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WORLD ENERGY MARKETS OBSERVATORY

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23rd Edition 2021

Climate Change
Global Perspective

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Climate Change Global Perspective

After the disastrous summer of 2021, and as temperatures continued to increase at a steady rate, the decarbonization of the economy must accelerate at an unprecedented rate

- **Summer 2021 provided an alarming foreshadowing** of the diversity of future climate disasters, with heat domes and raging wildfires in North America, Greece, and Turkey, while deluges and deadly floods struck Germany, Belgium, India, and China.

- **At 1.02°C over pre-industrial levels, 2020 was the warmest year on record** (tied with 2016), and the temperature is inching closer and closer to the 2100 1.5°C threshold set by the Paris Agreement.

- The 1.5°C threshold will be met before 2040. To ensure a 66% chance of stabilizing at 1.5°C with little or no overshoot,[1] the IPCC model pathway requires a **45% reduction** of all greenhouse gas (GHG) emissions (down to **25 GtCO2e/year**) by 2030. Equilibrium between sources and sink of GHG (net zero) is required by 2050.

- The challenge at hand, as stated in Kaya's equation, is to decrease the GHG content of energy (decarbonate), lower the energy intensity of economy (save energy), and invent new GDP and well-being business models.

$$GHC = \frac{GHC}{Energy} \times \frac{Energy}{GDP} \times GDP$$

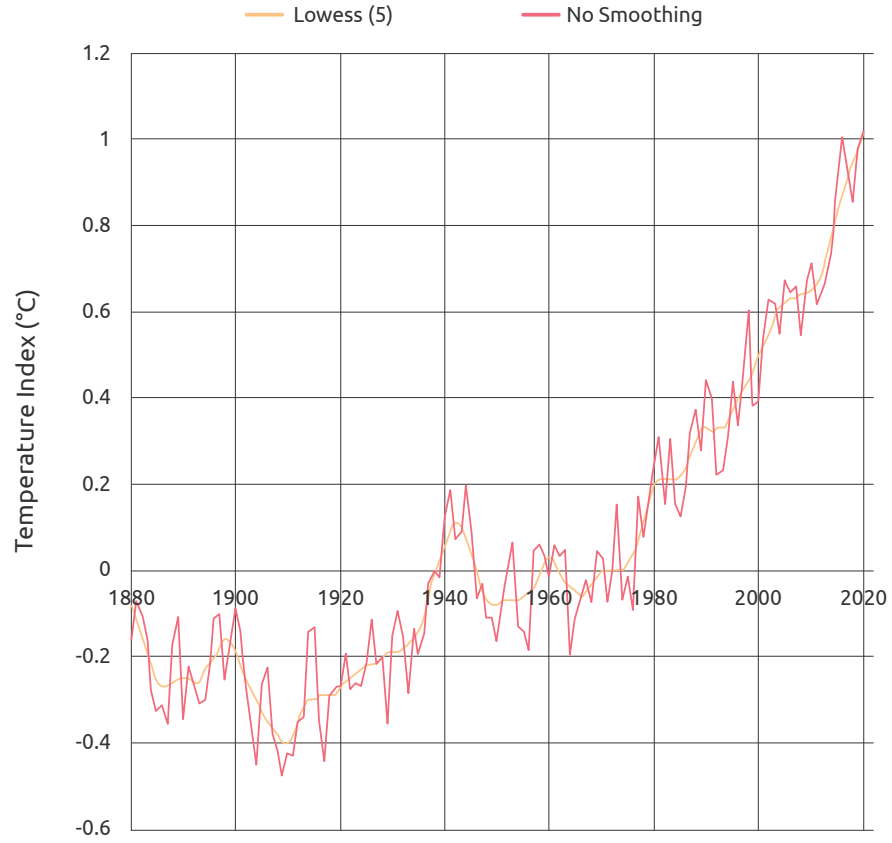
- **The global economy's GHG intensity must fall by 7.6% each year (5.2% for a 2°C pathway).** This is assuming a yearly GDP steady growth of **~2.5%**, which was the average value for the past decade (setting aside the 2020 outlier). In 2019, the global GDP reached a historic high at $87.7 trillion before undergoing an unprecedented drop in 2020.

- Meanwhile, there are now strong signs of an economic recovery; May 2021 witnessed the highest GDP growth rate in the past 15 years. The need to reduce the GHG intensity of the economy is hence more acute than ever.

1 IPCC : Special Report: Global Warming of 1.5°C

FIGURE 1

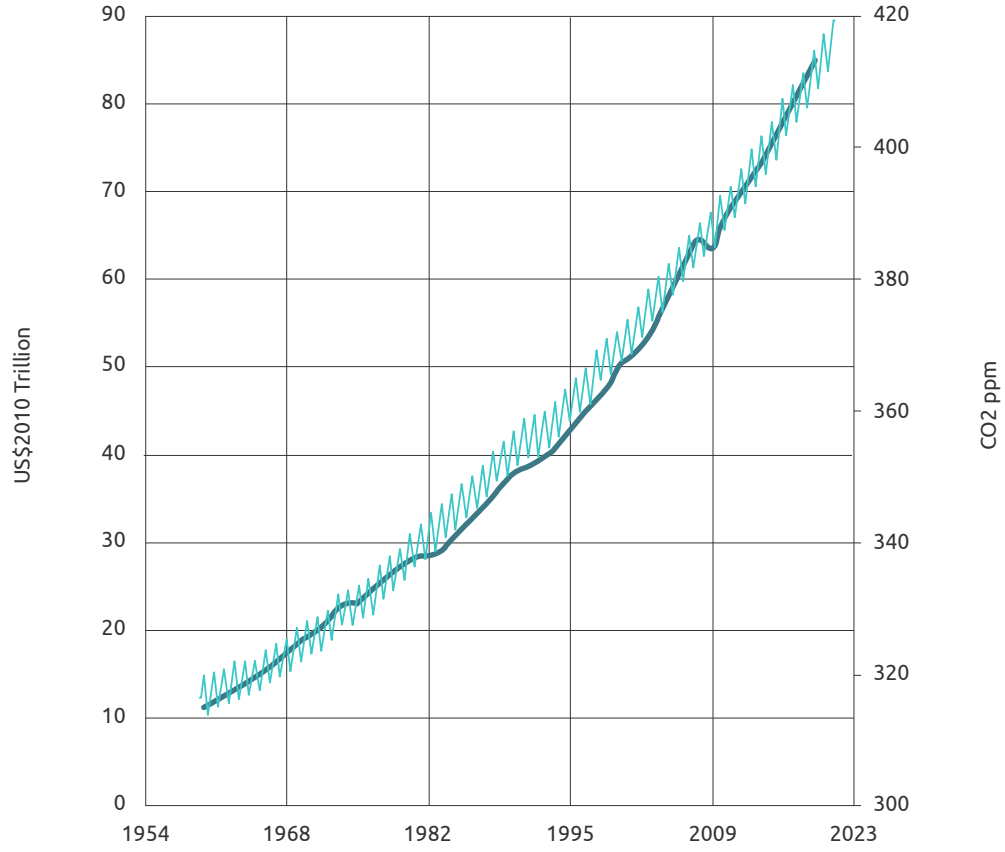
Average global temperature



Source: NASA (2021)

FIGURE 2

Global GDP compared to atmospheric CO2 concentration



Source: World Bank (2021), Global Monitoring Laboratory (2021)

To remain below 1.5°C, the CO_2 intensity of energy production must decrease annually by 6%, ten times more than the average intensity decrease observed over the past decade (0.6%)

- **Energy represents 73%** of all greenhouse gas emissions[2]. Its global consumption has increased by 1.9% annually in the past 20 years.[3]

- **A 6% annual decrease** (-3.7% for a 2°C pathway) of the carbon content of energy is necessary over the next ten years at the current rate of decoupling between energy and GDP (-1.6%/year[2]). In the past ten years, the annual decrease of the carbon content of energy was 0.6%.

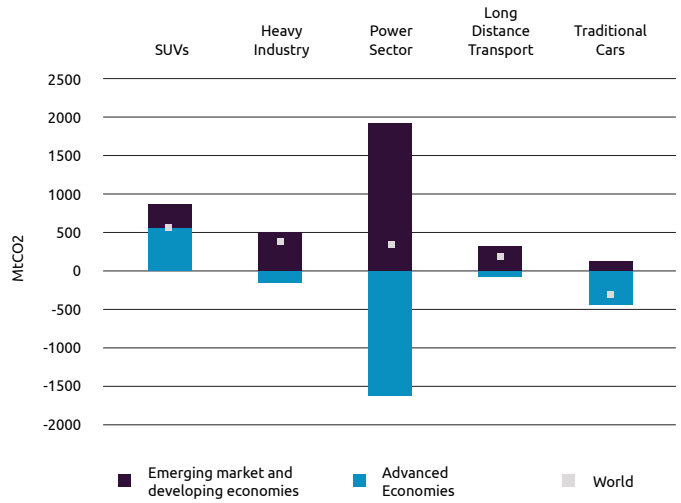
- **There is still a dynamic of absolute increase of emissions.** Gains in many sectors in advanced economies negated by the development of emerging markets. This increases the relative importance of emissions in Asia, a continent still largely dependant on coal power generation. In advanced economies, the automotive SUV sector emissions alone increased by 0.57 $GtCO_2$ in 2020, while a total decrease of 1.7 $GtCO_2$ was needed globally for the energy sector; this showcases the challenges ahead.

- **However, energy-related emissions dropped to 31.5 Gt of CO_2 in 2020 during the pandemic.** This was done at the cost of a 3.9% decrease in GDP.[4] During this time, the absolute concentration of GHG in the atmosphere still went up.

- There will be no way to reach net zero without a significant global move towards massive energy savings and the decarbonization of energy production.

FIGURE 3

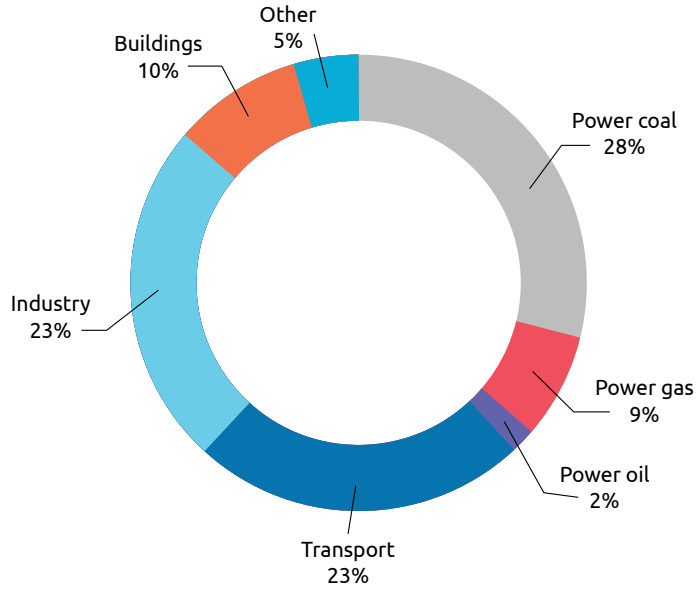
2019-20 Emission evolution by sector



Source: IEA, 2021

FIGURE 4

Global energy-related CO2 emissions by sector

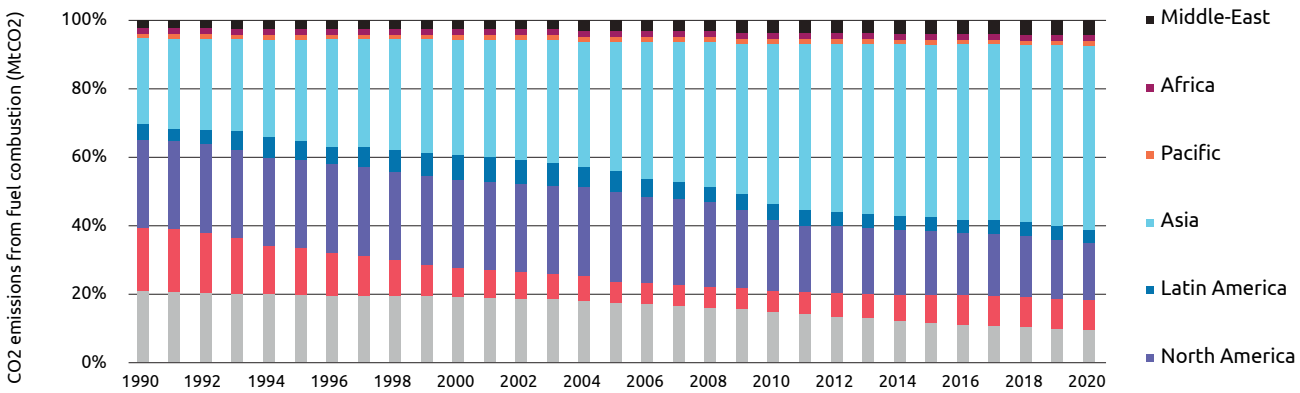


Source: IEA, 2021

2 IEA
3 Enerdata
4 IMF World economic outlook

FIGURE 5

Energy related emissions by region



Source: Enerdata, 2021

The historical 2020 drop in GHG emissions doesn't reflect real decarbonization.

Despite the profound impact of the pandemic on economies and lives around the world, it is not enough to put the planet on the road to 1.5°C.

In 2020, the COVID pandemic led to 5.8% GHG emissions reduction – although it comes at the expense of a major economic downturn – revealing the need for deep changes in order to make this level of reduction economically sustainable

- An analysis of the lockdown measures undertaken by different regions to address the **COVID-19 crisis illustrates the magnitude of the global effort that would be necessary in order to achieve carbon neutrality.**

- During this period, the intensity of the **lockdowns varied significantly, not only between geographical areas but also in duration.** In April 2020, 89% of CO_2 global emissions were produced in areas subject to some level of confinement (Fig 6).

- These lockdown policies resulted in a **significant reduction in activity.** In general terms, aviation and surface transportation were the activities most impacted (Fig 7), although the extent of the decrease depended on local policies.

- In addition, it was observed that the same policies **had different impacts on CO_2 generation depending on the local context:** Urban / rural; Residential / Industrial; etc.

- The **reduction in activity significantly improved the levels of air pollution** such us NO_2, SO_2, etc. In general terms, the **global CO_2 reduction was approximately in line with requirements to meet carbon neutrality targets.**

- Two main conclusions can be taken from this analysis:
    1. In the absence of massive structural changes, **the economy would suffer a huge blow if activity reduction were the only path to meeting climate objectives.**

    2. **It is imperative to develop profitable technologies to transform the economy** toward a more sustainable model.

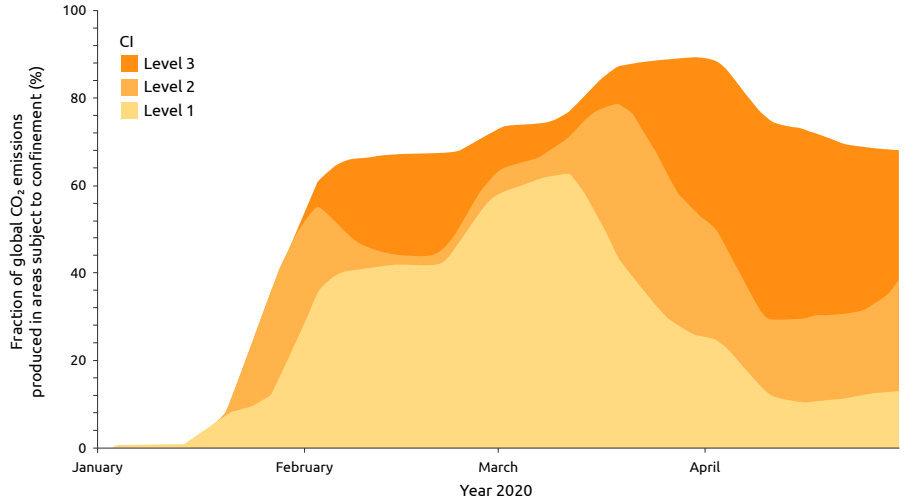
The global activity reduction due to the COVID-19 crisis resulted in CO_2 reduction rates that should be sustained in the long term to meet carbon neutrality targets.

However, in the current economy and energy system structure, the cost of this reduction is not viable.

It is imperative to develop profitable technologies to meet carbon neutrality targets and reshape businesses' operations.

FIGURE 6

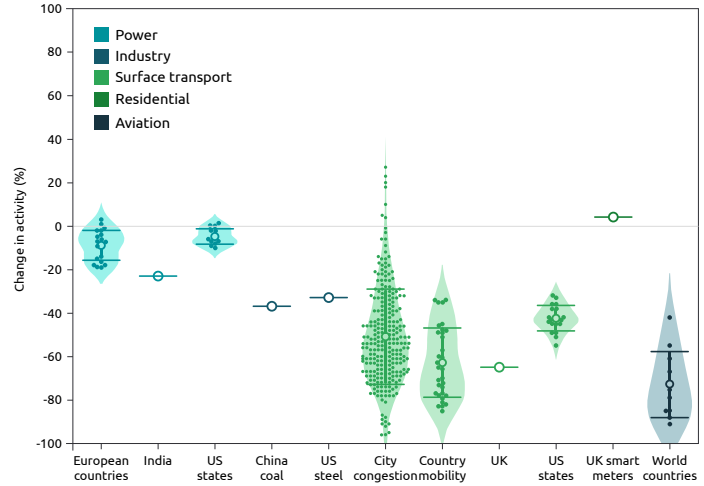
Fraction of global CO_2 emissions produced in areas subject to confinement



Source: Le Quéré, C., Jackson, R.B., Jones, M.W. et al. Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nat. Clim. Chang. 10, 647–653 (2020). https://doi.org/10.1038/s41558-020-0797-x

FIGURE 7

Change in activity by sector during confinement



Source: Le Quéré, C., Jackson, R.B., Jones, M.W. et al. Temporary reduction in daily global CO2 emissions during the COVID-19 forced confinement. Nat. Clim. Chang. 10, 647–653 (2020). https://doi.org/10.1038/s41558-020-0797-x

Current pledges and targets from the countries responsible for 70% of global emissions are still far from achieving the 1.5ºC target of the Paris Agreement

- Since the Paris Agreement in 2015, the GHG theoretical scenarios based on the pledges made by governments are improving. Nevertheless, **they are not yet reaching the 1.5°C target.** The global temperature is currently about 1.2ºC above pre-industrial levels.

- **The policies currently in effect will raise the global temperature to +2.9°C.**

- **Pledges and targets set in the last year could slow the temperature increase to 2.2ºC.** As of April 2021, 44 countries plus the European Union have compromised to reduce their emissions to meet the net-zero target. In other words, **the nations responsible for 70% of the global CO_2 emissions are committed to net-zero emissions target.**

- The **optimistic scenario of +2°C** includes previous announcements made by the U.S. and China committing to net-zero targets as well as the pledges made by Brazil, Kazakhstan and Panama, among other countries.

- According to the IEA, to achieve the Net Zero Emissions (NZE) scenario and keep the limit to 1.5ºC, much work is needed. **Countries need to strengthen their 2030 nationally determined contribution (NDC) targets.**

- Those countries that submitted NDC targets that are not track to reach the 1.5ºC target should reconsider their efforts and attempt to align.

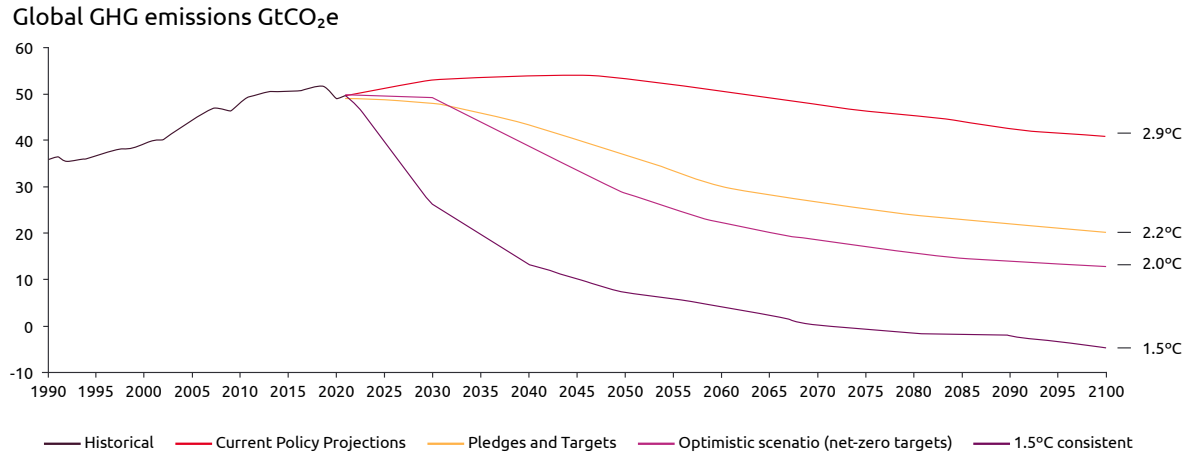
- **China (which represents 25% of global emissions share)** has not officially submitted its NDC, which makes it possible for leaders to consider strengthening their current unofficial plan.

- South Korea and New Zealand have promised to update their NDC.

- The following countries are currently submitting targets that are **less ambitious** than their first NDC: Russia, Brazil, Mexico, Australia, Singapore, and Vietnam.

FIGURE 8

2100 Emissions and expected warming scenarios



Source: Climate Action Tracker (2021)

- In the NZE scenario, CO_2 emissions would fall to 40% until 2030 and to net zero in 2050. It includes a **75% reduction in methane use** by 2030, while **solar energy would become the primary energy source** by 2050, providing nearly 70% of global demand.

- Developed countries with strong NDC targets will also have to scale up their climate finance if the 1.5ºC target of the Paris Agreement is to be met.

https://climateactiontracker.org/documents/829/CAT_2020-12-01_Briefing_GlobalUpdate_Paris5Years_Dec2020.pdf

https://climateactiontracker.org/documents/853/CAT_2021-05-04_Briefing_Global-Update_Climate-Summit-Momentum.pdf

https://climateactiontracker.org/documents/790/CAT_2020-09-23_Briefing_GlobalUpdate_Sept2020.pdf

https://iea.blob.core.windows.net/assets/beceb956-0dcf-4d73-89fe-1310e3046d68/NetZeroby2050-ARoadmapfortheGlobalEnergySector_CORR.pdf

5 https://www.iea.org/data-and-statistics/data-product/net-zero-by-2050-scenario
6 https://www.iea.org/reports/world-energy-model/sustainable-development-scenario
7 https://www.iea.org/fuels-and-technologies/hydrogen

Key levers to achieve global Net Zero ambitions by 2050 combine mature and industrialized solutions with emerging technologies - all of which require new infrastructures and huge scaling up

- **According to IEA's Net Zero Emissions (NZE) report[5], a blend of existing mature and novel solutions could enable CO_2 emission neutrality by 2050.** This not only implies achieving the SDS ambition to hold the temperature rise below 1.8°C[6], but doing so by following a path that may hinder climate change progress in the coming century.

- **Renewables such as wind, solar, and bioenergy will continue to be the most prominent solutions to reduce emissions until 2030,** mainly due to the polluting nature of today's power generation landscape. This trend is expected to wane given the impact of high shares of RES on supply security – unless dispatchable RES and energy storage exceed forecasted growth.

- **Hydrogen's potential relies on the ability to scale owing to its numerous applications.** Nowadays, its production accounts for 6% natural gas and 2% coal use, thus being responsible for 830 MtCO2 per year.[7] Scale-up is crucial to lower costs for electrolyzers and to reduce the price of green hydrogen.

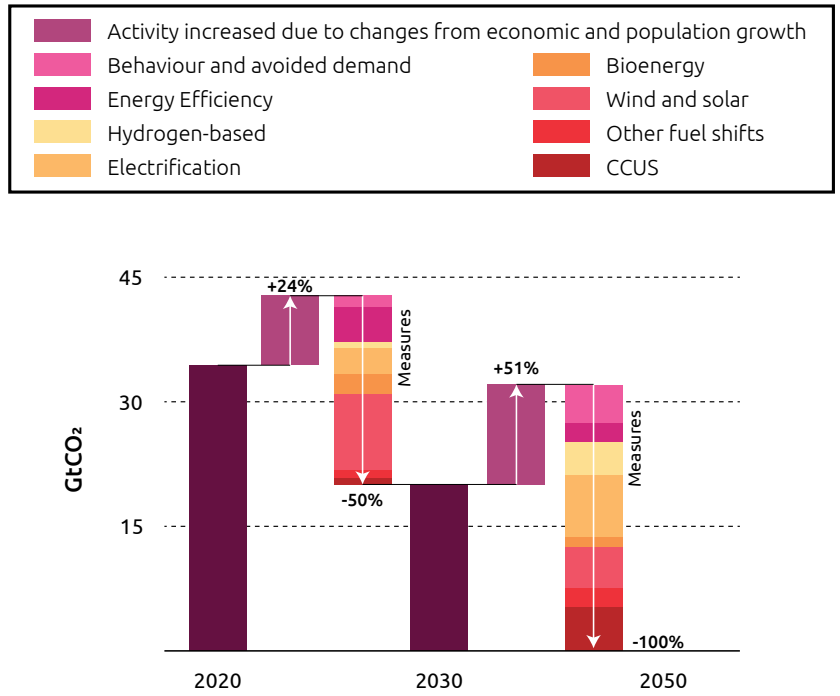
- **Currently, energy efficiency is the most comprehensive solution to reduce emissions, yet it will be overtaken by electrification after 2030.** Efficiency will particularly impact fuel usage in transport and heating/cooling consumption in the building sector.[1] This role will be taken over by electrification, leveraging a less carbon-emitting power supply, and having a cross-cutting impact on industry, buildings, and transport.

- **As opposed to other solutions, CCUS takes advantage of traditional assets, though** its true potential is expected to be harnessed only after 2030. Most suitable applications can be found in cement manufacturing and thermal power plants[1], but it also synergizes with the traditional hydrogen industry to produce so-called "blue" hydrogen.

- **It is important to acknowledge that NZE ambitions will ultimately rely on citizens' behavioral change and consumption habits.** Reducing energy demand at the very end of the value chain will become increasingly important as behavioral changes must take place gradually.

FIGURE 9

Emissions reductions by mitigation measure to reach Net Zero Emissions in 2050 (NZE scenario)



Sources: Net Zero by 2050 Report - IEA May 2021

RES such as wind, solar, and bioenergy will play a major role in energy transition in the coming years.

However, the focus now needs to be put on decarbonized heat, electrification, green hydrogen, CCUS, energy savings in all sectors, and behavioral change in order to achieve Net Zero by 2050.

Carbon pricing and markets: The coverage of global GHG emissions by carbon pricing tools increased by 6.6%, led by momentum in climate commitments, though volumes are still limited when compared to the Paris Agreement's aims

- As of July 2021, **41 countries have enshrined net-zero targets**[1] in laws or policy documents, or have proposed legislation to do so, despite the global pandemic. Most of these jurisdictions aim to achieve carbon neutrality by 2050, though China and Ukraine are shooting for 2060 and some European nations envision earlier dates.

- As of April 2021, **21.7%**[2] **of global GHG emissions were covered by carbon pricing tools such as a carbon tax or an Emissions Trading System (ETS)** in 45 countries and 35 subnational regions, as compared to 15.1% in 2020.

- This 6.6% increase is **largely due to the launch of China's national ETS in February 2021,** becoming the world's largest carbon market with a plan that regulates around 4,000 $MtCO_2e$ per year. The launch of an extended U.K. ETS, following its departure from the EU, and Germany's national fuel ETS, including all fuel emissions not regulated under the EU ETS (mainly heating and road transport), also contributed to this increase.

- **Unfortunately, only 3.8% out of the 21.7% of global GHG emissions in 2021 are covered by a carbon price above $40/tCO_2e,** recommended to be Paris compliant. Indeed, while welcoming the fact that a clear convergence towards carbon scheme can be observed worldwide, there is still a huge range of carbon prices, going from less than $1 to $137/$tCO_2e$ in 2021.

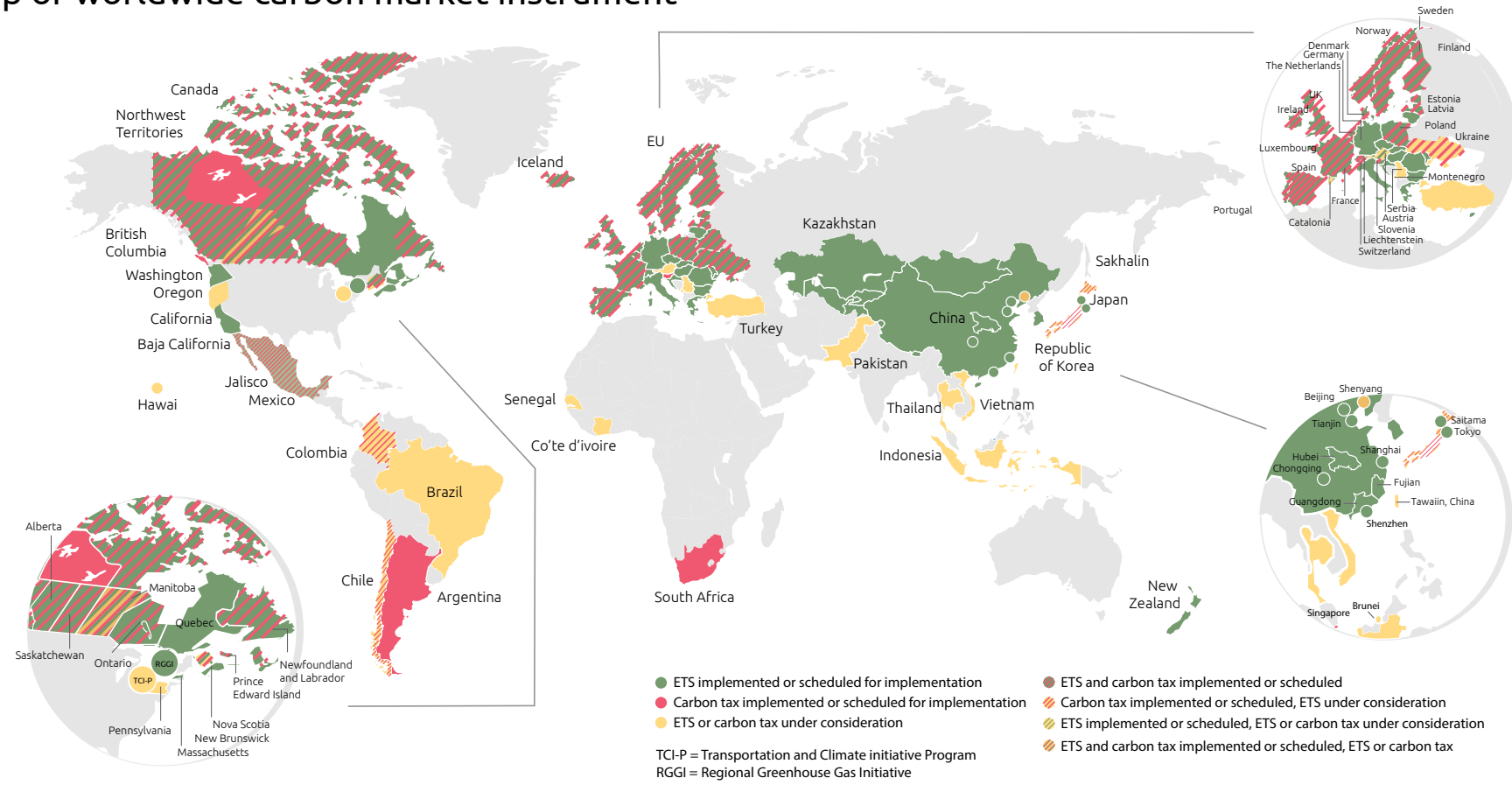
- With **$53 billion** in 2020 for **11.7$GtCO_2e$ covered,** global revenue generated by carbon pricing **instruments increased by around $8 billion** compared to 2019. This is mainly due to the increase **in the EU allowance price reaching $50/$tCO_2e$** today (while it was around $30 in 2020). 51% of 2020 revenues stemmed from carbon taxes, while the other 49% were generated by carbon quotas. It was respectively 53% and 47% in 2019.

- **Regarding voluntary carbon markets (Verra, Gold Standard, etc.), the 6% increase in 2019 up to 0.104 $GtCO_2e$ market volume and $0.320 billion**[3] **market value seemed encouraging. To reach the 1.5°C goal, voluntary** markets will likely need to expand more than fifteen-fold to hit around 2Gt by 2030. This derives from a rapid increase in companies' and countries' needs for carbon offsets that could generate a demand-supply gap. As demand grows, prices currently at their lowest ($1-5/$tCO_2e$) should increase and lead to growing offset supplies fostered by rising economic viability.

1 Net Zero Emissions Race (Energy & Climate Intelligence Unit)
2 State & Trends on Carbon Pricing, Carbon Pricing Dashboard (World Bank)
3 State of the Voluntary Carbon Markets 2020 (Ecosystem Marketplace)

FIGURE 10

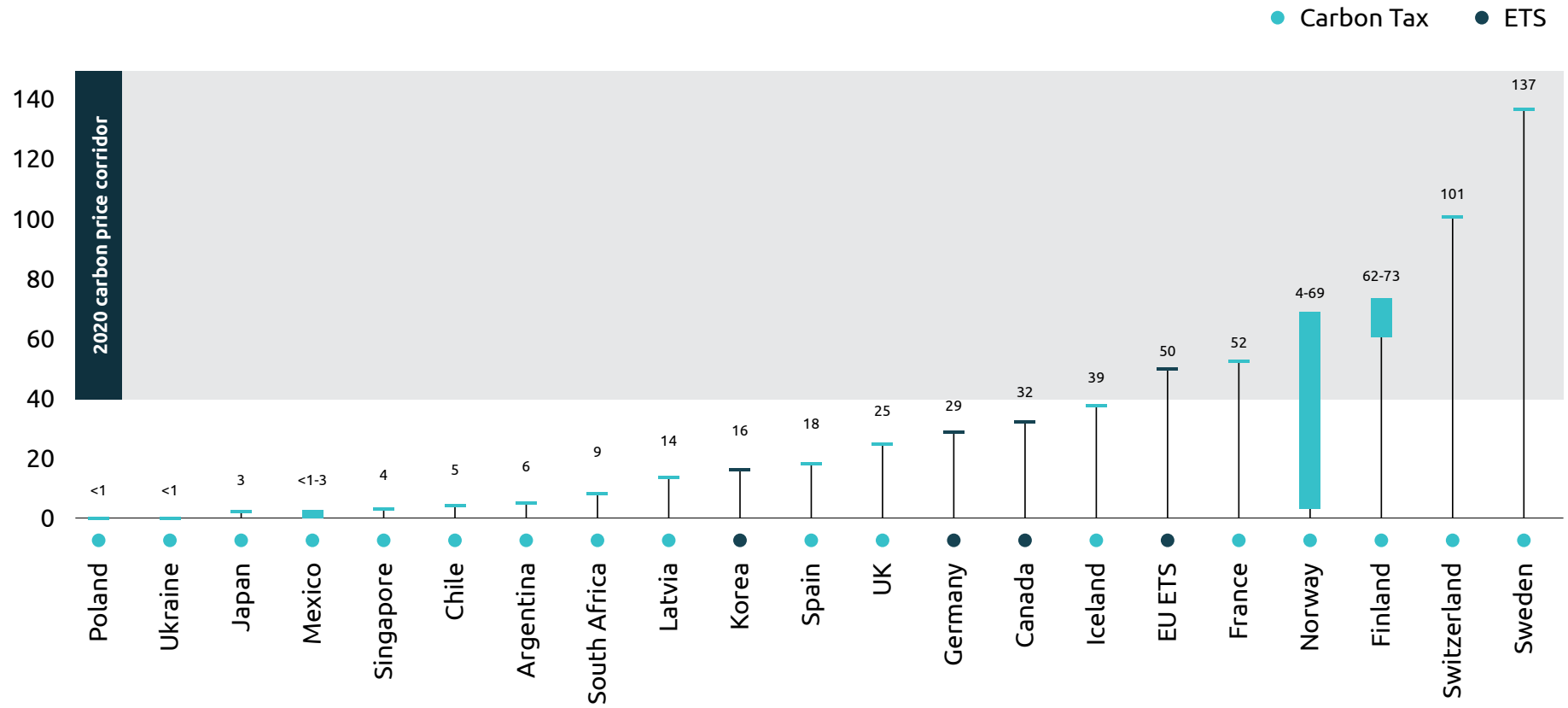
Map of worldwide carbon market instrument



Source: World Bank, 2021

FIGURE 11

Current carbon pricing (in USD/tCO2e)



Sources: World Bank 2021

The new reality for carbon markets is founded upon lessons learned from the former Kyoto Protocol's flexible mechanisms; most modalities nevertheless remain to be agreed upon in 2021-2022

	Kyoto Protocol (KP)	Paris Agreement (PA)
Signatories & GHG Coverage	36 mitigating countries that covered 21% GHG global emissions. Signatories divided into 2 categories: Annex I countries (AI) with emission-reduction/limitation commitments and non-Annex I (NAI) with no quantified mitigation requirements.	194 signatories that cover 98% GHG global emissions. Compelling headway as it brought for the first time almost all nations to adopt emissions limitation commitments. Difference between AI and NAI countries no longer stands.
Legal Agreement	Strong legally-binding agreement with overt penalties for non-compliance. Weakened by low demand due to low political will, first embodied by the U.S. non-ratification, then by the lack of comprehensiveness between mitigating and ratifying countries.	Seen as a voluntary, periodic pledge-and-review system with weak enforcement mechanisms. It is an executive agreement and no longer a treaty mandated under international law. "Softer" agreement but expected to foster collective goodwill and increase confidence to mitigate global emissions.
Targets	AI countries had clearly defined historical baselines and targets: 5.2% reduction compared to the 1990 level for the period 2008-2012 and 18% reduction compared to the 1990 level for the period 2013-2020 (Doha Amendment).	PA made it compulsory for countries to publicly communicate their national climate action plans, called **NDC** (Nationally Determined Contributions). But targets are now voluntarily set for a given period and can be of different natures, making them hard to compare.
Carbon Mechanisms	3 carbon instruments were used under KP: **IET** (International Emission Trading), **CDM** (Clean Development Mechanism) and **JI** (Joint Implementation). They enabled the trade of carbon allowances and credits between AI countries (AAUs under IET and ERUs under JI) and credits between AI and NAI countries (CERs under CDM). CDM and JI were baseline-and-credit project-based mechanisms, while IET was a cap-and-trade system.	Two new mechanisms replaced the three created under KP: CA (Cooperative Approaches) and **SDM** (Sustainable Development Mechanism). **CA** allows mechanisms operated by governments, NGOs, or corporations to transfer and account for international emission reduction units through ITMOs. SDM is a baseline-and-credit, project-based system considered an upgraded CDM, which owns broader international decisions and enables an indirect connection between emission reductions and (sub)regional or national ETS.

	Kyoto Protocol (KP)	Paris Agreement (PA)
Governance	CDM and JI were overseen respectively by the CDM EB and the JISC. IET had no dedicated supervising body. Its operations followed CMP rules and a UNFCCC international transaction log (ITL) authorized unit transfers between national registries.	The new logic is to minimize politicization. CA is described as a decentralized system allowing for bottom-up linkages governed by CMA rules. SDM is a centralized mechanism that will be overseen by a new UNFCCC body, similar to CDM EB.
Environmental Integrity	**Additionality:** Under CDM or JI, criticism was raised regarding the difficulty of proving that an offsetting credit was perfectly measurable and additional. That means the emission reduction would not have occurred without the project that generated the credit. In parallel, setting a baseline not sufficiently stringent in a cap-and-trade system like IET could have generated a surplus of emissions permits. In both cases, usage of credits and allowances could have resulted in a net increase in global GHG emissions and threatened the environmental integrity of the agreement.	**Double-counting:** While bringing more flexibility to carbon markets, PA appears to be even more ambiguous than KP by offering a large range of potential linkages across different instruments (carbon taxes, ETS, green and white certificates, etc.) and jurisdictions (multilateral, national, subnational). By doing so, it leaves open the door to double-counting risks. Thus, the CMA needs to clarify the broad accounting framework for ITMOs through transparent governing rules and an adequate corresponding adjustment to ensure environmental integrity and foster sustainable development.

Both at COP24 in Katowice and COP25 in Madrid, negotiations broke down and parties failed to agree on the precise rules that will govern international cooperation and carbon markets. Therefore, as new carbon mechanisms came into force in 2020, the global conceptual framework was already built, but no specific obligation to pledge for an improved NDC target was defined; neither was the detailed rulebook to operationalize the new carbon market instruments created by the Paris Agreement.

2021 is a crucial year regarding the climate change global governance, with ambitious COP26/CMA3 goals, reinforced regional commitments, and the establishment of a new carbon market era

- **The most eagerly awaited climate change-related event of 2021 is the next United Nations Climate Change Conference,** also known as COP26/CMA3*. After being postponed in 2020 due to the COVID-19 pandemic, it will take place in two rounds: the Pre-COP in Milan at the end of September 2021 (to launch preliminary negotiation rounds) and the actual summit in Glasgow in November.

- **The summit's first success lies in achieving pre-COP26 objectives, as requested by the Paris Agreement. But the UNFCC already warned that:**
  - Governments' climate actions plans fall far short of what is needed to limit global warming to 1.5°C by 2100, according to the NDC synthesis report published in February 2021.
  - Developed nations' 2010 pledges to mobilize $100 billion in climate finance every year until 2020 have not yet been met.

- **Thus, high expectations hinge on the COP26's official negotiations[1] to:**
  - Raise ambitions in countries' NDCs and back them up with concrete action on a common timeframe.
  - Ensure COVID-19 recovery plans worldwide are in line with the Paris Agreement and the Sustainable Development Goals.
  - Establish detailed rules for international carbon market mechanisms under Article 6 of the Paris Agreement: How will ITMOs be defined and generated, and by which body? Can the old CDM credits still be used to meet new targets? How to prevent double-counting of emissions reductions by multiple entities? How to interface regulated markets and international transfer of voluntary offsets?
  - Create a dedicated loss and damage funding mechanism for vulnerable countries.
  - Integrate Nature-Based Solutions (NBS) into the Paris implementation strategy.
  - Extend the yearly delivery of $100 billion from developed to developing countries in the period from 2020 to 2025.
  - Set new post-2025 goal for global climate finance.
  - Foster global commitment to urgently stop investing in unconventional hydrocarbons, oil, and gas by 2021, 2025 and 2035, respectively.
  - Endorse coal phase-out by 2030 in OECD countries and by 2040 elsewhere.

- **Despite seemingly ambitious objectives,** doubts remain among skeptics regarding the COP26's ability to enforce more restrictive measures while embracing most countries, unlike previous multilateral negotiations. For some experts, significant progress is now more likely to be achieved on the smaller scale than on an international level.

- **Besides formal negotiations, industry-specific and cross-sectoral side-events are also planned before, during, and after the COP26** and have proven to be a true source of climate change commitments. For instance:
  - **The Race to Resilience campaign,** launched in January 2021, brought together cities and corporate stakeholders (especially insurance companies) in adopting climate risk.
  - **The 2050 Climate Ambition** gathered 40 of the world's leading cement and concrete companies (among the GCCA) to set a carbon-neutral target for 2050.
  - **The Net-Zero Banking Alliance** encouraged 53 banks to align their lending and investment portfolios with net-zero emissions by 2050.

1 UKCOP26.org

- **Moreover, pledges made by the 3 biggest GHG emitters (50% global emissions altogether) are crucial to ensuring that global mitigation has a chance to be effective:**
  - **China** is called upon to play a more central role in global climate strategy and is expected to announce stronger near-term targets ahead of the COP26. However, current geopolitical tensions about Xinjiang litigations regarding Uyghurs' fundamental rights may undermine China's will to strengthen cooperation on climate change and find global consensus during COP26.
  - **The United States** reasserted its commitments by officially re-joining the Paris Agreement. Their withdrawal was the main pitfall to avoid since the Kyoto Protocol's non-ratification. Current debates on how the Biden plan will integrate the most ambitious measures proposed in the Green New Deal will also be at stake.
  - **The European Union** presented its "Fit for 55" package in July 2021 setting out a dozen climate-related legislative proposals with a primer on EU ETS that entered its 4th phase. Other important measures include the implementation of tougher Carbon Border Adjustment Mechanisms to increase levies on imports of emission-intensive products, hoping it will not exacerbate trade tensions with China.

Glossary

- **AAU:** Assigned Amount Unit
- **CA:** Cooperative Approaches
- **CDM EB:** Clean Development Mechanism Executive Board
- **CER:** Certified Emission Reductions
- **CMA:** Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
- **CMP:** Conference of the Parties Serving as the Meeting of Parties to the Kyoto Protocol
- **COP:** Conference of the Parties
- **ERU:** Emissions Reduction Unit
- **ETS:** Emissions Trading System
- **GCCA:** Global Cement and Concrete Association
- **GHG:** Greenhouse Gas
- **IET:** International Emission Trading
- **ITMO:** Internationally Transferred Mitigation Outcomes
- **JISC:** Joint Implementation Supervisory Committee
- **NDC:** Nationally Determined Contributions
- **SDM:** Sustainable Development Mechanism
- **UNFCCC:** United Nations Framework Convention on Climate Change

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