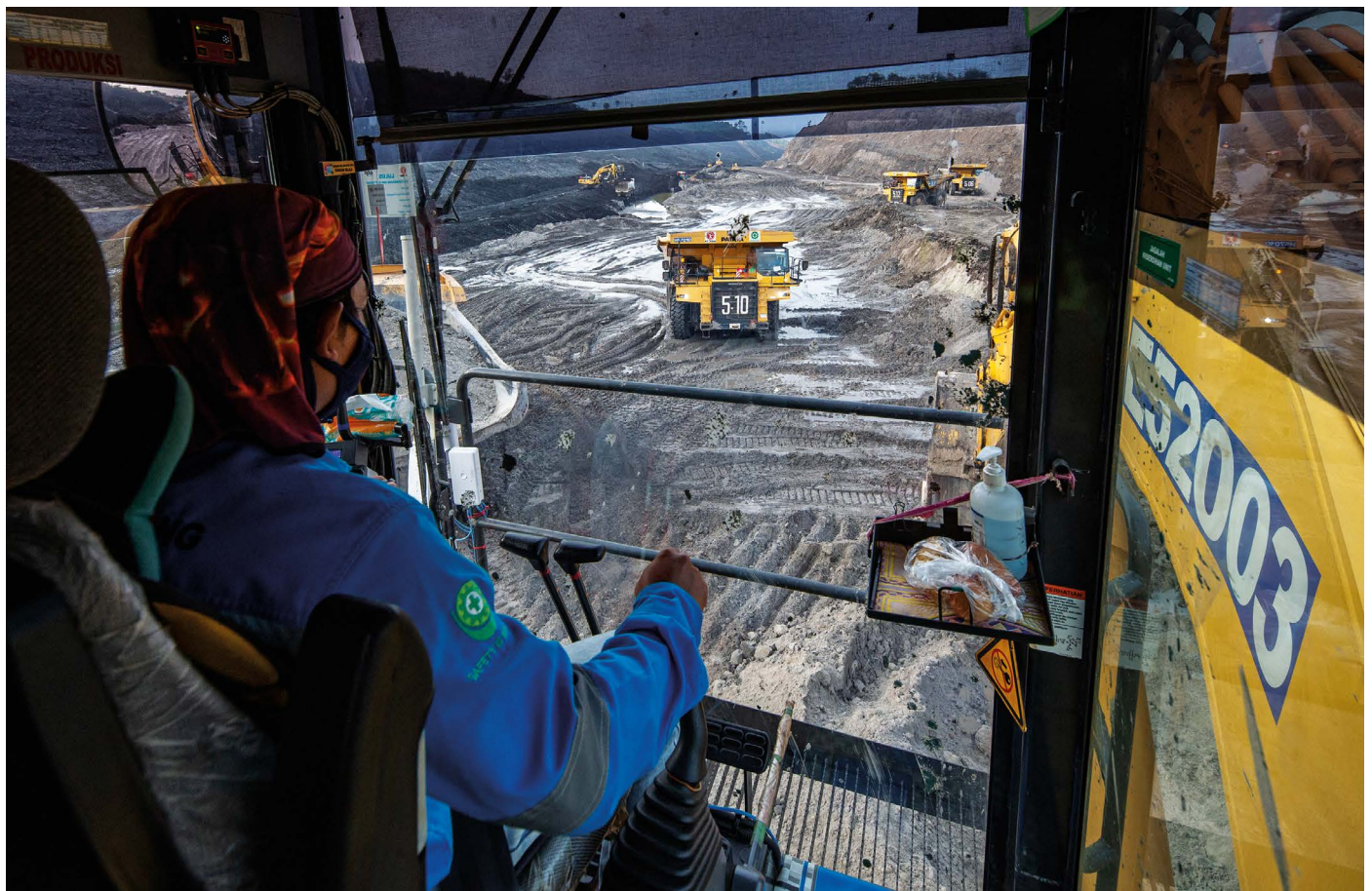


Comment



AFRIADI HIKMAL/NURPHOTO/GETTY

An excavator at a coal mine in Indonesia. The country holds the 2022 presidency of the G20 group of largest economies.

G20's US\$14-trillion economic stimulus reneges on emissions pledges

Jonas M. Nahm, Scot M. Miller & Johannes Urpelainen

Analysis of pandemic economic recovery packages from the 20 largest economies reveals that governments are not spending on emissions cuts despite promises to 'build back better'.

Governments are spending unprecedented amounts to escape the recession caused by the COVID-19 pandemic. In 2020 and 2021, the G20 group of the 20 largest economies spent at least US\$14 trillion – close to China's annual gross domestic product. Much of that total, rightly, went to shoring up health-care systems, wages and welfare. But climate action was widely promised, too – including 'green new deals' and 'building back better'.

Our analysis suggests that, so far, those promises have not been met. We created an inventory of fiscal stimulus spending during

the COVID-19 pandemic in G20 economies, and classified measures according to their likely impacts on greenhouse-gas emissions.

Overall, we found that only 6% of total stimulus spending (or about \$860 billion) has been allocated to areas that will also cut emissions, including electrifying vehicles, making buildings more energy efficient and installing renewables. Worse, almost 3% of stimulus funding has targeted activities that are likely to increase global emissions, such as subsidizing the coal industry. And there's been little change in strategies as nations have shifted from economic rescue mode during

lockdowns to recovery, as shops and other businesses have reopened.

Today's green investments are proportionately less than those that followed previous recessions. After the global financial crisis in 2007–09, for example, 16% of global stimulus spending was directed at emissions cuts (or about \$520 billion of \$3.25 trillion in total)¹. If a similar share had been committed today, the total would be \$2.2 trillion – more than double what has been pledged towards reducing emissions.

Global emissions must peak within four years to avoid catastrophic climate change (see go.nature.com/3h9dqsd). Current rates of green investment are not enough to reach 'net zero' emissions by 2050 and limit warming to 1.5 °C – that would require around \$7 trillion during 2020–24 (ref. 2). As of early this year, governments have spent much more than that in responding to COVID-19, but only one-ninth of what is needed on climate mitigation.

Current stimulus packages are also failing to ready economies for a low-carbon world. Long-term investments in infrastructure, transport electrification, building efficiency and clean-energy technologies will open up new sources of economic growth³. For instance, in 2021, the global market for renewable-energy technologies – including wind and solar – reached \$366 billion, making it a lucrative area (see also go.nature.com/3jczjx2). Jobs are also created, for example, in constructing, retrofitting, installing and maintaining renewables. In 2020, the renewable-energy industry employed almost 900,000 workers in the United States and more than 12 million people globally (see go.nature.com/3h9fejw).

It is not too late to change course. Now that vaccines, antivirals, masks and more could be offering a path out of the pandemic (at least on paper), national economies have a prime opportunity to shift to a low-carbon footing. Governments have demonstrated that they are willing and able to mobilize substantial resources to combat a global crisis. Some nations, especially in Europe, have spent generously to boost green growth. Major US investments have been passed as part of President Joe Biden's infrastructure package; more might yet be released by Congress.

Here we outline our findings, lessons and research priorities. We call on all governments to combine economic and climate objectives in upcoming recovery bills – even cheap measures can be effective, such as making bailouts conditional on emissions reductions. Researchers need to improve their understanding of

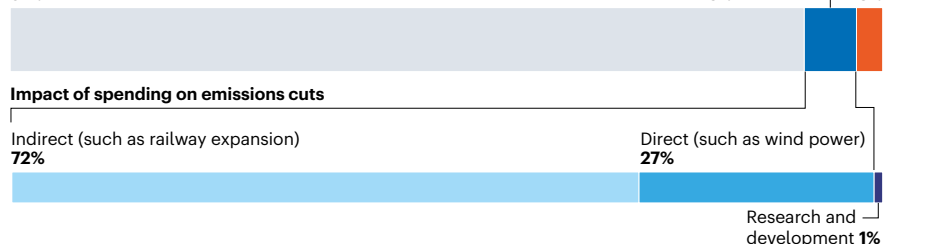
G20 STIMULUS SPEND

Governments of the 20 largest economies spent US\$14 trillion on fiscal recovery in 2020–21 in response to the COVID-19 pandemic. Less than \$1 trillion (6%) went to policies that will reduce emissions. Most of those impacts will be indirect and depend on consumer behaviour.

Effect on emissions

None

91%



why responses to this COVID-19 recession are different to others, to help make economies more resilient to future shocks.

Stimulus study

Our database covers national fiscal stimulus efforts for G20 economies between 1 January 2020 and 31 December 2021 (see Supplementary information for details). We focus on the G20 economies because these account for more than 80% of global emissions (see go.nature.com/3bnjnut) and 85% of global economic activity. For each bill, we recorded

“The vast majority of recovery spending (91%) did not seek to shift greenhouse-gas emissions.”

the date of passage, the amount and the target sector or sectors.

We judged whether the impacts would cut emissions, increase them or have no effect. Emissions-reducing policies include measures that promote energy sources generating fewer emissions and that boost energy efficiency (such as building wind turbines or insulating homes), or those that decrease activities that emit greenhouse gases (such as flying or driving). Measures that increase emissions support conventional fossil-fuel industries or encourage greater energy consumption (for example, by reducing petrol taxes). Emissions-neutral policies (such as wage premiums for essential workers in Russia) had no direct impact on emissions or an indeterminate net impact on activities that emit greenhouse gases.

We evaluated whether these policies would be short term or longer-lived. The former are typically one-off and temporary bailouts (of airlines, for example). The latter include permanent policy changes and construction of major

infrastructure that will alter the economy (such as high-speed railways or wind turbines).

We included only direct responses to the pandemic. For example, India dedicated almost \$14 billion to propping up its coal industry during the economic downturn, including modernizing mining infrastructure, attracting private-sector investment and reducing coal prices. By contrast, France earmarked \$66 million to subsidize bicycle parking and repairs – to encourage green transportation in citizens who shied away from public transport during the pandemic.

We used government press releases, legislative text and quotes from officials to exclude unrelated measures. We also excluded state and local measures, to focus on the large scale and avoid double-counting.

Our study does not include all climate-related spending during the pandemic. We focus on fiscal spending only and exclude other policy tools – including monetary policy and loans – through which governments can have an effect on emissions. Our research also excludes non-pandemic-related climate spending, which at times required us to make difficult decisions on which measures to count as stimulus spending. Finally, our estimates are based on government spending announcements, particularly for long-term spending packages. Actual investments might end up differing from the numbers presented here.

Same old

We found that, of the \$14 trillion G20 governments have pledged to fiscal stimulus since the beginning of the pandemic, less than \$1 trillion was allocated to recovery programmes that have direct or indirect climate objectives (see ‘G20 stimulus spend’). Of this amount, just over one-quarter (27%) targets measures that will cut emissions directly – for example, through grants to install insulation and energy-efficient heating systems in homes, as



MARTIN ZABALA/XINHUA/EYEVINE

Argentina invested in railway expansion during the COVID-19 pandemic to create jobs and improve train reliability.

in the United Kingdom and Germany. Most of the rest of the allocation (72%) has indirect impacts. These hinge on consumer behaviour and will require more regulatory and financial incentives. Examples include investments in Germany to construct electric-vehicle charging stations as part of its Coronavirus Recovery Package. Argentina spent on expanding railways to create jobs during the pandemic, while improving the reliability and safety of passenger rail.

The remaining 1% (\$10.6 billion) went to research and development (R&D). Such efforts might yield technological breakthroughs in the future, but are unlikely to affect global emissions before 2030. Examples include \$2.2 billion in South Korea for green innovation research (such as on carbon capture and renewables), and a \$216-million boost to hydrogen-power research in Australia. This \$10.6-billion global sum is similar to the US National Science Foundation's budget request for 2022 (ref. 4). It is much less than the combined R&D spending of countries in the Organisation for Economic Co-operation and Development, which totalled \$1.45 trillion in 2019 (see go.nature.com/2suftd2).

The vast majority of recovery spending (91%) did not seek to shift greenhouse-gas emissions. Often passed in large omnibus bills, such measures included funding for strained health-care systems, as expected during a pandemic. Most went to propping up the status quo: tax breaks, subsidies,

business bailouts and wages paid to workers or companies to avoid lay-offs.

Little has changed since the start of pandemic. In the first six months of 2020, green recovery measures accounted for 5% of overall stimulus spending. That rose to 12% in the second half of the year, largely because the European Union passed its large emissions-reducing spending package. The share fell back to 3% in 2021.

As restrictions have lifted, new rounds of stimulus packages have paid more attention to economic recovery and rebuilding. Still, few contained climate provisions. For instance, almost all G20 economies provided financial support to domestic airlines, but only France made its support conditional on meeting climate goals by asking Air France to cease domestic flights on routes that compete with high-speed rail. No environmental conditions or incentives were attached to the US Paycheck Protection Program or to Russia's support for its construction sector, for instance.

Leaders and laggards

Not all countries known for ambitious climate policies, for instance through strong commitments under the Paris climate agreement, stepped up to the plate. But some governments did more than others. The European Union and South Korea led the pack (see 'Varying investments'). Each dedicated more than 30% of their COVID-19 fiscal stimulus to emissions-reducing measures – even though

each had already invested nearly 60% and nearly 70% of their 2009 stimulus, respectively, in such projects¹. Brazil, Germany and Italy invested more than 20%, Mexico and France over 10%. In absolute terms, the EU has pledged just shy of \$500 billion on emissions-reducing measures, while Italy has committed \$70 billion and France nearly \$50 billion.

Such nations have, smartly, used stimulus packages to address many sectors at once. For example, Germany's budget will promote wind- and solar-energy deployment, energy-efficient buildings, electric and hydrogen-powered vehicles and more-efficient buses and aeroplanes.

At the other extreme, economies that are laggards are those dependent on fossil fuels, such as India, China and South Africa. China cut electricity prices by 5% in 2020 to ease financial stresses. It asked coal mines to increase production to help to stabilize prices. India delayed the deadline for coal power plants to implement air-pollution control measures. South Africa earmarked \$11.4 billion in guarantees to buy electricity from power plants (largely coal) in the face of plummeting demand, while decreasing purchases of wind power.

The middle of the pack holds the most surprises. The United States, Japan, Canada and the United Kingdom each committed less than 10% of recovery funds to emissions-reducing causes. These small investments stand

in stark contrast to their official commitments to the Paris climate goals.

This gap is concerning in the United States and China. Together, they account for more than 35% of total emissions (see go.nature.com/3bnjnut) and 59% of global stimulus spending. In this pandemic, China directed much of its stimulus to boosting new emissions-neutral sectors, including 5G mobile-phone networks, artificial intelligence and data centres. Yet in 2009, its priorities were high-speed rail, grid modernization, waste management and the solar industry.

That said, hopeful signs are emerging from the Biden administration and Chinese president Xi Jinping. In 2020, China announced its first official net-zero carbon goal and, in 2021, alone installed more offshore wind power than the rest of the world has done since 2016 (ref. 5). The United States rejoined the Paris agreement in 2021 and included investments in public transit, vehicle electrification and grid modernization in its infrastructure bill. Other climate legislation remains stalled in Congress.

But the United States and China have also committed large sums to supporting fossil-fuel-intensive industries and infrastructure projects in their recovery packages. These include unconditional bailouts for US domestic airlines and investments in Chinese roads and industrial parks. Such measures could have been conditional on meeting emissions goals or targeted at green industries.

Missed opportunity

Why have governments missed this chance to restructure their economies? The answer requires further research. Historically, governments have often prioritized economic growth over environmental and climate policy⁶. Yet the view that emissions reductions and economic

recovery are irreconcilable is incorrect. It is also at odds with growing concerns about the vulnerability of global supply chains that have led governments to build up domestic manufacturing, particularly in clean technology sectors, for which the world depends on China.

The COVID-19 recession was worse than previous ones, and different in cause. Spending decisions have focused on weathering a short-term health crisis and fighting economic fires. Structural problems in the economy lay behind the 2007–09 financial crisis, and received more attention.

Changing political landscapes are another factor. For example, having already invested heavily in clean-energy sectors after 2009, a country such as China might not feel the need to do so again so soon⁷. US presidents have come and gone. Congressional gridlock has stymied progress on President Biden's climate agenda in 2021. In 2009, former US president Barack Obama was able to pass climate-friendly recovery measures with greater congressional majorities.

Paths forward

There is still time for improvement. Four lessons can be learnt from recovery efforts.

First, governments should apply environmental conditions to stimulus bills. It is cheap and effective. As France has shown for aviation, attaching climate targets to corporate bailouts can shift entire sectors onto more sustainable trajectories at minimal cost to governments.

Second, governments should focus on recovery measures that have direct emissions impacts⁸. They should accelerate public spending on renewable energy to reduce the consumption of fossil fuels and increase the energy efficiency of housing, as in South Korea's Green New Deal. Or they could invest in

vehicle electrification, as Germany has done by purchasing electric vehicles for government fleets.

Third, governments should position their economies strategically to compete in a post-carbon world. That means investing in low-carbon industries. It also requires building institutions to make economies more resilient to future shocks, and to help those who rely on fossil-fuel-based industries to transition to new livelihoods. The EU recovery programme, for instance, offers grants, loans and subsidies to new industrial sectors, for instance by creating a European battery-supply chain. The EU has also pledged to use a portion of proceeds from the European emissions-trading scheme to fund training programmes and compensate those who lose employment as a result of the energy transition.

Fourth, the climate community, economists and social scientists need to examine the reasons behind the current drop in emissions-reducing recovery spending. Why are there large cross-national differences in approaches to stimulus, even between countries that have similar political institutions and levels of economic development? What kinds of investment will yield the best outcomes for both climate and economic recovery?

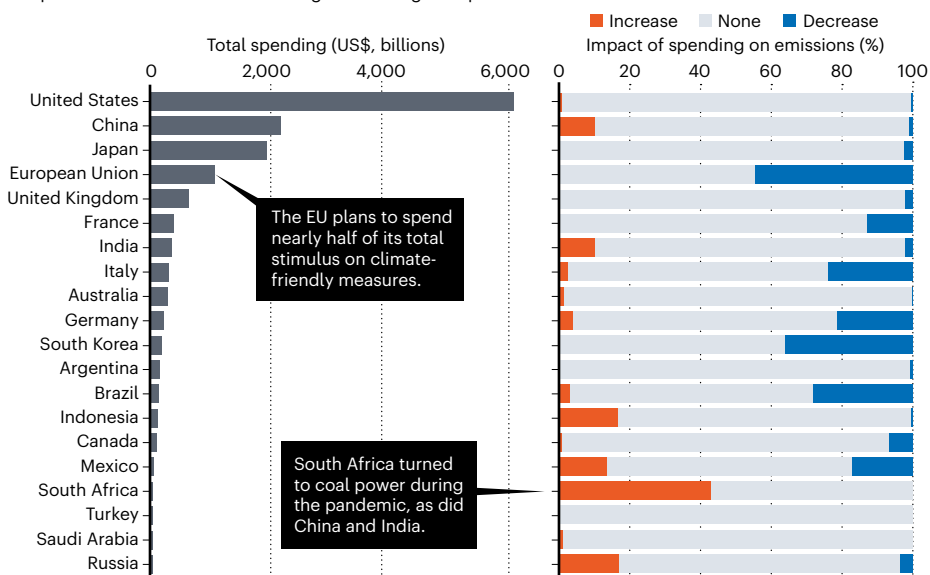
As the COVID-19 pandemic is showing, governments that turn a blind eye to risks fail to guard their citizens' lives and livelihoods.

The authors

Jonas M. Nahm is an assistant professor in the School of Advanced International Studies, Johns Hopkins University, Washington DC, USA. **Scott M. Miller** is an assistant professor in the Whiting School of Engineering, Johns Hopkins University, Baltimore, Maryland, USA. **Johannes Urpelainen** is a professor of Energy, Resources and Environment in the School of Advanced International Studies, Johns Hopkins University, Washington DC, USA. e-mail: jnahm@jhu.edu

VARYING INVESTMENTS

Countries that rely on fossil fuels often boosted sectors that increase emissions, despite stated commitments to limit global average temperature rise.



- Jaeger, J., Westphal, M. I. & Park, C. *Lessons Learned on Green Stimulus: Case Studies from the Global Financial Crisis* (World Resources Institute, 2020).
- Andrijevic, M., Schluessner, C.-F., Gidden, M. J., McCollum, D. L. & Rogelj, J. *Science* **370**, 298–300 (2020).
- Meckling, J. & Allan, B. B. *Nature Clim. Change* **10**, 434–438 (2020).
- US National Science Foundation. *FY 2022 Budget Request to Congress* (NSF, 2021).
- Vetter, D. 'China Built More Offshore Wind In 2021 Than Every Other Country Built In 5 Years.' *Forbes* (26 January 2022).
- Mol, A. P. J. *Environ. Polit.* **25**, 48–68 (2016).
- Nahm, J. *Collaborative Advantage: Forging Green Industries in the New Global Economy* (Oxford Univ. Press, 2021).
- Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J. & Zenghelis, D. *Oxford Rev. Econ. Pol.* **36**, S359–S381 (2020).

The authors declare no competing interests. Supplementary information accompanies this article; see go.nature.com/3ha3xqg.