STUDY 1.1

STOCKTAKING ECONOMIC, SOCIAL, AND ENVIRONMENTAL IMPACTS OF SUSTAINABLE RECOVERY, INCLUDING IMPACTS ON NDC IMPLEMENTATION

Indonesia, September 2022

Recover Together, Recover Stronger

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Acknowledgments

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The views and opinions of the authors expressed herein do not necessarily state or reflect those of the Government of Indonesia or project funders.

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List of Abbreviations

CH_4	Methane
CO_2	Carbon dioxide
DFI	Development finance institution
EV	Electric vehicle
E3ME	Energy-environment-economy macro-economic
GCF	Green Climate Fund
GDP	Gross domestic product
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ICT	Information and communication technology
IFI	International financial institution
IMF	International Monetary Fund
IRENA	International Renewable Energy Agency
LT-LEDS	Long-term low emissions development strategies
MDB	Multilateral development bank
MRV	Measurement, reporting and verification
NAP	National adaptation plan
ND-GAIN	Notre Dame Global Adaptation Initiative
NDC	Nationally Determined Contribution
PES	Planned Energy Scenario
SDG	Sustainable Development Goal
UNICEF	United Nations Children's Fund

Executive Summary

This stocktaking report aims to inform G20 members on how to upscale their recovery efforts to continue to pursue a sustainable, resilient, and inclusive recovery from the negative impacts of the COVID-19 pandemic. To this end, this report first assesses to what extent the G20 members' announced recovery spending supports the achievement of the international climate targets. Second, the report discusses the mitigation and socioeconomic implications of different recovery scenarios. Third, the report provides recommendations on how sustainable recovery efforts can further support the achievement of the Paris Agreement.

This report bases its findings on two assessments. First, a macro-econometric model assesses the greenhouse gas (GHG) emission reductions and socioeconomic impacts of the announced recovery measures under three scenarios: (1) the G20 recovery scenario (current spending), (2) the G20 recovery scenario with fiscal constraints reflecting a more conservative iteration, and (3) the G20 recovery scenario with extended support, reflecting higher ambitions in comparison with the initial G20 recovery scenario. The modeling results show to what extent G20 recovery measures to date can aid in limiting the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue further efforts to limit the temperature increase to 1.5°C.[1] Second, a literature review is conducted to evaluate how recovery measures from G20 members create an enabling environment for implementing the Nationally Determined Contributions (NDCs). The report examines how recovery measures have strengthened multiple aspects of the Glasgow Climate Pact (Decision 1-CMA.3), including capacity-building, coordination for implementation, and development of innovative financing mechanisms.[2]

The insights of this report—focused mostly on climate impacts—are complemented by the findings from the report *The role of mitigation-adaptation co-benefits for creating a more resilient future for all*, which examines the contribution of the G20 announced recovery efforts toward the achievement of the Sustainable Development Goals (SDGs).

This report divides its findings and recommendations into six action areas, each of which requires attention to advance an even sustainable recovery and to employ recovery efforts that facilitate the achievement of international climate targets. The action areas include (1) reinforcing the positive climate impacts derived from the announced G20 recovery spending beyond 2025; (2) ensuring equal support for both adaptation and mitigation recovery actions; (3) overcoming fiscal constraints for future recovery support; (4) maintaining long-term sustainable employment, especially green jobs, generated from recovery spending; (5) measuring the effectiveness of sustainable recovery spending; and (6) tackling compound risks.

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1   UNFCC. "Glasgow Climate Pact." Accessed June 15, 2022.

2   UNFCC. "Glasgow Climate Pact."

1. Introduction

The COVID-19 pandemic caused a deep social and economic crisis with substantial negative implications for achieving international climate targets.

Despite signals of recovery from the G20 members during the first quarter of 2022, the International Monetary Fund (IMF) forecasts a continuous trend of economic slowdown.[3] The G20's cumulative gross domestic product (GDP) growth rate exceeded its pre-pandemic (Q4 2019) level in Q1 2022.[4] In addition, G20 labor markets experienced a recovery at the beginning of 2022, with unemployment rates below pre-pandemic levels for most G20 advanced economies.[5] However, the IMF forecasts a 0.9% decrease in G20's cumulative GDP growth rate for 2022.[6]

Nevertheless, G20 climate policies, although improved and leading to slower growth in emissions, remain insufficient to meet the Paris Agreement.[7] The unique opportunity to shift G20 economies toward a low-carbon development pathway through green recovery efforts has not been sized. Carbon dioxide (CO_2) emissions from multiple G20 members have surpassed pre-pandemic levels.[8, 9] In addition, the COVID-19 pandemic has caused a long-term disruption of efforts and resources that address climate-driven challenges. COVID-19 has shifted attention and resources toward ending the pandemic and away from addressing climate change as a top priority, particularly in developing countries.[10]

To recover from the socioeconomic crisis, the G20 Presidencies in 2020 and 2021 highlighted the importance of paving the way toward an inclusive, low-carbon development pathway. Strengthening the alignment between sustainable finance, recovery, and impact investment agendas was prioritized.[11] The G20 Riyadh Summit set fundamental principles and commitments to support recovery and achieve strong, sustainable, balanced, and inclusive growth. The G20 Rome Leaders' Declaration focused on strengthening G20 members' actions to implement the G20 Action Plan on the 2030 Agenda and the G20 Support to COVID-19 Response and Recovery in developing countries.

Since then, the G20 members have pledged approximately USD 14 trillion on rescue and recovery measures to stimulate the economy, develop resilience in the health systems, and support employment creation.[12] However, only 6% of the total G20 announced spending (USD 860 billion) directly addresses climate change.[11]

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3   "Facing a Darkening Economic Outlook: How the G20 Can Respond." IMF. Last modified July 13, 2022.

4   OECD. "G20 GDP growth continues to slow in the first quarter of 2022." Last modified September 30, 2021

5   ILO. "Monitoring the impact of the COVID-19 pandemic on employment in the G20." Last modified November 25, 2021.

6   "Facing a Darkening Economic Outlook: How the G20 Can Respond." IMF.

7   Nascimento, Leonaro, Takeshi Kuramochi, and Niklas Höhne. "The G20 emission projections to 2030 improved since the Paris Agreement, but only slightly." Mitigation and Adaptation Strategies for Global Change, 27, no. 39 (2022).

8   IEA. "Global CO_2 emissions rebounded to their highest level in history in 2021." Last modified Mach 8, 2022.

9   DW. "Climate change: EU emissions surpass pre-pandemic levels." Last modified May 16, 2022.

10 Eurasia Group. "Top Risks 2021." Last modified 2021.

11 G20 Research Group. "Leader's Declaration." Last modified November 21, 2020.

12 Nahm, Jonas M., Scot M Miller, and Johannes Urpelainen . "G20's USD 14 trillion economic stimulus reneges on emissions pledges." Nature, 24, no. 3.

Research studies tracking global recovery spending found that G20 governments could further seize the opportunity to restructure their economies toward a low-carbon transition through recovery measures. Many of these studies highlighted the need for G20 members to address policy coherence and policy gaps to strengthen a sustainable recovery, better integrate nature and biodiversity[13] in their recovery plans, reevaluate environmentally friendly vs. business-as-usual measures to pursue a more ambitious transformation, and further understand the long-term impacts and opportunities of sustainable recovery. Furthermore, the G20 group has been exhorted by the IMF to avoid a two-track economic recovery between developed and developing countries. Developing countries with tight fiscal space and rising levels of debt experience limitations on the type and pace of recovery they can pursue. These limitations can widen inequality and hinder a country's ability to achieve more ambitious climate objectives.[14] A two-track economic recovery could result in slower and less definite actions to confront climate-related challenges, particularly in low- and middle-income countries. Avoiding a two-track economic recovery would require better recovery planning, improved access, and extended economic stimulus and technical assistance for developing countries.

To inform G20 members on how to better design and implement recovery plans that can support the achievement of international climate and development targets, it is necessary to understand the current and potential impacts of their recovery measures on mitigation, adaptation, and socioeconomic development (e.g., employment creation, impact on GDP). Additionally, G20 members need to continuously measure the progress of their recovery pledges and adjust plans when progress falls short of ambition. Nevertheless, there is a paucity of information on mitigation—particularly at a sectoral level—and advancements in adaptation because of recovery pledges being implemented.

This report aims to address the knowledge gap in the impacts of recovery measures on climate targets and the macroeconomic situation among G20 members. It aims to provide evidence-based insights that will contribute to the continuation of the efforts undertaken during the previous G20 summits in 2020 and 2021. Moreover, it aims to derive recommendations to better fight the systemic and global climate crisis through sustainable recovery efforts.

For this purpose, this report is divided into five sections:

Methodology lists the primary data sources and explains the undertaken analyses.

S*tocktake of Recovery Measures* takes stock of G20 members' announced recovery spending up to the first quarter of 2022. Additionally, it summarizes the contribution of announced recovery measures to achieving long-term mitigation and adaptation objectives. Finally, it identifies good practices of sector-specific recovery measures.

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13 This report focuses mainly on the impacts of COVID-19 on achieving climate targets (i.e., mitigation and adaptation). It limits its analysis of the COVID-19 effects on achieving biodiversity targets and the relationship between biodiversity targets and socio-economic co-benefits. This is because the report was commissioned and aims to inform the Climate Sustainability Working Group (CSWG) of the G20, which does not cover the topic of biodiversity.

14 Georgieva, Kristalina. "Urgent Action Needed to Address a Worsening 'Two-Track' Recovery." Last modified July 7, 2021.

Contribution of Recovery Efforts to NDC Implementation outlines how recovery measures have contributed to the creation of an enabling environment for NDC implementation in five areas: (a) planning and development of climate policies, (b) government coordination, (c) finance mobilization, (d) capacity development and resilient institutions, and (e) effective monitoring and regulatory frameworks. In addition, the section highlights opportunities to further utilize recovery measures as enablers for NDC implementation for each of those cross-cutting areas.

Current and Potential Recovery Scenarios establish different recovery scenarios to quantify the medium- and long-term impacts of the G20 announced recovery measures on CO_2 emissions reductions, employment creation, and GDP. The section discusses how the different recovery scenarios can help close the gap to limit global warming to well below 2°C, and to 1.5°C, compared to pre-industrial levels. The modeling of future recovery scenarios indicates the level of change required in recovery plans from the G20 members to support achieving the Paris Agreement goal.

Recommendations to Drive NDC Achievement Through a Sustainable Recovery provides policy recommendations for G20 members to (a) improve recovery measures to support the achievement of the Paris Agreement and (b) ensure an inclusive recovery.

2. Methodology

2.1 Data Sources

The study uses the Global Recovery Observatory[15] database, last updated on December 16, 2021 (referred to as *Observatory)*, as the main data source. The Observatory has compiled the announced national fiscal policy interventions of all G20 members since January 2020. The Observatory was selected over other data sources[16] because it has the highest depth and coverage of global recovery spending and provides the most granular data available. It introduces a temporal component to GHG considerations, includes social impacts of policies, and uses a significantly more granular categorization of spending (based on a classification of fiscal policy measures of 40 archetypes and 158 sub-archetypes) than other COVID-19 recovery databases.

The data from the Global Recovery Observatory[17] was complemented with data from the OECD Green Recovery Database (last updated in April 2022) and reports from the International Energy Agency Sustainable Recovery Tracker (last updated in March 2022)[18] to verify recovery measures up to the first quarter of 2022.

In addition, this study utilizes primary data on recovery spending and recovery measure case examples from surveys submitted to all G20 members. The survey was partially answered by seven G20 members—Germany, Indonesia, Japan, Russia, Saudi Arabia, the United Kingdom, and the United States—and one G20 permanent guest, Spain. The survey responses related to recovery spending were compared against the latest data from the Observatory. The survey questionnaire and a comparison of country responses about recovery spending can be found in Annexes 1 and 2.

Finally, secondary data—such as country-specific recovery plans, Nationally Determined Contributions (NDCs), national adaptation plans (NAPs), Sustainable Development Goal (SDG) indicators, and socioeconomic indicators—were used as input for the modeling and for assessing the impact of recovery measures to create an enabling environment for the implementation of NDCs.

2.2 Definitions

The study utilizes the following definitions aligned with the Global Recovery Observatory methodology:

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15 Global Recovery Observatory. "Draft Methodology Document." Last modified February 1, 2021.

16 For the development of this report, the most cited COVID-19 recovery trackers, tools, and reports were reviewed, including ADB's COVID-19 Policy Database; 'Greenness of Stimulus Index' by Vivid Economics (2020); the Global Recovery Observatory led by the Oxford University Economic Recovery Project and the UN Environment Programme (UNEP); ING's Green Recovery analysis, which focused on major economies in the Asia-Pacific region; the Climate Action Tracker, which has tracked recovery policies from China, the EU, India, South Korea, and the USA; IMF's Fiscal Monitor; the OECD COVID-19 Recovery Dashboard; and WRI's a Typology for Facilitating a Paris-Aligned COVID-19 Recovery. Additionally, sector-specific tools and reports were reviewed, such as the Energy Policy Tracker (2022), IRENA's Post-COVID recovery: An agenda for resilience, development, and equality; and IEA's World Energy Outlook Special Report on Sustainable Recovery (2020).

17 OECD. "Assessing environmental impact of measures in the OECD Green Recovery Database." Last modified April 21, 2022.

18 IEA. "Sustainable Recovery Tracker." Last modified April 2022.

- **Rescue measures** are defined as a short-term fiscal policy designed for emergency support to keep people and businesses afloat. They include, among others, temporary liquidity support to businesses and public entities, temporary life and livelihoods cash transfers, and tax and payment relief cuts.

- **Recovery measures** are defined as medium- or long-term fiscal policy incentives or investments to boost economic growth, which are considered part of the COVID-19 recovery efforts of a country. They include, among others, worker retraining and job creation policies; investments in education, health care, infrastructure, and research and development; disaster preparedness; and capacity building.

- **GHG emissions** are the atmospheric release of CO_2, methane (CH_4), and other gases that create a warming greenhouse effect. The baseline for assessing the net GHG emissions impact of recovery measures is the national emissions rate with no intervention, as expected at the time of policy intervention.

- **Short-term net GHG impact** relates to the immediate period of the implementation or the development period of a measure (e.g., the construction of a wind turbine will lead to increased consumption of concrete and steel in the short term). In contrast, **long-term effects on climate** relate to the period after one year of implementation (e.g., the construction of wind turbines will compensate for the emissions it caused during development and have a positive net effect).

- **Green recovery spending** refers to investments in recovery measures that positively impact GHG emissions and/or the environment. Green recovery spending can fall into the archetypes listed on Annex 3 and the positive sub archetypes listed on Annex 4 .

- **Adaptation readiness** refers to the country's ability to leverage investments and convert them to adaptation actions. The Notre Dame Global Adaptation Initiative (ND-GAIN) measures overall readiness by considering three components: economic readiness, governance readiness, and social readiness.

  o Economic: captures the ability of a country's business environment to accept investment that could be applied to adaptation that reduces vulnerability (reduces sensitivity and improves adaptive capacity).

  o Governance: captures the institutional factors that enhance the application of investment for adaptation.

  o Social: captures factors—such as social inequality, information and communication technology (ICT) infrastructure, education, and innovation—that enhance the mobility of investment and promote adaptation actions.

- **The study classifies G20 countries into two groups: *developed economies*** (i.e., Australia, Canada, South Korea, the United States, Italy, France, Germany, Japan, the United Kingdom, and the European Union) **and *developing economies*** (i.e., China, Brazil, India, Indonesia, Mexico, Russia, South Africa, Turkey, Saudi Arabia, and

Argentina), following the United Nations Country Classification.[19]

2.3 Analyses

The report consists of two independent analyses complemented by a literature review. The first analysis uses the Global Recovery Observatory's database of recovery measures, taxonomy, and methodology to assess the net GHG emissions impact of the G20 member states' recovery measures in four specific sectors (i.e., transport, building, energy, and agriculture and forestry). In addition, it compares the level of climate vulnerability and adaptation readiness to the recovery spending linked to adaptation of each G20 member. The results of this analysis are shown in section 3. A literature review on how recovery measures have contributed to creating an enabling environment for implementing the NDCs complements the findings of the analyses. The results of this literature review are shown in section 4. Finally, the second analysis inputs the Global Recovery Observatory's database of recovery measures into the E3ME model to compute three recovery scenarios. The results of this analysis are shown in section 5.

2.3.1 Analysis 1. Stocktake of recovery measures and its contribution to long-term mitigation and adaptation goals.

First, for mitigation, all G20 members' recovery measures from the Global Recovery Observatory are classified into four sectors (i.e., energy, agriculture and forestry, transport, and buildings). The sector classification is based on the direct impact on the emissions reduction and/or increase of the recovery measure to a respective sector. The industrial sector is not considered because the measures included in the database are likely to have an indirect effect, rather than a direct effect, on industry emissions through changes in consumption. *Annex 3 shows the alignment between policy sub-archetypes from the Global Recovery Observatory and the four sector*s.

Each classified recovery measured is assigned either a positive, negative, or long-term neutral effect on climate using the Global Recovery Observatory's Likert scale**.** A summary of the Observatory methodology can be found at the beginning of the Annex section. The analysis assesses the green recovery spending disaggregated by economic sectors and their climate impact.

Second, for adaptation, the recovery measures without a direct effect on GHG emissions related to health, education, green market creation, communication, and social and cultural sectors were considered to have an impact on adaptation readiness and were counted as recovery spending linked to adaptation.[20]

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19 UN. "Statistical Annex." Last modified 2021.

20 Spending on adaptation was estimated using the Global Recovery Observatory, considering the following recovery policy archetypes and sub archetypes: X: Worker retraining and job creation (1 Green wβrker retraining and job creation), Z: Health care investment (non-infrastructure) (1 General medical investment),   : Communications infrastructure investment (1 Broadband investmentθ2 Remote working infrastructure investment, 3 Civil cybersecurity programs, and 4 μnplementation of digital programs), : Local (project-based) infrastructure investment (1 Urban development programs),   : Natural infrastructure and green spaces investment (1 Public parks and green spaces investment, 2 Tree planting and biodiveπity protection, 3 Ecological conservation initiatives, 4 Waterway protection and enhτncement, and 5 Agricultural

The report compares the level of climate vulnerability and adaptation readiness to the recovery spending linked to the adaptation of each G20 member. The level of climate vulnerability and adaptation readiness of each G20 member was estimated based on the ND-GAIN Country Index.[21]

Limitations of the analysis

- There are inherent limitations to the data collected by the Observatory. For example, as the data has not been updated since December 2021, it might miss some longer-term policies that are still targeting recovery but have been put into place with longer-term aims. For instance, the Infrastructure Investment and Jobs Act is not included in the Observatory data.[22] In addition, the database is somewhat subjective by design (i.e., the classification of policies to archetypes is based on expert judgment), and some definitions lack granularity and exact specification. Nevertheless, based on current knowledge, this database provides the best available and most detailed data on recovery spending induced by the COVID-19 crisis.

- Limiting the assessment to the direct effect of GHG emissions ignores that some recovery measures have a different mitigation potential. Recovery measures will be assessed with the same score and thus sometimes misrepresent the picture of the assessment. For example, a measure to support airlines with green conditions is evaluated as positive because the scenario has a positive impact compared to no intervention. By the same logic, building new homes with green conditions or new energy infrastructure is also positive. From a climate policy perspective, however, the recovery measures mentioned as examples have a different relevance, which is not reflected in the GHG effect assessment but discussed qualitatively on section four.

2.3.2 Analysis 2. Modeling the impacts of recovery measures on the achievement of the Paris Agreement targets.

About the model

The modeling of impacts of the G20 recovery measures to achieve the 1.5°C target of the Paris Agreement was carried out using *Cambridge Econometrics' E3ME macro-econometric model*. The E3ME model has previously been used extensively to assess the socioeconomic and environmental impacts of climate policies. Being an E3 model, or energy-environment-economy model, E3ME is capable of capturing energy and emission impacts of economic policies, such as the recovery policies considered.

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uplift),   : Other large-scale infrastructure investments (3 Large-scale space infrastructure),   : Disaster preparedness and capacity building investment (1 Future epidemic reaction capabilities, 2 Disaster-response infrastructure (shelters, food-stocking, water supplies), 3 Anti-flood, fires, and other climate adaptation measures), ψ: Clean research and development investment (2 Agriculture R&D programs).

21 Chen, C., I. Noble, J. Hellmann, J. Coffee, M. Murillo, and N. Chawla. "Country Index Technical Report – University of Notre Dame Global Adaptation Index." Last modified November 2015.

22 According to https://recovery.smithschool.ox.ac.uk/tracking/ on 14/07/2022.

E3ME is global in scope and produces results for 70 regions (covering each G20 member separately), with 43 industrial sectors in each region. The two-way linkages between the economy, wider society, and the environment are key features of the model. Another core feature of the model is its treatment of technology in power generation, steel, land transport, and household heating. E3ME fully incorporates Future Technology Transformation (FTT) sub-models of new technologies that are needed for the low-carbon transition.[23]

The macro-econometric specification of the E3ME model provides a strong empirical basis for analysis and is not limited by many of the restrictive assumptions common to computable general equilibrium models. For example, E3ME does not assume fully rational behavior nor optimal utilization of resources as a starting point and, therefore, incorporates real-world features such as involuntary unemployment. The depiction of the financial sector in E3ME (including endogenous money) is recognized by central banks as an accurate representation. Again, this is a favored behavior for modeling recovery measures as the crisis has created a situation where involuntary unemployment and an increased output gap (i.e., the economy performing below its potential) are evident.

E3ME can be used to assess a wide variety of scenarios, which include stimulus or austerity measures as well as policies relating to the efficient use of resources in the economy. Further information, including the entire methodology manual, may be found on the model's website at www.e3me.com.

How the E3ME model assesses the impacts of recovery measures

Recovery measures aim at stimulating demand in the economy through public spending and might have positive, negative, or neutral impacts on climate and the environment. The modeling does not judge the environmental outcome of the simulated policies a priori. Rather, it takes the approach of using the E3ME model to simulate the economic policy and then infer from the model results what is the expected environmental outcome of the given policy. For example, recovery investments in renewable energy will likely produce positive environmental outcomes, while investments in fossil fuels will likely produce negative ones. In the case of neutral policies, the environmental outcome is entirely dependent on the existing economic and energy structures (and interactions from policies implemented at the same time). An advantage of the multi-regional, country-specific, and sector-specific simulation that E3ME is capable of is that environmental impacts of neutral policies will be dependent on country-specific structures within the model. For example, a simple VAT reduction policy may have vastly different environmental impacts in a country with a decarbonized energy system than in one that is reliant on fossil fuels only. The model is able to capture and show this difference.

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23 The FTT framework is discussed in detail in Mercure, Jean-François. "FTT: Power: A global model of the power sector with induced technological change and natural resource depletion." Energy Policy 48 (2012): 799-811. https://www.sciencedirect.com/science/article/abs/pii/S0301421512005356.

Information on G20 recovery measures, including the amount in USD, was taken from the Global Recovery Observatory database and modeled at the main archetype level for each of the G20 members. The full list of Global Recovery Observatory's recovery spending archetypes used can be found in Annex 4.

Scenarios

Six scenarios were developed to understand how G20 recovery measures contribute to or undermine the achievement of NDCs and long-term climate targets (i.e., 1.5°C and 2°C targets) (See Table 1). The modeling results of each scenario include socioeconomic impacts (i.e., GDP, investment impacts, and employment generation) and emissions mitigation potential for the recovery scenarios by country and by sector. Modeling results are presented as differences from the baseline.

Baseline: Business-as-usual baseline

It incorporates the latest data on the economy, jobs, energy demand, and emissions, considering the impacts of the COVID-19 crisis. It also includes government rescue measures that have already been implemented during the pandemic, such as spending on medical emergencies and direct support to workers and businesses during lockdowns. It is assumed that the world economy will follow the business-as-usual policies (pre-COVID-19) after the pandemic, and low-carbon technologies will continue to diffuse at the rates observed in the historical data. All other scenarios are compared against this baseline.

Pathway 1: Global 1.5°C scenario

The world's transition to the 1.5°C compatible pathway is modeled through a series of ambitious green stimulus programs (energy efficiency investment, renewable subsidies, feed-in tariffs, public procurements of new low-carbon technologies) and supporting climate policies (carbon and energy tax and phase-out regulations). The complete list of the 1.5°C policies is given in Annex 5.

This emissions pathway is likely to go beyond the existing NDCs' commitment. Given the urgent need to respond to the threat of climate change, it is assumed that climate policies will kick off immediately. In this scenario, additional revenues are raised through carbon taxation and are expected to be used to fund green stimulus programs.

Pathway 2: Global 2°C scenario

A global 2°C compatible pathway was modeled as a further comparison point. The pathway is built on the global 1.5°C pathway but has minor differences in the geographical distribution of measures implemented for reaching the climate pathway. This represents the reality that some regions are more likely to adopt climate mitigation measures than others.

Scenario 1: G20 recovery

This scenario models all recovery measures from the G20 members listed in the Global Recovery Observatory database. Recovery measures are additional to any government rescue measures included in the baseline. The objective of this scenario is to understand the emissions impacts of the G20 recovery measures. Emission outcomes from this scenario are compared against the baseline, the 1.5°C pathway, and the 2°C pathway.

This scenario assumes that the total amount of recovery spending is spread between 2022 and 2024, and national governments fund the recovery spending through government borrowing where budget deficits are incurred (no austerity assumptions later).

Scenario 2: G20 recovery under fiscal constraints

Developing countries may find it more difficult to mobilize domestic financial resources for recovery spending than developed countries. Therefore, this scenario provides an alternative to Scenario 1 and assumes that only half of the recovery measures are implemented in G20 developing countries to reflect their fiscal constraints.

Scenario 3: G20 recovery with extended funding for green measures in G20 developing countries

This scenario assumes a more ambitious recovery, especially in G20 developing countries, focusing on green measures. The scenario doubles the total current recovery spending in G20 developing countries (i.e., increasing announced G20 recovery spending by 12.6%) and allocates it solely under green recovery measures, distributed across the Global Recovery Observatory archetypes following global spending shares (see Table 1).

Table 1. Additional spending distribution across green measures

Green market creation[24]	23.7%
Clean transport infrastructure investment	34.1%
Clean energy infrastructure investment	16.3%
Building upgrades and energy efficiency infrastructure investment	5.2%
Natural infrastructure and green spaces investment	14.0%
Clean research and development investment	6.7%

Source: Cambridge Econometrics Modelling, March–July 2022

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24 Green market creation includes investments in capacity building for a green and sustainable pathway, increasing energy market participation for renewables and investing in transitional or modernization technologies.

Sensitivity Analysis

As a sensitivity, a high energy price version of the G20 recovery scenario is simulated. The results of the sensitivity scenario are compared against a baseline with the same increased prices (i.e., a business-as-usual baseline with higher energy prices). The sensitivity considers the impact of highly increased global natural gas prices due to recent geopolitical developments.[25] Therefore, when the report describes results from the sensitivity run and compares them to results from the standard run, the comparison focuses on marginal differences due to the policies (and their interaction with energy prices) rather than the impact of heightened energy prices.

Limitations of the analysis

- This assessment provides an overview of plausible scenarios and a general impact assessment before a detailed ex-post analysis per country is made. It does not produce accurate forecasts of outcomes.

- Non-fiscal policy measures, such as monetary and macro-financial measures or exchange rate and balance of payments measures, are not considered in the assessment as they are not included in the Global Recovery Observatory,[26] with the database being utilized as the primary data source.

- The low data availability on the timeline of implementation of recovery measures led to the assumption that recovery measures are spread out in 2022–2024, which might not entirely reflect the reality of developing countries.

- The G20 recovery plan scenario assumes all policies/measures included in the Global Recovery Observatory database are fully implemented (the different extents of implementation are considered in the sensitivity analysis).

- The scenarios do not make explicit assumptions about the financing of the measures.

- The G20 recovery plan scenario focuses on recovery measures but excludes the latest climate policies and targets announced at COP[26]. These policies and targets are included implicitly in the global 1.5°C scenario, supported by additional climate policies required to achieve long-term net-zero targets globally.

- The E3ME model is simulation based, meaning the model outcomes are path-dependent and are influenced by policy inputs. The results of the 1.5°C and 2°C scenarios and their associated economic and job opportunities should therefore be interpreted as a possible pathway, and not as optimal pathways. In contrast to general equilibrium economic models, E3ME does not seek the least-cost way to meet temperature targets.

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25 The price assumption for natural gas employed is based on the April 2022 edition of the World Bank's Commodity Markets Outlook, assuming that global prices develop in line with the most extreme European price trajectory until 2024 and then largely stagnate.

26 Global Recovery Observatory. "Draft Methodology Document." Last modified February 1, 2021.

3. Stocktake of Recovery Measures

As of December 2021, spending on rescue measures (81%) announced by G20 members overweighs spending on recovery measures (19%), adding up to a total investment of USD 17.8 billion (see Figure 1). Even though both types of expenditures—rescue and recovery—may support a sustainable recovery, this report solely focuses on assessing spending on recovery measures as this has the highest potential to generate long-term impacts.
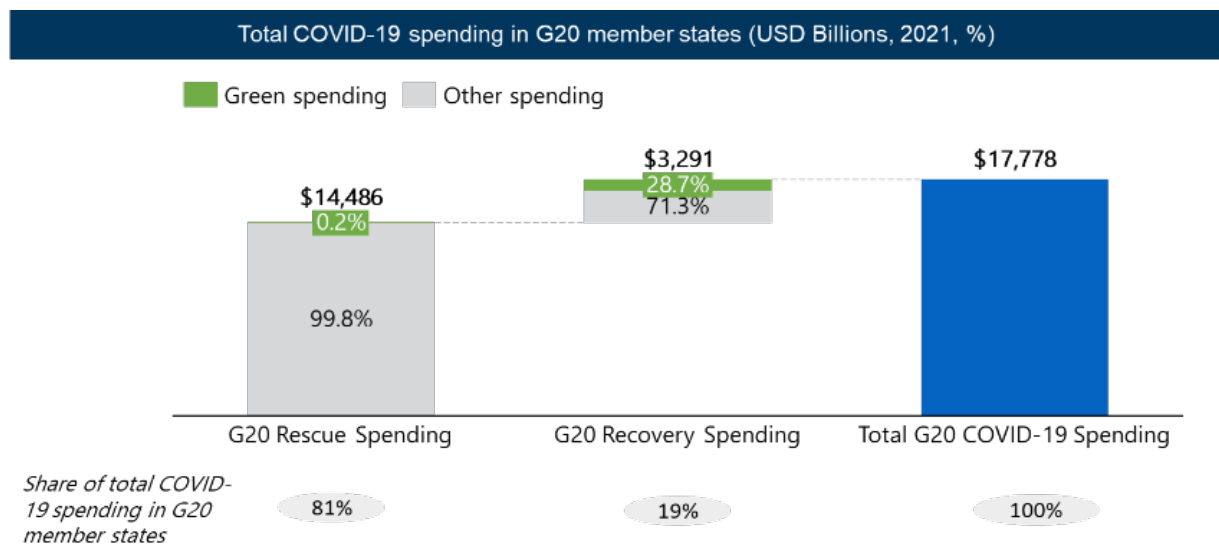
Figure 1. Total COVID-19 spending by G20 members, 2021 (USD billions)
Source: Developed by Wuppertal Institute with data from Global Recovery Observatory, last updated Dec. 2021

By the end of 2021, G20 members of developed countries announced on average 4.5 times more spending on recovery in relation to their GDP than G20 members of developing countries (Figure 2). **This is partially due to their tighter fiscal constraints and focus on social and economic rescue measures.** The difference in magnitude of recovery spending between G20 members of developed and developing countries is likely to continue. In 2022, G20 members of developing countries aim to normalize public spending to pre-pandemic levels to strengthen their fiscal health, while several G20 members of developed countries have announced an increase in recovery expenditure. For example, due to receding government spending, Argentina expects a slowing economic recovery in 2022.[27] Equally, the Indonesian 2022 budget saw a reduction in COVID-19 recovery support.[28] Moreover, even though economic recovery is identified as a key pillar underpinning the improvement of its fiscal outlook, Saudi Arabia's government budget is

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27 Zepeda, Mariana. "Argentina's economic recovery will slow in 2022 as government spending recedes." Frontierview. Last modified October 7, 2021.

28 World Bank. "Indonesia Economic Prospects (IEP), June 2022: Financial Deepening for Stronger Growth and Sustainable Recovery." Last modified June 22, 2022.

decreasing.[29] On the contrary, Japan has announced a record budget of approximately USD 797 billion (JPY 107.6 trillion) for the fiscal year 2022, reflecting an increase in spending on social security and addressing the spreading of the COVID-19 Omicron variant.[30]
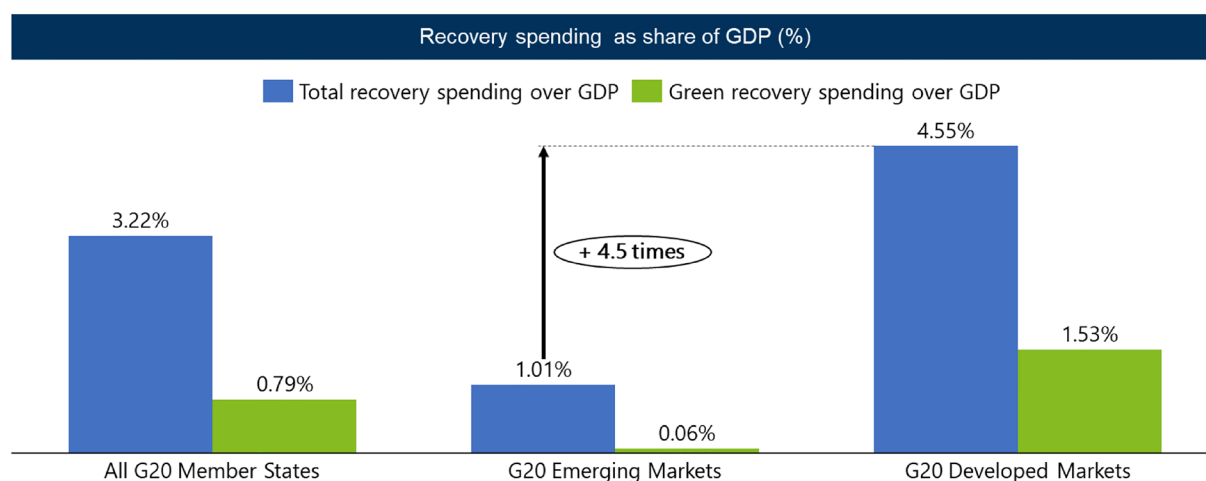
Figure 2. Recovery spending by type as a share of GDP by G20 members
Source: Developed by Wuppertal Institute with data from Global Recovery Observatory, last updated Dec. 2021

3.1 Contribution of Recovery Spending to Mitigation Objectives

By the end of 2021, green recovery spending represented nearly 29% of the total recovery spending (Figure 1)**.** Approximately 62% (USD 614 billion) of the green recovery spending of all G20 members has a positive long-term contribution toward climate goals, 32% (USD 315 billion) has no current climate contribution, and only 7% (USD 68 billion) has a negative climate contribution (Figure 4).

Green recovery spending is expected to increase slightly. During the first quarter of 2022, several G20 members announced additional green recovery spending. India stated it would spur the 2022–23 budget to sustain economic recovery and to boost economic growth.[31] The EU pledged its highest annual budget ever, dedicating USD 320 billion (EUR 313 billion) toward recovery—as the top priority to lay the foundation of a more resilient union. The second priority of this budget is the continuation of a green and digital transformation.[32] Even though its spending levels are returning to normal, Canada announced USD 9 billion (CAD 12 billion) in their 2022 budget for new green spending and incentives that aim to make adopting clean technologies more affordable over the coming years.[33]

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29   KPMG. Saudi Arabia budget report 2022. Last modified December 16, 2021.

30   Nippon.com. "Japan's Record ¥107.6 Trillion Budget for Fiscal 2022." Last modified January 17, 2021. https://www.nippon.com/en/japan-data/h01206/

31   Times of India. "Budget 2022-23 bets on spending spur to sustain eco recovery." Last modified February 1, 2022.

32   European Parliament. "EU Budget 2022 approved: investing more for a strong recovery." Last modified November 24, 2021.

33   The Conversation. "What the 2022 federal budget says about Canada's commitment to a green recovery." Last modified April 8, 2022.

3.1.1 Spending by sector.

Recovery spending with a direct impact on climate shows an imbalance across sectors. G20 members will spend approximately 70% of the total recovery budget in the transport and energy sectors. Green recovery spending was mostly allocated to economic sectors that directly impact climate. About 49% of the total green recovery spending by G20 members was focused on the transport sector, followed by 21% on the energy sector, 16% on agriculture and forestry, and 14% on buildings (Figure 4).

There are multiple reasons why allocating a high share of recovery spending in the transport and energy sectors can drive a fast, inclusive, and green recovery. However, balancing green recovery spending across sectors is necessary to ensure resilience and a shift toward an inclusive low-carbon development pathway. The electricity generation and transport sectors have the highest potential for a low-carbon transition[34] because they represent the highest share of GHG emissions among G20 members. Moreover, the energy and transport sectors have a high share of the workforce in both G20 developing and developed countries and are key sectors for developing societal resilience.[35, 36] However, other sectors should not be disregarded. For instance, recovery spending on sustainable agriculture and forestry practices may reduce agriculture's carbon footprint, capture the excess carbon generated by other industries and generate substantial co-benefits for biodiversity.[37] In addition, higher support to primary economic sectors might accelerate the reduction of inequality and promote social mobility, particularly in developing countries where support to the most vulnerable population is a priority.

The imbalance of green recovery spending across economic sectors seems to prevail in 2022 recovery budget allocations. Recovery measures announced in 2022 are still focused on energy, ground transport, and buildings. According to the Energy Policy Tracker, the United Kingdom announced four new recovery policies with a total commitment of around USD 11.9 billion, targeting the buildings and power generation sectors. The United States also announced two new recovery policies with a total commitment of USD 520 million for the buildings and power generation sectors.[38] Equally, Canada and Australia announced new energy-related recovery measures. Moreover, under the current geopolitical situation, G20 policymakers are reviewing energy security incentives to assure a green transition in a publicly supported way.

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34 Climate Transparency. "G20 GHG emissions per sector." Last modified 2021.
35 OECD. "Assessing environmental impact of measures in the OECD Green Recovery Database." Last modified April 21, 2022.
36 World Economic Forum. "Jobs of Tomorrow: The Triple Returns of Social Jobs in the Economic Recovery." Last modified May 2022.
37 World Economic Forum. Here's how we can use agriculture to fight climate change. Last modified September 20, 2019.
38 Energy Policy Tracker.2022. "G20 countries." Last modified August 17, 2022.

Recovery spending per contribution towards long-term climate goals per economic sector (USD Billions, 2021, %)

Positive contribution to climate   No contribution   Negative contribution to climate

	Total G20 green recovery spending	Transport	Energy	Agriculture & Forestry	Buildings
Total	$996	493	209	156	$139
Positive	62%	57%	81%	82%	27%
No contribution	32%	37%		18%	73%
Negative	7%	6%	19%		

Share of recovery spending (%): 100% | 49% | 21% | 16% | 14%

Figure 3. Distribution of green recovery spending per sector, 2021 (USD billions)
Source: Developed by Wuppertal Institute with data from Global Recovery Observatory, last updated Dec. 2021

3.1.2 Positive and negative spending.

G20 developing countries' efforts in green recovery were hampered due to competing priorities for addressing the health impacts of the COVID-19 pandemic. Therefore, it is observed that almost 90% of the green recovery spending with a positive long-term contribution toward climate goals comes from G20 members of developed countries (Figure 4). The imbalanced spending on recovery measures with a direct positive impact on climate between G20 members from developed and developing countries creates a two-track recovery. This imbalance hinders the achievement of international climate targets as future emitters are more likely to perpetuate business-as-usual and high-carbon activities.

Recovery spending per type of contribution towards long-term climate goals (USD Billions, 2021, %)

Positive contribution to climate   No contribution   Negative contribution to climate

	Total G20 green recovery spending	G20 Developed Countries	G20 Developing Countries
Total	996	$873	$123
Positive	62%	64%	41%
No contribution	32%	31%	33%
Negative	7%	4%	25%

62%
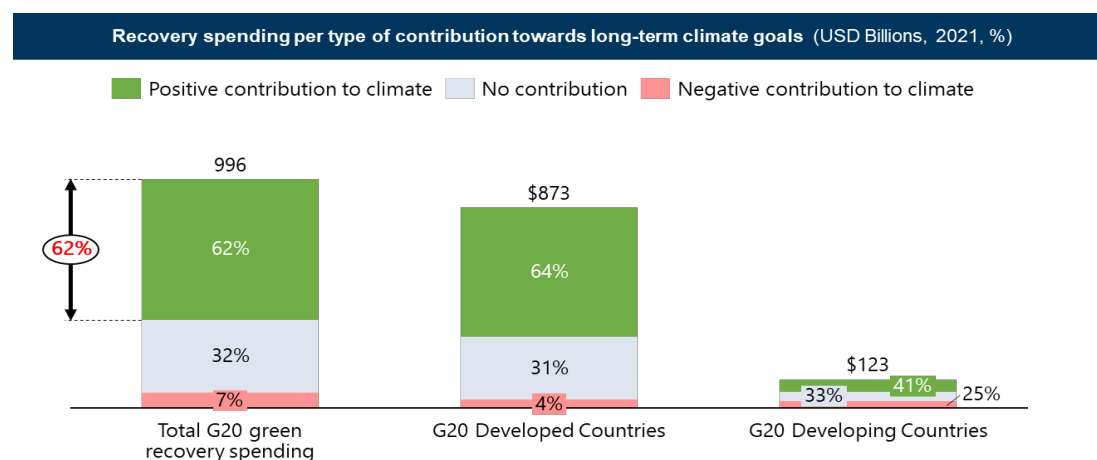
Figure 4. Recovery spending per contribution type toward long-term climate goals, 2021 (USD billions)
Source: Developed by Wuppertal Institute with data from Global Recovery Observatory, last updated Dec. 2022

Moreover, more than 95% of the recovery spending with negative long-term impacts on climate in G20 developing countries is concentrated in the energy sector (Figure 5). In response to the COVID-19 crisis**,** significant public investment commitments for fossil fuel-intensive activities in the energy sector were established, mostly by G20 developing countries, potentially missing opportunities for a low-carbon transition.[39] For example, in China, the provincial government of Hubei announced a CNY 90 billion investment over three years (2020–2022) in the coal, oil, gas, and electricity sectors to recover by increasing the energy supply capacity of the province's energy sector.[40] In Argentina, offshore activities, promotion of investment in hydrocarbons through law, and supporting activities in the Vaca Muerta natural gas reservoir are examples of long-term commitments to supporting fossil fuels. In Mexico, there is dedicated support for the national oil and gas company, PEMEX, as well as new refineries and thermal power plants. Brazil committed to building new thermal power plants and providing incentives for investment in hydrocarbon and coal-related activities.[41]
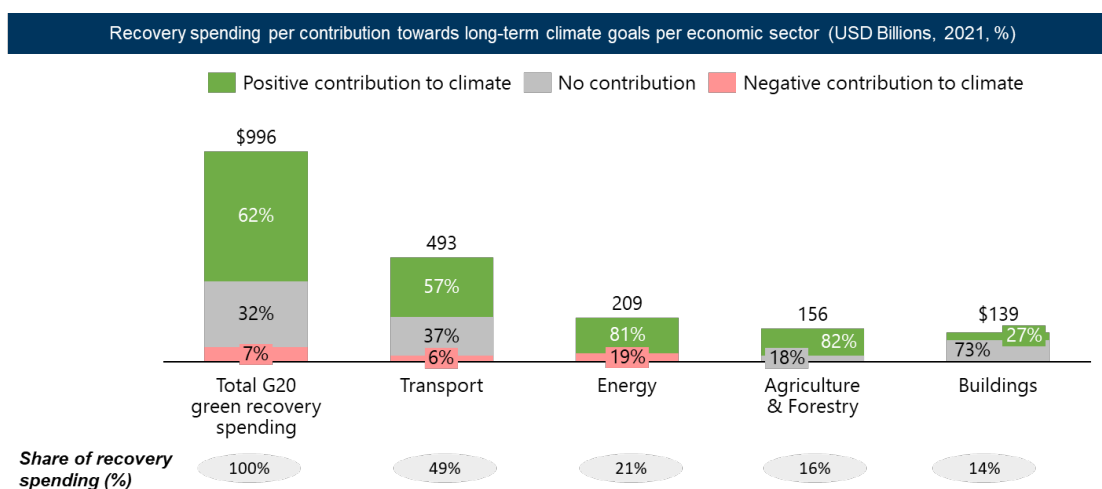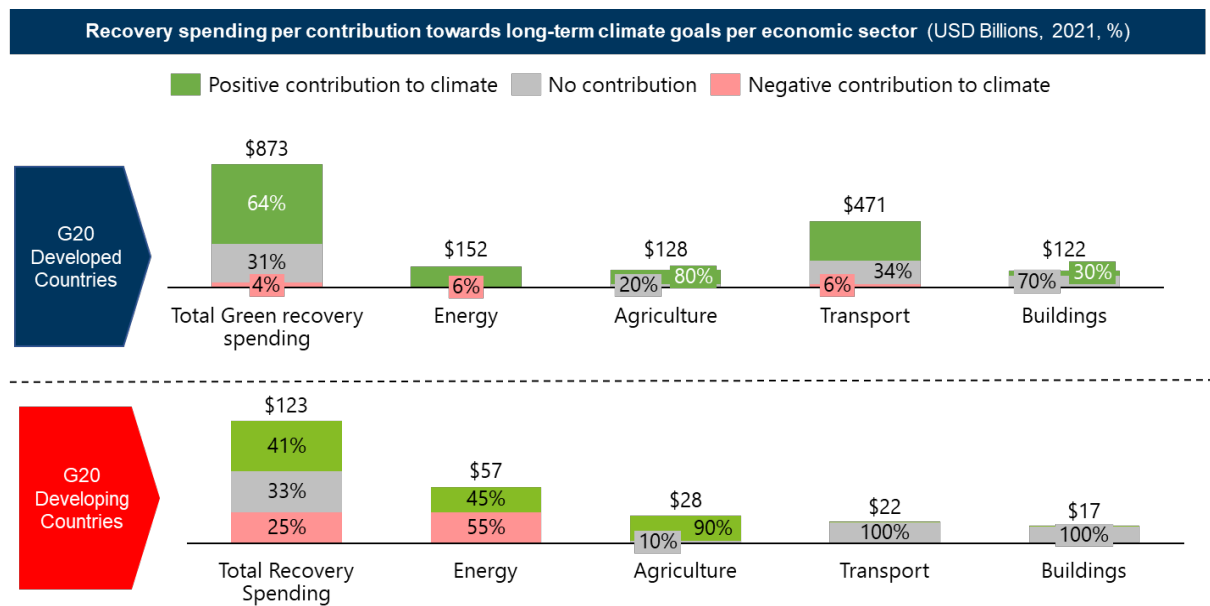

Figure 5. Distribution of recovery spending per sector and G20 group, 2021 (USD billions)
Source: Developed by Wuppertal Institute with data from Global Recovery Observatory, last updated Dec. 2021

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39 IISD. "Doubling Back and Doubling Down: G20 scorecard on fossil fuel funding." Last modified November 9, 2020.

40 OECD. "Assessing environmental impact of measures in the OECD Green Recovery Database." Last modified April 21, 2022.

41 SEI. "Pandemic recovery efforts undermine a just energy transition in Latin America." Last modified November 7, 2021.

3.1.3 Transformational effect of spending.

Some of the announced recovery spending with a positive impact on climate has long-term financial allocations, enabling a low-carbon transition. For example, Australia announced that beginning in 2021–2022, the government will provide AUD 1.6 billion for low emissions technology over ten years and AUD 20.1 million to deliver a comprehensive Global Resources Strategy over two years. In India, the government of Kerala announced a 50% reduction in motor vehicle tax for electric, fuel cell, and total hybrid battery electric vehicles (EV) for five years in the state's 2021–2022 budget. In July 2020, South Korea announced to commit KRW 160 trillion (USD 133 billion) to the K-New Deal, which aims for long-term carbon neutrality, a green transition of infrastructure, a low-carbon energy supply, and innovation in the green industry.[42] **However, green recovery spending with a positive impact on climate and short- to medium-term financial allocations was predominantly in G20 developed countries.** For example, Canada pledged to invest CAD 287 million over two years to continue the Incentives for the Zero-Emission Vehicles (iZEV) program until March 2022. The United Kingdom provided a Bus Recovery Grant (BRG) of GBP 226.5 million, which ran from September 2021 to April 2022, and provided up to GBP 56 million for the Light Rail and Tram Recovery Grant (LRTRG), which was under implementation from July 20, 2021 to April 5, 2022.

3.1.4 Multilateral spending.

Implementing cross-sectoral and cross-country recovery measures could reduce sectoral and geographic imbalances of recovery spending. This recovery approach also avoids implementing stand-alone recovery measures, which may not have a long-lasting impact, by encouraging synergies. For example, the ASEAN Socio-Cultural Community, of which Indonesia is a member, launched the ASEAN Comprehensive Recovery Framework (ACRF) to strengthen cross-sectoral and regional collaboration against the COVID-19 pandemic impacts.[43] The ARCF coordinates a regional recovery response through a cross-sectoral and cross-pillar approach that maximizes the synergies of the ASEAN market integration, avoiding the duplication of recovery efforts within the region and ensuring all recovery efforts are long-term oriented.[44]

3.1.5 Spending with no climate impact.

Recovery spending with no climate contribution in sectors that have a direct impact on climate is considered an untapped opportunity to be converted into spending with a positive long-term climate contribution. For example, recovery spending for building upgrades without green conditions will not contribute to long-term climate goals and may contribute to the short run negatively. However, linking the building upgrades to green requirements may trigger a long-term positive contribution.

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42 OECD. "Assessing environmental impact of measures in the OECD Green Recovery Database." Last modified April 21, 2022.
43 ASEAN. "ASEAN Socio-Cultural Community encourages stronger cross-sectoral collaboration towards COVID-19 recovery." Last modified March 16, 2021.
44 ASEAN. "ASEAN Comprehensive Recovery Framework." Last modified 2020.

3.2 Contribution of Recovery Spending to Adaptation Objectives

By the end of 2021, G20 members had limited announced recovery spending linked to adaptation. According to Krishnan and Brandon, only four G20 members (i.e., South Korea, China, the UK, and France) explicitly considered investing in adaptation or climate resilience in their recovery plans.[45] It is acknowledged that not all spending linked to adaptation and supporting recovery was announced, particularly by G20 developing countries.[46] For example, Indonesia increased its budget toward coast resilience, aiming to support a sustainable recovery through a blue economy program.[47] An imbalance between mitigation and adaption spending indicates that recovery packages lack a systemic response to the interaction of crises, including climate change, biodiversity loss, and the economic consequences of COVID-19.[48]

Moreover, based on the announced recovery spending, it is observed that G20 developing countries spend significantly less on recovery measures that directly or indirectly support adaptation and adaptation readiness, despite their higher vulnerability to climate change, than G20 developed countries. G20 members have different levels of vulnerability to the adverse impacts of climate change and adaptation readiness.[49] G20 developing countries have the highest vulnerability to climate change but the lowest level of readiness.[50] These countries are considered to have the greatest adaptation challenges and, therefore, have a greater need for investment to improve readiness and a greater urgency for adaptation action than G20 developed countries.[51] However, G20 developing countries have a considerably lower recovery spending on adaptation than developed countries. The increase in magnitude and frequency of climate shocks, in combination with the health crisis of COVID-19 and low recovery-related spending, may worsen poverty and inequality in developing countries, hindering an inclusive recovery (Figure 7).[52]

G20 members allocated recovery spending on measures that combine pandemic preparedness with long-term strategies for climate adaptation. Recovery spending on adaptation prioritizes food security, disaster risk prevention, access to improved sanitation and clean drinking water, employment creation for the purpose of ecosystem restorations, and infrastructure development, including nature-based solutions, resilient roads, and buildings. During 2019–2022, recovery measures for the agricultural sector address

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45 N. Krishnan and Brandon (forthcoming). "Are COVID-19 Stimulus Packages Building Climate Resilience?"

46 The low number of accounted recovery spending linked to adaptation is due to multiple reasons. For example, the launch of adaptation programs/ programs that do not necessarily emphasized its linked with recovery. The launch of adaptation projects or programs in a different timing than recovery packages, etc.

47 OECD. "Sustainable Ocean Economy Country Diagnostics of Indonesia." Last modified April 2021.

48 Ringsmuth, Andrew K., Ilona M. Otto, Bart van den Hurk, Glada Lahn, Christopher P.O. Reyer, Timothy R. Carter, Piotr Magnuszewski et al. "Lessons from COVID-19 for managing transboundary climate risks and building resilience." Climate Risk Management 35 (2022).

49 Tilleard, Simon, and James Ford. "Adaptation readiness and adaptive capacity of transboundary river basins." Climatic Change 137 (2016): 575–591.

50 Climate Transparency. "Climate Transparency Report: Comparing G20 Climate Action Towards Net Zero." Last modified 2021.

51 Chen, C., I. Noble, J. Hellmann, J. Coffee, M. Murillo, and N. Chawla. "Country Index Technical Report – University of Notre Dame Global Adaptation Index." Last modified November 2015. .

52 IDB. "The Inequality Crisis: Latin America and the Caribbean at the Crossroads." Last modified 2020.

adaptation and mitigation simultaneously.[53]

COVID-19 recovery packages have the potential to support G20 members' needs for adaptation investment and action, generating a durable economic benefit and reducing climate vulnerability. However, the evidence presented in the AGR21 report indicates recovery efforts are becoming a lost opportunity for adaptation.[54, 55, 56]
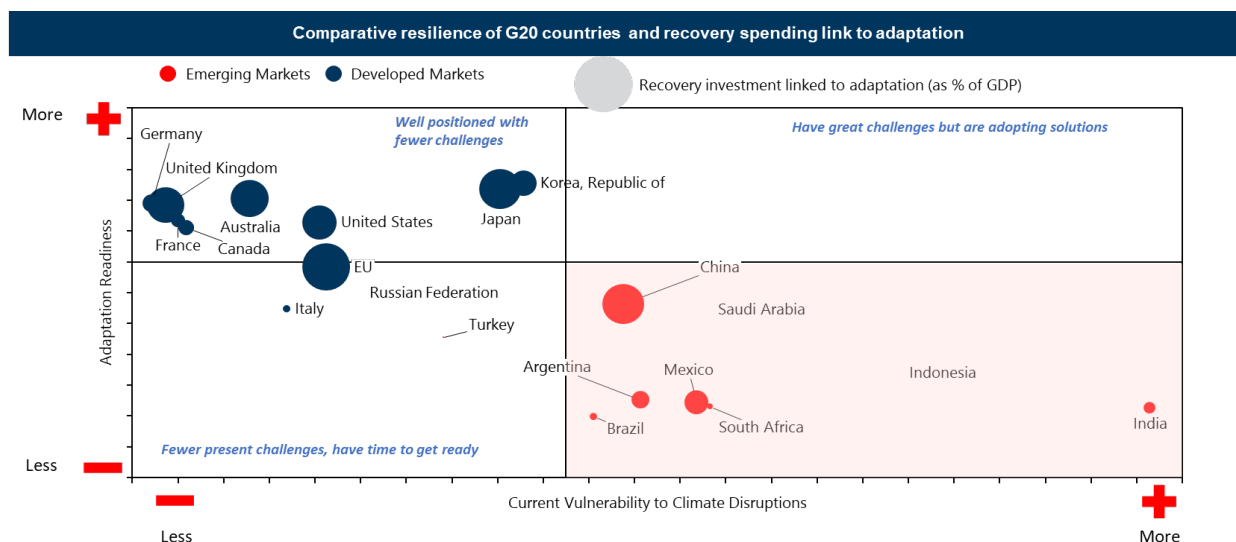

Figure 6. Comparative resilience of G20 members and recovery spending link to adaptation

Source: Developed by GGGI with data from Global Recovery Observatory, last updated Dec. 2021

3.3   Sector Recovery Measures' Positive Impact on Mitigation and Adaptation

3.3.1 Buildings

G20 recovery measures in the buildings sector with a positive effect on long-term climate goals are linked to green retrofitting programs, such as daylighting, electrification, and energy efficiency improvements. The most significant investments are taken by France (USD 9.4 billion), the United States (USD 9.1 billion), the United Kingdom (USD 5.7 billion), and South Korea (USD 5.2 billion).

Green retrofitting recovery measures have the potential to accelerate the energy transition and meaningfully contribute to achieving climate neutrality goals. The most successful green retrofitting recovery measures focus on deep (or staged deep) renovations and on the creation of frameworks for skills development, certification, awareness raising

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53 OECD. "Assessing environmental impact of measures in the OECD Green Recovery Database." Last modified April 21, 2022.

54 UNEP. "Adaptation Gap Report 2021: The gathering storm – Adapting to climate change in a post-pandemic world." Last modified November 1, 2021

55 Richmond, Morgan, June Choi, Paul Rosane, Matthew Solomon, Bella Tonkonogy (CPI) Dominic Molloy, Felipe Larrain, and Jennifer Jacobowitz Rae (GCA). "Adaptation Finance in the Context of Covid-19: The Role of Development Finance in Promoting a Resilient Recovery." Global Center on Adaptation. Last modified January 2021.

56 Global Center on Adaptation. "Global scientists call for economic stimulus to address climate adaptation and COVID." Last modified January 22, 2021.

and support for citizens, and attracting private finance.[57]

Countries with preexisting energy efficiency and building upgrade programs saw higher impacts by directing stimulus there. The use of preexisting structures may reduce the time and resources required to launch a widespread spending program.[58] An example of increasing funding to an existing program is a USD 7 billion worth upgrade—equivalent to nearly 20% of the recovery measures of the sector with a positive contribution to long-term climate goals—for the Weatherization Assistance Program in the United States (See Annex 6, Example 1).

3.3.2 Transport

Approximately 57% of G20 members' recovery spending with a positive contribution toward climate goals is linked to the transport sector. More than 70% of the total recovery spending in the transport sector was directed toward expanding existing infrastructure, 15% toward new public transport systems or line expansions, 4% to EV charging infrastructure, 4% to cycling and walking infrastructure, 4% to fuel efficiency initiatives, and 3% to others. The United Kingdom, the United States, and Mexico have allocated the most spending in this sector as a share of GDP.

Recovery spending on the transport sector, aiming to promote a behavioral change by increasing daily mobility with public transport or zero-emission options, is preferable to speed up a low-carbon development pathway. An example of a behavioral change local-level recovery action in the transport sector was the establishment of a temporary bike lane. Initially put forward by Mexico, due to its success, the intervention was replicated in Argentina, Colombia, and Peru (Annex 6, Example 3).

3.3.3 Energy

According to data from the Global Recovery Observatory, recovery spending contributing positively toward long-term climate goals in the energy sector ranges from R&D programs (16% of total recovery spending with positive climate impacts for the energy sector) to new or refurbished facilities to generate electricity from renewable sources (14%), carbon capture and storage/utilization (13%), other initiatives to reduce GHG emissions from existing fossil fuel assets (12%), hydrogen infrastructure (11%), and new or refurbished nuclear-fueled power generation plants (10%). Very little spending was recorded for battery and storage infrastructure or biofuels (4%). The great variety of green investments reflects the various needs for a successful transition of the energy sector: expanded transmission and distribution networks, smart grids, and storage are enablers for renewable energy penetration. As a share of GDP, South Korea stands out particularly positively, mostly resulting from the Korean Green New Deal (See Annex 6, Example 2).

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57 Green Recovery Tracker. 2021.

58 Oxford University. "Are We Building Back Better? Evidence from 2020 and Pathways to Inclusive Green Recovery Spending." Last modified 2021.

3.3.4 Agriculture, land use & forestry

Most of the recovery spending linked to agriculture, land use and forestry was deployed by the United States (USD 92 billion), followed by the European Union (USD 24.6 billion) and China (USD 23.7 billion). Recovery measures in this sector focus mainly on promoting ecological conservation initiatives. The most common recovery measures in this sector include wildfire risk reduction programs; air and water pollution prevention; soil protection programs; habitat restoration activities, such as planting trees and protecting biodiversity; investing in water management systems; and developing public parks and green spaces.

Due to its high employment creation potential, as well as its impacts on SDGs, recovery spending linked to the agriculture, land use and forestry sector was prioritized by G20 developing countries. Annex 6, Example 4 shows an Indian recovery measure that simultaneously fosters biodiversity, job creation, and tribal community support.

4. Contribution of Recovery Efforts to NDC Implementation

Multiple tools, databases, and periodic reports track climate action and NDC pledges in different countries. However, few studies have assessed the impacts of COVID-19 responses on the enabling environment for NDC implementation. The most prominent examples are the Climate Action Tracker,[59] the Global Carbon Project,[60] the UNDP Climate Promise Progress Report,[61] and a scientific report by Rochedo et al.[62]

This section synthesizes the existing literature on how recovery measures have contributed to the creation of an enabling environment for NDC implementation in five cross-cutting areas: (1) planning and development of climate policies, (2) government coordination, (3) mobilization of finance, (4) capacity development for the implementation of climate policies, and (5) more effective monitoring and impact measurements. In addition, it highlights further opportunities to utilize recovery measures as enablers for NDC implementation under those cross-cutting areas.

4.1 Planning and Development of Climate Policies

The alignment between national recovery plans and climate policies (i.e., NAPs, NDCs, LT-LEDS, and net-zero targets) has reinforced governments' response to economic and health needs while prioritizing the achievement of the Paris Agreement.

G20 countries are aligning and integrating NDC measures and strategies with COVID-19 recovery plans. For instance, Indonesia is generating data and evidence on the linkages between NDCs and green recovery, and Turkey's climate and recovery measures are directly linked to socioeconomic impact assessments. Other G20 members are increasingly using NDCs to make a socioeconomic case for ambitious climate action, including focusing on jobs.[63] However, opportunity areas remain unseized.

4.1.1 Mitigation

The required updating of the NDCs in 2020 and 2021 created the opportunity to integrate more ambitious climate actions and integrate recovery measures to lower emissions by 2030. However, many G20 members have not increased their previous pledges or sufficiently synergized recovery packages and NDCs. By the end of 2021, most G20 members had submitted their updated NDCs, reflecting on the impacts of the COVID-19 pandemic. Australia made the most recent submission in June 2022 and Brazil in

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59 Climate Action Tracker. Accessed June 23,2022. https://climateactiontracker.org/.

60 Global Carbon Project. "Global Carbon Budget 2021 CO_2 emissions rebound towards pre-COVID levels." Last modified 2021.

61 UNDP. "UNDP Climate Promise Progress Report." Last modified April 2021.

62 Rochedo, Pedro, Panagiotis Fragkos, Rafael Garaffa, Lilia Caiado Couto, Luiz Bernado Baptista, Bruno S.L. Cunha, Roberto Schaeffer, and Alexandre Szklo, "Is Green Recovery Enough? Analyzing the Impacts of Post-COVID-19 Economic Packages." Energies, 14, no. 17 (2021): 5567.

63 UNDP. Impacts of COVID-19 on raising ambition of national climate pledges under the Paris agreement, or Nationally Determined Contributions (NDCs).

April 2022. India has yet to submit any updates on its 2016 NDC. Out of all G20 members, 11 (i.e., Argentina, Australia, Canada, China, the EU,[64] Japan, Saudi Arabia, South Africa, South Korea, the UK, and the US) claimed stronger mitigation targets than their previous NDC, five (i.e., Brazil, India, Indonesia, Russia, and Turkey) did not increase their mitigation targets, and one (i.e., Mexico) reduced their mitigation target.[65] Of the 11 G20 members with increased ambitions, members that have practiced renewable energy, like Canada and the EU, show strong synergies between their green recovery measures and NDCs. Other G20 members show conflicting support between their NDCs and recovery measures. For example, countries that still use fossil fuels as a main source of energy—including Argentina, Brazil, and Mexico—bolster fossil fuel consumption in their economic recovery packages.

The pursuit of a green and resilient economic recovery partially motivated G20 members toward net-zero pledges. However, these are yet to be formalized in the NDCs. For example, China, Indonesia, and South Africa announced net-zero targets but have not yet reflected them in their NDCs. Moreover, contrary to Canada, the European Union, Japan, and the United Kingdom—which committed to legally binding net-zero emissions targets by 2050—the United States has not announced any legally binding net-zero pledges. Moreover, seven G20 members are yet to state net-zero targets (i.e., Australia, India, Mexico, Russia, South Africa, Saudi Arabia, and Turkey). It is estimated that if all G20 members adopt mid-century net-zero emissions commitments and align their NDCs with a 1.5°C pathway, end-of-century global warming could be limited to 1.7°C.[66]

4.1.2 Adaptation

After a delay in the development and implementation of NAPs due to the pandemic, G20 members ramped up efforts to develop and revise adaptation policies. Five G20 members published or reviewed at least one national-level adaptation planning instrument. The Russian Federation published its first National Adaptation Action Plan. South Africa published new adaptation policies that significantly updated previous versions from 2006 and 2011, respectively, and launched its National Climate Change Adaptation Strategy in September 2021. South Korea amended its National Strategic Plan for Climate Change Adaptation (2021–2025). Argentina decreed the creation of the regulation for the External Advisory Council to oversee the National Plan of Adaptation and Mitigation of Climate Change (2022) and continue the development of the plan up to 2030 and the long-term low-emissions resilient development strategy up to 2050, which is scheduled to be presented at the UNFCCC COP 27.

It is observed that G20 members' recovery and NAPs could further mutually reinforce actions on five adaptation fronts: (1) strategic assessment of compound risks, (2) disaster risk prevention and risk management systems, (3) the role of adaptation in increasing population health and reducing risks for infectious disease, (4) reinforced

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64 Included in the EU's NDC: Germany, France, and Italy.

65 Climate Action Tracker. Accessed June 10, 2022. https://climateactiontracker.org/.

66 Climate Analytics and World Resources Institute. "Closing the gap: The impact of G20 Climate Commitments on Limiting Global Temperature Rise to 1.5°C." Last modified September 2021.

local-level interventions, and (5) A wider application of nature-based solutions across G20 members to support adaptation as well as mitigation objectives should be pursued.

Opportunity area

In line with their net-zero pledges, G20 members should play a leading role in developing their LT-LEDS. LT-LEDS can guide recovery plans through their long-term trajectory and help with the allocation of financial resources. However, several G20 members are yet to submit their LT-LEDS (i.e., Turkey, Saudi Arabia, Russia, China, Australia, and Brazil).

4.2   Government Coordination

A critical requirement for aligning climate policies with sustainable recovery plans is extensive coordination within national institutions, between different government levels, and between stakeholders.[67] To allow for this complex coordination and the timely development of recovery plans in the wake of the COVID-19 crisis, G20 members established new coordination mechanisms. These coordination mechanisms can be maintained and leveraged to facilitate NDC implementation as they are agile, capable of delivering results under time constraints, and facilitate cross-sectoral prioritization.

The establishment of multi-ministerial technical task forces in charge of the economic recovery response to the COVID-19 crisis increased government coordination in a limited amount of time. The multi-ministerial approach ensured the alignment of government priorities and facilitated the identification of synergies across sectors. It also avoided the implementation of stand-alone measures. For example, Italy established an Experts' Task Force for Reconstruction, which aimed at identifying practical and systemic solutions. This task force also considered cross-cutting issues such as gender.[68]

Subnational-level coordination was also strengthened to facilitate a green recovery. For example, the decentralized cooperation between local government officials resulted in the replication of best recovery practices across EU cities. Similarly, the Alliance of Mexican Governors for Climate engaged in dialogues to promote an inclusive recovery through subnational coordination, allowing synergies between states and knowledge transfer of best green recovery practices.[69] These subnational coordination efforts should be further encouraged to ease the implementation of local- and provincial-level NDC measures.

Moreover, independent task forces for recovery strengthened the coordination between government and civil society. For example, Canada's Task Force for a Resilient Recovery is an independent group of finance, policy, and sustainability leaders that develops analyses and provides recommendations to the Canadian government on how to seize green recovery opportunities.[70]

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67   UNDP. 2020. "Building the Economy of Tomorrow: Using NDCs to Inform Green Recovery."

68   Jakubowska, Joanna, Ondřej Plevak, Patrik Szicherle and Zuzana Gabrizova "Drafting national recovery plans: A laborious exercise for Visegrad countries." EURACTIV. Last modified February 10, 2021.

69   WRI Mexico. "Abre la Alianza de Gobernadores Mexicanos por el Clima diálogos por la recuperación." Last modified August 23, 2020.

70   Task Force for a Resilient Recovery. 2020. "Let's build back better."

Opportunity area

Greater coordination between the different levels of governments needs reinforcement to encourage the scale-up or replication of subnational recovery and NDC actions. To do so, G20 members should leverage their Green Recovery Task Forces by integrating a regional perspective within their mandates. Moreover, recovery plans aligned with NDCs, NAPs, and LT-LEDS should include subnational targets or geographically differentiated measures for mitigation and adaptation.

4.3 Mobilization of Finance

The COVID-19 pandemic increased the financing gap for NDCs, with earlier estimates of government funds available for mitigation and adaptation projects sharply reduced as government budgets were diverted to large emergency relief programs.[71, 72] In addition, the recent geopolitical developments will likely further *divert financial* resources and reduce the speed of sustainable global recovery and implementation of the climate agenda. However, some recovery efforts have increased the availability and access to sustainable finance for the implementation of recovery measures and NDCs in the face of the current fiscal constraints.

Global green recovery initiatives have increased access to finance from multilateral financial institutions. For example, in a move to enhance collaboration in adaptation amid the COVID-19 pandemic, the Adaptation Fund (AF), the Climate Investment Funds, the Green Climate Fund (GCF), and the Global Environment Facility released a joint statement to support developing countries on the road to a climate-resilient recovery from COVID-19.[73] In line with this statement, the AF received unprecedented support with a record USD 356 million in new pledges—triple what it raised in 2020 and nearly triple its USD 120 million fundraising goal for 2021. G20 member contributors included for the first time the United States (USD 50 million), Canada, the European Union (USD 100 million), and new pledges from Germany (USD 50 million to AF and to USD 100 million GCF).

The use of innovative financing mechanisms[74] has increased, expanding private sector financing and allowing developing countries and Least Developed Countries to have a more stable funding source for their recovery measures and NDCs.[75] As a recovery response to the COVID-19 crisis, G20 members promoted innovative financing instruments (i.e., blended finance, sustainable bonds, and the redistributive allocation of Special Drawing

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71 ADB. "Green Finance Strategies for Post-COVID-19 Economic Recovery in Southeast Asia." Last modified October 2020.

72 Convergence. "The State of Blended Finance 2021." Last modified 2021.

73 Adaptation Fund. "Adaptation Fund: Key Achievements of 2021 and Entering 2022 with Promise." Accessed June 15,2022.

74 According to the Leading Group on Innovative Financing for Development, innovative financing includes those sources and mechanisms that are not covered by traditional aid flows such as ODA. Two sub-categories of innovative financing ara distinguished: (i) innovative financing sources generating new funds for sustainable development, and (ii) innovative financing mechanisms contributing to enhance the efficiency, impact, and leverage of existing resources (public, private, or under the form of public-private partnerships).

75 Gautam, Deepali, Rohit Goel, and Fabio Natalucci. "Sustainable Finance in Developing countries is Enjoying Rapid Growth, But May Bring Risks." IMF. Last modified March 1, 2022.

Rights) as a priority under the Saudi Arabian and Italian presidencies.[76] G20 efforts, in combination with the changes in financial markets, have resulted in an unprecedented 185% increase in the worldwide issuance of sustainability bonds volume since 2019.[77] Similarly, the annual capital flows of blended finance have increased by almost 200% since 2019.[78] Multilateral development banks (MDBs) and development finance institutions (DFIs) have also assumed a leading role in promoting innovative finance mechanisms to support G20 members' recovery plans. For example, to advance the development of more resilient water systems in Brazil, supporting adaptation and recovery simultaneously, the International Finance Corporation supported the first sustainability-linked loan in the Brazilian water sector.[79]

G20 members are using the recovery experience as an opportunity to build stronger public finance systems, which are crucial for a strong recovery. Ministries of finance are implementing emergency policies and procedures to withstand the fiscal and social impacts in the event of a disaster as well as to ensure the effective delivery of exceptional payments. Moreover, governments are increasingly switching toward performance-based budgeting, using accrual basis accounting, and applying performance budgeting systems at the sectoral level.[80] Similarly, innovative Climate Budget Tagging schemes are being implemented. For example, Indonesia has used Climate Budget Tagging to track climate-related expenditures in the national budget since 2016. This tool allows the government to monitor its climate spending, make informed decisions about future budgetary allocations, and prioritize climate spending.[81]

Opportunity areas (further details in finance track of the G20)

To increase finance mobilization for a green recovery, countries should pursue further integration across the planning, performance-based budgeting, and reporting.

To reduce future fiscal constraints for recovery measures, countries should prioritize recovery investments in economic sectors that might have positive impacts on future fiscal revenues or widen the tax base by reducing informality. For example, cash transfer recovery programs for forestry restoration can be deployed, in combination with social protection schemes focused on integrating the informal economy into the sector, thus reducing tax evasion and supporting mitigation as well as adaptation.

Allow DFIs to lead the collaboration with the private sector to drive more capital. DFIs can leverage private sector finance through innovative financing instruments, partner with local development banks, and complement the support with technical assistance to governments in a more effective fashion than governments.

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76 Berensmann, Kathrin. "How Can the G20 Support Innovative Mechanisms to Mobilise Financial Resources for LDCs in a Post-Pandemic World?" IAI. Last modified 2021.

77 Jones, Liam. "Sustainable Debt Tops $1 Trillion in Record Breaking 2021, with Green Growth at 75%: New Report. Climate Bonds." Last modified April 25, 2022.

78 Convergence. "The State of Blended Finance 2021." Last modified 2021.

79 Hanway, Cheryl Edelson, and Henri Blas. "Private sector financing can accelerate a green recovery for cities. World Bank." Last modified October 21, 2021.

80 Gurazada, Srinivas. "Public Financial Management in the Post-COVID World." PEFA. June 10, 2022.

81 OECD. "Sustainable Ocean Economy Country Diagnostics of Indonesia." Last modified April 2021.

4.4   Capacity Development for the Implementation of Climate Policies

Technical support tools, guidelines, and overall capacity for implementing recovery projects, innovative financing measures, government coordination, and enforcement of climate policies are often lacking. UNFCCC identified three capacity gaps in integrating sustainable recovery elements into coherent NDC implementation and planning: (1) limited articulation and communication strategies at the country level and development of project proposals, (2) mobilization of financial resources for NDC implementation and deficiencies in national regulatory frameworks related to financial systems, and (3) a lack of analysis of labor market trends.[82] Recovery efforts have slightly contributed to closing two of these capacity gaps.

Articulation and communication strategies at the country level and development of project proposals. The accelerated increase in sustainable finance has increased the demand for investment-ready sustainability projects. Consequently, countries are being forced to increase their capacity and knowledge to prioritize green projects within the national planning, packaging adaptation actions into project proposals for funding, identifying synergies sectors, enhancing their long-term capacity for planning, and developing bankable green projects. Countries have received support for capacity development in these areas from financial institutions. For example, under the GCF Readiness Programme, the GCF supports developing countries in advancing their climate-resilient recovery strategies and incorporating them into their NDCs.[83] This is done by providing a readiness grant, increasing the budget allocation of a current readiness grant, or via GCF technical experts' support. Moreover, the GCF Readiness Programme is being highlighted to increase countries' capacity for sustainable recovery project formulation.

Capacity to mobilize financial resources for implementing NDCs. Better prepared projects are the catalyst to attract increased flows of green capital. However, countries lack the knowledge and capacity to scale up innovative financial mechanisms. As part of their reinforced support for a sustainable recovery, MDBs have scaled up their capacity-building assistance to structure blended financing.

Opportunity area

Lack of analysis of labor market trends. Despite the importance of skills development to ensure both a sustainable recovery and a low-carbon transition, it is estimated that funding for skills training (green and non-green skills) in G20 members states' recovery plans amounts to about 3% of the total recovery budget, while funding for green skills training accounts for approximately 1%. Recovery expenditure related to skills development is primarily deployed by G20 advanced economies (i.e., China, the UK, the US, Canada, the EU, France, and South Korea). Moreover, the quantification of existing and potential green jobs, as well as the assessment of labor markets to anticipate green skill requirements for NDC implementation, is still insufficient, particularly in G20 developing countries and for adaptation-related activities.

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82   UNFCCC. "11th Durban Forum on Capacity-building." Last modified June 8, 2022.

83   GCF. "Guidance Note – GCF Readiness Support to Climate Resilient Recovery." Accessed June 10, 2022.

Therefore, best case examples of skills development programs for addressing labor market trends need to be emulated in G20 developing countries. For example, the United Kingdom launched the Green Jobs Taskforce[84] as part of its Ten Point Plan for a Green Industrial Revolution[85] to transform the job market so it can support the government's plan to Build Back Better[86] and net-zero targets. The taskforce brings together government, industry, the education sector, and other stakeholders to assess the skills needed for a low-carbon transition, provide recommendations for the upcoming national net-zero strategy, and direct apprenticeship courses and standards for reskilling.

A low number of recovery measures focused on adaptation-related research. Recovery plans in the United States, Germany, the United Kingdom, the European Union, France, Canada, and China include substantial support for research programs. According to the International Energy Agency Sustainable Recovery Tracker, recovery policies in force and ended supporting research focused mostly on circular economy and on low-emission transport and energy technologies, such as clean hydrogen technologies, EV supply chains, energy storage, alternative fuels, and direct air capture.[87] Recovery support for research related to adaptation and effective measures for resilience pales in comparison to the support for mitigation technologies. G20 countries could reallocate recovery funds to overcome the knowledge barriers. Recovery funds should help develop an understanding of climate change impacts at the local and sectoral levels, the potential for effective climate risk reduction, the assessment of systemic risks, and the development of adaptation technologies.

4.5 Recovery Spending on Climate, Environment, and Social Development

As a response to the COVID-19 crisis, G20 members leveraged their open and digital government solutions to increase transparency on the response to disease control and the allocation of public resources for recovery. As a member of the Open Government Partnership, the Republic of Korea is an example of using technology to secure public transparency and openness during the COVID-19 crisis.[88]

However, the lack of transparency for budget allocation and data gaps on the impacts of recovery measures remain a constraint for the development and implementation of recovery plans as well as NDCs.

Opportunity area

Most of the G20 members do not seem to have any recovery-related indicators to measure recovery impacts.

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84 GOV.UK. "Green Jobs Taskforce." Accessed June 10, 2022.

85 GOV.UK. "The Ten Point Plan for a Green Industrial Revolution (HTML version)." Last modified November 18, 2020.

86 GOV.UK. "Build Back Better: our plan for growth." Last modified March 3, 2021.

87 IEA. "Sustainable Recovery Tracker." Last modified 2021.

88 Sharon, Alita. "South Korea looks to tech to combat Covid-19". OpenGov Asia. Last modified March 14, 2020.

G20 members that have specifically established indicators to quantify the climate impact of recovery measures are Canada, the United States, and the European Union. The Recovery and Resilience Scoreboard of the European Union includes a set of 14 common indicators that are used to report national recovery progress and plans for all EU countries. The identified indicators cover all six EU policy pillars, and eight indicators involve the pillars of green transition and smart, sustainable, and inclusive growth. This includes indicators such as annual primary energy consumption savings, additional operational capacity installed for renewable energy, and populations benefiting from protection measures against floods, wildfires, and other climate-related natural disasters.[89] Countries like the United States or Canada have program-specific indicators. For example, the US Department of Energy has indicators to measure energy intensity and energy performance. The Canadian Expert Panel on Climate Change Adaptation and Resilience recommends a suite of 54 indicators across five different areas.[90] Among these five areas is reducing climate-related hazards and disaster risks, as well as building climate resilience through infrastructure, which include four objectives and corresponding indicators for each objective.

Certain G20 members, including Russia, Indonesia, and Italy, use indicators that can be linked to the SDG-related socioeconomic indicators—such as the growth rate of real income, the unemployment rate, the GDP growth rate, welfare, and household consumption— to track the impact of their NAPs.[91] Other examples of what countries reported as measures include having indicators to monitor the budget allocation in the economic recovery of the most vulnerable sectors (Mexico) or, more generally, reporting the recovery momentum and potential brakes in the coming months of 2022 (Brazil).[92]

Ex-ante and ex-post assessments need to be built into recovery measures to ensure that their impacts can be monitored over time.[93] This is particularly important for adopting evidence-based policies for a sustainable recovery and engaging stakeholders in decision-making.

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89 European Commission. 2021. Commission Delegated Regulation (EU) 2021/2106. Official Journal of the European Union. Accessed June 10, 2022.

90 Expert Panel on Climate Change Adaptation and Resilience Results. "Measuring progress on adaptation and climate resilience: recommendations to the Government of Canada." Last modified 2018.

91 Faculty of Economics and Business, Universitas Indonesia (LPEM FEB UI) and BAPPENAS. "Thinking Ahead: Indonesia's Agenda on Sustainable Recovery from COVID-19 Pandemic." Last modified December 2020; Elcano Royal Institute. "Italy's National Recovery and Resiliency Plan's climate impact." Last modified December 16, 2021.

92 Eco Emerging. "A recovery in loss of momentum." Last modified 2022.

93 OECD. "Assessing environmental impact of measures in the OECD Green Recovery Database." Last modified April 21, 2022.

5   Current and Potential Recovery Scenarios

Green recovery measures have the potential to support decarbonization and resilience activities, advancing NDC implementation and the achievement of the Paris Agreement.[94] Therefore, there are multiple studies assessing the future impacts of COVID-19 recovery spending on the international climate goals. For example, Rochedo et al. assessed the financial gap between pledged recovery packages and the investment needs to reach the Paris Agreement goals on a global level. Dafnomilis et al. examined the contribution of recovery measures to reducing global CO_2 emissions. While Pollitt et al., Hummelen et al. and Shan et al. all have analyzed the impact of possible recovery measures on global emissions as well as on the economy concluding that sufficient green recovery measures can contribute reaching climate goals.

This section assesses the impacts of the G20 announced recovery spending on the international climate goals for 2022–2050. It uses the E3ME macro-economic modeling to assess (1) the expected GHG emission reductions derived from recovery spending and (2) the expected macro-economic impacts (i.e., GDP and employment) of the recovery spending. To this end, six different scenarios were developed, as shown in Table 2. Scenario 1 is used as the baseline, scenarios 2 and 3 are climate trajectories, and scenarios 4, 5, and 6 directly focus on recovery.

Table 2. Overview of simulated scenarios

Scenario	G20 recovery measures included	Mitigation pathway	Further information
Baseline: Business-as-usual (BAU) baseline	None	None	• Business-as-usual pathway • Follows historical emission and technology adoption trends
Pathway 1: Global 1.5°C scenario	None	1.5°C by 2100 compatible pathway	
Pathway 2: Global 2°C scenario	None	2°C by 2100 compatible pathway	

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94 World Bank. "Impacts and Lessons Learned Supporting NDC Implementation." Last modified 2021.

Scenario 1: G20 Recovery	All G20 recovery measures from the Global Recovery Observatory database	N/A	• Assumes recovery measures are deployed during 2022 and 2024 • As a sensitivity, a high energy price version of this scenario is simulated to reflect the ongoing geopolitical situation
Scenario 2: G20 recovery under fiscal constraints	• As the G20 recovery scenario assumes, 100% of the recovery measures from G20 advanced economies are deployed • But only 50% of the recovery measures of G20 developing countries are deployed	N/A	
Scenario 3: G20 recovery with extended funding for green measures in G20 developing countries	• As the G20 recovery scenario assumes, 100% of the recovery measures from G20 advanced economies are deployed • But recovery spending of G20 developing countries is double, and it is spent on green measures	N/A	

5.1   GHG Emissions Reduction Impacts

5.1.1 Scenario 1: G20 recovery (i.e., current recovery spending).

The G20 current recovery spending (Scenario 1) leads to average emissions savings of around 1% compared to the baseline (approximately 0.3 $GtCO_2$ per year). This saving is persistent, achieved by 2025, and stable until 2050. This scenario includes all identified G20 recovery measures and not just green spending, so increases in emissions from higher economic activity are also included.

The main reasons for the limited reduction in emissions from the current recovery spending are:

- **A low recovery spending on mitigation measures**. Up to the end of 2021, less than 30% of the total recovery spending was classified as having a positive impact on reducing GHG emissions.

- **A short-term impact of current recovery spending**. The impact of the COVID-19 recovery response to climate change mitigation depends on long-term trajectory shifts. However, the current recovery spending is expected to last just a few years. Moreover, the economic crisis and lockdown restrictions linked to the COVID-19 pandemic in 2020 led to a temporary decline of only 5.4% in energy-related CO_2

emissions (1.9 billion tons of CO_2)—comparable to the annual emissions reduction rate needed to achieve the 1.5°C target. However, emissions soon rebounded to near pre-pandemic levels in 2021.[95] To achieve the 1.5°C target, global emissions would have to be reduced at a comparable rate every year.

- **Policies being incoherent with recovery efforts**. Without supporting policies, green recovery alone will not lead to large emissions reductions. For example, spending support for electricity generation from wind and solar will not be as effective as when accompanied by a coal phase-out policy or a carbon tax to help speed up the transition.

CO_2 emission reductions associated with G20 recovery spending
(% emission savings against baseline, 2020-2050)

Source: Cambridge Econometrics modelling, March-July 2022
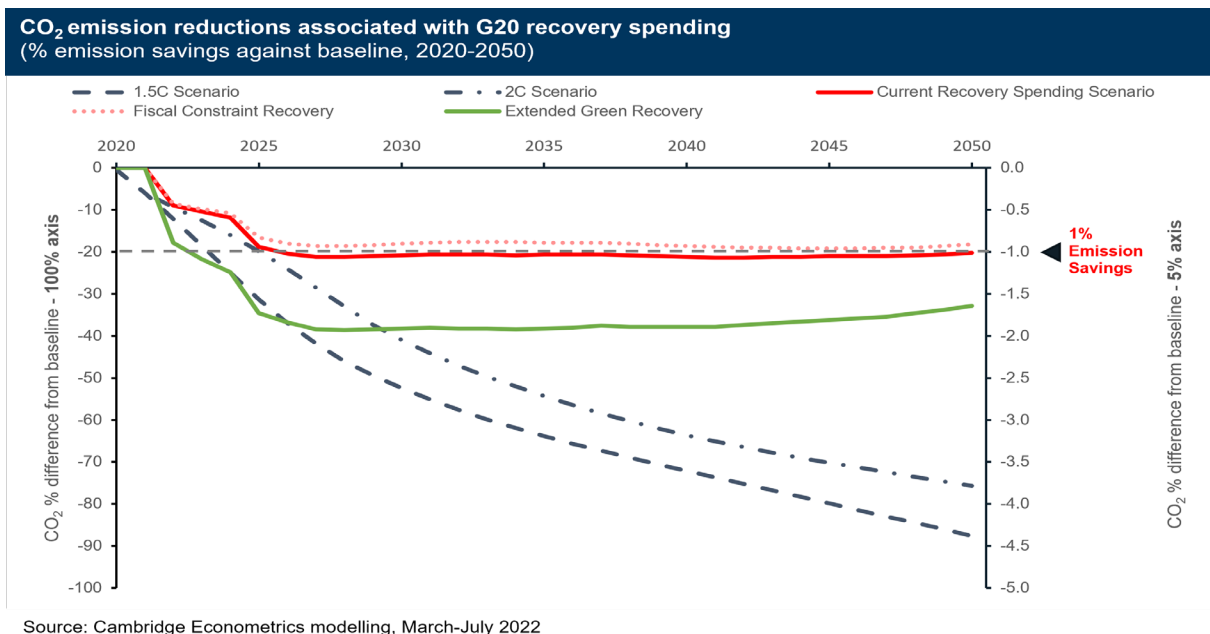
Figure 7. Emissions reductions associated with G20 recovery spending, 2020–2050 (% emissions savings against baseline)

5.1.2 Scenario 2: G20 recovery under fiscal constraints.

A fiscal constraints scenario (Scenario 2) was set up to understand the impacts of reduced implementation of recovery packages in G20 developing countries with little fiscal headroom. Scenario 2 assumes the same structure of recovery measures as the current recovery scenario (Scenario 1), but it limits the magnitude of recovery spending in G20 developing countries to 50%.

The *G20 recovery scenario under fiscal constraints* (Scenario 2) leads to an average emissions savings of 0.87% compared to the baseline for 2022–2050. The difference between the fiscal constraint and *current recovery spending scenarios* (Scenario 1) is small because total recovery spending is dominated by high-income G20 countries that are

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95 Global Carbon Project. "Global Carbon Budget 2021 CO_2 emissions rebound towards pre-COVID levels." Last modified 2021.

not subject to the same fiscal pressures in this scenario. Since the share of green recovery spending in G20 developing countries is also comparatively small, the emissions outcomes remain similar to the *current recovery spending scenario* (Scenario 1). For example, under the current G20 recovery spending scenario (Scenario 1), it is observed that the European Union, Japan, and the United States show the highest emissions reduction contributions because their green measures have a much larger share in total recovery spending. Recovery spending from G20 developing countries tends to have lower climate contributions (Table 3). Therefore, when assuming fiscal constraints, the climate contribution of G20 developing countries will not represent a big percentage change.

Table 3: Modeled percentage reduction in CO_2 emissions in 2030 compared to the baseline scenario per economy

Germany	-3.81
Japan	-3.75
United Kingdom	-3.68
South Korea	-3.17
United States	-2.49
France	-2.28
European Union	-1.79
Italy	-1.02
Mexico	-0.92
Australia	-0.78
China	-0.64
Canada	-0.63
South Africa	-0.39
Saudi Arabia	-0.3
Indonesia	-0.02
Russia	-0.02
India	0.00
Brazil	0.03
Turkey	0.09

Source: Cambridge Econometric modelling, March–July 2022

Countries with limited fiscal headroom may prioritize short-term growth and employment over an emissions reduction despite larger benefits in the long term. Therefore, **international financial support is key to enabling developing countries to adopt long-term emissions reduction policies**. IRENA's modeling of the Planned Energy Scenario (PES) on the World Energy Transitions Outlook (2021) explores the socioeconomic impacts of implementing such policies under a scenario of limited international financial support to developing countries that might be subject to fiscal constraints (see Box 1).

BOX 1 (1/2) Impact of selected policies on the distribution of socioeconomic outcomes: IRENA analysis

The 2021 edition of the World Energy Transitions Outlook (WETO) (IRENA, 2021) focused on the differential socioeconomic outcomes wrought by the two main scenarios: the Planned Energy Scenario (PES) and the 1.5°C scenario. The policy basket stipulated in the 2021 edition of WETO embraced relatively high carbon prices, aligned with the 1.5°C climate goal, and limited flows of international cooperation (USD 290 billion/year, or three times current pledges) through 2050. The global results improved GDP, jobs, and welfare. But regional or national socioeconomic disparities emerged between developed and developing countries, and these were in part linked to fossil fuel dependence. Indeed, a few countries—mainly developing countries or fossil fuel-dependent ones—saw dips in GDP when comparing the two scenarios: the 1.5°C scenario and PES.

In the 2022 edition of WETO (IRENA, 2022), a sensitivity analysis was carried out to better understand the implications of differing policies on economies and societies. Policy basket A (PB-A) entails a high carbon tax and low international cooperation (i.e., limited flows of funds to developing countries, although higher than current pledges). Policy basket B (PB-B) imposes a lower carbon tax (but higher than real-world levels) combined with stronger international cooperation.

Figure 8. Energy transition roadmaps and climate policy baskets

At the global level, both variants of the 1.5°C scenario enhance GDP in similar ways. Global GDP is 0.4% to 0.5% higher in the 1.5°C scenario than in the PES by 2030 (Figure 9, left bars) with both policy baskets. The policy baskets have nearly neutral effects on a global scale. In both models, GDP is 2.2%–2.3% greater than in the PES, on average, from now until 2030. PB-B, on the other hand, promotes employment more than basket A, rising from 0.9% to 1.2% in 2030. PB-B provides 1.6% more jobs across the economy than in the PES, on average, between now and 2030, while PB-A creates 1.2% more jobs.

This disparity can be explained by the increase in public investment and expenditure in labor-intensive sectors in developing nations that receive international assistance. When looking at policy baskets at the regional and country levels, various pictures emerge: a few countries are marginally worse off, while many others gain greatly. Improved budgetary freedom given by increased international engagement under basket B benefits recipient developing countries greatly. It enables social demands to be met and structural inequities to be eliminated, hence increasing the likelihood of popular acceptance of transition policies.

BOX 1 (2/2) Incidence of selected policies on the distribution of socioeconomic outcomes: IRENA analysis
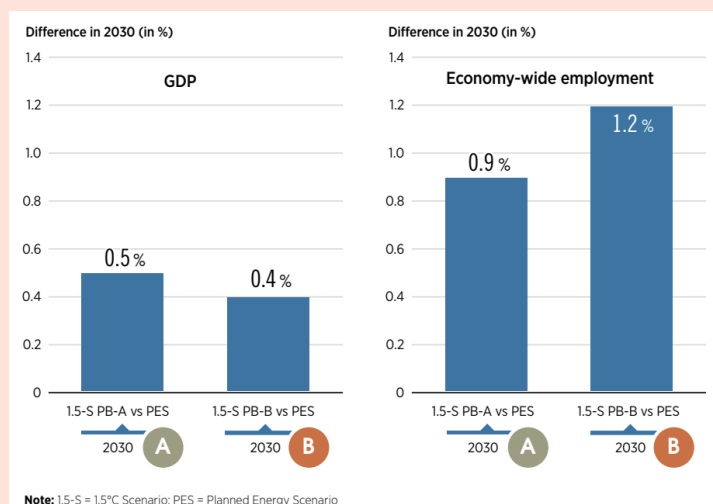

Figure 9. Global GDP and economy-wide employment in the two 1.5°C scenario variants

The number of people working in the global energy sector by 2030 could rise from 106 million under the PES to 139 million under the 1.5°C scenario (Figure 10). Job losses in conventional energy jobs (i.e., fossil fuels and nuclear) are more than offset by gains in renewables and other energy transition-related technologies (i.e., energy efficiency, power grids and flexibility, hydrogen). By 2030, the total number of renewable energy jobs more than doubles from 17.4 million in the PES to 38.2 million in the 1.5°C scenario, while other energy transition-related sectors rise from 45.8 million to 74.2 million.
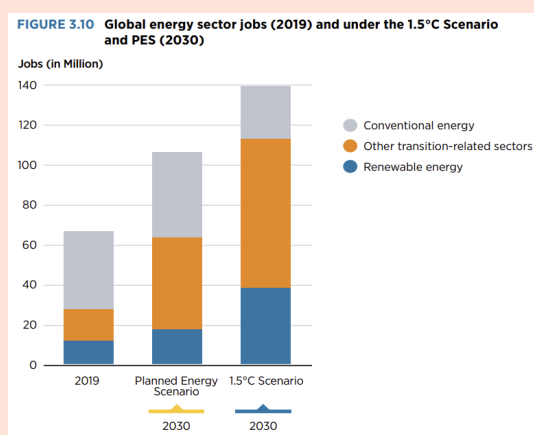
Figure 10. Global energy sector jobs (2019) under the 1.5°C scenario and PES (2030)

Additionally, welfare improves at a significantly faster rate than GDP and jobs. By 2030, both 1.5°C scenario policy baskets produce significant improvements over the PES, of approximately 20%, and much higher by mid-century. The primary purpose of this policy basket sensitivity analysis is to determine whether there is room to improve the distribution of transition burdens and benefits. The fact that both policy packages have identical results for GDP, economy-wide employment, and welfare at the global level suggests that distributional changes can be made while global socioeconomic growth is maintained.

5.1.3 Scenario 3: G20 recovery with extended funding for green measures in G20 developing countries.

Doubling the recovery spending of G20 developing countries and allocating it to green interventions leads to emissions savings of around 1.7% compared to the baseline. Emissions savings in Scenario 3 are 0.7 percentage points higher than in the current recovery spending scenario (Scenario 1).

Changes in the magnitude of the simulated recovery spending in G20 developing countries highly influence the emissions-saving results. In the fiscal constraints scenario (Scenario 2), the total recovery spending is 6.3% lower than in the current recovery spending (Scenario 1), while in the extended green recovery (Scenario 3), total recovery spending is 12.6% higher. In both cases, the reduction or addition is focused on G20 developing countries. Decreasing the spending in these countries by 6% shrinks the mitigation impacts of recovery measures disproportionately, by 10–12%. Nevertheless, increasing the recovery spending by about 12% and focusing it on green measures almost doubles the emissions reduction in the short term (70% increase).

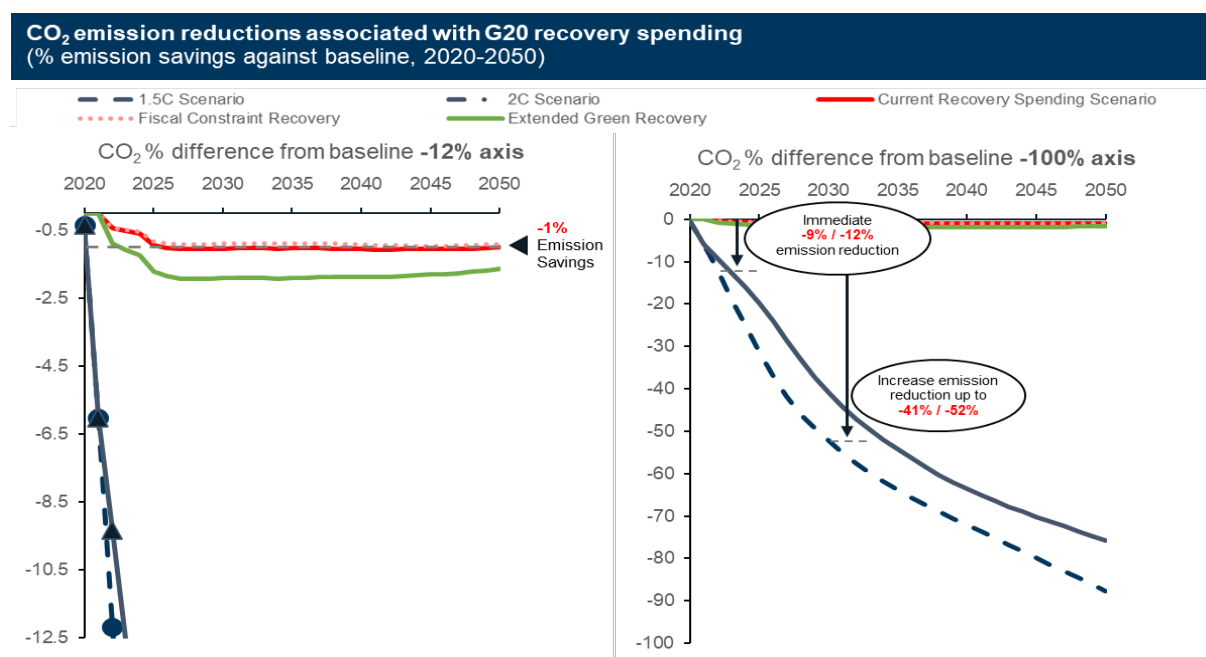### 5.1.4 Contribution to the Paris Agreement goal and aggregated G20 NDC targets.

Although G20 recovery packages provide emissions abatement, they are rather far from the scale that would be needed to contribute substantially to the climate goals of the Paris Agreement. The simulations show that large-scale action and transformation would be required to achieve the 1.5°C and 2°C targets. Scenarios 1, 2, and 3 show that the recovery packages, although involving considerable spending with some green elements, do not reach the scale necessary to significantly contribute to this transformation.

The emissions reductions in the current recovery spending scenario (Scenario 1) have a limited contribution to putting the G20 members on a pathway consistent with the 1.5°C or 2°C targets.[96] For comparison, the 1.5°C scenario requires an immediate 12% emissions reduction, compared to the baseline, in year one (2022), rising up to 52% in 2030. Meanwhile, the 2°C compatible scenario would require an approximate 9% emissions reduction by year one, with a 41% reduction by 2030. However, the *current recovery spending* scenario only leads to an immediate 0.45% emissions reduction in 2022, peaking at 1.6% in 2028.

Likewise, the GHG emissions reductions estimated from scenarios 2 and 3 have a limited contribution to the combined updated NDC pledges of the G20. The saving of 0.4 $GtCO_2$ from the baseline in 2030, from scenarios 2 and 3, is a small contribution to the aggregated G20 NDC pledge. Moreover, while reductions in the case of an extended green recovery (Scenario 3) are higher, the achieved 0.7 $GtCO_2$ reduction is still a limited contribution. To reach their combined NDC ambition, the G20 members must keep their emissions in 2030 relatively flat compared to 2015. However, despite a 6% drop in 2020 due to the pandemic, emissions of G20 members are now higher than their 2019 levels and are expected to rise under the business-as-usual scenario.

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96 This is one of the possible pathways based on cumulative emission results and outcomes of policy inputs, between 2017 and 2100. The E3ME model is simulation based and does not produce a cost-optimal scenario.

It is relevant to highlight that the aggregated NDC mitigation effect of the G20 members is insufficient to reach the 1.5°C Paris Agreement target in the coming ten years—making up for 66% of the total emissions gap (23 GtCO$_2$e) to reach the target. The updated G20 members' NDC targets are aligned with a 2.4°C pathway by the end of the century.[97]

CO$_2$ emission reductions associated with G20 recovery spending
(% emission savings against baseline, 2020-2050)

Source: Cambridge Econometrics modelling, March-July 2022

Figure 11. Emissions reductions associated with G20 recovery spending per economic sector (-12% axis vs -100% axis)

5.1.5 Sectoral contribution to emissions reductions.

Across all scenarios, recovery measures lead to the highest emissions reductions in transport, followed by electricity generation, and buildings. This is in line with the share of recovery spending for each sector. While emissions reductions are related to the amount of spending dedicated to individual measures, investing in affordable and widely deployable technologies generates more emissions reductions as the unit cost of abatement could be lower. For example, EVs could be more effective in mitigation as the technology is closer to a tipping point where the costs of EVs are becoming much more affordable. Solar and wind are often cost-competitive technologies for electricity generation, while renewable heating or hydrogen are still far more expensive than fossil fuel alternatives.

To lower the abatement cost of more expensive technologies being supported by recovery measures and to achieve higher emissions reductions, supporting policies will be needed on top of the spending.

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97 Climate Action Tracker. "Global Update." Last updated September 15, 2021.

CO$_2$ emission reductions per sector, Current Recovery Spending Scenario (1) and Extended Green Recovery scenario (3) (% emission savings against baseline, 2022-2050)
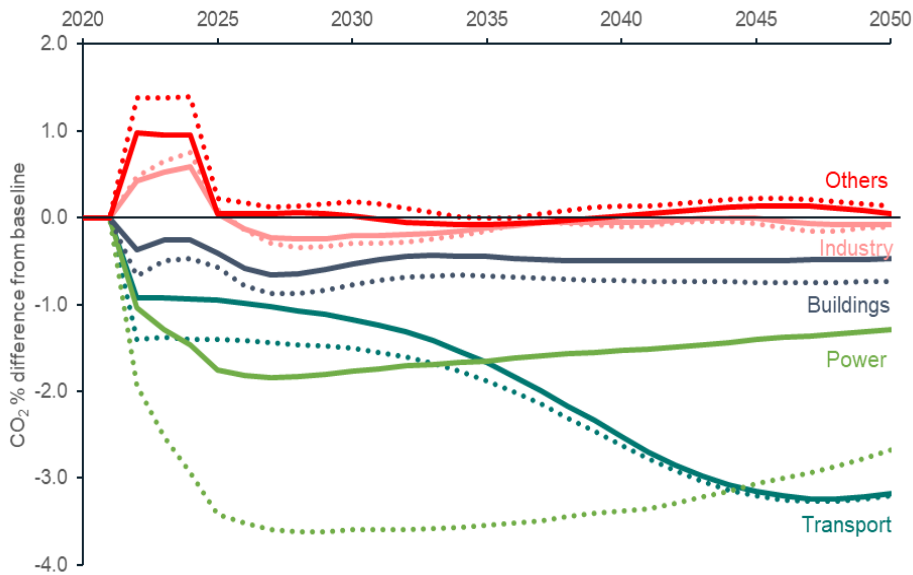
Figure 12. Emissions reductions associated with G20 recovery spending per economic sector, 2020–2050 (% emissions savings against baseline)
Source: Cambridge Econometrics modelling, March July 2022

5.2 Macroeconomic Impacts of G20 Recovery Spending

5.2.1 Gross Domestic Product (GDP)

Scenario 1: G20 Recovery

G20 recovery measures deliver positive GDP impacts, boosting GDP by around 1.6% (compared to the baseline) between 2022 and 2024. However, these increases are not sustained long term, declining sharply around three years after the introduction of the recovery measures.

To sustain the positive GDP impacts of recovery measures in the long term, it is necessary to implement supporting policies. Recovery measures are expected to create long-lasting, sustained effects on the economy (i.e., trigger structural reforms). However, in the absence of supporting policies, G20 recovery measures fail to initiate structural reforms, limiting the macroeconomic effects to the multiplier impacts of spending during the stimulus period and leading to a visible short-term decline.

In contrast, it is observed that the 1.5°C trajectory, which assumes a high degree of supporting policies, delivers much larger and longer-lasting impacts on GDP (compared to the baseline), reaching a peak of nearly 3% above the baseline scenario in 2028, with a much more gradual decline throughout the 2030s. The initial boost in GDP in the 1.5°C trajectory is driven mainly by the large amount of low-carbon investment that is needed for a transition. In the long

term, G20 GDP continues to improve due to an improved trade balance from a reduction in fossil fuel imports. Moreover, despite higher energy prices, overall expenditure on energy bills would be lower due to energy savings.
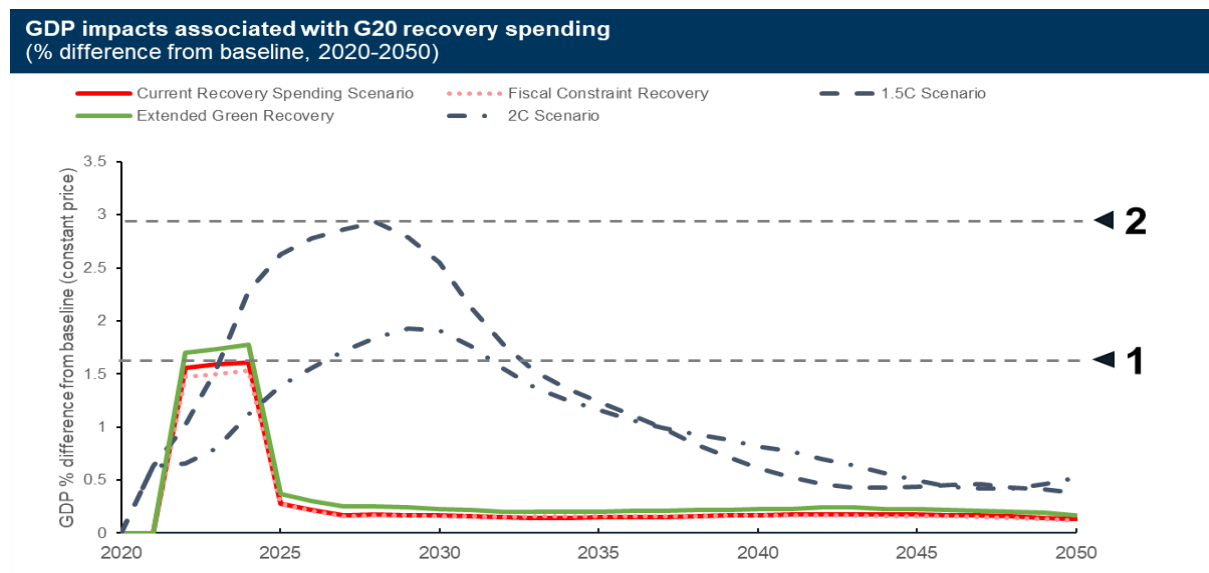

Figure 13. Impact of recovery measures on GDP, 2020–2050 (% difference from baseline)
Source: Cambridge Econometrics modelling, March July 2022

Other recovery scenarios

GDP impacts are somewhat lower in the fiscal constraint scenario, around a 1.5% GDP boost, and somewhat higher in the extended green recovery scenario, a 1.7% GDP boost. The relatively small changes are largely due to the lower weight of developing countries (who are mostly affected) in the G20 total GDP.

5.2.2 Employment

Scenario 1: G20 Recovery

The recovery measures also deliver net positive employment impacts, around 8.1 million jobs in 2024, but like GDP impacts, they are also unsustainable in the long term due to the nature of recovery spending and the lack of supporting policies. This is in contrast with the 1.5°C trajectory, where additional employment benefits are much greater, up to a net 44.1 million jobs at its peak. The difference in employment creation between the G20 recovery scenario and the 1.5°C trajectory is explained by the nature of the scenarios: for the 1.5°C pathway, a large-scale, sustained transition is necessary, while the recovery measures are concentrated in a few years and do not necessarily have sustained growth effects.
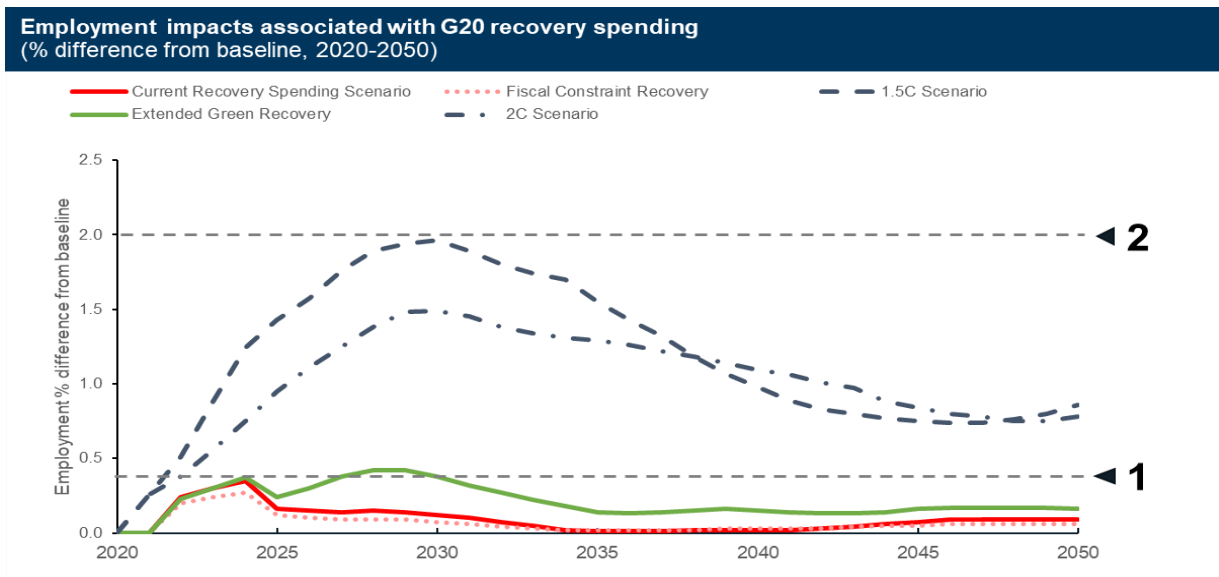
Employment impacts associated with G20 recovery spending
(% difference from baseline, 2020-2050)

Legend:
- Current Recovery Spending Scenario
- Extended Green Recovery
- Fiscal Constraint Recovery
- 2C Scenario
- 1.5C Scenario

Figure 14. Impact of recovery measures on employment, 2020–2050 (% difference from baseline)
Source: Cambridge Econometrics modelling, March July 2022

Other recovery scenarios

The recovery scenario with extended funding for green measures (Scenario 3) produces more long-standing employment benefits than the current spending G20 recovery scenario (Scenario 1). While Scenario 1 (current spending) peaks in the year 2024, Scenario 3 (extended spending) has two peaks: one in 2024 and one around 2028. In 2024, scenarios 1 and 3 produce similar employment results (8.1 million and 8.6 million, respectively). However, Scenario 3 induces transitionary processes in G20 developing countries; therefore, its outcome by 2028 is much more prominent. By 2028, the employment gains of Scenario 1 (current spending) are down to 3.3 million compared to the baseline, while Scenario 3 (extended spending) boosts a higher employment of 9.6 million compared to the baseline. **Considering what has been discussed earlier, a 12.6% increase in the magnitude of overall G20 recovery spending creates about 6 million more jobs (three times the employment impact by 2028) that remain stable over a decade.**

Sectoral contribution to employment

Employment benefits are unevenly distributed across industries. Sectoral distributional impacts are exceptionally small and short-lived in the current recovery spending scenario (Scenario 1, changes in total employment are less than 0.5% in any given sector at any time). During the employment creation peak in 2024, more jobs are created in consumer-related sectors since most of the recovery spending aims at stimulating consumer demand. In agriculture and forestry,[98] nature-based recovery measures boost employment, with a particularly strong effect in G20 developing countries. This is highlighted even more when

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98 The agricultural sector includes forestry and related services, which includes the creation and maintenance of green spaces and natural infrastructure.

green policies are boosted in G20 developing countries under the extended recovery support scenario (Scenario 3). In this case, agricultural and forestry employment will increase by over 2% by 2030. As was previously discussed, the extended green recovery scenario (Scenario 3) also leads to more sustained employment effects. Job losses are observed in all scenarios in the mining and utilities sector due to green recovery spending.

As a reference point, the 2°C trajectory brings much stronger employment impacts than any of the recovery scenarios (scenarios 1,2, and 3). Here it can be observed that the transition to a low-carbon pathway creates a high-scale restructuring of the economies. Similar to the recovery scenarios, the mining and utilities sector loses a substantial part of its jobs (up to 15%) in the 2°C trajectory. However, job creation in other sectors (in absolute terms) offsets these losses, resulting in overall net job gains.
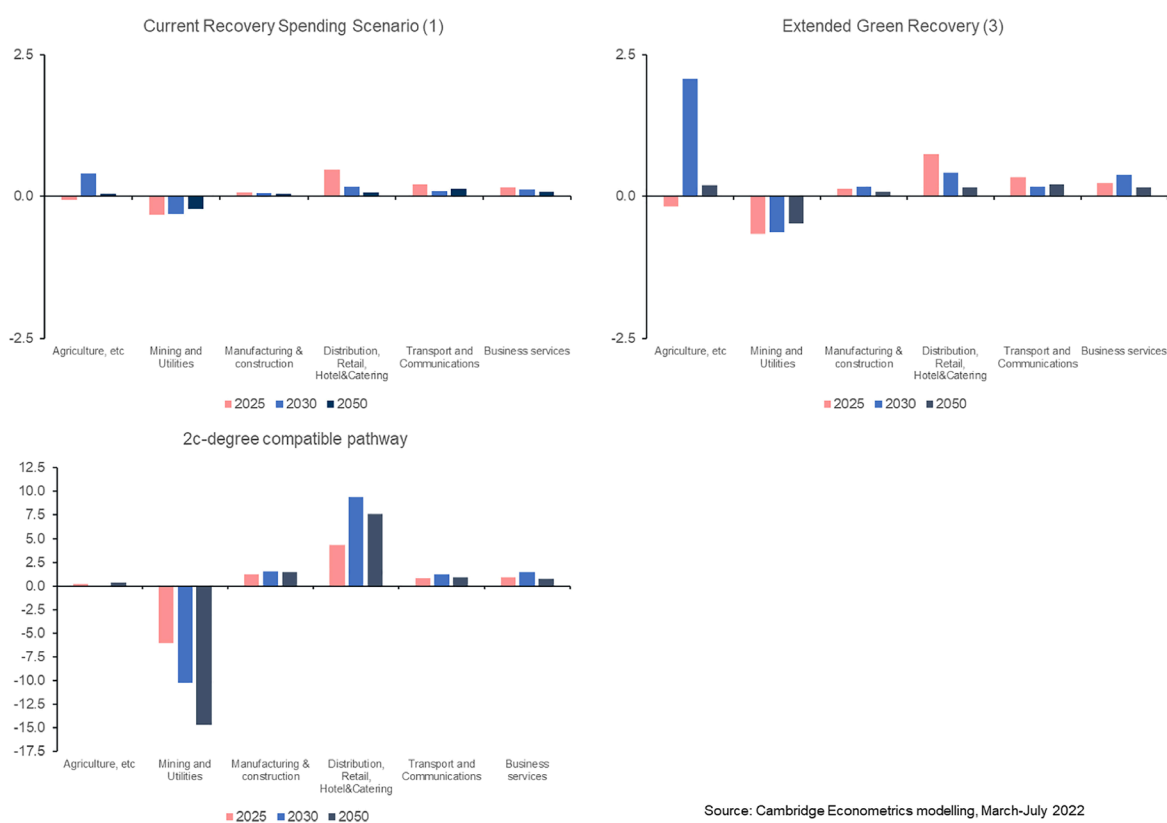
Source: Cambridge Econometrics modelling, March-July 2022

Figure 15. Impact of recovery measures by sector, 2020–2050 (% difference from baseline)

5.3 Impact of the Current High Energy Prices

A sensitivity analysis was carried out assuming higher energy prices than in the initial scenarios 1 to 3. In particular, the sensitivity analysis considered the impact of higher global natural gas prices to simulate the uncertainty in markets and recent developments in energy policy and global geopolitics.

To determine the marginal impacts of higher energy prices (global context) on mitigation, GDP, and employment, the following method was used. First, a baseline scenario and a recovery scenario with high energy prices were set up in addition to the standard baseline scenario (Scenario 1) and the standard current spending recovery scenario (Scenario 1). Second, the differences between the baseline with high energy prices and the recovery scenario with high energy prices were compared against the differences between the standard baseline scenario and the standard recovery scenario.

The sensitivity test resulted in negligible differences across the cases. GDP and employment impacts are within 0.1 percentage point between the standard and high energy price cases. However, there are some relevant differences in emissions reductions at the country level. Especially in European countries with substantial natural gas usage (i.e., Germany and the UK), emissions reduction impacts of the recovery scenarios are somewhat weaker (up to 0.6 percentage point) in 2020–2035, coinciding with higher natural gas prices. The reason for the weaker impacts is that the consumption of natural gas has already diminished due to its high price.

For recovery measures in general, given the uncertainties across fossil fuels and their pricing and market, there may be a case for an "organic" switching, from fossil fuels to other energy sources in some economic sectors. However, it could also become more difficult for policymakers to create policies that can bring further emission abatement—as the low-hanging fruits might disappear.

5.4 Results Overview

Table 4 below shows an overview of the key results. The main scenario, current recovery spending (Scenario 1), creates an approximate 1% sustained emissions reduction impact; it also has positive, small economic and job impacts, but these largely diminish over time and are concentrated around the implementation of the stimulus.

Table 4. Overview of simulation results, measured in % difference from the baseline scenario

Scenario	Reduction of CO_2 emissions		Economic activity (GDP)		Employment (jobs)	
	Short term (by 2025)	Long term (by 2050)	Short term	Long term	Short term	Long term
Scenario 1: G20 recovery	-0.94	-1.01	0.28	0.13	0.16	0.09
Scenario 2: G20 recovery under fiscal constraints	-0.83	-0.91	0.28	0.12	0.12	0.06
Comparison: Scenario 1 vs Scenario 2	-12%	-10%	0%	-8%	-25%	-33%
Scenario 3: G20 recovery with extended funding for green measures in G20 developing countries	-1.73	-1.64	0.37	0.17	0.24	0.16
Comparison: Scenario 1 vs Scenario 3	84%	62%	32%	31%	50%	78%
Climate scenarios for comparison						
1.5°C pathway	-31.28	-87.64	2.63	0.38	1.43	0.86
2°C pathway	-19.86	-75.7	1.39	0.52	0.95	0.78

6 Recommendations to Drive NDC Achievement Through a Sustainable Recovery

To ensure an inclusive recovery that supports the achievement of the Paris Agreement, individual and joint G20 actions are recommended to focus on six areas of intervention.

1. Reinforcing the positive climate impacts derived from the announced G20 recovery spending beyond 2025.

As of 2022, G20 members have announced a recovery spending of about USD 3.45 trillion. However, only 33% of the total announced recovery spending has a direct impact on reducing greenhouse gas (GHG) emissions and supporting adaptation. The long-term emissions reductions derived from the current recovery spending are moderate, closing the emissions gap by only 1% for the 1.5°C scenario during 2022–2050. The modeling of a G20 recovery scenario with extended support indicates that increasing recovery spending by approximately 13%, with a focus on green measures and G20 developing countries, can boost emissions reductions by 62% by 2050, compared to the base case scenario.

The recommendations below address the main reasons why the announced recovery spending has a limited contribution to emissions reductions.

a. Recovery spending is concentrated in G20 developed countries, with 64% of the total recovery spending having been announced. Therefore, recovery support that encourages a structural low-carbon transformation of future emitters should be increased.

b. Across all G20 members, recovery spending is mostly focused on two economic sectors, energy and transport, while other sectors (e.g., industry, forestry, and waste management) receive less support. A more balanced spending across sectors could accelerate an inclusive recovery.

c. Recovery spending allocation could further pursue long-term behavioral shifts in consumption or production by addressing the following:

- Prevalence of stand-alone green recovery measures, which offer ambiguous long-term market signals or incentives for long-term sustainable growth.

- Prevalence of green recovery spending with short-term financial allocations, limiting a long-term low-carbon transition.

- Prevalence of a top-down approach to recovery, which does not scale up local-level measures.

The lack of alignment between current climate and economic development policies and recovery measures potentially hinders action, financial flows, and impact. Conflicts between existing policies and recovery support are particularly observed in emission-intensive sectors such as electricity generation. Announced recovery spending should reinforce climate policies and provide a coherent low-carbon development pathway.

- Allocate resources to identify cost-optimal interventions—complementary to planned or ongoing projects—to reduce emissions in the current least supported sectors, such as industry, forestry, and waste management.

- Seek cross-sectoral and cross-regional integration of recovery measures to avoid stand-alone, short-term interventions with limited impact on a long-term behavioral shift.

- Promote a bottom-up approach to the design and implementation of recovery measures. A bottom-up implementation of recovery measures might adequately consider existing local initiatives, increasing efficiency and effectiveness as efforts focus on specific actions and incentivize subnational governments to hold a stake in the social protection response. This could be done by increasing vertical integration or coordination between different government levels so local interventions can be scaled up at a national level.

- Ensure policy coherence between recovery efforts and a low-carbon pathway. This can be done by identifying synergies, assessing trade-offs, and detecting political barriers to individual interventions before allocating resources.

2. **Ensuring balanced support for both adaptation and mitigation recovery actions.**

There is an imbalance of recovery spending between mitigation and adaptation interventions in both G20 developed and developing countries. For example, only four G20 members explicitly considered investing in adaptation or resilience in their recovery plans (i.e., China, France, the Republic of Korea, and the UK). The imbalance between recovery spending on mitigation and adaptation could lead to slower and less definite actions to confront climate-related challenges and compound risks, particularly for the more vulnerable G20 members. There is also a risk of missing out on the social and environmental co-benefits that adaptation recovery measures can provide. Therefore, the recommendations below seek to guide the use of recovery funds for both adaptation and mitigation measures.

- Prioritize and/or assign potential new recovery support based on:
  - finance gaps/needs assessment studies
  - dependence of the intervention on public resources
  - potential contribution to the SDGs
  - historic recovery support to the sector

- Improve alignment of recovery measures with NDCs, NAPs, and economic priorities, and incorporate the effect of recovery interventions into the long-term plans to reduce emissions (e.g., LT-LEDS).

- Utilize recovery resources to overcome the knowledge barriers to adaptation by increasing support for adaptation-related research.

- Increasing the understanding of climate change impacts at a geographically more granular level, as well as at a sectoral level, the potential for effective climate risk

reduction, and the systemic risks of climate change would enable effective adaptation interventions and the development of adaptation technologies.

- Increase the availability of financial resources for G20 developing countries, prioritizing those with high vulnerability to and low preparedness to address the negative impacts of climate change.

3. Overcoming fiscal constraints for future and ongoing recovery support.

G20 developing countries face tight fiscal constraints on implementing long-term recovery measures. The fiscal constraints recovery scenario of this analysis shows a 9.3% reduction in the already moderate impact on carbon dioxide (CO_2) mitigation and a 36% reduction in the employment impacts, compared to the base case.

Furthermore, G20 developing countries with tight fiscal space and rising levels of debt experience limitations on the type and pace of recovery they can pursue. These limitations can widen inequality and hinder a country's ability to achieve more ambitious climate objectives. A two-track and two-speed economic recovery could result in slower and less definite actions to confront climate-related challenges.

Limited public and international funds mean the private sector is crucial in supporting sustainable recovery measures. The recommendations below seek to increase the efficiency of public sector spending as well as leverage private sector financing and its engagement in recovery measures.

- To crowd in private finance for recovery, focus on developing a pipeline of investment-ready sustainability projects that can easily access blended finance or utilize the innovative financing mechanisms already supported by G20 members.

- Prioritize investments in economic sectors that might have future impacts on fiscal revenues or widen the tax base by reducing informality while seeking mitigation or adaptation benefits. *For example, cash transfer programs for forestry restoration, in combination with social protection schemes, seek to promote the integration of the formal economy. Formal employment would raise tax revenue.*

- Incorporate the ongoing recovery spending into the country's annual budget through a Climate Budget Tagging and performance-based budgeting approach. *A performance-based budgeting approach can improve the effectiveness and efficiency of public expenditure for recovery. Moreover, it would facilitate the linkage of recovery spending focused on mitigation and adaptation with the future annual budget allocation for sustainable activities.*

- Reallocate international support or extended economic stimulus and technical assistance to developing countries to address the two-track and two-speed economic recovery from the pandemic, focusing on countries with high fiscal constraints and high climate vulnerabilities.

4. Maintaining, medium term (5–14 years) and long term (15–20 years), the positive impacts of recovery spending on job creation, with a focus on green jobs.

G20's announced recovery measures will deliver net positive employment impacts, boosting GDP by around 1.5% between 2022 and 2024 and supporting approximately 3.7 million jobs in 2025 (employment peak). However, these impacts are not sustained long term, declining sharply around three years after effective spending. Without supporting policies and actions to maintain long-term growth, the impacts of recovery spending will be limited to multiplier impacts of expenditures during the stimulus period. For example, it is estimated that extended recovery support can boost outcomes, with employment impacts being 80% higher in 2050, compared to the base recovery scenario.

Moreover, despite the importance of skills development to ensure an inclusive recovery and a low-carbon transition, it is estimated that G20 recovery spending on green skills training amounts to approximately 1% of the total recovery budget and is particularly modest in G2O developing countries.

Therefore, the recommendations below aim to maximize the creation and long-term maintenance of green jobs linked to recovery measures and to further support the development of a labor market for a low-carbon development pathway.

- Avoid stand-alone job creation, skilling, reskilling, or training interventions by developing recovery policies with a cross-sectoral approach that considers the diverse labor requirements and impacts across sectors. A cross-sectoral approach could increase the employment multiplier effect on investment.

- Boost private sector participation in skilling, reskilling, and training programs by linking recovery measure support to SMEs and entrepreneurship to recovery measures supporting labor market development. Linking employment generation sources with skills development recovery programs (i) reduces the risk of mismatching skill demands with skills development, (ii) encourages the population to undertake continuous learning, and (iii) helps reduce the gap between high-skill and low-skill employees.

- Utilize a bottom-up approach to devise recovery measures linked to skilling, reskilling, and training that successfully targets vulnerable populations and most unattended sectors.

- Promote the inclusion of green job creation in climate targets at the national level.

- Promote knowledge sharing between G20 members to emulate the best examples of skills development programs for addressing future labor market demands.

- Ensure the continuous measurement and monitoring of green jobs creation linked to recovery measures by increasing countries' capacity to define, quantify, and analyze green jobs and future labor market needs. Accurate national data and analyses on employment inform policymakers on potential actions to improve labor markets, facilitate the identification of job creation opportunities, and represent the precondition for a continuous improvement process.

5. Measuring the effectiveness of sustainable recovery spending by improving reporting, disclosure, and continuous tracking of recovery measures.

Only three countries out of all G20 members have explicitly stated indicators to measure the climate impact of their recovery measures. These members are Canada, the European Union, and the United States. The following recommendations aim to promote the consistent quantification of recovery impacts across G20 members to support the development of data-informed policies and allow for continuous improvement of recovery measures.

- Increase transparency in announced and implemented resources tagged as recovery by (i) systematically and consistently recording recovery spending and (ii) making the information publicly available. Open data on recovery spending can support policy decisions based on technical assessments and facilitate the improvement of interventions.

- Implement cross-ministerial/cross-sectoral technical groups to evaluate recovery targets in coordination with national climate and development objectives.

- Establish a standard definition of what constitutes recovery spending and set global indicators or recovery to ensure comparability between countries. These definitions and indicators could be linked to existing SDG indicators and climate targets.

6. Tackling compound risks.

Individual recovery measures by themselves make it difficult to tackle compound risks exacerbated by the COVID-19 crisis. Not addressing compound risks leads to more significant and sustained adverse impacts on lives, livelihoods, and ultimately sustainable development outcomes.[99] The following recommendations aim to prompt the uptake of a multi-dimensional risk recovery approach.

- Increase resource allocation for the development of disaster risk management frameworks/strategies that can better prepare the country to identify and implement resource deployment strategies, governance directives, and policy responses for a combination of environmental, socioeconomic, and political risks.

- Strengthen transboundary recovery efforts capable of increasing resilience in multiple areas simultaneously (i.e., environmental, economic, and social).

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99 Refers to eradicating extreme poverty; reducing all poverty by half; implementing social protection systems; ensuring equal rights to ownership, basic services, technology, and economic resources; and building resilience to environmental, economic, and social disasters.

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8.   Annexes

The database of the Global Recovery Observatory contains policy items that are assessed, along with archetypes and sub-archetypes, for potential environmental impact (e.g., GHG emissions, air pollution, natural capital), social impact (e.g., wealth inequality, quality of life, rural livelihood), and economic impact (e.g., multiplier, speed of implementation). The policy items are first mapped to 40 exhaustive and mutually exclusive archetypes as well as 158 sub-archetypes. To assess GHG emissions, both short term and long term (i.e., high increase, increase, little net change, decrease, high decrease), a five-point Likert scale is used. A three-point Likert scale is used for all other assessments (i.e., improve, little net change, regress). Within the broad archetype categories, sub-archetypes are used to account for assessment variation.

GHG assessments include a temporal component, where the net effect is assessed both in the short term (while policies are being implemented) and long term (following policy implementation). This allows for greater nuance in green assessments and ensures that non-uniform emission life cycles are considered. Although long-term emissions certainly have a higher significance, short-term emissions are often politically relevant as governments strive to meet year-by-year emissions targets under international agreements. Clean energy infrastructure, for example, can be recognized for its short-term GHG impacts, such as through material use, and for its long-term effects of reducing GHG emissions through the provision of clean energy. Therefore, it is important to identify varied emissions profiles.

GHG emissions describe the atmospheric release of CO_2, CH_4, and other gases that create a warming greenhouse effect. The Global Recovery Observatory adopts the national rate of emissions with no intervention, as expected at the time of policy intervention, as a baseline for assessing the GHG emissions impact of archetypes. Short-term and long-term GHG emissions impacts are assessed separately on the five-point Likert scale. On this scale, -2 reflects a large increase in GHG emissions, -1 reflects a moderate increase, 0 reflects little or no change, +1 reflects a moderate decrease, and +2 reflects a large decrease. A negative score implies that the national rate of emissions is likely to increase, in comparison to a scenario where the investment is not made, and a positive score implies that the national rate of emissions is likely to reduce, compared to a scenario where the investment is not made.

1. Survey Questionnaire – Impact of a Sustainable Recovery in G20 Countries

Survey - Impacts of a sustainable recovery in G20 countries

IMPORTANT - READ BEFORE STARTING

This survey aims to collect and validate data on green recovery expenditure and its impacts on NDCs (mitigation and adaption) across all G20 member countries.

Your response will be used only for the preparation of the Climate and Sustainability Working Group Study (**Output 1.1): Stocktaking of economic, social, and environmental impacts of sustainable recovery, including impacts on NDC implementation.**

Delegates of the Climate and Sustainability Working Group are kindly invited to submit answers by Friday 29 April 2022.

The survey has 5 sections:

1. Contact Information
2. Validation of Green Recovery Expenditure
3. Budgeting Process for Green Recovery
4. Impacts of Green Recovery on Adaptation
5. Efforts to Measure Impacts of Green Recovery

The survey can be answered by more than one ministry or government agency simultaneously as more than one entry may be submitted and not all sections of the survey have to be responded to in order to submit a response.

For any questions and comments, please reach out to Diana Quezada, GGGI -Green Recovery Lead –diana.quezada@gggi.org.

1. CONTACT INFORMATION

This survey might be followed by a brief interview, based on the availability of the respondent

1. Country

_____

2. Full Name of Respondent

_____

3. E-mail

_____

4. Organization

_____

5. Are you available to be contacted for further clarifications?

❑Yes ❑No

2. GREEN RECOVERY SPENDING

The Climate and Sustainability Working Group Study (Output 1.1) utilizes the latest data on Green Recovery Expenditure published by the Global Recovery Observatory. (https://recovery.smithschool.ox.ac.uk/tracking/)

We aim to identify potential discrepancies between the Global Recovery Database and official national data.

Definitions used by the study

- Rescue Spending - Spending on short-term measures designed for emergency support to keep people and businesses alive

- Recovery Spending - Spending on long-term measures to boost economic growth

- Green Recovery Spending - Spending on measures that promote by themselves or have conditionalities for the mitigation of GHG emissions, adaptation against climate change impacts.

6. What is the total announced recovery spending in your country since March 2020 as of the end of March 2022?

_____

7. Do you monitor the environmental and climate impact of recovery spending? If so, what proportion (%) of your announced recovery spending do you considered green?

_____

8. Provide links or upload any national documents that can help us corroborate the total recovery announced spending provided above.

(E.g., List of policy/programme/projects/interventions approved for green recovery across all economic sectors, budgetary documents, recovery plans with investment amounts stated)

_____

9. Space to provide links and/ or a brief explanation to uploaded documents on question 8

_____

10. Provide links or upload the latest national green recovery or recovery plan/ roadmap/ strategy published.

(If your country does not have a recovery plan please provide the links to / name of the policy documents being utilized to guide recovery)

_____

11. Space to provide links and/ or a brief explanation to uploaded documents on question 10

_____

3. GREEN RECOVERY BUDGETING

This section aims to assess how countries are incorporating their green recovery spending into their national budget planning process? and Which policy measures are being implemented to finance green recovery?

Definitions used by the study

- Rescue Spending - Spending on short-term measures designed for emergency support to keep people and businesses alive

- Recovery Spending - Spending on long-term measures to boost economic growth

- Green Recovery Spending - Spending on measures that promote themselves or have conditionalities for the mitigation of GHG emissions, and/or adaptation against climate change impacts.

- Green Budget for Green Recovery Spending - National or Subnational Budget allocated for Green Recovery Measures

12. What is the total green recovery budget in your country as of the end of March 2022? (USD Billion)

_____

13. Does your country have any planned or ongoing policy/program/project/intervention for integrating green recovery budget into the ongoing budgeting process?

❑Yes ❑No

If yes, briefly describe the green recovery budgeting policy/initiative. (Name of Initiative, Status, Timeline of Implementation, Lead Institution, Objective, Relationship with Green Recovery, etc.)

14. Upload any national documents that could help us corroborate the information provided above.

_____

4. IMPACTS OF GREEN RECOVERY ON ADAPTATION

15. Mark the square if your country has implemented at least one green recovery intervention related to adaptation (Columns) incurring on one or more categories of recovery impact (Rows)

	Resilience in food production systems (agriculture/ Crop Production)	Resilience in food production systems (Animal and Livestock)	Resilience in food production systems (Fisheries Yields and Aquaculture Production)	Conservation and/ or restoration of natural capital	Sustainable use of terrestrial and marine biodiversity and ecosystem services	Water resource management	Development of resilient infrastructure	Circular Economy	Prevention and management of negative impacts of climate change on the human health and wellbeing	Implementation of risk disaster management systems
Governance (Includes: Awareness-raising, Capacity Building, Enhanced Policy Framework, Education, Collaboration, Public Procurement, Regulation, Strategy)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Job Creation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other Social Benefits (Incl. Better Work Environment, Gender Equality, Wage Improvements, etc.)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Environment	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Finance/ Investments	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Infrastructure and Technology	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Economy and Businesses (Incl. Support to SMEs, Economic Efficiency, and sustainable production)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Others :

16. Please provide a case example for each of the recovery interventions related to adaptation (columns) marked as "yes" in the matrix above. (Briefly describe, add links and/ or upload relevant documents)

_____

17. Upload any documents to respond to question 16.

_____

18. Please provide the number of total estimated beneficiaries from the -announced recovery interventions related to adaptation- (columns) marked as "yes" in the matrix above? (Million People

Resilience in food production systems (Agri)

_____

Resilience in food production systems (Livestock)

_____

Resilience in food production systems (Fisheries)

_____

Conservation and/or restoration of natural capital

_____

Sustainable use of biodiversity or ecosystem services

_____

Water management

_____

Circular economy

_____

Development of resilient infrastructure

_____

Implementation of risk disaster management systems

_____

Prevention and management of negative impacts of climate change on human health and wellbeing

_____

19. If available, please provide Impact Assessments or similar documents that establish the impact of the announced recovery policies.

_____

5. EFFORTS TO MEASURE IMPACTS OF GREEN RECOVERY

The Climate and Sustainability Working Group Study (Output 1.1) aims to measure green recovery impacts and progress in the different areas of adaptation via selected Global SDG indicators or country-specific indicators.

Thus, this section aims to identify key green recovery indicators and the number of people who benefited from recovery measures focused on adaptation in each G20 country.

20. Which indicators are you using to track the impact of your recovery policies? Please, list all indicators or provide a link to the relevant documents.

_____

21. Upload any national documents that can support the response to question 19

_____

22. Has your country estimated the potential averted costs/losses from climate change through the implementation of green recovery total or individual interventions? If yes, please explain the indicators used for that identification, or add link to relevant documents

_____

23. Has your country considered alignment between, or contribution of, green recovery plans and interventions to Sustainable Development Goals? If so, how? Please explain or add link to relevant documents

_____

2. Survey Responses – Recovery Spending Compared with Observatory Data

Green Recovery Spending		
Country	**What is the total announced recovery spending in your country since March 2020 as of the end of March 2022?**	**Budget mentioned in the Global Recovery Observatory**
Germany	130 billion Euro	Total spending: USD 1,357.74 billion Recovery spending: USD 92.23 billion Green Spending: USD 0.04 billion
Indonesia	The Indonesian government spent a recovery budget with a total amount of IDR 658.6 trillion. (USD 45.2 billion) in 2021, whilst realisation for 2022 until April 2022 reached IDR 29.3 trillion. (USD 2 billion), or 6.4% of the total 2022 budget allocation of IDR 455.62 trillion (USD 31.4 billion).	Total spending: USD 84.35 billion Recovery spending: USD 0.15 billion Green spending: USD 0.00 billion
Japan	JPY 8,320.9 billion (total amount for 2020 specifically relating to green recovery). JPY 9,192.8 billion (total amount for 2021 specifically relating to green recovery). JPY 106,609.7 billion (the FY2021 Budget Framework, not specially for green recovery but the total amount of the budget).	Total spending: USD 1,292.56 billion Recovery spending: USD 286.08 billion Green spending: USD 0.12 billion
Russian Federation	The recovery spending according to the National Recovery Plan accounts for RUB 6.4 trillion in total and includes 42 Strategic Initiatives (for example: initiatives that have a positive impact on adaptation in the areas of agriculture, fisheries and food production, inland water transport infrastructure, infrastructure and transport in connection with the adaptation measures started in 2019).	Total spending: USD 40.76 billion Recovery spending: USD 0.77 billion Green spending: USD 0.00 billion
Spain	EUR 79,603,000,000	Total spending: USD 1,249.97 billion Recovery spending: USD 207.15 billion Green spending: USD 0.06 billion
Saudi Arabia		Total spending: USD 100.52 billion Recovery spending: USD 4.21 billion Green spending: USD 0.00 billion
United States	The Bipartisan Infrastructure Law (BIL), signed by President Biden on November 15, 2022, provides roughly USD 1 trillion in funding that aims to rebuild America's roads, bridges, and rails; expand access to clean drinking water; ensure every American has access to high-speed internet; tackle the climate crisis; advance environmental justice; and invest in communities that have too often been left behind.	Total spending: USD 5,455.07 billion Recovery spending: USD 1,118.77 billion Green spending: USD 0.49 billion

3. List of Recovery Archetypes from the Global Recovery Observatory to Be Utilized in the Report

Further definitions of the spending archetypes can be obtained from the GRO methodology document: 20210201-Global-Recovery-Observatory-Draft-Methodology-Document-.pdf (ox.ac.UK).

R Targeted recovery cash transfers

S Tourism and leisure industry incentives

T Electric vehicle incentives

U Electronic appliance and efficiency incentives

V Green market creation

W Other incentive measures

X Worker retraining and job creation

Y Education investment (non-infrastructure)

Z Health care investment (non-infrastructure)

α Social and cultural investment (non-infrastructure)

β Communications infrastructure investment

γ Traditional transport infrastructure investment

δ Clean transport infrastructure investment

ε Traditional energy infrastructure investment

η Clean energy infrastructure investment

θ Local (project-based) infrastructure investment

λ Building upgrades and energy efficiency infrastructure investment

μ Natural infrastructure and green spaces investment

π Other large-scale infrastructure investments

σ Armed forces investment

τ Disaster preparedness and capacity building investment

φ General research and development investment

ψ Clean research and development investment

4 List of Selected (sub-)Archetypes to Be Utilized

Sector	Policy Archetype	Name Policy Archetype	Policy sub archetype	Name Policy sub archetype	Long-term GHG
Agriculture & forestry	μ	Natural infrastructure and green spaces investm	$\mu1$	Public parks and green spaces investment	1
Agriculture & forestry			$\mu2$	Tree planting and biodiversity protection	2
Agriculture & forestry			$\mu3$	Ecological conservation initiatives	2
Agriculture & forestry			$\mu4$	Waterway protection and enhancement	1
Agriculture & forestry			$\mu5$	Agricultural Uplift	0
Agriculture & forestry			μindiscriminate		2
Agriculture & forestry	ψ	Clean research and development investment	$\psi2$	Agriculture R&D programmes	2
Building	λ	Buildings upgrades and energy efficiency infrast	$\lambda1$	Green retrofitting programs (including daylighting, electricity and electrification, insulation)	2
Building			$\lambda2$	Rooftop solar support	2
Building			$\lambda3$	Other building upgrade support	0
Building			λindiscrimina	Various/ unspecified grants to improve energy efficiency and to install renewable	2
Building	θ	Local (project-based) infrastructure investment	$\theta2$	General new housing investment	0
Building			$\theta3$	Clean new housing investment	1
Building			$\theta4$	Public building investment	0
Building			θindiscrimin	Various/ unspecified housing and infrastructure investments	0
Transport	δ	Clean transport infrastructure investment	$\delta1$	New public transport systems or line expansions	2
Transport			$\delta2$	Existing public transport capacity expansions	2
Transport			$\delta3$	Electric vehicle charging infrastructure	2
Transport			$\delta5$	Cycling and walking infrastructure	2
Transport			$\delta6$	Efficiency initiatives to improve dirty transport	2
Transport			δindiscrimin	Promotion of other mobility/ transport such as shared transportation, public transp	2
Transport	γ	Traditional transport infrastructure investment	$\gamma1$	Road construction	0
Transport			$\gamma2$	ICE engine automobile support	-2
Transport			$\gamma3$	Aviation infrastructure	-2
Transport			$\gamma4$	Port and ship construction	-1
Transport			$\gamma5$	Rail construction and capacity	0
Energy	η	Clean energy infrastructure investment	$\eta1$	New or refurbished renewable energy generation facilities	2
Energy			$\eta2$	New or refurbished nuclear energy generation facilities	2
Energy			$\eta3$	New biofuel and other renewable fuel infrastructure	2
Energy			$\eta4$	Upgraded (or new) transmission Infrastructure	2
Energy			$\eta5$	Upgraded (or new) distribution infrastructure including smart grids	2
Energy			$\eta6$	Hydrogen infrastructure	2
Energy			$\eta7$	Battery and storage infrastructure	2
Energy			$\eta8$	Carbon capture and storage/utilisation	2
Energy			$\eta9$	Other initiatives to clean existing dirty energy assets	2
Energy			$\eta10$	Resilience of grids e.g. for more flexibility	2
Energy	ε	Traditional energy infrastructure investment	$\varepsilon1$	New or refurbished power plants	-2
Energy			$\varepsilon2$	New or refurbished refineries	-2
Energy			$\varepsilon3$	New or refurbished coal mines and oil/gas fields	-2
Energy			$\varepsilon4$	New or refurbished infrastructure for transport and transmission of fossil energy inputs/outputs	-2
Energy			$\varepsilon5$	Improved power access to SMEs (incl. Refurbishment for natural gas pipelines)	-2
Energy	ψ	Clean research and development investment	$\psi1$	Energy sector R&D programmes	2

5. Global 1.5°C Policies

The following policies are applied to all countries from 2021 onward in the global 1.5°C scenario. Policies marked with * are considered green stimulus policies.

Power sector policies:

- Feed-in tariffs for onshore and offshore wind generation (solar PV does not benefit from additional support policies beyond what is already in place).*
- Subsidies for investment costs for other renewables (geothermal, concentrated solar power, biomass, wave, and tidal), excluding hydro and solar PV. *
- Regulation of coal and gas generation. Coal is regulated so that new plants not fitted with CCS cannot be built, but existing plants can run to the end of their lifetimes. All remaining coal plants are forced to shut down in 2040. Gas plants all shut down by 2050.
- Public procurement for CCS on coal, gas, and biomass plants installations in many developed and middle-income countries where this does not already exist.*

- The use of BECCS (bioenergy with carbon capture and storage) is supported by existing policies and the introduction of further public procurement policies to publicly fund the building of BECCS plants in all countries endowed with solid biomass resources.*
- Hydro is regulated directly in most regions to limit expansion, given that in most parts of the world, the number of suitable sites is limited, and flooding new sites faces substantial resistance from local residents.

Road transport policies:

- Ban on the use of inefficient petrol and diesel vehicles.
- Capital cost subsidies on EVs. *
- Tax on petrol and diesel use in road transport.
- Tax on the purchase price of high-carbon vehicles.
- Public procurement programs for supporting the diffusion of EVs.*
- Yearly vehicle taxes linked to emissions.

Household heating policies:

- Taxes on household use of fuels for heating (coal, oil, and gas).
- Capital cost subsidies for heat pumps and solar water heaters.*
- Public procurement policies to increase the market share of the heat pump industry.*
- Ban on the sale of new coal, oil, and inefficient gas boilers.

Steel sector policies:

- Ban on the construction of new inefficient coal-based steel plants.
- Capital cost subsidies for new lower carbon plants, such as biomass and hydrogen-based iron ore reduction and smelting, and to fit CCS to existing high-carbon steel plants.*
- Subsidies on the consumption of low-carbon energy carriers.*
- Public procurement to build new low-carbon steel plants to develop markets in which they do not exist.*

Cross-sectoral policies (except sectors already mentioned above):

- Energy efficiency investments for end users are assumed to change in line with the IEA (2019), with corresponding investments in the respective sectors.*
- A global carbon price is applied to all end fuel users. The carbon price is exogenous and starts from USD 17 in 2020, rising to USD 250 in 2050 in real term.

6. Examples of Recovery Measures with a Positive Impact on Climate and Adaptation

Example 1. The Weatherization Assistance Program in the United States

The United States installed in 1976 the Weatherization Assistance Program to reduce energy costs for low-income households by increasing the energy efficiency of their homes while ensuring their health and safety. During the global financial crisis recovery, as well as during the COVID-19 pandemic recovery, investments in energy efficiency retrofits played a stimulatory role through an extended Weatherization Assistance Program. For the United States, expansion of existing programs, rather than investment in new programs, may reduce implementation costs and maximize the chances of success. Moreover, expanded programs could catalyze swift job creation in construction and manufacturing (E2, 2020). To ensure that economic returns are maximised (Allcott & Greenstone, 2012) and that marginalized populations who carry a disproportionate health and economic burden during the pandemic can reap the highest benefits, a careful targeting is required.

The United States can be seen as a key example of a country that is likely to benefit from stimulus investments in energy efficiency retrofitting programs. With one of the highest per-capita energy consumption rates in the world (World Bank, 2014), such energy efficiency programs can both reduce costs for low- and middle-income individuals and reduce GHG emissions.

Example 2. The Korean Green New Deal

The Korean Green New Deal aims to reduce GHG emissions by 16.2 million tons, relying on green industry innovation, the construction of green infrastructure, and green energy (Lee et al., 2020; Hwang et al., 2020). As explained by Oxford University (2021), the green energy component of the program includes investment in renewable energy production (wind and solar), hydrogen investment, and, in distinction to other nations, smart grid investment. Building on the South Korean Smart Grid National Roadmap, smart grids could support higher renewable energy penetration, bring more efficient electricity distribution by enabling demand response capabilities, and in this way use EVs to bolster a smart city ecosystem (see Government of the Republic of Korea, 2012).

Furthermore, it is notable that South Korea's green energy spending plan aims to "support a fair transition" and thereby cushion displaced workers (Lee and Woo, 2020). Another example for this kind of inclusive policy is Spain: The Spanish government earmarked parts of their recovery spendings to a "just and inclusive energy transition," emphasizing a green transition that promotes job creation and provides targeted support to sectors and communities whose livelihoods may be affected by the transition.

Example 3. Mexico (mainstreamed in Argentina, Colombia, Peru) – Improving cycling infrastructure for healthy people and cities

In July 2020, GIZ Mexico's Cities and Climate Change program assisted the implementation of a temporary bike lane for the city of León. Inspired by the public's positive response to the measure, the Mexican government supported further municipalities in implementing pop-up bike lanes through technical assistance in the design process, operations, communication strategies, monitoring and evaluation (Juliet Phillips, Felix Heilmann, 2021).

Building on the insights of the Mexican experience, the Inter-American Development Bank (IADB) published a guide on how to set up pop-up bike lanes and announced a plan to support three more cities in other Latin American countries: Fusagasugá and Tunja in Colombia, and Santa Fe in Argentina. According to IISD research, investments in cycling infrastructure are also a good opportunity to create green jobs.

The processes of planning and implementing pop-up bike lanes were characterized by fast decision-making and trial-and-error approaches. Implementation was realized through low-cost interventions. The focus on key routes for commuters and routes into community centers was critical to ensure residents' needs were met and bike lanes were accepted.

Example 4. Creating employment and supporting biodiversity protection through national economic stimulus programs

In May 2020, India announced as part of its Aatma Nirbhar Bharat stimulus-oriented reform campaign that it would encourage the simultaneous fostering of biodiversity, job creation, and tribal community support by allocating over USD 800 million from its Compensatory Afforestation Fund Management and Planning Authority (CAMPA). The campaign aims to support employing tribal and Adivasi people (collective term for tribes of the Indian subcontinent) for plantation work, forest management, and wildlife protection management. Consequently, it aims to reduce unemployment in rural and tribal populations while avoiding market-based financing of stimulus activities as it unlocks existing, idle public funds (Philips, Heilmann. 2021).

Concern has been raised in the past that afforestation under CAMPA has promoted monocultures rather than biodiversity. However, some recent projects have ensured a higher level of biodiversity, such as Dhubri's biodiversity park, which is set to have one thousand plant species (egreenwatch, 2021).

The campaign can be seen as a good example on improved representation of tribal representatives' decision-making processes. The World Resources Institute highlights the need to consider the complex people-environment relationships that govern land restoration projects, taking into consideration the Indian caste system and how it affects decision making (Singh, Shelar. 2020).