B20 ITALY

Energy & Resource Efficiency

Policy Paper 2021

B20 ITALY 2021

RESHAPE THE FUTURE: INCLUDE, SHARE, ACT

TABLE OF CONTENTS

Foreword by the Taskforce Chair

Polluting energy sources and unsustainable resource consumption are still causing severe global warming effects, alongside a continuous degradation of natural balance in ecosystems. It is of paramount importance to reach net zero carbon emissions by 2050 and set a pathway consistent with the 1.5°C goal of the Paris Agreement.

We have just started a crucial decade in which we must achieve the goals of the 2030 Agenda for Sustainable Development, for which we are currently not on track. Therefore, we must channel our efforts to recover better from the Covid crisis, solving also the climate crisis, with multilateralism and global actions based on science and technology. We cannot reach 2030 and regret the lack of ambition we should have today.

The G20 Presidency agenda is based on three fundamental pillars: People, Planet, Prosperity. These pillars reflect on the priorities set by the B20 Energy and Resource Efficiency Taskforce, that aims to provide impactful and actionable recommendations to empower a sustainable progress, reshaping our future in an inclusive and green way. The Taskforce focused on three main challenges:

- Accelerating the Clean Energy Transition, by promoting a significant acceleration of the transition to clean energy and leading man-made emissions into structural decline.

- Strengthening inclusive and sustainable growth, by implementing an effective global framework to support the transition to sustainable energy.

- Fostering Environmental Preservation, by pushing for global adoption of effective policies to reduce global consumption of unsustainable resources.

The energy sector has always been transforming, but - for the first time - we have the opportunity to accelerate the pace of transition in a short time frame, guided by the technological improvements that enable us to use energy in a more efficient and decarbonized way, without impacting the environment. Technology is therefore not a problem, since clean and renewable energy sources as well as energy efficiency are already available and effective solutions that will allow us to achieve a large part of this transition. To move in this direction development and modernization of enabling infrastructures and investments in innovation are key.

The energy transition is essential for the future of our planet, but in order to create value it must be just, sustainable and inclusive. An efficient use of energy will generate significant benefits both for the environment and the economy, fostering inclusive economic growth and ensuring access to critical resources, such as clean energy and water, for all communities.

Reducing the consumption of natural resources cannot be put off, as biodiversity loss and ecosystem collapse are worsening faster than ever. To halt environmental degradation and preserve the natural balance of ecosystems, a global commitment to the proper use of natural resources and the spread of circular economy approaches is needed.

The transition to a more sustainable and efficient system not only involves the energy sector, but also encompasses and impacts other sectors, which will un-

dergo important changes. G20 countries possess the capabilities to be the driving force of positive change in the global society and economy. In the wake of the post-Covid-19 recovery, together with the innovative capabilities of the business community, they have the opportunity to take decisive steps forward in the enhancement of sustainability, resiliency and inclusivity of the world economy. The management of financial resources linked to sustainable objectives will play a major role.

The time has come to take strong action towards the radical decarbonization of the global economy and a sustainable energy transition for a brighter future.

Sincerely,
Francesco Starace
Chair of the B20-Taskforce on Energy & Resource Efficiency
Position of CEO and General Manager of the Enel Group

Task Force Composition

Task Force Leadership	Why Energy & Resource Efficiency Matter
 **Gurdeep Singh** *Co-Chair* *Chairman & Managing Director, NTPC Limited*	*Transition to clean energy is about making an investment in our sustainable future. We need to ensure that clean energy is accessible and affordable to all while taking care of stakeholders and making ecosystems more resilient.*
 **Patricia Vincent-Collawn** *Co-Chair* *CEO, PNM Resources*	*This Policy Paper lays out recommendations and a path to make our planet more sustainable while providing a just transition and opportunities for all. It has been a privilege to serve on this task force that has created such an impactful document.*
 **Jean-Pascal Tricoire** *Co-Chair* *Chairman & Chief Executive Officer, Schneider Electric*	*We need to bridge progress and sustainability for all. Achieving a carbon neutral world will require a systemic and coordinated approach, leveraging existing technology to make the most of our energy and resources.*
 **Sergio Affronti** *Co-Chair* *CEO & Board Member, YPF S.A.*	*To achieve a sustainable future for all we must boost just energy transitions, fostering innovative solutions and actionable strategies while taking into account each country's starting point and development needs.*
 **Herbert Diess** *Co-Chair* *Chairman Board of Management, Volkswagen AG*	*Climate change calls for a clear policy framework by G20 members. In the mobility sector battery-electric vehicles are the only realistic option to make a change yet require a rapid transition to renewable energy.*
 **Xin Baoan** *Co-Chair* *Executive Chairman, State Grid Corporation of China (SGCC)*	*Consensus and cooperation are needed more than ever to meet the target of Paris Agreement and foster a community of life for man and Nature, following the principle of common but differentiated responsibilities.*

Task Force Coordination Group

Simone Mori
Deputy Chair
Head of Europe,
Enel Group

Massimo Beccarello
Task Force Manager,
Confindustria

Knowledge Partner

Deloitte.

Scientific Partners

LUISS

POLITECNICO MILANO 1863

Università degli Studi di Napoli Federico II

Università Bocconi MILANO

Università Cattolica del Sacro Cuore

Network Partners

International Chamber of Shipping
Shaping the Future of Shipping

World Economic Forum
COMMITTED TO IMPROVING THE STATE OF THE WORLD

The European House Ambrosetti

Recommendations: Executive Summary

Recommendation 1: Accelerate the transition of the energy system towards a sustainable and carbon neutral energy mix and an efficient use of energy, in order to meet the carbon-neutral goal of the Paris Agreement and targets set out in the National Determined Contributions

Policy Action 1.1: Shift energy end-uses towards clean energy – G20 members should promote and accelerate the shift in the energy end-uses, driving the substitution of fossil fuels with Decarbonized Electricity and other carbon neutral energy sources and carriers based on a cost effectiveness approach that will include indirect or direct costs of externalities as well.

Policy Action 1.2: Increase efficiency – G20 countries should sustain the increase of energy and resources use efficiency, substantially reducing energy intensity of domestic GDP while supporting its growth, with dedicated actions towards industrial and consumers sectors, building, transport and cities.

Policy Action 1.3: Develop infrastructures – The G20 should promote the development and modernization of infrastructures to sustain the transition towards a carbon neutral energy mix.

Recommendation 2: Provide effective policy pathways to foster sustainable growth and secure the energy transition

Policy Action 2.1: Leverage sustainable finance – The G20 should encourage and drive the adoption of common ESG frameworks and disclosures to foster the financial sector's role in supporting business transition towards long-term sustainable economic activities and value creation for stakeholders.

Policy Action 2.2: Drive carbon pricing – The G20 should drive effective and robust carbon pricing taking into account the local markets peculiarities and promote strategic dialogue to lay the foundation for global mechanisms to valorize environmental externalities, while quickly phasing out direct or indirect inefficient energy subsidies.

Recommendation 3: Ensure resilience and inclusivity of global resource supplies

Policy Action 3.1: Foster supply chain resiliency – G20 members should improve the resilience of global infrastructures to cope with adverse climate events, cybercrime, and other disruptive events.

Policy Action 3.2: Commit to a just transition – The G20 should commit to a just and inclusive transition across countries, vulnerable communities and economy sectors.

Policy Action 3.3: Guarantee resources access and security – The G20 should commit to grant affordable and secure access to clean energy and water to all communities.

Recommendation 4: Commit to preserve the equilibrium of the natural ecosystem, promoting a more sustainable use of natural resources

Policy Action 4.1: Exploit circularity practices to reduce the environmen-

tal impact of economies – The G20 should promote the diffusion of circular economy practices to use global resources more sustainably, increasing international collaboration.

Policy Action 4.2: Enhance sustainable use of marine and terrestrial resources – G20 members should commit to the preservation and restoration of the natural ecosystems, safeguarding life on land and below water.

Introduction

In the post-industrialization era, the unsustainable rate at which global society and economy consume energy and resources has caused a structural increase in greenhouse gases emissions and dramatic environmental degradation, which have a direct impact on human life. Despite the growing awareness of these issues, the actions implemented globally are not sufficient to change the trend. Humanity is currently consuming natural resources 1.75 times faster than the rate at which the planet can regenerate [1]; moreover, five years after the Paris Agreement, global warming estimates for the end of the century considering implemented policies have fallen by only 0.7°C from 3.6°C in 2015 to 2.9°C in 2020, far from the 1.5°C target [2].

The Covid-19 pandemic has caused an unprecedented negative energy demand shock; consequently, global energy-related CO2 emissions showed the largest annual drop since the Second World War [3]. However, the analysis of previous crises suggests that the reduction of emissions due to contingent phenomena is unlikely to turn into a long-term trend and have marginal impacts on the accumulation in the atmosphere of greenhouse gases, the main cause of climate change. Furthermore, after reaching a low in April 2020, global emissions rebounded strongly and soared above 2019 levels in December [3].

Therefore, three challenges are today more pressing than ever. First, global warming should be curbed by cutting greenhouse gases emissions caused by human activities, since it is essential to ensure the long-term livability of the planet. Second, inequalities and vulnerabilities among communities should be addressed: access to energy, water, advanced infrastructures and technologies are not fairly distributed across countries and these disparities might become deeper if the transition towards a sustainable and clean economy will not be properly carried out. Finally, environmental degradation should be halted since the natural balance in the ecosystems has been deteriorated by human activities, causing resources depletion, increasing air pollution, biodiversity loss as well as natural disasters.

The Energy and Resource Efficiency (ERE) Task Force of the B20 Italy is convinced that through collaboration among the actors of the business community and G20 leaders it is possible to achieve the challenging goal of fostering prosperity in a sustainable and inclusive way. Economic growth is essential to fight poverty and improve global quality of life; through innovation, it can be decoupled from unsustainable natural resource consumption and creation of social divides. However, as the last decade of the 2030 Sustainable Development Agenda begins, it is critical to act immediately, keeping into consideration the differences among countries in terms of development and natural endowment.

Building on the work of previous B20 and considering the changes to the global landscape, the ERE Task Force has identified three main vectors of actions: accelerating clean energy transition, strengthening inclusive and sustainable growth, and fostering environment preservation.

First, to put emissions into structural decline, it is essential to accelerate the clean energy transition. GHG emissions derived from energy consumption accounts for more than 70% of global emissions [4] and the carbon intensity of the energy mix has not improved over the last decade, continuing to rely extensively on fossil fuels [5]. In addition, despite the improvements in terms of energy intensity [6], the growing demand for energy has set an unsustainable development path for the energy system. Hence, to achieve carbon neutrality, it is necessary to shift energy end-uses towards clean energy carriers and, at the same time, improve efficiency to decrease the overall demand for energy without limiting economic growth. To do so, development and modernization of enabling infrastructures and investments in technological advancement, digital transformation and innovation are key.

Second, it is important to implement effective global frameworks to support a sustainable and just energy transition. To achieve collective climate goals, common policy pathways, forward-looking legislative and regulatory frameworks and harmonized taxonomies, are key to coordinate decarbonization strategies. In particular, sustainable finance principles and carbon pricing mechanisms are increasingly required to facilitate and accelerate the carbon-neutral transition. As different countries and communities, public and private actors align to decrease their environmental impact and enable sustainable economic growth, it is imperative to adhere to the principles of a just transition, fostering inclusivity and granting fairness. This commitment should be reflected in the support to communities most affected by the clean energy transition, with a focus on access to energy and water, job displacement, capacity building and creation of opportunities for younger generations and women.

Third, the global adoption of effective policies to reduce natural resources consumption cannot be postponed as biodiversity loss and ecosystem collapse are among the top five threats humanity will face in the next decade [7]. Building on the momentum of the Decade on Ecosystem Restoration, global economies should increase their level of circularity to use resources more sustainably. Moreover, countries should strengthen their commitment to preserve and restore the natural ecosystems, safeguarding life on land and below water.

The urgency of ensuring the sustainability of our presence on the planet is dramatically increasing. Addressing the needs of the planet is not an option, it is a necessary condition to our common well-being, to international peace and security and, ultimately, to our long-term survival on this “pale blue dot”. In line with the overarching priority themes, People, Planet and Prosperity, G20 countries have the responsibility of leading the world towards a better and brighter future for the entire global society and possess the capabilities to be the driving force of positive change in the global society and economy. In the wake of the post-Covid-19 recovery, together with the innovative capabilities of the business community, G20 countries can reignite growth and nurture a renewed prosperity while fostering sustainability, resiliency and inclusivity.

Recommendation 1: Accelerate the transition of the energy system towards a sustainable and carbon neutral energy mix and an efficient use of energy, in order to meet the carbon-neutral goal of the Paris Agreement and targets set out in the National Determined Contributions

Policy Actions

1.1 Shift energy end-uses towards clean energy – G20 members should promote and accelerate the shift in the energy end-uses, driving the substitution of fossil fuels with Decarbonized Electricity and other carbon neutral energy sources and carriers based on a cost effectiveness approach that will include indirect or direct costs of externalities as well.

• Accelerate the electrification of transport, building energy uses and industrial sectors.
• Promote the development and scaling up of clean fuels, such as green hydrogen, bioenergies and synthetic fuels, to decarbonize "hard to abate" industrial sectors, as well as the transport sector and, in particular, air, maritime and long distance transportation, preventing the displacement of land use from agriculture or forestry to fuel dedicated intensive cultivations.
• Facilitate the conversion of end use technology from heavy to free or lower carbon sources and carriers, such as blue hydrogen and flare free natural gas, as a transition measure for the mid-term, avoiding investments leading to stranded costs as well as compromising the urgent achievement of decarbonization objectives, while preventing long term lock in effects.

1.2 Increase efficiency – G20 countries should sustain the increase of energy and resources use efficiency, substantially reducing energy intensity of domestic GDP while supporting its growth, with dedicated actions towards industrial and consumers sectors, building, transport and cities.

• Scale energy upgrading interventions both in industrial and consumer sectors (e.g., Real Estate, Automotive, etc.).
• Implement more efficient systems in transport and buildings.
• Develop holistic energy efficient solutions for growing metropolitan areas.

1.3 Develop infrastructures – The G20 should promote the development and modernization of infrastructures to sustain the transition towards a carbon neutral energy mix.

• Foster carbon free power generation, storage, transmission, distribution, and specifically infrastructures to support reliability and growth of renewable energy sources, exploiting the potential of digital and smart technologies. Consider cost competitive and reliable Carbon Capture Sequestration and Utilization systems if and when their economic and reliability standards demonstrate a technological maturity to enable a possible reliable application to large scale in the future.
• Promote the deployment of economically competitive and carbon neutral hydrogen supply chain targeted to "hard to abate" sectors.

• Pursue the development and experimentation in suited sites of economically viable and environmentally reliable CCUS in "hard to abate" sectors (such as cement production), DAC and BECCS technology and nature-based solutions (e.g., afforestation) to provide carbon negative technology able to offset residual direct air greenhouse gas emissions.

Leading Monitoring KPI	Baseline (2020)	Target (2030)
Global energy-related CO2 emissions (Gt CO2)[1] *1. Includes carbon dioxide emissions from the combustion of fossil fuels and non renewable wastes, from industrial and fuel transformation processes (process emissions) as well as CO2 removals.*	33.9	21.1
Global % of renewables in total energy supply[1] *1. Includes solar, wind, hydro, modern solid, liquid and gaseous bioenergy, and other renewables.*	12%	30%
Global energy intensity[1] **CAAGR**[2] *1. Computed as Total Energy Supply/GDP (GJ per USD 1000, PPP);* *2. Compound average annual growth rate.*	-1.6%	-4.2%

SDGs impacted:

Recommendation 1 contributes to SDG 7 – Affordable and clean energy – by promoting increasing reliance on renewable energy sources, improvement of energy efficiency and investments in clean energy research and technology. This way, Recommendation 1 fosters a sustainable transformation of the energy system, aiming at conciliating the needs of a growing population with environmental and climate objectives.

Moreover, by promoting the development and modernization of infrastructures essential to achieve a carbon neutral energy mix and a sustainable transformation of industry, Recommendation 1 supports also SDG 9 – Industry, innovation and infrastructure.

Through its suggested actions, Recommendation 1 also sustain the achievement of SDG 11 – Sustainable cities and communities – and SDG 12 – Responsible consumption and production – by encouraging a more efficient use of resources and the shift of energy end-uses to carbon neutral clean energy sources and carriers.

Finally, since most of global greenhouse gases emissions are related to the production and use of energy, Recommendation 1 significantly contributes to SDG 13 – Climate action – advocating for a clean transition of the energy system and a drastic reduction of its environmental impact.

[1] *Data from: IEA (2021) - Net-Zero Emissions by 2050 Roadmap*

G20 Italy Priorities:

Recommendation 1 contributes to addressing G20 Italy Priorities People, Planet and Prosperity.

The use of energy impacts significantly the habits and lives of people; thus, by promoting a shift towards clean energy carriers and more efficient technologies, Recommendation 1 can foster improved quality of life.

Moreover, given the weight of energy production and consumption over the global emissions of greenhouse gases, the actions henceforth suggested contribute to reduce the environmental impact of economies and achieve long term decarbonization objectives.

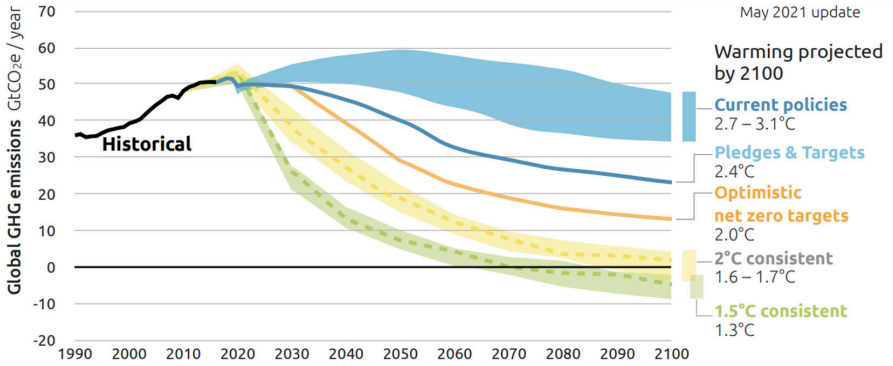
Finally, the promotion of infrastructure development and modernization to sustain the transition towards a carbon neutral energy mix and a more efficient use of energy represent an important driver to achieve prosperity.

Context

In 2015, 196 Parties at COP 21 adopted the Paris Agreement, a treaty aiming at limiting global warming to well below 2°C, pursuing efforts to limit it to 1.5°C, compared to pre-industrial levels. The Agreement entered into force on November 4th, 2016 [8]. Five years later, global efforts proved to be insufficient to follow a path aligned with its goals: considering implemented policies, global warming estimates for the end of the century have fallen by only 0.7°C from 3.6°C in 2015 to 2.9°C in 2020 [2]. Moreover, these objectives have been overcome by some nations, who are currently aiming at achieving the even more challenging goal of reaching net zero emissions: to date, net zero pledges cover about 70% of global GDP and CO2 emissions [9]. For instance, the European Union, Japan and the United States committed to becoming carbon-neutral by 2050 [10] [11] [12]; China aims to achieve carbon neutrality before 2060 [13].

Exhibit 1 | 2100 warming projection

Expected global greenhouse gas emissions and consequent warming estimates by scenario



The trajectory determined by current policies is significantly inconsistent with the targets set by the Paris Agreement. The scenario does not improve including current pledges and targets in the estimates. In fact, these would lead to global warming of 2.4°C by the end of the century.

Source: Climate Action Tracker (2021) - Warming Projections Global Update

To effectively curb global warming, it is of paramount importance to abate the emissions derived from energy consumption. In fact, they accounted for more than 36.4 GtCO2e in 2017, more than 70% of global greenhouse emissions [4]. The carbon intensity of the energy mix has remained constant over the last decade, producing an average of 2.4 tCO2/toe [5]; this is due to its reliance on fossil fuels, from which more than 80% of energy supply is derived[2]. In addition, the increase of global population and economic advancements have significantly increased the total energy consumption by more than 40% from 2000 to 2018[3]. Although in the same period the global energy intensity improvement rate of economies exhibited an increase ranging from 1.2% to 2.3% [6], the data still portrays an unsustainable development trajectory of the energy system. Therefore, a radical change in said energy system is needed as soon as possible to abate its contribution to global greenhouse gas emissions and requires the collaboration of different players across sectors [14], considering that the actions taken in the next decade will significantly determine the possibility to meet global climate objectives.

For a sustainable transformation of the current energy system, making it carbon neutral, three key actions should be undertaken. The first is shifting energy end-uses towards clean energy carriers, considering the possible transition role of low-carbon fuels in the short to mid-term, and as such working towards lowering their carbon footprint as well. The second consists of improving efficiency to decrease the overall demand for energy, without limiting economic growth[4]. The third is linked to the development and modernization of the infrastructures required to enable the transition.

[2] Deloitte analysis based on data from IEA, 2020
[3] Deloitte analysis based on data from IEA, 2020
[4] Refer to Policy Paper Trade & Investment: Policy Action 4.1

Policy Action 1.1: Shift energy end-uses towards clean energy

G20 members should promote and accelerate the shift in the energy end-uses, driving the substitution of fossil fuels with Decarbonized Electricity and other carbon neutral energy sources and carriers based on a cost effectiveness approach that will include indirect or direct costs of externalities as well.

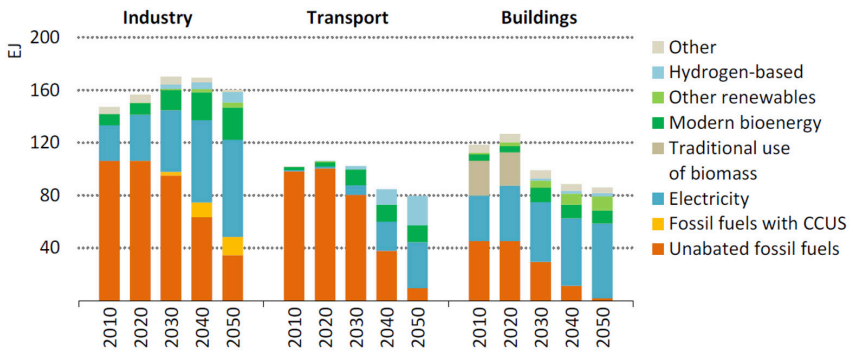
The transition of the energy system towards carbon neutral energy sources and carriers can accelerate if pulled by energy end-uses. This will significantly increase the share of renewables in the energy mix and displace the most polluting fuels. While current policies and announced pledges provide for a share of renewables in total final consumption equal to 12% in 2050, to limit the global temperature rise to 1.5 °C as set by the Paris Agreement, increasing this figure up to about 67% is necessary [9]. Energy end-uses have to shift towards renewables or carbon neutral energy sources to effectively offset the use of fossil fuels.

In the next decade, to boost the emissions decline, it is paramount to accelerate the deployment of all already available and early-adoption energy technologies, especially through electrification. In fact, a progressively and increasingly decarbonized electricity emerges as the most efficient energy vector to achieve net zero ambitions. In particular, it is imperative for energy uses in industry, buildings and transport, as these sectors are the main causes of global greenhouse gases emissions [4]. Clean and smart electrification is a cost-effective route to decarbonize large portions of total final energy uses. The transport sector progressively sees a growing role for direct electrification, mainly in the light duty segment, driven by the electrification of the passenger vehicle fleet through electric vehicles; electrification could find cost-effective applications also in the long haul heavy duty segments. Decarbonization of buildings relies on greater electrification achieved through the deployment of electric heat pumps and a deeper building renovation rate incorporating smart technologies. Electrification of industrial processes, including direct use of electricity and indirect use through carbon free hydrogen and e-fuels, will contribute to the decarbonization of industries. For instance, direct electrification could result from the fuel switching in industrial processes, such as iron and steel production using electric arc furnaces, or, in the cement industry, through the development of technologies for electrification of cement clinker production. To limit the rise in global temperature to 1.5°C, the share of renewable energy consumption in industry should increase from 12.4% in 2020 to 58% in 2050, with renewable electricity covering 40% of the total energy demand. Regarding the building sector, the variation during the same period should be from 15.5% to 81.8%, increasing the reliance on renewable electricity to 58%. Finally, in the transport sector, renewables should account for 54.5% of energy consumption in 2050, raising sharply from 3.5% in 2020, with renewable electricity satisfying 38% of demand[5].

[5] *Deloitte analysis based on data from IEA, 2021*

Exhibit 2 | Changes in the energy mix of energy end uses

Energy consumption in industry, transport and buildings sectors



Note: the portrayed scenario aims at achieving net zero CO2 emissions from the energy sector by 2050, consistently with the long-term goal of containing the average global temperature rise to 1.5°C, as well as achieving universal energy access by 2030 and delivering a major reduction in air pollution.

Source: IEA (2021) - Net Zero by 2050. A Roadmap for the Global Energy Sector

For some specific hard-to-abate sectors, direct electrification can be challenging. In addition, to support the achievement of emissions reduction objectives in the long-term, it is necessary to develop additional technological solutions to decrease the reliance of these end-uses on fossil fuels, also leveraging on R&D and innovation. A complementary option gaining traction is hydrogen, a clean-burning molecule constituting a flexible energy carrier for those parts of the economy that cannot be easily or economically electrified, once economies of scale are in place. It can be employed directly or combined with carbon to produce synthetic fuels when CO2 is captured from the atmosphere. Presently, hydrogen is mainly utilized for oil refinery and in the chemical industry, mostly for the production of ammonia and methanol. However, its versatility creates opportunities for different applications. In iron and steel production, hydrogen can be employed in the direct reduced iron (DRI) stage as a substitute for fossil fuels. In maritime and air transportation, it can substitute fossil fuels directly, in the form of ammonia or other synthetic fuels. Hydrogen might be a possible energy carrier also in the long haul heavy duty road transport, where fuel cell electric vehicles might present the advantages of operational flexibility, relatively short refueling time and large payload capacity. Furthermore, hydrogen could be employed to generate high-temperature heat in several industrial processes [15].

The environmental impact of shifting to hydrogen depends on how it is produced. The vast majority of present production employs natural gas or coal in reforming or gasification processes. These production methodologies are emission intensive, releasing between 10 and 19 tCO2/tH2 [15], resulting in the so-called grey hydrogen. Therefore, to sustainably increase the use of this molecule in the economy, it is necessary to scale the production of the green hydrogen. It is produced through water electrolysis and does not produce emissions if the electricity is sourced from renewables. Today, green hydrogen is not a cost-competitive solution yet, but technologies' improvement and falling costs of renewables and electrolyzers (whose cost in Europe and North America dropped by 40% between 2014 and 2019), if achieved on an industrial scale, might improve its economics in the future, possibly making

it the cheapest option to produce hydrogen within a decade [16]. To achieve this goal, however, both public and private investments and support to research, development and innovation programs are key.

Furthermore, if produced sustainably, carbon neutral synthetic and bio fuels might play a key role in a decarbonized energy system, provided long term lock in effects and land use that displaces agriculture and forestry at the expense of intensive fuel dedicated cultivations are avoided. Examples are ethanol, produced from corn and other crops, biodiesel, derived from vegetable oils, and biomethane, captured from landfills, livestock operations or wastewater and then refined. Biofuels present several advantages. First, they can avoid emissions produced by the natural decomposition of the organic matter from which they are derived. Second, in many cases, they can be used to fuel existing engines either directly or, as a transitional short-term option, blended with fossil fuels to contribute to reaching emission reduction targets more quickly. Third, if produced using waste as feedstock, such as crop residues or organic fraction of municipal solid waste, they can enhance the circularity level of the economy; to this end, it is necessary to collaborate to improve waste collection processes making them more economical, efficient and reliable. However, to assess the real reduction of greenhouse gases emissions associated with the production and use of fuels and energy carriers, it is necessary to take into account their entire life cycle as well as their impact in terms of local air pollution, implementing LCA methodology; this will ensure that equivalent zero-carbon energy solutions can be pursued taking into account local specificities. To this end, clear additionality needs to be considered and land occupation should not come at the expense of forestry and agricultural uses.

Finally, during the transition period towards the realization of a clean energy system, low-carbon fuels can support the change making the transition more efficient and affordable, provided that investments leading to stranded costs are avoided. They can be the last energy sources and carriers to be substituted by renewables and clean sources, as their environmental impact is lower than highly pollutant fossil fuels. Moreover, they can be used to switch from high- to low-carbon fuels if no investments in permanent infrastructures are required; this way, emissions reductions are achievable without incurring into stranded costs and lock-in effects. Coordinated efforts are necessary to manage the transition phase effectively at the global level, taking into consideration the differences among countries without compromising the achievement of urgent decarbonization objectives, making the energy system carbon neutral. In this context, natural gas represents a useful transitional resource for the mid-term to make the use of some technologies already in place more sustainable until the end of their lifecycle. Natural gas is indeed the least polluting among fossil fuels, generating the lowest amount of CO2 per MWh of energy produced [17]. However, flaring and methane leaks associated with gas extraction and transportation need to be severely reduced in order for natural gas to be a reliable transition fuel in the path to carbon neutrality. In fact, aside from not eliminable flaring (e.g., for safety reasons), severe pollution is caused by the so-called routing flaring, happening during normal operations in the absence of sufficient facilities or amenable geology to re-inject the produced gas, utilize it on-site, or dispatch it to a market [18]. To this end, disclosure methodologies and strict enforcement of policies will be needed to ensure methane leaks are detected and eliminated from the whole gas value chain. Furthermore, during this transition, it might be useful to explore the production of blue hydrogen, mainly based on natural gas reforming or coal gasification with carbon capture, ensuring the capture of at

least 90% of the emitted CO2 and low methane leakage, provided it proves to be an economic and reliable technology to decarbonize the present use of high carbon intensive grey hydrogen without incurring into stranded costs and lock-in effects. With blue hydrogen, a partial decarbonization of the existing hydrogen value chain can be carried out and environmental benefits can be achieved. In this context, it becomes critical to rapidly verify the technical and economic maturity of CCS technologies.

Actions:

• Accelerate electrification of transport, building energy uses and industrial sectors.
G20 countries should enable and promote a large-scale deployment of technologies fueled by renewable electricity in order to abate the consumption of fossil fuels in those end uses where electrification can easily replace incumbent carriers, such as private and public transport with electric vehicles, buildings with heat pumps and electric appliances and industrial processes happening at low or medium temperatures.

• Promote the development and scaling up of clean fuels, such as green hydrogen, bioenergies and synthetic fuels, to decarbonize "hard to abate" industrial sectors, as well as the transport sector and, in particular, air, maritime and long distance transportation, preventing the displacement of land use from agriculture or forestry to fuel dedicated intensive cultivations.
To support the achievement of emissions reduction objectives in the long-term, G20 members should scale up clean fuels , especially for sectors in which electrification is not a viable option yet, investing in and supporting research, development and innovation programs to make carbon free hydrogen, bioenergies and synthetic fuels a competitive, sustainable alternative to fossil fuels, also assuring a prompt and suitable development of the regulatory framework and pathways for the decarbonization of these sectors. Also displacing agricultural land use or forestry should be avoided.

• Facilitate the conversion of end use technology from heavy to free or lower carbon sources and carriers, such as blue hydrogen and flare free natural gas, as a transition measure for the mid-term, avoiding investments leading to stranded costs as well as compromising the urgent achievement of decarbonization objectives, while preventing long term lock in effects.
In the transition phase towards a carbon neutral energy system, without compromising the achievement of decarbonization objectives, G20 members should facilitate the switch from high- to low-carbon fuels as a measure for the mid-term, avoiding investments leading to stranded costs and lock-in effects.

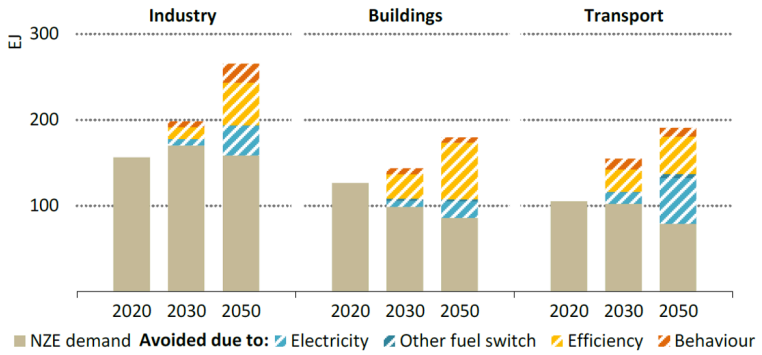
Policy Action 1.2: Increase efficiency

G20 countries should sustain the increase of energy and resources use efficiency, substantially reducing energy intensity of domestic GDP while supporting its growth, with dedicated actions towards industrial and consumers sectors, building, transport and cities.

The second driver of the energy transition is represented by the energy efficiency increase, the overarching objective being the decrease of the overall energy consumption without constraining human activities, end uses and economic development. Thus, the energy intensity of global economies has to improve. However, between 2010 and 2020, the average annual energy intensity improvement rate was equal to 1.6% [9]. Estimates show that energy intensity improvement has to increase to 4% per year between 2020 and 2030 and, later, to 2.7% per year until 2050 to reach the 1.5°C goal set by the Paris Agreement [9].

Exhibit 3 | Energy consumption improvement

Total final energy consumption and demand that should be avoided by mitigation measure and sector



Note: NZE stands for Net Zero Emissions Scenario, a scenario reaching net zero CO2 emissions from the energy sector by 2050, consistently with the long-term goal of containing the average global temperature rise to 1.5°C, as well as achieving universal energy access by 2030 and delivering a major reduction in air pollution.

Source: IEA (2021) - Net Zero by 2050. A Roadmap for the Global Energy Sector

Direct electrification represents the main solution to increase the efficiency of energy end-uses. Electric vehicles represent one example: on average, they convert over 77% of the electrical energy from the grid to power at the wheels, while vehicles fueled by gasoline convert between 12% and 30% of the energy stored in gasoline to power at the wheels [19]. Considering heating, the main energy use for buildings in regions such as the European Union and the U.S. [20] [21], heat pumps are, on average, two to four times more efficient than conventional heating systems [22].

In addition, other interventions and technologies could increase the overall energy efficiency of our economies. Thermal management technologies could enable further energy savings in vehicles. Considering buildings, im-

proved insulation, appliance modernization and energy-saving components could significantly contain unnecessary energy demand. Sustainable materials should be used from the design stage to reduce energy consumption, as well as making buildings more durable, resilient and adaptable to climate change; moreover, digital technologies, such as IoT, could be used to gather and analyze data to optimize resource consumption (e.g., smart thermostats could automatically regulate residential heating systems to decrease energy waste or enable predictive maintenance) [22]. These interventions would be critical to achieving decarbonization goals since, considering the European Union, buildings are responsible for approximately 40% of the energy consumption and 36% of greenhouse gas emissions from energy and almost 75% of the building stock is energy inefficient according to current building standards [23]. Besides, in the industrial sector, process improvements could lead to an energy consumption reduction of 25% [22]. Additional savings in industry can be achieved by implementing continuous energy management systems and regular and standardized energy audits, reducing costs and environmental impacts. Energy efficiency gains are achievable through process improvements, recycling, sector coupling (e.g., through green hydrogen) and electrification; the potential varies by type of industrial process, with significant gains in energy intensive sectors such as cement, steel and iron industry. Energy efficiency should be a key point of attention while developing and expanding metropolitan areas. Today, around 3.5 billion people already live in urban centers and this number is expected to grow up to 5 billion by 2030, with most of the increase due to developing countries [24]. This trend will significantly increase the demand for energy coming from cities and, without careful planning, also their contribution to global greenhouse gas emissions. Energy efficient solutions (e.g., for HVAC systems) can help to improve urban services curbing their environmental impact. However, several impediments prevent their deployment, such as financial, implementation capacity and awareness barriers [24].

Investments from public and private sectors in energy efficiency are not only necessary for the environment, but could also be accretive for the economy. One of the main benefits is linked to job creation. Compared to the business-as-usual scenario, accelerating the clean energy transition could increase the number of people employed in energy efficiency by 21%, reaching a total of 21.3 million people, two times as much as today [22]. Thus, proper incentive systems and standards might be implemented in order to promote investments in energy efficiency.

Actions:

• **Scale energy upgrading interventions both in industrial and consumer sectors (e.g., Real Estate, Automotive, etc.).**
G20 countries should provide incentives to investments directed to increasing the energy efficiency of industrial and consumer sectors, reducing the consumption of energy without impairing economic growth.

• **Implement more efficient systems in transport and buildings.**
G20 members should invest in the implementation of solutions increasing the energy efficiency of transport and buildings sectors, leveraging especially on electrification and smart technologies and accelerating the pace of regulation for highly efficient and sustainable technologies.

• Develop holistic energy efficient solutions for growing metropolitan areas.
G20 countries should face the increasing demand for energy coming from cities deploying efficient solutions for urban services, abating the environmental impact of metropolitan areas.

Policy Action 1.3: Develop infrastructures

The G20 should promote the development and modernization of infrastructures to sustain the transition towards a carbon neutral energy mix.

The clean energy transition has to be sustained with the needed infrastructure improvements. To this end, if operated in line with past practices and for the typical operational lifetimes, existing and under construction infrastructures would lock in a temperature increase of around 1.65°C, causing CO2 emissions of around 26.5 Gt in 2030 and 10 Gt in 2050, falling to zero only by 2070 [25]. Therefore, government support in research and development is needed to progress the required technologies until they become commercially viable, developing future-proof infrastructure for early-stage, emissions-neutral technologies and further advancing more mature innovations. Nevertheless, investments in infrastructures should provide an efficient allocation of resources and avoid the creation of stranded assets and the risk of lock-in effects, considering the time horizon set by climate-related objectives. Moreover, investments should be deployed in infrastructures connecting global and regional markets related to carbon free energy carriers to optimize energy use and security[6].

As mentioned above, drastically changing the composition of the energy mix increasing the share of renewables is critical. More in detail, to set a pathway consistent with the 1.5°C goal of the Paris Agreement, by 2050, renewables should represent ~30.5% of global energy supply by 2030, growing by 142% with respect to 2020 levels[7]. Thus, it is necessary to accelerate the development of power infrastructure for renewable generation, transmission and distribution with adequate investments. Consequently, the reliance on fossil fuels should radically drop, with specific regard to coal and oil, whose share in the energy mix should decrease in the same period by 53% and 21% respectively[8]. In the same timeframe, nuclear energy is expected to increase its share in total energy supply by up to ~8% [9]. To this end, it is recommended to invest in new research of more sustainable technologies to reduce the long-term environmental impact of nuclear energy.

Nevertheless, as the power sector increases the share of renewable energy and, consequently, the variability of its supply, together with the increasing electrification of final uses and electricity consumptions, it has to improve its flexibility. This requires new investments in grid facilities, both at transmission and distribution levels. In particular, smart grids accomplish the required optimization of the power network by using digital and advanced technologies. Relying on smart meters, advanced automation, remote controls, monitoring and communication systems, modern grids are crucial to sustaining the penetration of renewables; they enable the shift from a centralized to a decentralized distribution system, where consumers can be also producers and electric vehicles can help to balance energy demand and production peaks and plunges. Moreover, as consumers become prosumers, smart and flexible buildings gain importance to provide behind-the-meter control and energy management. Additional solutions, complementary to renewables,

[6] Refer to Policy Paper Finance & Infrastructure; Policy Action 2.2
[7] Deloitte analysis based on data from IEA, 2021
[8] Deloitte analysis based on data from IEA, 2021

able to increase flexibility are Battery Energy Storage System (BESS), green hydrogen production and pumped hydropower storage; they provide a way to store renewable energy, making its management more flexible and efficient. This brings to light the important role of the electricity grid as an enabler of the energy transition, requiring investments in modernization and digitalization: they are necessary to increase the penetration of renewables by connecting new production capacity to the grid, reducing costs linked to the risk of curtailments, as well as to increase the flexibility and integration of the energy system. Moreover, to enable the above-mentioned electrification of road transport, a proper charging network should be developed to overcome barriers to adoption.

Investing in these infrastructures could also have a positive effect on employment: by 2050, a development of the energy sector aligned with the Paris Agreement objective could increase by 14% the number of jobs related to power grids and energy flexibility compared to a business-as-usual scenario, doubling the number of today's employees in this field [22].

Furthermore, in order to tackle the emission of "harder to abate sectors" and according to the future deployment of hydrogen solutions, it could be also necessary to develop suitable infrastructures to exploit the benefits of hydrogen. Hydrogen poses challenges linked to its transportation and storage, due to its low energy density on a volume basis that implies the need for larger storing facilities and higher transportation costs. The main alternatives currently available are geological formations and tanks for storage, pipelines, ships and trucks for transport, for which common rules and standards for readiness assessment should be set. However, technological advancement can ease the development of a cost-efficient supply chain. To this end, green hydrogen produced through electrolysis can also optimize the infrastructure allowing the installation of electrolyzers fueled by the electric grid close to the location of hydrogen demand, as opposed to transporting hydrogen. Moreover, if and when fuel cell heavy-duty trucks are going to become a viable alternative for the transport and logistics industry, a proper network of hydrogen refueling stations along the main national and regional transit routes, logistics centers and urban nodes has to be developed, as well as adequate hydrogen-related infrastructures in ports. Additionally, to ramp up the deployment of zero-carbon hydrogen, clusters of industrial activities represent a major opportunity since they offer the possibility to co-locate demand and supply, reducing upfront costs for transmission and distribution, and employ large volumes of hydrogen [15]; to this end, ports represent an example of cluster enabler as they can sustain the use of hydrogen in maritime sector and connect the entire hydrogen value chain.

However, as shown in Exhibit 1, to meet the most ambitious goals of the Paris Agreement, it is not sufficient to stop emitting greenhouse gases; global economies have to take a step forward and become carbon negative, i.e. actively remove CO2 from the atmosphere. This is necessary to decrease the concentration of carbon dioxide and reduce the amount already released in a faster way. Alongside cost effective nature-based solutions such as afforestation and reforestation, which may provide additional carbon sequestration if managed sustainably [26], Carbon Capture, Usage and Storage (CCUS) technologies can contribute to this objective. Technological options are particularly useful as they grant more predictable outcomes and are less land-intensive. The most relevant alternatives in this field are Direct Air Capture (DAC) and Bioenergy with Carbon Capture and Storage (BECCS). DAC solutions, which capture CO2 directly from the atmosphere, are still at small-scale pilot and

demonstration stage. Thus, their cost estimates are still uncertain. However, due to the low concentration of CO2 in the air, which is the main cost driver of CCUS technologies, DAC technologies are highly energy-intensive and, consequently, expensive [27]. BECCS technologies are able to capture and store CO2 from processes where sustainable biomass is converted to energy or used to produce materials; if sustainable biomass is converted into a fuel and BECCS technologies are applied, less CO2 is released into the atmosphere (when the fuel is burnt) than is removed (by the crops during their growth), making the process carbon negative. BECCS is the most mature carbon removal technology, but requires a life-cycle assessment to evaluate its effectiveness, considering also the sustainability of the biomass feedstock and the land-use change [27]. CCUS technologies can contribute also to reduce non-energy related emissions from hard-to-abate sectors along their production processes. Industrial process emissions were equal to 2.5 GtCO2 in 2019, 63% of which produced by the cement sector and more than half of the rest coming from the chemicals and steel sectors [27]. Thus, adequate resources might be implemented in order to advance experimentation in the field of CCUS in suited sites and the needed technology-related R&D that should bring the cost of these technologies to desired economic levels.

As already highlighted above, digital technologies and innovation will play a critical role in the clean energy transition, enabling both the shift of energy end uses towards clean energy sources and carriers and higher efficiency. This is why investments in digital technologies by energy companies have increased significantly over the last few years, accelerating the digitalization process of the energy system [28]. In particular, through digital technologies it is possible to: deploy smart demand response strategies, providing flexibility to the energy system and saving investment in new production infrastructures; integrate variable renewable energy sources, matching supply and demand peaks and reducing curtailment risks; implement smart charging for electric vehicles, providing additional flexibility to the grid; and develop distributed electricity resources, integrating prosumers in the energy system [28]. For this to happen, however, it is necessary to ensure a high level of interoperability. Moreover, to significantly advance the level of digitalization of the energy system, it is necessary to consider also supporting information and communication technologies and infrastructures, with special attention for data collection, management and protection.

Actions:

• Foster carbon free power generation, storage, transmission, distribution, and specifically infrastructures to support reliability and growth of renewable energy sources, exploiting the potential of digital and smart technologies. Consider cost competitive and reliable Carbon Capture Sequestration and Utilization systems if and when their economic and reliability standards demonstrate a technological maturity to enable a possible reliable application to large scale in the future.
G20 countries should invest and incentivize the production of renewable energy and in the development of the relative transmission, distribution and storage infrastructure, exploiting the potential of digital and smart technologies such as smart grids.

• Promote the deployment of economically competitive and carbon neutral hydrogen supply chain targeted to "hard to abate" sectors.
To support the decarbonization of sectors in which electrification is not a viable option yet, G20 members should enable the development of convenient infrastructures for the hydrogen supply chain.

• Pursue the development and experimentation in suited sites of economically viable and environmentally reliable CCUS in "hard to abate" sectors (such as cement production), DAC and BECCS technology and nature-based solutions (e.g., afforestation) to provide carbon negative technology able to offset residual direct air greenhouse gas emissions.
To address residual emissions and actively remove CO2 from the atmosphere, G20 countries should invest in additional R&D efforts on CCUS technologies aiming at reducing costs and increase the effectiveness of carbon capture technologies. At the same time, G20 countries should consider the contribution achievable through sustainably managed and cost effective nature-based solutions.

Recommendation 2: Provide effective policy pathways to foster sustainable growth and secure the energy transition

Policy Actions

2.1 Leverage sustainable finance – The G20 should encourage and drive the adoption of common ESG frameworks and disclosures to foster the financial sector's role in supporting business transition towards long-term sustainable economic activities and value creation for stakeholders.
• Promote policy pathways towards harmonized taxonomies for finance products to qualify as sustainable.
• Compel improved ESG and particularly climate risks assessment and disclosures by companies.

2.2 Drive carbon pricing - The G20 should drive effective and robust carbon pricing taking into account the local markets peculiarities and promote strategic dialogue to lay the foundation for global mechanisms to valorize environmental externalities, while quickly phasing out direct or indirect inefficient energy subsidies.
• Drive the adoption of effective carbon markets in local jurisdictions.
• Foster linking of local carbon markets through agreeing to and enforcing Article 6 of Paris Agreement considering solutions to limit the risk of relocation of industrial activities due to different national climate ambitions and carbon related regulation, while taking into account the principle of common but differentiated responsibilities.
• Harmonize carbon pricing metrics and leverage new technologies for carbon data acquisition and analysis.
• Reorganize current fiscal policies to complement carbon markets schemes with non-market-based initiatives where needed.
• Phase out inefficient energy subsidies vs carbon neutral targets, and provide adequate incentives by advancing fiscal tools for the energy transition to promote affordable and carbon neutral energy sources.

Leading Monitoring KPI	Baseline (2020)	Target (2030)
Global % of CO2 emissions covered by carbon pricing mechanisms1 *1. Includes both market-based mechanisms (ETS) and carbon taxes implemented at global level;* *2. Target set on the hypothesis of a liner increase leading to meet 100% coverage in 2050.*	22%	48%[9]

SDG impacted:

Recommendation 2 contributes to SDG 8 – Decent work and economic growth – by promoting the financial sector's role in securing adequate resources for the energy transition and supporting sustainable economic growth, therefore effectively decoupling economic prosperity from environmental degradation.

Moreover, this recommendation also aims to ensure that long-term value creation for all stakeholders is at the center of companies' business models, therefore fostering economic and social equality for all, in accordance with the SDG 10 – Reduce inequality. At the same time, increased international cooperation and harmonization will support developing countries in reaching decarbonization objectives in a just and inclusive manner.

In accordance with SDG 13 – Climate action – the recommendation also calls for robust international standards on ESG metrics and for effective carbon pricing mechanisms in order to make all economic actors accountable and encourage their progresses in tackling climate change.

All these measures will reach their scope only if adopted through global coordination, with a strong partnership and shared policy pathways among all countries. In this context, and in line with the SDG 17 – Partnerships for the goals – the recommendation underlines the key role of collaboration between governments, international organizations, the private sector and NGOs in order to agree on global standards and metrics in the area of sustainable finance and GHGs taxation.

G20 Italy Priorities:

Recommendation 2 contributes to addressing all the G20 Italy's Priorities of People, Planet and Prosperity.

In particular, the implementation and harmonization of carbon pricing could generate substantial revenues for national governments, which could be used to support vulnerable groups and communities along the energy transition and strengthen social safety nets.

Moreover, adequate carbon taxation, along with the adoption of the ESG disclosure for companies, could lead to a significant abatement of GHG emissions at global level, potentially limiting climate change and triggering positive repercussion on the environment.

Finally, the reorientation of financial flows toward sustainable investments and new low-carbon technologies could foster economic growth and employment, therefore increasing the prosperity and resilience of all countries.

[9] *Data from: World Bank (2021) - Carbon Pricing Dashboard*

Context

In order to reach the goals of the Paris Agreement, more than technology and efficiency is needed for societies to hit their targets. Thus, a large collection of incentives – in terms of policies, regulations and market-based solutions – are increasingly required to facilitate and speed-up the carbon-neutral transition.

In this context, despite large differences at national level, in recent years G20 governments have increasingly recognized the importance of establishing common policy pathways to coordinate decarbonization strategies and secure sustainable growth in their economies. International discussion and negotiations after 2015's Paris Agreement, including in fora such as UNFCCC COP, have provided much-needed advancements in governments' ambitions and coordination on climate change, but fragmentation of policy frameworks remains one of the key challenges to overcome in the coming years. Existing G20 efforts need to be further strengthened by more concrete action plans at different levels and by mobilizing the private sector. Stable, forward-looking legislative and regulatory frameworks, as well as harmonized technical standards, will be key to facilitate the flow of private capitals and investments toward carbon neutral opportunities. Moreover, strong collaboration between international public finance and the private sector is essential to mobilize the vast amount of investments needed for the energy transition, also through global initiatives aimed at financing green technologies development and deployment. In addition, governments should put in place a sound environment for capital flows in order to attract investments and reduce financial risks for businesses, in particular in developing countries, which will require significant private capital alongside public funding.

To this end, the B20 recommends the G20's members to define shared policy pathways in a number of areas which are considered critical to achieve collective climate goals and secure an inclusive transition, with a specific focus on sustainable finance principles and carbon pricing mechanisms.

Policy Action 2.1: Leverage sustainable finance

The G20 should encourage and drive the adoption of common ESG frameworks and disclosures to foster the financial sector's role in supporting business transition towards long-term sustainable economic activities and value creation for stakeholders.

Sustainable finance represents one of the key enablers of the energy transition and should be regarded by governments and companies alike as an efficient instrument to facilitate the financial sector's role in supporting businesses transition toward long-term sustainable activities[10]. In particular, sustainable finance frameworks should aim, among others, at:
• Reorienting capital flows towards sustainable investments.
• Managing financial risks deriving from climate change, resource depletion, environmental and social degradation.
• Promoting transparency and long-term vision in economic and financial activities.
• Integrating sustainable finance best practices in the investment decisions of governments and development finance institutions[11].
• Facilitating the understanding and adoption of sustainable finance principles within all economic actors, including SMEs.

[10] Refer to Policy Paper Trade & Investment: Policy Action 2.3
[11] Refer to Policy paper employment & education: Policy action 3.1

In this context, despite decades-low oil prices and the Covid-19 devastating impact on virtually all world's economies, ESG metrics and climate risks considerations are increasingly gaining attention from both institutional and retail investors – to this end, it is clear that the pandemic did not divert attention from climate change.

From January through Decembers 2020, investors in mutual funds and ETFs invested $288 billion globally in sustainable assets, a 96% increase over 2019. Many large groups worldwide – as well as a growing number of SMEs – made public their carbon commitment for different time-scales, but mostly in line with the goals of mid-century carbon neutrality. Governments and companies are expected to issue $500 billion in green debt in 2021, nearly half the total that has been raised since the asset class inception.

At the same time, while the reallocation of capital toward green organizations and products is taking place globally at an increasing pace, many institutional investors, shareholder groups and civil society actors are also pressuring companies into placing ESG considerations at the core of their business models. This is partly due to the need of addressing the growing regulatory, financial and reputational risks that companies face when they fail to set ambitious ESG targets for their operations[12].

Exhibit 4 | ESG benefits for businesses

Sustainable finance encourages companies to include environmental, social, and governance (ESG) considerations in their business model and long-term strategic objectives. These considerations entail:

• **Environmental** - Refers to the energy a company consumes and the waste it discharges, the resources it needs, and the consequences for living beings as a result. It also encompasses carbon emissions and climate change.
• **Social** - Refers to a company's relationship with employees and its approach to human rights, as well as the engagement it fosters with stakeholders, including the people and institutions it does business with. Social propositions also help employees' formation and retention, and strengthen companies' social responsibility.
• **Governance** - Refers to the internal system of practices, controls, and procedures a company adopts in order to govern itself, make effective decisions, comply with the law, and meet the needs of external stakeholders, also in terms of transparency and accountability.

In this context, ESG performance of a business positively correlates with its financial performance: for example, a strong ESG proposition correlates with higher equity returns, higher credit ratings and lower cost of debt (such as loan and credit default swap spreads). Several ESG propositions can make a positive impact on financial performance, including:

• Market share growth, fostered by changes in consumer preferences. Over 70% of consumers in multiple industries would pay an additional 5% for a sustainability produced product.
• Cost reductions, particularly during operating phases of the asset, due to greater efficiency and lower operational costs.
• Lower regulatory intervention, and potential increased access to government support.
• Higher productivity, since a strong ESG proposition helps businesses attract and retain quality employees, and enhances employee motivation through a sense of purpose. Employees' satisfaction is positively correlated with productivity and shareholder returns.

[12] *Refer to Policy Paper Finance & Infrastructure, Policy Action 1.2 and to Policy Paper Action Council, Policy Action 1.2*

• Asset optimization and risk management, as allocating capital to sustainable initiatives can enhance investment returns, while avoiding investments losses due to longer-term environmental issues.

Even in times of economic distress, such as during the Covid-19 pandemic, a strong ESG proposition can help reduce negative impacts for companies. For example, a strong governance foundation can help neutralize fraudulent or risky activities that could be exacerbated during times of stress. In addition, prioritizing social considerations related to ESG – such as employees' health and safety – can improve businesses' ability to safeguard their workforce and minimize business disruptions. Financial aid from governments and investors is also increasingly focused on sustainable development.

Despite recent capital flows momentum and regulatory and public attention to these matters are on the rise in many geographies, the lack of consistent metrics and standards identifying sustainable financial products and companies represents an acute barrier to wider market adoption, and can lead to investors' uncertainty and to so-called "green-washing" practices. Assessing sustainability requires that policymakers, regulators and investors have access to consistent, high-quality, and material public information.

To this end, one of the key challenges that the G20 governments should address in this context is the lack of harmonized taxonomies on sustainable finance. To this day, little global coordination exists on sustainable finance taxonomies. While there has been a harmonization process in some geographies, there are still multiple taxonomies across jurisdictions, with different objectives and focus on different components of ESG. The majority of the newly-created frameworks emphasizes the environmental aspect. Moreover, the lack of consistent application of common and globally-accepted ESG taxonomies across jurisdictions leads to different interpretations of the sustainability-related performance of large corporations and SMEs.

A global coordination and harmonization on taxonomies is seen as an essential reform that could bring positive results and benefits for all economic actors. Indeed, harmonized taxonomies have been assessed as tool available to all financial market participants to identify sustainable assets, reducing the costs of developing their own classification. Harmonizing taxonomies has also demonstrated to ensure a high-level playing field and reduce fragmentation, bringing more clarity to definitions, which may limit greenwashing and reputational risks. In this context, a holistic approach to taxonomy should take into account life-cycle analysis and carbon abatement cost per ton of CO2 for all technologies, in order to foster carbon neutral innovation in all sectors.

Also, global coordination on taxonomy can be used by companies in different regulatory frameworks, such as disclosure of environmentally sustainable investments and financing. The growing interest in taxonomy has also led businesses to incorporate sustainability concerns into their strategy. Further, by identifying its green activities, a company can diversify its investors' base. A common approach to taxonomies could also provide a clear path for companies on how to leverage the energy transition and be used as a metric in a long-term business strategy and for marketing purposes.

For retail consumers, consistent taxonomies have proven to reduce information asymmetries, increase transparency of activities and easier access to sustainable products have, improve awareness among retail investors and limit research costs. This would also led to increased competition, allowing retail investors to more easily compare financial products with each other.

In this context, regulators and supervisors would also use the taxonomy to implement new sustainable investment frameworks as a reference for establishing policies that encourage sustainable investment by private and public actors. This would also be used to monitor capital flows to green investments and to set targets.

A second challenge that G20 governments should address in order to leverage sustainable finance principles is the lack of shared non-financial disclosure frameworks. As a matter of fact, current sustainability disclosures do not follow common standards, which limits a user's ability to run comparisons across businesses and jurisdictions, and often results in comparative disadvantages and increased regulatory burden depending on companies' reporting jurisdiction. So far, progress has been made around standardizing sustainable disclosures with a primary focus on climate-related financial disclosures, but multiple frameworks still exist. Also, sustainability reporting remains largely voluntary and adoption uneven among publicly traded corporations across geographies, with little external verification and attestation of the reliability of the disclosed data, partly due to different levels of market preparedness among countries.

To this end, transparent measurement and disclosure of sustainability performance is a fundamental component of an effective business management, and essential to preserving trust in business as a force for good. Sustainability disclosure not only is increasingly critical for investors, as they seek to make robust economic decisions, and for regulators, as they look at the overall stability and efficiency of financial markets, but to a wide variety of stakeholders who rely on companies to preserve and improve the communities where businesses operate.

In the last 50 years, financial reporting has matured as a result of internationally recognized accounting standards that bring transparency, accountability and efficiency to financial markets around the world. The financial reporting eco-system has achieved global legitimacy through regulatory mandates by policymakers and users, while at the same time enabling the preparation of comparable and reliable information that can be consumed by a wide variety of data aggregators, analytics, ratings and indices providers. Its transparent, collective standard-setting process and governance structure have resulted in a body of standards that are widely accepted as fit-for-purpose and globally used.

In order to reach the same level of maturity and reliability in the ESG disclosure's ecosystem, the G20 should foster ongoing international efforts of leading standard-setters, integrated reporting framework providers and regulators, including the TCFD, the IFRS Foundation and the International Organization of Securities Commissions (IOSCO), to design and disseminate a common standard for ESG disclosure by businesses, also building on existing best practices developed by regional and national policymakers and ensuring alignment with their efforts in this area.

Such standards should provide users with material and comparable informa-

tion on all business' key sustainability metrics and should allow for external verification of such information to assure its reliability, similarly to that provided for financial data across markets worldwide. Moreover, in order to drive increased adoption, ESG disclosure frameworks should demonstrate sufficient flexibility to be applied to a wide variety of industries and sectors, as well as being adaptable to reflect changes in circumstances and in technologies. Standards should also take into account the double materiality concept, and its right balance with administrative burden. Finally, also in light of global discussion on integrated and interconnected reporting, sustainability disclosure frameworks and standards should be designed to easily blend within businesses' annual reports, disclosing financial and ESG information alongside as part of a comprehensive corporate reporting system that sheds light on how value is created at all level.

For all these reasons, the G20 should support international discussion on harmonized taxonomy for sustainable finance products, as well as foster adoption of ESG and climate risks assessment and disclosure for all organizations.

Actions:

• Promote policy pathways towards harmonized taxonomies for finance products to qualify as sustainable
G20 countries should ensure alignment between existing or future taxonomies for financial assets in order to provide more certainty to all economic actors on the transition path and facilitate capital flows towards sustainable assets.
• Compel improved ESG and particularly climate risks assessment and disclosures by companies.
G20 countries should foster the adoption of robust ESG disclosure frameworks for all businesses in order to promote long-term value creation, while at the same time managing financial risks deriving from climate change and providing comparable, material information on businesses' key sustainability metrics.

Policy Action 2.2: Drive carbon pricing

The G20 should drive effective and robust carbon pricing taking into account the local markets peculiarities and promote strategic dialogue to lay the foundation for global mechanisms to valorize environmental externalities, while quickly phasing out direct or indirect inefficient energy subsidies.
The global nature of carbon emissions poses significant challenges, most notably from the policy perspective: given the border-free circulation of CO2, all countries have to act together to reduce carbon emissions and fight against climate change within the multilateral frameworks of the UNFCCC and the WTO. In this context, the COVID-19 pandemic only granted a short-term reduction in global emissions and will not lower long-term emissions unless countries pursue an economic recovery that incorporates strong decarbonization strategies.

Economists, businesses, governments, NGOs and international bodies like the World Bank, the International Monetary Fund (IMF) and the Organization for Economic Cooperation and Development (OECD) are advocating for carbon pricing as a key instrument in transitioning to a low-carbon economy. The adoption of financial frameworks that put a value on carbon and effecti-

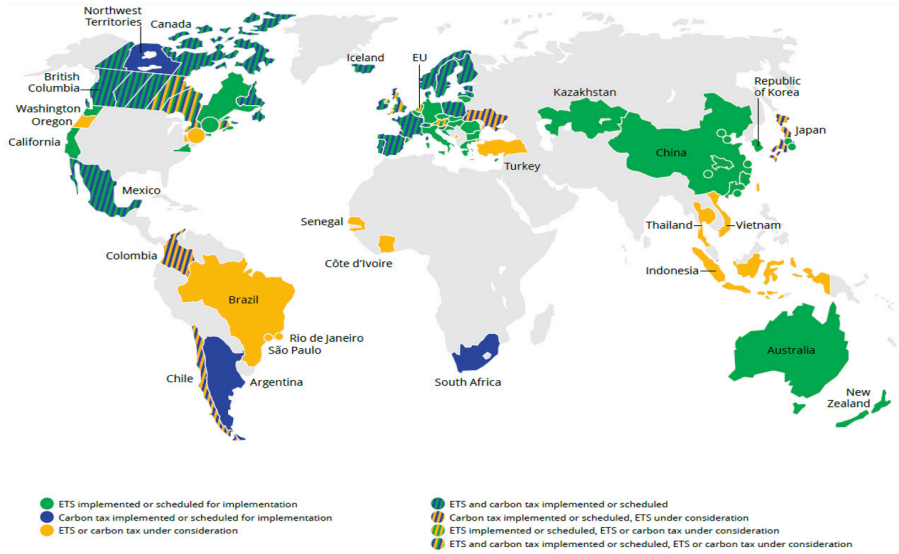
vely reallocate capital is seen as an effective, flexible and low-cost tool to decarbonize a wide range of sectors and spurs innovation into zero-carbon technologies[13].

Article 6 of the Paris Agreement provides for both market-based approaches (such as Emission Trading Systems, or ETS, and Joint-Crediting Mechanism, or JCM) and non-market-based instruments (such as carbon taxes). Both systems often exist side by side in the same jurisdiction, together with other complementary policies.

As of 2021, more than 60 national or sub-national jurisdictions have launched initiatives to valorize environmental externalities. However, the fragmentation of these carbon pricing schemes – which in some cases differ even within the same country – and their co-existence with other policy instrument greatly reduces the effectiveness of these instruments and can lead to market distortions and a high carbon price volatility. At the same time, 46% of energy-related CO2 emissions in G20 countries do not face a carbon price at all, while 88% of emissions in the same countries are priced below US$35 per ton of CO2, substantially lower than the one needed to be consistent with the Paris Agreement. As a matter of fact the Paris Agreement required an estimated average of US$50–100 for ton of CO2 by 2030, to be reached tacking into consideration the peculiarities of different geographies and the needs of the developing countries.

Exhibit 5 | Overview of carbon pricing initiatives worldwide

ETS and carbon tax mechanisms implemented or scheduled for implementation



Source: World Bank (2020) - State and Trends of Carbon Pricing

[13] *Refer to Policy Paper Action Council; Policy Action 1.1*

In this context, because country-specific shadow carbon prices (i.e. prices necessary to meet specific mitigation targets) vary substantially across countries and regions, there is a large potential for cost savings from international cooperation through carbon markets. In particular, benefits tend to be higher with broader participation of countries, broader coverage of emissions and sectors. The synergies from such cooperation can facilitate the adoption of more ambitious policy goals (e.g. with emission reduction targets that go beyond Nationally Determined Contributions - NDCs - and align with the goals of the Paris Agreement).

For these reasons, international co-operation on carbon pricing - in particular trough market-based mechanisms - can deliver both economic (e.g. lower mitigation costs) and environmental benefits (e.g. reduced GHG emissions), although the economic dividend of international co-operation may vary across countries and regions. It is estimated that a global effective carbon pricing mechanisms and the reduction of fossil fuel subsidies alone could lead by 2030 to a decline in fossil-fuel related emissions by over 20% globally [29], reduce air pollution related deaths by over 50% and boost government revenues by $2.9 trillion (3.6% of global GDP) [30].

Moreover, using carbon markets to help countries meet the mitigation goals in their initial NDCs with a uniform global carbon price has the potential to reduce global mitigation costs by 58 to 63% compared to countries meeting these targets unilaterally, translating into annual cost savings of up to USD 259 billion by 2030. These same benefits are estimated to be much higher if countries were to set NDCs that are in line with limiting global warming to 2°C, resulting in savings up to 1.240 billion by 2030. In this context, economic benefits can be the foundation to raise ambitions.

Article 6 provides for international cooperation mechanisms supporting the linking of carbon pricing approaches across countries and jurisdictions – mainly through foreseeing cross-country trade of internationally transferred mitigation outcomes (ITMOs) and other offsetting certificates that countries can account against their NDCs. Even though this would clearly result in a reduction of emissions by a greater magnitude than what is possible solely at domestic level, Paris Agreement's Parties have not yet concluded the negotiation on the specific Article 6 implementing provisions within the Paris Agreement Rulebook. Despite the greater effectiveness of global frameworks for carbon pricing, governments' discussion on potential shared approaches should also take into consideration local specificities and different grades of preparedness at national level, also to secure the affordability and accessibility of energy for everyone, particularly in emerging economies. Moreover, coordinating the convergence towards global carbon prices should take in to account the uneven distribution of cost-savings among countries and regions, as well as among different households and groups within the same country. International cooperation on carbon pricing should therefore consider the need to safeguard countries' competitiveness (which could be affected by higher carbon prices), also through developing international platforms and multilateral agreements to share best practices and technologies that might facilitate the transition. In terms of country-level impacts, national policymakers should consider carbon revenues recycling mechanisms that are progressive in nature and can facilitate an even distribution among households of the cost-saving benefits deriving from pricing carbon.

Despite these issues, local markets' considerations should take into account solutions to limit the risk of relocation of industrial activities due to different national climate ambitions and carbon related regulations. In this respect, G20 members should cooperate closely with third countries and the corresponding WTO and UNFCCC institutions in order to reduce these risks – also through fair, mutually-agreed trade mechanisms of energy intensive goods – aiming to strike the right balance between the inevitable differences in carbon prices and minimizing the risk of trade distortions. However, while these mechanisms could help create a level playing field between different sectors and countries, global coordination on GHGs pricing remains the primary way to ensure a cost-efficient emissions reduction, finance the transition of developing countries, and mitigate the risk of global trade disruption which could result from the implementation of such mechanisms. Such coordination should be firmly grounded within both the WTO framework and its trade principles of open borders and non-discrimination, as well as the UNFCCC framework and its principles of cooperation but also common but differentiated responsibilities.

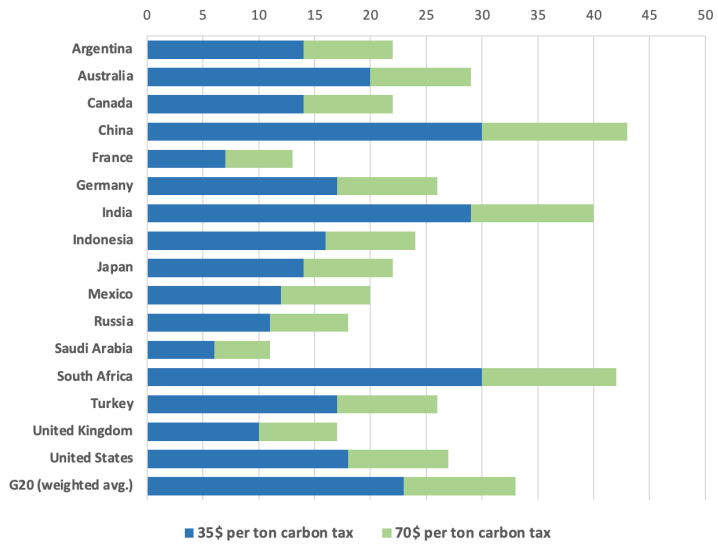
Exhibit 6 | The price of carbon worldwide

Despite the fact that carbon prices are increasing in many jurisdictions, they remain substantially lower than those needed to be consistent with the Paris Agreement.

The High-Level Commission on Carbon Prices estimated that carbon prices of at least an average of US$40–80/tCO2 by 2020 and US$50–100/tCO2 by 2030 are required to cost-effectively reduce emissions in line with the temperature goals of the Paris Agreement, although with significant differences among countries.

As of today, less than 5% of GHG emissions currently covered by a carbon price are within this range, with about half of covered emissions priced at less than US$10/tCO2, and the IMF calculates the global average carbon price is only US$2/tCO2.

Percentage of CO2 reduction in 2030, compared to "business as usual"



Source: IMF (2019) - The case for carbon taxation: putting a price on pollution

In view of these challenges, G20 governments should first secure effective carbon markets in local jurisdictions while at the same time providing platforms to share best practices and foster dialogue to lay the foundation for global, market-based mechanisms to valorize environmental externalities, based on Article 6 of the Paris Agreement. To ensure greater coordination, governments should also consider supporting the development of pilots under Article 6 to demonstrate its effectiveness.

Other potential forms of market-based cooperation should include extending the coverage of pricing schemes towards non-CO2 (NC) GHGs and towards other economic sectors which are not included within current frameworks: both measures are considered to be unambiguously beneficial for all participating countries, regardless of their developing levels.

In particular, while CO2 accounted for the largest share of global GHG emissions in 2017 (74%), other sources of GHG include CH4 (17%), N2O (7%) and fluorinated GHGs (2%).This means that current carbon pricing schemes exclude a number of low-cost abatement opportunities from NC-GHGs, such as methane leaks from animal agriculture. Although extending the coverage to these gases could result in measurement and metrics challenges, on balance, cost savings would be around 50% more compared to excluding NC-GHGs. In this context, one third of the reduction target would be met by low-cost abatement options of NC-GHGs, particularly in sector such as agriculture and forestry.

Also, current carbon prices (i.e. also taking energy taxes into consideration) within countries vary considerably across sectors, ranging from more than US$ 350/tCO2 in the road sector to zero in other sectors (e.g. buildings) at OECD level [31]. Sectoral coverage of ETS is much lower for sectors with large number of diffuse emitters, including buildings, transport, and waste, as well as for domestic aviation. Expanding sectoral coverage would generally reduce mitigation costs at an aggregate level through harmonizing carbon prices across sectors, while reducing the risk of inter-sectoral leakage.

However, cooperation on emission trading systems at regional or global level might not be enough to decarbonize all economic sectors. In particular, all these mechanisms should be implemented in a coherent legal context in order to ensure effectiveness and efficiency of the policy mix in each jurisdiction. Differently, governments' efforts in adopting carbon pricing approaches could be jeopardized by other contradictory policies. Therefore, the G20 should complement market-based approaches with adequate environmental taxation – such as carbon taxes and incentives for the energy transition – while taking into account national circumstances and energy price levels in order not to hinder social and economic progress.

For specific sectors in which market mechanisms are not a viable option, as well as for certain developing countries, which may not have adequate structural resources to administer efficient ETSs, carbon taxes can represent complimentary policies in the context of reaching a full price coverage of GHGs emission worldwide, also thanks to their relatively low implementation and administration costs. In this context, well-designed carbon taxes, both explicit or implicit, send market signals that can unlock new business models and mobilize private investing and spending in greener alternatives, reducing climate damage and air pollution. This taxes can also raise much-needed revenues which can be used to support vulnerable groups in adjusting to higher energy prices or to strengthen social safety nets.

Regardless of the carbon pricing mechanism adopted, each country should also take into account the distortionary effects of inefficient energy subsidies – in terms of carbon neutrality targets – which represent countervailing policies to carbon pricing, as they can act as a negative carbon price. In this context, while these subsidies can be used to achieve specific policy goals, such as providing affordable energy for low income households, or enhance energy security, they often incentivize carbon-heavy energy production and inefficient use. For these reasons, the G20 governments should coordinate with relevant international organizations to collect energy subsidy data, analyze their impact on carbon neutral pathways and socio-economic issues (such as employment, income distribution, and energy security), and devise effective pathways to withdraw all inefficient subsidies, while also taking into account local specificities. The potential savings from reforming these subsidies could go towards financing climate change mitigation and adaptation measures, scaling up R&D support for climate-friendly technologies, or to providing compensation for trade-exposed, energy-intensive sectors.

Finally, the G20 should also promote carbon data and metrics harmonization through new technologies with the goal of simplifying the administration of the carbon pricing. In this context, the increasing ability to generate, capture, transmit as well as learn from data will be a critical feature for jurisdictions to refine and coordinate their carbon pricing policies. Innovative projects, such as the World Bank's Climate Warehouse meta-registry, demonstrate the potential of a decentralized IT approach to link climate market registry systems, supported by AI, IoT and blockchain technologies.

Actions:

• **Drive the adoption of effective carbon markets in local jurisdictions.**
G20 countries should foster the creation of robust and comprehensive local carbon markets in order to meet their mitigation targets and spur innovation in low-carbon technologies, and should exchange best practices for a level playing field, also taking into account different grades of preparedness in the different geographies.

• **Foster linking of local carbon markets through agreeing to and enforcing Article 6 of the Paris Agreement, considering solutions to limit the risk of relocation of industrial activities due to different national climate ambitions and carbon related regulation, while taking into account the principle of common but differentiated responsibilities.**
G20 countries should finalize Article 6's Rulebook in order promote interconnected carbon markets at global level and consistently reduce mitigation costs, while minimizing the risk of trade distortion through the review of WTO's provisions.

• **Harmonize carbon pricing metrics and leverage new technologies for carbon data acquisition and analysis.**
G20 countries should introduce a common set of metrics on GHGs emissions and adopt innovative technologies for measurement in order to simplify the administration of carbon markets and obtain reliable data on effective emissions reductions.

• **Reorganize current fiscal policies to complement carbon markets schemes with non-market-based initiatives where needed.**
G20 countries should adopt a holistic approach to reduce GHGs emissions,

complementing market-based instruments with coherent fiscal policies and carbon taxes in local jurisdictions in order to abate harmful emissions throughout all the economic sectors.

• **Phase out inefficient energy subsidies vs carbon neutral targets, and provide adequate incentives by advancing fiscal tools for the energy transition to promote affordable and carbon neutral energy sources.**
G20 countries should agree on effective pathways to withdraw the inefficient energy subsidies, while taking into account national circumstances and the objectives of a just and inclusive transition, and introduce adequate incentives to accelerate the shift toward clean energy sources and consumption.

Recommendation 3: Ensure resilience and inclusivity of global resource supplies

Policy Actions

3.1 Foster supply chain resiliency – G20 members should improve the resilience of global infrastructures to cope with adverse climate events, cybercrime, and other disruptive events.

• Develop plans to strengthen the climate resilience of infrastructure (including energy systems, transport infrastructure, buildings, ICT systems, and water supply systems).
• Promote research and development of new digital products and services in order to increase the resilience of the energy and water systems, with special regard to the cyber-security.

3.2 Commit to a just transition – The G20 should commit to a just and inclusive transition across countries, vulnerable communities and economy sectors.

• Promote capacity building, vocational training, up-skilling, re-skilling and other measures for communities and countries affected by energy transition.
• Implement policy pathways and support for affected countries, communities and economy sectors.

3.3 Guarantee resources access and security – The G20 should commit to grant affordable and secure access to clean energy and water to all communities.

• Facilitate funding and foster the adoption of innovative financing vehicles to facilitate clean energy and water access in less developed markets.
• Promote international collaboration to share best practices on water and energy infrastructure innovation.

Leading Monitoring KPI[14]	Baseline (2020)	Target (2030)
Global % of population with access to safely managed drinking water services11 *1. Aligned with SDG Goal 6, Target 6.1, Indicator 6.1.1.*	71% (2017)	100%
Global % of population with access to electricity1 *1. Aligned with SDG Goal 7, Target 7.1, Indicator 7.1.1.*	90% (2019)	100%

SDG impacted:

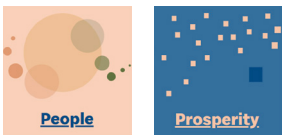
Recommendation 3 contributes to SDG 6 – Clean water and sanitation – and SDG 7 – Affordable and clean energy – by advocating for a secure access to clean energy and water for all, posing particular attention to developing countries and vulnerable communities.

Additionally, by focusing on the impacts of the energy transition on society and the job market, Recommendation 3 sustain the achievement of SDG 8 – Decent work and economic growth. In this context, remarking the importance of a just transition, Recommendation 3 also contributes to SDG 10 – Reduced inequalities.

Moreover, Recommendation 3 supports SDG 9 – Industry, innovation and infrastructures – and SDG 13 – Climate action – promoting the improvement of global supply chains resiliency by strengthening infrastructures against the effects of climate change and other disruptive events.

Finally, given the need for international cooperation and solidarity required to tackle the aforementioned challenges, Recommendation 3 sustains SDG 17 – Partnerships for the goals – suggesting means of collaboration and encouraging international support.

G20 Italy Priorities:



Recommendation 3 contributes to addressing G20 Italy Priorities People and Prosperity.

The tree suggested Policy Actions aims at tackling existing inequalities and divides, building a more inclusive society and protecting the most vulnerable by promoting capacity building and safe and secure access to fundamental resources such as energy and water. This way, it would be possible to progress in both the People and Prosperity priorities.

Context

The transition to a more sustainable and efficient energy system is not deferrable. Its effective completion, however, requires a global effort and collaboration across sectors. Different countries and communities, public and private actors have to align their objectives to decrease their environmental impact and unlock sustainable economic growth. Therefore, there is a need for them to agree on the principle of a just transition, fostering inclusivity and granting fairness.

The backbone of this process is constituted by global supply chains and the infrastructures upon which they are built. As climate change and cybercrimes threaten their functionality, it is necessary to boost their resilience to disruptive events. Moreover, global supply chains should grant access to basic resources to all communities, especially energy and water. This objective is specifically targeted by SDGs 6 and 7 [32] and can produce positive social and economic output.

Furthermore, the clean energy transition will affect communities and industry in a heterogeneous way. Inevitably, despite the clear benefits it can provide, the transition will deeply transform several economic sectors, with direct consequences for the job market and the society as a whole. Thus, the risk of inequalities has to be addressed with effective policies granting an equitable distribution of the transition's upsides.

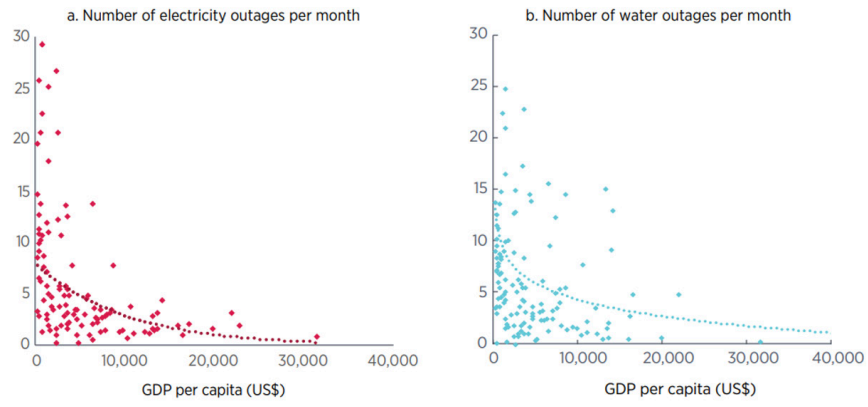
Policy Action 3.1: Foster supply chain resiliency

G20 members should improve the resilience of global infrastructures to cope with adverse climate events, cybercrime, and other disruptive events.

Infrastructures are a core enabling element for social and economic development. They serve most basic human needs and support the growth of innovative ventures ensuring effective supply of resources, communication and mobility. However, infrastructures often lack the required investments, both in developing and developed countries [33]. Additionally, infrastructures are critical to addressing inequalities, as poorer countries are suffering more from infrastructure disruptions, which hinders their ability to grow [34][15].

Low-income countries suffer the most due to inadequate infrastructures

Exhibit 7 | Relationship between per capita GDP and infrastructure disruption



Source: The World Bank (2019) - Lifelines: The Resilient Infrastructure Opportunity

[15] *Refer to Policy Paper Integrity & Compliance; Policy Action 2.3*

Climate change constitutes a severe threat to global infrastructures. The impact of rising sea levels, changing temperatures and extreme weather events can deeply disrupt their functioning. These risks are clearly perceived by the business sector, as companies estimate potential losses equal to USD 1 trillion due to climate impacts by 2025 [35]. Therefore, plans and investments are needed to make infrastructure climate-resilient, both mitigating climate change and adapting to its inevitable consequences; this way, it will be possible to protect communities and businesses from related risks[16].

Several actions could be implemented. First, new infrastructure should be designed to be climate-resilient over their lifetime. Second, existing infrastructure should be analyzed to assess their need for being retrofitted or managed differently. Third, it can be evaluated the need for additional infrastructure able to mitigate the impact of climate events, such as sea walls or nature-based solutions [36], which can, for instance, help to cool urban areas or provide coastal protection [26].

Moreover, while most critical infrastructure protection and disaster management programs only address physical threats, to strengthen the resilience of modern infrastructure it is also necessary to cope with cyber threats, possibly causing service disruption or public safety concerns[17]. Indeed, cybersecurity is among the top ten risks of the World Economic Forum Global Risks Perception Survey 2019–2020, both in terms of likelihood and impact [7]. In the energy sector, for instance, the increase of data-driven processes might generate vulnerabilities in the communication networks and information systems. Cyberattacks present unique challenges since they lack distinct borders, employ constantly evolving technologies and tactics and require coordination between private and public actors [37][18].

Resilient infrastructures risk being disrupted by several menaces, but they are also a key factor to resist and thrive against them. To this end, resilient infrastructures are fundamental to ensure services and resources provision, increase the life of assets and protect the return they can generate. However, to meet the environmental and economic objectives set for 2030, approximately USD 6.9 trillion per year should be invested in resilient infrastructures [33]. Therefore, global collaboration and coordination are fundamental to collect the funds and plant the investments required to make the international infrastructure system future-proof, considering also the importance of markets integration and systems interconnection in crisis situations[19].

Furthermore, supply chain resiliency is fundamental to sustain the clean energy transition. The production of minerals is expected to increase by up to 500% by 2050 to satisfy the demand generated by clean energy technologies, corresponding to over 3 billion tons of minerals and metals [38]. The pandemic has deeply stressed these supply chains, raising the need for resiliency-focused interventions, considering the whole industry chain and life cycle of emerging energy technologies, which are key to improve energy security and enable the clean energy transition.

An important role is played by insurance and reinsurance players. Their activity can decrease barriers to investing in climate-resilient infrastructures in several ways: they can offer financial compensation for large losses linked to environmental disasters so that those affected can recover faster; they can help to assess, communicate and signal risks through premiums, deductibles and payments, increasing understanding and awareness of threats and encouraging measures to prevent and address the effects of climate risks; final-

[16] Refer to Policy Paper Trade & Investment: Policy Action 2.3
[17] Refer to Policy Paper Health & Life sciences; Policy Action 3.3
[18] Refer to Policy Paper Action Council; Policy Action 3.1

ly, they can create incentives or requirements for risk management, limiting potential impacts of extreme weather events [39].

Actions:

• Develop plans to strengthen the climate resilience of infrastructure (including energy systems, transport infrastructure, buildings, ICT systems, and water supply systems).
G20 countries should assess the ability of existing infrastructures to cope with climate change and, consequently, plan investments in both retrofitting of existing infrastructures and design of new infrastructures, necessary to secure critical, national and international supply chains.

• Promote research and development of new digital products and services in order to increase the resilience of the energy and water systems, with special regard to the cyber-security.
G20 members should invest in digital technologies useful to monitor the state of infrastructures and improve their resiliency and interconnection, also preventing service disruption or public safety concerns due to cyber threats.

Policy Action 3.2: Commit to a just transition

The G20 should commit to a just and inclusive transition across countries, vulnerable communities and economy sectors.

The transition of the energy system towards a sustainable energy mix and efficient use of energy is expected to generate significant benefits both for the environment and the economy. However, as with every transformation, its impact will affect in different ways countries, local communities and industries. Therefore, it is necessary to plan carefully for the transition to be just, ensuring wide participation in the gains and support for the most affected[20]. The idea of just transition is embedded in the Paris Agreement. It underlines the importance of creating decent work and quality jobs, posing "the imperatives of a just transition of the workforce" [40]. Moreover, the just transition concept is also a link among many SDGs [41], representing a pillar of the 2030 Sustainable Development Agenda.

Two aspects have to be considered to enable a just transition: work displacement (distributive effects on the society) and affected economic sectors (industrial competitiveness). Moreover, the transition has to be sustainable from a socio-economic point of view even in the short run, making sure that "no one is left behind". The shift to a low-carbon and climate-resilient economy will change the skills and qualifications needed by the workforce. In particular, the deployment of clean technologies requires skills in technological application, adaptation and maintenance; additionally, skills are fundamental to adapt quickly to changes caused by climate change and environmental policies [42]. This will substitute or even eliminates existing jobs, but offers also significant opportunities for the creation of new jobs: with a clean energy transition, by 2030, jobs linked to clean energy, efficiency and low emissions technologies could employ additional 30 million people, increasing the number of additional jobs in this sector by almost four times compared to stated policies scenario [9]. Moreover, the effects of a green economy transition will not be homogenous among countries and businesses. Those who are going to be most disrupted include countries exporting fossil fuels

[19] *Refer to Policy Paper Trade & Investment: Policy Action 1.3; Policy Action 2.2*
[20] *Refer to Policy Paper Action Council; Policy Action 1.1*

and companies reliant on the use of fossil fuels for energy production and consumption [43].

Therefore, governments need to consider the full repercussion on communities disproportionately impacted by the clean energy transition, taking into account the effects on displaced workers and their families, as well as on local businesses. On the one hand, efforts should be directed to develop and implement effective training, re-skilling and up-skilling programs to enhance the resilience of the workforce to these changes[21]. On the other hand, adequate support should be granted to communities and industries that are going to be most challenged, requiring proactive plans to be developed and implemented in collaboration with local and national governments, leading to new, viable industries and labor markets. These actions should be especially directed to strongly affected regions. Achieving a just transition will consequently require dialogue among workers, industry, and governments to define an inclusive agenda to be implemented in their geographical, political, cultural, and social contexts [44].

Furthermore, this process has to take into particular consideration younger generations and women[22]. As job opportunities grow, more students should be choosing STEM and energy-related educational paths (including apprenticeship and vocational training) and deploy acquired competences to foster innovation and progress to build a climate-resilient and sustainable energy future. Despite the hurdles faced during the pandemic, particularly on education and employment, young people represent the main human resource for development and key agents for social change, economic growth, innovation and environmental protection [45]. At the same time, gender diversity is crucial to develop more innovative and inclusive solutions for the energy sector. However, women account only for 22% of the labor force in the oil and gas sector and 32% in renewables, while representing about 48% of the global labor force; it is also harder for women in the energy sector to reach leadership roles than in the broader economy [46]. Thus, a just transition has to promote youth participation and gender equality to fulfill its mission.

Actions:

• Promote capacity building, vocational training, up-skilling, re-skilling and other measures for communities and countries affected by energy transition.
G20 members should invest and promote programs aiming at developing the skills needed to adapt to and foster the clean energy transition, especially STEM, with particular attention to younger generations and women; countries may cooperate with multilateral and regional development banks and educational institutions to provide capacity development.

• Implement policy pathways and support for affected countries, communities and economy sectors.
G20 countries should provide clear regulation and milestones to allow businesses to plan for an effective transition to a clean energy system, offering incentives for research and development activities dedicated to the implementation of clean and efficient processes and material usage. In this context, it should be key to ensure seamless coordination between central and local government and promote full stakeholder participation in transparent planning processes.

[21] Refer to Policy paper employment & education: Policy action 1.1
[22] Refer to Policy paper employment & education: Policy action 3.1; Policy action 3.2

Policy Action 3.3: Guarantee resources access and security

The G20 should grant affordable and secure access to clean energy and water to all communities.

In order to ensure a just transition and foster inclusive economic growth, access to fundamental resources such as clean energy and water should be granted to all communities. This objective is also set by the 2030 Sustainable Development Agenda through the SDGs 6 and 7 [32]. However, today we are still far from granting universal supply of sustainable and safe energy and water.

Energy can contribute to the achievement of all the SDGs and, more in detail, to meet 125 out of 174 targets [47]. Despite the improvement in global energy access, 789 million people lacked electricity in 2018, while 2.8 billion people could not rely on clean cooking fuels and technologies [48]. Moreover, energy access is not distributed equally across regions, as countries with higher poverty levels generally have lower access to modern energy services [47]. In 1990, 45% of people without access to electricity were located in South Asia; by 2016, the largest share was concentrated in Sub-Saharan Africa [49]. In this region, the pandemic has partially reversed the progress made in the last years in terms of energy poverty, with people with no access to electricity forecasted to increase for the first time since 2013 and the fraction of the population without access to clean cooking growing [25]. If urgent actions are not taken, by 2040, about 600 million people will not have access to electricity yet [50].

A similar portrait emerges analyzing world access to clean water. While an enormous amount of treated water is lost every day due to crumbling infrastructures causing water leaks (e.g., in the United States, this amount is almost equal to 23 billion liters [51]), in 2017, considering the global population, only 71% had access to safely managed drinking water and 45% to managed sanitation services, whilst 785 million had not even basic drinking water [52]. Moreover, on average, while high-income countries are able to treat about 70% of municipal and industrial wastewater, the percentage falls to 38% in upper-middle-income countries, to 28% in lower-middle-income countries and to 8% in low-income ones [53]. This has immediate health implications. Contaminated water and poor sanitation are linked to the transmission of diseases such as cholera, hepatitis A, typhoid, and polio. In 2019, unsafe water, sanitation, and handwashing caused around 1.7 million death [54]. Again, low-income countries are the most affected by these issues, particularly in Sub-Saharan Africa and Asia [55].

Water and electricity are strictly linked, since water plays a crucial role in energy production (e.g., in hydroelectric plants, in cooling thermal plants, etc.) and energy is required to process and distribute water, to treat wastewater, to pump groundwater and to desalinate seawater [56]. Together, they are critical for many human activities; one example is represented by food production, considering that agriculture is responsible, on average, for the withdrawals of about 70% of all global freshwater [57] and the agrifood chain employs roughly 30% of the world's available energy [58]. To this end, managing water, energy, and food resources simultaneously and meet multiple potentially conflicting objectives, without compromising the resource base of any sector, represent a challenge that has to be addressed with urgency [59]; it demands an integrated approach, in which clean energy can act as an enabler of increased food security, agricultural productivity and improved access to water resources. This way, the water-food-energy nexus

has the transformative power to build new markets for access to energy and water and to increase economic productive capacity.

In this context, increased global commitment and collaboration are needed to effectively tackle these concerns. To meet SDGs 6 and 7 in all low- and middle-income countries, where water and energy access levels are currently lower than 100%, the investment need could be of USD 5.8 trillion between 2016 and 2030 [60]. The two objectives are strongly bonded, as water scarcity materially impacts energy production and reliability; considering that in rural areas almost 66% of those who lack access to electricity also lack access to clean drinking water, planning for water supply and clean electricity provision together can trigger several synergies [61]. Possible solutions have already been advocated. For instance, to spread access to clean electricity and clean cooking solutions for underserved communities, countries could invest in grid-electrification providing connections to urban and rural areas and in off-grid electrification through community-level micro- or mini-grid systems [47]. Though, the effect of taxation on vulnerable consumers should be carefully considered to avoid the exacerbation of energy poverty issues. These investments not only provide social benefits, but also economic ones. For example, a WHO study estimates that every USD 1 invested in improved sanitation generates an average global economic return equal to USD 5.5 [62].

Actions:

• **Facilitate funding and foster the adoption of innovative financing vehicles to facilitate clean energy and water access in less developed markets.**
G20 countries should invest to enable clean energy and water access for all through innovative financing vehicles, such as sustainability-linked bonds, in order to achieve SDGs 6 and 7 and unleash opportunities for global economic development.

• **Promote international collaboration to share best practices on water and energy infrastructure innovation.**
G20 members should increase the level of collaboration and sharing of data and best practices useful to improve critical water and energy infrastructures, harnessing the benefits of innovation to grant access to and security of these essential resources.

Recommendation 4: Commit to preserve the equilibrium of the natural ecosystem, promoting a more sustainable use of natural resources

Policy Actions

4.1 Exploit circularity practices to reduce the environmental impact of economies – The G20 should promote the diffusion of circular economy practices to use global resources more sustainably, increasing international collaboration.

• Agree to a common set of metrics to assess and monitor the progress of circularity indicators.
• Incentivize increased use and reuse of products and waste resources, product life extension and other circular models.

4.2 Enhance sustainable use of marine and terrestrial resources – G20 members should commit to the preservation and restoration of the natural ecosystems, safeguarding life on land and below water.

• Prevent and significantly reduce marine pollution and plastic pollution in oceans, rivers and all water habitat.
• Halt the degradation of natural habitats and the loss of biodiversity.
• Establish international collaboration agreement to preserves oceans and lands.

Leading Monitoring KPI[23]	Baseline (2020)	Target (2030)
Global % of recycled natural resources employed in the economy1 *1. Computed as cycled resources/total resources entering the global economy;* *2. Defined in reference to a 1.75° trajectory to be achieved by 2032, thereby meeting the goal of the Paris Agreement.*	8.6%	17%[2]

SDG impacted:

Recommendation 4 contributes to SDG 6 – Clean water and sanitation – by promoting a more conscious use of scarce resources such as water and a higher level of commitment to reducing pollution and release of hazardous chemicals and materials in water ecosystems.

Moreover, sustaining innovative business models leveraging innovation to decouple economic growth from resource consumption, Recommendation 4 support the achievement of SDG 9 – Industry, innovation and infrastructures – and SDG 12 – Responsible consumption and production – through the advancement of the circularity level of the global economy.

Circular economy practices are necessary also to manage the trends of population growth and urbanization sustainably; in this regard, Recommendation 4 also contributes to SDG 11 – sustainable cities and communities – by

[23] *Data from: Circle Economy (2021) – The Circularity Gap Report*

encouraging, for instance, better waste management solutions.
Finally, Recommendation 4 strongly supports the achievement of SDG 13 – Climate action –, SDG 14 – Life below water – and SDG 15 – Life on land – shedding light on the critical conditions of our environment and suggesting actions to preserve and restore natural ecosystems and their balance.

G20 Italy Priorities:

Recommendation 4 contributes to addressing G20 Italy Priorities People, Planet and Prosperity.

Promoting a higher level of circularity for global economies and the preservation and restoration of the environment, Recommendation 4 aims at improving people's quality of life as well as protecting the natural balance of the planet.

At the same time, by implementing more sustainable economic practices and business models, it is possible to sustain long-term prosperity and growth.

Context

As the last ten years of the 2030 Agenda for Sustainable Development start, the world is on track to meet only 17% of the environment-related SDGs [63]. This means that there are insufficient political support and technical capacity in both the public and private sectors to effectively tackle the challenge of environment preservation. For this reason, the UN Member States have decided to implement a Decade on Ecosystem Restoration to increase the commitment toward achieving the SDGs and curb environment depletion [64].

These actions cannot be procrastinated. The global population is currently consuming the environment and its resources at an unsustainable rate, 1.75 times faster than ecosystems' ability to regenerate themselves, consequently compromising future resource security [1]. The effects for the planet are devastating, including deforestation and increasing carbon dioxide concentration in the atmosphere, leading to biodiversity loss, climate change and extreme weather events. These phenomena impact directly on human life. For instance, in 2015, 19.2 million people in over 110 countries were displaced due to weather, water, climate and geophysical hazards, more than two times of those displaced by conflicts or violence [65].

Accomplishing the objectives of the UN Decade on Ecosystem Restoration would also unlock significant economic benefits. In fact, every US dollar spent on environment restoration is expected to generate between USD 3 and USD 75 of economic benefits from ecosystem goods and services [64]. Therefore, it is time to accelerate global efforts to preserve the equilibrium of the natural ecosystem.

Policy Action 4.1: Exploit circularity practices to reduce the environmental impact of economies

The G20 should promote the diffusion of circular economy practices to use global resources more sustainably, increasing international collaboration.

In order to increase the chances of achieving the SDGs, it is necessary to change the economic paradigm from a "take-make-waste" model to a circular one. In fact, circular economy not only addresses the greenhouse gas emissions which cannot be abated by the energy transition, but also contributes to decreasing biodiversity losses and water stress [66].

However, the current circularity level of the global economy is equal to 8.6% and is declining from the 9.1% reached two years ago: of the total 100.6 Gt of resources entering the global economy, only 8.6 Gt are cycled, while the rest is constituted by newly extracted resources; besides, of the 32.6 Gt of materials collected as waste, 23.9 Gt are lost [67]. Moreover, global resource consumption is expected to double in the next 40 years [68] and the annual production of waste is forecasted to rise by 70% by 2050 [69]. These consumption rates are unsustainable in the long term.

Circular economy addresses this challenge by promoting an economic model that does decouple activities from the consumption of not renewable resources, designing restorative and regenerative processes[24]. This way, circular economy could decrease primary material consumption by 32% by 2030 [70] and could contribute to 45% of the CO2 emission reduction targets by 2050 [71]. This is even more relevant considering that the share of global emissions caused by materials production increased from 15% in 1995 to 23% in 2015 [72]. Through circularity practices, it is possible to introduce and scale effective waste and wastewater management solutions, which are crucial to cope with population growth and urbanization. Circular economy could also contribute to solving the issue of food waste, which amounts to about one-third of total yearly food production and causes emissions equal to 4.4 Gt CO2eq [73], thorough regenerative practices and exploitation of food by-products. Furthermore, alongside environmental benefits, implementing circularity practices has the potential to unleash also economic gains. In Europe, implementing circularity principles could increase GDP by an additional 0.5% by 2030 and create around 700,000 new jobs [74]. In China, circular economic practices could generate business and household savings of around USD 10 trillion by 2040 [75]. Therefore, the level of awareness related to circular economy should be raised among countries globally in order to harness its benefits more effectively.

Several business models could change the way value is created, decoupling economic growth from resource consumption. They aim at minimizing the use of new resources exploiting recycled materials, reducing the carbon footprint. Additionally, they extend the useful life of products both designing for durability and innovating their applications or ownership models. They can be applied to a wide variety of sectors, such as mobility, healthcare, food production and ICT. Examples of circular business models are resale or product-as-a-service platforms [76]. They both increase product utilization, providing greater market access and discouraging the production of unnecessary goods. Furthermore, effective industrial symbiosis can be promoted as a strategy to increase economic competitiveness, sustainability, resource efficiency and resource security by transforming the waste and by-products of an industry or industrial process into productive inputs for others.

[24] *Refer to Policy Paper Finance & Infrastructure; Policy Action 1.2*

Exhibit 8 | Enabling elements of the circular economy

CIRCLE ECONOMY'S ENABLING ELEMENTS	DESCRIPTION	BARRIER ADDRESSED
Design for the Future	Account for the systems perspective during the design process, to use the right materials, to design for appropriate lifetime and to design for extended future use	Ability to disassemble products and reuse components or materials due to design flaws Ability to recover value from waste due to contamination, lack of knowledge, or legislation
Rethink the Business Model	Consider opportunities to create greater value and align incentives that build on the interaction between products and services	Economic incentives are misaligned to a regenerative ecosystem and the wellbeing of society
Incorporate Digital Technology	Use digital, online platforms and technologies that provide insights to track and optimise resource use, strengthen connections between supply chain actors, and enable the implementation of circular models	Incomplete information about location and condition of assets or resource usage leads to inability to optimise resource usage within and across organisations
Team Up to Create Joint Value	Work together throughout the supply chain, internally within organisations and with the public sector and communities to increase transparency and create joint value	Conflicting interests and misaligned goals between stakeholders in the value chain stymies progress and/or generates wasted resources
Strengthen and Advance Knowledge	Develop research, structure knowledge, encourage innovation networks and disseminate findings with integrity	Lack of knowledge, information silos and asymmetries, and generally disaggregated and unstructured information

Source: Circle Economy (2021) – The key elements of the circular economy framework

The deep transformation of the economy implied by the transition to these business models requires both private and public collaboration. In this context, circularity has to be considered holistically, taking into account its impacts on the society, the environment and the economy. Therefore, new policy frameworks are needed to support circular practices and ensure a just and inclusive transition[25]. To this end, several actions could be implemented such as: the use of virgin natural resources should be disincentivized to favor models focused on redesign, repair, reuse and recycle; incentives should be directed to materials with a high degree of recycling without losing their original qualities, as well as goods with a low carbon footprint. Moreover, all industrial support initiatives should have a circular economy focus, taking into consideration resource efficiency, redesign, shift towards circular inputs and closing the loop. At the same time, since the accounting and fiscal frameworks in use were developed for a linear economic model, now they should be updated in order to facilitate the transition to a circular economy. Finally, the upcycling/repowering of existing assets should be supported in order to reduce the social, environmental and economic impacts associated with the transition to a circular economy.

As currently there is a plurality of frameworks developed by different organizations or single companies that might hinder comparability across corporations and countries and sharing of best practices, one of the greatest challenges associated with circular economy is the definition of a common set of metrics. This can then be applied in accordance with the specific needs and objectives of each country. Clear indicators are useful to identify solutions, assess their potential and actual impact, monitor progresses and drive improvements.

[25] *Refer to Policy Paper Trade & Investment: Policy Action 4.1*

Actions:

• Agree to a common set of metrics to assess and monitor the progress of circularity indicators.
Since having common metrics is critical for comparability and sharing, G20 countries should define a common set of indicators able to capture the progress in terms of circularity of their economy and to be applied taking into account the differences among countries, with a specific focus on supply chains critical to the energy transition such as transport, industry, buildings and power generation.

• Incentivize increased use and reuse of products and waste resources, product life extension and other circular models.
G20 members should provide incentives to businesses and consumers to increase the circularity of their production and consumption habits, favoring innovative circular business models able to create value while reducing environmental impact and funding for research for new technologies and scaling of existing solutions. To this end, transparent standards on waste management and manufacturing and usage of materials with high recyclability rate without losing original qualities and low carbon footprint should be promoted.

Policy Action 4.2: Enhance sustainable use of marine and terrestrial resources

G20 members should commit to the preservation and restoration of the natural ecosystems, safeguarding life on land and below water.

According to The World Economic Forum's 2020 Global Risks Report, biodiversity loss and ecosystem collapse constitute one of the top five threats humanity will face in the next decade [7]. Human life depends heavily on environment and natural ecosystem balance, which provides food, energy and materials. However, air quality, biodiversity losses and environmental degradation are worsening faster than ever and this trend is due to unsustainable human activities [77]. For instance, agriculture, which has caused about 20% of global greenhouse emissions between 2010 and 2017 [78], is the leading cause of water pollution in several countries and a major factor of land consumption and degradation [79].

Human health protection and environmental preservation are becoming ambitious goals across the world. Bad air quality and exposition to pollutants remain a serious unresolved problem not only causing reduced health for citizens and a deteriorated environment but also high directly and indirectly related monetary costs. Most of air pollutants concentration comes from the tertiary and residential sectors that are the biggest emitters of primary particulate matter, while transport is the biggest emitter of nitrogen oxides, for which exceedances occurred almost entirely in the proximity of traffic stations [80].

The marine ecosystem has been deteriorating significantly, creating serious threats for the 3 billion people relying on it for their livelihoods [81]. Ocean temperatures are increasing, as well as the concentration of carbon dioxide, which makes waters more acidic [82]. This has halved live coral cover on reefs in the past 150 years, consequently reducing the ability of coastal marine ecosystems to provide sustainable livelihoods and protect shorelines [77]. Moreover, around 8 million metric tons of plastic are dumped yearly in mari-

ne environments, adding up to the already estimated 150 million metric tons dispersed into the oceans [83]. This has affected several marine species and may impact humans directly through food chains.

Human activities have also degraded the terrestrial ecosystem, directly and indirectly. Only approximately 25% of land is sufficiently not impacted by human intervention [77]. Consequently, the existence of many life forms is endangered: around 9% of the world's terrestrial species have insufficient habitat for long-term survival and are committed to extinction if no action is undertaken [77]. Particularly critical is the situation of forests. They host roughly 80% of the world's terrestrial biodiversity and contribute significantly to climate change mitigation [84]. However, in 2018 alone, around 12 million hectares of tropical forest were lost worldwide [7] and about 80% of global deforestation is due to the expansion of land used for agriculture [84].

Nature-based solutions such as afforestation and reforestation, if managed correctly, can not only contribute to curbing CO2 concentration in the atmosphere, mitigating climate change, but also help to protect and restore the natural balance providing ecosystem services such as pollination, pollution treatment or groundwater recharge [26]. Moreover, more sustainable practices and emission absorption projects can contribute to reducing the environmental impact of agriculture and LULUCF.

Environment degradation has other direct consequences for human life. One major risk is linked to future food security. For instance, land depletion has reduced productivity in 23% of the global terrestrial area, and annual global crop output risks to be diminished by USD 235 - 577 billion due to pollinator loss [77]. A second one is related to human health. On the one hand, increased pollution can cause a variety of diseases, such as respiratory infections [85]. On the other hand, reduced biodiversity can hinder the development of medicine, considering that 50 – 70 thousand plant species are employed for traditional or modern medicine and about 50% of modern drugs were developed from natural products [7].

Thus, increased commitment and global cooperation are needed to tackle effectively environment degradation and foster a sustainable use of natural resources. One area of action could be data collection and sharing. In the recent past, lack of data has caused the impossibility to track progress on 68% of environment-related SDGs, consequently inhibiting the chances to invest and act to achieve them [63].

Actions:

• Prevent and significantly reduce marine pollution and plastic pollution in oceans, rivers and all water habitat.
G20 countries should define standards for sustainable water and wastewater management and governance systems to drastically reduce the presence of human-made pollution such as plastic and microplastics in oceans, rivers and all water habitats.

• Halt the degradation of natural habitats and the loss of biodiversity.
G20 members should set clear objectives for the preservation and restoration of natural ecosystems and enforce better monitoring and control systems against hazardous behaviors negatively affecting the environment and its biodiversity, addressing, for instance, deforestation and forest degradation issues.

• Establish international collaboration agreement to preserves oceans and lands.

G20 countries should promote greater international collaboration to fight the global issue of environment degradation and tackle the growing problem of air quality degradation, define governance, monitoring standards and guidelines on the sustainable exploitation of natural resources and financial support programs; they should also involve the private sector to ensure common understanding and effective deployment.

Annex

Acronyms

BECCS	Bioenergy with Carbon Capture and Storage
BESS	Battery Energy Storage System
CCS	Carbon Capture Sequestration
CCUS	Carbon Capture, Utilization And Storage
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
COP	Conference of the Parties
DAC	Direct Air Capture
DRI	Direct Reduced Iron
ERE	Energy and Resource Efficiency
GDP	Gross Domestic Product
Gt	Gigatons
H2	Hydrogen
HVAC	Heating, Ventilation and Air-Condition
ICT	Information and Communication Technologies
IEA	International Energy Agency
IoT	Internet of Things
IRENA	International Renewable Energy Agency
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LULUCF	Land Use, Land-Use Change and Forestry
MWh	Megawatt-Hour
NDC	Nationally determined contributions
R&D	Research and Development
STEM	Science, Technology, Engineering and Mathematics
T	Tons
Toe	Tonne(s) of oil equivalent
UN	United Nations
USD	United Stated Dollars
WHO	World Health Organization

Schedule of Taskforce Exchanges

#	Date	Event	Location	Theme
1	23/02/2021	TF Videoconference 1	Virtual	Review of 1st draft of Policy Paper
2	23/03/2021	TF Videoconference 2	Virtual	Review of 2nd draft of Policy Paper
3	27/04/2021	TF Videoconference 3	Virtual	Review of 3rd draft of Policy Paper
4	01/06/2021	TF Videoconference 4	Virtual	Review of 4th draft of Policy Paper
5	06/07/2021	TF Videoconference 5	Virtual	Review of final version of Policy Paper
6	7-8 October, 2021	B20 Summit	Rome; Virtual	Presentation of TF Policy Paper

Distribution of Members

Country	#	Country	#	Country	#	Country	#
Argentina	4	France	5	Mexico	1	Spain	1
Belgium	2	Germany	4	Netherlands	1	Sweden	1
Brazil	3	India	3	Poland	1	Switzerland	1
Canada	2	Indonesia	1	Russia	9	Turkey	9
China	16	Italy	69	Saudi Arabia	2	United Kingdom	2
Egypt	1	Japan	1	South Africa	3	USA	3

Taskforce Members

Name	Company/Organization	Country	Deputy
CHAIR			
Francesco Starace	Enel	Italy	Simone Mori
POLICY MANAGER			
Massimo Beccarello	Confindustria	Italy	
CO-CHAIRS			
Sergio Affronti	YPF S.A.	Argentina	Silvina Oberti Joaquin Mahdjoubian Diaz Cano
Patricia Collawn	PNM Resources	United States of America	Maureen Gannon
Herbert Diess	Volkswagen AG	Germany	Jens Hanefeld
Gurdeep Singh	NTPC Limited	India	Mohit Bhargava
Jean-Pascal Tricoire	Schneider Electric	France	Sandrine De Guio
Baoan Xin	State Grid Corporation of China	China	Guangchao Zhu

COORDINATION GROUP

Name	Function	Company/Organization
Marco Alberti	Senior International Institutional Affairs Officer	Enel Group
Laura Filipazzi	CEO Office, International Institutional Affairs	
Andrea Andreuzzi	Collaborator	Confindustria
Jacopo Terrosu	B20 Secretariat	
Olivia Zangrilli		
Angelo Era	Knowledge Partner	Deloitte.
Paola Rolli		
Alessandra Di Salvo		
Alessandro De Luca		
Anoushka Marie Marthe Alexandre		
Emmanuel Orlando		
Daniele De Gregorio		
Luca Villani		
Alberto Giammattei		
Cesare Pozzi, Full Professor	Scientific Partner	LUISS
Umberto Monarca, Full Professor		
Fabio Inzoli, Full Professor		Politecnico di Milano
Roberto Zoboli, Full Professor		Università Cattolica del Sacro Cuore
Piero Salatino, Full Professor		Università di Napoli Federico II
Stefano Pogutz, Researcher with Tenure		Università Bocconi
Noam Boudissam, Lead, Energy & Materials Platform	Network Partner	World Economic Forum
Lorenzo Tavazzi, Partner		International Chamber of Shipping – ICS
Alessandro Viviani, Business Strategy Senior Consultant		The European House – Ambrosetti

MEMBERS

Name	Company/Organization	Position	Country
Alessandro Curti	Curti Costruzioni Meccaniche Spa	Director	USA
Alessandro Russo	Gruppo Cap	Ceo	Italy
Alessandro Saglio	Confindustria Polonia	General Manager	Poland
Alexander Dumin	Inter Rao	Head Of Capital Markets, Investor Relations, Investment Projects And International Cooperation	Russia
Alexander Kazimirov	Russian Railways	Deputy Head Of Department	Russia
Alexandre Fongaro	Kering	Institutional Relations Officer	France
Analia Gay	Organizacion Techint	Institutional Relation	Argentina
Andrea Bos	Hydrogenpark Scarl	President	Italy
Andrea Cotrufo	Quantum Investments	Chairman	Italy
Andreas Guertler	Eiif - European Industrial Insulation Foundation	Foundation Director	Switzerland
Andrey Logatkin	Pjsc "Rosseti"	Director - Head Of Department For International Cooperation	Russia
Andrey Melen'kin	Pjsc Gazprom Neft	Project Manager, Government Relations (Gr) Department	Russia
Andrey Melnichenko	Russian Union Of Industrialists And Entrepreneurs	Chairman Of The Committee On Climate Policy And Carbon Regulation	Russia
Andrey Sapozhnikov	En+ Group	B20 Project Manager	Russia
Anna Gubina	Russian Union Of Industrialists And Entrepreneurs (Rspp)	Expert Of The Center For Multilateral Cooperation And Eurasian Integration	Russia
Anna Tavano	Hsbc Italy	Head Of Global Banking, Italy	Italy
Annalisa Del Pia	Maire Tecnimont	Group Institutional and International Relations & Clients Assistance Manager	Italy
Antoine Sautenet	Michelin	Public Affairs Manager - Diplomatic Advisor	Canada
Antonio Brufau	Repsol	Chairman	Spain
Antonio Fazzari	Fater	General Manager & Chief Operating Officer	Italy
Antonio Gozzi	Duferco Italia Holding	President	Italy
Antonio Lazzarinetti	Itelyum	Chairman	Italy
Aurelio Regina	Manifatture Sigaro Toscano	Vice President	Italy
Averaldo Farri	Zucchetti Centro Sistemi SpA	Green Innovation Division Director	Italy
Bernardino Vega	PT Pembiayaan Digital / Indonesian Chamber of Commerce and Industry	CEO	Indonesia
Bruno Fierro	Anima	Vice President	Italy
Carolina Clemente	Siemens Gamesa	Public Affairs	Spain

Dany Qian	Jinko Solar	Jinko Solar	China
Dario Molteni	Schlumberger	Global Account Director & Chairman Italy	Italy
Davi Bomtempo	National Industry Confederation (Cni)	Executive Manager	Brazil
Davide Cucino	Fincantieri Spa	Vp - Head Of Brussels Office	Belgium
Dennis Burke	Global Federation Of Insurance Associations/Reinsurance Association Of America (Raa)	Chair - Gfia Extreme Events Working Group; Vice President And Director Of Extreme Events Policy , Raa	USA
Eberhard Von Rottenburg	Bdi - Federation Of German Industries	Deputy Head Of Department	Germany
Ed Brzytwa	American Chemistry Council	Director For International Trade	USA
Elena Morettini	Globant	Director Sustainable Business	Argentina
Elsa Di Paolo	Italfluid Geoenrgy Srl	Chartered Accountant And Legal Auditor	Italy
Emanuela Lucchini	Ici Caldaie Spa	President	Italy
Emily Hickson	The B Team	Head Of Advocacy	United Kingdom
Emma Beccio	Gala S.P.A.	Direttore Generale - General Manager	Italy
Eugenio Madero	Rassini Mexico	President & CEO	Mexico
Fabio Marchetti	Assicurazioni Generali	Director	Italy
Faisal Alfadl	Saudi Green Building Forum	Secretary General/ Chief Representative To United Nations	Saudi Arabia
Fatih Abras	Fca / Tofas	Facilities And Technical Services Manager	Turkey
Federico Suria	Microsoft	Ec Lead	Italy
Filippo Carzaniga	FIMER S.p.A.	Chairman	Italy
Filippo Maria Stefanelli	Acea Produzione Spa	Managing Director Generation & Energy Solutions Acea Spa, Ceo Acea Produzione Spa	Italy
Fortune Mojapelo	Bushveld Minerals	Chief Executive Officer	South Africa
Francesco Del Pizzo	Terna	Director Of Grid Development Strategies And Dispatching	Italy
Francesco Somma	Impes Service Spa	President	Italy
Franco Del Manso	UNEM	International Relations, Enviromental and Technical	Italy
Gary Litman	U. S. Chamber Of Commerce	Vice President, Global Initiatives	USA
Gianandrea Ferrajoli	Mecar S.p.A.	Chairman	Italy
Giovanni Baroni	X3energy S.P.A.	Ceo	Italy
Giovanni Gasparini	Renco	President	Italy
Giovanni Lombardi	Tecno	Founder, Shareholder and Chairman	Italy
Giovanni Musso	Irem Spa	CEO	Italy
Giuseppe Ricci	Eni Spa	Energy Evolution Chief Operating Officer	Italy

Guangbin Sun	Ja Solar Technology Co., Ltd.	Senior Vice President	China
Guangying Liu	China Datang Coporation Ltd.	Vice President	China
Guido Grimaldi	ALIS – Associazione Logistica dell'Intermodalità Sostenibile	President	Italy
Hangdong Hu	Tibet Summit Resource Co., Ltd.	President	China
Hiroyuki Tezuka	Jfe Steel Corporation	Fellow & General Manager, Climate Change Policy Group, Technology Planning Department	Japan
Ibrahim Yelmenoglu	Turkish Petroleum Refineries Corp.	Ceo	Turkey
Ivan Zhidkikh	Suek	Head Of Special Projects And Analysis Division	Russia
Jakob Flechtner	Dihk E.V. - Association Of German Chambers Of Industries And Commerce	Director Climate Policy	Germany
Jarredine Morris	Business Unity South Africa	Energy And Environmental Policy Manager	South Africa
Jean-Baptiste Baroni	Medef	Deputy Sustainability Director	France
Jerry Jiao	China Minmetals Corporation	Vice President	China
Jiaqiang Liu	China National Chemical Engineering Group Corporation Ltd.	President	China
Jieyuan Zhang	Shanghai Haicheng Resources (Group) Co., Ltd.	Vice President	China
Joanne Yawitch	National Business Initiative	Chief Executive Officer	South Africa
Khaled Sharbatly	Desert Technologies	Managing Partner	Saudi Arabia
Letizia Magaldi	Magaldi Power S.P.A.	Vice President	Italy
Lin-Jie Huang	Sanhua Holding Group	Vice President, Chief Scientist	China
Lisandro Deleonardis	Organizacion Techint - Tecpetrol	Institutional Relation	Argentina
Long Han	Bgrimm Technology Group	President	China
Lorenz Isler	Ingka Group (Ikea)	Public Affairs Leader Sustainability & People	Sweden
Luca G. Donelli	Donelli - Corrosion Protection Applications Since 1911	Market Dev. Manager	Italy
Luca Matrone	Intesa Sanpaolo	Head Of Energy - Imi Cib Division	Italy
Majda Dabaghi	International Chamber Of Commerce	Director, Inclusive & Green Growth	France
Marco Amleto /Giuseppe Golinelli	Wärtsilä	Director Energy Solutions	Italy
Marco Decio	Siram Veolia	Managing Director Business Unit	Italy
Marco Geneletti	Tenaris	Senior Planning Director Europe	Italy
Marco Oriolo	Kerry Project Logistics Spa	Shareholder & CEO	Italy
Margaret-Ann Splawn	Climate Markets And Investment Association	Executive Director	United Kingdom
Maria Giovanna Gulino	Ima Industria Meridionale Alcolici Srl	CEO	Italy
Mario Branco	Abinee - Brazilian Association Of Eléctrical And Eletronics Industries	External Trade Advisor	Brazil

Mario Mattioli	Confitarma - Confederazione Italiana Armatori	President	Italy
Mario Zagaria	C.O.M. S.C.P.A.	General Manager	Italy
Marta Martinez	Iberdrola	Head of Analysis and Special Projects, Climate Change and Alliances Direction	Spain
Massimiliano Turci	Nuovo Pignone, Part Of Baker Hughes Company	Massa Plant Manager	Italy
Massimo Bonato	Areti	CEO	Italy
Massimo Di Genova	Nokia	Sales Manager	Italy
Matteo Bertolini	Sime S.R.L.	Chief Executive Officer	Italy
Matthias Berninger	Bayer Ag	Svp Public Affairs	Germany
Maurizio Coratella	SAIPEM	Chief Operating Officer E&C Onshore Division	Italy
Meltem Türker	Dow	Government Affairs Leader	Turkey
Michele Somma	Tecnoparco Valbasento Spa	Ceo	Italy
Michele Stangarone	Nuovo Pignone, Part Of Baker Hughes Company	President Nuovo Pignone	Italy
Michele Ziosi	Cnh Industrial	Vice President Institutional Relations Europe, Middle East, Africa And Asia Pacific	Italy
Mirco Viotto	Elettromeccanica Viotto	Ceo	Italy
Mohamed Kassem	Federation Of Egyptian Industry Fei	Board Member And Chair Of Foregin	Egypt
Nevio Benvenuto	Guccio Gucci	Csr Manager	Italy
Nicola Angelo Marotta	Technip Italy Direzione Lavori S.P.A. (Tpidl S.P.A.)	Chief Executive Officer	Italy
Nicola Monti	Edison Spa	Ceo	Italy
Norine Kennedy	USCIB	Senior Vice President for Policy and Global Strategy	USA
Nurşen Numanoğlu	Tusiad-Turkish Business And Industry Association	Deputy Secretary General	Turkey
Oscar Guerra		Corporate Ceo - Board Member Of Assorisorse – The Italian Sustainable Energy & Resources Industry Association	Italy
Paola Fienga	Webuild	Corporate Communication Manager	Italy
Paolo Ghirelli	Bonatti S.P.A.	Chairman (And Board Member Of Assorisorse - The Italian Sustainable Energy & Resources Industry Association)	Italy
Paolo Stabellini	Edilteco Spa	Ceo	Italy
Pascal Roger	Fedene	President	France
Philippe Ducom	ExxonMobil Europe	President	Belgium
Piero Manzoni	Neoruralehub Srl	Founder & Ceo	Italy
Pistorio Rosario	Sonatrach Raffineria Italiana S.R.L.	Ceo	Italy
Qi Zhou	China Global New Technology Import& Export Co. Ltd.	President	China
Rachel Cheng	Rachel Innovation Technology Corporation Limited	CEO	China

Raghav Kanoria	India Power Corporation	Managing Director	India
Renato Mazzoncini	A2a Spa	Ceo And General Manager	Italy
Renato Vito Bocca	Consorzio Industriale Lucano	President	Italy
Richard Wang	Hengtong Group Co., Ltd	Director, Overseas Invst & PIM	China
Roberto Bocca	Li.Bo Srl	Business Developer Manager	Italy
Roberto Carpaneto	Rina Consulting S.P.A.	Rina Consulting Ceo	Italy
Roberto Savini	Settore Consumo e Utenza Confcooperative	President	Italy
Roberto Vavassori	Brembo S.P.A.	Chief Institutional Affairs Officer	Italy
Robin Edger	Insurance Bureau Of Canada (Ibc)	National Director, Climate Risk	Canada
Rogelio Pagano	DESA	CEO & Chairman	Argentina
Rogerio Ghesti	International Chamber Of Commerce - UK	Head of International Policy	United Kingdom
Ruggero Corrias	Snam Spa	Ceo Diplomatic Advisor And Head Of International Relations	Italy
Sachin Joshi	B20 Saudi Arabia	Policy Director	India
Salvatore Antonio De Biasio	Cmd S.P.A. - Costruzioni Motori Diesel	Manager	Italy
Salvatore Russelli	Hydros S.R.L.	Legal Rappresentant	Italy
Sarp Kalkan	Union Of Chambers And Commodity Exchanges Of Turkey (Tobb)/ B20 Turkey	Deputy Secretary General/B20 Turkey Sherpa	Turkey
Sebastiano Bongiovanni	Tes Srl	Amministratore Unico	Italy
Sergey Chestnoy	Uc Rusal	Official Representative	Russia
Stefan Spindler	Industrial Schaeffler AG	CEO	Germany
Sudhakar Asawale	Jsw Steel Piombino Spa ,Italia	Chief Operations Officer (C.O.O)	Italy
Susan Shannon	Shell	Vice President International Organizations & Policy	Netherlands
Vineet Mittal	Avaada Energy	Chairman	India
Vito Grassi	Graded S.P.A	Ceo	Italy
Xibing Wang	Tibet Summit Resource Co., Ltd.	CEO	China
Yiyang Liu	Trinasolar	Vice-President,Head Of Strategic Development Department	China
Yuwei Kan	Air Liquide	Public Affairs Director, International Development, Air Liquide	France
Yuzhuo Zhang	China Petrochemical Corporation (Sinopec Group)	Chairman	China
Zhiyong Li	China Council For The Promotion Of International Trade	Division Director Of The Department Of International Relations	China

Bibliography

[1] Global Footprint Network, «Earth Overshoot Day 2019 is July 29, the earliest ever,» 23 06 2019. [Online]. Available: https://www.overshootday.org/newsroom/press-release-july-2019-english/. [Consultato il giorno 01 02 2021].

[2] Climate Action Tracker, «Global update: Paris Agreement Turning Point,» 01 12 2020. [Online]. Available: https://climateactiontracker.org/publications/global-update-paris-agreement-turning-point/. [Consultato il giorno 27 01 2021].

[3] IEA, «After steep drop in early 2020, global carbon dioxide emissions have rebounded strongly,» IEA, 02 03 2021. [Online]. Available: https://www.iea.org/news/after-steep-drop-in-early-2020-global-carbon-dioxide-emissions-have-rebounded-strongly. [Consultato il giorno 30 04 2021].

[4] World Resources Institute - Climate Watch, «Historical GHG Emissions,» 2020. [Online]. Available: https://www.climatewatchdata.org/ghg-emissions?breakBy=sector&chartType=percentage&end_year=2017&source=CAIT&start_year=1990. [Consultato il giorno 27 01 2021].

[5] IEA, «CO2 intensity of energy mix (CO2/TES), World 1990-2018,» 2020. [Online]. Available: https://www.iea.org/data-and-statistics?country=WORLD&fuel=CO2%20emissions&indicator=CO2Intensity. [Consultato il giorno 27 01 2021].

[6] IRENA, «Global energy transformation: A roadmap to 2050 (2019 edition),» International Renewable Energy Agency, Abu Dhabi, 2019.

[7] World Economic Forum, «The Global Risks Report,» 2020.

[8] United Nations, «The Paris Agreement,» [Online]. Available: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement. [Consultato il giorno 27 01 2021].

[9] IEA, «Net Zero by 2050. A Roadmap for the Global Energy Sector,» International Energy Agency, 2021.

[10] European Commission, «2050 long-term strategy,» [Online]. Available: https://ec.europa.eu/clima/policies/strategies/2050_en#:~:text=The%20EU%20aims%20to%20be,action%20under%20the%20Paris%20Agreement.. [Consultato il giorno 16 02 2021].

[11] Y. O. Aron Sheldrick, «Japan set to target zero emissions by 2050 in policy shift,» Reuters, 23 10 2020. [Online]. Available: https://www.reuters.com/article/climate-japan-policy-shift-idUSKBN2780RN. [Consultato il giorno 16 02 2021].

[12] World Economic Forum, «The US wants to be carbon neutral by 2050. These 3 policies can make it possible,» World Economic Forum, 15 03 2021. [Online]. Available: https://www.weforum.org/agenda/2021/03/usa-us-american-climate-change-environment/#:~:text=The%20United%20States%20intends%20to,target%20to%20be%20announced%20shortly.&text=Our%20new%20research%20highlights%20specific,policies%20to%20tackle%20climate%20ch. [Consultato il giorno 30 03 2021].

[13] «Statement by H.E. Xi Jinping President of the People's Republic of China At the General Debate of the 75th Session of The United Nations General Assembly,» Ministry of Foreign Affairs of the People's Republic of China, 22 09 2020. [Online]. Available: https://www.fmprc.gov.cn/mfa_eng/zxxx_662805/t1817098.shtml. [Consultato il giorno 08 04 2021].

[14] UNFCCC, «Transforming our systems together. A global challenge to accelerate sector breakthroughs for COP26 – and beyond.,» 2021.

[15] IEA, «The Future of Hydrogen,» International Energy Agency, 2019.

[16] BloombergNEF, «Hydrogen Economy Outlook,» 2020.

[17] IPCC, «Guidelines for National Greenhouse Gas Inventories,» Intergovernmental Panel on Climate Change, 2006.

[18] The World Bank, «Zero Routine Flaring by 2030,» The World Bank, [Online]. Available: https://www.worldbank.org/en/programs/zero-routine-flaring-by-2030. [Consultato il giorno 01 07 2021].

[19] U.S. Department of Energy, «All-Electric Vehicles,» [Online]. Available: https://www.fueleconomy.gov/feg/evtech.shtml#:~:text=Energy%20efficient.,to%20power%20at%20the%20wheels.. [Consultato il giorno 27 01 2021].

[20] European Commission, «Energy consumption by end-use,» European Commission, 2013. [Online]. Available: https://ec.europa.eu/energy/content/energy-consumption-end-use_en. [Consultato il giorno 18 02 2021].

[21] U.S.A. Department of Energy, «Quadrennial Technology Review - An Assessment Of Energy Technologies And Research Opportunities,» 2015.

[22] IRENA, «Global Renewables Outlook: Energy transformation 2050 (Edition 2020),» International Renewable Energy Agency, Abu Dhabi, 2020.

[23] European Commission, «A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives,» Brussels, 2020.

[24] ESMAP, «Energy Efficient Cities,» [Online]. Available: https://www.esmap.org/node/57881. [Consultato il giorno 08 02 2021].

[25] IEA, «World Energy Outlook 2020,» International Energy Agency, 2020.

[26] UNEP, «The Economics of Nature-based Solutions: Current Status and Future,» United Nations Environment Programme, Nairobi, 2020.

[27] IEA, «CCUS in Clean Energy Transitions,» 09 2020. [Online]. Available: https://www.iea.org/reports/ccus-in-clean-energy-transitions/ccus-in-the-transition-to-net-zero-emissions#removing-carbon-from-the-atmosphere. [Consultato il giorno 02 02 2021].

[28] IEA, «Digitalisation and Energy,» International Energy Agency, Paris, 2017.

[29] IMF, «IMF Survey : Counting the Cost of Energy Subsidies,» International Monetary Fund, 17 07 2015. [Online]. Available: https://www.imf.org/en/News/Articles/2015/09/28/04/53/sonew070215a. [Consultato il giorno 16 02 2021].

[30] World Economic Forum, «The Net-Zero Challenge: Fast-Forward to Decisive Climate Action,» World Economic Forum, Geneva, 2020.

[31] J. E. Daniel Nachtigall, «The economic and environmental benefits from international co-ordination on carbon pricing: Insights from economic modelling studies,» OECD Environment Directorate, Paris, 2021.

[32] United Nations, «17 Sustainable Development Goals,» [Online]. Available: https://sdgs.un.org/goals. [Consultato il giorno 02 02 2021].

[33] OECD/The World Bank/UN Environment, « Financing Climate Futures: Rethinking Infrastructure,» OECD Publishing, Paris, 2018.

[34] The World Bank, «Lifelines: The Resilient Infrastructure Opportunity,» World Bank, Washington DC, 2019.

[35] World Economic Forum, «Why it's time to invest in climate resilient infrastructure,» 22 09 2019. [Online]. Available: https://www.weforum.org/agenda/2019/09/why-it-s-time-to-invest-in-climate-resilient-infrastructure/. [Consultato il giorno 05 02 2021].

[36] OECD, «Climate-resilient Infrastructures,» 2018.

[37] Deloitte, «Cybersecurity for critical infrastructure - Growing, high-visibility risks call for strong state leadership,» 2017.

[38] The World Bank, «Minerals for Climate Action: The Mineral Intensity of the Clean Energy Transition,» World Bank Publications, Washington, 2020.

[39] European Commission, «Using insurance in adaptation to climate change,» Publications Office of the European Union, Luxembourg, 2018.

[40] United Nations, «Paris Agreement,» 2015.

[41] EBRD, «What is a just transition?,» [Online]. Available: https://www.ebrd.com/what-we-do/just-transition. [Consultato il giorno 09 02 2021].

[42] ILO, «ILO Global Forum on a just transition towards environmentally sustainable economies and societies for all,» in Summary Report: Boosting skills for a just transition and the future of work, Geneva, 2019.

[43] EBRD, «The EBRD just transition initiative,» European Bank for Reconstruction and Development, 2020.

[44] IISD, «Just Transition,» [Online]. Available: https://www.iisd.org/topics/just-transition. [Consultato il giorno 09 02 2021].

[45] IRENA, «IRENA Youth Forum: The New Generation of Decision Makers,» in Renewables Beyond 2030: The Key Role of Youth in the Global Energy Transformation, Abu Dhabi, 2020.

[46] IEA, «Gender diversity in energy: what we know and what we don't know,» International Energy Agency, 2020.

[47] The World Bank, «State of Electricity Access Report 2017,» Washington DC, 2017.

[48] United Nations, «SDG 7 - Progress and info,» 2020. [Online]. Available: https://sdgs.un.org/goals/goal7. [Consultato il giorno 04 02 2021].

[49] H. Ritchie, «Access to Energy,» 11 2019. [Online]. Available: https://ourworldindata.org/energy-access. [Consultato il giorno 04 02 2021].

[50] IRENA, «Off-grid for Energy Access,» 2017. [Online]. Available: https://www.irena.org/offgrid. [Consultato il giorno 04 02 2021].

[51] CNT, «The Case for Fixing the Leaks: Protecting people and saving water while supporting economic growth in the Great Lakes region,» Center for Neighborhood Technology, 2013.

[52] United Nations, «SDG 6 - Progress and info,» 2020. [Online]. Available: https://sdgs.un.org/goals/goal6. [Consultato il giorno 04 02 2021].

[53] WWAP , «The United Nations World Water Development Report 2017: Wastewater, The Untapped Resource.,» UNESCO, Paris, 2017.

[54] Global Burden of Disease, «Unsafe water, sanitation, and handwashing—Level 2 risk,» The Lancet, 2020.

[55] H. Ritchie, «Clean Water,» 11 2019. [Online]. Available: https://ourworldindata.org/water-access#unsafe-water-is-a-leading-risk-factor-for-death. [Consultato il giorno 04 02 2021].

[56] GWP-Med, «Water-Energy-Food-Ecosystems Nexus,» Global Water Partnership-Mediterranean, 2020.

[57] The World Bank, «Water In Agriculture,» The World Bank, 08 05 2020. [Online]. Available: https://

www.worldbank.org/en/topic/water-in-agriculture#:~:text=Water%20is%20a%20critical%20input,the%20total%20food%20produced%20worldwide.. [Consultato il giorno 29 03 2021].

[58] FAO, «Energy Smart Agriculture,» Food and Agriculture Organization, 09 07 2018. [Online]. Available: http://www.fao.org/e-agriculture/blog/energy-smart-agriculture. [Consultato il giorno 29 03 2021].

[59] A. Purwanto, J. Sušnik, F. Suryadi e C. de Fraiture, «Water-Energy-Food Nexus: Critical Review, Practical Applications, and Prospects for Future Research,» MDPI, 2021.

[60] Global Infrastructure Hub, «Global Infrastructure Outlook,» 2017.

[61] IEA, «Introduction to the water-energy nexus,» Inetrnational Energy Agency, 23 03 2020. [Online]. Available: https://www.iea.org/articles/introduction-to-the-water-energy-nexus. [Consultato il giorno 19 02 2020].

[62] WHO, «Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage,» World Health Organization, 2012.

[63] UN Environment Program, «Closing data gaps is essential to achieving the environmental dimension of the Agenda 2030 for Sustainable Development,» 2019.

[64] UN Environment Program, «United Nations Decade on Ecosystem Restoration 2021-2030,» 2020.

[65] World Meteorological Organization, «WMO provisional Statement on the Status of the Global Climate in 2016,» 2016.

[66] Ellen MacArthur Foundation, «Universal Circular Economy Policy Goals,» 2021.

[67] Circle Economy, «The Circularity Gap Report,» 2020.

[68] OECD, «Global Material Resources Outlook to 2060,» 2018.

[69] The World Bank, «What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050,» 2018.

[70] Ellen MacArthur Foundation, «The Circular Economy In Detail,» [Online]. Available: https://www.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail. [Consultato il giorno 01 02 2021].

[71] Ellen MacArthur Foundation, «Completing the Picture: How the Circular Economy Tackles Climate Change,» 2019.

[72] IRP, «Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future,» United Nations Environment Programme, Nairobi, 2020.

[73] FAO, «Food wastage footprint & Climate Change,» Food and Agriculture Organization, 2011.

[74] European Union, «Circular Economy Action Plan,» Publications Office of the European Union, Luxemburg, 2020.

[75] Ellen MacArthur Foundation, «The circular economy opportunity for urban and industrial innovation in China,» 2018.

[76] Circle Economy, «Avoiding blind spots: promoting circular & fair business models,» 2020.

[77] IPBES, « Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services,» IPBES secretariat, Bonn, Germany, 2019.

[78] FAO, «The Contribution of Agriculture to Greenhouse Gas Emissions,» 2020. [Online]. Available: http://

www.fao.org/economic/ess/environment/data/emission-shares/en/. [Consultato il giorno 08 02 2021].

[79] CGIAR, «Tackling agricultural water pollution – a 21st century challenge,» 2020. [Online]. Available: https://wle.cgiar.org/thrive/2020/03/30/tackling-agricultural-water-pollution-%E2%80%93-21st-century-challenge. [Consultato il giorno 08 02 2021].

[80] EEA, «Emissions of the main air pollutants in Europe,» EEA, 11 05 2021. [Online]. Available: https://www.eea.europa.eu/data-and-maps/indicators/main-anthropogenic-air-pollutant-emissions/assessment-6. [Consultato il giorno 18 06 2021].

[81] OECD, «Ocean economy and developing countries,» [Online]. Available: https://www.oecd.org/ocean/topics/developing-countries-and-the-ocean-economy/. [Consultato il giorno 02 02 2021].

[82] WWF, «The Effects Of Climate Change,» [Online]. Available: https://www.wwf.org.uk/learn/effects-of/climate-change. [Consultato il giorno 02 02 2021].

[83] Ocean Conservancy, «Fighting for Trash Free Seas,» [Online]. Available: https://oceanconservancy.org/trash-free-seas/plastics-in-the-ocean/. [Consultato il giorno 02 02 2021].

[84] European Commission, «Developments and Forecasts of Climate Change and Environmental Degradation,» [Online]. Available: https://knowledge4policy.ec.europa.eu/foresight/topic/climate-change-environmental-degradation/developments-forecasts-climate-change-environmental-degradation_en. [Consultato il giorno 02 02 2021].

[85] WHO, «Health consequences of air pollution on populations,» 15 11 2019. [Online]. Available: https://www.who.int/news/item/15-11-2019-what-are-health-consequences-of-air-pollution-on-populations. [Consultato il giorno 02 02 2021].

[86] IRENA, «Renewable Power Generation Costs in 2019,» International Renewable Energy Agency, Abu Dhabi, 2020.

[87] WBCSD, «Circular Transition Indicators (CTI),» [Online]. Available: https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Metrics-Measurement/Circular-transition-indicators. [Consultato il giorno 01 02 2021].

[88] Ellen MacArthur Foundation, «Circulytics - measuring circularity,» [Online]. Available: https://www.ellenmacarthurfoundation.org/resources/apply/circulytics-measuring-circularity. [Consultato il giorno 01 02 2021].

[89] IEA, «World Energy Outlook 2019,» 11 2019. [Online]. Available: https://www.iea.org/reports/world-energy-outlook-2019. [Consultato il giorno 02 02 2021].

[90] IEA, «Energy Efficiency 2020,» 12 2020. [Online]. Available: https://www.iea.org/reports/energy-efficiency-2020. [Consultato il giorno 02 02 2021].

[91] ENISA, «Critical Infrastructures and Services,» [Online]. Available: https://www.enisa.europa.eu/topics/critical-information-infrastructures-and-services. [Consultato il giorno 05 02 2021].

[92] BloombergNEF, «New Energy Outlook,» 2020.

[93] World Bank, «State and Trends of Carbon Pricing,» 2020.

[94] Climate Action Tracker, «Warming Projections Global Update - May 2021: Climate summit momentum: Paris commitments improved warming estimate to 2.4°C,» 2021.

B20 ITALY 2021

RESHAPE THE FUTURE: INCLUDE, SHARE, ACT

An initiative by

CONFINDUSTRIA

Knowledge partners

Deloitte.

Network partners

The European House Ambrosetti

International Chamber of Shipping

WORLD ECONOMIC FORUM
COMMITTED TO IMPROVING THE STATE OF THE WORLD

Scientific partners

LUISS

POLITECNICO MILANO 1863

UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

Università Bocconi MILANO

UNIVERSITÀ CATTOLICA del Sacro Cuore