The Low Carbon Pathway

Governments across the world are increasingly responding to the climate crisis by adopting policies and market mechanisms to help reduce emissions, writes Mamadou-Abou Sarr, President of V-Square Quantitative Management

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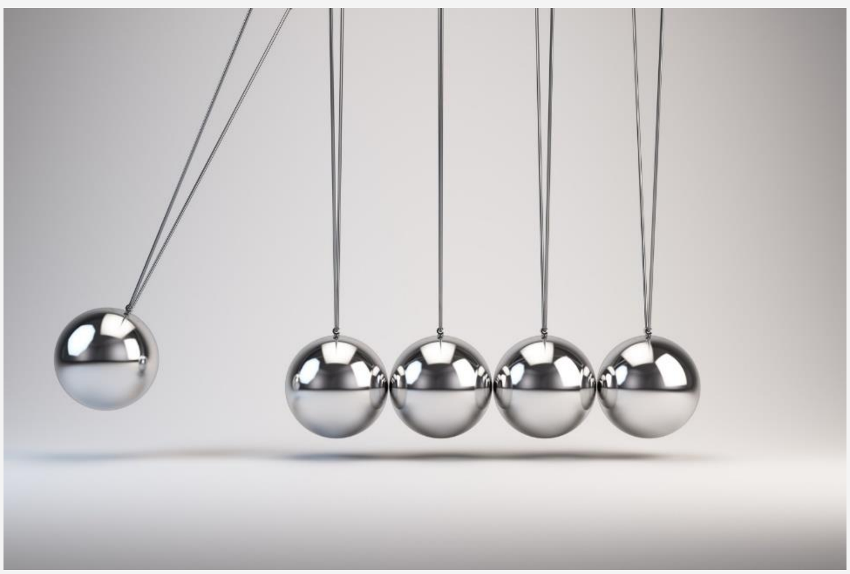
"Nothing is lost, nothing is created, everything is transformed."

Antoine Lavoisier, father of modern chemistry



Much has been said about the paths to a low carbon economy. From national to regional pledges to reduce emissions, a few central banks adopting reduction measures, and now a growing number of net-zero commitments from countries and companies, the race to address climate change risks and develop green solutions has accelerated.

However, one could ask if the surge of new initiatives/pledges is not just a growing tree hiding in the forest. In other words, the announcement's effect keeps the topic as a discussion item yet, without follow-through from all stakeholders, there is no meaningful progress toward a lower carbon economy.

The concept of attempting to address climate change risks through global policies and financial market mechanisms is not new *per se*. In the past few decades, we have seen policy makers set and reset their global climate change policies and an emergence of carbon markets scattered around the world. According to the World Bank in 2020, more than 30 cities over 46 national jurisdictions (regions and nations) now have a price on carbon dioxide emissions (CO_2), covering just over 22% of the annual global greenhouse gas (GHG) emissions.

What are the different approaches to move towards a low carbon economy? Is achieving net zero emissions a zero-sum game? Can a cap-and-trade structure reduce emissions? These are the questions that governments, policy makers, and market participants grapple with as they attempt to curb the harmful effects of global climate change.

In this paper, we focus on the main policy approaches and market mechanisms in place to address climate change risks. From our perspective, it is important to assess the relevance and challenges of these tools and focus on a global policy roll out as opposed to a myriad of small initiatives.

The policy square

Addressing negative externalities (for example, pollution) on a public good (for example, clean air) requires the acknowledgement by market participants of the marginal social and economic costs of climate change (for example, health damage, climate refugees, productivity) and the need to measure and mitigate those costs. The challenge of relying only on financial markets stems from the misalignment between the quarterly earning cycles for companies and long-term nature of climate change.

Therefore, it is not surprising that some of the key initiatives to combat climate change came from the policy front rather than free markets. Policies may act either as a catalyst for change or aim to “command and control”.

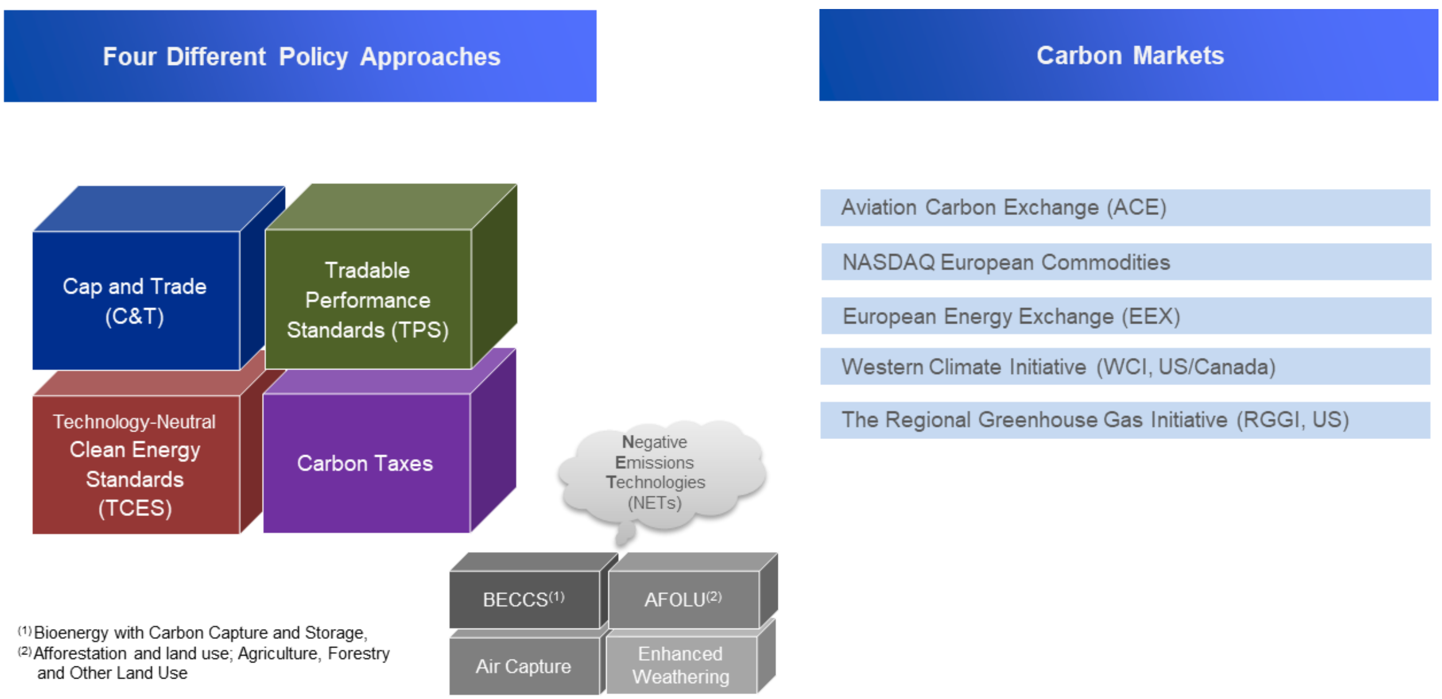
The main climate policy approaches fall into both categories and, to a certain extent, force companies to adapt and innovate. *Exhibit 1* below gives an overview of the key policy approaches that have been adopted and the markets that have been developed to trade carbon emissions.

Cap-and-trade is a system for controlling carbon emissions and other forms of atmospheric pollution. Governments establish an upper limit on the amount of pollution a given business or other organization may produce, but the system allows for further capacity to be bought from other organizations that have not used their full allowance. The cap-and-trade system has been praised for its flexibility as emitters can decide how to achieve their reductions, yet the political nature of defining the cap threshold and the uncertainty on carbon prices call for some improvement of this system.

Beside the cap-and-trade approach, the other approaches that have been designed to curtail emissions include Tradable Performance Standards (TPS), Technology-Neutral Clean Energy Standards (TCES), and Carbon Taxes.

Under a TPS program, the regulating authority determines a performance standard for a sector it is regulating. This is also called a rate-based standard or intensity standard[1]. Sources with emission rates below the performance standard earn credits they can sell; sources with emission rates above the standard must acquire those credits to cover their excess emissions. A TCES program is a market-based, technology-neutral portfolio standard that requires a certain percentage of retail electricity sales to come from non or low-emitting sources. Finally, a Carbon Tax is a fee imposed on the burning of carbon-based fuels (coal, oil, gas).

Exhibit 1 - Toward zero or low carbon-generating technologies



Experts generally agree that a single policy or market mechanism will not be sufficient to keep the increase in global average temperature to below 2 °C (3.6 °F), let alone to intensify efforts to limit the increase to 1.5 °C (2.7 °F). Instead, a combination of policies, market mechanisms, and technology innovations is required to tackle the climate change risks and scale up opportunities.

[1] United State Environmental Protection Agency EPA (2003) and Burtraw et al. (2012).

Cap-and-trade: a focus on emission trading schemes (ETS)

An Emission Trading Scheme (ETS) is a cap-and-trade system where emitters of GHG can trade emission units to meet their emission targets set by a nation or by a governing body. The scheme establishes limits or caps on carbon associated with fossil fuels or electricity generation. Companies that are covered by the regulation are permitted to trade their emission allowances, and a market develops as a result.

The European Union (EU) ETS: the first and the largest

The EU ETS launched in 2005 and was among the first systems to use a cap-and-trade structure to address climate change.

It currently includes over 31 countries and more than 11,000 installations (for example, power stations and industrial plants). This has led to a large number of EU ETS participants, which in turn make the carbon market in Europe competitive and efficient. The system covers *circa* 40% of the EU's emissions from the power sector, manufacturing industry, and aviation within the European economic area. Every year, a linear reduction factor is applied to accelerate the pathway to a lower-carbon economy. For example, the cap for 2020 was 1,816 $MtCO_2e$ (million tonne[2] CO_2 emission) compared with 2,084 $MtCO_2e$ in 2013.

The world looks at Europe as a leader in driving policy to tackle climate risks. For example, the EU has adopted a policy to reduce the GHG levels by 55% (compared to 1990) and achieve a net zero emission target by 2050.

The EU ETS plays a key role in the EU's ambitious plan, and it represents another form of leadership. Specifically, the EU ETS has linked with other exchanges and emission-saving projects in the world to accept international emission credits.

There is evidence that this collaboration is working – the EU achieved in 2020, ahead of schedule, its 20% target reduction in carbon emission (compared with 1990).

Another example is the new revised Phase 4 guidelines that went into effect for the period 2021 to 2030. The target reduction of carbon emissions for Phase 4 is expected to be achieved with a steeper annual reduction of the overall cap, increasing market coverage by including maritime and land transport, and reducing the surplus of allowances from the market.

The EU continues to improve the EU ETS in order to achieve its long-term policy goal to cut emissions by at least 55% by 2050. It has revised the guidelines for Phase 4 to expand the scope and include other sectors such as transportation and real estate (buildings).

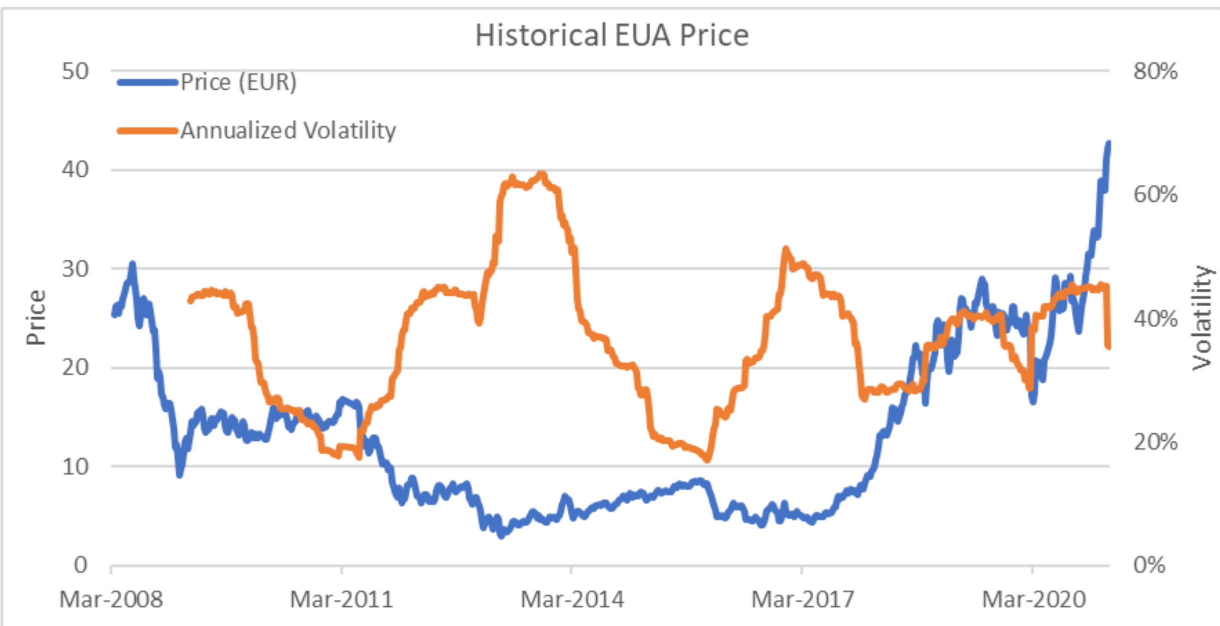
[2] Metric Ton, equal to 1,000 kg, or 2,204.6 pounds.

In addition, it created the Market Stability Reserve (MSR), a mechanism to protect against the risk of carbon leakage (i.e., producers moving their production to a country with less stringent emission policies).

The scheme is also an important source of revenue for the EU with nearly €19.2 billion ($21.8 billion) collected in 2020. At least half of the revenue generated is to be channeled towards climate and energy-related purposes by member states.

However, there have been some criticism around the cap-and-trade system. For example, a cap-and-trade system leads to a high volatility in carbon prices (see *Exhibit 2*), which makes it difficult for investors to gauge the expected returns of investing in eco-innovations, thereby slowing down the advancement of new technology. These limitations have prompted the rise of other systems, such as a carbon taxing policy, that are simpler and more stable.

Exhibit 2



EUA are the European Union Allowances. Tracking the European Union Emissions Trading System carbon market price day-by-day. All prices are in Euros. One EUA gives the holder the right to emit one tonne of carbon dioxide, or the equivalent amount of two more powerful greenhouse gases, nitrous oxide (N2O) and perfluorocarbons (PFCs).
Source: Ember Climate. As of March 22nd, 2021 – The volatility is calculated as the standard deviation of the daily price returns.

The latest ETS – China

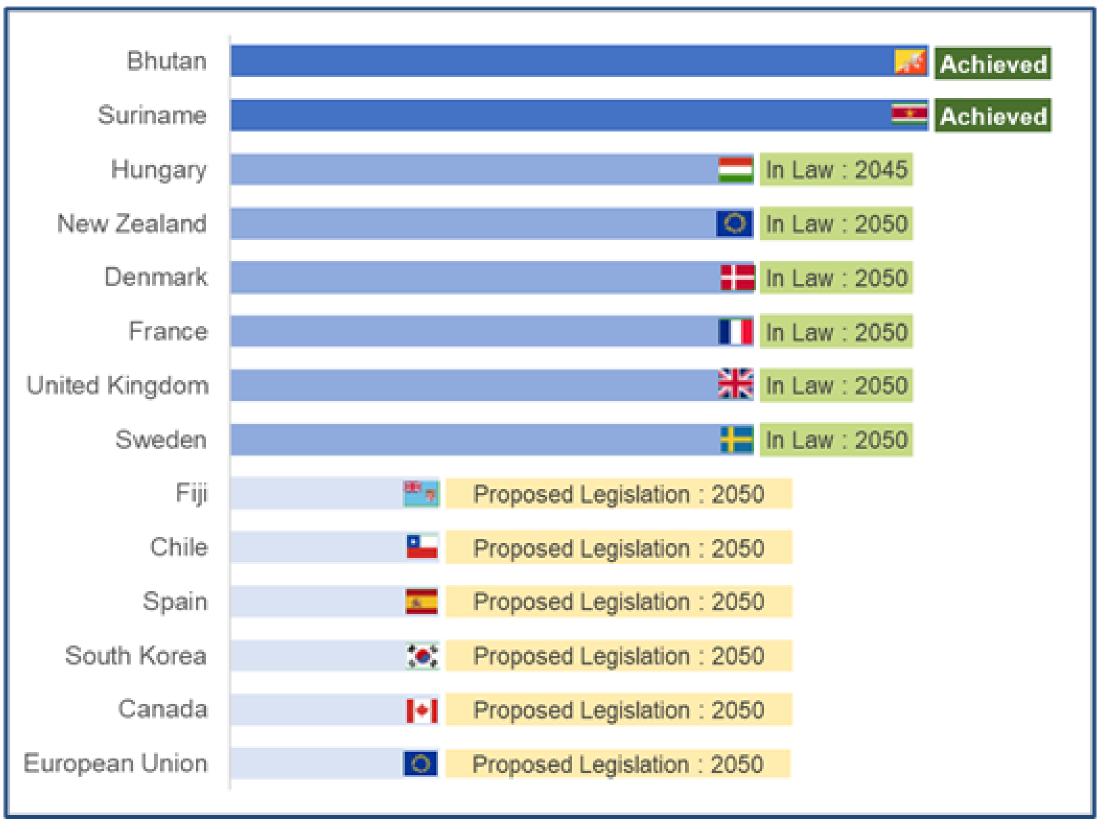
After running various successful pilot ETS platforms, China is set to launch its National ETS by mid-2021. The trading platform is expected to have the highest GHG coverage in the world, overtaking Europe. In the meantime, China released rules for carbon emission trading management in February 2021 for the first time. Also, the country already runs various regional ETS like the Shanghai ETS that has aggregated 156 million tonnes of trading volumes, as of February 2021.

The current expectation using 2020 as a base line is that at least 7% of China's CO_2e could be covered by the ETS. There are high expectations that the China ETS will be instrumental in addressing climate change, given that the country represented 28% of the total global emissions in 2020.

Net zero emission pledges and targets are needed

To meet the Paris Agreement's goal of remaining below 2 °C of warming, all countries need to reduce their emissions even more.

Exhibit 3



Source: Energy & Climate Intelligence Unit, 2020

Countries like China, Japan and Korea have recently announced a goal to achieve net zero target emission by dates ranging from 2050 to 2060. However, the plan to achieve those goals is still unclear. Fourteen countries (*Exhibit 3*) have already adopted a net zero carbon emission target in either their policy or with a proposed legislation.

While this is a good start, numerous other countries still need to incorporate net zero emission targets in their climate policy framework in order to achieve a global low carbon economy. Furthermore, all countries need to incentivize investors and firms to move in a direction that can accelerate the reduction pace of carbon emission.

Looking forward

Initiatives to implement ETSs are spreading throughout the world as countries shift from merely acknowledging the impact of GHG on climate to taking action to address the problem.

ETSs reduce emissions in a cost-effective manner, stimulate technological innovations, and create synergies across the borders.

As shown in *Exhibit 3*, only a handful of countries have established net zero carbon emission targets so far; a growing ETS ecosystem can be instrumental in increasing the number of countries that achieve a net zero emissions target.

Notwithstanding the fact that more countries are setting net zero targets, two major challenges remain and must be discussed: a much-needed harmonization of ETSs as well as the ability to trade across different ETSs, and the future of carbon sequestration as a safe tool to reduce CO_2 emissions.

Regarding the first challenge, at the country level, legislated ETSs exist in the EU (27 EU States since 2008), Switzerland (since 2008), New Zealand (since 2008), Australia (since 2012), South Korea (since 2015), and Kazakhstan (since 2013).

Furthermore, subnational schemes are legislated in the US (California), Canada, and Japan.

Lastly, the Kyoto Protocol[3] also provides a framework for covered countries and industries for emissions trading across nations. The nature of global warming and the increased globalization of companies' operations call for a

[3] The Kyoto Protocol is an international treaty which extends the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) that human-made CO_2 emissions are driving it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties (Canada withdrew from the protocol, effective December 2012) to the Protocol. The Protocol is based on the principle of common but differentiated responsibilities.

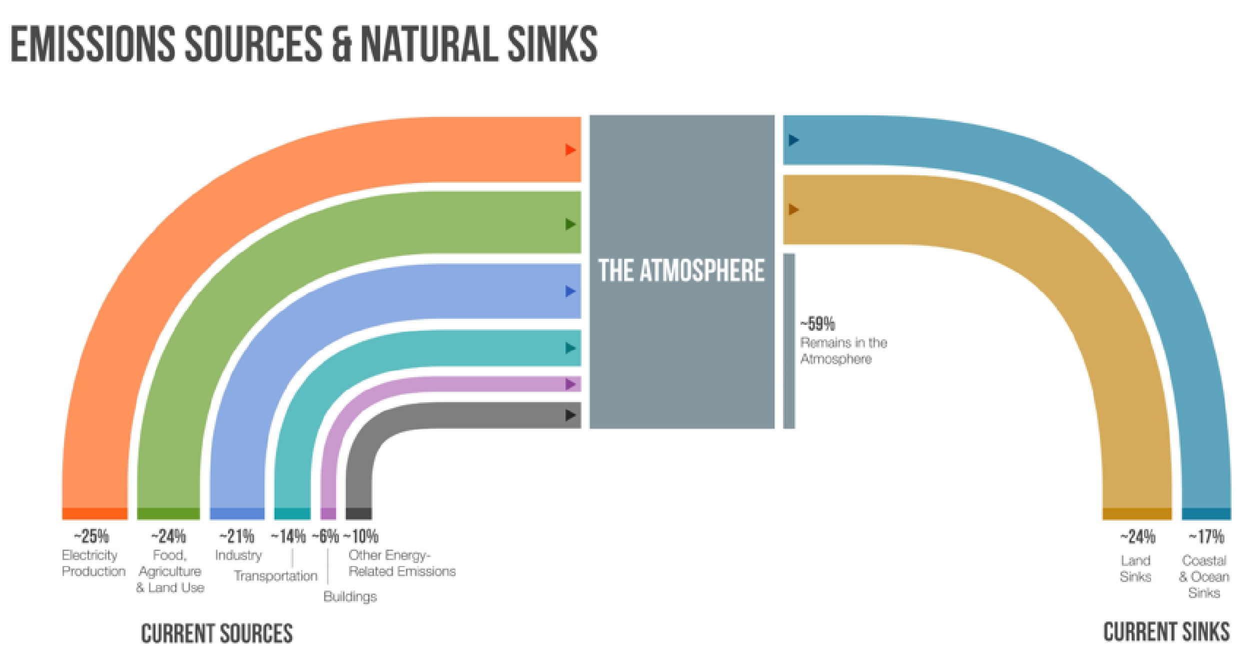
harmonization of the standards and for entities in one region to be able to trade with entities in a different part of the world. This would increase the number of participants, thereby boosting efficiencies.

However, this is not a simple endeavor as this will demand greater coordination across regions. Absent coordination, a heterogenous pricing of carbon due to inconsistent caps and policies across regions in the world might be the main hurdle to inter-regional ETS trading.

The second challenge is the expansion of carbon sequestration as a technology to reduce the CO_2 emissions. Carbon sequestration or carbon dioxide removal (CDR) is the long-term removal, capture or sequestration of carbon dioxide from the atmosphere to slow or reverse atmospheric CO_2 pollution. The carbon removal can be done through protection and restoration of biomass and soil ecosystems, or through geological engineered capture (Carbon Capture and Storage, CCS).

In their biomass and soil, forests are powerful carbon storehouses; degraded lands can be used in ways that increase biomass and, as a result, foster carbon sequestration. 59% of the emissions currently are trapped in the atmosphere despite the current land, and ocean natural sinks (see *Exhibit 4*).

Exhibit 4



Source: Project Drawdown (2020); IPCC (2014) & Global Carbon Project (2019)

On the other hand, as mentioned earlier, carbon capture can also be engineered in ways that it is buried and locked underground in depleted oil and gas reservoirs, saline formations, or deep, un-minable coal beds.

Analogous to hazardous waste program, acid gas disposal, or oil-gas exploration, one cannot disregard the potential risks, short-term and long-term, of such a technology. Despite studies[4] concluding that the CCS associated risks and hazards appear small and manageable, black swan types of events cannot be discounted.

Leakage of CO_2 is the greatest concern for the long term, as any abrupt or gradual leakage – due to injection well failure or undetected faults and fractures – could negate the intended benefit of capturing the CO_2 and may turn toxic for human health.

An improper choice of the storage sites, operation risks, as well as potential induced seismicity are the typical concerns that are voiced.

Global warming is happening, and carbon emissions are a big contributor.

In an attempt to realize its scale in a tangible manner, we resurrected a dynamic playful visual – Greenhouse Gamble™ Wheels – where the wheels can be spun to show the likelihood of temperature change by 2100, depending on a set of greenhouse gas policies scenario.

The wheels were originally developed by the MIT Joint Program on the Science and Policy of Global Climate in 2001 to convey uncertainty in climate change prediction[5]; the work was updated in 2021. The ETSs and other mechanisms are ingenious solutions to combat the global warming, and they are constantly being improved. However, they should always be mindfully implemented to avoid creating new issues while attempting to solve the current ones.

[4] NRDC, Global Security Principle Directorate LLNL (Lawrence Livermore National Laboratory) contracted by the U.S. Department of Energy.
[5] The wheels are based on data from the following paper: Morris, J., A. Sokolov, A. Libardoni, C. Forest, S. Paltsev, J. Reilly, A. Schlosser, R. Prinn and H. Jacoby (2021), A Consistent Framework for Uncertainty in Coupled Human-Earth System Models.

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