B20 BRASIL 2024

INCLUSIVE GROWTH FOR A SUSTAINABLE FUTURE

ENERGY TRANSITION & CLIMATE

POLICY PAPER

CNI Brazilian National Confederation of Industry | B20 BRAZIL SECRETARIAT

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FOREWORD BY THE TASK FORCE CHAIR

The urgency to address the escalating climate crisis has never been more latent. As we navigate a fraught landscape, convoluted by geopolitical challenges and energy security uncertainties, it is imperative to tackle climate change. The commitments under the Paris Agreement aiming to limit global warming to well below 2°C compared to pre-industrial levels are at a critical juncture. Even if every country meets its current commitments, estimations from the IPCC suggest that global emissions will still surpass the 1.5°C threshold. To keep global warming within the 1.5°C limit, the world must cut its current emissions by 40% by 2030. While it is imperative to address the impact of climate change, it is equally important to confront proposed solutions with socioeconomic challenges, acknowledging the necessity for a balanced approach to have a secure, sustainable, and affordable energy transition.

We are witnessing the intensifying impacts of climate change. *From devastating floods to unprecedented heatwaves worldwide, these events starkly illustrate the consequences of inaction. As Chair of the B20 Energy Transition & Climate Task Force, I believe our path forward requires coordinated, concrete, and multifaceted actions.*

Collaboration is essential. *Humanity has never faced a bigger challenge, not even during COVID. Governments, industries, and communities must unite to propel the energy transition forward. This is not a solitary endeavor but a collective responsibility to advance cleaner technologies, enhance energy efficiency and security, and foster innovation. But unlike other moments in history, there seems to be undisputed consensus around the need to fight climate change.*

All solutions must work together *to make the combined effort for a smooth and effective transition to a low-carbon future. No single approach can sufficiently address the multifaceted challenges and the growing global energy demand. Renewable energy sources like solar, wind, and hydroelectric power provide sustainable alternatives, but their intermittent nature requires integration with energy storage technologies and smart grid systems to ensure a reliable supply.*

Biofuels are key in this transition. *Brazil, with its abundant natural resources and expertise in renewable energy, leads the way. Continuing to develop and deploy biofuels like sugarcane ethanol (both first- and second-generation ethanol), biodiesel, and biomethane will significantly reduce our carbon footprint and set a global example. The importance of biofuels cannot be overstated – they offer a competitive, readily available, low-carbon, and drop-in solution to meet rising decarbonization demands while mitigating climate impacts.*

***There is a significant shift in the energy sector's approach**, with a consensus among major energy companies, both traditional and renewable, on the necessity of adopting clean energy solutions globally. This Task Force believes that achieving a low-carbon future while fostering environmental conservation and restoration is only possible through close cooperation between businesses and governments. Additionally, it was our goal to bring to light the paramount importance of approaching the problem from a global perspective, highlighting the need for multilateral solutions to address these issues, while considering regional particularities accurately. Moreover, developing solutions to finance climate solutions is a must, and that includes committing to a global carbon credit market.*

Bearing in mind this context and the B20 Brasil theme, "Inclusive Growth for a Sustainable Future," this Task Force dedicated special attention to identify key areas of action and bring them to this document in the form of policy recommendations. We focused our discussion in three areas:

- *Accelerate the development and use of renewable and sustainable energy solutions to boost decarbonization both in the short (2030) and long term (2050) while ensuring energy security.*
- *Double energy efficiency global improvement average rate through to 2030 while promoting resource efficiency and circular economy.*
- *Promote effective Natural Climate Solutions to mitigate climate change and enhance biodiversity.*

To address these priority areas and ensure access to energy supply, it is essential to consider affordability and energy security as important levers in the pursuit of a fair and accessible energy transition. Emphasis must be placed on multidimensional enablers, such as financing mechanisms, that are necessary to facilitate this transformation. Beyond being flexible and adaptable, it is crucial to identify the most efficient and cost-effective pathways to achieve net-zero emissions. This approach should leverage and enhance the industrial and technological capabilities of each region, as well as the capacity of natural ecosystems to capture greenhouse gas emissions.

Together, through concerted efforts, knowledge sharing, and united action, we can pave the way for a future where businesses drive positive transformation. Let us create a world that is inclusive, sustainable, transcends borders and is prosperous to future generations.

Ricardo Mussa
Chair of the B20 Brasil Task Force on Energy Transition & Climate
CEO, Raízen

FOREWORDS BY THE TASK FORCE CO-CHAIRS

CO-CHAIRS	FOREWORDS
 **Daniel Godinho** Director of Sustainability and Institutional Relations, WEG	*The transition to a cleaner and more efficient energy model is not only an environmental necessity but also a unique opportunity to boost economic development and ensure energy security. Effective policies are essential to promote energy-efficient solutions, renewable energy, and low-emission transport. In this context, energy efficiency should be a priority as the easiest and fastest path for energy transition and decarbonization.*
 **Jean-Pierre Clamadieu** Chairman of the Board of Directors, Engie	*This year B20 in Brazil takes place at another critical point of time. Reaching net-zero emission target is imperative as climate change consequences have become more extreme globally. In order to succeed, all levers must be activated to make this clean energy transition a reality. We must enhance global cooperation to accelerate the development of renewable power and gases, grids, energy efficiency, and flexibility solutions. There is an urgent need to define a mature regulatory environment with the right policies and financing models. Amid geopolitical tensions on energy value chains, maintaining the competitiveness of our economies and people's quality of life remains critical.*
 **José Ignacio S. Galán** Executive Chairman, Iberdrola	*The energy transition is key to reach climate goals and to promote our competitiveness and sustainability with a secured, affordable energy supply. Brazil is the best example that electrification with renewables is the best path. With the right ambition and policies, the G20 can trigger the large investments in renewables, grids, and storage we need.*

CO-CHAIRS	FOREWORDS
 **Jimmy Samartzis** Chief Executive Officer, LanzaJet	*We believe in the urgency to address climate change and to enable the energy transition with actions required today to see a better and different tomorrow. The alignment from the business community on the frameworks and actions necessary to protect our climate gives me hope that we are continuing to make meaningful progress. The strong support for the mechanisms and initiatives needed to advance Sustainable Aviation Fuel, like LanzaJet's, are critical to decarbonize aviation – an industry that connects global commerce, governments, cultures, and families.*
 **Maria Luiza Paiva** Executive Vice President for Sustainability, Vale	*In an adverse global scenario, in which the challenges of a just energy transition are present and increasingly urgent, this Task Force's set of recommendations and monitoring indicators concretely translate the business sector's proposal for the expected and necessary transformation.*
 **Oscar Fahlgren** Chief Investment Officer and Head of Brazil, Mubadala Capital	*Addressing carbon emissions requires a comprehensive global approach rather than region-specific solutions. The private sector and capital markets play crucial roles in redirecting investments towards sustainability goals. It's essential to shift away from investment practices that merely avoid issues, focusing instead on proactive solutions, prioritizing scalable projects that can make meaningful impact.*
 **Paolo Scaroni** Chairman, Enel	*A crucial task of the B20 is to instill a sense of urgency in all those involved in the energy transition. Only in this way will we be able to pragmatically bring ambitions within reach.* *As we move through volatile times, we must accelerate the relevant technologies – with a focus on clean electrification, renewables, and electricity networks – and we must effectively address the economic and political realities that affect their development and their deployment.*

CO-CHAIRS	FOREWORDS
 **Tadaharu Shiroyama** President, Mitsui Gas e Energia do Brasil	*In this honorable year of B20 to be held in Brazil, heavy rain is impacting the South of Brazil. We are experiencing various phenomena throughout the world. There is not a single solution fit to solve all the issues. Multiple solutions need to be sought. I hope the policy paper would contribute to providing some reference for G20 and guidance for COP30 in the coming year.*
 **T V Narendran** CEO and Managing Director, Tata Steel	*In an era of urgent climate action, the complexity and challenge of achieving a fair and equitable global energy transition cannot be overstated. This journey will entail a transformation across economies, requiring significant changes to the way we do business today. We need to push for rapid development of diverse low-carbon solutions, increased investments for commercial-scale implementation, whilst continuing to improve energy efficiency and productivity. The recommendations of this Task Force provide a holistic approach to addressing climate change while fostering sustainable development and energy security.*
 **Zhang Zhigang** Executive Chairman, State Grid Corporation of China	*Dialogue and cooperation are needed more than ever to ensure energy security, drive energy transition, and meet climate goals. Boosted by collective efforts and dynamic innovations, building a new type of energy and power system with a fair and balanced energy governance framework are constructive and viable solutions for inclusive growth and a sustainable energy future.*

RECOMMENDATIONS: EXECUTIVE SUMMARY

Executive Summary

Recommendation 1: Accelerate the development and use of renewable and sustainable energy solutions portfolio to boost decarbonization both in the short (2030) and long term (2050) while ensuring energy security.

- **Policy Action 1.1:** Devise policy schemes, regulations, and incentives to triple renewable energy capacity by 2030, expand grid infrastructure, and accelerate broad electrification, aiming to ensure just, responsible, efficient, and reliable access to energy, working towards Paris Agreement targets achievement.
- **Policy Action 1.2:** Establish mechanisms and initiatives to leverage sustainable bioenergy and biofuel potential and readiness for decarbonization, accelerating the achievement of net-zero emissions while safeguarding food security.
- **Policy Action 1.3:** Enable expansion of other solutions necessary for the transition to net-zero emissions, such as carbon capture, utilization, and storage (CCUS); clean hydrogen; and nuclear power.

Recommendation 2: Double the average annual rate of global energy efficiency improvement through to 2030 while promoting resource efficiency and circular economy.

- **Policy Action 2.1:** Double the average annual rate of global energy efficiency improvement through to 2030 by evolving policies on technical efficiency, investment programs, and measures to increase public awareness.
- **Policy Action 2.2:** Promote efficient use of global resources and circular economy by developing policies considering the entire materials life cycle and fostering financing and awareness programs to enhance the adoption of circular practices.

Recommendation 3: Promote effective Natural Climate Solutions to mitigate climate change and enhance biodiversity.

- **Policy Action 3.1:** Ensure a thriving Natural Climate Solutions (NCS) global market by 2030, widening protection and restoration projects and scaling the international carbon market.

INTRODUCTION

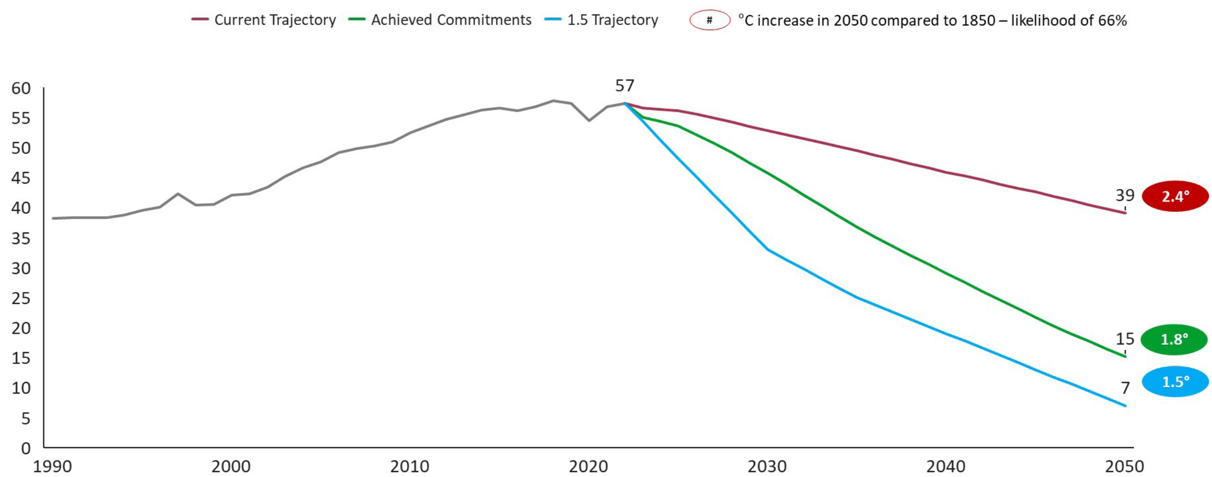
Introduction

The climate crisis and the urgent need for a global and equitable energy transition represent one of humanity's most important challenges in the 21st century. Despite increasing concerted public and private efforts, the global economy needs to catch up in addressing global warming and its associated impacts. To maintain global warming below the critical threshold of 1.5°C, a coordinated collaborative effort is required from various stakeholders, encompassing governments, businesses, institutions, communities, and a vast range of other actors. The complexity of achieving this goal is multifaceted, necessitating a broad range of actions and commitments, including changes in the energy matrix as well as the decarbonization of hard-to-abate sectors (e.g., oil and gas, cement, and steel).

This policy paper is nonexhaustive and concentrates on the changes in the energy matrix, where there is more opportunity for public–private collaboration. Nonetheless, decarbonization is fundamental and should advance, especially in energy efficiency.

In fact, recent data shows that humanity is lagging on the path to net-zero emissions. Despite a temporary decline during the COVID-19 pandemic, greenhouse gas (GHG) concentrations reached their highest levels ever recorded in the atmosphere in 2023[1]. Furthermore, 2023 marked the hottest year on record[1], with average temperatures reaching almost the recommended limit of 1.5°C above pre-industrial levels to prevent severe global warming effects[2]. Even if all countries fulfill their current commitments, estimates indicate that global emissions will still exceed the 1.5°C threshold (Exhibit 1). To limit global warming to 1.5°C, the world needs to reduce its current emissions by around 43%[3] by 2030.

Exhibit 1 – Global GHG historical emissions and average global warming projection, gigatons CO_2 equivalent ($GtCO_2e$)



Source: Emissions gap report 2023: Broken record, UN Environment Programme, November 20, 2023[4]; Global Energy Perspective 2023, McKinsey, October 18, 2023[5]; Global warming of 1.5°C, Intergovernmental Panel on Climate Change, 2018; "Temperatures," Climate Action Tracker, December 5, 2023[6]

The consequences of not meeting the target have already been observed worldwide. For instance, the Arctic region warms 2 to 4 times faster than other locations on Earth, leading to permafrost[i] thawing and releasing methane and carbon into the atmosphere, which means that the permafrost is becoming a source of emissions instead of a carbon sink[8]. According to the World Economic Forum (WEF), by 2050, climate change might cause 14.5 million of deaths and USD 12.5 trillion in economic losses worldwide, both in terms of the health outcomes themselves (mortality and healthy lives lost) and in

i Permafrost is any area of land that remains frozen for at least two years. It can vary from less than a meter thick to more than 1,500 meters think. While in some areas it is simply frozen rock, in other parts, soils and organic matter acted like a sponge and taken in water, which subsequently froze. As ice, water takes up a larger volume than its liquid form, but permafrost creates large pits in the land when it melts[7].

terms of the financial costs to the healthcare system[9] – not to mention losses in terms of biodiversity, cultural heritage, etc. However, although it is a global problem and cannot be addressed effectively with only isolated or local action, the consequences are geographically diffuse. Hence, the price to be paid for "spending" this carbon budget[ii] is not distributed equally – in fact, it tends to significantly impact developing countries and regions that lack the necessary resources to invest in mitigation and adaptation efforts.

According to The Loss and Damage Collaboration group[11], data show that an average, representing 97% of the total recorded number of people affected by these events and 79% of the total recorded deaths[11]. Analyses also show that the number of extreme weather and climate–related events that developing countries experience has more than doubled over this period, with over 676,000 people killed[11]. Even within specific countries, imbalances related to bearing the climate costs exist; the Working Group II's contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) found that across 92 developing countries, the poorest 40% of the population experienced losses from climate hazards that were 70% greater than the losses of people with average wealth[12]. Considering the growing occurrence and intensity of natural disasters, it is crucial to strengthen climate mitigation and adaptation through capacity building to mitigate climate change's social, environmental, and economic effects.

While addressing climate impact is essential, it is also crucial to handle the socioeconomic challenge, recognizing that society demands a balance in secure, decarbonized, and affordable energy. According to the United Nations, in 2022, 685 million people were yet to be connected to the electrical grid, and 2.1 billion were still cooking with unsafe and polluting fuels[13]. It is imperative to ensure a fair energy transition, be just and inclusive while meeting environmental targets, provide access to affordable energy, and enable communities to benefit from it. According to the International Energy Agency (IEA)[14], investments in sustainable energy in emerging markets and developing economies (EMDEs) need to more than triple from USD 770 billion in 2022 to USD 2.2–2.8 trillion per year by the early 2030s. Hence, it is crucial to secure financing for the distribution of accessible and sustainable energy, enabling a fair and inclusive energy transition. To this end, public and private stakeholders should be involved, including governments, high-income countries, private investors, and institutions.

Despite some progress in the decarbonization and energy transition pathway, the world still falls short of achieving balanced strides in the so-called energy triangle by the WEF, which encompasses equity, security, and sustainability, and the complexity increases as affordability, macroeconomic shocks, system resiliency, and geopolitics might pose additional threats to reaching net zero. According to the Energy Transition Index (ETI) framework of WEF, only India and Singapore are currently making advances in all aspects of the triangle. Also according to the WEF, the energy transition window is rapidly closing, and "the limited number of countries advancing across all aspects of the energy triangle highlights the challenges that countries face in progressing along their energy transition pathways"[15]. Hence, G20 countries need to take urgent and concrete action towards this transition as soon as possible.

Albeit demanding efforts from the entire international community, responsibility arises among G20 countries to meet the Paris Agreement goal of keeping the 1.5°C within the limit and delivering the UAE Consensus[iii] from COP28 because they are responsible for 80% of global emissions – even though the G20 houses only 60% of the worldwide population, as estimated by the UN[2]. It is also crucial to reinforce the concept of Common But Differentiated Responsibilities (CBDR) which were formalized in international law at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro. In the CBDR, countries acknowledge the shared responsibility of all nations to address global

ii Carbon budgets set how much carbon in CO_2 equivalents the world can still emit to limit global warming to 2°C or lower. The aim is to reach net-zero emissions as soon as possible – striking an equal balance between the carbon released into the atmosphere and carbon removed from it[10].

iii "The UAE Consensus[16] includes an unprecedented reference to transitioning away from all fossil fuels in energy systems .... Encourages Parties to accelerate 'ambitious, economy-wide emission reduction targets' in their next nationally determined contributions; [o]ffers a new, specific target on tripling renewables and doubling energy efficiency by 2030; [r]ecognizes the need to significantly scale adaptation finance beyond doubling, to meet urgent and evolving needs; [b]uilds momentum towards reform of the global financial architecture, recognizing the role of credit rating agencies for the first time, and calling for the scaling up of concessional and grant finance."

environmental challenges while recognizing their different contributions to environmental degradation and climate change, their economic and technological capabilities, and their developmental needs while seeking to ensure that climate action and environmental protection are pursued in a fair and equitable manner. Thus, developed countries are expected to take the lead in reducing emissions and providing financial and technical support to developing countries, enabling countries in different circumstances to contribute effectively to global sustainability goals.

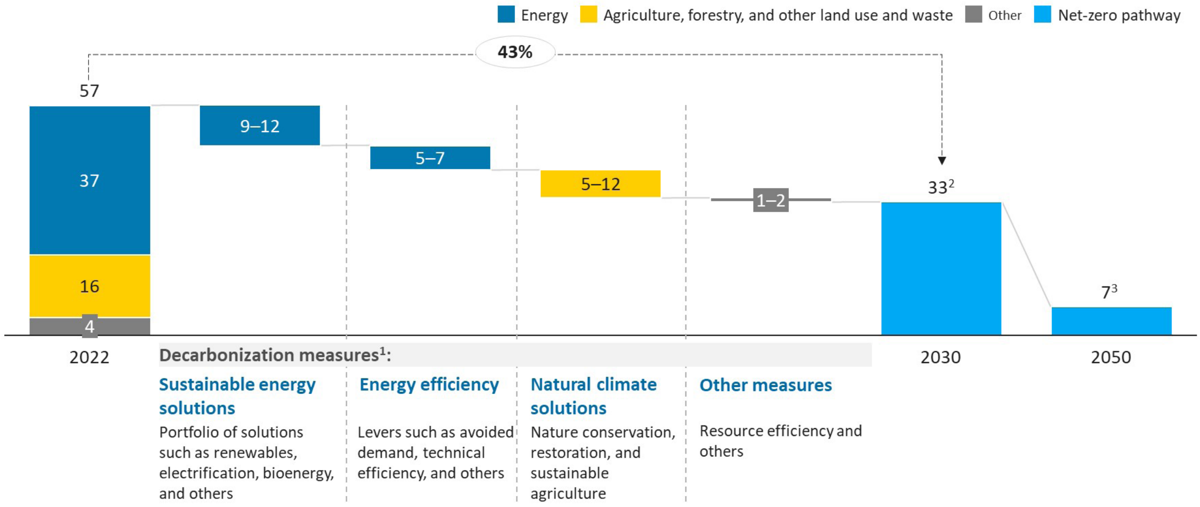
The B20 Task Force on Energy Transition and Climate believes that transforming towards a low-carbon future while promoting environmental preservation and restoration is achievable only when businesses and governments work closely together. Additionally, this Task Force emphasizes the importance of approaching the problem from a global perspective, highlighting the need for global/multilateral solutions to address these issues and finance long-term solutions. The goal is to promote inclusion and effectiveness while avoiding distortions from approaches that result in unbalanced incentives. In this regard, public policies, subsidies, and incentives for emerging sectors should consider regional capacity and characteristics and be accompanied by a precise end date. This approach ensures a gradual transition to the sector's economic independence, preventing prolonged dependence on government support and fostering long-term innovation and competitiveness.

Building on the work of the previous B20 and considering changes in progress in the global scenario, this Task Force has identified three key areas of action: (i) accelerating the development and use of a sustainable-energy solutions portfolio, such as wind (onshore and offshore), solar, sustainable bioenergy, sustainable biofuels, and clean hydrogen[iv], to boost decarbonization both in the short and long terms while ensuring energy security; (ii) enhancing energy and resource efficiency, combining cost-effectiveness, reduced environmental impact, and socioeconomic development (i.e., worker reskilling and transition, job generation, energy access, poverty alleviation, etc.); and (iii) implementing natural-climate approaches to mitigate climate change and enhance biodiversity. To address these priority areas and ensure access to energy supply, it is imperative to consider affordability and energy security towards a fair and accessible energy transition and focus on multidimensional enablers, such as financing mechanisms – especially considering the CBDR concept – necessary to carry out the transformation (beyond being flexible and able to adapt), finding the routes to the net-zero emissions in the fastest and most cost-effective way, leveraging and enhancing each region industrial and technological capabilities, and improving the capacity of natural ecosystems to capture GHG emissions.

A broad spectrum of sustainable solutions is immediately needed to achieve a fair, secure, and affordable energy transition in energy and materials, including, but not limited to, solar and wind power, electrification, sustainable bioenergy and biofuels, geothermal, clean hydrogen, and carbon capture, utilization, and storage (CCUS), each of which varies in importance/weight from one country to another, depending on regional specificities and availability of local resources and taking into account integrated solutions. In addition to scaling sustainable-energy technologies, improving energy and resource efficiency across economic processes, especially in high-emitting activities, is paramount, as is working on information availability and awareness campaigns to motivate consumers and companies to switch to low-emission products. Finally, measures for protecting and restoring natural systems also need to escalate because their impact goes far beyond climate benefits, including water security and soil and biodiversity protection, that reinforce their relevance as options for action (Exhibit 2).

iv Clean hydrogen refers to both hydrogen produced through electrolysis powered from renewable sources (green hydrogen) and hydrogen produced from natural gas in conjunction with carbon capture and storage (CCS) by steam methane reforming (blue hydrogen), ever since methane leakages are minimized to near zero, the carbon capture rates are high, and the carbon captured is permanently stored underground to prevent its release into the atmosphere[17].

Exhibit 2 – Emissions gap for net-zero pathway aligned with the Paris Agreement, $GtCO_2e$



[1]Nonexhaustive. [2]Median estimate of level consistent with 1.5°C. [3]Emissions above zero due to residual emissions of other GHGs.
Source: Energy efficiency 2023, IEA, November 2023; Emissions gap report 2023: Broken record, UN Environment Programme, November 20, 2023; World energy outlook 2023, IEA, October 2023;[18] proprietary McKinsey EMIT database; Climate Trace data, accessed 2024[19]

It is critical to foster a global liquid financing system premised on sustainability and economic feasibility that could speed up efforts to reduce carbon emissions. Estimates suggest that the capital spending required to reach net-zero emissions sums up to USD 275 trillion until 2050, i.e., USD 9.2 trillion annually on average between 2021 and 2050. This represents an annual increase of USD 3.5 trillion from today's investments, equivalent to half of global corporate profits, one-fourth of global tax revenue, and 7% of household spending[20].

A comprehensive approach will be necessary, such as carbon pricing to stimulate operations' decarbonization, scaling the high-quality international carbon market, and allocating robust investments. In this context, it is imperative to provide solid and stable domestic policy ecosystems aiming to provide a more predictable environment, not only for the businesses to better plan their solutions but also to attract private capital as well as increase cooperative funding from developed to developing countries – accomplishing commitments such as the USD 100 billion per year agreed in 2009 at COP15 and extended to 2025 at COP21 for climate action in developing countries – beyond strengthening collaboration and incentives from governments, regulators, nongovernmental organizations, academia, industry associations, financial institutions, investors, and businesses. Funding entities should expand their planning and investment horizons while promptly taking action to mitigate risks and seize opportunities. When addressing global objectives and national mitigation strategies, it is crucial to refine and update comprehensive implementation plans that include specific short- and medium-term targets. These should be supported by sound frameworks and regulatory systems, particularly to enhance access to climate finance for emerging and developing economies. Therefore, G20 countries should make all the necessary efforts to cooperate and strive to bring together such frameworks.

While the challenges of transitioning to a net-zero economy are significant, they also present opportunities for the public and private sectors to reshape their operations and value chains as they decarbonize, leading to further innovation, increased efficiency, and new sustainable business models. This transition also opens avenues to support both decarbonization efforts and the rise of low-carbon products to replace high-carbon ones. Overall, embracing the transition to a net-zero economy addresses environmental challenges and unlocks the potential for sustainable inclusive growth.

RECOMMENDATION 1

Recommendation 1

Recommendation is partially aligned with previous B20 editions

Accelerate the development and use of renewable and sustainable energy solutions portfolio to boost decarbonization both in the short (2030) and long terms (2050) while ensuring energy security

Policy Actions

Policy Action 1.1: Devise policy schemes, regulations, and incentives to triple renewable energy capacity by 2030, expand grid infrastructure, and accelerate broad electrification, aiming to ensure just, responsible, efficient, and reliable access to energy, working towards Paris Agreement targets achievement.

Policy Action 1.2: Establish mechanisms and initiatives to leverage sustainable bioenergy and biofuel potential and readiness for decarbonization, accelerating the achievement of net-zero emissions while safeguarding food security.

Policy Action 1.3: Enable expansion of other solutions necessary for the transition to net-zero emissions, such as CCUS, clean hydrogen, and nuclear power.

Key Performance Indicators	Baseline	Target	Classification
Global energy-related CO_2 emissions ($GtCO_2e$) Includes CO_2 emissions from the combustion of fossil fuels and nonrenewable wastes, from industrial and fuel transformation processes (process emissions), and will require removals through nature-based solutions and CCUS deployments	**37.4**[21] 2023	**23–24**[22,23] 2030	Aligned with previous B20s editions
Triple renewable energy generation capacity (gigawatts [GW]) Includes solar, wind, hydro, geothermal, solid, liquid and gaseous bioenergy, and other renewables	**3,655**[24] 2022	**11,000**[25] 2030	Aligned with previous B20s editions
Annual global electrical grid investments (billion USD 2022) Investment in electrical grids includes transmission and distribution as well as spending on digital equipment for the smart monitoring and operation of the grid (e.g., smart meters, automation, and public electric-vehicle charging stations)	**332**[26] 2022	**680**[27] 2030	New indicator (from IEA)
Global bioenergy demand (exajoules [EJ]) Includes demand from buildings, electricity generation, industry and transport sectors	**30**[28] 2022	**58**[28] 2030	New indicator (from IEA)

The "Leading Monitoring KPIs" are intended to offer suggestions for indicators that measure global progress on the theme. They seek to encourage the adoption of actions. These indicators and targets do not suggest a commitment for specific countries or a replacement of their commitments under their Nationally Determined Contributions (NDCs).

SDGs

Recommendation 1 **contributes to the achievement of the following UN SDGs**:

SDG 7: Affordable and Clean Energy – the recommendation focuses on the development of and access to affordable, reliable, sustainable and modern energy for all.

SDG 8: Decent Work and Economic Growth – sustainable economic growth is related to the acceleration of sustainable solutions, including through innovation.

SDG 9: Industry, Innovation and Infrastructure – Recommendation 1 relates to the fulfillment of several SDG 9 targets, such as developing sustainable, resilient, and inclusive infrastructures; promoting inclusive and sustainable industrialization; upgrading all industries and infrastructures for sustainability; and enhancing research and upgrading industrial technologies.

SDG 11: Sustainable Cities and Communities – it fulfills at least two SDG 11 targets: sustainable transport systems and sustainable and resilient building

SDG 12: Responsible Consumption and Production – the acceleration of sustainable energy solutions increases efficiency, boosts sustainable infrastructure, and creates green/sustainable jobs.

SDG 13: Climate Action – the acceleration of sustainable energy solutions is an imperative to urgently tackle climate change and its impacts.

SDG 15: Life on Land – shifting to sustainable energy sources supports the protection of terrestrial ecosystems.

Relevant B20 Brasil Guiding Claims

Recommendation 1 has the strongest impact on the following B20 Brasil Guiding Claim:

Accelerate a fair net-zero transition because expediting the development and use of sustainable-energy solutions is directly related to accelerating the shift to a carbon-neutral economy by reducing GHG emissions.

Relevant G20 Brasil Priorities

Recommendation 1 contributes to the following priorities of the G20 Brasil:

Recommendation 1 contributes to addressing G20 Brasil's Energy Transition key priorities: (I) Accelerating Financing for Energy Transitions, especially in EMDEs and (II) Innovative Perspectives on Sustainable Biofuels. Recommendation 1's three policy actions address the importance of financing the acceleration of a mix of energy solutions, adopting a range of instruments (e.g., fiscal measures, grants, etc.). In addition, a specific policy action on the scaling of bioenergy covers innovation for sustainable biofuels.

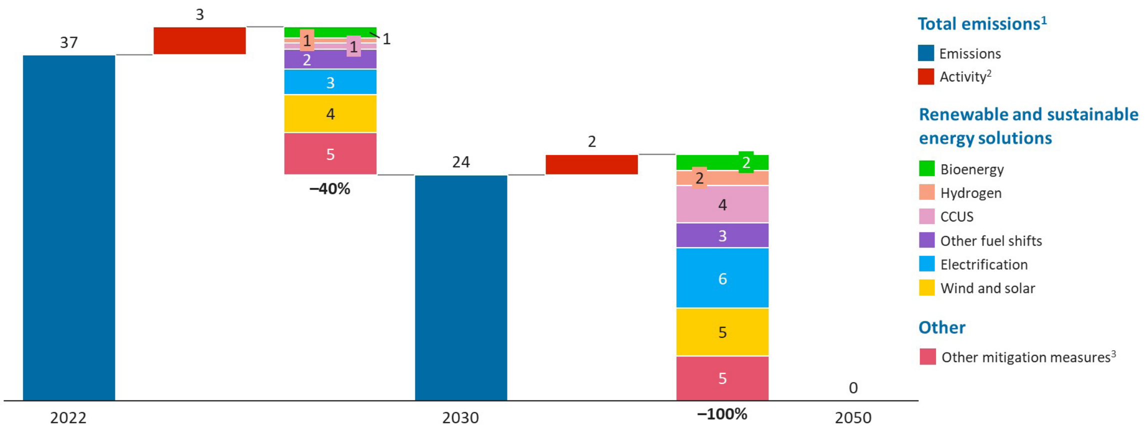
Recommendation 1 contributes to addressing G20 Brasil's key Bioeconomy priorities: (I) Research, Development, and Innovation for Bioeconomy; (II) Sustainable Use of Biodiversity for Bioeconomy; and (III) Bioeconomy as an Enabler for Sustainable Development—because this second policy action centers on the potential of sustainable biomass applications for energy, leveraging innovation and contributing to sustainable development.

Recommendation 1 contributes to addressing G20 Brasil's Agricultural key priorities: the central role of achieving food and nutritional security, rural development, and sustainable management of natural resources while excelling bioenergy and biofuel potential and other solutions necessary for the transition to net-zero emissions, such as carbon capture.

Context

Despite several commitments, such as the Paris Agreement, to mitigate GHG emissions and prevent worse consequences of climate change, global emissions will probably lead to an increase above 1.5°C at the current stage, even if all countries deliver on their current commitments[3]. To meet the Paris Agreement's goal of limiting global warming to 1.5°C and achieving net-zero emissions by 2050, GHG emissions from the energy sector are expected to reduce by around 40% by 2030 (Exhibit 3). Therefore, the efforts of this Task Force are particularly relevant to this urgent global effort.

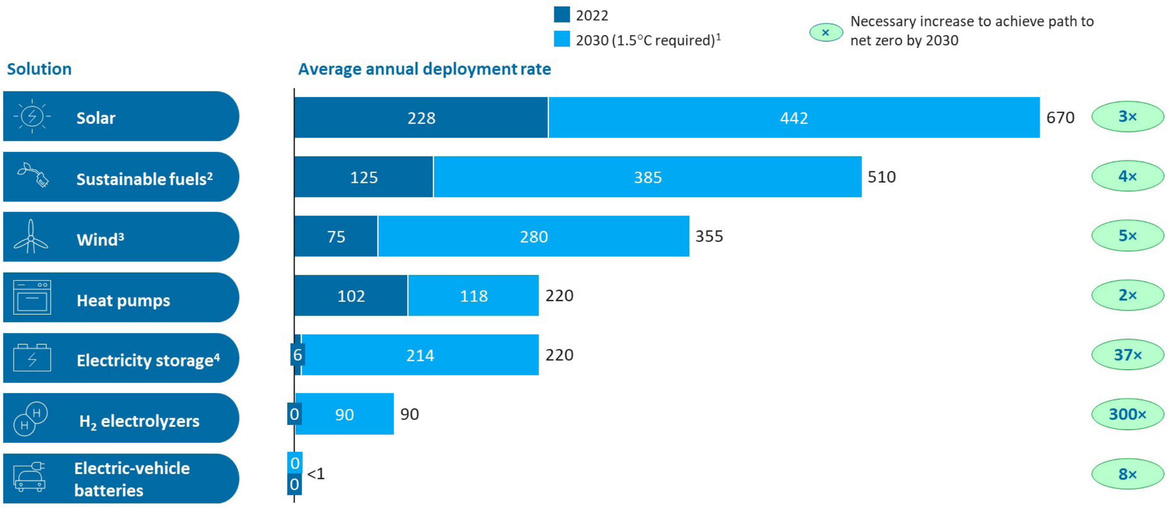
Exhibit 3 – Energy emission changes over time by mitigation measure in the IEA Net Zero Emissions Scenario, $GtCO_2e$, 2022–50



Note: Figures do not sum to totals. Because of rounding. [1]Considers only energy emissions, excludes agriculture, forestry, other land use waste, and other types of emissions. [2]Additional emissions related to economic growth activities. [3]Including energy efficiency, behavior changes, and avoided demand.
Source: Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach, IEA, September 2023[27]

A broad spectrum of sustainable energy solutions and technologies should be considered to achieve net-zero emissions in energy and materials, considering national circumstances, resource availability, and energy capacity, including, but not limited to, bioenergy, renewables (e.g., onshore and offshore wind, solar, hydropower, geothermal energy), and other solutions (e.g., CCUS, clean hydrogen, nuclear), as also mentioned in IPCC AR6[198]. Exhibit 4 shows a non-exhaustive portfolio of sustainable-energy solutions that would need to increase their participation in the global energy mix on the path to net-zero emissions by 2050. It demonstrates a significant gap in the 1.5°C pathway: to get on track, it is necessary to scale up every major solution severalfold. Sustainable and renewable fuels are crucial in the energy transition due to their central role and commercial readiness to scale. However, some solutions, such as clean hydrogen, have high production costs, making measures such as de-risking instruments (e.g., subordinate debt, credit guarantee, offtake agreement) and carbon-pricing mechanisms (e.g., carbon markets) essential to accelerating their development. While fossil fuels will continue to play a significant role in meeting global energy demands in the near future, transitioning away from them in energy systems in a just, orderly, and equitable manner in this decade is critical enabling the world to reach net-zero emissions by 2050, in keeping with the science[16].

Exhibit 4 – Increase in sustainable energy capacity required by 2030 on the path to net zero, GW/year



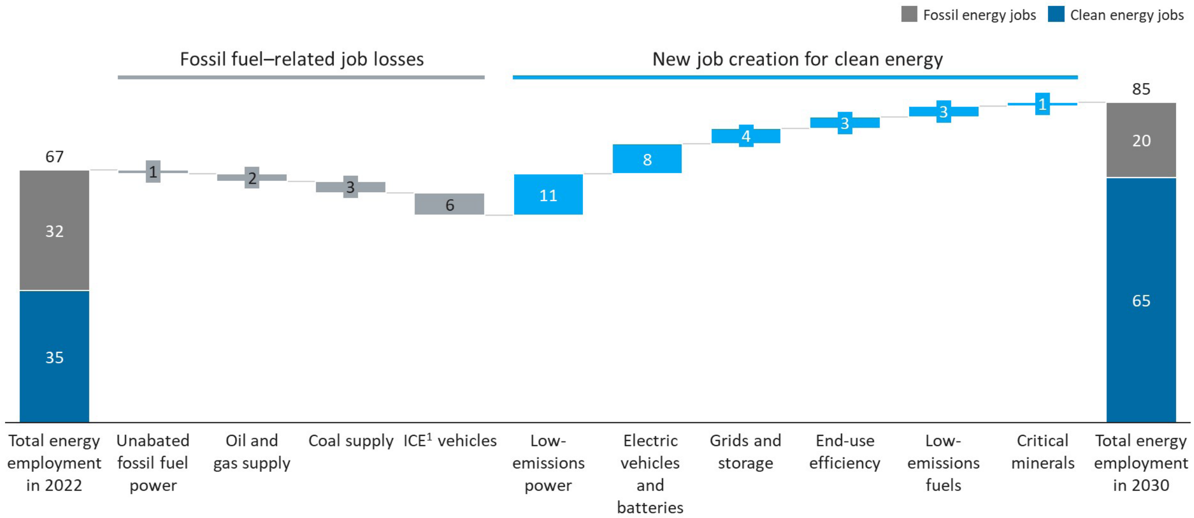
[1]Approximated to the nearest multiple of 5; mix of IPCC AR6 scenarios 25th–75th percentile of selected 97 scenarios and IEA "Net zero emissions by 2050 scenarios" when IPCC data is not available. [2]Assuming ~33 Mt per EJ currently and ~28 Mt per EJ in 2030. [3]Both onshore and offshore. [4]Current deployment based on 2021.
Source: "Net zero emissions by 2050 scenario (NZE)," IEA, 2023; *Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach*, IEA, September 2023; "Renewable electricity capacity additions by technology and segment, 2016-2028," IEA, updated January 11, 2024;[29] *AR6 synthesis report: Climate change 2023*, IPCC, March 2023[30]; World Business Council for Sustainable Development climate scenario tool[31]

Each country's energy mix is influenced by various factors such as regional specificities, availability of local resources, and skilled labor. As shown in Exhibit 5, clean energy–related jobs are expected to grow faster than fossil fuel-related jobs[v]. Then, reskilling workers and promoting transitions to clean energy jobs are of the utmost importance. According to LinkedIn's *Global Green Skills Report 2023*[32], the transition to a greener economy is catalyzing the growth of green skills[vi] across all sectors, including carbon-intensive industries. Notably, the green talent concentration in the oil and gas sector has risen consistently since 2016, reaching 21% in 2023. Additionally, the growth in demand for green skills is already outpacing growth in the supply of green talent. Science, technology, engineering and mathematics (STEM) skills are at the top of the list because many green jobs are grounded in science and math fundamentals. Gateway roles also can serve as critical stepping stones for workers transitioning into sustainability-related jobs; they give workers the opportunity to acquire the green skills they'll need to move on to traditional green roles, which is important considering that approximately 41% of individuals moving into these roles have no prior sustainability experience[32]. By acquiring green skills and experience through gateway jobs, workers enhance their prospects for securing dedicated green positions in the future.

v As the energy transition is underway, it is necessary to develop upskill and reskill programs so that professionals in the field (many of whom currently work in the fossil fuel-related value chain) can cope with the new reality/context and the technologies inherent to it.

vi Nonexhaustive examples of green skills: climate action planning, sustainability education, carbon emissions, carbon accounting, corporate sustainability, drinking-water quality, energy engineering, and carbon credits[32].

Exhibit 5 – Changes in global energy employment by sector in the IEA Net Zero Emissions Scenario, million workers



[1]Internal combustion engine.
Source: World energy employment 2023, IEA, November 2023[33]

In addition to job creation and green skills, rapid deployment and adoption of commercially available solutions, along with the fast-paced development of a coordinated energy infrastructure, are also necessary. This infrastructure would effectively integrate new sustainable energy generation expansion with existing assets, like natural gas infrastructure and capacity mechanisms. Such integration will be key to enabling a flexible, safe, affordable, and reliable energy transition, which is essential for meeting the Paris Agreement targets and achieving net-zero emissions.

Policy Action 1.1

Devise policy schemes, regulations, and incentives to triple renewable energy capacity by 2030, expand grid infrastructure, and accelerate broad electrification, aiming to ensure just, responsible, efficient, and reliable access to energy, working towards Paris Agreement targets achievement.

Executive Summary

Renewable energy and electrification will be key to following the path towards net-zero emissions in the short, medium, and long terms. As such, G20 countries should: (i) devise policy schemes to increase renewable energy generation, (ii) update regulations and prioritize investments to ensure expansion and modernization of energy infrastructure (e.g., grid) and storage technologies, and (iii) establish strategies and adopt fiscal and financial incentives to accelerate electrification and enable its widespread adoption.

Background and context

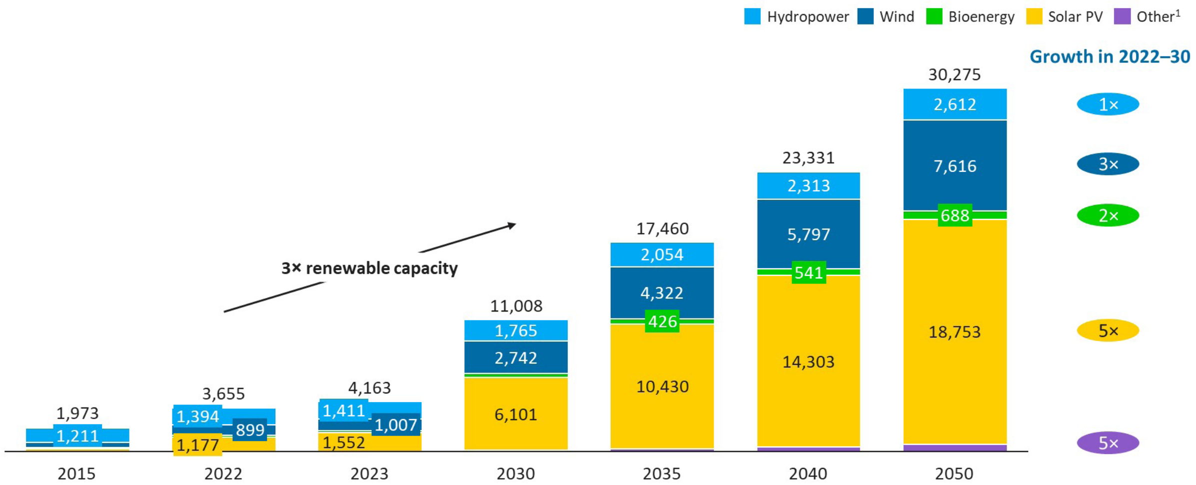
The key climate technologies necessary to achieve deep decarbonization already exist. Thus, the current challenge resides in reducing implementation and operations costs to expedite their deployment to achieve technical and commercial breakthroughs – which is a reality, particularly in the case of renewables and green/sustainable electrification. According to the IEA, more than 60% of abatement potential[34] from climate technologies comes from commercially available alternatives, some of which may still require support for competitiveness, while others can already compete globally.

Renewable energy capacity doubled between 2015 and 2022, showcasing remarkable growth across various technologies utilizing renewable resources[35]. However, according to the IEA's Net Zero Emissions (NZE) scenario[27], further capacity expansion is necessary. Specifically, the share of renewable energy in the global energy supply would need to increase from its current level of 12% to 30% by 2030[36]. Achieving this scenario would require significant effort from countries and companies worldwide.

Of the 194 Nationally Determined Contributions submitted by parties to the Paris Agreement, only 14 explicitly target a total renewable-power capacity by 2030[37]. An IEA analysis[37] of policies, plans, and projections from nearly 150 countries indicates that countries' overall ambitions could elevate global renewable-power capacity to almost 8,000 GW by 2030. That means that even if all nations fully implement their current plans, there would still be a 30% shortfall in achieving the target of tripling the global renewable capacity to over 11,000 GW by 2030. Currently, ambitions are predominantly focused on solar photovoltaics (PV) and wind energy, while other renewable sources such as hydropower, bioenergy, and geothermal receive less emphasis.

In this respect, 133 countries signed the Global Renewables and Energy Efficiency Pledge at COP28[25], committing to work together to achieve the goal to triple the world's installed renewable energy generation capacity from 3,655 GW in 2022 to at least 11,000 GW by 2030[25] (Exhibit 6), taking into consideration different starting points and national circumstances. To achieve this ambitious target, leveraging the current global renewable energy expansion momentum and slightly increasing it could be effective – specifically by raising the annual growth rate from 14% in 2023 to 15% annually from 2024 through to 2030.

Exhibit 6 – Total renewable electricity generation installed capacity in IEA Net Zero Emissions Scenario, GW



[1]Concentrated solar power, geothermal, and marine sources.
Source: Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach, IEA, September 2023; "Renewable energy progress tracker," IEA, updated June 4, 2024;[38] Renewables 2023, IEA, January 2024

Moreover, electrification is another major factor in the global energy transition, expanding across all regions and sectors while the electricity mix becomes cleaner. As more energy end uses become electrified, the share of electricity in total final energy consumption would increase from 20% in 2022 to 27% in 2030 and to over 50% in 2050 to achieve net-zero emissions[39]. In recent years, this share has been increasing steadily. To get on track with the net-zero emissions scenario, the speed of this increase will need to double to reach the 2030 milestone[39].

According to the IEA, much of the need can be met by electrifying low-temperature heat processes in industry (e.g., food drying and beverages processes)[39], shifting towards electric transportation and installing heat pumps[40]. Moreover, technological advancements are facilitating innovative solutions in other areas, including thermal storage, the production of steel using green hydrogen, and the direct electrification of high-temperature furnaces[41]. Notably, electric mobility will play a key role in this context, accelerating the energy transition in the transport sector, where electric vehicles (EVs), including battery electric vehicles, plug-in hybrid electric vehicles, and others, are expected to grow at scale. And, according to the IEA[42], EV annual sales skyrocketed from around 100,000 in 2012[43] to nearly 14 million in 2023, accounting for 18% of total sales share in 2023. In a net-zero emissions scenario, EV sales are projected to reach approximately 65% of total car sales by 2030[44]. The strategy to reduce GHG emissions in the transportation industry also promotes intermodal and multimodal transport solutions, such as rail and waterways, across various scales – international, national, regional, and local. This approach is designed to be equitable and enjoys public support, maximizing the utilization of existing low-carbon modes and operations and ensuring its effectiveness and broader acceptance. Implementing this interconnected approach can substantially decrease the transportation sector's carbon footprint[45].

Heat pumps, powered by low-emission electricity[vii], are the key technologies for large-scale global transition towards secure and sustainable heating solutions. In fact, current heat pump models on the market are three to five times more energy efficient than natural gas boilers[40]. They reduce households' exposure to fossil fuel price spikes, and many of them can provide cooling as well, eliminating the need for a separate air conditioner for the 2.6 billion people living in regions requiring heating and cooling by 2050. Currently, heat pumps meet only around 10% of the global heating need in buildings[40]. To get on track with the net-zero emissions scenario by 2050, the global heat pump stock would need to almost triple by 2030 to cover at least 20% of global heating needs[40].

Access to reliable electricity is essential for economic growth and quality of life, yet many countries still require assistance to achieve this. In some areas, weak infrastructure and insufficient power supply mean people cannot enjoy reliable electricity. To address this issue, the primary solution is to develop and employ new electric grid systems that are green, secure, sufficient, affordable, efficient, supply–demand coordinated, flexible, and smart. They play a pivotal role in enabling the shift to a more decentralized energy system, allowing small-scale renewable generation to access the grid and empowering residential prosumers, commercial, and industrial entities. These innovative solutions will be vital to ensure energy security and facilitate a just transition to a greener future.

Additionally, the expansion and resilience of energy grid infrastructure and storage capacity are crucial for scaling renewable energy and electrification worldwide. This involves accommodating new renewable sources and shifting end-users to electrified solutions in transport, industry, and other sectors. Accelerating the implementation of Long-duration energy storage (LDES) technologies, such as battery energy storage systems (BESS), will also play a vital role in enabling the greater inclusion of renewable energies in the energy matrix, ensuring greater efficiency and security for the system.

Specific Actions

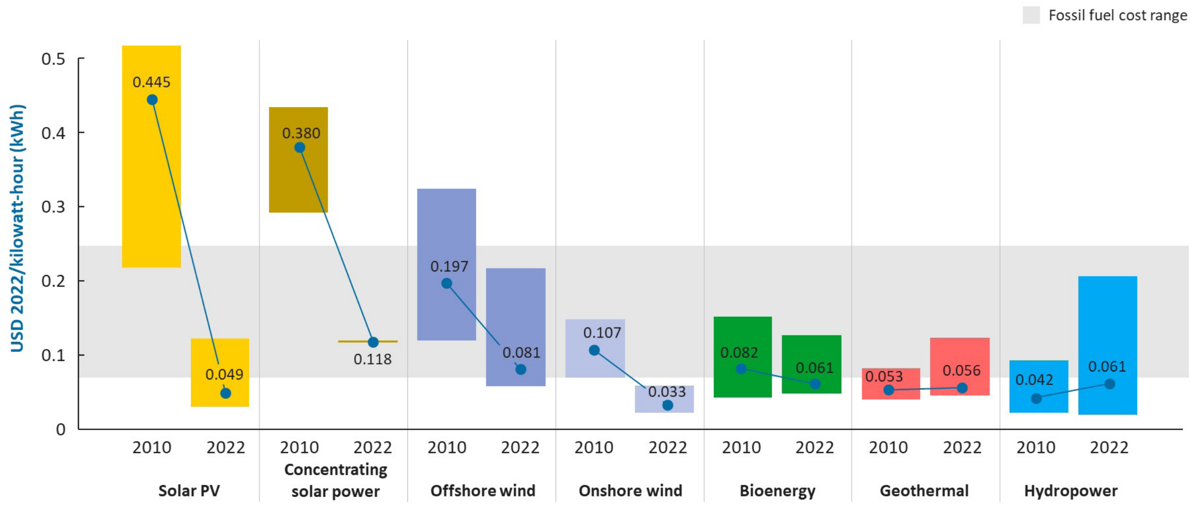
I) Devise policy schemes to increase and accelerate renewable energy generation

The growth of renewables has consistently exceeded predictions over the past decade, with estimates regularly being revised upwards, constructing a positive path for competitive prices. The global levelized cost of electricity (LCOE) for many key renewable energy sources has consistently declined over the past decade[47] (Exhibit 7), with special mention for solar PV (around 90% LCOE reduction) and onshore wind (around 70% LCOE reduction). However, further scaling in renewable energy generation at the required pace to meet the targets, it is important to simplify red tape and permitting processes, as well as to develop a secure supply chain[48].

In this context, G20 countries should consider devising policy schemes that strengthen international cooperation, such as the transfer of technology, to increase renewable energy generation. These schemes include public policies that streamline permitting procedures, strengthen planning, and improve remuneration. Tax credits (among other mechanisms) could also play a significant role in increasing the economic attractiveness of renewable energy projects to further enhance and sustain the cost-competitiveness of renewable energy over time, if necessary. Together, policy schemes are expected to promote around 87% of global renewable utility-scale capacity growth from 2023 to 2028[49].

vii Electricity generated from low-emission sources including, but not limited to, renewables (e.g., solar, wind, and hydro) and nuclear[46].

Exhibit 7 – Global LCOE from newly commissioned utility-scale renewable power technologies, 2010 and 2022



Note: These data are for the year of commissioning. The thick lines are the global weighted average LCOE value derived from the individual plants commissioned in each year. The LCOE is calculated with project-specific installed costs and capacity factors, while other assumptions, including weighted average cost of capital, are detailed in Annex I in Renewable power generation costs in 2022. The gray band represents the fossil fuel–fired power generation cost in 2022 – assuming that 2021 fossil gas prices were the correct lifetime benchmark, rather than the crisis prices of 2022 – while the bands for each technology and year represent the 5th and 95th percentile bands for renewable projects.
Source: *Renewable power generation costs in 2022*, International Renewable Energy Agency, August 2023[50]

II) Update regulations and prioritize investments to ensure the expansion and modernization of grid infrastructure and storage technologies

Grid infrastructure and LDES technologies, such as BESS, are essential enablers for the required increase in renewable energy generation and mass electrification. In terms of energy infrastructure, G20 countries should consider updating their regulations and planning procedures to incentivize grids, including transmission and distribution, to keep up with changes in electricity demand and supply as well as adequacy of the electricity system (especially for distribution networks). Furthermore, G20 countries should facilitate and simplify permitting processes, address administrative barriers as well as technical and nontechnical losses (e.g., unlawful appropriation or diversion of electricity), reward high performance and reliability, and promote innovation.

When devising these regulations, it is important to align preparation for transmission and distribution grids with long-term planning processes, accelerate the connections with renewable energy sources, anticipate the growth of distributed resources, and consider connections with other sectors[51]. In addition, regulatory regimes should be adapted to keep pace with and enable the energy transition, promote broad participation of grid operators, and improve the grid infrastructure's resilience to adverse events due to climate change. On this subject, the Italian Regulatory Authority for Energy, Networks and Environment (ARERA) introduced in 2018 – and updated in 2023 – an incentive mechanism to encourage distribution system operators to perform investments that enhance the distribution grid's resilience against climate-related risks such as heat waves, ice accumulation on overhead lines, flooding, and windstorms[52].

Over the past decade, global grid investments have stagnated, but there is now an urgent need to scale them up in the short term. By 2030, these investments need to nearly double from 2022's USD 352 billion to USD 680 billion per year in order to meet national climate targets[27,53], enable triple global renewable energy generation capacity, and strengthen energy security[54]. These investments should cover a range of initiatives, including the expansion/modernization of transmission and distribution grids, regional integration, digitalization, demand response technologies, and the implementation of embedded advanced analytics and artificial intelligence algorithms to create larger, more efficient, more robust, and smarter grids[51,55]. Worldwide, different initiatives and policies have been designed to develop and promote this type of grid, including the New-Type Power System in China[56,57] and the Smart Networks for Energy Transition in the European Union[58].

Likewise, promoting LDES capacity deployment, such as BESS and pumped hydroelectric storage, is crucial for facilitating the widespread implementation of renewables and ensuring energy efficiency, access, and security. In fact, to achieve the net-zero emissions scenario, global LDES capacity would need to increase almost sixfold, from 268 GW in 2023 to 1,500 GW by 2030[54,59]. Remarkably, BESS is expected to account for 90% of this growth, with its capacity surging from approximately 90 GW to 1,200 GW—an increase of almost 14 times[59]. To reach this target, the deployment of battery storage must continue to increase by an average of 25% per year until 2030[42]. The expansion of battery storage capacity in the power sector is already on a rapid trajectory, with more than 40 GW added in 2023 alone, doubling the previous year's increase, split between utility-scale projects (65%) and behind-the-meter systems (35%)[59].

To enable such deployment, G20 countries should consider implementing regulatory reforms, smoothing the approval process and structuring investment frameworks for research and development support, especially in countries in the initial stages of LDES/BESS capacity deployment, incentivizing grid investment and revenue models. For instance, in 2022, India released its National Electricity Plan draft, setting specific targets for the development of BESS, with a projected installed capacity of 51 to 84 GW by 2031–32[60]. Another example is China, which solidified its position as the leader in the global battery storage market, having tripled its capacity additions in 2023 to 23 GW, expansion in utility-scale storage primarily due to regional policies encouraging integration with renewable energy sources[61].

Finally, implementing robust and cost-efficient capacity mechanisms is crucial for ensuring the stability and adequacy of the electricity supply. Capacity mechanisms are financial support systems designed to ensure that power plants are available to generate electricity when needed[62]. These mechanisms, which encompass capacity markets, auctions, and payment mechanisms, provide essential revenue streams to conventional power plants, such as natural gas thermal plants, enabling them to transition from primary energy providers to roles emphasizing firming and flexibility within the power system. This shift is essential because renewable energy sources like wind and solar are intermittent and cannot always independently meet peak demand. These mechanisms could also further contribute to energy decarbonization by promoting the use of low-carbon energy sources (such as biomass, biomethane, and clean hydrogen) in existing power plants.

III) Establish strategies and adopt fiscal and financial incentives to accelerate electrification and enable its widespread adoption

To achieve the increase foreseen for electrification in the net-zero emissions scenario, some key barriers need to be overcome, such as supply chain vulnerabilities (e.g., shortages of components and critical materials); lack of electricity access, infrastructure, and grid capacity, particularly in developing countries; and uncertainties surrounding capital investments[63]. To reach net-zero emissions, investments in global electrical systems need to increase from USD 800 billion annually to USD 2.2 trillion by 2030[64].

In this context, G20 countries should consider adopting fiscal and financial incentives to accelerate clean and accessible electrification (supported by renewable and sustainable energy deployment) as it represents around 45% of the decarbonization effort, both by 2030 and 2050[27]. These incentives could support businesses in facing the high up-front investment costs that are a significant challenge for electrification across sectors, including the transport sector[39]. Several governments have implemented supportive measures for various initiatives. For example, Finland established a fund dedicated to the electrification of heavy industries[39]. Similarly, the European Union's REPowerEU plan expanded the budget of the European Union Innovation Fund to foster innovative electrification projects in industry and hydrogen development[39]. In Brazil, the Programa Luz para Todos aims to provide electricity access to rural populations and residents in remote areas of the Brazilian Legal Amazon who lack access to the public electricity distribution service[65].

In the transport sector, the IEA's *Global EV Outlook 2024*[42] highlights a significant uptrend in electric car sales, projecting that they could reach approximately 17 million units by 2024, accounting for more than one in five cars sold worldwide. This represents over 20% of global car sales, underscoring electric vehicles' growing role as a critical component in decarbonizing urban mobility alongside sustainable biofuels. However, realizing this potential demands strong political support to drive industry investment and boost confidence in the continued acceleration of electrification supplied by low-emission sources. The electrification also applies to other types of transportation, such as rail and waterways, with corresponding infrastructure, ensuring an intermodal or multimodal transportation strategy. For instance, the regulation for the deployment of alternative fuels infrastructure, part of the Fit for 55 legislative package to deliver the European Green Deal, "sets mandatory deployment targets for electric recharging and hydrogen refueling infrastructure for the road sector, for shore-side electricity supply in maritime and inland waterway ports, and for electricity supply to stationary aircraft"[67].

Therefore, G20 countries should devise policies and incentives that facilitate infrastructure and supply chain development to accelerate broad electrification, particularly in developing countries. Recent policy developments have further raised expectations for rapid electrification, including the adoption of new emissions standards in Canada, the European Union, and the United States over the past couple of years[68]. Additionally, industrial incentives such as the European Union's Net-Zero Industry Act[69], China's 14th Five-Year Plan[70], and India's Production Linked Incentive[71] schemes are pivotal in enhancing value addition and job creation within these regions' EV supply chains.

Ensuring access to a diversified and competitive supply chain is paramount to successfully enabling the energy transition. This necessitates the establishment of well-crafted global trade agreements to facilitate the smooth acquisition of essential equipment and materials, such as cobalt, copper, nickel, lithium, and rare earth metals such as neodymium and dysprosium. These agreements are crucial in preventing unexpected delays in energy projects[72].

Furthermore, promoting a just and equitable transition that supports sustainable development is essential. This includes guaranteeing that extracting critical minerals for renewable technologies is conducted ethically, adhering to fair labor practices, and upholding human rights. Additionally, investing in and developing the communities from which these materials are sourced is vital, ensuring they gain access to reliable, affordable, secure, and sustainable energy and transportation systems. This comprehensive approach not only facilitates the global shift towards renewable energy but also enhances the quality of life and development in resource-rich communities.

Policy Action 1.2

Establish mechanisms and initiatives to leverage sustainable bioenergy and biofuel potential and readiness for decarbonization, accelerating the achievement of net-zero emissions while safeguarding food security.

Executive Summary

Scaling up a global and diversified portfolio of sustainable biomass solutions for energy is a key measure in global decarbonization efforts, especially considering the 2030 targets, national circumstances, and bioresource availability. In this context, three main actions should be adopted by G20 countries: (i) establish blending mandates to promote the use of bioenergy (e.g., sustainable biofuels), (ii) implement policies to promote global and diversified bioenergy supply chains, and (iii) set up regulations and provide investments to scale new bioenergy applications (e.g., biomethane and sustainable aviation fuel [SAF]), all of which are further detailed below.

Background and Context

Bioenergy is a quickly-produced solution for accelerated decarbonization. It serves as a valuable complement to other low-carbon energy solutions, particularly in the transportation and mobility sectors. Its cost-efficiency, commercial readiness, competitiveness, and compatibility with existing infrastructure make bioenergy a key lever that could achieve up to 1.2 $GtCO_2e$ of the required reduction in global GHG emissions by 2030 – while also generating significant socioeconomic impacts. Although its application may be subject to national conditions, its importance was recognized in previous G20 and B20 editions, as we can notice with the launch of the Global Biofuel Alliance during 2023's edition of G20, which has the aim of boosting supply and demand for biofuels[73].

Bioenergy involves using biological materials such as energy crops, agricultural waste and residues, forest biomass, and organic waste to produce energy for diverse applications, including the use of liquid biofuels and biomethane for transportation as well as biomass (e.g., timber, wood pellets, and sugarcane bagasse) and biogas/biomethane for heat and power generation in buildings, industries, and/or power grids. Beyond the use for bioenergy, these biological materials are also key for the decarbonization of the chemical sector (e.g., enabling the production of bioplastics and biomethane) and the iron/steelmaking processes (e.g., serving as feedstock for low-carbon reduction agent, in substitution to coal).

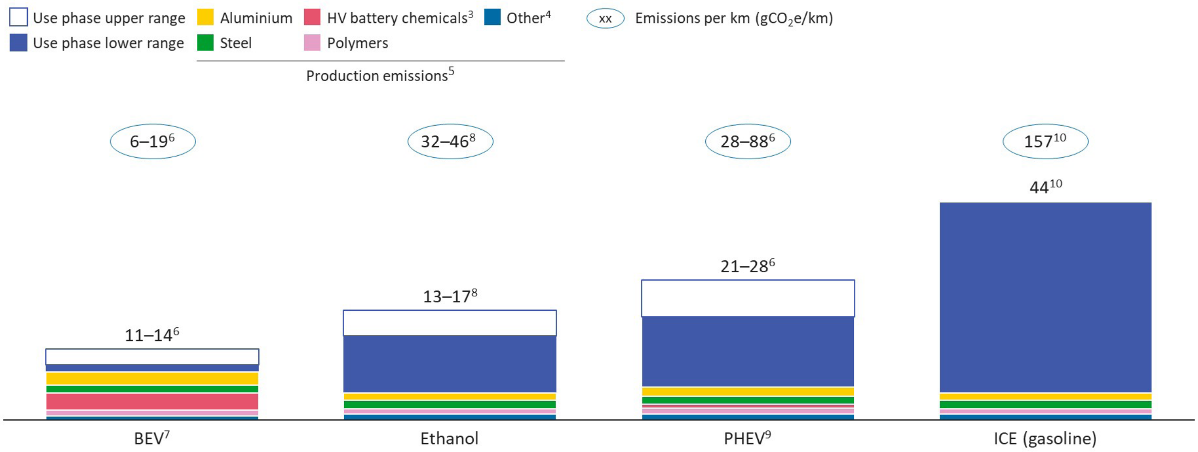
In this discussion, sustainable biofuels[viii] play a vital role. Global demand for sustainable biofuels is growing fast, and a quadrupled increase in capacity by 2030 would be needed to be on track for net-zero emissions by 2050[74,75]. Considering transportation segments, they already represent a competitive low-carbon alternative for fossil fuels on internal combustion engine (ICE) light vehicles (see Exhibit 8). Moreover, sustainable biofuels are particularly relevant for decarbonizing hard-to-abate

viii Sustainable biofuels include conventional biofuels such as ethanol or fatty acid methyl ester (FAME), which can be blended until the blend wall is reached, or more advanced drop-in fuels such as hydrotreated vegetable oil (HVO) or biokerosene.

transportation segments, where electrification is projected to be limited due to infrastructure, weight, or range requirements. For example, in aviation, drop-in SAFs that can directly replace jet fuel with GHG emissions reductions of 70% to 100%, are expected to contribute to nearly 40% of total aviation energy demand by 2050[75,76].

Scaling bioenergy can offer several advantages, such as reducing CO_2 emissions; provisioning reliable, safe, and efficient energy; lowering costs compared to traditional matrices; reducing waste; and incentivizing the development and use of green/sustainable innovative technologies. Bioenergy can support CO_2 emissions mitigation through a biogenic cycle that reabsorbs CO_2 emissions during biomass production, thus preventing the intensification of climate change[77]. However, this is only possible when production adheres to sustainable land-use guidelines, when operations are decarbonized, and when national circumstances are considered. Regarding job creation, projections from the International Renewable Energy Agency (IRENA)[74] indicate that in 2020, the employment opportunities supported by biogas, solid biomass, and liquid biofuels amounted to 3.53 million globally. These opportunities have the potential to soar to 13.7 million jobs by 2050.

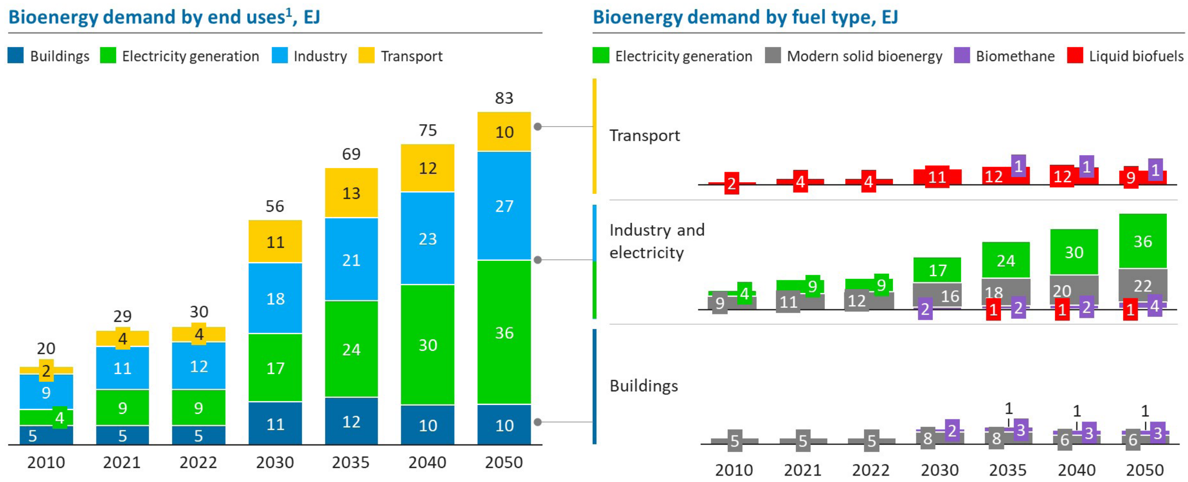
Exhibit 8 – Life cycle emissions of light vehicles[1] for different fuels, by vehicle powertrain type, tCO_2e[2]



[1]Life vehicles emitting <6 metric tons of lifetime GHG emissions, including production and use phase. [2]Estimated use phase of 243,000 km. Clean grid perspective for use phase only, excluding additional emission savings by, e.g., green steel and clean battery cathode/anode material. [3]High-voltage battery chemicals. Including lithium, nickel, manganese, cobalt, iron, phosphate, graphite, electrolytes. [4]Including, e.g., other metals and glass. [5]Global average vehicle, similar to C-segment. [6]The lower range considers a power mix that is ~70% cleaner, based on the comparison between the average European mix and Brazilian mix; accounts for 10% charging losses. [7]Battery EVs; estimated average energy consumption of 15 kWh per 100 km. [8]The upper range considers 1G ethanol and the lower range 2G ethanol, which allows a ~35% emissions reduction. [9]Plug-in hybrid EVs; estimated 50/50 split between kilometers driven electrically and with ICE vehicles. [10]157.6 g/km of CO_2e emissions in the use phase.
Source: Umweltbundesamt data[79]; Julian Conzade et al., "Why the automotive future is electric," McKinsey, September 7, 2021[80]; "O futuro da mobilidade no Brasil: uma rota para eletrificação" ("The future of mobility in Brazil: A route to electrification"), McKinsey, January 27, 2023[81]

To achieve the net-zero pathway, the demand for bioenergy is expected to increase by around 180% by 2030 (Exhibit 9). However, scaling bioenergy to accomplish this demand may face several barriers, including difficulties in securing finance, varying levels of technology readiness, feedstock flexibility and reliability, efficiency for different bioenergy solutions, need for skilled workers, infrastructure, and reliable information[74]. Addressing these barriers requires a comprehensive and coordinated approach that involves a mix of policy measures tailored to the local context and aligned with sectoral and international frameworks and strategies. In this context, the proposed measures focus on promoting the use of bioenergy, fostering innovation, and strengthening supply chains.

Exhibit 9 – Bioenergy demand by end use and fuel type until 2050



[1]Excludes conversion losses and traditional use of biomass.
Source: *Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach*, IEA, September 2023

Specific Actions

I) Establish blending mandates to promote the use of bioenergy (e.g., sustainable biofuels)

Bioenergy options often come with higher costs, necessitating strategies to improve their economic competitiveness. Implementing such measures can make adopting bioenergy sources more financially feasible for businesses and affordable for consumers.

In this context, G20 countries should consider establishing financial measures and blending mandates to promote the use of bioenergy, considering national conditions and specificities. Blending mandates involve incorporating a specific proportion of liquid biofuels into conventional fossil fuels for transportation. These mandates should be based on clear regulatory frameworks and take into account the feasibility of blended fuels as a substitute for conventional fossil fuels, including changes in fuels' chemical properties (e.g., calorific value, flash point, and pH) and the readiness of fleet to use blended fuel and potential transition measures for safe implementation (e.g., incentives for fleet retrofit/renew to accept blended fuels). Over 70 countries[74] have implemented similar mandates, with the major part focusing on bioethanol, such as Brazil[82] (27% ethanol blending on gasoline since 2015) and India[83] (20% ethanol blending on gasoline by 2026), and biodiesel/renewable diesel, such as Indonesia[84] (35% biodiesel blending on diesel since 2023) and South Korea[85] (8% biodiesel/renewable diesel blending on diesel by 2030).

II) Implement policies to promote global and diversified bioenergy supply chains while safeguarding food security

The complexity of bioenergy supply chains can pose a significant challenge to bioenergy development, particularly for large-scale plants or projects. These supply chains encompass various stages, including feedstock cultivation, harvesting, collection, pretreatment or upgrading, and transportation, with variations depending on geography, national/regional specificities, feedstock type, and conversion technology. In particular, feedstocks play a key role in bioenergy supply chains, corresponding to approximately 60–80% of production costs, depending on the specific bioenergy solution[75].

In this context, G20 countries should consider implementing policies to promote global and diversified bioenergy supply chains by balancing supply and demand flows as well as diluting the effects of environmental disasters in production (e.g., drought and floods)[74]. For instance, measures to reduce barriers to the international trade of biofuels would help foster a global biofuel economy.

By 2030, global cropland demand is expected to increase by at least 70 to 80 million hectares (Mha) to meet the growing demand for food, bioenergy, and nature[86]. Increased demand might exacerbate competition between food and energy crops, which would result in pressure on nature and food prices. Instead of converting natural habitats for farming, a more sustainable approach would be to restore degraded lands for bioenergy crop feedstock. Latin America and sub-Saharan Africa, for instance, have more than 190 Mha of degraded land, which is more than sufficient to cover the land requirement for local and global food/bioenergy needs[86]. To seize this opportunity, G20 countries should take a clear stance on prioritizing cropland expansion in degraded areas rather than native forest areas. Additionally, they could actively encourage the establishment of public–private partnerships and innovative financing mechanisms specifically tailored to support the cultivation of food and energy crops on recovered lands. Brazil is a case example that sustainable conversion of degraded land is possible. The country has committed to recovering around 15 Mha of degraded pasturelands by 2030[87] and has exceeded its goals, totaling 26.8 Mha successfully restored for crop production through the creation of several strategic public–private partnerships under the Plan for Adaptation and Low Carbon Emission in Agriculture (Plan ABC)[88].

Additionally, regenerative agriculture[ix] practices and the use of high energy density varieties that are also highly tolerant to drought and poor soils could enable sustainable and competitive biomass production while restoring degraded land and sequestering carbon. This approach would promote the development of local economies while establishing a comprehensive chain for bioenergy supply and security.

In order to effectively reduce GHG emissions while ensuring food security, biodiversity protection and development of local communities, it is crucial that biomass/bioenergy is produced sustainably. To this end, it’s important to consider international certification and standardization schemes. These alternatives can help to build convergence among regulations, promote interoperability, and harmonize principles across all regions. One example worth assessing is the International Sustainability Carbon Certification, which offers certification schemes for biomass and bioenergy that comply with the EU Renewable Energy Directive (RED II)[90,91]. Other examples are the Forest Stewardship Council[92] and the Programme for the Endorsement of Forest Certification[93], which are widely recognized for ensuring sustainable forest biomass.

III) Set up regulations and provide investments to scale bioenergy infrastructure and innovation (e.g., biomethane, SAF)

Promoting infrastructure and fostering innovation are vital in scaling bioenergy advancements and ensuring global and diversified supply chains. Investing in research and development of advanced biofuel technologies is essential to unlock access to more abundant and cost-effective feedstocks such as agricultural residues, dedicated energy crops, and municipal solid waste[94]. Over the long term, the development of e-fuels – synthesized from hydrogen produced by electrolyzers (and powered by low-emission or renewable electricity), combined with CO_2 from biogenic, concentrated waste streams or atmospheric sources – could significantly enhance the range of decarbonization strategies for the aviation and shipping industries. This approach not only diversifies energy options but also offers substantial synergy potential with biofuel production, especially in the form of biogenic CO_2 utilization[95].

ix Regenerative agriculture describes farming and grazing practices that, among other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity – resulting in both carbon drawdown and water cycle improvement[89].

Globally, three relevant examples of commercially available drop-in solutions that require investments in infrastructure to scale while incorporating emerging technologies are biogas/biomethane, bio-based/synthetic SAF[x] and second-generation (2G) biofuels[xi].

In this context, it is essential for G20 countries to drive investments in infrastructure and ongoing innovation in bioenergy solutions, thereby enhancing competitiveness and unlocking the potential of commercially viable options. For example, many countries already have extensive natural gas infrastructure in place, which can also be accessed by biomethane at various blending levels (natural gas and biomethane are interchangeable). By leveraging/expanding this existing infrastructure and increasing the proportion of biomethane in natural gas blends, countries can diversify their energy supplies and significantly reduce reliance on more polluting fossil fuels, such as coal and oil. This approach not only facilitates the transition to a lower-carbon energy system but also enhances energy reliability, serving as a security energy supply for heat demand and electrical grid[98].

Another example is the investments in developing bio-based/synthetic SAF, which could contribute to up to 55% of the emission reductions required in international aviation by 2050. To achieve this target, an estimated total investment of approximately USD 3,200 billion is needed by 2050 to scale up production capacity. This breaks down into USD 950 billion for biomass-based SAF, which is projected to cover 42% of the international aviation energy demand by 2050, USD 1,700 billion for SAF derived from gaseous waste (46%), USD 460 billion for SAF synthesized from atmospheric CO_2 (10%), USD 60 billion towards low-temperature gasification–low carbon aviation fuel (LTAG-LCAF), and USD 55 billion for hydrogen-based fuels (2%)[99]. These capital expenditures are designated for new greenfield fuel production plants and do not account for the investments in the conventional fuel sector that would otherwise be necessary in a business-as-usual scenario[99]. Furthermore, these investments will likely drive local economic growth, mainly through refineries that utilize renewable or waste feedstocks to produce SAF, thus fostering regional economic development and creating opportunities in rural communities.

Furthermore, G20 countries could set up clear regulations to facilitate investment decisions and create a favorable environment for developing and deploying bioenergy technologies, including the establishment of calls for projects (e.g., the United Kingdom's Advanced Fuels Fund's £135 million call to develop SAF projects[100]) and feed-in tariffs (e.g., France's feed-in tariffs since 2011 for biomethane injected into the French natural gas grid for projects with production capacity below 25 GWh/year[101]). Additionally, direct investments in increasing production capacity would be necessary, with an estimated annual global investment of over USD 50 billion to expand production capacity, foster innovation, and overcome potential feedstock bottlenecks[75].

x SAFs have been commercially available since 2011[76] and are expected to experience rapid global demand growth. They can be produced using multiple sources and technologies with different degrees of maturity and decarbonization potential. Bio-based SAFs have the most potential for scale in the short to mid-term, including hydro-processed esters, fatty acids (HEFA), and ethanol-to-jet routes. Their commercial application currently requires a blend with traditional jet fuel, with a maximum current blend of 50%[96] of sustainable fuel, depending on its composition. Still, noncommercial tests have already proven the possibility of 100% SAF flights.

xi The 2G bioconversion industry, with its first commercial-scale plant established in 2013[97], allows bioenergy production from nonedible sources, mitigating supply chain risks. Innovations in the production of 2G ethanol include the use of cellulosic alcohol – made from nonfood plants, grasses, forest biomass, and agricultural waste fermentation, which can increase the variety and quantity of suitable feedstock for 2G ethanol. Investments in innovation are key for developing and scaling other 2G technologies, producing energy with low environmental impact[74].

Policy Action 1.3

Enable expansion of other solutions necessary for the transition to net-zero emissions, such as carbon capture, utilization, and storage (CCUS); clean hydrogen; and nuclear power.

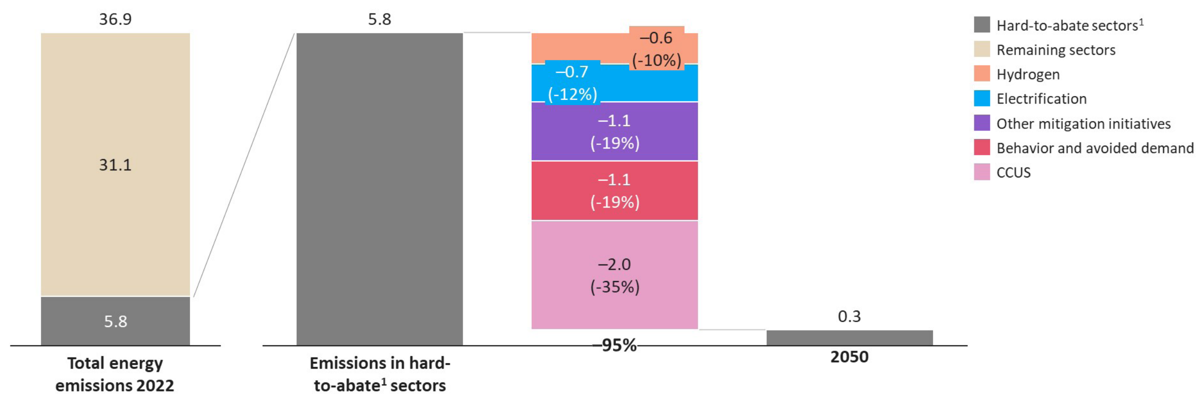
Executive Summary

Besides the measures stated in policy actions 1.1 and 1.2, decarbonization efforts should cover expanding other solutions necessary for net-zero emissions targets, such as CCUS, clean hydrogen, and nuclear power. This should include (i) establishing legal and regulatory frameworks to promote the development of CCUS hubs, (ii) providing supply (e.g., funding) and demand incentives to develop clean hydrogen solutions, and (iii) ensuring safe nuclear power generation in compliance with global security and risk parameters.

Background and Context

To complete the decarbonization mix, it is pivotal to continue investing in diverse low-carbon energy sources, especially for hard-to-abate sectors/uses/industries and residual emissions, to achieve net-zero emissions (Exhibit 10). For instance, developing the CCUS industry will be important to the net-zero emissions pathway because it can work as a retrofit in current production processes. Clean hydrogen will likely play a key role in hard-to-abate sectors, such as heavy transportation and steelmaking. Last, nuclear power is also a relevant solution, given its current operational capacity, dispatchable generation, and growth potential[102]. Other important tools should also be deployed in tandem with other mitigation methods, such as carbon dioxide removal (CDR) approaches. According to the IPCC[103], these approaches are not a substitute for deep emissions reductions but are needed to limit warming to 2.0°C or lower and counterbalance emissions, particularly in hard-to-decarbonize sectors.

Exhibit 10 – Global CO_2 emissions and reductions in hard-to-abate sectors1 by mitigation initiative in the IEA Net Zero Emissions scenario, $GtCO_2e$



[1]Hard-to-abate sectors are cement, steel, and primary chemicals.
Source: *Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach*, IEA, September 2023

First, CCUS is a process centered around capturing CO_2 from large point sources, such as power generation or industrial facilities that use fossil fuels or biomass as fuel. It is then compressed and transported to be used in various applications (using it, CCU) or injected into deep geological formations (storing it, CCS) such as depleted oil and gas reservoirs or saline aquifers[104]. CCUS is expected to play a crucial role in achieving climate goals, especially in reducing the carbon intensity of hard-to-abate sectors, such as chemicals, steel, cement, and concrete. According to the IEA, to achieve net-zero emissions targets, the global capacity for CCUS must increase by more than 100 times in the long term, reaching up to 6 Gt by 2050[105]. This would account for approximately 8% of the total energy-related decarbonization required and represent 35% of the decarbonization needed for hard-to-abate sectors[105].

One of the advantages of CCUS is that it can be retrofitted to existing power and industrial plants, allowing for continued operation. Among CCUS options, bioenergy with carbon capture and utilization or storage (BECCUS) stands out as an alternative that combines biomass energy production with CO_2 removal, with the potential of being a carbon sink with the capture of biogenic carbon[106]. However, to achieve global scalability of CCUS employment, some challenges should be overcome, including the high costs and long lead times for project development, the identification of suitable and leakage-proof geological formations for storage, the alignment of different carbon accounting regimes/standards, the access to long-term financial capital to support the installation of carbon capture units and infrastructure, and the establishment of supportive regulatory frameworks[107,108].

Second, hydrogen plays a crucial role in achieving net-zero emissions by 2050 by complementing other energy decarbonization efforts and reducing carbon emissions in hard-to-abate sectors[109]. The dominance of grey hydrogen[xii] in today's consumption is expected to diminish as the demand for clean hydrogen surges and its costs become increasingly competitive[109]. According to the IEA[111], by 2050, low-emission hydrogen could represent about 98% of total hydrogen demand, with green hydrogen[xiii] constituting around 78% of the supply, followed by blue hydrogen[xiv], which is expected to account for the remaining market share. Announced low-emission hydrogen production projects currently represent 55% of the 2030 target in the IEA NZE Scenario. Thus, ambitious action is required to create demand and stimulate investment in these production projects[111].

Hydrogen is a versatile energy vector with many applications, such as fuel for long-haul transportation (e.g., aviation and maritime) and feedstock or fuel in steel, chemicals, and power generation industries. Moreover, when generated using renewable energy sources, it can serve as a versatile renewable energy carrier, making it one of the preferred choices for sector coupling, using periods of excess renewable electricity to produce hydrogen; and as a reducing agent for low-carbon steelmaking to produce hot briquetted iron. As such, the potential benefits of clean hydrogen solutions that complement other energy decarbonization efforts are significant, including reduced emissions, improved air quality, and increased energy security.

Finally, nuclear power currently accounts for 10% of global electricity generation and has significant potential to contribute to the power sector's decarbonization[113]. It has historically been one of the most important global contributors of carbon-free electricity, currently being the second-largest source of low-emission power after hydropower[102]. Nuclear power plants contribute to electricity security in multiple ways by keeping power grids stable and complementing decarbonization strategies because they can adjust their output to accompany shifts in demand and supply[102]. However, nuclear power also faces challenges, including high up-front costs, long lead times, public opinion opposition, and regulatory obstacles to its establishment – and any effort should be in compliance with global security and risk parameters.

xii Grey hydrogen is hydrogen's most common form and is generated from natural gas or methane through a process called steam reforming[110].

xiii Green hydrogen is produced by using clean energy from renewable electricity[112] sources, such as solar or wind power, to split water into two hydrogen atoms and one oxygen atom through a process called electrolysis[110].

xiv Blue hydrogen is the hydrogen produced from natural gas by steam methane reforming in conjunction with CCS. Blue hydrogen can only be labeled "clean" if methane leakages are minimized to near zero, the carbon capture rates are high, and the carbon captured is permanently stored underground to prevent its release into the atmosphere[110].

Specific Actions

I) Establish legal and regulatory frameworks to promote the development of CCS/CCU hubs

Scaling up CCUS encounters significant challenges, including the substantial investments needed for deployment and the safety issues related to constructing extensive pipelines and storage networks for CO_2 collection and disposal. To address these challenges and accelerate the development of carbon-removal technology and infrastructure, developing CCS/CCU hubs stands out as a promising alternative[104,106].

A CCS hub is a cluster of high-emission facilities that share the same CO_2 transportation and storage infrastructure, spreading costs and generating economies of scale. The storage of the captured CO_2 is mainly made in deep geological formations, such as saline aquifers and oil and gas reservoirs. Examples of CCS hub initiatives are in Brazil, China, Italy, the Netherlands, Norway, Saudi Arabia, the United Kingdom, and the United States[114].

A CCU hub represents a cluster of emission facilities that share only the CO_2 transportation infrastructure, independent of specific geological formations. The final use of the captured CO_2 varies according to the needs of the end buyer or consumer, encompassing industries such as food and beverages, chemicals, fuels, and consumer goods[115].

In this context, G20 countries are incentivized to consider establishing legal and regulatory frameworks to promote the development of CCS/CCU hubs. Together with other measures such as tax incentives, investment pools, crediting schemes, or direct funding, these frameworks can help ensure that shared infrastructure networks are accessible to all developers without discrimination and establish guidelines for sharing costs.[106]

II) Provide supply (e.g., funding) and demand incentives to develop clean hydrogen solutions

To unleash hydrogen's potential, some obstacles should be overcome, including the high cost of clean hydrogen production and utilization technologies; the need for affordable transportation, storage, and usage costs to support hydrogen market development (such as repurposing existing natural gas pipelines and storage facilities to ensure lower costs); uncertainties surrounding future hydrogen demand; and a lack of clarity regarding certification and regulation[109]. Given the urgency and complexity of these challenges, action is needed on both the supply and demand sides.

On the supply side, for instance, G20 countries should consider allocating funds to enhance production capabilities, as well as establishing regulations that support offtake agreements and power purchase agreements. This could include developing investment pools, accelerating renewable energy generation and infrastructure deployment, and providing support to identify project opportunities. By making these resources available, G20 countries can enable a scale-up compatible with their decarbonization goals.

On the demand side, considering specific circumstances as capacity and technology advancement, regulations (such as quotas or mandates) could be issued to require the adoption of clean hydrogen in existing applications. Simultaneously, the private sector could contribute by promoting demand aggregation in industries like chemicals and refining, which are viable options for boosting short-term demand[109]. Additionally, the development of hydrogen hubs, integrated with other energy solutions hubs, such as bioenergy CCU, could further stimulate the demand for clean hydrogen as a feedstock for producing low-emission chemicals and e-fuels[xv] (e.g., green ammonia, e-methanol, and Fischer–Tropsch-based fuels).

xv Low-emission e-fuels can add to the diversification of decarbonization options that are available for aviation and shipping and present a high-potential synergy with biofuel production, especially in the form of biogenic CO_2 utilization[95].

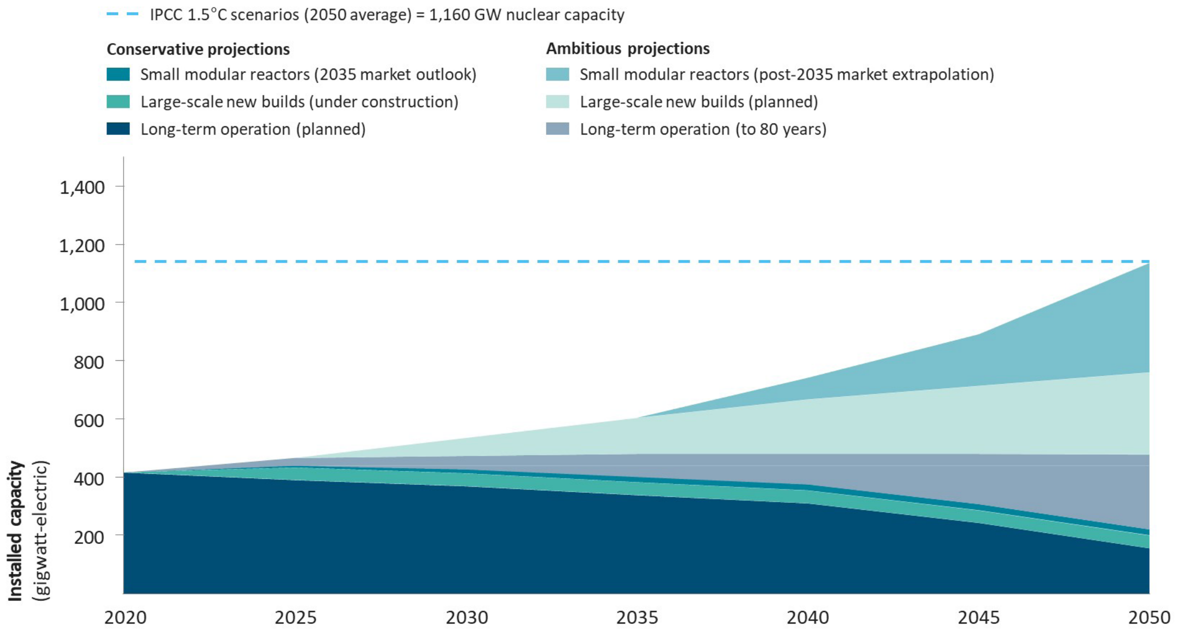
III) Ensure safe nuclear power generation in compliance with global security and risk parameters

Several strategic initiatives could be pursued to ensure that nuclear power generation contributes effectively and safely to net-zero emissions (Exhibit 11). These include expanding production capabilities at existing nuclear plants, establishing new facilities, and investing in cutting-edge technologies such as Generation III+ and IV reactors, small modular reactors, and fusion reactors, all in compliance with stringent global security and risk standards[116,117].

Extending the operational lifespan of existing nuclear power plants is also a relevant strategic initiative, representing a cost-effective method to produce low-emission electricity and has already yielded positive results in various countries[102]. Additionally, implementing a long-term payment scheme, establishing robust cost-risk management systems, and developing effective strategies for managing high-level radioactive waste are critical measures that should be actively promoted to support the sustainable expansion of nuclear energy.

To forestall the potential risks related to natural hazards, human error, mechanical failure, design flaws, radioactive waste and contamination, G20 countries should adopt consistent safety standards for new designs and existing nuclear plants. This could involve adhering to the International Atomic Energy Agency's (IAEA) guidelines, including its Emergency Preparedness and Response framework[118], and clearly communicating licensing requirements to all parties involved[119].

Exhibit 11 – Full potential of nuclear contributions to net-zero emissions



Source: *Meeting climate change targets: The role of nuclear energy*, OECD Nuclear Energy Agency, May 2022
Global cooperation to establish fusion regulations should be enhanced, promoting the swift deployment of safe fusion facilities worldwide in response to the rapid expansion of fusion industries[120]. Furthermore, dialogue among nuclear and fusion regulatory authorities should be encouraged to facilitate sharing best practices and cases.

RECOMMENDATION 2

Recommendation 2

Recommendation is partially aligned with previous B20 editions

Double the average annual rate of global energy efficiency improvement through to 2030 while promoting resource efficiency and circular economy

Policy Actions

Policy Action 2.1: Double the average annual rate of global energy efficiency improvement through to 2030 by evolving policies on technical efficiency, investment programs, and measures to increase public awareness.

Policy Action 2.2: Promote efficient use of global resources and circular economy by developing policies considering the entire materials life cycle and fostering financing and awareness programs to enhance the adoption of circular practices.

Key Performance Indicators	Baseline	Target	Classification
Global average annual rate of energy efficiency improvement Computed as the yearly progress (%) on energy intensity efficiency[xvi]	**~2%**[25] 2022	**~4%**[25] 2030	Aligned with previous B20s editions
Global percentage of recycled resources employed in the economy Computed as cycled resources/total resources entering the global economy	**7.2%**[121] 2023	**17%**[122] 2030	Aligned with previous B20s editions

The "Leading Monitoring KPIs" are intended to offer suggestions for indicators that measure global progress on the theme. They seek to encourage the adoption of actions. These indicators and targets do not suggest a commitment for specific countries or a replacement of their commitments under their Nationally Determined Contributions (NDCs).

SDGs

Recommendation 2 contributes to the achievement of the following UN SDGs:

xvi Amount of energy required to produce a unit of GDP. Computed as the ratio between total energy supply and GDP in constant 2015 USD using purchasing power parity.

SDG 7: Affordable and clean energy – the recommendation focuses on the development of and access to affordable, reliable, sustainable, and modern energy for all.

SDG 8: Decent work and economic growth – sustainable economic growth is related to the acceleration of sustainable solutions, including through innovation.

SDG 9: Industry, innovation and Infrastructure – implementation relates to the fulfillment of several SDG 9 targets, such as developing sustainable, resilient, and inclusive infrastructures; promoting inclusive and sustainable industrialization; upgrading all industries and infrastructures for sustainability; and enhancing research and upgrading industrial technologies.

SDG 11: Sustainable cities and communities – Recommendation 2 fulfils at least two of its targets: sustainable transport systems and sustainable and resilient building.

SDG 12 – Responsible consumption and production – acceleration of sustainable energy solutions involves increasing efficiency, boosting sustainable infrastructure, and creating green/sustainable jobs.

SDG 13: Climate action – acceleration of sustainable energy solutions is imperative to tackle climate change and its impacts urgently.

SDG 15: Life on land – shifting to sustainable energy sources supports the protection of terrestrial ecosystems.

Relevant B20 Brasil Guiding Claims

Recommendation 2 has the strongest impact on one B20 Brasil Guiding Claim:

Accelerate a fair net-zero transition because energy and resource efficiency are crucial steps in the path to net-zero emissions.

Relevant G20 Brasil Priorities

Recommendation 2 contributes to the following priorities of the G20 Brasil

Recommendation 2 contributes to addressing one of **G20's Brasil Energy Transition** key priorities: (I) Accelerating Financing for Energy Transitions, especially in EMDEs, because Policy Action 2.1 addresses financial and fiscal incentives to promote energy efficiency.

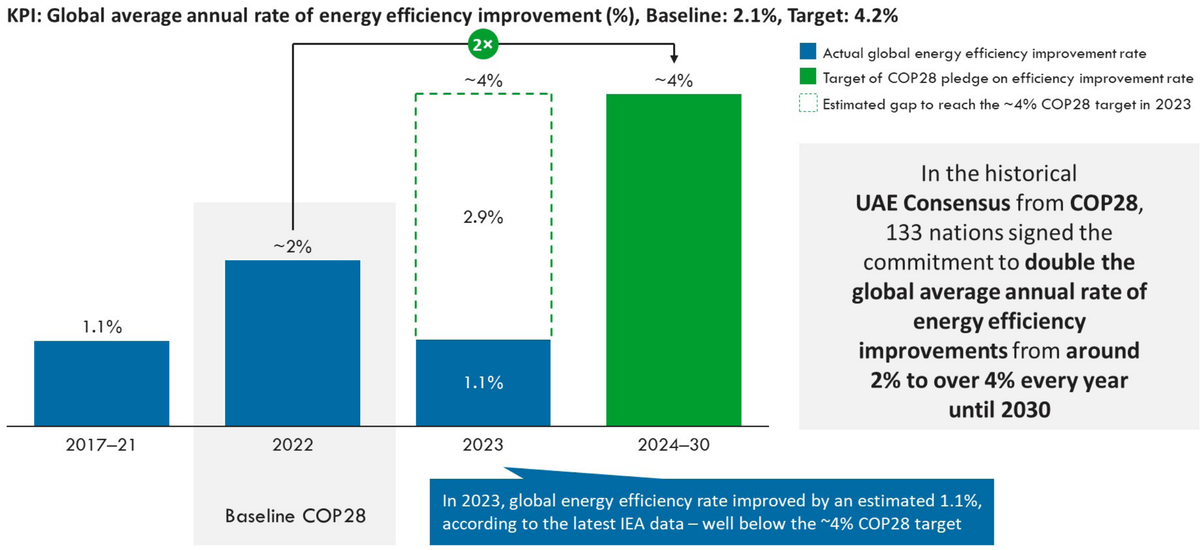
Recommendation 2 contributes to addressing one of **G20's Brasil Environment and Climate Sustainability** key priorities: (IV) Waste and Circular Economy because its Policy Action 2.2 focuses on collaborating to foster the adoption of circular economy principles to reduce waste and carbon emissions.

Context

The availability of secure and reliable energy, materials and other resources is essential for industrial processes and the provision of public services, such as lighting, heating, cooking, information, technology, and mobility. However, estimates show that we are already using more than the available amount of Earth's natural resources and if current trends were to continue, we would need three planets by 2050[123]. Increasing energy and resource efficiency and applying circular economy principles are key opportunities to reduce waste and move onto a net-zero emissions path, securing the economy's functionality.

Over the past few years, insecurity surrounding energy availability coupled with the inflationary impact of rising energy prices on the world's economies made imperative, for almost all governments, to lower consumer bills and secure reliable access to supply. Focusing on achieving energy efficiency is one of the best responses to simultaneously meet affordability, supply security, and climate goals. Following COP28's pledge, the world should double the global average annual rate of energy efficiency improvements from around 2% in 2022 to over 4% every year until 2030[25] (Exhibit 12).

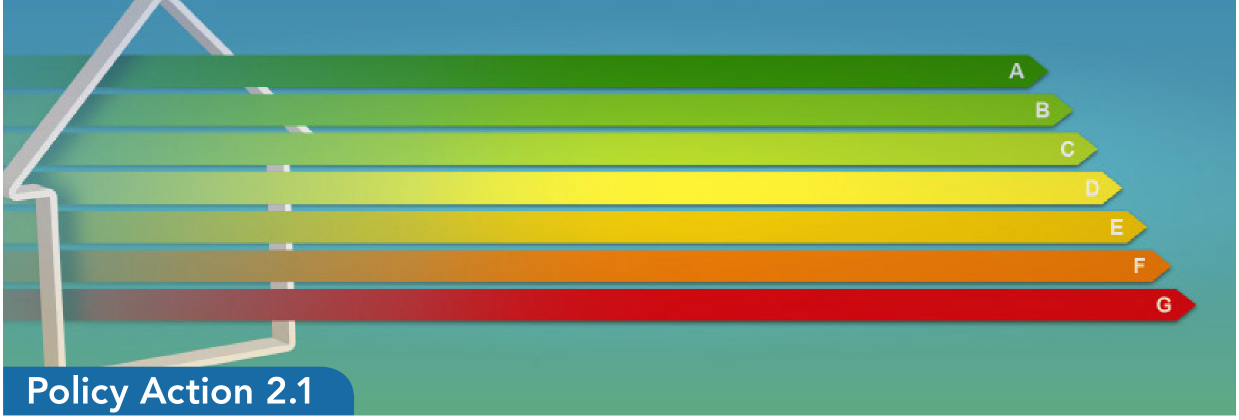
Exhibit 12 – Average annual rate of global energy efficiency improvement and target of COP28 pledge on doubling the annual rate every year until 2030, %



Source: "COP28: Tracking the energy outcomes," IEA, 2023; "The UAE Consensus foreword," COP28, accessed July 2, 2024

The net-zero transition relies on materials supply as an enabler once industries are undergoing rapid and fundamental technological changes, making them a significant driver for materials demand in the future[124]. Having a reliable and robust energy supply chain is one of the main challenges industrial companies face in accelerating the energy transition. Given that, international cooperation and the development of local suppliers are key to accessing materials such as critical raw materials, batteries, solar panels, etc.

To boost resource efficiency, it is vital to undertake a materials transition, which involves replacing materials with high energy and emission levels with those that are more efficient and less polluting, considering national conditions and available resources. Additionally, integrating circular-economy principles through developing tailored policies for local conditions and enhancing public–private partnerships is crucial. These actions collectively serve as an effective method to decrease industrial GHG emissions.



Policy Action 2.1

Double the average annual rate of global energy efficiency improvement through to 2030 by evolving policies on technical efficiency, investment programs, and measures to increase public awareness.

Executive Summary

Investing in energy efficiency improvements is a cost-effective way to boost decarbonization measures and get closer to net-zero emissions. Its strategic position was recognized in the COP28 pledge with an agreement to double the average annual rate of global energy efficiency improvements from 2% to 4% through to 2030[25]. To this end, and considering national circumstances and available resources, three sets of actions should be implemented: (i) Set energy efficiency policies to improve technical efficiency; (ii) Strengthen investment programs to enhance energy efficiency and reduce disparities worldwide; and (iii) Disseminate information and promote awareness (i.e., labeling programs) of energy efficiency to stimulate behavior change.

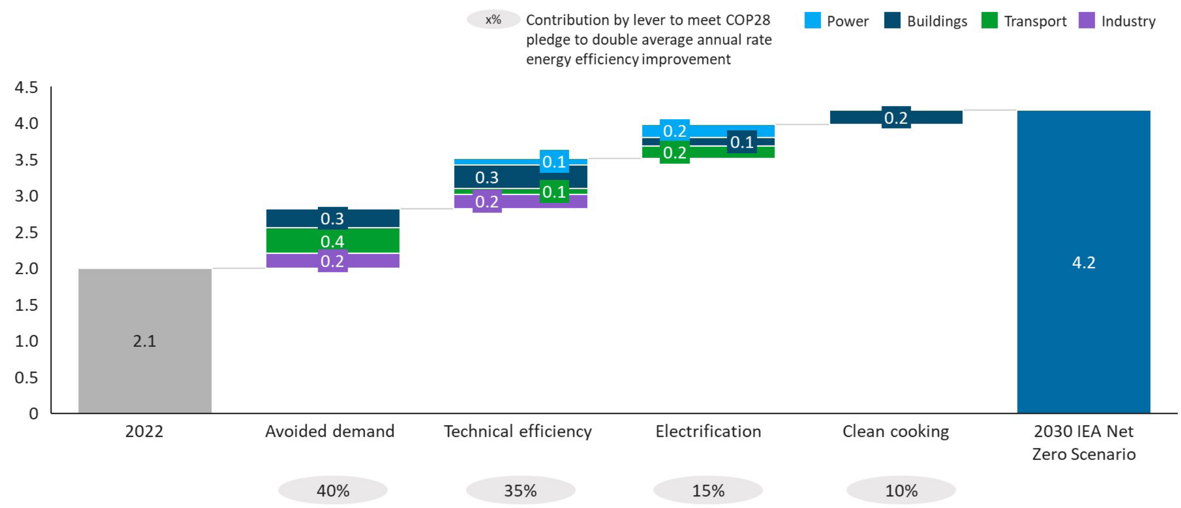
Background and Context

Energy efficiency is increasingly being recognized as the first and best response to align security, affordability, and climate goals simultaneously,[125] with the potential to abate up to 5 $GtCO_2e$[126]. It encompasses a broad spectrum of measures, such as using energy-efficient appliances, changing industrial processes to minimize energy use, improving transportation efficiency, and switching end uses to more-efficient energy vectors, such as electricity. In the COP28 Global Renewables and Energy Efficiency Pledge, countries committed to doubling the average annual rate of global energy efficiency improvements (Exhibit 12) as well as making energy efficiency the "first fuel" at the center of their policymaking, planning, and major investment decisions. Every country should take these measures, considering different starting points, national circumstances, and the unique realities of different regions[25], ensuring fairness in the transition.

By improving energy efficiency, countries can make the most of their existing energy sources and slow down the depletion of finite resources. They can also reduce energy dependence, thus contributing to energy security. Investing in energy efficiency presents significant economic opportunities for businesses and consumers. For instance, home energy bills today in advanced economies could be lowered by a third[127]. This stimulates economic growth, creates approximately 4.5 million additional jobs[125] and drives innovation in energy-efficient technologies and practices. By embracing energy efficiency, businesses can reduce operational costs, enhance competitiveness, and contribute to a more sustainable future[128].

That said, there are four strategic levers to consider when reducing energy intensity and achieving the pledge to double the average annual rate of global energy efficiency improvements: avoided demand, technical efficiency, electrification and renewables, and clean cooking (Exhibit 13).

Exhibit 13 – Potential path to double the rate of annual primary energy intensity improvements by 2030, %



Note: Figures do not sum to total, because of rounding.
Source: *Net Zero Roadmap: A global pathway to keep the 1.5 °C goal in reach*, IEA, September 2023

Avoided energy demand includes behavior change while technical efficiency involves sector-specific innovation – including hard-to-abate sectors, e.g., oil and gas, cement, and steel – focusing on reducing sector impact by decarbonizing their operations during the transition to a low-carbon economy. Gains in efficiency related to electrification (e.g., employment of heat pumps and EVs) were already discussed in Recommendation 1, and its share of the energy efficiency solution portfolio will depend on lifecycle energy and emission assessments of the different technologies and on consideration of regional contexts. Finally, clean cooking refers to the use of cooking technologies and fuels that minimize harmful emissions and improve efficiency[129], which is also related to reliable, affordable, and sustainable access to primary cooking by shifting from cooking facilities fueled by sources such as charcoal and solid biomass, which release pollutants harmful to human health, to other technologies and cleaner fuels such as biogas and electricity, which have a positive impact on health, communities, and the environment.

Specific Actions

I) Set energy efficiency policies to improve technical efficiency

Effective energy efficiency measures require policies to incentivize consumer and business adoption, which is essential in driving the transition from less efficient products and operations to more efficient ones. These policies can also support the mid- and long-term decarbonization strategy, promoting technological innovation on sectoral road maps, including the hard-to-abate sectors.

G20 countries should update and set new policies specifying guides and goals for the sectors to improve technical efficiency in cooperation with the transition to a low-carbon economy. For instance, in the building sector, Tokyo's current government is committed to reaching zero emissions for all buildings by 2050 through actions such as the introduction of the Tokyo Zero Emission House specification, which ensures energy-efficient performance to be widely adopted and encourages switching to high-energy efficient home appliances[130]. Another example from the industry sector is India's Perform, Achieve and Trade (PAT) scheme, which has been in place since 2012[131]. The PAT scheme identifies designated consumers across select energy-intensive industries who must meet mandated energy efficiency targets in a given period, including steel and aluminum.

In the industrial sector, the broader implementation of combined heat and power (CHP) technology can significantly enhance the efficiency of on-site power generation. By minimizing losses and utilizing heat that would otherwise be wasted, CHP systems can provide facility loads with necessary process heating, steam, hot water, or even chilled water. These systems offer the advantage of resilient, round-the-clock power during grid outages and can be seamlessly integrated with other distributed energy technologies such as solar PV and energy storage systems[132]. Cogeneration, the process underlying CHP, is up to 40% more efficient than generating heat and power separately[133]. This efficiency translates to a substantial reduction in carbon emissions, with at least 250 million tons of CO_2e ($MtCO_2$e) being avoided annually in Europe alone[134].

In the oil and gas sector, specific regulations can also guide the fulfillment of the Global Methane Pledge, which aims to advance technical and policy work that will serve to underpin the domestic actions of over 155 country participants[135]. For instance, Canada's Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector) focus on fossil fuel operations[136], stipulating technical requirements to reduce the emission of methane (i.e., minimum rate of methane captured or conserved that is routed to the equipment, among others[137]). Complementing national efforts, the Oil and Gas Climate Initiative (OGCI), led by CEOs from 12 of the world's top oil and gas companies, targets a reduction in the carbon intensity of its members' operations[138]. The initiative aims to decrease the aggregate upstream carbon intensity from 23 $kgCO_2$e/boe[xvii] recorded in 2017 to 17 $kgCO_2$e/boe by 2025[139]. Since 2017, OGCI's members have made significant progress, reducing collective upstream methane emissions by half and reducing carbon intensity by 21%, reaching 18 $kgCO_2$e/boe in 2022, just 6% away from its 2025 goal[140].

G20 countries should also consider setting progressive minimum energy performance standards (MEPS) to encourage developing and adopting more efficient equipment. MEPS are considered one of the most effective policy tools for energy efficiency because they ensure that new equipment meets minimum requirements. For example, the Directive 2009/125/EC and Regulation (EU) 2017/1369 on energy-efficient products[141] set eco-design and efficiency requirements by product category in the European Union; and specifically for electric motors, which encompass nearly 50% of the electricity the EU produces, the policy estimated savings of 46 terawatt-hours (TWh) in 2020 and expects to reach 106 TWh in 2030, avoiding 40 $MtCO_2$e annually[142]. On the consumer side, MEPS are frequently combined with other policy measures like comparative labels (further elaborated in sub-action III) to encourage consumers to choose products that exceed the minimum standards set by regulations. For example, India's MEPS and labeling program for air conditioners has expanded to cover 100% of residential-space cooling consumption[xviii] and now also includes ceiling fans, having saved 69.78 TWh and avoided emissions of 57 $MtCO_2$e in 2021–22[125].

II) Strengthen investment programs to enhance energy efficiency and reduce disparities worldwide

Encouraging private and public investments to ensure a fair energy efficiency improvement transition, particularly in developing countries, is an enabler to achieving the COP28 pledge of doubling the average annual rate of global energy efficiency improvements through to 2030[25]. Substantial efforts are required to achieve this goal, according to the IEA[53]. Investments in key areas, such as retrofitting buildings, are lacking, with spending declining in 2023. To achieve the efficiency targets, it is necessary to triple annual spending on efficiency to about USD 1.9 trillion by 2030. Although the private sector is increasingly involved in financing energy efficiency, the public sector still plays a prevalent role in this field, because in EMDEs, high financing costs are a significant barrier. These high costs are driven by macroeconomic, country-specific, and energy sector–specific risks. National policymakers and enhanced support from development finance institutions are crucial for lowering financing costs and attracting more private capital[53].

xvii Barrel of oil equivalent.

xviii Up from 37% in 2009[125].

In this context, G20 countries should de-risk the investment environment as much as possible and promote financial mechanisms for energy efficiency projects. Many countries have already provided economic incentives for energy efficiency, helping accelerate the deployment of more efficient technologies. One example is the Innovation Fund[143], implemented by the European Climate, Infrastructure and Environment Executive Agency, aiming to create financial incentives for companies and public authorities to invest in low-carbon technologies. The money is raised from the EU Emissions Trading System and is reinvested into the fund for large-scale projects. At the same time, the European Investment Bank provides development assistance to promising projects intending to increase their maturity. In 2023, applications were submitted under the topics of general decarbonization, innovative electrification in industry and hydrogen, clean tech manufacturing and midsize pilots[144].

In fact, for every USD 1.00 spent on capital investments related to fossil fuels worldwide, USD 1.70 is spent on sustainable energy, with USD 0.60 explicitly invested in energy efficiency[125]. However, more and more evenly distributed investments are necessary, and, according the IEA[125], the global annual energy efficiency–related investment would need to triple from current levels. G20 countries should consider cooperating to reduce disparities in worldwide investments. According to the IEA's Government Energy Spending Tracker, 70%, or around USD 470 billion of the total government energy efficiency investment support since 2020 was enacted by only five countries[xix]145. Meanwhile, most emerging and developing economies face restricted financial resources and underdeveloped utilities, needing 3.5 times higher investment levels by 2030 to get on track to net-zero emissions[125]. To illustrate, the IEA review on the National Energy Policy for Uganda 2023[146] discussed that in Uganda, only 30% of the population has electricity access, and less than 6% use clean cooking fuels. The government aims for universal electricity and 50% clean-cooking access by 2040, but affordability and inconsistent financial support hinder progress. Initiatives like social tariffs and free connections exist, but low grid connectivity limits their effectiveness, and liquefied petroleum gas is widely available only in urban areas. Thus, reaching the 2040 access target for electricity and clean cooking will also require foreign investment.

III) Disseminate information and promote awareness (i.e., labeling programs) of energy efficiency to stimulate behavior change

Together with investments and other measures, the COP28 Global Renewables and Energy Efficiency Pledge highlights raising public awareness and encouraging behavioral changes as enablers for energy efficiency commitments[25]. Disseminating information and amplifying capacity building on energy efficiency play a vital role in achieving energy efficiency goals by driving the adoption of commercially mature technologies and motivating consumers and companies to switch to low-emission products[125].

G20 countries should invest in knowledge and information to promote awareness of energy efficiency and behavior change as a means of driving avoidance of demand. This includes educational qualifications, awareness campaigns, and programs like comparative product energy efficiency labels. Energy labels empower consumers to make informed decisions when purchasing appliances[xx]. For instance, in Brazil, the *Programa Nacional de Conservação de Energia Elétrica* (Procel) indicates to consumers that products are efficient through a label with a tag indicating the level of energy efficiency[148]. In 2022, Procel contributed to savings equivalent to 22 billion kilowatt-hours (kWh), which corresponds to supplying 11.16 million homes for a year[149].

xix France, Italy, Germany, Norway, and the United States.

xx MEPS and labeling measures conform to energy efficiency standards and labeling (EES&L) programs, which are increasingly recognized as crucial tools to promote energy efficiency, drive market transformations and product innovations, create jobs, and reduce CO_2 emissions. They have been operating in over 120 countries worldwide with a positive impact. Advanced EES&L programs contribute to 7–10% of total energy-related emissions reductions annually in countries where they are established, resulting in 343 $MtCO_2$ avoided emissions in the US and 311 $MtCO_2$ in the European Union[147].

In terms of capacity building, an example is the Energy Efficiency Learning Networks, established by the Argentinian government with funding from the European Union and GIZ, a German development agency. These networks involve 68 participating companies, accounting for 15% of the country's industrial energy consumption. The companies set goals through the initiative and receive technical support to improve energy efficiency. The government estimates that each network has achieved savings of 4–7% in power consumption and 5–8% in natural gas consumption[150] (concluded in 2011). Another example is the Young Energy Europe – supported within the framework of the European Climate Initiative of the German Federal Ministry for Economic Affairs and Climate Action – which enables young professionals from European countries, such as Croatia and Poland, to extend their education in the fields of energy and resource efficiency in businesses[151]. Regarding awareness campaigns focused on behavioral change, one example is the "Be in the know" campaign, from of the SuisseEnergie program launched by the Swiss Federal Office of Energy. The campaign is geared towards encouraging consumers that are considering buying a car to make an informed choice by comparing emissions between electric mobility and other propulsion technologies[152].

Policy Action 2.2

Promote efficient use of global resources and circular economy by developing policies considering the entire materials life cycle and fostering financing and awareness programs to enhance the adoption of circular practices

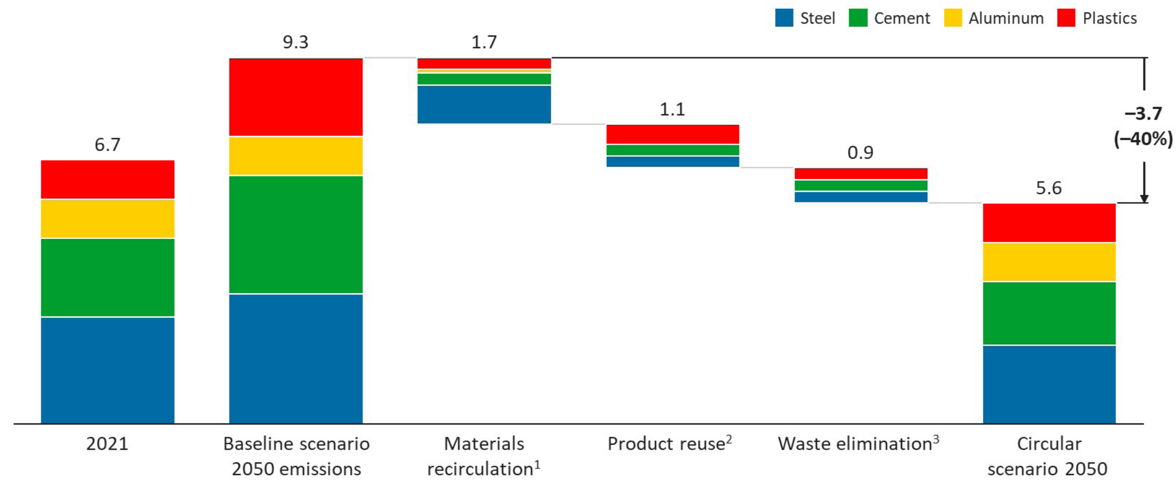
Executive Summary

Implementing sustainable practices across value chains is key to mitigating climate effects, reducing emissions and waste production globally. To achieve this, G20 countries should adopt three main specific actions: (i) develop policies to accelerate the adoption of the circular economy; (ii) foster financing programs to enhance the adoption of resource efficiency and carbon circular practices; and (iii) promote measures to provide information and increase awareness about resource efficiency and circularity.

Background and Context

The current pace and forms of consumption come with social and planetary impacts that result from designing, producing, transporting, using, and discarding products[153]. Resource efficiency and the circular economy[xxi] consist of reducing waste and losses including new ways of designing, using, and reusing natural capital as efficiently as possible and finding value throughout the life cycles of finished products. By implementing a circular strategy, key materials production – steel, cement, aluminum and plastics – can reduce annual emissions by 40%, resulting in a yearly decrease of 3.7 $GtCO_2e$ by 2050[154] (Exhibit 14).

Exhibit 14 – Global emissions from key materials production, $GtCO_2e$ per year



[1]The circular economy scenario modeled explores opportunities for new business models that stimulate collection, sorting, and recycling. The scenario envisages an increase in recycling rates and the quality of both inputs and outputs. It also forecasts an increase in demand for recycled materials giving rise to economies of scale. [2]Service-based business models such as renting, sharing, and pay-per-use can increase the utilization (i.e., intensity of use) of products and assets, as well as extend their lifetime through activities such as reuse, refurbishment, and remanufacturing. [3]Eliminating waste across value chains and in the design of products offers opportunities for avoiding GHG emissions using measures such as material-efficient designs for buildings, industrialized construction processes, and lightweighting vehicles.
Source: *Completing the picture: How the circular economy tackles climate change*, Ellen MacArthur Foundation, 2021; McKinsey analysis of *Mission possible: Reaching net-zero carbon emissions from harder-to-abate sectors*, Energy Transitions Commission, November 2018

xxi The circular economy is a framework for systems solutions and transformation that tackles global challenges such as climate change, biodiversity loss, waste, and pollution. It has three principles, all driven by design: eliminating waste and pollution, circulating products and materials, and regenerating nature[154].

Studies from the Ellen Macarthur Foundation and Material Economics[154] show that design and processes play a key enabling role in reducing waste as well as reusing and circulating products. The main levers are: (i) designing for circularity to ensure that products and materials are made from the outset to be kept in use (e.g., refillable designs for plastic packaging can lead to an 80–85% reduction in GHG emissions compared to single-use bottles in beauty and personal care, as well as home cleaning); (ii) designing for material efficiency to help eliminate waste by reducing material input and waste generation (e.g., 15% of building materials are wasted in construction); (iii) substituting materials for renewable, low-carbon, or secondary materials (e.g., bio-based plastics have a negative emissions potential of –2.2 kg CO_2e per kg of bio-based polyethylene produced, compared to 1.8 kg CO_2e per kg of fossil fuel–based polyethylene produced); (iv) implementing reuse of products and components, by conserving embodied energy and resources (e.g., doubling the amount of time garments are worn can avoid 44% of GHG emissions by preventing them from going to waste); and (v) recirculating materials, which refers to increasing materials recycling by increasing recycling rates and improving the design for recycling (e.g., shifting to mono-materials in plastics packaging design for the more than 40% of flexibles that are currently multi-material[156]), then avoiding the production of new virgin material and end-of-life treatment (e.g., steel recycling uses 10–15% of the energy required to produce primary steel). There are ongoing discussions on materials pollution approach, for example at INC on Plastic Pollution.[66]

To accelerate the implementation of a circular economy approach, some coalitions were created across the globe among the public and private sectors. For instance, the Global Alliance on Circular Economy and Resource Efficiency[157] was launched in 2021 as a coalition of governments at the global level willing to collaborate and advocate for a worldwide fair circular-economy transition and more-sustainable management of natural resources at the political level. The Circular Bioeconomy Alliance, established in 2020, offers informed support alongside a platform for learning and networking that links investors, companies, governmental and nongovernmental organizations, and local communities. This initiative promotes the advancement of the circular bioeconomy and the restoration of biodiversity[158]. The Industrial Deep Decarbonization Initiative (IDDI) is a policy framework introduced at COP26 to promote sustainable procurement practices and reduce carbon emissions in the industrial sector. Led by the United Kingdom and India, the initiative is a collaboration between public and private organizations to increase demand for low-carbon materials. The IDDI is focused on establishing minimum emission standards for steel and cement, defining a reporting framework and evaluation process, implementing a certification process for producers, and creating a global 2050 outlook for decarbonizing both industries[159]. The Kunming-Montreal Global Biodiversity Framework's target 16[160] is to "Enable Sustainable Consumption Choices To Reduce Waste and Overconsumption".

Hence, successful circular solutions reduce risks intrinsically linked to traditional models by reducing dependence on dwindling natural resources and improving resource security and resilience to price volatility, supply shocks, global supply chain disruptions, and macroeconomic challenges[161] as well as supporting the energy transition, which is material intensive. Nevertheless, according to the *Circularity Gap Report*, despite the circular economy entering the mainstream, global circularity is still declining, with the share of secondary materials consumed by the worldwide economy decreasing from 9.1% in 2018 to 7.2% in 2023, which represents a 21% drop in the past five years[121].

Specific Actions

I) Develop policies to accelerate the adoption of the circular economy

There are key principles of the circular economy approach that tackle critical challenges: (i) eliminate waste considering the end-to-end cycle and (ii) keep products and materials in use, promoting retention of embodied emissions. Both principles can be attempted by rolling out bold and contextually appropriate policies[121].

G20 governments should have harmonized definitions and set up policies to accelerate the adoption of alternative and more-sustainable materials still in the concept stage, simplify procedures for sustainable materials authorization, promote reduction of raw materials consumption, encourage second materials use, foster new ways of designing out waste, and define clear accountabilities throughout the life cycle. With policies, solutions become more valuable instruments and begin to replace linear norms. For instance, the Dutch National Circular Economy Programme[162] addresses four strategies that foster circular design: reducing raw material usage, substituting raw materials, extending product lifetime, and high-grade processing. Another example is Japan's Fundamental Plan for Establishing a Sound Material-Cycle Society[163], which positions the transition to a circular economy as a national strategy.

When developing these policies, governments could consider measures such as establishing minimum targets for the entire life cycle. For instance, they could create recycling targets for different materials, such as critical minerals (which also supports the reliability of the supply chain and leads to advanced energy production, transmission, and storage, meeting the urban mining[xxii] concept) stimulating demand and supporting the energy transition, which is material intensive. To illustrate, the EU has directives on recovery and recycling targets for different sectors, such as Directive 2006/66/EC that defines the targets for the collection rates and the recycling efficiencies of batteries and accumulators or Directive 2012/19/EU with rates for collection on waste electrical and electronic equipment placed on the market. Another example with clear targets is the National Waste Policy Action Plan 2019[165] from the Australian government, with targets and actions to implement the 2018 National Waste Policy, such as reducing the total waste generated in Australia by 10% per person and achieving an 80% average recovery rate from all waste streams by 2030.

II) Foster financing programs to enhance the adoption of resource efficiency and circular practices

To achieve a more circular economy, governments should create an economic environment in which businesses and consumers choose sustainable and circular products, making them an easy choice. This includes joint efforts with financial institutions, pricing measures to create more attractive sustainable and circular activities and products, a stimulus to encourage businesses to opt for circular choices, provision of financing and insurance instruments, and attractive schemes for green savings and investments with the private sector.

Furthermore, circular practices could consider the Circular Carbon Economy framework[166] that aims to optimize carbon management through 4 Rs: reduce, reuse, recycle, remove. The last R (remove) reinforces the importance of a comprehensive approach to the energy transition that includes carbon removal technologies as part of the solution. An example of this is the PORTHOS[167] project, a joint CCS effort from the Port of Rotterdam, European Commission, and other public and private entities to capture CO_2 emitted by the industry in the Port, transport it, and store it in empty gas fields beneath the North Sea. Operation is expected to start in 2026.

Thus, G20 governments should promote broad financing programs dedicated to the circular economy, leveraging financial instruments to support products and businesses that are resource efficient, and strengthen circular economy. A circular and resource-efficient economy requires financing in infrastructure, knowledge, technology, and processes to coordinate gaps within value chains. An specific program could de-risk investments into market applications so that circular solutions could replace linear practices and be directed at products and services that bring a positive impact[168,169]. As an example of one such initiative, in 2022, the Circular Economy Working Group of the Sustainable Finance Platform from the Netherlands, set up by financial institutions and the government, published a Roadmap for Circular Finance for 2030[170], proposing four actions: integrally assessing linear and circular risks, taking account of circular metrics in financing to increase transparency; gaining experience by closing landmark deals and fine-tuning circular propositions of funding, and expanding and optimizing financing instruments to make circular financing the new "business as usual."

xxii According to the WEF, urban mining is extracting valuable materials from waste, much of which would otherwise go to landfill or incineration. This can include common metals and plastics as well as rarer but valuable elements. Strong examples are electronic waste and waste metals from demolition or construction.[164]

III) Promote measures to provide information and increase awareness about resource efficiency and circularity

Consumers can play a crucial role in adopting more sustainable practices. A study by NielsenIQ found that 78% of US consumers say that a sustainable lifestyle is important to them[171]. However, this trend varies across generations, and there is much room to improve. Therefore, raising awareness about resource efficiency is critical to accelerating the transition towards a circular economy.

G20 governments should promote measures to increase overall information and awareness about resource efficiency, accelerating the required behavior changes associated with circular practices. Transparency and traceability help build trust and can also influence consumer standards. This could be done through (i) providing information with maximum possible transparency, for example, including an environmental score on product labels and fostering traceability tools, such as the materials' passport[xxiii], that would allow reliable traceability and homogeneous measurement of final products' circularity and stimulate the secondary market and (ii) promoting awareness reinforcing circular principles and cross-industry partnerships, such as advisory centers and waste separation campaigns in urban, rural, and industrial areas to stimulate recycling and use organic waste as raw material for the production of bioenergy. As an example of an advisory center, the Circular City Centre, concentrated on the transition of cities towards circular models, completed its pilot phase in 2023 as a competence and resource center within the European Investment Bank to support, identify, and prepare sound circular projects for financing, supporting cities in four different ways: awareness raising and mobilization, knowledge sharing and dissemination, the Circular City Advisory, and the Circular Project Advisory[173]. As an example of the specific awareness campaign, the Ministry of Environment in Taiwan is collaborating with businesses to promote sustainable practices, such as incentivizing customers to switch away from plastic utensils and promoting the reuse of plastic bags by providing discounts if they bring their own or tax rebate if they return plastic bottles. They have also piloted rental programs for reusable drink containers and encouraged waste sorting[174].

xxiii A digital certified identity of a single product, containing registrations during the entire life cycle of this object[172].

RECOMMENDATION 3

Recommendation 3

Recommendation is partially aligned with previous B20 editions

Promote effective Natural Climate Solutions to mitigate climate change and enhance biodiversity

Policy Action

Policy Action 3.1: Ensure a thriving NCS global market by 2030, widening protection and restoration projects and scaling the international carbon market

Key Performance Indicators	Baseline	Target	Classification
Protection of land, waters, and seas Percentage of terrestrial and inland waters protected area and OECM[xxiv] coverage Percentage of marine protected area and OECM coverage	**16.98%** terrestrial and inland waters[176] **8.26%** seas[176] 2022	**30%** terrestrial and inland waters[177] **30%** seas[17] 2030	New indicator
Primary forest loss Area, global primary forest[xxv] loss	**3.74 Mha**[179] 2023	**0 Mha**[180] 2030	New indicator
Nature-based carbon sequestration $GtCO_2e$ per year, issuance on nature-based sequestration activities[xxvi]	**0.04 $GtCO_2e$**[181] 2023	**2.9 $GtCO_2$**[182] 2030	New indicator

The "Leading Monitoring KPIs" are intended to offer suggestions for indicators that measure global progress on the theme. They seek to encourage the adoption of actions. These indicators and targets do not suggest a commitment for specific countries or a replacement of their commitments under their Nationally Determined Contributions (NDCs).

SDGs

Recommendation 3 contributes to the achievement of the following UN SDGs:

xxiv Other effective area-based protection measures (OECMs) are areas that are achieving the long-term and effective in situ protection of biodiversity outside of protected areas[175].

xxv This is identified by mature natural humid tropical forest cover that has not been cleared entirely and regrown in recent history. Primary forests are among the most biodiverse forests, providing many ecosystem services, making them crucial to monitor for national land use planning and carbon accounting[178].

xxvi Nature-based carbon sequestration activities include afforestation, reforestation and revegetation, agricultural carbon sequestration, improved forest management, and wetland restoration.

SDG 8: Decent Work and Economic Growth – sustainable economic growth is related to the acceleration of sustainable solutions, including through innovation.

SDG 10: Reduced Inequalities – Recommendation 3 mitigates inequality within and among countries; for instance, 1.2 billion people today are exposed to land degradation around the world[183].

SDG 11**: Sustainable Cities and Communities – the recommendation fulfills at least two SDG 11 targets: sustainable transport systems and sustainable and resilient building.**

SDG 13: Climate Action – the acceleration of sustainable energy solutions is an imperative to urgently tackle climate change and its impacts.

SDG 15: Life on Land – shifting to sustainable energy sources supports the protection of terrestrial ecosystems

SDG 17: Partnership for the Goals – Recommendation 3 strengthens cross-border partnerships and cooperation that enable scale of NCS global market

Relevant B20 Brasil Guiding Claims

Recommendation 3 has the strongest impact on the following B20 Brasil Guiding Claim:

Accelerate a fair net-zero transition because the main goal of scaling NCS is achieving net-zero emissions mainly through protection, afforestation, reforestation, and revegetation projects, reducing emissions and capturing CO_2.

Relevant G20 Brasil Priorities

Recommendation 3 contributes to the following priority of the G20 Brasil

(I) Environment and Climate Sustainability ("Emergency and preventive adaptation to extreme climate events" and "Payments for ecosystem services") since the main goal of NCS is implementing protection and restoration projects to prevent and mitigate the effects of climate change; (II) Disaster Risk Reduction: greater application of ecosystem-based approaches to disaster risk reduction because NCS projects are highly relevant to preventing catastrophes related to climate change consequences; and (III) Agriculture: sustainability of agrifood systems in their multiple paths because agriculture is a key sector for promoting restoration, reforestation, and protection projects.

Context

Natural capital, which refers to the world's stock of natural assets, plays a crucial role in supporting the global economy and providing essential services and resilience. It facilitates water cycles and soil formation; safeguards communities from severe weather events such as storms, floods, fires, and desertification; and mitigates climate change by absorbing CO_2. Moreover, biodiversity, an integral part of natural capital, has far-reaching implications, including pharmaceutical innovations, ecotourism, and crop pollination[184].

However, scientific studies have demonstrated that human activity significantly contributes to the decline in the value generated by natural capital. For instance, agriculture, forestry, and other land use sectors (AFOLU), account for approximately 23%[xxvii] of net global GHG emissions[185]. In 2023 alone, the world lost around 3.7 million hectares of primary tropical forest, equivalent to almost 10 soccer fields per minute.[187] Furthermore, the destruction of natural marine reefs and mangroves poses a significant threat to protecting coastal human populations against storms and flooding[184]. Simultaneously, ecosystem fragmentation, habitat loss, and climate change have resulted in a staggering decline of wildlife populations by an average of two-thirds over the past 50 years, leading to a significant decrease in biodiversity[188].

Introduced in 2009 and updated in 2015, the planetary boundaries[xxviii] framework[189] evaluates Earth's capacity to sustain human life, defining a safe operational space that governs the stability of the Earth's atmosphere, oceans, and ecosystems based on nine critical systems[xxix]. It warns that exceeding limits in eight of these systems could cause irreversible environmental damage. Current findings show that human activities have surpassed safe levels in six areas[190]. In addition, ocean acidification is also approaching its planetary boundary[190]. This framework enables a broader perspective in assessing the nine critical systems' exposure to nature-related risks and to strategize for adaptation in a dynamic world. It emphasizes that climate is only one component of the intricate web of Earth's systems, which are all intricately linked.

Hence, combined with previous recommendations, NCS[xxx] play a role in avoiding/reducing emissions and removing/sequestering emissions by implementing ecosystems' protection, restoration (e.g., of natural habitats and pasturelands[192,193]), and sustainable management of ecosystems. Despite the broad spectrum of NCS needed to scale, avoiding emissions by preventing the loss or degradation of natural ecosystems is the most cost-effective and immediate one[194]. For these protection projects, the biomes with the highest impact are forests, peatlands, and coastal wetlands, of which, according to *Nature*[195], the avoided forest conversion has a potential four to five times that of avoided peatland conversion and ten to twelve times that of avoided coastal wetland conversion[xxxi].

NCS have the potential to abate 5–12 $GtCO_2e$ per year by 2030 (Exhibit 15), contributing about 20 –50% of the required reduction to be on the path to net-zero emissions. This requires developing a robust value chain to scale high-integrity protection and restoration projects and improving financing and market mechanisms to develop these initiatives. For that, governments, the private sector, scientific and expert communities, and civil society can collaborate to share resources, knowledge, and best practices, leading to more effective and efficient implementation of NCS. One important action is to leverage international frameworks, such as the Kunming-Montreal Global Biodiversity Framework, which was adopted at COP15 and aims to halt and reverse biodiversity loss by 2030, with 23 targets and four global goals to preserve biodiversity for current and future generations[196]. Along the same lines, it is essential to double down efforts to conclude Article 6 of the Paris Agreement to ensure that countries can pursue voluntary cooperation to reach their climate targets, strengthening global cooperation; adopting a universally accepted carbon market mechanism; and developing clear and broadly recognized standards, protocols, and monitoring, reporting, and verification. Scaling up NCS is essential to addressing the urgent challenges posed by climate change and ensuring a sustainable and resilient future for the planet.

xxvii 11% coming from agriculture and 12% from other AFOLU activities[185,186].

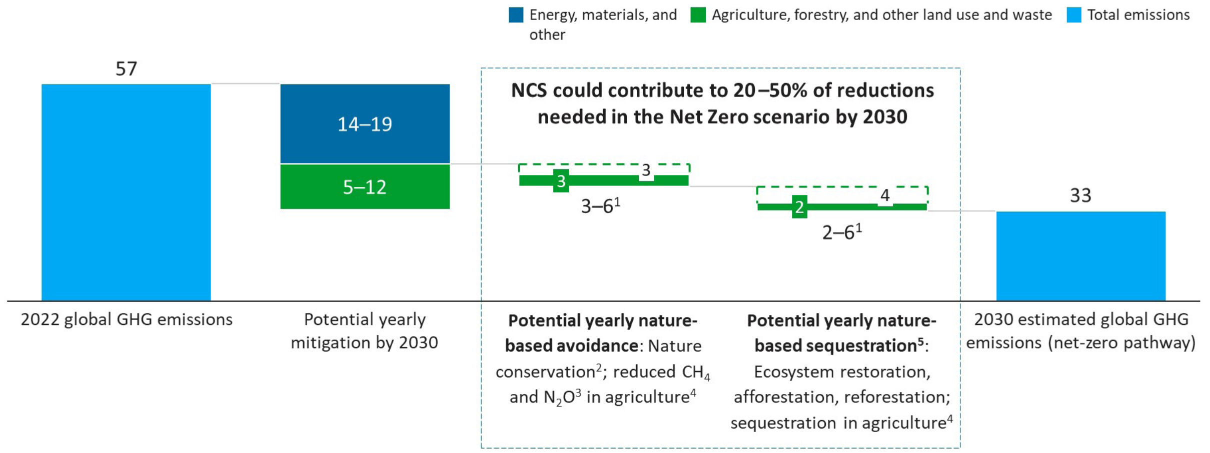
xxviii The planetary boundaries approach focuses on the biophysical processes of the Earth system that determine the planet's self-regulating capacity. It incorporates the role of thresholds related to large-scale Earth system processes, the crossing of which may trigger nonlinear changes in the functioning of the Earth system, thereby challenging socio-ecological resilience at regional to global scales[186].

xxix The nine critical Earth systems are climate change, changes in biosphere integrity, stratospheric ozone depletion, ocean acidification, biogeochemical flows, land-system change, freshwater use, atmospheric aerosol loading, and the introduction of novel entities[186].

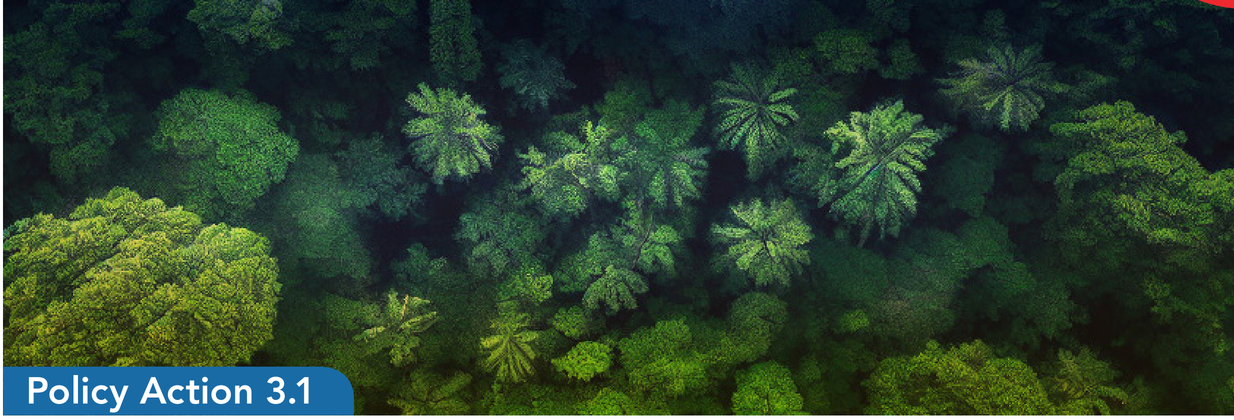
xxx NCS is a subset of nature-based solutions that lead to climate change mitigation, besides biodiversity gains and other societal benefits. NCS are actions that avoid GHG emissions and increase carbon storage in forests, grasslands, and wetlands. Examples include forest protection, restoration, and management; not only preserving/returning forests to a healthy state but also increasing the amount of carbon sequestered; improving biodiversity and the quality of soil and water in the ecosystem; and providing economic benefits for communities that depend on that forest[191].

xxxi Avoided forest conversion (2.9 $PgCO_2yr^{-1}$), avoided peatland conversion (0.68 $PgCO_2yr^{-1}$), avoided coastal wetland conversion (0.27 $PgCO_2yr^{-1}$).

Exhibit 15 – CO_2 emission mitigation opportunity in NCS, $GtCO_2e$/year



[1]NCS minimum opportunity considers carbon price of 0–50 USD/ton of CO_2e. NCS maximum opportunity considers carbon price of 50–200 USD/ton of CO_2e. [2]Includes natural ecosystems conversion reduction and forest and fire management. [3]Methane and nitrous oxide. [4]Agriculture-related topics are being addressed by the Sustainable Food Systems & Agriculture Task Force. [5]The KPI related to nature-based sequestration credits issuance is ~46% of total potential as estimated by TSVCM.
Source: *Emissions gap report 2023: Broken record*, UN Environment Programme, November 20, 2023; *Climate change 2022: Mitigation of climate change, IPCC, April 2022*[197]; "Figure SPM.7," IPCC, 2022[198]



Policy Action 3.1

Ensure a thriving NCS global market by 2030, widening protection and restoration projects and scaling the international carbon market

Executive Summary

It is paramount to scale protection, restoration, and sustainable management projects to ensure a thriving NCS global market by 2030. For this, four specific actions should be discussed and implemented: (i) accelerate Paris Agreement Article 6 implementation to enable a high integrity carbon market; (ii) foster operationalization and accounting integrity of NCS through the improvement of infrastructure and development of protocols; (iii) facilitate investments in CDR projects from NCS through offtake agreements and carbon-pricing mechanisms; and (iv) grow protection projects by establishing a global endowment fund while actively involving local and traditional communities.

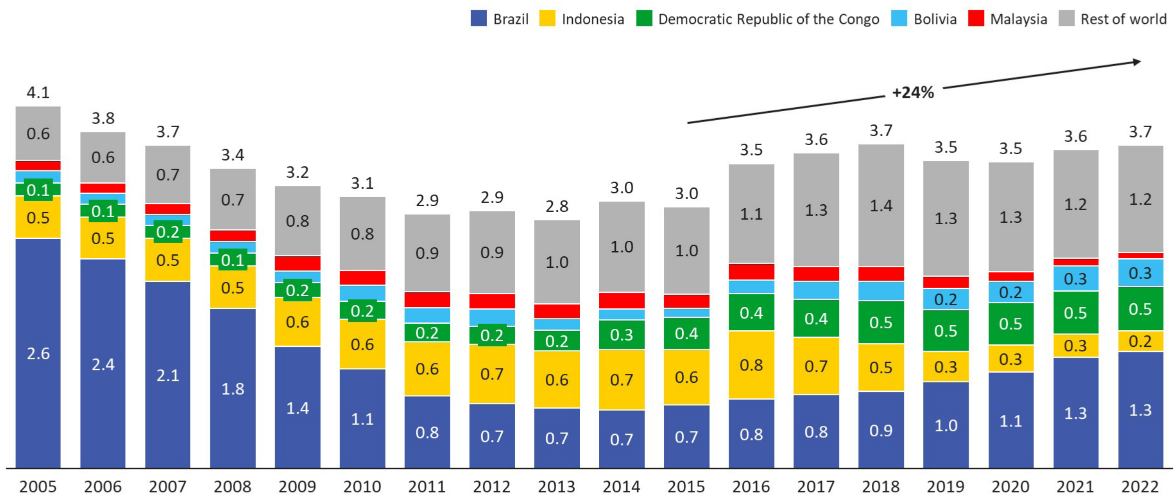
Background and Context

Three-fourths of the land and two-thirds of the marine environment have been significantly altered by human actions[199]. The world has lost over half of its coral reefs[200] since the 1950s and almost 70% of wetlands since 1900[201]. Underneath 25% of the northern hemisphere lies permafrost, which is also degrading, with its southern boundaries retreating northward by 30–80 km in recent decades and with the Arctic region warming twice as fast as the global average and potentially releasing significant amounts of methane[202]. Approximately one-third of rivers in Latin America, Africa, and Asia suffer from significant pathogenic pollution[203] and over 420 Mha of forest were lost to deforestation from 1990 to 2020, of which tropical areas experienced over 90% of that loss[204].

Approximately 1.6 billion people depend on forests for their livelihoods and 80% of all terrestrial biodiversity is found in tropical forests[205]. Besides, according to the World Resources Institute, "over 3 billion people worldwide grapple with the consequences of land degradation"[206]. Damaged forests, farms, grasslands, and mangroves lead to less water and food, declining rural incomes, and creeping deserts[206]. According to the United Nations Convention to Combat Desertification's (UNCCD) dashboard of national reports of 126 countries, more than 100 million hectares of healthy and productive land were degraded annually from 2015 to 2019[207]. To reduce the erosion of natural capital, scientists and policymakers have called for the permanent protection and restoration of at least 30% of the planet's surface as well as degraded terrestrial, inland water, and marine ecosystems by 2030[184]. These objectives are in accordance with the COP15 30x30 initiative and the Kunming-Montreal Global Biodiversity Framework, which aim to ensure that by 2030, at least 30% of all terrestrial, inland water, and marine coastal areas are conserved and managed through well-connected, equitable, and effective systems of protected zones, with a focus on crucial areas for biodiversity and ecosystem services[196].

Tropical areas contain 45% of the world's forested areas and serve as a natural carbon sink, playing a critical role in regulating regional and global climate and have the highest biological diversity on Earth, both in absolute and density (species per area) terms[204]. Despite a reduction at the beginning of the 21st century, global primary forest loss has increased by approximately 24% from 2015 to 2022 (Exhibit 16), threatening biodiversity, environmental services, livelihoods of forest communities, and resilience to climate shocks[204].

Exhibit 16 – Primary forest loss, by country (3-year moving average), Mha/year

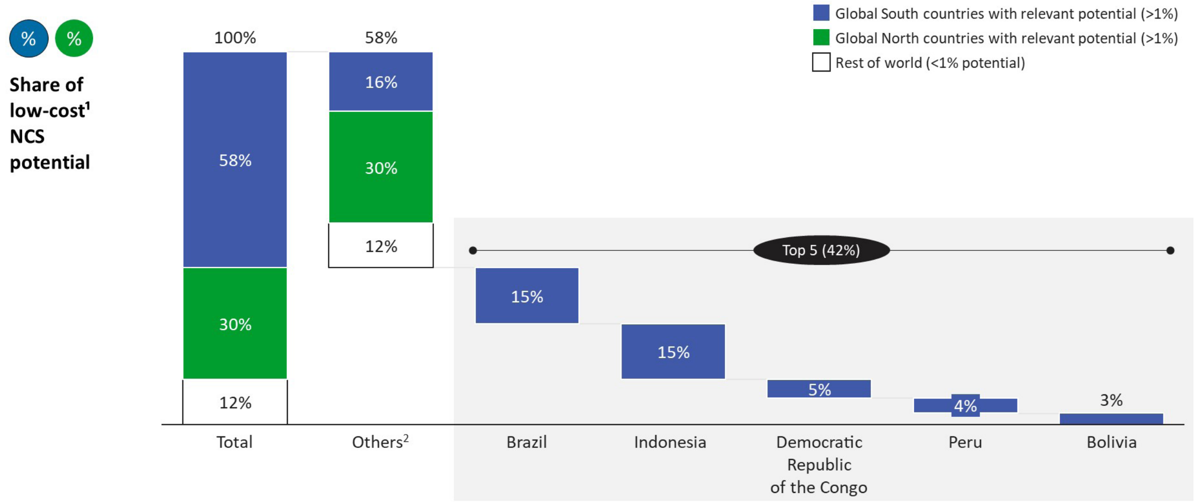


Source: Global Forest Watch; TerraBrasilis

In this context, it is of the utmost importance that G20 countries resolutely support and welcome the agreement on the operationalization of Article 6 of the Paris Agreement at COP29, ensuring environmental robustness but also consistency with the "Article 6 Rulebook" agreed upon at COP26 and building a workable system that the private sector has full confidence in. Article 6 sets out how countries, through international cooperation, can tackle climate change and unlock financial support[209] to establish a global carbon crediting mechanism, help fund the development of new technologies, and support overall emission reduction efforts.

Article 6 could leverage high-integrity protocols from the Voluntary Carbon Market (VCM), which is crucial to establish robust principles that guarantee integrity – such as the guidelines published by The Integrity Council for the Voluntary Carbon Market (IC-VCM) and its Core Carbon Principles (CPP), Voluntary Carbon Markets Integrity Initiative (VCMI), among others, both in supply and demand side. Scaling carbon markets could facilitate capital mobilization to the Global South, where most of the potential for low-cost NCS lies (Exhibit 17), contributing to a just transition in a low-carbon economy.

Exhibit 17 – Share of low-cost NCS potential across the globe, %



[1]"Low cost" refers to the practical potential of NCS, with high-medium feasibility. Practical potential is a portion of the total NCS abatement potential in recognition of the fact that it becomes progressively more difficult to secure carbon credits as the total potential of each source is approached. It uses an economic filter (agricultural rent) to identify and remove "low feasibility" lands. We refer to it primarily as "practical" instead of "low cost" to reflect that it is just one of a number of barriers to mobilizing NCS (e.g., social, political, etc.). However, it is important to highlight that "practical" is also a reflection of the low costs that help to explain the bulk of volume in the Global South. [2]Excluding top 5 countries.

Source: *Consultation: Nature and net zero*, WEF and McKinsey, January 2021

To scale up financing and promote high-integrity NCS projects, it is fundamental to adopt integrated monitoring, implementation, and certification methodologies. Monitoring tools need to consider the specifics of the projects and their diversity in different biomes as well as standardize the methodology for accounting and verifying projects to promote the international carbon market. In this sense, protocols and frameworks provide a robust foundation for implementing NCS projects, ensuring that these solutions are scientifically sound and transparent. By following protocols, countries, organizations, and communities can maximize their natural climate actions' effectiveness, integrity, and credibility. Examples of key protocols for efficiency and climate are the Verified Carbon Standard, a standard for measuring and verifying reductions and removals of GHG emissions, and the Climate, Community, and Biodiversity Standards, which provide a framework for assessing the social and environmental co-benefits of NCS projects. Although fundamental, they may not reflect the specificities of the biomes and have monitoring, reporting, and verification that could be more scalable, with manual techniques difficult to automate.

Additionally, funding is one of the key enablers for scaling NCS globally. NCS finance encompasses investment mechanisms that leverage cash flows generated through the sustainable management of ecosystems. These cash flows are utilized to support the ecosystem's restoration and/or protection while also providing returns to investors. Although it has a relevant potential for mobilizing investments, NCS finance faces significant barriers associated with scale, aggregation, and costs of the intangible benefits of ecosystem services. So, it is important to not only to accelerate and distribute financing from different stakeholders such as governments, high-income countries, private investors, and institutions but also to reduce the costs of protection, restoration, and sustainable management projects by developing the NCS value chain and infrastructure while involving local and traditional communities.

Specific Actions

I) Accelerate negotiations and cooperative implementation of Paris Agreement Article 6 to enable a high-integrity carbon market

Article 6 of the Paris Agreement enables international cooperation to tackle climate change. Under this mechanism, countries could transfer carbon credits earned from reducing/removing GHG emissions to help one or more nations meet their climate targets. The IETA[211] found that implementing an international carbon market under the Paris Agreement could lead to cost reductions of USD 250 billion per year in 2030 and facilitate an additional emissions decrease of 50%, or approximately 5 $GtCO_2e$, per year in 2030, with the potential of generating up to USD1 trillion a year by 2050[212].

Articles 6.2 and 6.4 particularly establish two different market solutions for cooperative mitigation approaches. Article 6.2 allows bilateral mitigation outcomes by transferring Internationally Transferred Mitigation Outcomes (ITMOs) from one country to another. In contrast, Article 6.4 creates a new international trading mechanism of certified emissions removals and reductions among countries and companies. Both solutions encourage countries to find cost-effective ways to reduce emissions and incentivize investment in cleaner technologies and practices. They also facilitate international cooperation in addressing climate change by allowing companies in different countries to help finance emissions reduction efforts overseas, enabling global NCS to benefit from this market and increasing the climate-related benefits associated with these activities.

Thus, G20 governments should accelerate negotiations and cooperative implementation of the Paris Agreement's Articles 6.2 and 6.4 to scale these international trading mechanisms, ensuring cross-border recognition and providing the infrastructure for their implementation. This includes developing methodologies for nonconsensual questions as well as supporting robust accounting and methodologies that generate high-quality mitigation outcomes/certificates. Additionally, national and transnational country groupings and organizations' carbon registries should be launched to facilitate carbon credit tracking and trading.

II) Foster operationalization and accounting integrity of NCS through the improvement of infrastructure, knowledge and development of protocols

To foster the operationalization and account integrity of NCS, it is essential to address three key aspects: (i) improving infrastructure and knowledge, (ii) establishing protocols that consider the characteristics of different biomes, and (iii) implementing a robust monitoring system.

Scaling an economically viable infrastructure and human capital is an enabler for successful project implementation. This involves incentivizing public and private partnerships to invest in infrastructure and promote the knowledge of diverse ecosystems needed to scale NCS and protect biodiversity. For example, Embrapa is a public company from Brazil that focuses on generating knowledge and technologies for Brazilian agriculture and holds several projects, such as technology transfer to consolidate low-carbon agriculture and monitoring and participatory management of artisanal fishing for sustainable development in communities in the Amazon region.

Thus, G20 countries should uphold the principle of Common But Differentiated Responsibilities and Respective Capabilities (CBDR–RC) and support international scientific collaborations that advance knowledge. G20 should also invest in developing specific infrastructure to enable the operationalization of projects, such as enhancing the coproduct supply chain, promoting sustainable forest management, and fostering nurseries and plantations for restoration projects. An example of an initiative that makes the infrastructure and specific knowledge needed explicit is Regreening Africa, recognized by the United Nations as one of the seven UN World Restoration Flagships. Regreening Africa has been operating since 2017 in eight sub-Saharan countries and restored more than 350,000 ha of land[213], aiming to achieve 1 Mha, a 5% decrease in soil erosion, a 10% increase in tree cover, and a 10% average increase in household income until 2023[214]. The restoration practices employed include tree-growing through planting and grafting as well as farmer-managed natural regeneration. These practices were combined with soil and water protection measures, policies, and value chain strenghtening[215]. The approach was tailored to local conditions and needs and involved multiple development and research organizations, governments, and local communities in sub-Saharan African countries, including Ethiopia, Ghana, and Kenya[214].

Developing customized protocols for quantifying associated emission reduction or removals is also required, and G20 countries should leverage scientific research to develop technology and effective methods to improve the accounting of nature-based mitigation outcomes/certificates. Thus, developing international standards, building monitoring systems, and sharing and standardizing these monitoring and assessment systems to create a unified database of monitoring methods aligned with UN Framework Convention on Climate Change are key to setting up data storage and analysis in different biomes. When implementing robust monitoring systems, these actions would increase the traceability, integrity, and accuracy of the economic estimation of NCS, facilitating financial flows to support their growth and optimizing certification processes.

III) Facilitate investments in CDR projects from NCS through offtake agreements and carbon pricing mechanisms

Due to their relatively high expenses, restoration-based projects are projected to demand more than half of the annual 2030 NCS financing, reaching approximately USD 125 billion annually by 2025 and surpassing USD 177 billion by 2030[216]. Among these, the three primary types absorbing the most funds include forest, seagrass, and peatland restoration. The significant restoration cost arises from intensive resource inputs and the substantial opportunity costs associated with changing land use. To address these challenges, G20 countries should promote national and international project financing mechanisms related to (i) offtake agreements (e.g., commitment to future purchases of reforestation carbon credits) as a key mechanism to equilibrate the cost-return balance of carbon dioxide removal projects and (ii) inclusion of carbon credits from sequestration-based NCS into the carbon pricing mechanism to boost demand of restoration projects.

Project financing with offtake agreements is the basis for increased investments for high-capex projects. Adapting such a system for nature restoration could unlock more significant flows of private investments to such projects. By securing a market for the products or services generated by CDR projects from nature, such as commitment to future purchases of reforestation carbon credits, offtake agreements provide a reliable source of revenue for project developers. This, in turn, can attract more investment, accelerating the pace and scale of restoration efforts.

Accordingly, allowing the inclusion of carbon credits from restoration projects in national carbon pricing mechanisms can effectively support companies in reducing their carbon emissions and achieving their sustainability objectives. This policy has the potential to increase the demand for nature-based sequestration carbon credits, thereby stimulating the supply of such credits and encouraging the development of more restoration projects. By integrating NCS into compliance markets, companies can effectively offset their emissions and contribute to global climate goals while also promoting the restoration of natural ecosystems.

IV) Grow protection projects by establishing a global endowment fund while actively involving local and traditional communities

The United Nations Environment Programme (UNEP) estimates[216] that, in 2023, USD 75.9 billion from public and private finance flows were directed to the protection of biodiversity and landscapes[xxxii]. As early as 2025, an additional USD 48 billion annually is needed for protection measures, increasing quickly to USD 66 billion per year as countries implement the target of protecting 30% of land and sea

xxxii Finance for protection-related NCS includes the establishment of new protected areas and avoided conversion of key ecosystems, for example, avoided deforestation and degradation of peatlands and mangroves.

by 2030 from the Kunming-Montreal Global Biodiversity pledge. Protection is the most cost-effective NCS according to UNEP, representing 80% of the additional land area needed by 2030 while absorbing only 20% of the estimated additional finance.

Hence, in addition to national policies and programs that encourage or require protection, the global community, and especially the developed countries in the G20, could increase financing on protection projects by supporting a global endowment fund to promote funding from developed to developing countries and invest in areas of native vegetation with the most significant potential for CO_2 sequestration, biodiversity, and associated co-benefits. In line with the Global Biodiversity Framework's target 19, governments should mobilize USD 30 billion per year by 2030 through international finance for biodiversity[217]. Nations could use the Global Risk Assessment Framework to assess NCS project risks and determine the best initiatives to address funding. An example is Fundo Amazônia, founded in 2009, which has more than one hundred projects supported for protection and restoration. A second example is the Community Development and Knowledge Management for the Satoyama Initiative (COMDEKS), a Japanese fund implemented in various landscapes and seascapes in twenty countries worldwide since 2011[218]. Another example includes the Meloy Fund, implemented by Rare, which is the first fund for sustainable small-scale fisheries in Southeast Asia to improve the protection and conservation of coral reef ecosystems by providing financial incentives to fishing communities in the Philippines and Indonesia to adopt sustainable fishing behaviors and rights-based management regimes[219].

In addition to scaling funding, involving local communities and protecting their areas is important since at least a quarter of the world's land area is owned, managed, used, or occupied by Indigenous People. These areas are home to 80% of biodiversity. Indigenous Peoples' lives, survival, development chances, knowledge, environment, and health conditions are threatened by environmental degradation[220,221]. Reports show that their reserves are one of the most protected areas and that Indigenous communities play a key role in nature protection and restoration[222]. Involving these communities in protection and restoration initiatives as well as leveraging and scaling their knowledge is crucial to preserving land because they hold vital ancestral knowledge and expertise on adapting, mitigating, and reducing climate and disaster risk. An example of community inclusion in projects is the Priceless Planet Coalition, formed by more than 140 partners working to restore 100 million trees in a joint effort with the local communities from places with the high potential for positive impacts on climate, communities, and biodiversity, such as Brazil, Colombia, Madagascar, and the Philippines[223]. Ensuring the sustainable development of the local population is key to guaranteeing longevity in local economy[224].

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ANNEXES

Annex A – Composition and Meeting Schedule

Distribution of Members by country

Country	#
Argentina	5
Australia	1
Belgium	2
Brazil	82
Canada	2
China	10
Denmark	1
France	11
Germany	9
India	13
Indonesia	7
Italy	14
Japan	1
Korea, Republic of	1
Malta	1
Nigeria	1
Norway	3
Portugal	2
Russian Federation	4
Saudi Arabia	4
South Africa	1
Spain	6
Sweden	3
Türkiye	3
United Kingdom	11
United States	20
Total	**218**

Distribution of Members by gender

Gender	#
Female	78
Male	140

Task Force Chair

Name	Organization	Position	Country
Ricardo Mussa	Raízen	CEO	Brazil

Task Force Deputy Chair

Name	Organization	Position	Country
Paula Kovarsky	Raízen	Strategy, Mergers & Acquisitions, and Sustainability VP	Brazil

Task Force Co-Chairs

Name	Organization	Position	Country
Daniel Godinho	WEG	Sustainability and Institutional Relations Director	Brazil
Jean-Pierre Clamadieu	Engie	Chairman of the Board of Directors	France
José Ignazio Sánchez Galán	Iberdrola	Executive Chairman	Spain
Jimmy Samartzis	Lanzajet Inc.	CEO	United States
Maria Luiza Pinto e Paiva	Vale	Executive Vice-President for Sustainability	Brazil
Oscar Fahlgren	Mubadala Capital	Chief Investment Officer and Head of Brazil	United Arab Emirates
Paolo Scaroni	Enel	Chairman of the Board of Directors	Italy
Tadaharu Shiroyama	Mitsui Gas	CEO	Japan
T V Naredran	Tata Steel	CEO & Managing Director	India
Zhang Zhigang	China State Grid	Executive Chairman	China

Task Force PMO

Name	Organization	Country
Miguel Angel Castro Riberos	National Confederation of Industry	Brazil

Task Force Members

Name	Organization	Position	Country
Abyd Karmali	Bank of America	Managing Director, Climate Finance	United States
Achmad widjaja	Kadin Indonesia	Chairman standing committee industry & association	Indonesia
Adriana Aparecida de Oliveira	Conscience Carbon Group SA	CEO	Brazil
Adriano Leite de Barros	General Motors South America	Governmental Affairs Director	United States
Adriano Nogueira Zerbini	Compass	Director of Sustainability, Corporate Affairs and Communications	Brazil
Aisha Izzet	Takamol	Senior Executive Advisor	Saudi Arabia
Aleksander Skaare	Scatec	Brazil CEO	Norway
Alessandra Polin	General Filter Italia SpA	Owner	Italy
Alexandra Rogan	Council for Inclusive Capitalism	Executive Director	United States
Alice Pilia	Conde Nast	Global Head of Public Policy & Sustainability	United Kingdom
Amaury Martins de Oliva	Brazilian Federation of Banks	Diretor Executivo de Sustentabilidade, Cidadania Financeira, Consumidor e Autorregulação	Brazil
Ana Paula Hauffe Torquato	Weg Equipamentos Elétricos	Gerente de Relações Institucionais	Brazil
Anatoly Khramtsov	Joint Stock Company "Russian Railways" (JSCo "RZD")	Deputy CEO – Chief Engineer	Russian Federation
André Luiz Baptista Lins Rocha	SIFAEG	CEO	Brazil
Andre Meloni Nassar	Brazilian Association of Vegetable Oil Industries	Execitive President	Brazil
Andre Passos Cordeiro	ABIQUIM-Associação Brasileira da Industria Química	Chief Executive Officer	Brazil
André Souza de Melo	Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável	Coordenador de Água e Economia Circular	Brazil
Andrea Cotrufo	Quantum Investments	C.E.O. and Chairman	Italy
Andrea Zamolyi Park	Caterpillar Brasil Ltda	Director of Government & Corporate Affairs	United States
Andrey Melnichenko	Russian Union of Industrialists and Entrepreneurs (RSPP)	Chairman of the RSPP Committee on Climate Policy and Carbon Regulation	Russian Federation
Andrey Sapozhnikov	En+ Group	Associate Director, Department for International Cooperation	Russian Federation
Angele Kedaitiene	Club Climate Europe	Secretary General	Belgium
Anna Celsing	Alfa Laval	Chief Sustainability Officer	Sweden
Anna Tunkel	Sustainable Impact LLC	Founder & Principal, Sustainable Impact LLC	United States

Name	Organization	Position	Country
Anthony Utomo	KADIN (Indonesia Chamber of Commerce)	Energy Transition Task Force Chair	Indonesia
Anuradha Kapoor	Reliance Industries Limited	Senior Vice President (Head-policy)	India
Arthur Costa Sousa	Servtec Energia	Managing Partner	Brazil
Arzann Rustom	Colliers International	Manager | Occupier Consulting	Canada
Atul Mudaliar	Climate Group	Head of Business Initiatives India	United Kingdom
Aurelien Maudonnet	Helexia Brazil	CEO	France
Bárbara Ferreira Viegas Rubim	Associação Brasileira de Energia Solar Fotovoltaica - ABSOLAR	Vice-President	Brazil
Beatriz Mejia	Coca Cola Company	Director Environment Latin America	United States
Bianca Conde	Vale	Gerente Geral de Sustentabilidade Corporativa	Brazil
Bruna Soares Mesquita	Michelin	Sustainability Manager Michelin South America	France
Bruno Flach	IBM	Director, Strategy and IBM Research Brazil	United States
Budi Margono ST, MBA	MBMF Foundation	CEO	Indonesia
Camila Cristina Zelezoglo	Brazilian Textile and Apparel Industry Association	Sustainability and Innovation Coordinator	Brazil
Carlos Restaino	Cámara Argentina de Comercio y Servicios	Director	Argentina
Carmen Virasoro	Carbon Group Agro-Climatic Solutions SRL	Director	Argentina
Carolina Grassi	RSB - Roundtable on Sustainable Biomaterials	Business Development and Innovation Manager	Brazil
Carolina Telles Matos	Amcham Brasil	Manager for Brazil-US Relations and Sustainability	Brazil
Carolyn Wu	Apple	Head of International and Diplomatic Affairs	United States
Cassia Carvalho	US Chamber of Commerce	Executive Director	United States
Celia Roldan Santias	Iberdrola	Responsable Institutional Affairs Chairman Office	Spain
Chanakya Chaudhary	Tata Steel Ltd	Vice President Corporate Services	India
Chunshan Cao	Hexing Holding Brazil	Commericial Director	Brazil
Cindy Lim	Keppel Infrastructure	Chief Executive Officer	Brazil
Claudio Viveiros	Wilson Sons	Manager Institutional Relation	Brazil
Daniel Marques Hubner	Yara Brasil Fertilizantes S.A.	SVP Industrial Solutions	Norway
Daniel Paska	Ericsson	Director Sustainability Policy	Sweden
Danielle Silva Bernardes	Confederação Nacional do Transporte	Gerente Executiva do Poder Executivo	Brazil
Dany Qian	Jinko Solar Co., Ltd.	Global Vice President	China
Dario Molteni	SLB	Global Account Director & Chairman Italy	United States

Name	Organization	Position	Country
Davi Bomtempo	Brazilian National Confederation of Industry (CNI)	Executive Manager - Environmental and Sustainability	Brazil
David Frank	Microsoft	Director Policy Engagement	United States
David Snyder	American Property Casualty Insurance Association	Vice President, International Policy	United States
Dielze mello	FIEA	Gerente àrea Internacional FIEA	Brazil
Domenico Luigi Vito Greco	GIG - Gestioni Industriali Group	CEO GIG - Gestioni Industriali Group	Italy
DR Riza Suarga	Indonesia Carbon Trade Association (IDCTA)	President Director	Indonesia
Dr. Nirav Mandir	Shree Ramkrishna Exports Pvt. Ltd.	Chief Human Capital & Sustainability Officer	India
Dr. Richard Lobo	Tata Chemicals	Global Head Innovation, R&D and Business Excellence	India
Eduardo do Couto e Silva	Brazilian Center for Research in Energy and Materials (CNPEM/LNBR)	Director, Brazilian Biorenewables Laboratory /CNPEM	Brazil
Eduardo Ferreira Kantz	Prumo Logística	ESG and Institutional Relations Officer	Brazil
Eduardo Gorchs	Siemens	CEO	Germany
Eduardo Ribeiro de Freitas	Iveco Group	Public Affairs Director	Brazil
Elaine Gerchon	ABIHPEC (Associação Brasileira de Higiene Pessoal, Perfumaria e Cosméticos)	Diretora de Inteligência de Mercado	Brazil
Elbia Gannoum	Associação Brasileira de Energia Eólica e Novas Tecnologias - ABEEólica	Presidente Executiva	Brazil
Elena Morettini	Globant	Global Head Sustainable Business	Argentina
Ellen Jackowski	Mastercard	Chief Sustainability Officer	United States
Emiliano Serracchiani	Snam Spa	Senior Manager International Legislative Affairs	Italy
Evandro Herrera Bertone Gussi	UNICA - União da cana-de-Açúcar e Bioenergia	President	Brazil
Everton Lopes da Silva	MAHLE	Head of MAHLE Tech Center South America	Germany
Ezequiel Costa Malateaux da Silva	Petrobras	Portfolio Decarbonization and Business Integration, Coordinator	Brazil
Fabiane Lazzareschi	Inpasa	Head of Institutional Relations	Brazil
Fabio Brasiliano	ABIHPEC	Director	Brazil
Fahad Abdulaziz AlSherehy	SABIC	Vice President,Corporate Sustainability	Saudi Arabia
Faisal Alfadl	Saudi Green Building Forum	Secretary General	Saudi Arabia
Farida Khan	Sasol	Head of Regulatory Services	South Africa
Fernanda Claudino	Abrasca - Associação Brasileira das Companhias Abertas	General Manager	Brazil

Name	Organization	Position	Country
Fernando Castellanos Silveira	UN Global Compact	Head, Environment and Climate	United States
Fernando Luiz Ruschel Montera	Firjan	Oil, Gas and Maritime Market Intelligence Coordinator	Brazil
Flavia Heller	Eneva	VP of Strategy and Sustainability	Brazil
Flavio Ribeiro	Bunker One	CEO	Brazil
Florian Schmalz	Eurochambres - The Association of European Chambers' of Commerce and Industry	Policy Advisor for Sustainability	Belgium
Francesca Zarri	Eni S.p.A.	Director, Technology, R&D and Digital	Italy
Francisco Javier Canalejo Ariza	REPSOL	Head of International Relations	Spain
Gabriel Kropsch	Associacao Comercial do Rio de Janeiro ACRJ	President of the Energy Transition Council	Brazil
Gabriela Aguilar	Excelerate Energy	Country Manager Brazil & Argentina VP Latam	United States
Gianfranco Caccamo	Icaro Ecology S.P.A.	General Director	Italy
Gianluca Russo	Q&T Srl	Head of Operations	Italy
Giuliana Franco	Natura	Government Affairs Manager	Brazil
Gloria Maria Guimarães Aranha	Federação Nacional de Seguros Gerais	Gerente	Brazil
Graf von Harrach	PT JawaPower	President Director	Indonesia
Gustavo Rodrigo Bonini	Scania Latin America Ltda	Diretor Institucional	Sweden
Guy Sidos	VICAT SA	Chairman & CEO	France
Halla Al Najjar	Shell plc.	Senior Policy & Advocacy Advisor - Climate & Sustainability	United Kingdom
Hanguang Li	XCMG Brazil industria Ltda.	General manager	China
Henrique Paiva	Siemens Energy	Head of Government Affairs for Siemens Energy Brazil	Germany
Irene Alfaro	ARPEL	Managing Director	Argentina
Isabella Martins do Carmo	Cargill	Government Relations Director Brazil	United States
Isinsu Kestelli	Agritrade Co Ltd	Founder & Managing Director	Türkiye
Jean-Baptiste Baroni	Mouvement des Entreprises de France (MEDEF)	Head of Climate Policy	France
Jean-Pierre Clamadieu	Engie	Chairman of the Board	France
Joachim Hein	Federation of German Industries	Senior Manager Energy and Climate Policy	Germany
Joana Laura Bischoff	Statkraft	Sustainability	Norway
Joanes Ferreira Ribas	Telefônica Brasil (Vivo)	Sustainability Director	Brazil
João Augusto Azeredo da Silva	SINAVAL	Vice President	Brazil
João Marques da Cruz	EDP	CEO EDP Brasil	Portugal
Joel Jacky Ruet	TEH BRIDGE TANK	Chairman	France

Name	Organization	Position	Country
Jorge Augusto Mazzei	AstraZeneca	Diretor-Executivo de Relações Corporativas	United Kingdom
José Carlos da Fonseca Junior	Ibá - Brazilian Tree Industry	International Affairs	Brazil
José Fabiano Lima de Barros	Vesuvius	Health, Safety, Environmental and Sustainability Manager South America	United Kingdom
Josephine Möslein	DIHK, German Chamber of Commerce and Industry	Director Energy and Climate Policy	Germany
Juliana de Andrade Alves Da Cruz Rocha	Pepsico do Brasil Ltda	Public Policy and Government Affairs Manager (Brazil)	Brazil
Julio Cesar Torres Ribeiro	Celulose Nipo-Brasileira S/A - CENIBRA	Vice President	Brazil
Julio Espirito Santo	SENAI Institute of Innovation in Biotechnology	Head of Unity	Brazil
Julius Opio	International Chamber of Commerce - Kenya	Board Director & Chair Environment & Energy Commission	France
Justin D'Agostino	Herbert Smith Freehills	CEO	United Kingdom
Jyoti Mukul	Confederation of Indian Industry	Chief of Energy	India
Karl Vella	World Business Council for Sustainable Development	Climate Policy Director	Malta
Katherine Thomasson	Shell	Head of International Climate Advocacy	United Kingdom
Katya Almeida Bastos	Federação Nacional de Seguros Gerais/FenSeg	Analista Técnica de Seguros	Brazil
Lais Nara Barbosa e Castro	Organização das Cooperativas Brasileiras	Technical-Institutional Analyst	Brazil
Lavesh Hariramani	Taleski EV	Director	Australia
Leandro Campos de Faria	Companhia Brasileira de Aluminio	Chief Sustainability Officer	Brazil
Leonardo Colombo Fleck	Santander	Head Inovacao Sustentavel	Spain
LI Zhiyong	China Council for the Promotion of International Trade	Division Director	China
Lida Preyma	Global Climate Finance Accelerator	Co-founder & Managing Partner	Canada
Ligia Paula Pires Pinto Sica	Sigma Lithium	VP of Institutional/Government Relations and Communication	Brazil
Lilian Amaral	Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras - ANPEI	Gerente de Relações Institucionais	Brazil
Lippolis Gabriele Menotti	Confindustria Brindisi	President	Italy
Lokita Prasetya	Dian Swastatika Sentosa	Managing Director & CEO Energy and Chemicals Business	Indonesia
Luca Giovanni Donelli	Donelli	CFO	Italy
Luca Matrone	Intesa Sanpaolo	Head of Energy	Italy

Name	Organization	Position	Country
Lucía Aparicio Sarraceno	Seguradora Zurich	Customer Office, Marketing & Communications, Innovation & Sustainability Director	Brazil
Luciano Coutinho	Mtempo Capital and Institute of Economics at UNICAMP, University of Campinas, Brazil	Professional Consultant and Professor	Brazil
Luiz Ricardo de Medeiros Santiago	Volkswagen do Brasil	Director	Germany
Luiza Helena Rezende Demoro	BloombergNEF	Head of Energy Transitions	United States
Manuel Fravega	Union Industrial Argentina	Partner	Argentina
Marcela Chacon	Bayer	Global Director, United Nations Relations	Germany
Marcela Flores	Associação Nacional de Pesquisa e Desenvolvimento das Empresas Inovadoras - ANPEI	Presidente	Brazil
Marcelo Marangon	Citi	Chief Executive Officer Citi Brasil	United States
Márcio Rafael Maciel	Sindicerv - Sindicato Nacional da Indústria de Cerveja	Executive President	Brazil
Marco Antonio Saltini	Volkswagen Truck & Bus	Vice president of Institutional Relations	Brazil
Marco Aurélio Buchmann de Gerais Rangel	FPT Industrial	Executive Director	Italy
Mariana Orsini	Dow	Government Affairs Director	United States
Marina Grossi	Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável (CEBDS)	President	Brazil
Marina Rocchi Martins Mattar	UNIGEL	Director of Corporate Affairs	Brazil
Mario Cezar de Aguiar	Sistema FIESC	President	Brazil
Mario William Esper	ABNT	Presidente	Brazil
Masami Hasegawa	Keidanren	Director, Environment & Energy Policy Bureau	Japan
Mathieu Gardies	HYPE	CEO and Founder	France
Maurem Kayna Lima Alves	Klabin S.A.	Sustainability Advisor	Brazil
Mauro Gilberto Bellini	Marcopolo	Membro do Comite de Estrategia	Brazil
Menelaos (Mel) Ydreos	International Gas Union (IGU)	Interim Secretary General, International Gas Union	United Kingdom
Monica A Bernardi	NGD	Director	Spain
Murray Auchincloss	bp	Chief Executive Officer	United Kingdom
Musaab Al-Mulla	Saudi Aramco	VP Energy & Economic Insights	Saudi Arabia
Mustafa Oguzcan Bulbul	Abdi Ibrahim Pharmaceuticals	President, Human Resources, Communications & Sustainability	Türkiye
Natalia Tsuyama Cócolo	Global Shapers Community	Curator	Brazil

Name	Organization	Position	Country
Navneet Singh	Samsung	Corporate Sustainability Manager	Republic of Korea
Nicke Widyawati	PT. Pertamina (Persero)	President Director & Group CEO	Indonesia
Nitin Prasad	Shell India	Ex-Chairman Shell India	India
Nuno Rebelo de Sousa	EDP Energias do Brasil	Chief Marketing Officer	Portugal
Nursen Numanoglu	TÜSIAD	Deputy Secretary General	Türkiye
Pallavi Ahuja	We Mean Business Coalition	Senior Manager	India
Paolo Giuseppe Rotelli	Polo Tecnologico Magona	Ingegnere	Italy
Paolo Scaroni	Enel Group	Chairman	Italy
Paolo Stabellini	Edilteco Spa	CEO	Italy
Patricia de Freitas Soeiro	AXA Seguros	Life & Partnerships UW Superintendent	France
Patrick Sabatier	L'Oréal	Chief Corporate Affairs Officer	Brazil
Paul Holthus	World Ocean Council	Founding President and CEO	Spain
Paulo de Tarso Petroni	Instituto Rever	President	Brazil
Paulo Henrique Quintiliano Moura	Fiep (Industries Federation of Paraná State)	Environmental Analyst	Brazil
Pedro Moraes Torres Pinto	Gerdau	Chief Communication and Public Affairs Officer	Brazil
Pedro Roberio de Melo Nogueira	Sindicato da Industria do Açúcar e do Álcool no Estado de Alagoas	Presidente	Brazil
Per Anker-Nilssen	Confederation of Norwegian Enterprise	Director	Denmark
Petra Laux	Syngenta Group	Group Chief Sustainability Officer (CSO) and Head CP Sustainability and Corporate Affairs	Germany
Pietro Bertazzi	CDP	Global Director, Policy Engagement and External Affairs	United Kingdom
Rafael Segrera	Schneider Electric	CEO Schneider Electric South America	France
Rafael Tello	Ambipar Group	Sustainability Director	Brazil
Rafaella Cruz Fernandes de Bulhões Dortas	BTG Pactual	Head of ESG	Brazil
Raghunath Mahapatra	Excelpot Catalyzer Pvt. Ltd.	Founder	India
Raj Sahu	Samsung India Electronic Pvt. Ltd.	Senior Director	India
Raphael de Paiva Barbosa	Grupo Florestas	Chief Executive Officer	Brazil
Rebeca Peres de Lima	CDP	Executive Director	United Kingdom
Renan Albino Perondi	IBGC - Instituto Brasileiro de Governança Corporativa	Public Affairs Coordinator	Brazil
Renata Beckert Isfer	ABiogás (Associação Brasileira de Biogás)	Presidente Executiva	Brazil
Ricardo Tortorella	Associacao Nacional de Difusao de Adubos - ANDA	ANDA Director Executive	Brazil

Name	Organization	Position	Country
Ritu Ghosh	Panasonic	Associate Director, Corporate Affairs	India
Roberta Cox	GWEC - Global Wind Energy Council	Policy Director Brazil	Brazil
Roberto Furian Ardenghy	Brazilian Petroleum & Gas Institute (IBP)	CEO	Brazil
Robson Del Casale Moreira	Federação das Indústrias do Estado de Mato Grosso do Sul - FIEMS	Chefe de Gabinete da Presidência da FIEMS	Brazil
Rodolfo Walder Viana	BASF	Senior Sustainability Manager BASF South America / Managing Director Fundação Eco +	Brazil
Rodrigo Simonato	Tereos Brasil	Head of Institutional Relations	France
Ruberval Baldini	CIRJ/Firjan - ABEAMA- Brazilian Association of Alternative Energy and the Environment	Advisor / President	Brazil
Sanjay Khare Khare	Skoda Auto Volkswagen India Pvt. Ltd.	Executive Advisor- Sustainability (Past Vice President & Member of the Executive Board)	Germany
Sergey Tverdokhleb	EuroChem	Advisor to the CEO	Russian Federation
Sérgio Besserman Vianna	Comitê - CRISTO G20	Conselheiro	Brazil
Siddharth Banka	KSE Electricals Private Limited	Managing Director	India
Silvio Cezar Pereira Rangel	Sistema FIEMT	Presidente	Brazil
Simon Li	Trinasolar	Director of the Chairman's Office	China
Swati Tewari	Confederation of Indian Industry - CII	Senior Counsellor	India
Talita Alves da Silva	Repsol Sinopec Brasil	Coordenador de Comunicação e Relações Externas	Spain
Theodore Casey Waddelow	Visa	Head of Sustainability Policy	United States
Thiago Falda	Brazilian Bioinnovation Association	Executive President	Brazil
Thiago Martins	Equinor	Gerente de Relações Públicas e Governamentais	Brazil
Thiago Valejo Rodrigues	Firjan	Oil, Gas and Maritime Project Manager	Brazil
Tomiloba Josephine Babarinde	Nigeria Employers Consultative Association	Legal Officer	Nigeria
Vaishali Nigam Sinha	ReNew Private Limited	Co-Founder & Chief Sustainability Officer	India
Viviane Aversa Franco	Raízen	Sustainability Advocacy Specialist	Brazil
Wei Wang	CNCEC Engenharia Brazil Ltd	CEO	China
Weiqi Yang	GWM Brasil	President	China

Name	Organization	Position	Country
Xuan Liang	Goldwind Equipamentos e Soluções em Energia Renovável Ltda	GM of South America Regional Center	China
Yuankai Mao	XI ZANG Everest Resources Co., Ltd	CEO	China
Zheng Jianya	SANY Renewable Energy Co., Ltd	General Director	China
Zhu Hong	China Three Gorges Brasil Energia S.A.	vice president	Brazil

Task force Meetings Schedule

Data	Format
20 February 2024	Virtual
26 March 2024	Virtual
15 April 2024	Virtual
14 May 2024	Virtual

Annex B – Partners

Knowledge Partner

McKinsey & Company

Network Partners

iea

ICC

OECD