BUILDING A COMPETITIVE, LOW-CARBON AND CLIMATE CHANGE-RESILIENT ECONOMY

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Abstract: *The effects of climate change are becoming more and more visible; they are already manifesting themselves and are intensifying due to the increasing accumulation of greenhouse gas (GHG). The starting point of the article is the presentation of the situation in which we find ourselves, Europe's commitment in the field of combating climate change, in achieving zero emissions of greenhouse gas.*

The potential to reduce GHG emissions exists, both at the EU level and in Romania. Firm actions are required, both on the part of governments, citizens and the private sector in the direction of their reduction, through new solutions and technologies, and, simultaneously, for practical adaptation to the new realities. We will highlight the challenges that await us.

Keywords: *climate change, reducing greenhouse gas emissions, solutions.*

JEL classification*: Q56.*

Introduction

The effects of global warming are real. To combat climate change and build a strong green economy and society, the focus at EU level is to reduce net greenhouse gas emissions. The EU participates in global efforts to reduce greenhouse gas emissions, aiming to reduce its emissions by 40% by 2030 and 80-95% by 2050, and the European Commission is responsible for reviewing data reported by Member States with on current and projected emissions, as well as proposing EU policies and measures to achieve emission reduction targets.

The EU has proven that it can reduce emissions with economic growth and should do the same under the new 2030 target. For European citizens and the EU, this more ambitious target will mean a cleaner environment, lower health costs , new jobs and a more sustainable diet, increased energy security, greener transport and more energy efficient homes.

The realization of a modernized and resilient European economy envisages: reducing atmospheric pollution by 60% by 2030; improving living conditions and health – EUR 110 billion lower health costs by 2030; clean public transport and reducing pollution; new green, local jobs; cleaner energy; improved energy security and savings of EUR 100 billion by 2030 due to reduced imports; reducing the action burden for future generations.

The 2030 climate and energy framework include policy targets and objectives at EU level for the period 2021-2030.

Key Objectives:

- reduction of greenhouse gas emissions by at least 40% (compared to the level of 1990);

- over 32% share of renewable energy;

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- at least 32.5% improvement in energy efficiency.

All three will contribute to achieving the proposed objective of reducing net greenhouse gas emissions, which is registered as an increased ambition at the level of the whole of Europe.

The transition to climate neutrality requires increasing ambitions in the field of environment, energy and climate, ambitions reflected in the unitary approach provided through the European Green Deal, and implicitly in the update of the 2030 Framework in the field of energy-climate change, which provided for a reduction target to EU level of greenhouse gas emissions of 40% compared to the 1990 level.

The decarbonization process requires a balanced approach to the climate and energy transition effort, both at the industrial and social levels. Thus, the Fit for 55 package of legislative measures, part of the European Ecological Pact, which aims to reduce greenhouse gas emissions by at least 55% by 2030 at the EU level, will represent both a challenge and an opportunity at the level of all member states.

Under the conditions of the new sustainable and resilient approaches from the climate point of view, Romania will have to identify its areas with development potential, which will be able to bring competitive advantages in the medium and long term. In this regard, the present study intends to provide an analysis of the current and existing situation and solutions on the way to building a competitive, low-carbon and climate-resilient economy.

The current situation

It is an important moment. In order to understand how to act, it is necessary to have a clear and real picture of the situation in which we are positioned.

The climate crisis is present, the large-scale climate changes of recent years are of an unprecedented scale in the context of the entire history of mankind, and climate risks are now appearing faster and becoming more pronounced.

It is a pivotal decade for decisions and investments that will define the scale of irreversible changes and losses that lie ahead. In order to achieve the goal of the Paris Agreement, there are still ways to substantially limit future damage, risk and loss, and to enable many options for adaptation, but the window of time in which we can act is rapidly shrinking.

Actions must be focused on measures to mitigate the effects of climate change, requiring the assessment of different alternatives for the decisive years ahead as greenhouse gas emissions continue to be a major problem.

EU emissions (total excluding land use, land use change and forestry (LULUCF)), by pollutant, in 2020 were: 80% CO2, 11% methane (CH4), 6% nitrous oxide (N2O), 2% hydrofluorocarbons (HFCs) and less than 0.2% other substances: perfluorocarbons (PFCs), sulfur hexafluoride (SF6), nitrogen trifluoride (NF3).

CO2 is the greenhouse gas released in the largest quantity, being constantly produced by human activities. Other greenhouse gases are emitted in smaller amounts but trap much more heat than CO2, such as methane which is 80 times more potent than CO2 over a 20-year period.

From a historical perspective, Our World in Data estimates indicate that Romania has a share of CO2 emissions per capita of 0.22% compared to global annual CO2 emissions. (Figure 1)

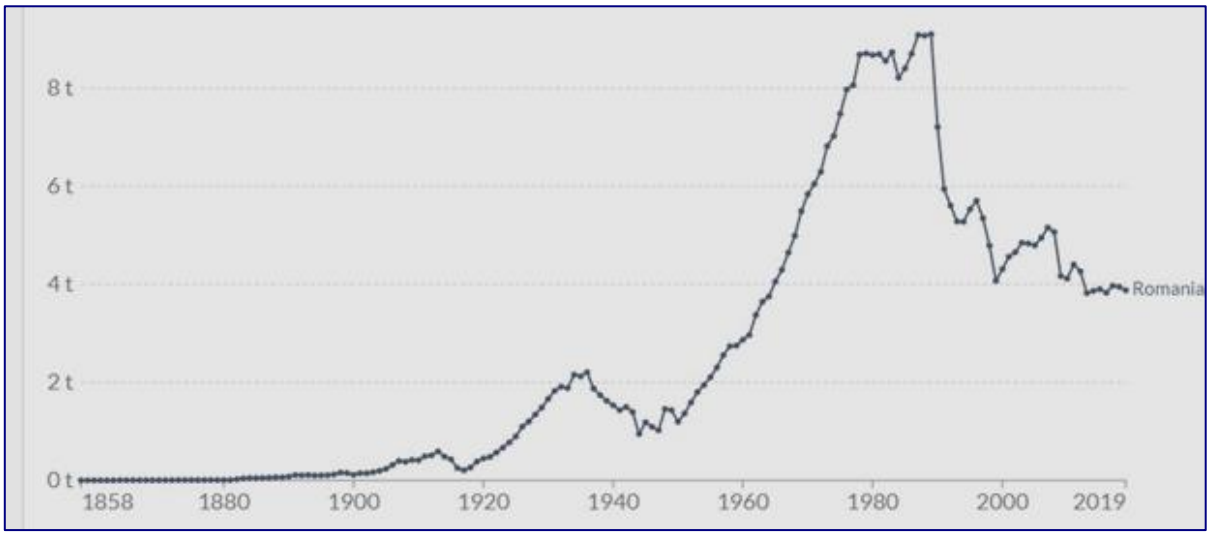

Figure 1: CO2 emissions per capita in Romania

Sursa: Our World in Data based on Global Carbon Project; BP; Maddison; UNWPP; https://ourworldindata.org/co2/country/romania

Note: carbon dioxide emissions from burning fossil fuels for power and cement production were taken into account.

From a historical perspective, a downward trend in CO2 emissions can be observed in Romania.

At decade level, the tendency to reduce GHG emissions can be distributed as follows:

- 1980 – there is a peak in value growth, but with an overall tendency of decreasing emissions (8.68 t);
- 1990 – the downward trend in GHG emissions continues at a higher rate than in the previous decade (7.21 t);
- 2000 – accelerated rate of decrease in GHG emissions (RO: 4.31 t);
- 2017 – the accelerated downward trend in GHG emissions continues (RO: 3.97 t).

- Between 2010 and 2019, global emissions growth was slower than in the previous decade. However, total net greenhouse gas (GHG) emissions are now 54% higher than in 1990, the year international climate negotiations began. (Table 1)

- In developed countries as a group, fossil fuel emissions have fallen by about 10% since 2010.

At least 18 of these have recorded a decade of absolute emissions decline. However, they have remained so high that none have reduced their emissions at the rate required to meet the 1.5°C warming limit.

Tabel1

Total greenhouse gas emissions* at EU level

(kilotons of CO2 equivalent**)

EU member countries	Total greenhouse gas emissions
Belgium	116.651
Bulgaria	55.955
Czech Republic	122.639
Denmark	45.812
Germany	809.799
Estonia	14.699
Ireland	59.778
Greece	85.631
Spain	314.529
France	442,985
Croatia	23.605
Italy	418.281
CYPRUS	8.842
Latvia	11.132
Lithuania	20.368
Luxembourg	10.742
Hungary	64.433
Malta	2.175
Netherlands	180.309
Austria	79.842
Poland	390.745
Portugal	63.470
Romania	*111.767*
Slovenia	17.065
Slovakia	39.948
Finland	53.021
Sweden	50.920
Total	**3.612.361**

Source: United Nations Framework Convention on Climate Change (UNFCCC), 2020. Note:*All sectors except land use, land use change and forestry (LULUCF); **CO2, N2O in C2O equivalent, CH4 in C2O equivalent, HFC in C2O equivalent, PFC in C2O equivalent, SF6 in C2O equivalent, NF3 in C2O equivalent

Tabel 2

The largest emitters of greenhouse gases globally

(kilotons of CO2 equivalent)

Country	Total greenhouse gas emissions
China	13.067.691
US	6.444.396
eu	3.612.361
India	3.346.954
Russia	2.233.876
Japan	1.359.553
Brazil	1.229.246
Indonesia	897.159
Iran	815.652
Canada	779.870
Mexico	770.319
Saudi Arabia	709.787

South Korea	704.272
Australia	658.586
South Africa	581.471
Turkey	510.286
Pakistan	405.400
Thailand	397.109
Argentine	385.223
Kazakhstan	360.129

Source: JRC Report on fossil CO2 and greenhouse gas emissions from all countries of the world, 2020

In terms of EU greenhouse gas emissions in 2019, broken down by main sectors, there are large differences. (Table 3) Tabel 3

Tabel 3

EU greenhouse gas emissions broken down by main sectors*

(%)

Nr.	Section	Greenhouse gas emissions
1	Power	77,01
2	Industrial processes and product use	9,10
3	Agriculture	10,55
4	Waste management	3,32

Source: European Environment Agency (EEA), 2020

Note: * all sectors except land use, land use change and forestry (LULUCF) Percentages do not add up to 100% due to rounding figures used

- Regional differences in per capita emissions remain considerable. In terms of production-based emissions, North America still emits more than Europe and more than ten times more than LDCs. On the other hand, East Asia (China and South Korea) currently emits more than 40% more than Europe per capita, and more than four times more than South Asia. High levels of emissions from land use led to high per capita emissions in Southeast Asia and Latin America.

- Direct and indirect climate legislation has also seen steady progress and is supported by a growing list of financial investors. However, many of the net zero goals are ambiguously defined and the policies needed to achieve them are not yet in place. Opposition, as well as insufficient low-carbon financial flows, are obstacles to the establishment and implementation of strict climate policies that cover all sectors.

In Romania's national report, at the sectoral level, regarding Romania's Greenhouse Gas Inventory 1989-2019, submitted in 2021 to the UNFCCC, the potential to reduce GHG emissions is presented as being distributed as follows:

➢ the energy sector contributed 66.72% to the total national GHG emissions in 2019, having a reduction contribution of 68.50% compared to the base year 1989.

➢ industrial processes and product use represented 11.52% of total GHG emissions in 2019, having a reduction contribution of 71.52% compared to the base year 1989. This reduction trend is associated with the decrease in industrial production at the national level .

➢ the agricultural sector contributed 50.91% to the total national GHG emissions in 2019 compared to the base year 1989, having a reduction contribution of 16.54%. This downward trend is associated with the decline of livestock, the decrease in the area cultivated with rice (from 49300 ha in 1989 to 7430 ha in 2019), the level of crop production and the application of synthetic nitrogen-based fertilizer).

➢ the LULUCF sector has a contribution of absorption/reduction of GHG emissions by 19.88% higher in 2019 compared to the base year 1989.

➢ in the waste sector, GHG emissions increased by 14.53% in 2019 compared to the base year 1989, having a reduction contribution of 5.23%.

Regarding the emission reduction potential of the ETS and non-ETS sectors, the continuation of this trend is observed in the perspective of 2030. (Figure 3)

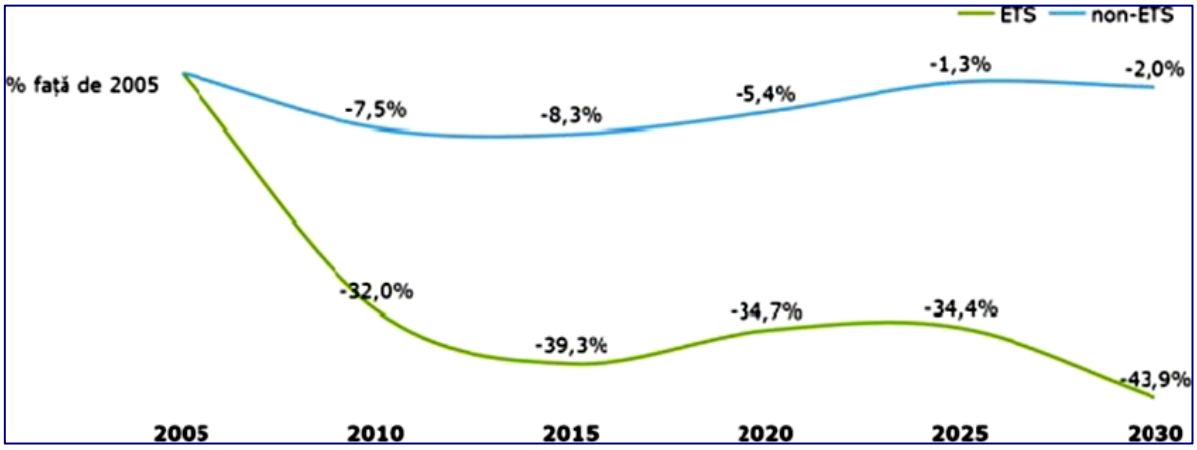

Fig. 3: Historical and projected evolution of emissions from the ETS and non-ETS sectors

Source: National Integrated Energy Climate Change Plan
https://ec.europa.eu/energy/sites/default/files/documents/ro_final_necp_main_ro.pdf

Note: Forecasts were made taking into account available policies

In the perspective of 2030, Romania has been allocated a target of reducing greenhouse gas emissions of 12.7% compared to 2005, in line with the provisions of Regulation 2018/842 on the sharing of efforts (Effort Sharing Regulation - ESR) in the case non-ETS sectors.

In order to achieve the climate ambition and support the potential to reduce GHG emissions, Romania will need the reconfiguration of the national legislative framework, especially in the case of national strategies in different sectors of activity (climate change, energy, transport and mobility).

- Implementing only countries' current emission reduction targets and policies would block compliance with the 1.5°C warming limit. While recent improvements in national targets have

narrowed the gap between required actions and countries' national plans for 2030 by around 15-20%, nationally determined contributions still use up the remaining zero-carbon budget for the 1.5°C threshold until 2030.

- The current fossil fuel infrastructure will emit more greenhouse gases than is compatible with limiting warming to 1.5°C, unless it is phased out sooner or its use is reduced. This underlines the importance of early phase-out, especially of existing fossil-fuel power plants and the cancellation of new ones, as the energy sector is relatively easy to decarbonize. Otherwise, the continued installation of fossil fuel-based infrastructure will "block" the achievement of the proposed targets.

- Progress in aligning financial flows with the objective of the Paris Agreement remains low, and the analyzed climate change financing flows are unevenly distributed between regions and sectors.

The total annual financial flows analyzed for climate change adaptation and mitigation increased by up to 60% between 2013-2014 and 2019-2020, but growth has slowed recently. Climate finance flows from developed to developing countries remain below €100 billion per year, and public and private flows to fossil fuels continue to exceed those to climate change adaptation and their mitigation.

But the actions that had a positive evolution should not be omitted:

- several low-carbon technologies have made rapid progress in terms of cost, performance and adoption – increasing the feasibility of rapid energy transitions. This is the result of a combination of policy instruments that have enabled these cost reductions and supported worldwide adoption.

- the rapid deployment and falling unit cost of modular technologies such as solar, wind and batteries have occurred much faster than experts anticipated and predicted in previous mitigation scenarios. The political, economic, social and technical feasibility of solar energy, wind energy and electricity storage technologies have improved considerably in recent years. Since 2010, the unit costs of solar energy have fallen by 85%, wind energy by 55%, and lithium-ion battery costs by 85%, while the use of solar energy has increased more than tenfold, and that of vehicles electric over a hundred times.

- the levelized costs of solar and wind energy are currently equal to or cheaper than coal and gas, even before considering the damage (externalities) caused by fossil fuels.

- starting with the IPCC Fifth Assessment Report (AR5) - Climate Change Report and continuing with the Sixth Assessment Report (AR6) - Climate Change 2022, there has been significant progress on opportunities to reduce GHG emissions from transport in a way economically efficient due to the electrification of ground vehicle systems that are now available on the market.

- there is a continuing shift in mindset regarding the opportunities for all industries to reach zero emissions, with electrification and hydrogen among the key mitigation options as renewable electricity costs rapidly fall. Regarding demand in the industrial sector, increased attention has been paid to end-use demand, material efficiency and more and better-quality recycling measures.

- also, the development of integrated approaches for the construction and modernization of buildings, has led to the expansion of the number of buildings with zero energy/carbon emissions in all climate zones.

Solutions for building a climate resilient economy

- The situation presented, the identified needs demonstrate the need for large-scale solutions, both at EU and national level.
- To meet the warming target set out in the Paris Agreement, global carbon emissions must be halved by 2030 from current (2019) levels, reaching net zero by mid-century, while all GHGs will reach net zero in 2070-2075. This is consistent with scenarios that limit warming to 1.5°C, with little or no overshoot with at least 50% certainty, and which would most likely stay below 2°C.
- Fossil fuel use must decline rapidly, with the fastest rates of decline required under scenarios targeting the 1.5°C limit, with reduced reliance on carbon dioxide removal and reduced pressure on land and biodiversity and which involve efficient use of resources. By 2050, coal *use in such scenarios would decline by up to 100%, oil by up to 90%, and gas by up to 85% from 2019 levels.*
- *Solutions exist to at least halve global GHG emissions by 2030, with more than half of this potential being no-cost, low-cost (less than $20/tCO2-eq) or negative-cost. This means that some of the options, such as solar and wind power and more efficient mobility and housing, can save money compared to continuing current trends.*
- *Important contributions to closing the gaps for 2030 could be made by: solar and wind energy, improving energy efficiency, reducing deforestation, restoring ecosystems, conserving soil carbon in agriculture and reducing CH4 emissions.*
- *The implementation of immediate and substantial emissions reductions and systemic transformations will be required in all sectors, from energy to urban systems, industry, buildings, transport, land and food systems, and in all these sectors there are solutions.*

To replace the use of fossil fuels, large-scale electrification of various end-uses in all sectors is required.

- *The agriculture, forestry and other land use (AFOLU) sector offers significant short- and long-term mitigation opportunities, while providing food, timber and other renewable resources, as well as biodiversity conservation. In total, they cover about a third of the potential by 2030, at costs below 100 euros tCO2-eq, mostly at low costs (0-20 euros tCO2-eq). If properly implemented, such actions could bring substantial co-benefits and help address many of the wider challenges associated with land management. If used inappropriately, then, together with the increasing need to produce food, animal feed, fuel and timber, they could exacerbate trade-offs in habitat conservation, adaptation, biodiversity and other services and expose millions more at risk of starvation. At the same time, the land's ability to support these functions could be threatened by climate change*
- *By 2050, comprehensive market demand strategies across all sectors could reduce GHG emissions by 40-70% compared to stated policy projections. Such "Avoid, Change and Improve" strategies aim to deliver welfare services (nutrition, mobility, shelter and products) with lower emissions by changing infrastructure design and use, adoption of end-use technology and socio-cultural factors (social norms, culture and behavior) that influence demand.*
- *Rapid and major changes in demand make it easier to reduce emissions for each sector. The greatest potential for "Avoid" comes from reducing long-haul air transport and providing low-carbon urban infrastructure for short-haul. The biggest "Switch" potential would come from switching to a plant-based diet. The greatest 'Improve' potential comes from the construction sector, and in particular from the increased use of energy-efficient end-use technologies and low-energy housing.*
- *Providing better services with less consumption of energy and resources is in harmony with ensuring well-being for all. Demand potential differs from region to region, and some regions need additional energy, capacity and resources for well-being and combating malnutrition.*

- *People with a high standard of living contribute disproportionately to rising emissions and have a high potential to reduce emissions while maintaining reasonable standards of living and well-being. Addressing inequality and many forms of consumption behavior supports efforts to mitigate climate change.*
- *Achieving net zero CO2/GHG emissions at the global/country level involves using carbon dioxide removal (CDR) to offset hard-to-remove residual emissions (e.g. emissions from aviation, agriculture, industrial processes industrial). CDR implementation faces constraints related to feasibility and sustainability, especially at large scale. Currently, afforestation, reforestation, improved forest management, agroforestry and soil carbon conservation are the only widely used CDR methods. Afforestation and reforestation, biomass production for bioenergy with capture and storage (BECCS) and biochar can compete for land, water and other resources, with possible negative outcomes for ecosystem health, biodiversity, livelihoods and food security. CO2 removal and storage through vegetation and soil management can be reversed by human or natural disturbances; it is also vulnerable to the effects of climate change. There are concerns that the prospect of a large-scale CDR could obstruct emissions reduction efforts in the short term, fail to deliver the intended benefit of removing CO2 from the atmosphere sustainably, and have negative side effects.*

We ask ourselves what conditions are required to have the emission reductions mentioned as necessary to be achieved.

- Changing development methods in the direction of sustainability requires transformational changes that disrupt existing development trends. Climate change is the result of decades of unsustainable production and consumption patterns, as well as governance arrangements and political-economic institutions that maintain resource-intensive development models. Changes to these development paths would include technological, systemic and socio-behavioral changes.

- The need for integrated policies, economy-wide approaches and enabling conditions in governance, politics, finance, institutions, innovation, behavior and lifestyle

- Annual investment flows in solutions will need to multiply to achieve the emissions reductions required by 2030.

Current mitigation financial flows (public, private, national/international) are 3-6 times lower than average levels required by 2030 in scenarios limiting warming to 2°C or 1.5°C. Investment differences are largest for the Agriculture, Forestry and Other Land Use (AFOLU) sector in relative terms and for developing countries. When investment needs for, for example, adaptation, loss and damage reduction, general infrastructure and climate-adapted social protection are taken into account, the funding gaps and challenges for developing countries become even greater compared to those for developed countries.

- Implementation of the right incentives.

If investment in coal and other infrastructure using fossil fuels continues, energy systems will be constrained by higher emissions. Also, in terms of urban infrastructure, the construction of new infrastructure and the upgrading of existing ones may result in significant committed emissions by 2030.

- There is enough capital and liquidity worldwide to bridge investment gaps, but barriers, both inside and outside the financial sector, as well as macroeconomic constraints facing developing regions, should be overcome. Obstacles to the use of trade finance include inadequate assessment of climate risks, a mismatch between capital and investment needs, national bias considerations, differences in risk perception, country debt levels, economic vulnerability and limited institutional capacities. Despite growing investor concern and numerous initiatives by regulators and financial institutions to assess and address climate-related financial risks, there is little evidence that this concern has had a direct impact on emissions reductions. Financial institutions and markets continue to largely underestimate the risks, which limits the reallocation of capital needed for the transition to a low-carbon economy.

- Political intervention and leadership capacity remain essential to address uncertainty, which is a fundamental barrier to redirecting financial flows. Existing policy imbalances, including fossil fuel subsidies, undermine the credibility of public commitments and limit the actions of the financial sector. Sending clear signals from governments and the international community, including stronger alignment of public sector finance and policies and higher levels of public sector climate finance, would reduce uncertainty and transition risks for the private sector.
- Eliminating fossil fuel subsidies could reduce emissions by up to 10% by 2030, while improving public revenues and macroeconomic performance, supporting low-income groups and achieving other environmental and sustainable development benefits. A gradual reorientation of existing subsidies to agriculture and forestry would also go a long way towards mitigating the effects.
- Justice and equity are important considerations for effective climate policy and ensuring national and international support for deep decarbonisation, given differences in GHG emissions contributions, vulnerability and impact, as well as capacities in within and between nations.
- Accelerated international financial cooperation is a key enabler for fair and low-carbon transitions and can address fundamental inequalities in access to finance and costs and vulnerability to the effects of climate change. Options include: climate legislation enabling mitigation by providing direction for action, setting targets, mainstreaming mitigation into sectoral policies, increasing regulatory certainty, creating statutory agencies, creating fulcrums for social mobilization and attracting international funds. Both market-based and regulatory policies have distinct but complementary roles.
- Changes in the path of development result, both from sustained political interventions, and from bottom-up changes in public opinion. The collective action of individuals within social movements or lifestyle changes is the basis of system change.
- The number of climate-related disputes is increasing and may affect the outcomes and objectives of climate governance. Since 2015, at least 37 systemic proceedings have been initiated against states challenging a state's global effort to mitigate or adapt to climate change. If successfully resolved, such procedures can lead to an increase in a country's overall ambition to combat climate change. Climate litigation has also challenged governments' permits for high-emissions projects, setting precedents in favor of climate action. Also, the number of climate-related litigation against the private sector and financial institutions is increasing.
- Effective climate governance is based on the involvement of civil society, political actors, local communities, young business people, the workforce and the media. The extent to which different actors are involved influences political support for climate change mitigation and ultimately policy outcomes.

All of the above are presented as solutions from which decision makers are expected to draw conclusions in order to take action.

Conclusions

We faced a common challenge that demonstrated the need to build a competitive, low-carbon and climate-resilient economy. Global challenges require common viable solutions, more than ever.

The goal of reaching zero global carbon emissions by at least halving them by 2030, while also reducing other emissions, represents the minimum milestones for action. States with greater capacity and responsibility must lead by example and support other states in this endeavour.

Governments need to align their targets to 1.5°C, but under current policies we are still heading for a future with a 3°C rise, and finance continues to go towards exacerbating existing problems. No new investments in fossil fuels should be made, and existing fossil fuel-based

power plants should stop their activity as soon as possible. Governments still plan to produce more than twice the amount of fossil fuels in 2030 than would be compatible with limiting warming to 1.5°C. This demonstrates the urgency of aligning 2030 targets, policies, investment plans and financial flows to 1.5°C.
Removing carbon dioxide does not provide a sufficient solution. It is crucial to protect and strengthen the capacity of our forests and soils to sequester more carbon. But given the many uncertainties, barriers and risks, it is not possible to rely on large-scale carbon removal. Our highest priority must be to stop new emissions from entering the atmosphere, rather than relying on a theoretical future effort to eliminate emissions on a large scale.
In order to aim to limit the increase in the global average temperature to 1.5°C, the reorientation of investments will be essential to avoid the deadlock in the field of carbon dioxide emissions. Actions to simulate the ecological attitude - greenwashing, with commitments on "net zero emissions", based on unsustainable offsets, only accentuate the current situation.
We must honor our obligations jointly. Governments of developed countries must meet their climate finance commitments, ensure technology transfer, take the initiative to close the adaptation gap, and truly address loss and damage.

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