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The integration of climate action into economic development and stimulus measures: Policy options for the G20

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Although an increasing number of studies project large economic costs of climate inaction, G20 nations still account for 78% of global greenhouse gas (GHG) emissions and remain collectively not on track to meet their Paris Agreement commitments. Studies also show that effective implementation of climate policies can unlock potential economic, social, and environmental benefits. However, serious climate action is still viewed as a costly option and awaits adequate integration into economic planning and development strategies. The current COVID-19 pandemic adds economic and social challenges, while paradoxically offering an opportunity to align recovery plans with long-term climate objectives. G20 nations, as the world's leading group, are expected by the rest of the international community not only to pioneer ambitious climate action but also to support less developed countries through finance, technology transfer, and capacity building. In this policy brief, we consider key policy options that support sustainable, climate-resilient economic growth and recovery in G20 countries, while considering the heterogeneity of climate impacts and opportunities across G20 members.

Challenge

Climate risks and opportunities need to be adequately integrated into G20 economic development strategies and stimulus measures. G20 members that are Paris Agreement signatories have reiterated their commitment to climate actions at all levels, including clean technologies deployment and associated quality infrastructure (G20 2019). Moreover, G20 nations are currently facing the challenges of developing resilience while recovering from the social and economic crises caused by the COVID-19 pandemic. G20 nations, as global leaders, can pioneer ambitious climate action and support less developed countries through financial measures, technology transfer, and capacity building.

Another challenge for G20 nations is that while member countries account for 78% of global GHG emissions, they are collectively not on track to meet their Paris Agreement commitments (UNEP 2019). Despite cumulative scientific studies regarding the economic, social, and environmental costs of climate inaction (Stern 2007; Kompas et al. 2018), governments persist in viewing serious climate action as a costly option. Table 1 presents recent estimates suggesting that all regions, irrespective of their geographic location or development level, would experience relative reductions in their income levels by 2100 in the absence of effective climate change policies. According to this projection, Gross Domestic Product (GDP) per capita in all G20 countries will decline, with most countries experiencing significant losses in the high emissions scenario (i.e., Representative Concentration Pathway [RCP] 8.5) (Kahn et al. 2019). However, the overall impact of temperature increases on income may vary across countries depending on the pace and historical variability of climate conditions. Climate action as captured in the RCP 2.6 Scenario mitigates most of the losses for all countries. Moreover, such projections frequently underestimate the potential impact of climate change since they do not take into account tipping points in the climate system (Yumashev et al. 2019).

	Percentage loss in GDP per capita					
	RCP 2.6 Scenario			RCP 8.5 Scenario		
	2030	2050	2100	2030	2050	2100
Argentina	0.2	0.71	2.5	0.79	2.78	8.17
Australia	0.06	0.17	0.56	0.64	2.25	6.93
Brazil	0.02	0.06	0.15	0.99	2.79	7.35
Canada	0.2	0.56	1.68	1.37	4.4	13.08
China	-0.45	-0.8	0.45	0.58	1.62	4.35
France	-0.03	-0.07	-0.17	0.62	1.92	5.82
Germany	-0.22	-0.39	0.08	0.21	0.61	1.92
India	0.26	0.81	2.57	1.16	3.62	9.9
Indonesia	0.19	0.61	1.92	0.91	2.79	7.51
Italy	0.01	0.02	0.05	0.89	2.56	7.01
Japan	0.33	1.06	3.47	1.12	3.72	10.7
Mexico	-0.1	-0.21	-0.23	0.64	1.97	5.54
Russian Federation	-0.14	-0.34	-0.71	1.03	3.08	8.93
Saudi Arabia	-0.26	-0.38	0.78	0.34	1.05	3.35
South Africa	0.04	0.11	0.35	0.67	2.46	7.56
South Korea	0.3	1.15	4.34	0.96	3.73	11.68
Turkey	0.07	0.2	0.64	0.6	2.26	7.98
United Kingdom	-0.02	-0.05	-0.11	0.34	1.16	3.97
United States	0.2	0.6	1.88	1.2	3.77	10.52

Table 1: Percentage loss in GDP per capita by 2030, 2050, and 2100 for G20 countries

Source: Kahn et al. 2019

Climate change poses several challenges for human and natural systems across G20 countries (IPCC 2018), including reduction in labor productivity and impacts on human health. Climate action has the potential to unlock many economic, social, and environmental benefits (Mason and Gencsu 2019). For instance, transitioning to 100% clean, renewable energy is estimated to reduce global energy needs by 57%, create 28.6 million net jobs, and reduce energy, health, and climate costs by 91% compared with a business-as-usual scenario with no serious climate action, including in all G20 countries (Jacobson et al. 2019).

Despite these findings, climate risks and opportunities have not yet been incorporated into economic planning and development strategies. Additionally, G20 nations must now implement a resilient recovery plan to address the COVID-19 pandemic.

Proposal

G20 countries that are signatories to the Paris Agreement must seek its full implementation while reflecting common but differentiated responsibilities and respective capabilities, in light of different national circumstances (G20 2019). Therefore, certain proposed instruments in this brief are pertinent to advanced countries (G20-AD), while others are better suited to the contexts of emerging countries or commodity exporters (G20-EM). The overall objective of this brief is to provide policyrelevant, acceptable, and viable actions to reach the common objective of reducing GHG emissions and stabilizing global temperatures while unlocking economic, environmental, and social co-benefits for all G20 members (Figure 1).

Figure 1: Developed, developing, and fossil-fuel dependent economies in the G20

Proposal I: Strengthening existing climate policies

Proposal 1:

G20 countries must implement measures to increase their capacity for the global policy-driven energy transition. This includes reforming domestic energy markets through the removal of inefficient fossil-fuel incentives and deploying energy efficiency measures.

Rationale

In 2009, G20 members pledged to establish and implement an accelerated program to phase-out fossil-fuel incentives (G20 2009). However, G20 members still favor fossil fuel use with incentives estimated at 3.4 trillion dollars for the year 2015 (Coady et al. 2019).[1] Moreover, a significant portion of these involve the G20-EM countries. Between 2010 and 2018, G20-EM countries accounted for half of the world's fossil-fuel incentives, with an average cost of 2% of their GDP in 2018 (IEA 2019a).[2] Although removal of fossil-fuel incentives is subject to substantial political and economic barriers (IEA 2010), many developing countries took effective measures for its phase-out (OECD/ IEA 2019). Nevertheless, adapting policies to national circumstances, while addressing equity and competitiveness issues, is still hindering the accelerated removal of fossilfuel incentives.

While fossil-fuel incentives cause market inefficiencies and pose a financial burden on government budgets, in addition to their environmental cost, energy efficiency represents one of the most cost-effective mitigation options. Although the significant deployment of energy efficiency measures might generate economic (including employment and energy security) and social (including improved health impact and new business opportunities) co-benefits, it lacks scalable financial incentives for initial investments and adequate information programs (Edenhofer 2015).

Means for G20 interventions

- **G20 members should consider additional commitments to phase-out fossil-fuel incentives with clear timeframes** Although G20 countries (recently led by the G20-EM) took steps to reform their energy markets through gradually removing inefficient fossil-fuel incentives, the scope and pace of the reforms was insufficient to address climate change (Asmelash 2017). G20 countries should consider further steps to standardize definitions and enhance transparency and accountability (Whitley 2013). Pricing reforms can be advanced by strengthening the peer-review mechanisms for fossil-fuel incentives and by setting annual (or multi-annual) targets at country-scale level, with price floor improvements, followed by enhanced reporting and monitoring processes.

- **The policy design and implementation for the phase-out of fossil-fuel incentives should ensure equitable support for vulnerable groups**. Assessment of the impact of the removal of fossil-fuel incentives on the most vulnerable incomegroups is critical for the success of the reform agenda (Gerasimchuk et al. 2017). G20 members should collaborate on best practices for social protection programs, while considering subsidy types across countries (consumption versus production subsidies). A review process is required to generate and enhance social dialogue and create allowance packages that are effective and visible.
- **G20-EM should strengthen the existing local efficiency initiatives by enhancing capital flow**In leading economies of the G20-EM, rapid economic growth will drive rising energy demand in upcoming decades (IEA 2019b).[3] Energy efficiency, if stimulated with suitable incentives, has the potential to meet growing demand, while providing reliable energy services and expanding access (UNEP 2017). G20-EM members are urged to expand the development of local energy service companies (ESCOs) through tailored legal and financial policies, which reduce related contractual complexities. Indeed, lessons from experiences in developing countries show that adapted financing mechanisms such as special funds, credit lines, and local guarantee loans have created sustained shifts toward demanddriven and commercially viable investments (Sarkar and Singh, 2010).

Proposal 2:

- G20 countries must consider dedicated **financial mechanisms for low-carbon technologies, and support climate technology transfer** to assist member countries in achieving their mitigation and adaptation objectives.

Rationale

Bridging the gap between the current scale of climate technology use and the Paris Climate Agreement temperature goals requires rapid technological innovation and widespread transfer and implementation of technologies in both developed and developing countries (IPCC 2018). Global organizations and initiatives have been created to achieve this, including UNFCCC's Technology Mechanism (TM); IEA's Technology Collaboration Programme (TCP); and the International Renewable

Energy Agency (IRENA)–G20 Toolkit of Voluntary Options for Renewable Energy Deployment. The speed and scale of these projects, however, remains impeded by the key challenges of: finance (Micale et al. 2018); Intellectual Property Rights (IPR); and technical and human capacity constraints in recipient countries (ICTSD 2011; Rajyalakshmi 2018).

Means for G20 interventions

The G20 should work closely with and support international organizations in their efforts to enhance effective climate technology innovation, transfer, and implementation. While international organizations can provide experience and knowledge, the G20 can offer political commitment to the agendas of international organizations through bilateral and multilateral collaboration under the G20 framework. Furthermore, the G20 can incentivize mitigation activities by improving access to capital while reducing its cost, while easing investment-related risks. The G20 must support technology transfer and financial collaboration in the following areas:

- **Improving the institutional framework for climate finance** Instruments such as government guarantees, credit insurance, and local currency finance ensure protection to lenders, thereby expanding funds' availability and reducing their cost (Wuester et al. 2016). Climate factors should be incorporated within the broader financial system. The G20 should support transparency and disclosure aligned with the low-carbon transition. Member states are urged to implement legally binding measures, integrating Environmental, Social, and Governance (ESG) factors and climate-related risk disclosure, building on the work of the G20 Sustainable Finance Study Group. These should be increasingly integrated into the investment valuation process, including the cost-benefit analyses conducted by Government Finance Ministries and other relevant authorities.
- **Strengthening IPR strategy**. Climate technology industries have achieved growing success in the G20-EM, for example China and India, but most patents are publicly funded or privately owned in the G20-AD like the US, Japan, and Germany (ICTSD 2011;, Rajyalakshmi 2018). Consequently, diffusion of the most advanced climate technologies has been largely restricted by IPR held in the G20-AD (Goldar et al. 2019). The G20 should encourage mutually beneficial technology partnerships and international cooperation through: bilateral initiatives (such as joint research); development and deployment of climate technologies between the G20-EM and the G20-AD; and

multilateral initiatives of the IEA's TCP. The G20 must provide an inclusive forum (for both developed and developing countries) to discuss means and ways to make climate technologies more accessible and accelerate crossborder market access, for example at G20 Energy Ministers' Meetings.

- **Supporting technical and human capacity building in developing countries** G20-EM countries require assistance with developing human capacity (knowledge, techniques and management skills), developing appropriate institutions and networks, and with acquiring and adapting specific hardware (Metz et al. 2000). The G20 must play a proactive role in supporting the efforts of international organizations such as the IEA's TCP and IRENA to facilitate the flow of expertise and support of skills development, ensuring that transferred technologies meet local needs and priorities, and that there is an appropriate enabling environment for promoting climate technologies.

Proposal 3:

G20 fossil-fuel dependent economies should seek economic diversificationas a sustainable mitigation policy of climate action impacts on their economies and to achieve multiple co-benefits.

Rationale

Decreasing GHG emissions will require significant reductions in use of fossil fuels. For major exporters, most mitigation scenarios will result in reduced revenues, mostly in oil and coal trade (Edenhofer 2015). As this income shrinks, and domestic use of these resources is restricted, the fossil-fuel dependent economies should seek alternative solutions to ensure long-term sustainable and resilient economic growth (Ollero et al. 2019). Breaking the dependence on hydrocarbon revenues through economic diversification may require decades to materialize (Cherif and Hasanov 2014). In this proposal, however, we urge fossil fuel dependent G20 countries to speed up economic diversification not only to avoid the adverse climate-related economic impacts but also to achieve the climate-economy co-benefits associated with cutting GHG emissions.

Means for G20 interventions

G20 fossil-fuel dependent economies (where fossil fuels are the primary source of revenue or account for a significant portion of the energy mix) are recommended to take the following policy actions:

- **The G20 should act as a source of expertise for diversification of economies and the energy mix**The G20-AD should assist less diversified economies to create the institutional architecture required for diversification objectives. This can be done by creating dedicated platforms, such as climate-economy working groups. Within this framework, countries will develop action plans to provide knowledge on best practices, build local expertise, and access necessary funding support. Such schemes will allow policymakers to rank policies according to specific national circumstances (UNCTAD 2019).

- **Economic diversification should be aligned with national climate pledges (National Determined Contributions [NDCs])** Diversification could act as an effective adaptation measure, to increase the resilience of climate-sensitive sectors, and a mitigation tool for cross-border responses (UNFCCC 2016). G20 fossil-fuel dependent countries should factor climate-related economic risks, resulting from depressed fossil-fuel demand and volatile prices, into long-term planning. Governments should ensure that economic diversification acts as a tool for implementing national mitigation and adaptation objectives by restructuring economic activity and investment toward resilient, low-carbon sectors, including high-tech industries. Importantly, policymakers should adopt the appropriate metrics, such as export-complexity indices, that might help to direct the support toward NDC-compatible activities.

- **Governments should prioritize sectors with higher co-benefit outcomes** Sector-specific taxation frameworks could incentivize a diversified services and manufacturing base, which could attract investment, including foreign capital, to emerging activities (OECD 2008). NDC-related economic diversification actions, such as investment in clean energy, energy efficiency, and sustainable transport as well as in non-fossil-dependent sectors, such as health and information technology, can unlock several co-benefits in the form of spillover effects. Learning through technology results in human capital development by creating a skilled workforce that facilitates the development of knowledge-based sectors.

Proposal II: Measures for a sustainable post-pandemic recovery

Rationale

Current energy, transport, building, and water infrastructure account for more than 60% of global GHG emissions (OECD 2018), and whilst the pandemic has led to deep emission cuts, these would be needed annually to meet the most ambitious climate goals. Infrastructure assets of different types have a long lifespan. For example, rail tracks and transmission lines have a design lifetime of around 50 years (Gibson of different types have a long lifespan. For example, rail tracks and transmission lines have a design lifetime of around 50 years (Gibson 2017). This implies that current investments determine whether global climate goals can be achieved. Sustainable infrastructure investment therefore needs to be a critical part of recovery packages during the current crisis (Cantore et al. 2020). To ensure that new investments are targeted on sustainable infrastructure, there is a need to adjust market incentives, such as fossil-fuel incentives and carbon pricing (WEF 2019). In the 2009 financial crisis, various countries implemented a range of green stimulus measures such as: (i) general government spending, (ii) tax cuts, and (iii) other government spending, including investment in infrastructure (ILO 2011). Approximately 16%, or $521 billion, of all fiscal measures were allocated to "green stimulus" in 2009 (Robins, Clover and Singh 2009; ILO 2011), and this proportion needs to be substantially increased in 2020, given that G20 countries are failing to meet their climate commitments. The unique nature of this crisis may also allow time to build an infrastructure project pipeline for when the stimulus is needed (Hallegatte and Hammer 2020). Therefore, G20 countries should incorporate sustainable infrastructure into green/sustainable stimulus and recovery packages.

Means for G20 Interventions

- **Develop and support comprehensive national infrastructure plans with a longterm vision informed by circular thinking**These plans should be aligned with NDCs, the 2030 agenda, and biodiversity plans for meeting revised Convention on Biodiversity (CDB) targets. A robust methodology for project selection should incorporate all aspects of sustainability. A focus on prior planning and organizational capacities is critical to drive a shift in global infrastructure to meet global challenges (Serebrisky et al. 2018). At the upstream phase of infrastructure development there is lower path dependency or lock-in due to perceived sunk costs (Mabey et al. 2018). Therefore, this is the most effective time to maintain and preserve ecosystem services. Benefits and "resilience services" of natural capital assets for natural-based solutions such as forests that stabilize hillsides or manage catchment areas, are provided on a larger scale than specific projects (Bartlett 2019), demonstrating the value of strategic spatial planning. Consideration of all affected parties may also prevent long-term social issues (IADB 2017). Moreover, hybrid infrastructure, combining green and grey technologies, provides costeffective protection from the impact of climate-related incidents such as storm surges (TNC 2015; Browder et al. 2019). Investing $1.8 trillion globally from 2020 to 2030 in five areas could yield $7.1 trillion in net benefits (GCA 2019). Comprehensive infrastructure plans will be important to ensure that sustainability benefits are captured in post-pandemic recovery packages, and since infrastructure projects have stalled, this may also provide an opportunity for better strategic planning. Whilst current infrastructure has been designed for, and perpetuated by, a linear economy (Peake and Brandmayr 2019), the rise of a circular economy can unlock $4.5 trillion in new economic growth by 2030 (Accenture 2015). Examples include infrastructure for collecting high quality waste streams for re-use (Peake and Brandmayr 2019) and circular water infrastructure to preserve water resources (Giezen 2018; Voulvoulis 2018). Co-benefits of reduced price volatility and supply risks (WEF 2014) can potentially increase resilience to future shocks and regenerate natural systems. Furthermore, G20 countries can also support upstream planning capacities through development finance institutions and multilateral development banks (MDBs).
- **Incentivize investment in energy efficiency, clean energy manufacturing, and production as part of recovery packages**Energy efficiency can be considered as a core infrastructure investment to support climate action and arguably needs to be treated as an energy source in its own right. For example, to implement the Paris Climate Agreement, two-thirds of the investment in low-carbon energy infrastructure in the EU must be directed toward energy efficiency until 2040 (Amon and Holmes 2016). Energy efficiency accounted for over two-thirds of total stimulus spending in the EU during the 2009 crisis. It was mainly focused on building efficiency (ILO 2011) with key measures including tax incentives, investments in insulation, and efficient lighting. There is a growing consensus that promoting energy efficiency can create jobs while meeting economic, climate, and health goals (EEIG 2020). Energy efficiency has the potential to boost economic growth while reducing energy demand. Additionally, by making homes warmer, energy efficiency measures can dramatically improve well-being (IEA 2014). Thus, there are strong co-benefits for economic growth, innovation, and health. The broader benefits of energy efficiency have been found to be true also for emerging economies (Rajbhandari and Zhang 2018; Bayar and Gavriletea 2019). In the US, direct financial support for clean energy technologies accounted for approximately $92 billion of the $840 billion in the 2009 American Recovery and Reinvestment Act (ARRA)—a small proportion of the total, with some of these measures including basic research programs, investment tax credits, tax grants, and targeted loan guarantees (Mundaca and Richter 2015). An assessment of its effectiveness found that, by the end of 2011, there were 470 wind turbine manufacturing facilities in the US, over ten times the number of such factories in 2004 (Mundaca and Richter 2015). One of the benefits of these stimulus packages is the relative labor intensity of the investments. Compared to fossil-fuel power plants, renewable energy generates more jobs per unit of installed capacity, per unit of power generated, and per dollar invested (UNEP/ILO/IOE/ITUC 2008).
- **Prioritize sustainable transportation and information and communication technology (ICT) infrastructure in economic stimulus measures**. Transport plays an important role in the current economy and has a significant impact on growth and employment.

Investment in sustainable transportation has co-benefits for health and climate change. Investment in ICT infrastructure may reduce the need for transportation, as has been evident during the COVID-19 pandemic that has required social distancing measures. Emissions resulting from transport are the fastest-growing source of carbon dioxide (CO_2) emissions, with most projected increases expected to be attributable to developing Asia (ADB 2020). The health burden of air pollution is significant as it is responsible for approximately 7 million deaths per year. Road transport is estimated to be responsible for up to half of the particulate matter emissions in OECD countries (WHO 2020). Sustainable transport investments have potential economic benefits for GDP and growth. For example, road congestion already costs Asian economies an estimated 2%–5% of GDP every year due to lost time and higher transport costs (ADB 2020). If the last three decades are a guide, accelerated vehicle renewal programs can be expected to feature in future stimulus programs (Perkins 2011). However, supply-side efficiency measures for new cars or new railway engines are not often "shovel ready" or easily implementable at rapid timescales, meaning they are less obviously an effective tool for short-term recovery (Bowen et al. 2009), compared to building efficiency or afforestation. During the 2009 financial crisis, many stimulus packages also put an emphasis on deploying ICT infrastructure and a "networked recovery" with the aim of reviving the economy (Guelleci 2009). Within the current pandemic, ICT technologies have enhanced the resilience of businesses, enabling them to continue functioning during the crisis. Remote working can boost worker productivity and reduce office rental costs (Bloom et al. 2013), resulting in reduced air pollution and congestion on local roads (Giovanis 2018). ICT infrastructure investments and the uptake of remote work may therefore have positive benefits for climate action.

- **Inclusion of natural infrastructure in green stimulus packages** Natural infrastructure describes natural or semi-natural structures that offer alternatives to built infrastructure, for example, wetlands that provide water purification and flood risk reduction (WWF and HSBC 2017). Loss of global biodiversity is linked to unsustainable infrastructure investment (WWF 2017), despite biological diversity itself being described by the UN's Executive Secretary of the Convention on Biological Diversity as the "natural infrastructure" that supports life on earth (Paşca Palmer 2018). Investments in natural infrastructure, such as enhanced protection, reforestation, and restoration, as part of green stimulus packages, can be rapidly implemented (Bowen et al. 2009). The co-benefits of investing in natural infrastructure include health benefits and resilience, such as trees reducing stormwater and lowering temperatures in urban areas (Ossola et al. 2020). Investing in natural infrastructure also addresses one of the catalysts of pandemic risk, since there is a link between ecosystem destruction and zoonotic diseases (Bloomfield et al. 2020). Urban ecosystems also provide benefits for pollution removal, stormwater management, and carbon sequestration, with one study finding that the economic benefits of existing trees across 10 megacities amounted to around $500 million (Endreny et al. 2017). Given the range of possible benefits, G20 governments should include natural infrastructure investment in recovery packages.

Key Recommendations

The following key policy recommendations enable the G20 to take the lead in establishing a unified platform for climate action, channeling investment toward a low-carbon economy, and fostering the underlying co-benefits across its members:

- Implement measures to increase resilience to the challenges of the global policydriven energy transition. This includes reforming domestic energy markets within G20 countries through the **phase-out of inefficient fossil-fuel incentives and implementing energy efficiency** measures.
- Adopt dedicated financial mechanisms by **promoting climate investment instruments** Facilitate **the transfer of climate technologies** through inclusiveness of innovation within appropriate institutions and networks while assisting developing members to achieve their mitigation and adaptation objectives.
- **Support sustainable economic diversification**, by aligning climate mitigation and adaptation commitments with economic policies, to enhance a swift transition to sustainable and climate-resilient economic growth.
- Integrate sustainable infrastructure investments into **economic stimulus packages** for post-pandemic sustainable economic recovery.

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Appendix

[1] . The sample of G20 countries excludes Brazil, Japan, Italy and South Korea.

[2] . The sample of developing countries excludes Brazil and Turkey.

[3] . China and India alone will account for half of the total primary energy demand between 2018 and 2040 (IEA, 2019b).

Existing Initiatives & Analysis