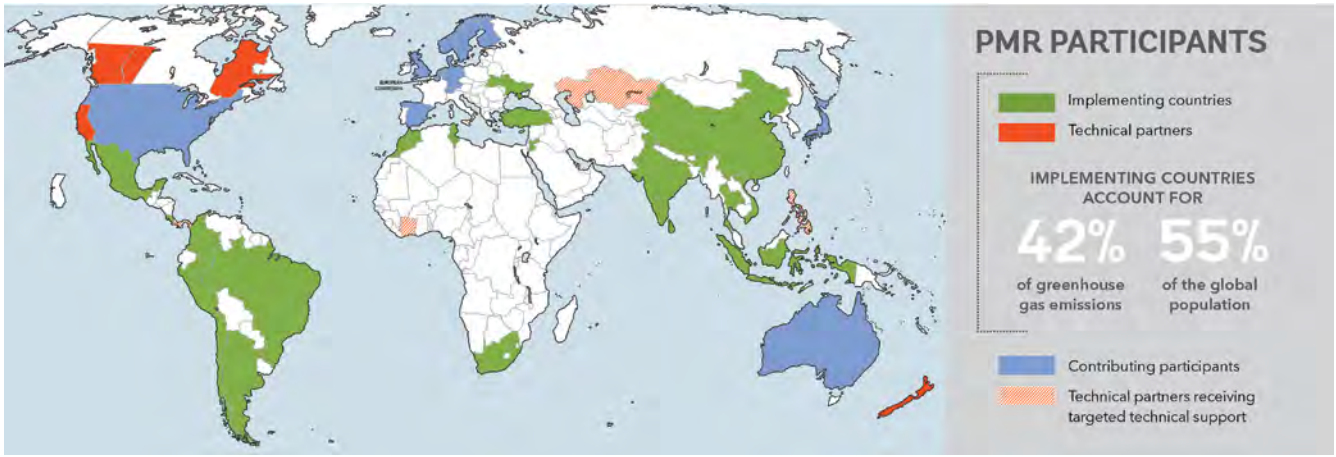
Thailand has an offset programme, voluntary emissions reduction programme and a voluntary ETS in place.

Ukraine has had its MRV law passed through the Parliament and is actively exploring an ETS.

Vietnam included carbon pricing in its climate law, which is awaiting Parliamentary approval.

The achievements and progress in countries demonstrates their political commitment on moving forward with carbon pricing

Figure 2: PMR partner countries



PMR's legacy and the future

Over the past decade, carbon pricing has continued to gain prominence, as shown in the World Bank's 2020 state and trends of carbon pricing report. Over 65 national and other jurisdictions have an active carbon pricing programme or are in the process of establishing one; and more than $45 billion was raised from carbon revenues in 2019. More than 85 of Paris NDCs included carbon pricing as an option indicating a growing demand.

One implication of PMR countries becoming 'ready' in the near future is the substantive mitigation potential to be realised if they actually implement the carbon pricing programmes and policies. Further, as the countries move to deal with the fall out of the COVID-19 pandemic and rebuild their economies in the short and medium run, there is an opportunity to adopt low-carbon sustainable measures, and carbon pricing could play an important role from a revenue generation perspective. Finally, the partnership and knowledge sharing approach of the PMR could become a model for others to adopt in advancing the climate mitigation agenda.

The World Bank has thus established the Partnership for Market Implementation (PMI) as the PMR's successor, with the objective of helping countries move towards implementing carbon pricing as part of a larger decarbonisation framework. This new programme builds on the solid foundation created by the PMR and incorporates the best practices and lessons into its design. As part of the World Bank's Climate Change Action Plan, the PMI aims to support at least 10 countries in implementation of carbon pricing, and another 20 new countries in building their readiness. The programme, expected to begin operations in early 2021, targets a capitalisation of $250 million over its 10 years' duration.

The achievements and progress in countries demonstrates their political commitment on moving forward with carbon pricing

This transition from PMR to PMI is aimed at being part of an accelerated process of climate action to enhance countries' climate ambition towards achieving the Paris goals and a sustainable future. This model of cooperation and laying a solid foundation for implementation puts us in good stead for the future.

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Harikumar Gadde is Technical Program Coordinator for the PMR and a Senior Climate Change Specialist at the World Bank, with over 15 years of experience on carbon markets.

Article Eleven

Long Live the Voluntary Carbon Market

The voluntary carbon market is critical in ensuring net-zero pledges are met and in driving further climate ambition. **David Antonioli** lays out his vision for the future of this vital and evolving market

The voluntary carbon market (VCM) has gone from being the ugly stepchild in the world of climate action to being a key driver of finance for climate solutions. However, governments have been slow to step up to the greater challenge the climate crisis requires, while responsible corporations, non-profit organisations and individuals have taken matters into their own hands, by both reducing their internal footprints and investing in projects that reduce GHG emissions and/or remove carbon from the atmosphere. As a result, the VCM today is thriving and continues to grow, with a number of initiatives aiming to increase activity in the VCM by orders of magnitude.

As we look to the future of carbon offsetting, there are several aspects worth exploring. First, the underlying rationale for the use of carbon credits to compensate for unavoidable emissions. Second, how the VCM has changed over time, and what changes we might see in the future. The conclusion provides some thoughts about how the VCM relates to the global imperative to control GHG emissions and remove atmospheric carbon so that we can have a sustainable climate.

As we look to the future of carbon offsetting, there are several aspects worth exploring

Why does the VCM work?

The VCM has a very clear logic that underpins its success. At itscore is a realisation that climate change is profoundly affecting people's lives and deserves real and immediate action, and that governments are not doing enough about it. With the impacts of climate change becoming ever more clear, more and more consumers are making purchasing decisions based on climate leadership. This means companies are becoming highly sensitised to the issue and taking action.

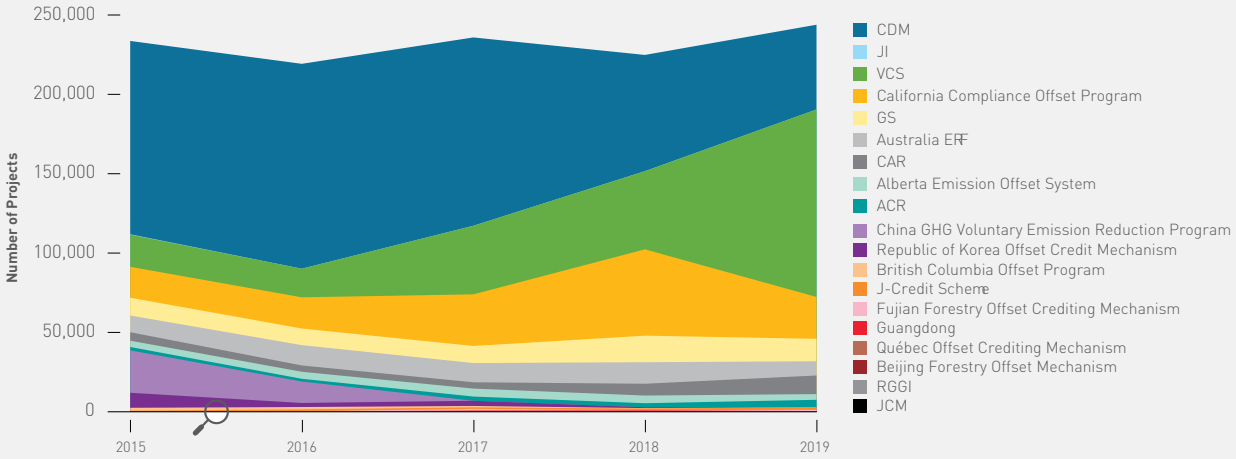
Despite the success of initiatives such as the Science Based Targets initiative (SBTi) to encourage companies to reduce their internal footprint, many corporates are taking on even more ambitious targets, in many cases committing to carbon neutrality or net-zero. These targets can generally only be achieved through the purchase and retirement of carbon credits; even the SBTi, a long-time outspoken critic of carbon offsets, is now considering how to recognise corporates using these instruments in its efforts to define "net zero"[1].

One compelling reason for the success of the VCM is that carbon credits are the only asset that can truly address previously hidden climate liabilities. Once a carbon footprint has been measured and internal reductions made, corporates with more ambitious targets like the clarity that carbon credits provide, in particular because they mirror what the private sector does -- investing in and trading assets that fulfill business imperatives. In this case, carbon credits are purchased and retired as a means of addressing a liability that, until a carbon footprint had been created, did not exist.

Several years ago, Verra conducted a consultation on the creation of an alternative unit, the Contribution Carbon Unit (CCU), which would have enabled corporates to claim that they were contributing to climate mitigation, but not make offsetting claims. The results of this consultation were telling. Corporates did not like the idea precisely because it removed the ability to address their footprint in a transparent and reliable way. Furthermore, many stakeholders reported that relying on claims of contributions to climate mitigation merely put those investments on a par with traditional grants usually done through corporate foundations, and therefore undermined the additional finance being brought to the table because carbon credits are helping to address what is, in essence, a liability.

[1] Science Based Targets initiative, Foundations for Science-based Net Zero Target Setting in the Corporate Sector, September 2020.

Figure 1: Annual volume of issuances by crediting mechanism for 2015–19



Source: World Bank, State and Trends of Carbon Pricing 2020, May 2020 (adapted)

As a result of the above, taking demonstrable climate action is quickly becoming accepted best practice among corporates. For example, the number of companies with active GHG emissions reduction targets continues to grow, as does the number of companies that now have an internal price of carbon to guide their operations.[2,3], Indeed, the VCM is now eclipsing compliance markets in terms of crediting carbon reductions and removals, with the VCS Program issuing more credits than the CDM and all other regulatory markets in 2019 (see Figure 1). Given the uncertainty surrounding Article 6 of the Paris Agreement, the fact that countries are still far away from being able to commit to purchasing or selling emission reductions/removals in the context of the Paris Agreement, and the continued growth of the VCM, it is unlikely that this trend will be reversed anytime soon. In fact, the VCS is continuing to experience growth in 2020 despite the COVID-induced economic downturn.

How will the VCM evolve?

One of the defining features of the VCM is that it is nimble and can adapt quickly to changing circumstances. One excellent example of this is the work undertaken to enable carbon finance to help conserve and restore forests. Specifically, the VCM created pooled buffer systems to assess and manage reversal risks, thereby enabling the issuance of permanent and fungible units by land-based projects (a.k.a., Natural Climate Solutions, or NCS). This, in turn, helped facilitate a variety of project opportunities related to avoided deforestation, reforestation and other land-based project types that previously had not been able to access carbon finance. Another good example are the recent decisions by both the Gold Standard and the VCS Program to exclude grid-connected renewable energy projects in non-LDCs given these projects no longer need carbon finance.

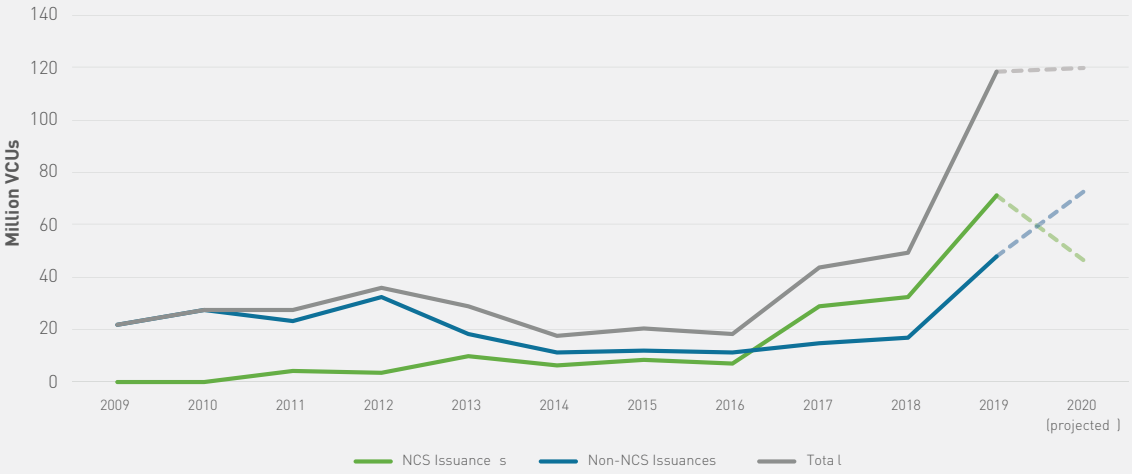
Over time, we can expect that there will be underlying trends that help shape the VCM. Already we are seeing one major trend, which is the transition away from renewable energy projects as the main source of credits to NCS. Figure 2 below illustrates how Verified Carbon Units (VCUs) from NCS projects slowly increased until 2016, when they effectively eclipsed credits from other projects.

While 2020 data suggest a reversal to the prior situation, there are some underlying reasons why we might expect NCS credits to regain their dominance in the market in the near term. First, the development of grid-connected renewable energy projects will be limited to LDCs. Second, regulations to address climate change are likely to unfold in steps, with easy-to-regulate sectors being the first to be subject to regulations, and more diffuse sources of emissions being the last. Figure 3 below illustrates this concept nicely by showing that the power and industrial sectors are the first to be covered in emissions trading systems, whereas more diffuse sectors such as agriculture and forestry tend to be excluded at first. Of course, regulation is one of the first steps GHG programmes such as the VCS take into account when considering additionality, which means that these programmes will need to closely track GHG regulations to ensure that any credits issued are not required by regulation and are thus additional.

One of the defining features of the VCM is that it is nimble and can adapt quickly to changing circumstances

(2) CDP, Foundations for Science-based Net-zero Target Setting in the Corporate Sector, September 2020. (3) World Bank, State and Trends of Carbon Pricing 2020, May 2020.

Figure 2: NCS and non-NCS VCU issuances 2009-20



Source: Verra registry (registry.verra.org)

The third reason why NCS credits are likely to continue to be important is that these projects tend to deliver measurable sustainable development outcomes that are critical to corporate commitments to address climate change. For a long time, these other benefits were seen as nice-to-have; however, the success of many NCS projects has brought to light just how critical these benefits are to land-based projects. Indeed, most successful land-based projects deliver these sustainable development benefits in partnership with communities, which means there is a lot that can be accomplished if one delivers economic opportunities, health care services, education and other services that help communities thrive and succeed. The recent certification of the Rimba Raya REDD+ project to Verra's Sustainable Development Verified Impact Standard (SD VISta) illustrates the kind of broad collaboration project developers and communities can achieve; in its first verification against SD VISta, Rimba Raya was able to demonstrate it contributes to all 17 Sustainable Development Goals (SDGs).

Within the NCS sector, there are two trends that will affect the composition of the VCM going forward.

- Focus on removals. There is undoubtedly a renewed interest in projects that are removing carbon from the atmosphere, especially as the world recognises the need to draw down atmospheric carbon. However, those projects face the daunting challenge of securing finance in their early phases because it takes a while for the carbon to accumulate. From a global perspective, it will be critical to not let the focus on removals draw our attention away from the need to protect standing forests. Only once existing ecosystems are protected should we be shifting our attention exclusively towards removals.
- Standalone and jurisdictional NCS credits. Another driver for the future of the VCM is the evolution to jurisdictional accounting for NCS projects. This, of course, depends on what host governments are doing in respect of accounting for carbon-related activities and/or pools at the jurisdictional scale. Currently, jurisdictional accounting applies mostly to forest conservation and avoided degradation activities, meaning that project-based activities focusing on these activities will soon need to be nested into those jurisdictional efforts. It seems likely that in the not-so-distant future we will see actual REDD+ crediting at the jurisdictional scale, as well as more and more jurisdictional REDD+ programmes. The evolution towards jurisdictional accounting, however, will take a while to complete, mostly because only a fraction of NCS activities are currently covered by jurisdictional programmes. For example, even in the forest sector, many jurisdictional efforts are still not accounting for either forest enhancements (afforestation, reforestation and revegetation, or ARR) or improved forest management (IFM). In addition, a number of other NCS activities, such as soil carbon enhancements and blue carbon are currently not and may not for the foreseeable future be accounted for by jurisdictional programmes. Until then, these activities will need to operate as standalone (ie, not nested) activities.

A final trend that we can see already taking shape is the development of innovative technologies that could add to our options in drawing down atmospheric carbon. For example, Direct Air Capture (DAC) could pull carbon directly out of the atmosphere, even though currently it is too expensive and not yet proven as a scalable technology. Over time, though, as both costs fall and prices in the VCM rise, one could see a scenario where DAC and other such technologies could secure early finance through the carbon markets. The VCM has a history of driving such innovations given some voluntary buyers are often willing to pay more for credits coming from innovative project types, which contrasts with regulatory markets underpinned by allowance price homogeneity.

(4) Data for 2020 are based on actual issuances through Q3, and projected numbers through the end of the year.

The role of the VCM in helping to achieve a stable climate

The growth of the VCM has raised questions, and created tension, about how this particular market relates to regulatory action and, more broadly, achieving the goals set out by the Paris Agreement. There are a number of issues related to this, including accounting, encouraging ambition and equity, all of which need to be addressed and are perhaps part of another paper. What is clear, though, is that the VCM has demonstrated it provides a clear and transparent way for corporates to finance entrepreneurs delivering cost-effective emission reductions and removals, which in many cases are helping to improve people's lives.

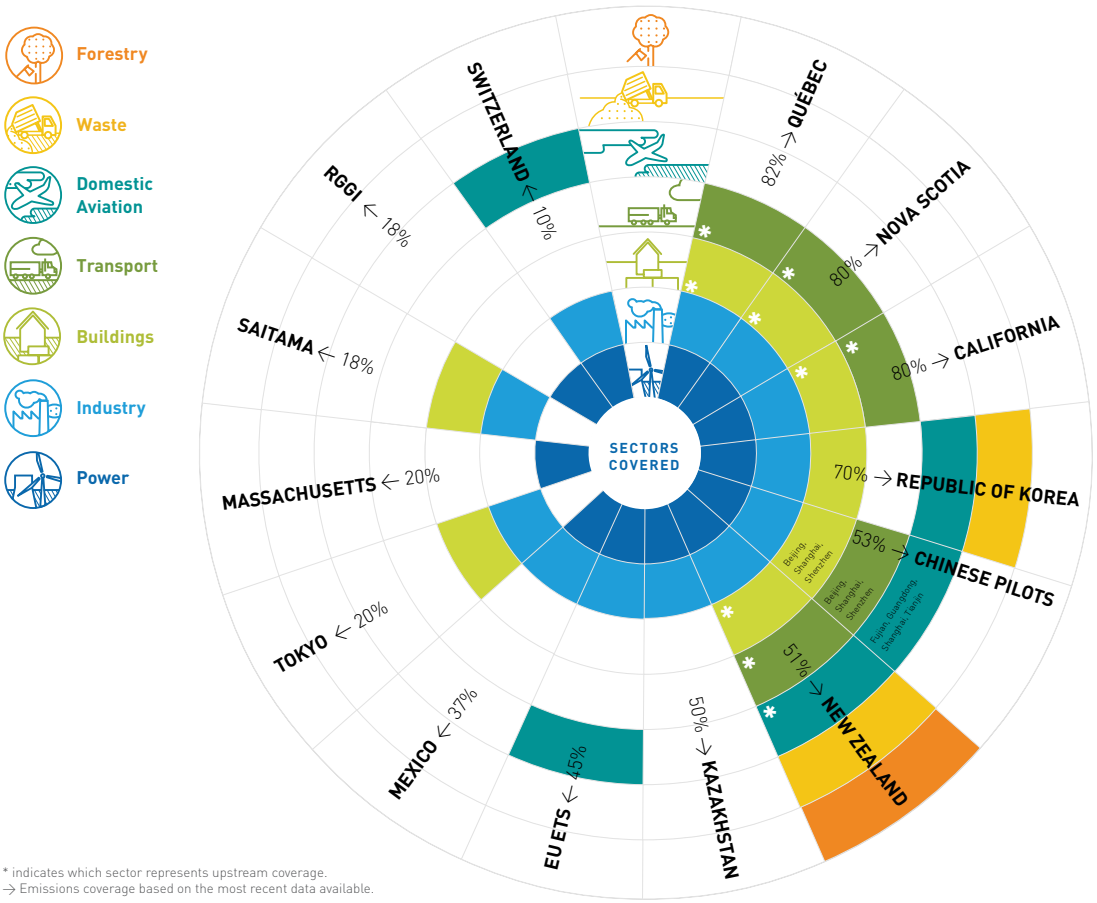
As we think about meeting the Paris Agreement targets, why not go beyond? Even if we assume that governments do step up and deliver the policies and regulations that get us to that mythical 1.5°C world, we should aspire to achieve less global warming, especially considering that the current 1°C above pre-industrial levels we are already witnessing is accompanied by devastating changes. Imagine the contribution to climate change if, over time, most companies in the world go beyond any targets their governments might impose on them and invest in projects that are removing carbon from the atmosphere.

We need to recognise that a key component of climate action rests with a healthy and robust VCM

As we think about the world in 2050, and voluntary climate action in particular, we need to recognise that a key component of climate action rests with a healthy and robust VCM. In the short time it has been in existence, the VCM has served as a laboratory for the development of new solutions which have driven finance to innovative actions on the ground. The underlying logic behind the VCM will continue into the future, and can help to close both the finance and the emissions gap, even beyond the 1.5°C world that we currently aspire to achieve. Surely the VCM will evolve over time, but its fundamental features will ensure that it continues to play a key role in achieving a sustainable climate in the long run.

David Antonioli is Chief Executive Officer of Verra where he oversees all aspects of the organisation, including setting out the strategic direction of Verra and making sure that Verra's certification programmes meet high-quality integrity and transparency standards. As Verra has broadened its scope to include new standards and frameworks for a sustainable world, David has been engaging thought leaders around the world to ensure maximum impact.

Figure 3: Sectors covered by emissions trading systems



* indicates which sector represents upstream coverage.
→ Emissions coverage based on the most recent data available.

Source: International Climate Action Partnership, Emissions Trading Worldwide-Infographics, March 2020. Copyright © 2020 by International Carbon Action Partnership (ICAP).

Article Twelve

Natural Climate Solutions: *The Market of Tomorrow*

The past few years have seen increasing interest in natural climate solutions, beyond forest conservation. These approaches are essential if the world is to fulfil the goals of the Paris Agreement. **David Hone** lays out how the sector can realise its potential

"We must rewild the world . . . . . Forests are a fundamental component of our planet's recovery"

David Attenborough – A Life on Our Planet

In the closing minutes of his new documentary, A Life on Our Planet, David Attenborough makes clear that biodiversity is the key to balancing human needs with planetary sustainability and that therefore forests and other natural habitats are a fundamental component of our planet's recovery. But, as Attenborough notes midway through his story, humankind has already cut down three trillion trees and removed half the global rainforest cover. This also extends beyond forests and includes wetlands, mangrove swamps, peat bogs and many other such natural carbon sinks.

Few, if any, scenarios that look towards an energy transition and the attainment of the Paris Agreement's goals exclude the need to address the carbon stock within the natural environment. The Intergovernmental Panel on Climate Change (IPCC) Special Report on Climate Change and Land[1] identified land as simultaneously a source and a sink of carbon dioxide (CO2), due to both anthropogenic and natural drivers. The report estimated net CO2 emissions of 5.2 ± 2.6 gigatonnes (Gt) per year from land use and land-use change between 2007 and 2016, reducing the overall sink capacity of the biosphere by that amount. These net emissions are mostly due to deforestation, partly offset by afforestation and reforestation, as well as emissions and removals by other land use activities. While the land remains a net sink for CO2, the amount of removals continues to fall.

Increasing the sink capacity of the land is an essential step that must happen alongside the energy transition to a net-zero emissions future

The IPCC Special Report on 1.5°C[2] illustrated the importance of the land, highlighting the need to increase the sink capacity that the land system can offer. Particularly in higher energy demand scenarios, the land is used to deliver significant sink capacity through a combination of natural climate solutions and technology solutions utilising harvested biomass. In a more middle-of-the-road scenario (P3), the land increases its sink capacity by about 10 Gt CO2 per annum, as well as providing significant biomass resource for energy generation.

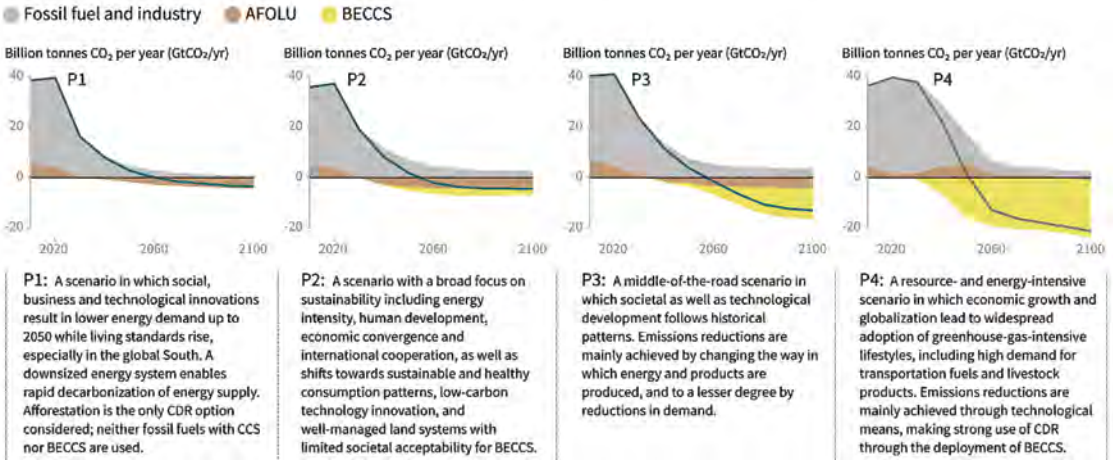
Increasing the sink capacity of the land is an essential step that must happen alongside the energy transition to a net-zero emissions future. But changes on this scale mean dealing with hundreds of millions of hectares of land, an area that exceeds the size of all but the very largest countries. The question this poses is how such a change might emerge and how might it be coordinated?

Today, governments mainly manage the land, in that they zone areas for farming and urban development, create national parks and forests and hold large areas of undeveloped land for the future. Within this framework, the carbon sink capacity of the land has not been an overriding priority, although some governments have managed this aspect to some extent. Forestry and natural habitats have always been and remain important in many countries, not just because of commercial interests but for the broader wellbeing of society. Nevertheless, change is needed to reach the goals of the Paris Agreement.

Based on the importance of carbon sinks and the attractiveness of them in some areas of commerce, a modest but growing voluntary market has emerged over the past 20 years in the trade of carbon units. This is based largely on private projects which seek to preserve existing forests and natural habitats for certain animal species but also to grow new forests. That market has reached a scale of about 100 million tonnes (Mt) per annum of CO2 in terms of carbon certificate trade, valued at around $300 million[3]. It largely serves retail-based sectors offering carbon neutral goods and services.

(1) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. IPCC, 2019. (2) Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. IPCC, 2018. (3) State of Voluntary Carbon Markets – Special Climate Week NYC 2020 Installment. Ecosystem Marketplace, September 2020.

Breakdown of contributions to Global Net CO_2 Emissions in Four Illustrative Model Pathways



Source: IPCC SR15 (2018)

While this is a commendable achievement, it was at a similar level of activity a decade ago and is hardly comparable to the task at hand, which is measured in multiple gigatons of additional sinks, as well as preserving the vast store of existing sinks. While we might look to governments to fill this gap, the more likely driver is commercial and business interests, where very significant sums of money can be channelled towards land projects (or natural climate solutions) very quickly and efficiently.

Governments will nevertheless have a critical role to play. As the broad decision makers on land use, they will need to prioritise the use of land for forest projects and limit the destruction of forests for urban expansion and agriculture. Governments will also need to create the demand for forest carbon units such that business can apply its commercial prowess to creating them. While the voluntary market has attempted to do this through its offerings for commercial activities such as aviation, governments can bring scale to the task. This means broader use of emissions trading systems (ETSs) and, within them, the acceptance of carbon units from natural climate solutions.

In countries with considerable natural sink potential, acceptance could mean gearing carbon management systems around the use of sinks, rather than around the use of emission allowances such as in the EU ETS. Eventually this will be the case anyway, as net-zero emissions requires a balance between sinks and emissions sources; there will be no allowances issued by the systems that are operating today.

The idea of sink-based trading systems has been gaining traction, with the Oxford Martin School in the United Kingdom proposing a carbon take back obligation (CTBO) instead of an ETS.[4] Under such a system, a fossil fuel producer or downstream emitters would be obligated to sequester an increasing proportion of the extracted carbon, until emissions are matched with sinks and therefore a net-zero outcome is reached. The obligation would start at a relatively low level of a few percent per year, gradually rising every year towards full coverage. At the same time, the prospect of the future cost of compliance would drive down emissions through mechanisms other than sequestration, but primarily through substitution away from fossil fuels.

The endgame of a CTBO must be matching remaining fossil carbon extraction with geological sequestration, but there can be a very important role for natural sinks in the interim.

A policy framework that draws on the various concepts outlined above could see countries both introduce a rising carbon price into the domestic economy and channel funding towards an immediate policy goal, that of reforestation and natural habitat restoration, with the government only acting to ensure compliance. Allowing time for policy formulation, capacity building, market development and implementation, systems formulated along these lines could begin operation by 2025.

Brazil provides an interesting example of how such a system might develop over time. In 2025, CO2 emissions in Brazil from the use of fossil fuels might be around 450 Mt, so an initial 5% sequestration obligation would require a 22.5 MtCO2 sink in the first year. This could not be achieved through geological sequestration in that time so, in the early years, compliance would be achieved entirely using carbon units derived from natural sinks.

(4) https://www.oxfordmartin.ox.ac.uk/blog/co2-capture-may-be-our-only-option-for-stabilising-temperatures-we-need-to-find-out-the-costs-fast/

With the incorporation of sinks into national emissions policy through some form of balancing mechanism, the need to source such sinks becomes the issue

A demand in excess of 20 Mt per year would equate to an initial reforestation of some +1 million hectares. It is estimated that current Amazon deforestation is approximately 800,000 hectares per annum, so this starting point could counter that trend and make a small net contribution to reforestation and natural habitat destruction. Over a period of 35 years, this would rise from 5% coverage in 2025 to 100% coverage around mid-century, thereby delivering a net-zero emissions economy for Brazil. The system could both manage fossil fuel emissions and deliver large scale reforestation and habitat restoration in the Amazon area.

In the early years of operation, and assuming reforestation and various wetland projects could be delivered for $10-20/tCO2, the carbon price introduced into the economy would be under $1/t, even in the poorer parts of developing country society. This low price emerges by combining the cost of sequestration with the percentage obligation. However, that price will rise over time for three reasons: the increasing requirement for sequestration, the prospect of a rising cost of reforestation due to the need to acquire land and rapidly repurpose it as permanent forest cover, and the need to introduce a rising requirement for geological sequestration.

There are variations on how such an approach might be implemented, but the common feature is to use natural climate solutions to balance emissions in the early years as the economy brings energy technologies forward to manage emissions.

Australia already has an early version of this operating. The combination of the Emission Reduction Fund and the Safeguarding Mechanism have directed well over A$1 billion towards natural climate solutions. Importantly, the system allows private investment in a way that seamlessly aligns – from an accounting perspective – with its Nationally Determined Contribution under the Paris Agreement.

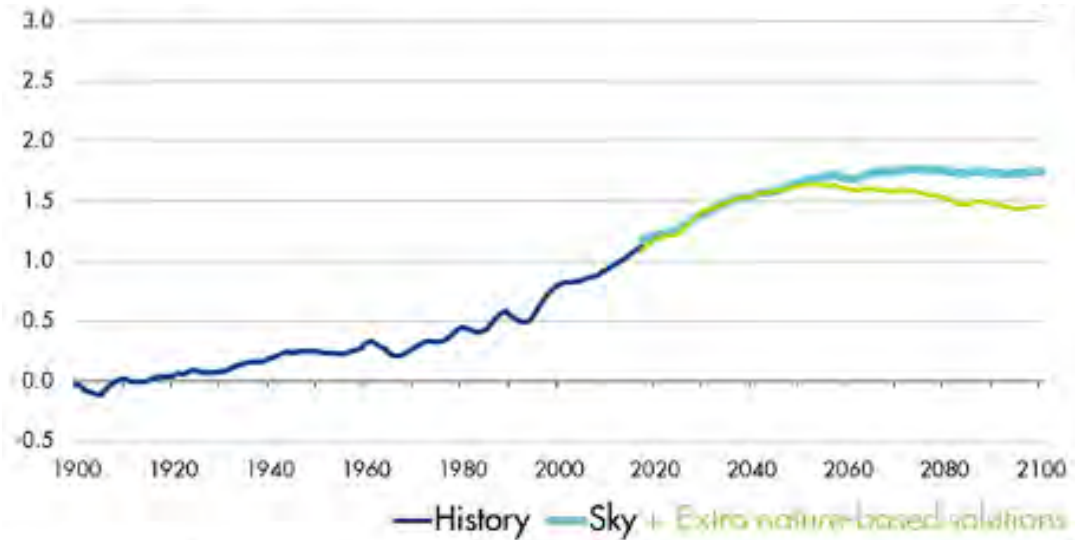
The announcement by China to reach a net-zero emissions goal by 2060 is likely to place considerable pressure on the role of sinks. In the Shell Sky Scenario, which details a rapid global energy transition, Chinese emissions in the 2060s remain at around 1 Gt, even with considerable use of carbon capture and storage (CCS). Natural climate solutions could play an important role in reaching net-zero through a provision built into the China ETS. Other regions will face the same eventual energy maths – something will be needed to fill the gap between the established goal and the reality of transition.

As the years pass and the annual linear allowance reduction within an ETS continues, there will come a point where there is no further issuance of allowances under the system, hence no mechanism to emit. This is now set for 2050 in the EU, but it is unlikely that the sectors covered by the system will be at zero emissions. At a minimum, aviation and some industrial processes will still require some form of emission allowance for at least a portion of their operations and some thermal power plants may continue to operate. Even with the on-site application of CCS for large emitters, some emissions will remain, including from mobile emission sources.

Historical Market-Wide Voluntary Offset Transaction Volumes, 2019

Source: Ecosystem Marketplace Sate of Voluntary Carbon Markets 2020 report

Average Global Surface Temperature Rise (°C)



Source: Massachusetts Institute of Technology, Shell Sky data

The net-zero solution, as guided by Article 4 of the Paris Agreement, is to introduce sinks, or emission removals. No mechanism exists within the EU ETS today to allow the system to operate under conditions of net-zero emissions, but the creation of a new unit under the EU ETS that represents a tonne of CO2 removed from the atmosphere and sequestered could be introduced, which would allow nature based solutions to fill any remaining gap, eventually followed by industrial air capture and geological storage if necessary for the longer term. In the recent Shell EU 2050 Scenario Sketch, that gap is some 300 Mt per annum in 2050, albeit declining.

With the incorporation of sinks into national emissions policy through some form of balancing mechanism, the need to source such sinks becomes the issue. While countries like Brazil and Australia have vast domestic opportunities available, that is not true for all the Parties to the Paris Agreement, nor is it true for sectors such as aviation and shipping. For example, Singapore is a geographically small country, but has considerable industrial capacity and is a major distribution hub for the region.

The solution lies within Article 6 of the Paris Agreement, which is designed to foster cooperation between Parties in reaching net-zero emissions. Units that represent sequestered carbon, from both geological and nature-based projects could transfer under Article 6, providing a route to net-zero emissions for certain countries and an important source of investment for forestry projects in others.

While the voluntary market has provided a critical springboard for the world and should continue to grow along with demand, it will be the application of compliance systems driven by the net-zero emissions goal of the Paris Agreement that provide the scale and certainty required for David Attenborough's vision of rewilding to be achieved. But this isn't a journey to begin in 2050; rather it is one that must start now, both to build up the scale necessary and set about correcting the natural world as early as possible.

The more likely driver is commercial and business interests, where very significant sums of money can be channelled towards NCS very quickly and efficiently

David Hone works for Shell International Ltd. and is the Chief Climate Change Adviser in the Shell Scenarios Team. He joined Shell in 1980 after graduating as a Chemical Engineer from the University of Adelaide in Australia. He has worked in refinery technology, oil trading and shipping areas for Shell. David is an IETA board member, was Chairman of IETA from 2011-13 and is a board member of C2ES in Washington and GCCSI in Melbourne. David is a regular climate blogger and is the author of a 2017 book on climate change, 'Putting the Genie Back: Solving the Climate and Energy Dilemma'.

“If Article 6 is allowed to work efficiently, it could lower costs and make targets more affordable”

Article Thirteen

Technology for Tomorrow

The COVID-19 recovery is a chance to reset and build the policy frameworks to deliver net-zero ambitions. Carbon pricing is essential to driving the technology investments tomorrow needs, writes **Joan MacNaughton**

Most of us expect to think in terms of 2020 as 'the year of COVID'. History may view it through other lenses. It would be good if it came to be seen as a tipping point in setting the world on the path to delivery of net-zero emissions. There are several reasons it could: the speed and scale of government action this year removes any alibi for moving tentatively; the heightened role of governments in investment decisions could drive a step change in green investment to deliver economic recovery from the pandemic; and peoples' changing attitudes offer the political space for governments to act. The technologies exist to drive towards net zero, and many are already cost competitive with carbon intensive alternatives. Pricing carbon could accelerate the impact of policies to transition to a low carbon world.

Policies government should adopt

The policies must address huge challenges. Essentially, to have a chance of keeping within 1.5°C of temperature rise, the world must replace or adapt all the legacy carbon intensive capital stock built up since the 19th century in the energy, transport and built environment sectors, as well as devise new industrial and food and agricultural processes – all within 30 years.

To succeed, governments will need to act (with the urgency seen earlier in the COVID-19 pandemic – though not everywhere, it has to be said) to execute policies which drive new investment as well as behavioural change – whether by individuals or corporates. The next 10 years are crucial. Delaying action steepens the hill to climb, possibly to an unmanageable degree.

Pricing carbon could accelerate the impact of policies to transition to a low carbon world

Each year, the World Energy Council evaluates the energy policies of governments against whether they deliver secure, reliable, sustainable and affordable energy supplies (the 'World Energy Trilemma', which I chaired for six years). The defining difference between the best and worst performing countries was not the choice of free or regulated energy markets, nor whether they possessed energy resources. Rather, the key lay in the quality of policy formulation and execution, such as ensuring coherence across different policy actions, consulting meaningfully, and having regulatory frameworks to deliver predictable decisions. In the most successful countries, decision-makers adopted a whole systems approach, avoiding the destabilising effects of concentrating on too narrow a set of questions – a lesson which, sadly, some governments did not apply during the pandemic.

Although governments will have to formulate the policies and frameworks within which they are delivered, businesses will play a major part in executing projects. In many of the most important sectors, like energy and the manufacturing industry, businesses have an engineering ethos with a strong leaning towards systems-based approaches. Governments would therefore be wise to leave the choice of technologies to the market, which is better at ditching underperforming technologies or projects than having to make decisions constrained by political considerations.

What governments must do is set emission reduction targets, establish appropriate regulation, and offer financial incentives in defined circumstances. Crucially, these should include a carbon price. Different pricing mechanisms will be suitable for different countries' political economies; but carbon pricing in one form or another will help firms to take an informed view on likely multi-year returns of technologies or projects in economies in transition. And pricing carbon under a market-based framework, such as emissions trading, would allow for innovation by market participants and the direction of investment to the lowest cost solutions or geographies, among other things. Emissions trading mechanisms also tend to be longer lasting than a carbon tax – particularly important for investment decisions with long term payback periods.

Government policies in the main should be technology neutral but, as so often in the real world, there have to be exceptions to the principle, in particular to correct for market failures and to redress the power of incumbency. As to that, while direct subsidy is usually no longer needed for solar and onshore wind power to be cost competitive, and offshore wind power is moving steadily towards that position, other technologies would struggle to scale up without help.

Electric mobility is a striking example. A recent BNP Paribas report concluded that sometime during this decade, the cost of mobility on a lifecycle basis will be nearly seven times greater for petrol (gasoline) than for electric vehicles powered by a renewable electricity grid. Given that the price of solar and wind power electricity continues to fall, and their penetration of electricity grids to increase, petrol fuelled cars might well be able to compete with EVs only at an oil price of $11 or $12 per barrel: scarcely a sustainable business model for that sector.

Of course, the decision to purchase a car will depend not just on lifecycle cost, but on confidence you'll be able to recharge it easily. Infrastructure to support petrol cars is universal and the investment in it is a sunk cost, whereas providing charging capacity for electric vehicles needs huge investment. The advantages of scale have not yet accrued to the manufacture of electric cars, so the price initially is high – which matters a great deal to would be purchasers. Governments need to prioritise the development of charging infrastructure alongside accelerating demand for electric vehicles, as many countries are already doing. EV100, a Climate Group-led initiative, harnesses the purchasing heft of businesses to grow the market through company commitments to replace their fleets or support their employees and customers to buy electric. A carbon price increasing steadily towards the horizon would undoubtedly speed up the effectiveness of all of these actions.

Other similar examples abound, in relation to carbon removal, whether CCS at the power station or industry, or direct air capture of CO2, or nature-based solutions – the latter a prime illustration of the huge potential of carbon allowance trading.

Perhaps one of the biggest market failures is the whole area of energy efficiency.

Along with transport, the built environment is one of the biggest sources of emissions globally, now that the electricity sector is well on the way to decarbonisation in many countries. The widespread failure to implement energy saving measures with short payback periods is astonishing, as not only do the savings accrue predictably and quickly, but energy efficiency projects also have considerable benefits in health terms, in tackling poverty and in improving a country's or company's competitiveness. According to the IEA, energy efficiency measures can yield benefits 2.5 times greater than the value even of the avoided energy costs. One Indian company – Mahindra Group – reported to the Climate Group's energy productivity initiative (EP100) that it had saved $38 million over six years through various projects to improve energy efficiency.

Many of the barriers to greater investment in energy efficiency would fall away under a stronger regulatory regime. But, as with electric mobility, a carbon pricing regime with a clear sense of direction on the price level and the longevity of the scheme would also speed up action significantly.

Delaying action steepens the hill to climb, possibly to an unmanageable degree

Conclusion

To return to where this piece began, the scale of COVID-19 recovery stimulus packages offers an unique opportunity to take climate action to another level. Recent analysis by Imperial College suggests that only a relatively small proportion of the $12 trillion announced so far needs to be directed to climate sensitive investment for the world to be able to reach net-zero by 2050 – about 12% of the stimulus cumulatively over the next five years.

Moreover, the lessons from the Global Financial Crisis point to clean energy policies being more effective as 'economic multipliers' than many alternatives, according to a global survey of economists led by Oxford University. For example, enhanced investment in renewable energies creates good quality jobs quickly, then releases manpower as the sector matures, releasing labour to meet increasing demand as the economy recovers. Other policies with a strong multiplier effect include clean energy infrastructure and R&D, which are known to have long term benefits for competitiveness.

They can also help avoid significant cost in the future. The Rocky Mountain Institute has calculated that the cost to the United States of a 4.5°C increase in global temperatures would be over $5 trillion – through the direct impact of extreme weather events, loss of asset values and returns, and the risk premium of uncertainty for investors. Policies to avoid this would have very high economic returns: a deep retrofit of the US building stock costing $350 billion, for example, would yield $1.4 trillion in added value, including through energy savings. And this is before one takes into account the co-benefits such as improved public health, quality of life and competitiveness.

The pandemic has been a wakeup call not to fall prey to short termism, but to plan for a sustainable future

Governments face challenges almost unimaginable a year ago. They must not only control the pandemic but also stabilise their economies while looking out for the most vulnerable and creating jobs to replace those lost during the pandemic. This is, understandably, the highest immediate priority. But we must also recognise that the impact of climate change beyond the 1.5°C scenario is likely to be even more devastating than anything experienced to date, including the pandemic – and that we still have the chance to avoid it.

We can do so if we make the period to 2030 'the decade of delivery', setting us on the path to deliver net zero by 2050. Further delay carries the risk of well-nigh intolerable social and economic disruption.

The social imperative is clear, as is the commercial one. The pandemic has been a wakeup call not to fall prey to short termism, but to plan for a sustainable future. It can be a prosperous one.

A final personal thought. We do not lack the technological tools to do what is needed. But we do need to boost the collective will to deploy them through policy, investment, business and consumer decisions.

Pricing carbon can help here, as well, by serving to validate perceptions of what is and is not responsible behaviour and reinforcing the case for it.

Joan MacNaughton is currently Chair of the Climate Group and of the Advisory Board of the New Energy Coalition of Europe. She sits on the Strategic Advisory Board of Engie UK, is a Non-Executive Director of the James Hutton Institute and of the Energy Savings Trust, a member of the Council of Warwick University, and sits on several other advisory boards. She is also an IETA Fellow.

From 2010 to 2016, Joan was Executive Chair of the annual assessment of countries' energy policies for the World Energy Council, the 'Trilemma', and is now Honorary Chair. In 2012 she was Vice Chair of the CDM Policy Dialogue. She worked for the UK government until 2007, when she joined Alstom and set up and ran its clean energy advocacy unit until 2011. In 2006 she was made a Companion of the Order of the Bath by HM The Queen.

Perhaps one of the biggest market failures is the whole area of energy efficiency

Article Fourteen

Today's Innovations, Tomorrow's Norms

If we are to realise the Paris Agreement's ambitions and deliver on net-zero pledges, we need to find new ways of doing things – from energy production to manufacturing to farming, and beyond. IETA is proud to have innovators among its members, who are blazing a trail for a new, cleaner, sustainable tomorrow

Zero Carbon Humber:
Creating the world's first net zero industrial cluster

Developing carbon capture usage and storage (CCUS) technology and hydrogen in Yorkshire and the Humber would preserve jobs by enabling energy intensive industries to continue to operate and thrive, even against a backdrop of ever tighter emissions targets linked to the UK's carbon budgets.

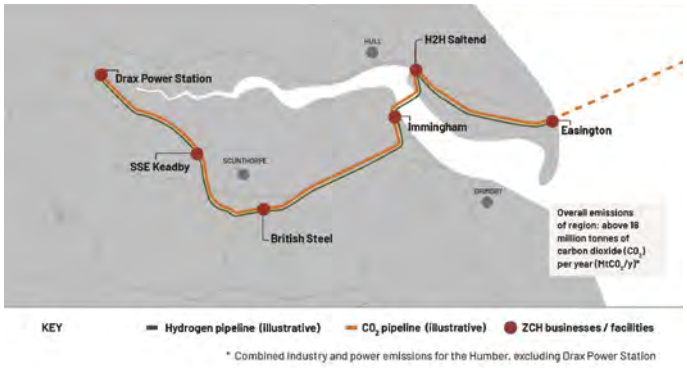
Without CCUS, the Humber will face a significant challenge transitioning to a Net Zero future. The region is an essential and valued part of the UK's economy, contributing to over £18 billion in GVA and over 55,000 jobs in manufacturing alone – but it is also the most carbon intensive industrial cluster in the UK, emitting 12.4 million tonnes of carbon dioxide (CO2) each year.

The Zero Carbon Humber partnership consists of 12 leading companies and organisations in the region, including Drax, working together to create the world's first net zero industrial cluster by 2040. The project plans to capture CO2 at scale from existing industrial process and power stations around the region, as well as new hydrogen production facilities. This CO2 will be transported via pipelines to be permanently and safely stored under the southern North Sea.

Through the pioneering developments of large-scale carbon storage across the Humber – enabling a hydrogen economy as well as bioenergy carbon capture and storage (BECCS) to create the world's first negative emissions power station at Drax – Zero Carbon Humber will accelerate decarbonisation across the wider Yorkshire region and reinforce the UK's position as a global leader in clean growth.

The Zero Carbon Humber partnership consists of 12 leading companies and organisations in the region working together to create the world's first net zero industrial cluster by 2040

Zero Carbon Humber Site Map



For all of this to happen, the UK Government will need to bring forward an investment framework that enables power and industrial facilities to commit capital towards CCS technology and infrastructure. Carbon markets will play an important role within these business models by providing an incentive to decarbonise. The UK government is looking at how a Contracts for Difference scheme can be used to stabilise carbon prices through emissions trading scheme to support industrial decarbonisation, with the potential to adapt this scheme to support the deployment of BECCS and other greenhouse gas removal solutions including afforestation and direct air capture.

Karl Smyth
Drax

Tree planting is more urgent than ever. Together, we need to solve the climate crisis – and work to mitigate the direct impact of our changing climate on people, wildlife, and critical ecosystems

Arbor Day:
Driving environmental impact through tree planting

Founded in 1972, the Arbor Day Foundation's mission is simple: we inspire people to plant, nurture, and celebrate trees. This mission is the driving force behind all of our work, from global reforestation to disaster recovery and verified carbon credits.

Tree planting is more urgent than ever. Together, we need to solve the climate crisis – and work to mitigate the direct impact of our changing climate on people, wildlife, and critical ecosystems. In 2018, the Foundation launched Time for Trees – our boldest-ever goal to plant 100 million trees and engage 5 million tree planters by 2022, the 150th anniversary of Arbor Day. These trees will address many of the critical global issues we face, and the tree planters will cultivate a growing community of individuals dedicated to greening our planet.

The Foundation works to accelerate reforestation and agroforestry carbon removal projects, creating verified carbon credits and forestry-based social enterprises. Since the launch of Time for Trees, key corporate partners, including IETA members PricewaterhouseCoopers and Bank of America, have grown their commitment to verified carbon credits through the Foundation, collectively offsetting more than 2.5 million tonnes.

Forestry carbon credits offer more than a means to reach corporate sustainability goals – they help us protect, manage, and restore forests, our highest-potential carbon sinks[1]. Our vision is to build a climate-positive economy that restores forest ecosystems, empowers people, and revitalises communities – all while stabilising our climate.

Time for Trees was designed to convene highly engaged corporate partners and our network of more than 1 million annual members to drive high-impact forestry initiatives around the globe. By convening environmental advocates in the form of large corporations down to small non-profits and individuals, we aim to cultivate a network of environmental stewards who will create a greener world for generations to come.

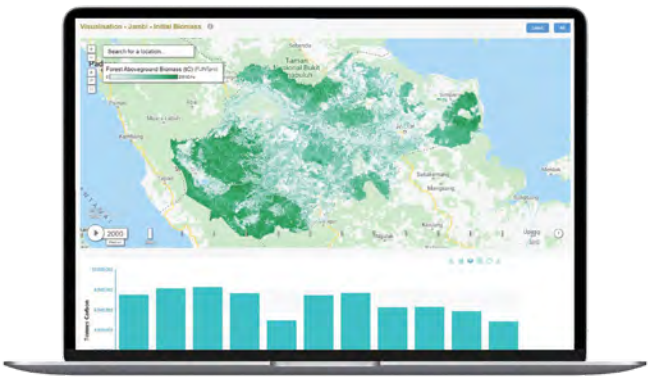
The Foundation is ahead of schedule to plant 100 million trees by our target date – and as of 30 June, 2020, we have counted more than 5.8 million individuals engaged in our mission to better the world by planting trees. This milestone is more than just a number – it is a reflection of healthier and stronger communities, environmentally conscious companies, and a rising generation of tree planters committed to greening their world. Looking beyond Time for Trees, those passionate environmental stewards will help lay the groundwork to achieve even more ambitious goals in the future.

Jeremy Manion
Arbor Day Foundation

FLINTpro:
Analytics for land-sector climate finance

FLINTpro's unique analytics platform empowers and promotes climate-smart management of agriculture, forestry, and other land use (AFOLU).

The platform enables organisations from multiple sectors to effectively measure and manage land-sector GHG emissions. FLINTpro simplifies the aggregation of large and complex environmental data sets, applies globally recognised scientific and analytical models, and runs advanced simulations for its users. Automated, cloud-based software systems communicate results in visually compelling ways for use by policymakers, business leaders, Investors, advocacy groups, and science professionals.



(1) Griscom et al., Natural climate solutions, October 2017, PNAS.

The software can provide analytics data and information services to corporate enterprises, financial services, governments, and NGOs working on a broad range of nature-based solution to climate and biodiversity issues around the world.

Among the many challenges and barriers involved with the scaling of natural capital solutions (NCS) markets is how best to measure, report and verify emissions from the sector. Catalysing climate action for the land sector will require advanced technologies working systemically. FLINTpro is engineered to achieve just that, as the advanced artificial intelligence and satellite data underpinning the platform allows NCS to be scaled up reliably.

Stephen Scofield
Mullion Group

CrossWind:
Pioneering clean energy innovations offshore

CrossWind is a joint venture between Shell and Eneco. As two leading Dutch energy companies, we have the experience, expertise, and financial strength necessary to develop Hollandse Kust (noord): a subsidy-free offshore wind farm with innovations focused on system integration; a first!

By working alongside the Dutch government, we aim to accelerate the energy transition and help to meet the objectives of the Dutch National Climate Accord and the EU's Green Deal.

CrossWind plans to have Hollandse Kust (noord) operational in 2023, with an installed capacity of 759 MW generating at least 3.3 TWh per year. This is enough clean power to supply more than 1 million Dutch households. The wind farm will be located 18.5 km off the coast of Egmond aan Zee.

The wind doesn't always blow consistently. So how can a wind farm provide electricity when there is little wind? CrossWind and its partners are exploring five different innovations designed to address these challenges. Through these innovations, an offshore wind farm could be capable of providing more constant electricity regardless of the wind conditions.

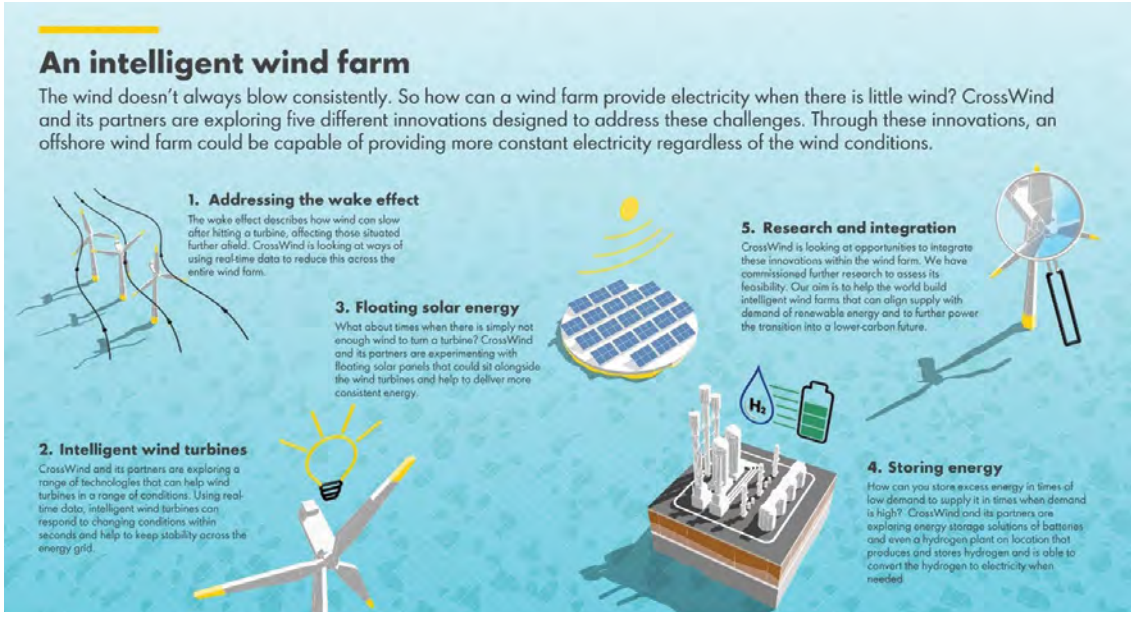
The offshore wind farm will include five technology demonstrations that could be implemented at full-scale in the future:
1. Addressing the wake effect
2. Intelligent wind turbines
3. Floating solar energy
4. Storing energy
5. Research and integration

While the technologies themselves are not new, combining them offshore in this way is a novel approach and could be a game-changer for wind power and the energy transition.

Working together is crucial for the energy transition, and the CrossWind team will work closely with universities and scientific institutions to develop these innovations. We intend to share our lessons learned with a broad audience – varying from the academic world to the general public.

Tjalling de Bruin
CrossWind

While the technologies themselves are not new, combining them offshore in this way is a novel approach and could be a game-changer



Radicle:
Smart tech for farming

Radicle, the largest developer of agricultural carbon credits in North America, is partnering with fellow innovative companies to leverage cutting edge agricultural systems to deliver a new high-tech carbon credit programme.

The company is endeavoring to simplify the process by which farmers can generate carbon credits, or measure, report, and verify other sustainable agricultural practices they can get paid for. To do this at scale, Radicle has been actively partnering with companies that provide agronomic services, working together to accelerate and simplify payment for farmers executing sustainable initiatives.

Being able to pay farmers for their sustainable initiatives shouldn't be a challenge, but unfortunately it is. Accessing and finding the farmers that are leading in this space – the ones who are wanting to participate in these markets, knowing that at the outset it's always a bit more difficult – hasn't been so simple. But the goal, and value to the farmers and the environment, is certainly worth the effort.

Radicle has successfully generated over C$53 million (US$40.9 million) for farmers in Alberta and wants to be able to do the same for farmers outside of the Canadian province. The company is working towards making credit development a streamlined process that fits well into a farmer's standard agricultural practice, changing the landscape of farming in the future.

The programme provides additional incentive for growers to implement sustainable solutions that sequester carbon in the soil, thereby reducing emissions while providing food more sustainably to consumers.

Alastair Handley
Radicle

Radicle has successfully generated over C$53 million (US$40.9 million) for farmers in Alberta

HYBRIT:
A value-chain for fossil free iron- and steelmaking

In 2016, SSAB, LKAB and Vattenfall joined forces to create the HYBRIT Initiative to achieve a fossil free energy-mining-iron-steel value chain. HYBRIT aims to replace coal and coke, traditionally needed for ore-based steel making, with fossil free electricity and hydrogen. By doing so, CO2 will be replaced with H2O as the by-product.

A pilot phase is underway until 2024, and on 31 August 2020 one important milestone was reached on the path to fossil free steel with the start-up of the direct reduction pilot plant in Luleå, Northern Sweden. The research facility is now used for testing.

A demonstration plant for direct reduction of iron ore using hydrogen is planned for 2025. This industrial demonstration starts in LKAB's iron ore mines in northernmost Sweden and ends in SSAB's steelworks in Oxelösund in Southern Sweden, with fossil-free electricity from Vattenfall. At the heart of this value chain, HYBRIT will construct a new demonstration plant for a 1.1 million tonne/year production of hydrogen-based sponge iron (H-DRI) and hydrogen production by electrolysis (500 MW). As such, the project will be a complete first-of-its-kind demonstration of fossil-free iron- and steelmaking from mine to crude steel. The goal is to offer fossil-free steel to the market in 2026.

HYBRIT's value chain, including large-scale hydrogen generation and storage, can support the transition towards a fossil free energy-mining-iron-steel value chain while simultaneously playing an important role in the renewable energy system.

The technology has a potential to drastically reduce global CO2 emissions and help achieve the Paris Agreement's long-term targets. In the roadmap for the HYBRIT Initiative, a gradual conversion from blast furnace to an electric arc furnace will begin from 2025.

By 2045, the total emission reductions for Sweden from the project will be 10% and for Finland 7%.

Vattenfall

Article Fifteen

The Green Stimulus Opportunity for Resource Rich, Developing Countries

The COVID-19 pandemic has sparked calls to 'build back better' and drive forward the low-carbon transition. But what are the challenges facing resource rich developing countries in delivering clean economic stimulus packages? **Steve Nicholls** offers some insights from South Africa

South Africa is extremely vulnerable to physical climate risk and, as a resource rich country, is also extremely vulnerable to transition risk. It is clear for South Africa and other resource rich countries that the consequences of physical climate risk far outweigh the risks embedded in transition. We cannot allow the concerns around the economic consequences of transition risk to justify inaction. If anything we should embrace transition risk, as it is at least more in our control.

The transition risk is extensive however, and responding will require a coordinated multi-stakeholder plan. According to a Climate Policy Initiative report[1], the risk to the South African economy just from transitioning from coal is worth roughly 35% of GDP. Other impacts will come from transitions in automobile manufacturing, liquid fuels, agriculture and transport. It is fair to say that South Africa, and likely other resource rich countries, need to think this through very carefully.

Furthermore for small, developing, resource rich countries the risk is almost entirely exogenous. The role of balance of payments in managing a country's ability to finance imports (often beneficiated products, like liquid fuels) and to manage national debt is worth exploring. South Africa's top exports by value include platinum group metals, coal, gold, iron ore and ferroalloys, and motor vehicles and their parts (chiefly internal combustion engines). A significant change in demand for these export commodities would threaten the financial stability of the economy, impacting credit ratings, capital costs and currency valuations.

Considering that a third of platinum group metal demand comes from internal combustion engine use, we can expect the global shift towards electric vehicles (of around 2035, probably earlier) to have severe consequences on South Africa's economy. And as coal use is phased out globally, the pressure on South Africa's economy is immense.

The consequences of physical climate risk far outweigh the risks embedded in transition

Add to this the developing country context. Other key employers, economic contributors and heavy emitters under threat include steel and cement. Given long periods of economic under-performance and low infrastructure investment, these sectors struggle alongside their struggling economy. Extended under-investment means we now have the scenario that trade-exposed sectors with marginal profitability and low capital availability need to invest in green technology to remain competitive in a low-carbon economy. The national balance sheet is in no place to stimulate this investment and the sectors struggle to invest on their own.

Perhaps the most critical factor to consider is the socio-economic context. Pre-COVID, the South African debt-to-GDP ratio was 62%, with 29% unemployment, 50% youth unemployment and ratings agencies were predicting negative growth and medium-term debt-to-GDP ratio trending to 90%. Post-COVID, as of late October 2020, we have lost more than 600,000 jobs and the country's debt-to-GDP ratio is already over 80%. It is now almost certain that the debt-to-GDP ratio will exceed 100% in the medium term. For a people where more than half our population live in poverty and where inequality is the highest in the world, it is critical that we make the social outcomes of poverty, inequality and unemployment our priority.

(1) Huxham, Matthew, Muhammed Anwar and David Nelson. Understanding the impact of a low carbon transition on South Africa. March 2019, Climate Policy Initiative

A post-COVID stimulus and a #BuildBackBetter campaign is thus of upmost importance. Countries have the challenge of investing across three timelines: they must simultaneously manage the short term humanitarian crisis, medium term company (especially small and medium enterprises) and household liquidity, and long term economic competitiveness. Developing countries are harder hit by COVID (with poorer health and healthcare services to begin with) and have less fiscal space to stimulate the economy where borrowing is often more expensive. As a consequence, in contrast to developed countries, less of the smaller amount of net stimulus is spent on long term competitiveness (infrastructure investment and market reform) which opens up structural gaps between developed and developing countries. In other words, inequality between nations could be enhanced by how nations deploy stimulus packages.

Given the historical context of existing country level inequalities, we should emphasise that common but differentiated responsibility is a real world thing, not a negotiation tactic. Given that the low-carbon transition is embedded in trade and fundamental global and local economic structures, it is unlikely that it will be achieved without international support and cooperation. Without this international cooperation and shared learning, #BuildBackBetter could overlook the critical element of a Just Transition.

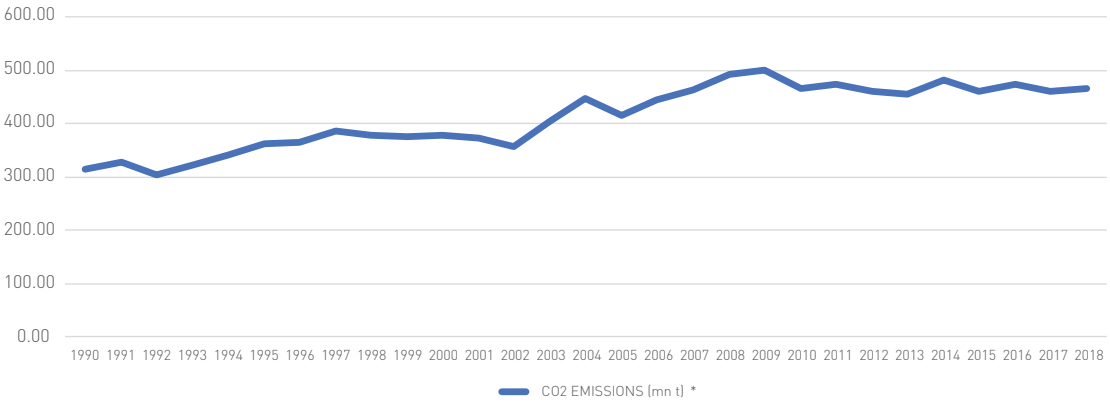
A post-COVID stimulus and a #BuildBackBetter campaign is of upmost importance

Despite that rather grim picture, all is not lost. The global transition to a net zero-carbon economy presents plenty of opportunity. South Africa has a number of significant assets, not the least of which is plenty of sun and wind. Renewables-dominated energy systems and local manufacture are key. Our coal assets are old and we can decommission within a carbon budget with minimal stranded asset risk. Our motor vehicle manufacturing expertise could easily be transitioned to electric vehicle production. Our stable and well-regulated financial services sector (among the most competitive in the world) would make a strong base for green finance for the continent. The combination of wind and solar enables the right kind of conditions for green hydrogen, setting the stage for us to be a net exporter. The role of platinum group metals in hydrogen and fuel cell use and the increased demand for certain mined commodities (such as copper) for use in green technology could bolster the minerals sector. Our experience with the Fischer–Tropsch process positions us to be the world leader in carbon neutral fuels. And who knows what other innovations await.

The key is to leverage international support, trade and concessional green finance to power a national investment and economic stimulus plan that puts the economy on a competitive net-zero by 2050 path. This plan cannot focus just on the technical transition but must also include the social elements so critical to economic transformation. Transforming our energy system and evaluating our mining and chemicals sector vulnerability and options is the first step. The National Business Initiative, Business Unity South Africa and the Boston Consulting Group are working in partnership to develop a business perspective on net-zero pathways and feeding this work into the national conversation on a just transition.

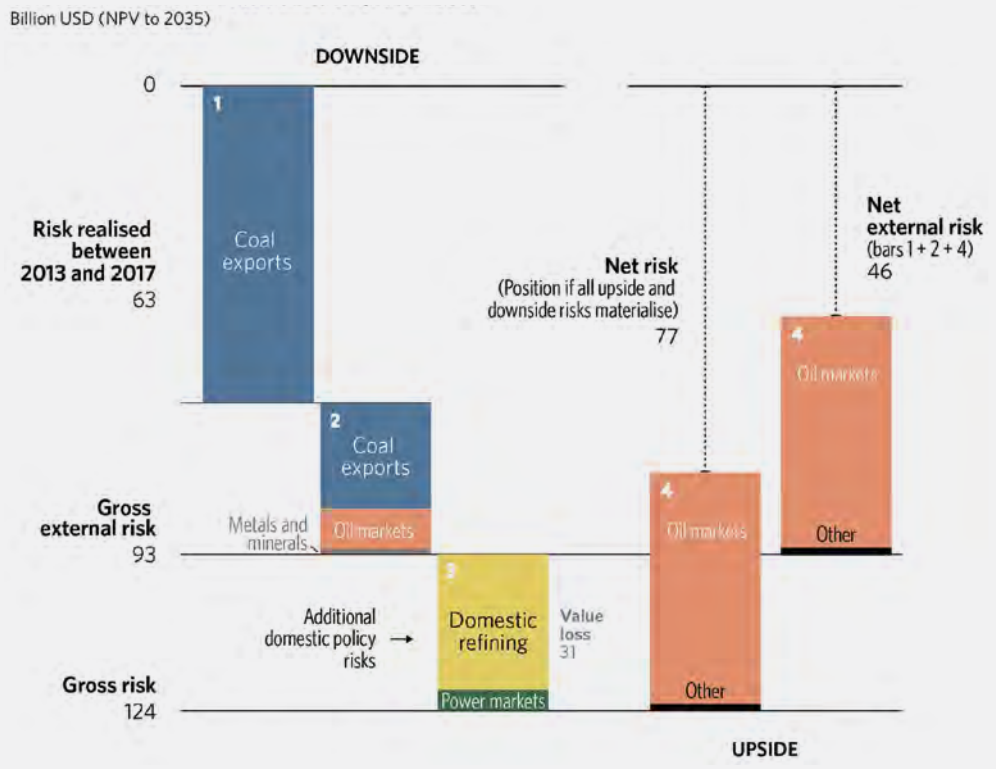
In South Africa, our preliminary work on transition pathways show that the jobs gained from construction and operations and maintenance of a renewables-dominant energy grid are greater than the jobs lost from coal phase out. If South Africa moves quickly to use this potential renewables boom and establish the country as a hydrogen exporter, the economic impact of climate transitions would be overwhelmingly positive.

South Africa GHG emissions 1990-2018



*from fossil fuels for energy and cement; excludes land-use
Source: Our World in Data. https://ourworldindata.org/co2/country/south-africa?country=~ZAF

Sources of Risk in a Climate Transition (2013-2035)



Source: Climate Policy Initiative

However the economic impacts of this transition are not distributed evenly. As witnessed around the world, certain regions and industries will be hit harder than others. This will not be limited to electrical energy and coal; they are merely experiencing it first. In South Africa, the majority of transition job losses will take place in the north-west of the country. Taking into account jobs multipliers, the number of people with livelihoods at risk exceeds half a million, concentrated in a relatively small part of the country with few other options. The protection of these people must be built into the national plan and into transition finance.

Just transition therefore simultaneously plays out globally and locally. It is something that needs to be built into international and national stimulus and cooperation as well as something that is highly regional and very personal. Not only is there a need for strong procedural justice (the involvement of the marginalised), but outcomes also need to be just. This means dealing with local job disruptions and implementing the technical options in a way that creates net employment, transfers ownership and deals with the welfare of communities that would otherwise be left behind.

Given the exogenous risk, it is critical that developing countries quantitatively get on top of transition risk

It is a big job! Given the exogenous risk, it is critical that developing countries quantitatively get on top of transition risk, develop integrated national plans that clearly specify the levels of cooperation needed to transition, and start to work with state and non-state actors in implementation. The private sector need to soberly engage with what it will take to reach net-zero by 2050 and contribute constructively and meaningfully to this planning. If we don't, we really need to deal with the far more scary consequences of physical climate risk, which are particularly dire for developing economies.

Steve Nicholls is Head of Environment at the National Business Initiative, a voluntary coalition of South African and multinational companies working towards sustainable growth and development in South Africa and the shaping of a sustainable future through responsible business action.

Article Sixteen

The Good Fight

Lisa DeMarco and **Daniel Vollmer** analyse how to successfully defend common legal challenges to carbon pricing

In 2020, it is almost trite to state that jurisdictions all over the world are embracing carbon pricing as an efficient means to facilitate the transition to a lower carbon economy. The World Bank's Carbon Pricing dashboard reports that some 64 carbon pricing systems covering 46 countries, 35 sub-national governments, and nearly 23% of the world's GHG emissions, are currently being implemented. Nonetheless legal challenges to carbon pricing regimes are increasingly common.

Canada alone has seen four recent provincial challenges[1] to the federal Greenhouse Gas Pollution Pricing Act (GGPPA), with the final determination of the Act's validity awaiting a pending decision from the Supreme Court of Canada. US and European jurisdictions have also experienced recent carbon pricing legal challenges. In this article we examine certain commonalities among recent legal challenges to carbon pricing, and effective defence strategies that were deployed.

Despite the many and varied legal traditions and regimes that support carbon pricing around the world, the legal challenges intended to thwart carbon pricing appear to fall within three main categories: (i) ultra vires – the law is beyond the jurisdiction of the enacting government; (ii) the law has a discriminatory or targeted effect; and (iii) the operation of the law may be frustrated on the basis of it being characterised as a tax, fee, or punitive charge. All three strategies were applied in the recent Canadian cases.

The legal challenges intended to thwart carbon pricing appear to fall within three main categories

(i) ultra vires – the law is beyond the jurisdiction of the enacting government

The main thrust of the three Canadian provincial challenges[2] to the GGPPA was that the federal government had no specific jurisdiction over climate change or GHGs, and that the minimum national benchmark standards for carbon pricing that are included in the Act were so broad in their effect that they encroached upon the province's ability to regulate matters that are squarely within provincial jurisdiction. The provinces also argued that the GGPPA was an unauthorised tax and was targeted at fossil fuel producers.

The hyperbole used by the challengers was best exemplified by the Court in the Alberta Reference, which found the law to be beyond federal jurisdiction and actively questioned whether the law allowed the federal government to regulate whether citizens would drive a Prius or a truck, drink carrot juice instead of orange juice, be prosecuted for home heating and not wearing a sweater, and have their fireplaces banned.

In contrast, the Saskatchewan and Ontario Courts upheld the law by narrowly characterising its purpose and effect and relying heavily on the extensive record that included a significant portion of scientific and international evidence supporting the existential crisis of climate change, the transboundary nature of GHG emissions, the absence of evidence supporting a jurisdictional conflict, and the law's relatively minimal impairment of provincial ability to also regulate GHGs.

In the US, it was the Trump federal government (DOJ) that launched a challenge to California's cap and trade legislation, largely on the basis of its linkages to the Canadian province of Quebec's carbon market. In July 2020, the US District Court, Eastern District of California rejected the DOJ challenge and upheld California's carbon pricing scheme. The decision supports the view that, while climate change may be beyond the area of traditional state responsibility, it does not preclude state programmes if there is no conflict with international climate commitments at the federal level. Again, no evidence of actual conflict was determinative.

(1) Provincial constitutional references by Saskatchewan, Ontario, and Alberta have been heard by their respective appellate courts and have been appealed to the Supreme Court of Canada; a judicial review by Manitoba may or may not be heard following the anticipated Supreme Court decision. (2) Reference re Greenhouse Gas Pollution Pricing Act, 2020 ABCA 74; Reference re Greenhouse Gas Pollution Pricing Act, 2019 ONCA 544; Reference re Greenhouse Gas Pollution Pricing Act, 2019 SKCA 40

The DOJ sought a summary judgement that the California programme was pre-empted by the Foreign Affairs Doctrine, arguing that it conflicted with the US withdrawal from the Paris Agreement, assisted Canada in complying with it, and undermined the American government's ability to develop a new international arrangement. Judge Shubb rejected this argument on the basis that, much like the Canadian provinces, the DOJ could not point to any evidence of specific federal policy that conflicted with the California programme. The decision provides that "[t]he United States cites no authority for the proposition that an intent to negotiate for a 'better deal' at some point in the future is enough to pre-empt state law."

While the matter has been appealed by the Trump administration, the decision highlights that evidence matters, and the often-absent evidence to support allegations of jurisdictional conflict is worthy of emphasis. It is also strategically contrasted with the plethora of evidence supporting the existential threat and scientific consensus on climate change, GHG emissions, and the effectiveness of carbon pricing to mitigate GHG emissions and facilitate lower emissions infrastructure.

Similarly, the US 9th Circuit Court of Appeal upheld California's Low Carbon Fuel Standard (LCFS). In Rocky Mountain Farmers Union v. Corey, the court held that the LCFS was within California's jurisdiction, was not impermissible extraterritorial regulation, and it did not violate the interstate commerce clause or structural federalism. California could not offer "a potential solution to the perverse incentives that would otherwise undermine any attempt to assess and regulate the carbon impact of different fuels … without the ability to differentiate the different production processes and power generation that are used to produce those fuels." This approach of highlighting the fundamental economic basis of carbon pricing is effective in any carbon pricing challenge.

(ii) the law has a discriminatory or targeted effect

In the Canadian cases, the Saskatchewan and Ontario Courts of Appeal rejected arguments on discriminatory effects and found that the federal law applied consistent sectoral standards to all large emitters regardless of industry. The Alberta Court of Appeal rejected the law in part on the basis of allegations of its disproportionate impact on Alberta's fossil fuel industry.

In the US, the Court in Mirant Mid-Atlantic, LLC v. Montgomery County, 8:10-cv-01381, D. Md found that a carbon tax that affected only one large emitter in the county was not a valid carbon tax, but rather a punitive and prejudicial regulatory fee that was conducive to challenge. Similarly, in France, Re French Carbon Tax: Decision No. 2009-599 DC of Dec. 29, 2009, the French Constitutional Council annulled a tax on carbon emissions, as it contained too many exemptions and would not have applied to 93% of industrial emissions.

It may therefore be effective to meet legal challenges alleging discriminatory or targeted effects with evidence of: (a) the economy wide nature and impact of the carbon pricing programme and (b) procedural evidence on how the standards were set in a consistent and even handed manner, including any consideration of the leakage and competitiveness impacts on specific trade exposed industries.

Highlighting the fundamental economic basis of carbon pricing is effective in any carbon pricing challenge

iii) the operation of the law may be frustrated on the basis of it being characterised as a tax, fee, or punitive charge.

The Canadian cases also attempted to invalidate the law as an unauthorised tax or an improper regulatory fee. The reviewing courts largely rejected the corresponding characterisation and related procedural restrictions on the basis of the preamble and purpose of the GGPPA. This issue of tax characterisation and related procedural rights is currently live in one of the many California PG&E insolvency cases where the value of emission allowances intended to defray low income customer payments are at risk.[3]

Similarly, in Western States Petroleum Association v. Oregon Commission on Environmental Quality, 296 Or App 298 (2019), the Oregon LCFS was challenged as a fuel tax that was subject to legislation limiting its use for only road related purposes. The Court found that a purchase of LCFS credits is not a tax, and therefore there was no violation of legislation stipulating the use of revenue from fuel taxes. An examination of the underlying climate change purpose of the LFCS was relevant to the determination.

As a result, the strategic defence to a tax-based carbon pricing challenge may include recourse to a clear purpose or preamble provisions of the legislation, and hansard and other external and legislative materials to support the specific GHG mitigation purpose of the carbon pricing scheme.

As carbon pricing systems proliferate around the world, we anticipate further legal challenges to those systems to follow. In fact, challenges may grow in light of recently announced trade related measures, including border carbon adjustments. To date, the pattern of challenge has predictably fallen into the three main categories. A proactive defence to anticipated challenges may be supported by a strong a comprehensive record, drawing on the scientific and international consensus on the climate crisis, the economy-wide nature of the carbon pricing mechanism, and evidence on how the rules or regulations were set – learning from the cases above.

Lisa DeMarco is Senior Partner and CEO, Resilient LLP (formerly DeMarco Allan LLP). Lisa and her colleague Jonathan McGillivray represented IETA in the constitutional legal challenges before the Saskatchewan, Ontario and Alberta Courts of Appeal and at the Supreme Court of Canada.

Daniel Vollmer is Associate, Resilient LLP (formerly DeMarco Allan LLP).

(13) City of Arcata v. Pacific Gas & Electric Co., CGC-20-585483, Cal. Super. Ct

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