



# ROADMAP TO GREEN RECOVERY

How could green fiscal spending support the economy, the environment and social welfare in face of economic crisis?



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# Executive Summary

**Government responses to COVID-19 have the potential to significantly influence the course of climate change.** Emerging research suggests that public investment in green initiatives can deliver strong economic returns, and if well-targeted, address social inequalities and create a cleaner natural environment. This appears particularly true during periods of economic downturn where job creation and economic rejuvenation are of paramount importance. By contrast, investment in fossil-heavy infrastructure that perpetuates a high-carbon status quo could bring significant long-term economic and climate dangers, while disproportionately harming minority communities.

**This report explores how governments can turn aspirations for a green COVID-19 recovery into a viable roadmap:**



A 'three pillars' framework is proposed to consider (i) policy and regulatory measures, (ii) public and private financing and (iii) requirements for institutional support and capacity building.



Core co-considerations are highlighted for policymaking in the COVID-19 era. In particular, the need to stagger benefits due to the unknown duration of the pandemic, the need to consider worker protection from infection with the virus and an imperative for a larger focus on enhancing equity as the crisis has disproportionately impacted the world's most vulnerable.



A simple modelling methodology from Vivid Economics is introduced to quantify the economic, environmental and health benefits of green fiscal stimulus. The process of this modelling is described so that governments might replicate it and apply it to their own nations.

Whilst this roadmap is written in the context of the COVID-19 recovery, the lessons are broadly applicable to many global, national and localised economic crises and recovery strategies.

India, China and Poland are considered as case studies. For each country, green recovery progress is explored using the Oxford University Global Recovery Observatory. The three pillars framework and modelling process is then applied to each country. Investment in a package of green policies is modelled in comparison to equivalent spending on coal.

**In each case, according to Vivid Economics' modelling, the green package creates more jobs in the short term, delivers higher total economic value, reduces greenhouse gas emissions and saves lives.**



**In India**, the Global Recovery Observatory finds that so far only USD16.1bn has been allocated to COVID-19 recovery (0.56% of GDP compared to up to 15% of GDP in other nations) and only 5.1% of that has been green (up to 100% in other nations). Vs. a cost-equivalent coal investment, Vivid Economics' modelling shows that a green stimulus package could deliver 2.6% more jobs per dollar in the investment phase and 70% greater economic impact per dollar in the first year. A USD 7.7bn spend on coal (base

case) instead of a green package might cost 34,000 lives and 11Mt in CO<sub>2</sub> emissions (0.4% of India's annual emissions). Following the three pillars framework, recommendations for India include:

- Policy and regulatory: prioritise investment in electric transport, clean cooking, renewable energy solutions, natural capital and sustainable agriculture
- Public and private financing: explore sovereign green bonds, green financial incentives, large-scale co-financing and methods for increasing concessional international finance
- Institutional support and capacity building: pursue a whole-of-government approach, introduce a task force on green recovery, and encourage long-term investment in capacity building at all levels of government



**In China**, the Global Recovery Observatory finds that only USD430bn has been allocated to COVID-19 recovery (3.0% of GDP) and only 12% of that has been green. Vs. a cost-equivalent coal investment, Vivid Economics' modelling shows that a green package could deliver 9.5% more jobs per dollar in the investment phase and 70% greater economic impact in the first year. A small USD 28.4bn spend (base case) on coal instead of a green package might cost 59,000 lives and 51Mt in CO<sub>2</sub> emissions (0.4% of China's annual emissions). Following the three pillars framework, recommendations for China include:

- Policy and regulatory: prioritise investment in the energy transition, green urbanisation and ecosystem restoration
- Public and private financing: accelerate public investment (either direct or through state-owned enterprises, enabled by currently available fiscal space), recycle revenues from carbon pricing initiatives, develop additional city-level environmental tax and charge policies and reforms and incentivise private green investment through blended finance and green financial sector reform
- Institutional support and capacity building: transfer and enhance carbon and energy intensity targets in the 14<sup>th</sup> Five-Year Plan to sector-specific plans and shift the productive priorities of state-owned enterprises towards green priorities



**In Poland**, the Global Recovery Observatory finds that so far only USD17.1bn has been allocated to COVID-19 recovery (2.9% of GDP) and 31% of that has been green. This is a higher green percentage than some countries, but smaller as a percentage of GDP. Vivid Economics' modelling shows that a green stimulus package could deliver 23 job years per million dollars in the investment phase. A EUR 1.75bn investment in green initiatives, unlocked by committing to a 2050 Net-Zero target under the European Commission's Just Transition Fund could boost employment by 46,000 job years and reduce CO<sub>2</sub> emissions by 2Mt (0.7% of Poland's annual emissions). Following the three pillars framework, recommendations for Poland include:

- Policy and regulatory: prioritise investment in residential energy retrofits, electric vehicles, renewable energy, natural capital, green spaces and green worker retraining
- Public and private financing: secure additional European Commission Just Transition Funds with a 2050 Net-Zero Target, prioritise crowding in private investment (partially through green financial incentives) and consider large-scale co-financing



- Institutional support and capacity building: introduce a dedicated task force on green recovery with decision-making function to allocate resources between investment priorities, and integrate robust and transparent monitoring of all COVID-19 investments

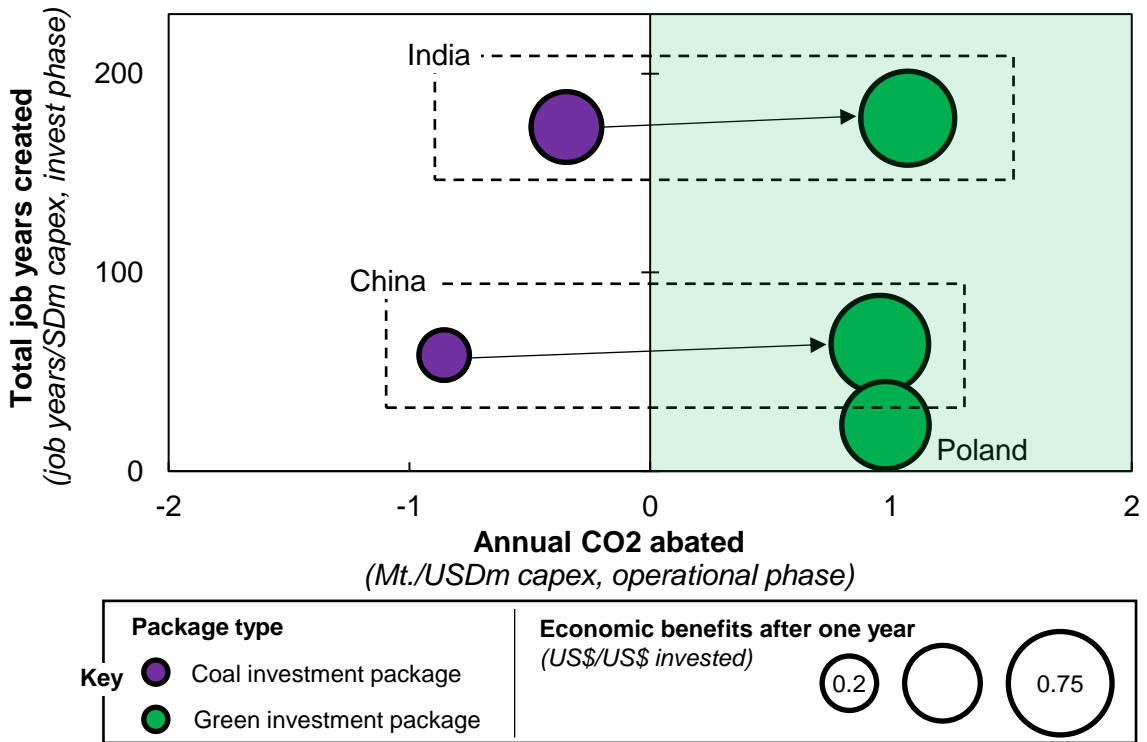


Figure 1.1 Performance of green investment packages vs. coal investment packages by country using modelling output from Vivid Economics.

# 1 Introduction

**The COVID-19 pandemic has devastated global economies, induced widespread social turbulence and brought renewed attention to similarly existential risks like climate change.** Global GDP growth fell from 2.8% in 2019 to -3.2% in 2020, only recovering to a projected 6.0% in 2021. (IMF, [2021](#)). Social capital has been hit hard with net unemployment increasing by an estimated 114 million people in 2020, and a jobs shortfall predicted until at least 2023 (ILO, [2021a](#)). Social inequality has widened, with the world's most already vulnerable groups the worst impacted by the pandemic (Tai et al., [2020](#); Bottan et al., [2020](#); Cucagna and Romero [2021](#); Iacobucci [2020](#); Heslin and Hall [2021](#); OHCHR [2020](#); Tesoriero et al. [2021](#)). Following suit, progress towards most United Nations Sustainable Development Goals (SDGs) has been reversed (Nature, [2020](#); UN, [2021](#)). The number of people living in extreme poverty has doubled, its first increase in more than two decades (IMF, [2020](#)).

In response, governments have introduced significant fiscal spending measures of two varieties: rescue spending to immediately protect lives and livelihoods and recovery spending to rejuvenate economic production and demand. Over time, recovery will shift to a period of reinforcement, likely to last many years into the future. In the later reinforcement stage, effective governments will take new growth paths started in the recovery stage and turn them into long-term development pathways.

**Policymakers have wide discretion in the fiscal means used in rescue, recovery and reinforcement spending, but particularly in recovery and reinforcement.** Hepburn et al. ([2020](#)), O'Callaghan and Murdock ([2021](#)) and Shan et al. ([2020](#)) all highlight significant potential disparity in climate change outcomes based on the investment decisions made in response to COVID-19. Given over USD17 trillion in COVID-19-related spending so far, it is expected that the nature of the COVID-19 fiscal response could similarly impact a wide range of economic, social and other environmental factors. In this way, strategic fiscal policy can simultaneously meet short-term needs and maximise future prosperity if directed towards future-oriented investments.

**For instance, policymakers can use fiscal policy to decouple greenhouse gas (GHG) emissions from economic growth by promoting green initiatives ranging from clean energy to natural capital and sustainable transport (Hepburn et al, 2020).** But what are the economic and social advantages of this compared to traditional measures? Is there a way to quantify benefits? What are the most important factors in designing such investment packages and where may the money come from? How can we best prioritise equity needs at all stages of the policy design process?

In corollary, it seems logical that spending must be directed away from those initiatives which have negative health consequences, are economically irresponsible and/or otherwise degrade natural, social and financial capital. Coal and other fossil fuel investments meet each of these criteria (Haines et al., [2006](#); Kampa and Castanas, [2008](#); Mercure et al., [2018](#)).

In response to previous crises, some government stimulus spending focused on short-term GDP outcomes, with inadequate concern for boosting long-term prosperity. This report aims to show that in the face of significant environmental, social and economic challenges predating the COVID-19 crisis, stimulus can and should incorporate long-term prosperity targets.

Building forward better could help to secure sustained and sustainable growth beyond the immediate recovery.

The evidence so far suggests that governments are largely failing to take advantage of the opportunity to use rescue and recovery fiscal packages to shift economies onto a more sustainable growth trajectory (O’Callaghan et al., 2021; Vivid Economics 2020).

Over 2020-21, several studies have provided early evidence in support of green stimulus measures (Hepburn et al., 2020; Forster et al. 2020; IEA 2020; McNeely 2021). Country-specific investigations have emerged to explore the economic potential of green stimulus in South Africa (Kiss-Dobronyi et al., 2021; Montmasson-Clair, 2020; O’Callaghan et al., 2021a), and the Democratic Republic of the Congo (O’Callaghan et al., 2021b), among others. Individually and collectively these works determine that green recovery measures – such as investment in renewable energy, low-emission transport, energy efficiency and nature-based mitigation and adaptation solutions – can provide higher employment intensity, better financial and economic returns and wider social benefits than policies which seek to prop up high-carbon and polluting industries and energy generation (Allen et al, 2020; International Energy Agency, 2020; WWF, 2020; Vivid Economics, 2020). In these studies, such measures are described as offering governments a win-win solution, by providing rapid and strong stimulus effects in the short term and mitigating environmental degradation in the long term. While these country-level studies are helpful as case studies, there is a need to present a generalisable approach for understanding green recovery potential across the world.

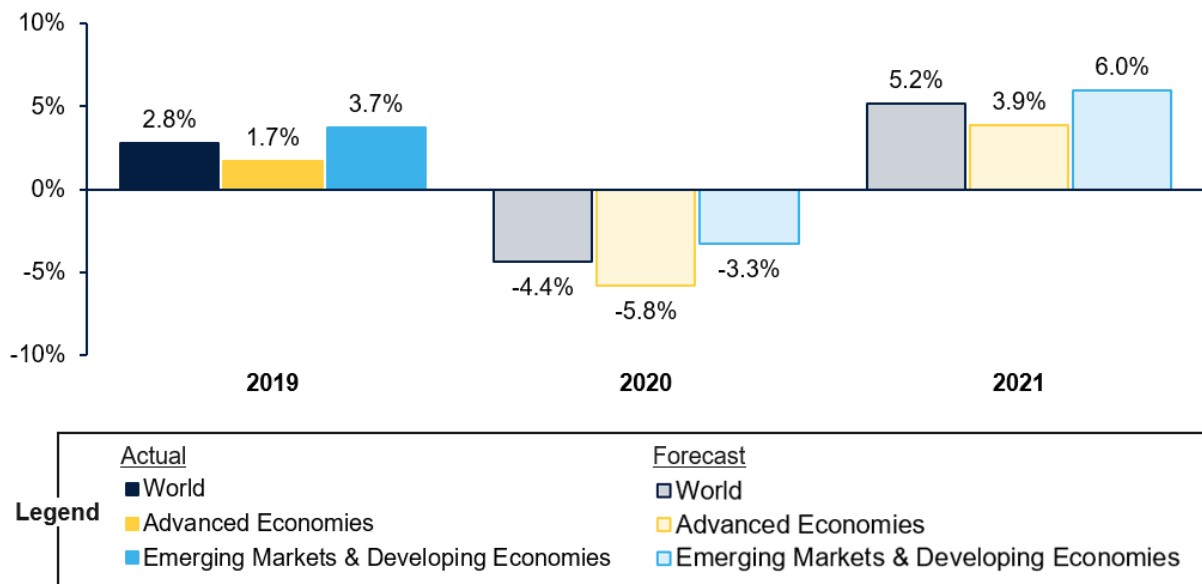


Figure 1.1. Global economic growth forecast, 2019-21, selected countries and regions from IMF World Economic Outlook, October 2020 (IMF, 2020).

**Given their large contributions to global greenhouse gas emissions, particularly through the burning of coal, India, China and Poland are particularly interesting case studies for the potential of green stimulus.** In electricity production, these nations rely heavily on fossil-generated power; 73.6% of energy consumption is met by fossil fuels in India, 87.7% in China and 90.3% in Poland (World Bank, 2020). For China and India, it is tempting,

although not economically rational, to fill increasing demand for electricity with new coal and gas investment (IEA, [2019](#)). However, in all three nations, shifts towards renewable energy in the electricity mix have accelerated over the past decade (IEA, [2020](#); IRENA, [2020a](#); O'Meara, [2020](#)). Although the dangers of further coal investment have been well-documented under long-term horizons (Caldecott, [2016](#); Farfan and Breyer, [2017](#), Pfeiffer et al., [2016](#)), their comparative weakness as stimulus is not well-understood. There is a need to explore how government support of green investment compares to coal investment in terms of (a) economic outcomes, (b) health outcomes and (c) environmental outcomes. Our hypothesis is that in a generalisable case, and in the cases of India, China and Poland, green investment would outperform coal investment on each criterion. If this were to be true, green stimulus should be actively prioritised to boost future prosperity, and spending on coal actively discouraged to avoid inferior outcomes.

Importantly, a green recovery from COVID-19 is about more than fiscal policy. Indeed, non-fiscal government policy measures including standard setting, carbon trading and changes to the legal system can significantly impact economic incentives and environmental outcomes (Aldy and Stavins [2012](#); Aldy et al., [2012](#); Peel and Osofsky, [2015](#); Zhao and Mattauch, [2020](#)). Regulatory measures, for instance cutting red tape in green industries to make investment easier could also be stimulatory (Guerin, [2017](#); Hu et al., [2018](#)). Central banks can play a role in use of monetary policy to advantage green development, for instance through green corporate QE programmes (Dafermos et al., [2018](#)). And of course, businesses and consumers also have central demand-side and supply-side roles to play to shift the global economic system towards greener modes of production. This report focuses on the fiscal opportunities of government, only discussing other green recovery support in tangent to fiscal discussions.

**This report sets out a roadmap for policymakers to design their own green fiscal recovery strategy and introduces a generalised framework for understanding and modelling the benefits of a green recovery.** Section 2 describes the evolving priorities and opportunities for fiscal policy to support a green transition through the recovery cycle. Section 3 presents a comprehensive tri-pillar roadmap for policymakers to design an effective green fiscal recovery strategy. Section 4 sets out a methodology for understanding the economic, environmental and health benefits of green stimulus in comparison to coal investment. Section 5-7 applies these analyses to three case study countries – India, China and Poland.

## 2 The Recovery Life cycle

**Economic crises and recoveries are not binary states, but dynamic and evolving processes.** Planning for a sustainable recovery requires a clear understanding of the recovery cycle. This section describes an illustrative recovery arc where, in line with previous work, we consider how conditions and priorities change over a three-phased recovery. Whilst this roadmap is written in the context of the COVID-19 recovery, the lessons are broadly applicable to many global, national and localised economic crises and recovery strategies.

### 2.1 Life cycle of a recovery

**Economic crises are not binary; they do not switch on and off.** From the early emergence of risks to the return to long-run equilibrium growth, economies transition through several phases, each characterised by evolving expectations and sentiments, business and consumer confidence, financial and money market movements and macroeconomic trends. Policy objectives and responses need to match the evolving situation.

**Each economic crisis and ensuing recovery is unique, but history suggests there are common patterns.** Crises, which usually follow a shock which radically deteriorates confidence, are, by their nature, hard to predict. Most economies tend to grow in the long run, driven by improvements in technology, greater accumulation of knowledge and know-how and productivity gains, reinforced by growth in labour markets and capital stocks. Crises result in households and businesses rapidly re-evaluating their expectations around revenues, incomes and liquidity. Spending and investment decisions are put on hold, and rapid declines in asset prices, economic activity and employment ensue. Whilst the collapse is often rapid, the recovery to full employment can be more protracted as the economy readjusts onto a new course.

**In the following section, we adopt the three-phased view set out in [O’Callaghan, forthcoming]:** (i) short-term **rescue** spending, to keep businesses and people alive, (ii) longer term **recovery** investment, to reinvigorate the economy and (iii) **reinforcement** processes, to embed new economic trajectories from recovery investment into long-term development plans.

**Understanding these different stages of the recovery will enable policymakers to develop and explain a clear policy arc.** As set out below, the evolving economic conditions create different priorities for economic policy at different stages of the recovery. What may be an appropriate response during the rescue stage, such as untargeted wage subsidies may hamper the structural transformation needed in the long term if it is not phased out at the right time. Developing short-, medium- and long-term objectives and communicating them in stages sends signals to the market that help people and businesses plan and act efficiently and with confidence. Short-term measures should not lock in economic activity which is incompatible with long-term goals. Businesses need to plan decisions around their labour force and around investment decisions that align with anticipated changes in the conditions set by government. Trailing future public policy and regulatory changes or stimulus investments helps businesses prepare an anticipatory response, which shortens the time between a policy change being enacted and its impact being felt. Since each stage of economic response is costly and disruptive, speed is a driving objective.

**Box 1** The phases of recovery

- **Rescue** includes emergency measures in the short term to address concerns that have directly emerged from the economic crisis and related crises. These measures might be mandatory, without room for government discretion. The primary objectives of the rescue stage are to avoid mass unemployment and a depression, stabilise the economy and address any other pressing non-economic concerns emerging as a part of the crisis (e.g., dealing with the immediate health concerns of the COVID-19 pandemic). This is typically achieved by injecting liquidity into the private sector and strengthening countercyclical social security measures. These actions boost confidence in the market and mitigate against a cash flow crunch and a collapse in aggregate demand. Since the response to an economic shock must be rapid, rescue measures tend to support the business-as-usual economy
- **Recovery** stage objectives are to spur demand growth, facilitate job creation and create the conditions that orient the economy towards a long term sustainable path. Employment is a central political and economic priority and requires targeted upskilling, either through dedicated or on-the-job retraining programmes, to sync the capabilities of the workforce with the needs of emerging growth industries. Governments that can afford a muscular fiscal response have more tools to shape their economy's direction, but there are also many lower-cost policy, regulatory and pricing opportunities that can improve a country's trajectory
- **Reinforce** the foundations laid during the recovery phase through productivity-focused measures that have impacts in the long term (more than a few years to a few decades) and support sustainable and resilient growth. The purpose of these measures is to embed durable change by creating the policy, regulatory and enabling architecture that permanently shifts investments and behaviours towards sustainable systems and avoid a reversion to 'business as usual'

**2.1.1 Stage 1: Rescue**

**The rescue phase begins in the immediate aftermath of the economic shock.** Whilst the full implications of the shock will remain unknown, horizon risks increase in probability and begin to materialise. Depending on the severity of the shock, and the speed and strengths of support measures, the rescue phase may be well beyond the point where the initial trigger has stabilised, as the repercussions ripple through the economy.

**The rescue phase is usually characterised by a significant deterioration of business and consumer confidence.** Crises are often associated with high volatility in asset prices. Falling consumer confidence can lead to an increase in the savings rate. Confidence can quickly turn, resulting in rapid price adjustments. Falls in asset prices and financial markets can pass through to the real economy as investors and savers see declines in their wealth, further eroding confidence and decelerating consumer spending and investment. Similarly, businesses, faced with a deterioration in economic outlook and rising uncertainty, are likely to postpone investment and hiring decisions.

**Losses in confidence can rapidly trigger a liquidity crisis.** Falls in confidence, exacerbated by falling asset prices and wealth, can lead to a slowdown in household consumption (the biggest component of demand). As consumers tighten their purse strings and postpone major purchases, businesses, in turn, could see a decline in revenues and may face a cash flow

shortfall. Greater volatility and asset prices and a negative outlook tend to drive up the risk premium and, where not offset by cuts in central bank rates, a rise in the cost of borrowing, fuelling liquidity concerns. Investors have a lower appetite for taking on risks and, facing higher costs of capital, in turn postpone investment decisions, further dragging demand in the economy. Finally, businesses, facing suppressed revenues and constrained liquidity, will begin to suspend hiring decisions and may start to reduce their headcount, triggering unemployment. Crises which begin in one economy can quickly spread internationally through global capital markets and trade networks. The result is sharp falls in key macroeconomic variables: investment, employment and GDP.

**Stabilisation is the immediate priority.** Governments need to restore confidence in financial markets, businesses and consumers. Volatility in asset prices needs to be managed. In developing countries, drops in commodity prices and tourism, and a weakening exchange rate are likely to pose extra challenges. Governments should not be relied upon to prop up inflated prices or prevent bubbles from bursting, but managed price adjustments are preferable to high variance. Monetary policy, including interest rates and quantitative easing, can be used to stabilise fluctuations in exchange rates, bond yields and stock markets.

**Viable businesses may find themselves squeezed between temporarily suppressed demand, changes in prices and sudden increases in the costs of borrowing and required liquidity support.** MSMEs, in particular, often lack the financial cushions to overcome these temporary constraints. OECD research on the impacts of COVID-19 on MSMEs found that, without government intervention, 20% of SMEs in the OECD would have exhausted their liquidity in a month, 30% in two months and 40% in three months. SMEs have faced a tougher liquidity crunch due to late payments since the pandemic, with 51% of SMEs reporting a squeeze on cash flow in 2020 compared to 39 % pre-COVID-19. SMEs are also less able to access capital markets and face higher interest rates for debt financing (OECD, [2020c](#)). MSMEs account for 70% of employment worldwide. It is therefore critical that they have access to emergency liquidity, for example, through publicly underwritten emergency loans, cash grants or tax deferrals, to weather the storm. The risk of delay and costs mean that targeting such support during the rescue phase, when emergency measures need to be rolled out quickly to stabilise economies, may not be feasible.

**Larger businesses may also require support.** These include businesses in exposed sectors, such as airline and hospitality businesses which faced an unexpected set of restrictions and collapse in demand during the COVID-19 pandemic, or property developers who saw a collapse in book values in the global financial crisis. Other large businesses may be caught out by a combination of increased costs of capital, tight liquidity, subdued demand, exchange rate movements and/or investment losses. Governments face an uncomfortable choice between allowing Darwinian market forces to drive out ailing and uncompetitive businesses to fail whilst risking further ripple effects across the economy; or propping up nationally-critical or strategic businesses deemed 'too big to fail', putting public money at risk and raising the prospects of future moral hazard.

**The importance of consumer spending means that mass unemployment must be averted.** It is inevitable in an economic crisis that many jobs will be lost, the creative-destruction forces kill off weaker enterprises whilst creating room for more competitive ones to thrive. Capital and labour ultimately need to follow these forces. However, sudden mass-extinction events, which result in spiking unemployment need to be avoided to ensure consumer demand does not also collapse, deterring the very investment needed to soak up spare capacity and exacerbating liquidity concerns across consumer-facing businesses.

In the wake of the COVID-19 crises, job protection schemes have been rolled out globally, supporting 50 million workers across the OECD by May 2020 (OECD, [2020d](#)).

**Extending support to those who have become unemployed can provide further support to consumption, stabilisation and avoid the entrenchment of inequalities.** Whilst many countries have directly subsidised wages to avert unemployment, others have increased support to those that have become unemployed. Social security and unemployment benefits have been increased around the world, including Albania, Argentina, Bulgaria, Chile, Iceland, Indonesia, Lithuania, Norway, Slovakia, Sweden, the UK and the US. Access has been eased and/or eligibility extended in Cyprus, France, Greece, Israel, Luxembourg, Malaysia, Panama, South Africa, Spain and Tanzania, amongst others. Canada and Germany have increased payments for childcare (IMF, [2021b](#)).

**Consumer spending has been directly supported through innovative incentives to boost spending and reverse behaviour changes that may have a lasting and damaging economic impact.** In Poland, eligible families with children have been issued a tourism voucher to be spent at hotels or tourist events in Poland to promote domestic tourism. In the UK, the *Eat Out to Help Out* scheme subsidised restaurant meals and helped reintroduce people to the hospitality industry and cut VAT for the hospitality sector, with similar cuts in Austria, Bulgaria, Costa Rica, Cyprus, Egypt, Germany, Greece, South Korea and Uruguay. Broader cuts in VAT have been seen in Ireland. Consumer loans have been promoted in Egypt, Germany, Pakistan and Vietnam. In the US, individuals received direct cash transfers of USD 1,400 designed to boost consumption (IMF, [2021b](#)).

#### Box 2 Summary of the rescue stage

##### Economic trends

- Falling business and consumer confidence, investment and spending
- Rising unemployment
- Turmoil in asset markets

##### Government priorities

- Addressing the immediate non-economic crisis at hand (e.g., COVID-19 health crises)
- Prevent economic collapse, widespread bankruptcy and mass unemployment
- Stabilise financial markets and asset prices

##### Typical responses

- Accelerated spending on public health measures and direct provision of basic needs
- Loans, bailouts, tax deferrals
- Employment subsidies, extension of unemployment benefits and emergency cash transfers
- Tax suspension for individuals and corporations

**The environmental consequences of spending decisions risk being overlooked during the rescue phase, doubling down on business as usual.** The necessary speed of the response is likely to limit the degree to which many different priorities can be balanced, including green ones. There is little or no opportunity to undertake detailed environmental impact assessments of interventions. Even where environmental impacts are known, they may be given a lower priority than economic objectives. International coordination is likely to be less feasible during the early stages of crisis without pre-existing frameworks. The challenges of targeting support for sustainable growth in the immediate aftermath of any crisis means it is



very likely to entrench business-as-usual pathways. The rescue phase is, by definition, focused on propping up historic economic structures and patterns of production. Governments, keen to prevent widespread unemployment and contain the turmoil may find themselves providing emergency support to industries which both were struggling before the arrival of the crisis and are incompatible with longer term climate objectives. The climate sensitivity of any rescue phase stimulus will largely reflect the underlying environmental intensity of a country's economy.

**Governments should set minimum environmental standards which govern early stimulus measures.** Whilst speed is of the essence, governments cannot afford to completely disregard the climate implications of rescue phase spending decisions. All governments face limits on their abilities to borrow, raise taxes and spend, and must match these against the substantial private and public investment required to achieve the objectives of the Paris Agreement. At the same time, the large funds which have been mobilised in rescue measures provide governments with levers to influence the future shape of the economy. A failure to optimise rescue spending to deliver on both economic and environmental objectives would not only represent an opportunity lost, but could further entrench business-as-usual and push the economy further away from achieving its climate objectives. Governments cannot afford to 'give away' rescue funds without considering their implications for the environment. At a minimum, an approach of 'Do No Significant Harm' should set a policy floor (European Commission, [2018](#)).

**Climate objectives should be reflected in prioritisation criteria.** Governments providing emergency bailouts to businesses or sectors deemed too strategic to fail should consider the long-term compatibility of the firm or industry with climate objectives in their assessment of strategic significance. Polluting sectors, such as airlines, fossil fuel extraction and power generation, internal combustion engine and vehicle manufacturing, heavy industry and land-intensive agriculture, including State-Owned Enterprises, should face a high bar and greater conditionality for public support. Conversely, businesses playing a critical role in the achievement of low-carbon growth should be a higher priority.

**Green conditionality should be attached to rescue measures supporting high-emission industries.** Whilst burdensome screening processes may cause disproportionate delays in providing liquidity support, particularly to SMEs, attaching green strings to large corporate bailouts is a viable option. Unconditional bailouts to airline industries during COVID-19 were an opportunity missed. Whilst there were some examples of conditionality, opportunities were missed in the bailouts in a number of other countries. Transport and Environment tracked over EUR 40 billion of bailouts to EU airlines, with only France and Austria adding any climate conditions (Transport and Environment, [n.d.](#)). Current levels of emissions from the airline industry are incompatible with climate objectives, so such conditions should be imposed, or the industry allowed to contract. Fossil fuel companies, automotive manufacturers and steel manufacturing have likewise benefited from state support.

**Emergency tax cuts should not make climate objectives harder to achieve.** Whilst broad-based support to the economy is accelerated, governments should be careful not to introduce measures which promote a carbon intensification of the economy. Broad consumption and sector-agnostic tax holidays, such as reductions to sales taxes or value added tax to support consumption, property and land tax holidays and deferrals of employment taxes to boost liquidity should be prioritised over cuts to duties on fossil fuels, electricity charges (for carbon-intensive grids) and air passenger duties, in line with the 'Do No Harm' principle. Indeed, where wholesale energy prices have fallen, there may be an opportunity for governments to increase duties and increase social security payments, cash handouts or other tax cuts which are fiscally

neutral, but encourage greener behaviour (or at least, do not promote greater use of carbon-intensive energy).

**Environmental standards should not be sacrificed to support industry.** Some governments have suspended regulatory or prudential restrictions on economic activity in the immediate aftermath of COVID-19 to expedite investment and reignite the economy, including environmental regulations. In China, the Ministry of Ecology and Environment sort to improve the efficiency of environmental regulation without relaxing standards (Xu and Goh, [2020](#)). In Indonesia, public participation in environmental impact assessments was scaled back to expedite decision-making. Both moves have been challenged by NGOs and environmental groups. Elsewhere, the scaling back of environmental standards has been more overtly detrimental to the climate. In the US, fuel efficiency standards were significantly reduced in March 2020 and many environmental regulations suspended (Degnarain, [2020](#); Beitsch, [2020](#)). In Brazil, COVID-19 meant further scaling back of surveillance effort to prevent illegal deforestation in the Amazon (Watts, [2020](#)). Such moves risk challenging new investment into unsustainable activities, pushing the economy further away from climate objectives, increasing the future costs of decarbonisation and risking the creation of stranded assets.

### 2.1.2 Stage 2: Recovery

**The recovery phase can begin once the economy has stabilised and contraction has levelled off.** Although economic output and labour markets have eventually ended their free-fall and levelled off, the repercussions may still be rippling through the wider economy. Businesses continue to face constrained demand and access to liquidity. Whilst there is a more positive outlook, many investment and hiring decisions may still be on hold as businesses readjust expectations going forward. The impact of the recession on public finances has by now started to become clear. With the depth of the recession better known and forecasts for recovery being made, the cost to the Treasury in terms of reduced tax revenues has become clearer, as have the costs of emergency measures deployed during the rescue phase. As risk appetites remerge and equity markets rally, yields on sovereign debt may start to rise, especially if governments continue to run a large deficit. This may have implications for recovery measures by limiting fiscal headroom.

**Governments face careful balancing acts during the recovery stage.** These include a balancing act between withdrawing support too soon and undermining confidence before the recovery is well-established, and allowing Darwinian market forces to cleanse the economy of uncompetitive companies and reallocate workers and capital to more productive endeavours. Likewise, a balancing act between the need to stimulate the economy with fiscal injections, and the need to address deficits in public finances and ensure the long-term sustainability of debt requires careful judgement. Whilst emergency support measures may be gradually redrawn, governments often bring forward investment in infrastructure. Increased support to reskilling and wider training and education may be provided, especially for those who have lost jobs in industries which are unlikely to fully recover, to prevent the economic scarring associated with long-term unemployment.

**During the recovery stage, governments typically enter a public-led, invest-to-grow strategy.** The key objective is to foster a jobs-led recovery – boosting employment and consumer confidence and containing any further ripple effects. Governments have an opportunity to appraise options and take more strategic spending decisions than during the Rescue phase, where rapid action is of the essence. Public spending and investment which delivers economic growth and environmental and social benefits simultaneously should be

identified and prioritised. The large economic restructuring which can occur during an economic recovery is an opportunity for the Government to guide the economy towards a sustainable and inclusive pathway, by developing and publicising the targets, themes and commitments which will govern long-term growth once the economy has recovered and enters the Reinforce stage. The coincidence of COVID-19 recovery spending and the five-year Anniversary of the Paris Agreement has provided the perfect opportunity for Governments to raise ambition and provide clear signals for future patterns of growth. The US and EU have ramped up climate objectives, whilst the UK has laid out its 10-point plan for a green industrial revolution, and set a legally-binding 2050 net-zero target and committed to the elimination of new internal combustion engine vehicles by 2030 (HMG, [2020](#)).

### Box 3 Summary of the recovery stage

#### Economic trends

- Stable asset markets
- Stable or growing investment, economic activity and employment, but ongoing output gap and higher-than-usual unemployment
- Shifts in sovereign debt markets

#### Government priorities

- Jobs-based recovery and the restoration of sustainable economic growth

#### Typical responses

- Investment support policies
- Public works (infrastructure)
- Temporary incentives for consumer spending
- Training and education support

**Almost all countries have identified infrastructure investment needs to deliver net zero.** Many governments and industry associations have analysed emissions reduction pathways by sector, with investment priorities set out in Nationally Determined Contributions, Long-Term Low-Emission Development Strategies, National Adaptation Plans, and 20-, 25- or 30-year visions. The UK's Climate Change Committee produces a Carbon Budget with investment requirements across different sectors. The recovery phase is an ideal opportunity to bring forward these projects. Investments and policies deployed in the recovery stage should accelerate positive environmental economic shifts that were already underway before the crisis, and should help laggard sectors retool and reskill. Green investments are widely seen as offering employment and growth opportunities at least as strong as traditional infrastructure investments.

**Government should seek to crowd in and accelerate private sector investment to increase fiscal multipliers.** The economic benefits of deploying public funds into green infrastructure will be maximised where they complement, rather than displace private investment. This requires the appropriate fiscal instruments to be deployed, reflecting both prevailing economic conditions and the maturity of the technology. Accelerating investment during periods of temporary high employment will increase fiscal multipliers by boosting the additionality of jobs created during construction phases, which might otherwise result in displacement of workers elsewhere when the economy returns to full employment. In all cases, public investment should be geared towards assets and sectors that will be contributing to

economic productivity in a decade, and not assets or organisations that will be stranded when tighter environmental restrictions bite in future.

**Investment priorities and opportunities extend beyond physical infrastructure projects.**

The Recovery phase is the time to identify skills gaps and invest in upskilling the workforce to prepare for the low-carbon economy envisioned in the Reinforce stage. Governments should be business-led in identifying likely skills gaps that will emerge in the future-looking economy and be flexible in how they support upskilling. Investments in vocational training can meet specific labour force demands that are heightened by the recovery stimulus.

**Emergency liquidity support to business should be much more targeted and include green conditionality.** Including green conditionality helps high-emitting sectors improve environmental performance. The Recovery stage allows stimulus to be targeted towards investments that couple business support with environmental objectives. Green conditionality can help to ensure that high-emitting sectors will use financial support to progress environmental objectives and shift towards business models and operations that align to a country's net zero and other environmental commitments. Existing commitments and rubrics, such as the UN Sustainable Development Goals or a country's National Determined Contributions, can help to ensure all sectors contribute to achieving national commitments. In the Recovery stage, policies and financial support should move beyond the Do No Significant Harm principle.

**Environmental and prudential measures should be evaluated and strengthened during the Recovery phase.** Governments should use the opportunity for regulatory refresh to introduce transparency measures about climate-related risks, like TCFD and forthcoming TNFD standards. Prudential measures were strengthened following the 2008/09 financial crisis, with banks' balance sheets subjected to stress tests to identify and correct for instabilities and imbalances. Central banks and regulators should take the opportunity to further strengthen resilience by requiring climate-related risks to be measured and monitored and by promulgating disclosure standards.

### 2.1.3 Stage 3: Reinforce

**As the economy returns to full employment, governments should seek to reinforce the foundations laid during the recovery phase for sustainable growth.** Further support to households will not create additional employment or growth when the economy is already at full employment (though may be required on redistributive grounds). Likewise, the short-term jobs associated with infrastructure spending are likely to displace workers from other activity. The focus must therefore turn to spending which supports productivity gains and addresses market failures. Extra care should be used to ensure public spending does not crowd out private sector investment or distort competition. Government priorities should focus on addressing inequality (e.g., support to regions or demographic groups which the recovery has left behind) and market failures (e.g., suboptimal levels of investment in research and development by the private sector which cannot capture the full economic benefits of innovation).

**The engine of growth transitions from employment-led to productivity-led.** The primary objective of government likewise shifts from getting people back to work towards supporting structural shifts which increase productivity and prosperity. This typically means a shift from broad-based stimulus policy towards investment in skills, better matching of workers with jobs, ensuring infrastructure supports rather than hinders growth and allowing less competitive firms to exit the market.

## Box 4 Summary of the Reinforce stage

**Economic trends**

- Full employment – growth now driven by productivity
- Large government debt and higher costs of servicing Full employment – growth now driven by productivity
- Large government debt and higher costs of servicing

**Government priorities**

- Productivity-led, inclusive and sustainable growth
- Ensuring the sustainability of public finances

**Typical responses**

- Rebalancing the economy towards more sustainable and more equitable growth
- Addressing the public deficit through reductions in spending and increasing taxes

**Public investment should focus on addressing market failures.** Although the economy has returned to capacity, market failures may still result in the under-provision or underinvestment in specific goods and services. Market failures are particularly rife where positive externalities, such as the environmental benefits accruing from green investments, cannot be monetised by private investors making the investment decision. Many infrastructure investments, whether in electricity networks, EV and public transport infrastructure and green spaces will provide productivity and health externalities. Positive externalities can also result in underinvestment in research and development, again where private investors cannot capture all the potential spillover benefits. Markets tend to have higher discount rates and lower risk appetite than society as a whole, so public intervention may be required to de-risk projects or support infrastructure investments with very long-term horizons. Governments should clearly identify instances of market failure to ensure public investments do not simply crowd out private investment with little or no additionality. Investment in green infrastructure remains a priority but the direct jobs created in construction, operation and maintenance are no longer additional.

**Public support should promote investment in broad forms of capital which enhances productivity.** Productivity growth is recognised to not just depend on investment in roads and rail, factories and machines (physical capital), but the skills of the labour force and the strength of the institutions which govern market interactions. Increasingly, the role of natural capital as an economic asset, which delivers health, leisure, risk reduction and yield-enhancing ecosystem services, is recognised amongst economists. Governments should recognise investment in broad forms of capital as essential through augmented wealth accounting. The ‘four capitals’ framework, for example, recognises the economic potential and wealth of an economy across physical, human, natural and social capital. Investment in non-physical forms of capital are particularly susceptible to market failures and warrant particular focus in

economic and industrial policy during the Reinforce phase. Metrics that assess and evaluate economic health more holistically can also be designed, implemented and creatively visualised to improve decision-making. Beyond GDP, metrics like Wealth Accounting or inclusive wealth methodologies, the Canada Tangible and Intangible Assets methodology Natural Capital Accounting, and Natural Capital Committees, as is in the UK, Sweden and Costa Rica, can be developed and strengthened. To use these metrics to strengthen decision-making, they must be made more visible, including by creating integrated dashboards that show the trade-offs between different decisions and scenarios.

**Sustainable growth can be reinforced through new investment vehicles, funding facilities and capital market instruments to help finance future, green investments.** The enormous growth of green bond markets and demand for other environmentally-conscious investment products means that infrastructure developers have special incentive to design and build according to low carbon standards. Especially in developing countries, countries can 'double down' on addressing the infrastructure gap for basic infrastructure while investing in durable, low-emissions designs that meet tighter environmental standards and qualify for green finance. It is important these are established with robust governance mechanisms to ensure that public money is used to address market failures, rather than crowd out private investment. This is essential for ensuring value for money. These should be measured by holistic metrics that integrate across Sustainable Development Goals, Nationally Determined Contributions, the post-Aichi targets under the Conservation for Biological Diversity and the Sendai Framework for Disaster Risk Reduction, among others.

**Smarter stewardship of the private sector can ensure the market delivers 'the growth we want'.** The Reinforce stage creates space to global promulgation of green investment standards, common carbon pricing and accounting standards, and carbon and nature financial disclosures and reporting metrics. Such standards are already being set, like through the Task Forces for Climate-Related and Nature-Related Financial Disclosures, the European Commission's Sustainable Finance Taxonomy, and the G7-OECD-UNDP SDG Alignment Initiative. Common metrics allow for clear and predictable carbon pricing to be coupled with information on carbon performance of investments and equipment, a clear taxonomy of what counts as green, and lists of alternative low-carbon options. The mass adoption and deep penetration of these standards can be achieved in the Reinforce stage.

**Environmental taxes and levies can contribute to a rebalancing of public finances whilst continuing to promote sustainable development.** Governments will by now have significantly higher debt-to-GDP ratios, and may see higher costs of borrowing as investors seek higher returns. Governments need to develop credible plans for ensuring the sustainability of debt and fiscal consolidation, either through scaling back public spending and/or increasing revenues through taxes. As the economy returns to capacity, governments will need to manage down deficits in the annual budget and ensure that overall debt levels are sustainable and provide room for manoeuvre in future crises. The Global Financial Crisis showed the risks of enacting austerity measures too quickly. Increasing taxes, which will tend to slow down the economy, are mostly undesirable during the Rescue and Recovery phases, but may be more palatable during the Reinforce phase. This provides governments with the ability to adopt both a carrot and stick approach to environmental stewardship of the economy, discouraging 'bad' behaviour through taxes and charges as well as promoting positive change through investment and subsidies. Carbon taxes, in particular, can help to simultaneously address public deficits and constrain environmentally-damaging activities.

# 3 How To Design a Green Fiscal Recovery Strategy?

## 3.0 Introduction

This roadmap provides policymakers with a structure by which to design and implement a long-term-oriented green fiscal recovery strategy. There are three key design pillars to a strong fiscal strategy: policy and regulation; funding and financing; and institutional capabilities (Figure 3.1). Each includes important considerations for policymakers looking to maximise recovery benefits according to their unique priorities. By considering all pillars in tandem, decision makers could develop a single unifying recovery roadmap for economic policy that takes both immediate economic recovery and long-term prosperity into account. Within each pillar, the phasing of activities must align with the evolving recovery, priorities, and opportunities described in Section 2.

Underpinning the three pillars, the unique characteristics of the COVID-19 recession require consideration of three additional and very much fundamental co-considerations: the timeline of implementation given uncertain infection trajectories; the need to ensure COVID-19-safe work environments; and an imperative for even further enlarged focus on enhancing equity, as the crisis has disproportionately impacted the world’s most vulnerable. The need to integrate equity considerations into every stage of recovery design cannot be overemphasised. Each co-consideration will influence policy design as well as delivery.

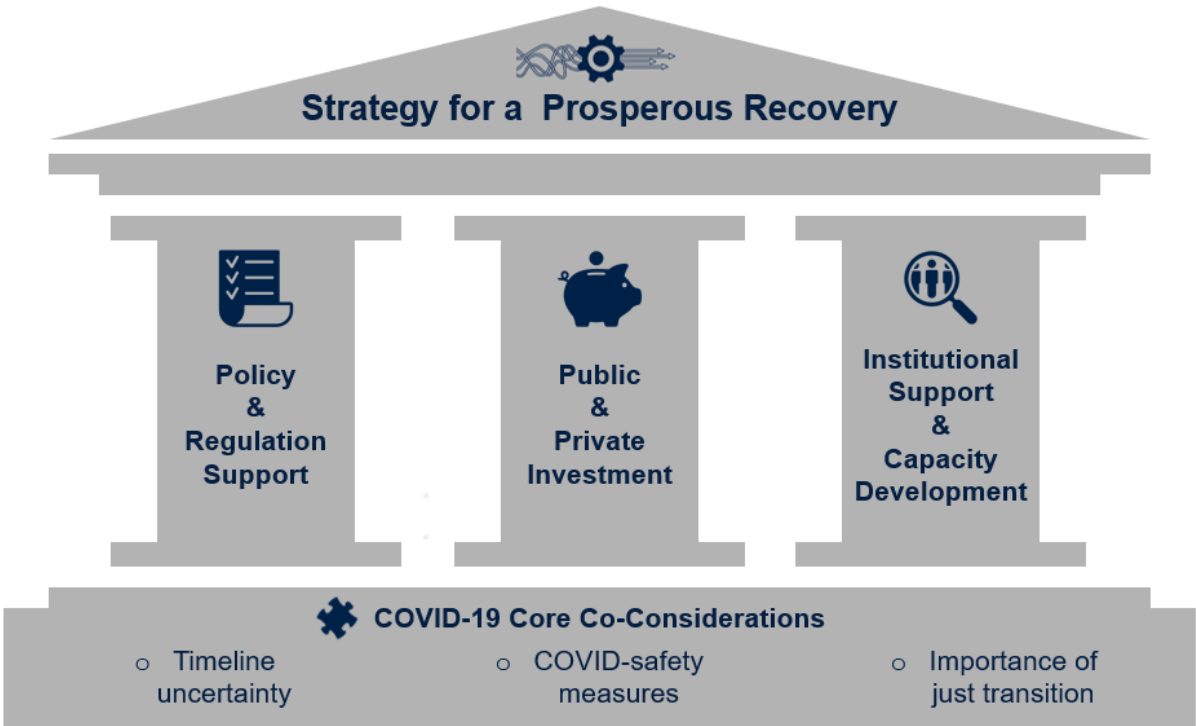


Figure 3.1. Framework for building a long-term oriented COVID-19 recovery strategy.

**In considering each pillar of a recovery strategy, policymakers define their starting point and priorities, which will vary with different national contexts.** Differences in economic, social, environmental, political and legal/regulatory context should all be considered. Alongside inherent contextual differences, national long-term commitments are also key inputs. These may include commitments to making progress against the Sustainable Development Goals (SDGs), legally binding net-zero targets, and Nationally Determined Contributions (NDCs) to reducing GHG emissions.

**Each of the three pillars targets a discrete element of fiscal recovery strategy design.**

- **The first pillar considers policy and regulatory support.** Once nations decide to invest, it is important to consider what factors may influence how they do so, as well as the relative importance of each factor. These factors may range from short-term needs for protection of life to long-term development priorities, and should also consider existing economic, social and environmental strengths and capabilities. Nations must then bring these factors together to identify priority fiscal policies from a universe of options. Priorities will evolve over the recovery cycle and the selection of fiscal instruments needs to reflect the prevalent economic conditions and balance the dynamic costs and benefits of deploying different instruments. Despite this report's focus on fiscal measures, a green recovery is about not only fiscal interventions, indeed the use of supporting regulatory, monetary and other market interventions can maximise the beneficial outcomes of fiscal investment.
- **The second pillar considers public and private investment.** Policymakers can draw from a wide range of funding approaches and investment tools to implement the policies and regulations of the first pillar. Funding strategy decisions will be based primarily on the fiscal space available to government, the characteristics of available debt, and the financial position of private sector corporations. While public investment depends directly on public finance, there is significant scope to reduce overall costs for government by leveraging private finance.
- **The third pillar considers institutional support and capacity building.** As recovery strategies require coordination across actors and sectors, strong institutions are needed to provide leadership and guide policy. Furthermore, in both the public and private sectors, adequate human capital is essential for implementing recovery goals. If well-designed, recovery strategies will reorient national economies towards the future and often direct significant focus to entirely new industries. This may require significant skills-building programmes to ready the employment base. For policymakers designing a recovery strategy, comprehensive skills gap assessments may be necessary. In many nations, focusing on institutional support and workforce skills may be a prerequisite to implementing large-scale projects at speed and fully realising economic and environmental gains.

With vast economic upheaval caused by the ever-growing impacts of climate change, it is crucial that core social and environmental imperatives are always prioritised in setting overall strategy. It is particularly important that the long-term consequences of inaction for these two imperatives are highlighted in civil society, business and government.

This roadmap is designed to be relevant to nations in all phases of the COVID-19 economic crisis. Even nations that have already invested significant funds in stimulus often have an opportunity to shift funding priorities or implementation strategy after announcement. These nations may be able to gain by reorienting their recovery strategies to better prioritise their



economic, environmental and social interests. Many of the lessons contained in this roadmap will prove useful to policymakers responding to future international, national and localised crises.

### 3.1 Pillar 1: Policy and regulatory support

There are three major considerations to effective policy development in economic recovery. First, fiscal interventions are selected based on existing national strengths, long-term growth priorities and the characteristics of different intervention options. Second, policy is designed to incorporate known best practice, leverage existing programmes, and be targeted to priority groups based on national contexts. Third, fiscal policy should be supported by regulatory action: this can maximise benefits from fiscal spending, but is highly dependent on existing national regulations.

#### 3.1.1 Fiscal stimulus policy selection

Policy selection should be driven by the core attributes of individual policies, within the context of national priorities. Economic, social and environmental outcomes will vary significantly based on the characteristics of a fiscal recovery strategy.

The interactions of policies and the set of existing capabilities and strengths of the domestic economy are also important considerations. Perhaps most importantly, policy choice should be informed by the existing and future skill profiles of the labour force, as well as existing and growing industrial policy strengths. In the short-term, nations should seek to build on existing strengths – a nation with strong R&D capabilities in high-value manufacturing, for example, could consider investing in low-cost production of green hydrogen technologies like electrolyzers to best leverage this capability. However, governments should also aim to be ambitious, considering how investment now may create future competitive advantage. In many cases, optimal policy is *not* about ‘doing what we are doing except faster’, as practices may become inefficient in the long term or deliver decreasing marginal returns. For example, countries with accelerating renewable energy penetration may not require additional government support of energy generation facilities but could be better aided by improved systems of energy storage through battery investment or distribution through new power lines and smart grids.

#### A weighted set of priorities

Nations should develop policy priorities, weighted by economic and environmental factors, along with social considerations. This should be informed by economics, science, and public opinion, which may vary between nations. For example, nations with high inequality between rural regions and urban areas may prioritise policies that specifically target improvement for rural livelihoods, like energy efficiency retrofits targeted at rural communities. Nations that have a high proportion of their workforce in fossil-intensive industries may prioritise policies that enable the survival of these industries in a net-zero world, such as carbon capture and storage. Nations with high youth unemployment may prioritise policies that have a high job creation potential and low training requirements, like promoting opportunities in natural capital or in building energy efficiency.

Priorities will change as the economic crisis and recovery unfolds. In the early months of the COVID-19 crisis in the first half of 2020, the priority was to contain the economic fallout from public health interventions through income support and additional liquidity. As governments shifted from rescue mode towards recovery, job creation was paramount, with large

infrastructure investments. When employment returns to pre-pandemic levels, future measures will increasingly need to focus on productivity-led growth, rather than employment-led growth.

In all cases, the importance of climate crisis mitigation and inequality reduction remain paramount. As such, nations must pay particular attention to existing climate and other commitments, as well as existing green growth pathways. NDCs and legal pledges such as net-zero targets should serve as important milestones, towards which a recovery strategy can be directed. In many localities, consideration of the UN's SDGs may help policymakers incorporate social considerations alongside environmental considerations.

### **Core policy attributes**

It is important that policymakers consider the environmental and social impacts of fiscal decisions alongside their economic impacts. This can be done at a generalised level using assessment methodologies like that of O'Callaghan et al. (2020), described below, or through specialised models of varying complexity, as described in Section 3.

As a starting point, to help policymakers understand the universe of policy options available, the Oxford University Economic Recovery Project has developed a comprehensive fiscal policy taxonomy. This taxonomy identifies 41 investment archetypes and 155 sub-archetypes commonly considered by policymakers. The taxonomy is designed to be mutually exclusive and collectively exhaustive, covering stimulatory spending policy including recovery typologies (incentive measures and investment measures) and rescue typologies (temporary liquidity measures, temporary life and livelihood measures, and temporary tax and payment relief measures). Clean spending options are explicitly separated from others that may be dirty or neutral. A list of these policies is shown in Figure 3.2 and a full list including sub-archetypes is reprinted from O'Callaghan et al. (2021) in Appendix A: Fiscal policy taxonomy.



Figure 3.2. List of policy archetype options. See Appendix A: Fiscal policy taxonomy. Source: O'Callaghan et al. (2021).

Economic, social and environmental impacts of spending decisions vary significantly across archetypes, sub-archetypes and national contexts. Building on O'Callaghan et al. (2020), core notable impact indicators include:

- Economic impacts: job creation per dollar spend, fiscal multiplier, long-run economic multiplier and speed of implementation,
- Social impacts: quality of life impacts, wealth and income inequality impacts, health impacts, rural livelihood impacts, gender impacts and impacts to marginalised communities, and
- Environmental impacts: short-term GHG emissions (those associated with input materials and immediate impacts), long-term GHG emissions, air pollution and natural capital impacts (including biodiversity).

Section 4 illustrates a technical approach for computing some of these at a national level using data inputs from the Global Recovery Observatory and Vivid Economics Greenness of Stimulus Index. Broad global perspectives covering economic and GHG impacts are explored by Hepburn et al. (2020) and IEA (2020).

### Interactions between policies

Fiscal stimulus policies may interact with each other in at least four distinct ways.

1. Policies may be path-dependent. The success of one policy can depend on the implementation of another. For example, a step-change in renewable energy investment could lead to a significant increase in the demand for labour with the

relevant skill sets. This may require public investment in retraining of workers in green skills, if retraining is unlikely to happen fast enough without government intervention.

2. Policies can create new opportunities for other policies. The implementation of one policy can improve the potential outcome of another policy. For example, a step-change in renewable energy investment may increase demand for solar panels. This would increase the effectiveness of spending to support domestic solar panel manufacturing, for both economic and environmental measures.
3. Policies may be mutually reinforcing. A designed simultaneous implementation of two policies may lead to better outcomes than the combined benefit of implementing the two policies separately. For example, renewable energy investment combined with hydrogen investment may combine to provide low-cost energy to support new domestic manufacturing.
4. Policies may compete for input resources. Recovery strategies should consider and assess cases where this is a risk. For example, in dense urban centres, land scarcity could mean that new green urban spaces compete with public housing investment. Choices may depend on national contexts and priorities, on top of calculated policy outcomes.

### Existing core national capabilities and strengths

A strength-based approach can ensure that nations capitalise on areas of natural or created comparative advantage. In the process of policy selection, nations should consider their core strengths, so that they can maximise policy outcomes and make more informed decisions about policy design. Core strengths to consider include natural resources (e.g., high solar/wind potential), industrial policy strengths, skill profiles of existing workforce, any backlog of planned projects (e.g., ecosystem protection in the UK [WCL, 2020]) and existing programmes that can be expanded (e.g., pre-existing retrofit funding programmes, or pre-existing retraining programmes [Tienhaara, 2018]). These areas are often where green stimulus benefits can be easily and efficiently captured, aligning with existing and unmet priorities. Leveraging these strengths can build on existing advantages and create new ones, inducing future comparative advantages.

#### 3.1.2 Fiscal stimulus policy design

Recovery strategies following the 2008-09 Global Financial Crisis (GFC) were wide-ranging in type and impact. Economic studies after the fact indicate that the specifics of policy design greatly influence policy success. Even within policy archetypes and sub-archetypes, there can be wide variation in policy outcomes based on policy design. For instance, home energy efficiency retrofits were problematic in Australia but successful in the US and Canada (Tienhaara, 2018). In another example, feed-in-tariffs have been shown to be more effective than subsidies for incentivising investment in less mature renewable energy investments (Polzin et al., 2015)

There are at least five key general and thematic lessons from the GFC relevant to policy design:

##### 1. Capture co-benefits

Co-benefits could include targeted social uplift (e.g., of rural populations or low-income groups); reduced waste, pollution, congestion and inefficiency; improved health

outcomes; biodiversity; and ecosystem sustainability. Nations should identify priorities and design policies with key co-benefits in mind.

For developing economies, priorities may be aligned with SDGs, and focus on higher growth and development. Energy security remains one key priority. As such, renewable energy incentives, for example, may focus on off-grid solar grants, rather than feed-in tariffs, which may be more appropriate for developed nations. Such a policy would also provide social uplift.

Meanwhile, emerging economies are more likely to be larger polluters and, in some cases, may face higher negative health consequences from fossil fuel air pollution. Policy design may therefore focus on achieving sharp reductions in air pollution, such as through electric vehicle (EV) incentives. The current cost of EVs may make such a policy much less attractive to developing economies. EV incentives in emerging economies and advanced economies could improve health outcomes, while reducing income inequality, which is often more prevalent in higher-income nations.

## **2. Build on existing programmes**

Academic literature investigating previous attempts at recovery strategy emphasises the importance of integrating new spending into existing structures, especially for green policies. This can enhance outcomes and increase speed of implementation, while reducing overall risk. By implementing post-GFC stimulus into pre-existing programmes, including the Weatherization Assistance Program and State Energy Efficient Appliance Rebate Program, the US was able to more rapidly implement their interventions and capture co-benefits as low-income households took up the voucher schemes (Tienhaara, [2018](#)).

## **3. Set targets and measure progress**

Targets should be directly linked to an overall recovery strategy and responsibility for meeting targets should be assigned to implementing parties, as well as the relevant oversight bodies. The SMART guidelines (Specific, Measurable, Achievable, Relevant and Time-bound) form a useful framework for target setting. SMART policy design can support policymakers, implementing parties, politicians and academics in transparently and accurately measuring progress.

When setting targets, governments should consider economic models and projected growth pathways, as well as climate models, so that targets help to minimise climate damage. If this information is unavailable, policymakers might consider indicative policy taxonomies, like O'Callaghan et al. [2020](#), which synthesise existing research on the economic, social and environmental characteristics of different spending options and apply these to the real-world policy options available to governments.

Policy-level targets should clearly and comprehensively contribute to economy-wide targets in government priority areas. An often-used economy-wide climate target is net-zero greenhouse gas emissions by 2050; policymakers should build from this type of broad target to set policy-specific targets. In this way, progress can be disaggregated and benchmarked against the goals of individual policies. For example, the targets of an EV incentive could include overall funds distributed, emissions avoided and proportional impact by income group. In meeting economy-wide targets, there are opportunities to both introduce new policies and tweak existing policies. Indeed, addressing climate change requires a whole-of-economy approach, whereby

every piece of investment and legislation should be considered for its climate impacts and for opportunities to improve these impacts.

#### **4. Consider synergies between policies**

If the recovery strategy is formed around a single set of priority outcomes, policy selection should naturally lead to opportunities to build synergies between different initiatives. For instance, priorities for job creation and affordable electricity access may result in investment in new transmission infrastructure, new renewable energy installations, hydrogen demonstrator projects and a retraining initiative targeting skill sets relevant to these infrastructure projects. By considering naturally-linked interventions as a part of a whole, there is an opportunity to better coordinate the impacts of public investment. For instance, in the previous scenario, new infrastructure could be efficiently co-located, and retraining programmes could target the same regions. This approach would likely bring greater opportunity for impact than a scenario in which each intervention is designed and implemented in isolation.

In all synergistic investments, policy implementation teams should attempt to measure cross-benefits (and cross-costs). With this information, in some cases it may be possible to ascertain new opportunities for increasing synergistic impact. In the long run, this information could guide better future policy selection and design.

#### **5. Maximise short- and long-run multipliers**

The fiscal multiplier is the relationship between public spending and overall economic activity. A fiscal multiplier of 1 means that the economy grows 1-for-1 with every additional dollar of public spending. A higher fiscal multiplier means that the economy grows faster than the fiscal injection, whilst a lower multiplier suggests that government spending results in crowding out or leakages. Fiscal multipliers vary hugely according to the timing and instrument used and the period of appraisal. They combine macroeconomic factors and sector-specific considerations.

In normal times, when the economy is at full employment, fiscal multipliers are less than 1, and even lower for tax cuts. With the economy at full employment, increases in spending in one area mean a reallocation of labour and capital from another area to accommodate. The result is a net impact much less than the gross spending, and may in time be completely reversed by price rises. The only benefits are where fiscal policies result in an increase in productivity (for example by investing in infrastructure or skills), and the benefits are more likely to be realised in the long term than in the year of spending (suggesting a low short-term multiplier).

However, during slowdowns, the potential of government spending to put to productive use under- or unemployed workers means that multipliers rise. Not only does output grow thanks to the productivity of the workers directly or indirectly employed by government spending, but the increase in incomes can trigger higher consumption (so-called induced impacts). Where they restore confidence to the system, avoid skills erosion and build productive capacity or improve infrastructure, the long-term multipliers may be significantly higher. A review by Hepburn et al (2020) found that 'Fiscal injections during such slowdowns have been found to generate multipliers as high as 1.5-2 or even as high as 2.5. Three models for the UK, applying estimates only to fiscal injections based on additional borrowing, find that the long-run multiplier lies in a narrow range of 2.5 to 3.0.'

The size of the fiscal multiplier will very much depend on how spending and taxation initiatives interact with private decisions and how they are targeted. At the household level, support to lower income groups, which have a higher propensity to consume, will be more effective than tax cuts (which are less effective in general) to the rich (who are more likely to save any windfall). Direct public investment may crowd out private investment if it is not well targeted, whereas de-risking tools such as loan guarantees may accelerate private investment at a low-price tag to the public purse. Stimuli measures which promote investment in productive infrastructure or research and development may have high long-term multipliers, but be less effective in promoting growth in the short term than income support measures to the poor and vulnerable. Supporting people to invest in human capital (such as their health and skills) will be more effective than ensuring they can eat at restaurants, go on holiday or drive for leisure purposes.

#### Box 5 The importance of MSMEs in a recovering economy

**Micro-, small- and medium-sized businesses (MSMEs) make up more than 90% of all businesses in most countries and account for 70% of employment worldwide (Strand and Toman, 2010).** Their success is vital for an effective, transformative recovery. In OECD countries, MSMEs also make up more than 75 % of employment in sectors particularly hard-hit by this crisis, such as wholesale and retail trade, air transport, accommodation and food services, real estate, professional services. A nuanced understanding of MSMEs, their priorities and how to reach them is critical. They tend to have less access to policymakers and a quieter voice in influential industry associations. As such, active outreach and engagement, rapid testing of policy ideas and understanding how to leverage and adapt existing financial conduits such as the tax authority or the banking system are critical. Having clear legal definitions of MSMEs, social enterprises and the self-employed also helps channel support to qualifying business entities that may be most threatened by the shock.

### 3.1.3 Supporting regulatory actions

In many instances, the impact of new fiscal spending initiatives can be enhanced through influencing relevant standards and regulation. Depending on the policy and circumstance, useful regulatory actions could involve removal of regulation that acts as a barrier to investment, modification of regulation where appropriate and introduction of new regulation as a form of incentivising transition. Some of these are detailed below to guide experts in their decision-making.

- **Removing barriers to investment:** overly obstructive regulation has long been recognised as a barrier to renewable energy uptake, raising installation costs and preventing new market entrants (Marinot and McDoom, [2000](#); Painuly, [2001](#); Woody, [2012](#)). As a part of its economic recovery efforts, the Australian Government has stated an intention to cut regulation for businesses looking to invest in green technologies, particularly clean energy (Taylor, [2020](#)). Similarly, the UK Government has relaxed planning legislation for large-scale batteries, to expand the UK's renewable energy storage capacity, which could treble the amount in operation, along with a GBP 10m investment for a liquid air battery facility (Kwarteng, [2020](#)). Fostering a more conducive

regulatory environment for innovators and entrepreneurs could lower costs as market competition increases in tandem with fiscal initiatives.

- **Creating an investment signal:** modifying existing regulations to become more climate-ambitious alongside fiscal initiatives may support consumer uptake and act as a significant signal to private investors. For example, the UK Government brought forward the phase-out date for the sale of new petrol and diesel cars and vans to 2030 along with GBP 1.8bn of funding for greater update of zero emission vehicles (Sharma and Shapps, [2020](#)). This is supported by the introduction of green license plates, adding a behavioural incentive for consumers through regulation (Shapps, [2020](#)). Altogether, modifying legislation can signal a growth in government commitment, in this example to electric vehicles, leveraging private investment to support government investment.
- **Direct emissions reductions:** The introduction of new regulation can serve as a direct method to reduce emissions if used appropriately. Carbon pricing, through a tax or cap and trade, can encourage investment in new technologies and retrofits to enable more efficient production. For instance, effective carbon pricing is likely to incentivise new renewable energy investments. With rising costs for fossil fuels, the private sector is incentivised to drive down renewable energy costs and increase adoption. This has already been demonstrated in many nations and studies of China's power industry have concluded that the right carbon price could promote increased renewable energy adoption and investment there too (Liang et al., [2019](#)). A carbon take-back obligation could similarly force private sector actors to invest into carbon capture and storage technologies, complementing government subsidies (Jenkins et al., [2020](#)). Under an effective carbon pricing mechanism, private actors can be incentivised to invest in new technologies, which stimulates emerging industries and stands as an economic boon. The removal of inefficient existing regulation can be similarly beneficial. For instance, removing fossil fuel subsidies can quickly reshape the relative efficiency of clean modes of energy production, leading to new investment in clean energy, less investment in fossil energy and a more environmentally-sustainable society (Bridle et al., [2019](#)).

The wider targets of regulatory interventions should be set by policymakers, while industry practitioners, along with economists, should be consulted on the nature and size of interventions, so that regulations to meet stated targets are guided by expertise. This could prevent overbearing or unnecessary red tape, reducing costs and increasing speed of implementation and efficiency.

### 3.2 Pillar 2: Financing a Green Economic Recovery

**To catalyse a green recovery, governments must stimulate growth, which means boosting the two components of demand – consumption and investment – through direct and indirect actions.** Governments can directly invest in the green recovery and fund these investments through taxation systems, public borrowing, and accessing international funds. They can also encourage private sector investment through blended finance instruments that mobilise the capital and credit of households and firms, through international and domestic capital markets and through non-fiscal private incentives. To support an economy in crisis, governments should deploy tools that boost liquidity, instruments that encourage investment and mechanisms that encourage socially advantageous outcomes and discourage negative ones, according to the immediate objectives associated with the stage of the recovery.



**This section discusses the measures and tools that could be used to direct investment towards climate- and nature-positive outcomes.** The objectives of the policy response evolve over time as the likelihood of economic collapse diminishes and the risks change. Green fiscal stimuli need to balance short-run employment effects, long-run growth effects and effects on environmental metrics including carbon emissions and nature. The policies aimed at these different objectives often involve trade-offs. Stimulus measures with a significant short-term employment focus and near-term environmental benefits may be less likely to have significant long-run impacts, and vice versa (Strand and Toman, [2010](#)).

**The range of approaches that will be available or most suitable for any given country depends on the context.** The policy response varies according to the stage of the crisis, the fiscal headroom that constrains a country's spending and the maturity of technology that can be used to achieve a desirable recovery.

### 3.2.1 Stage of response

**The stage of recovery affects the priority and feasibility of different policy options.** Rescue measures should help to save economies from collapsing, keep companies afloat by boosting cash flows, enhances access to capital and maintains household liquidity. In the recovery phase, measures should encourage green investment and strengthen the foundation for longer-term climate resilience. The Reinforce stage should build upon these foundations by reaping the benefits of low-carbon innovation, by leveraging green standards and institutions like green banks, and to redirect capital markets toward mitigation and adaptation measures.

**During the rescue stage, the priority is to maintain liquidity of households and firms, minimise bankruptcy, limit deep job losses and avoid economic collapse.** Measures such as grants and cash transfers, furlough and short work schemes, strengthened unemployment support, emergency loans, corporate bailouts, subordinated debt and tax deferrals should be strategically but immediately deployed to prop up faltering economies, recognising that speed is of the essence.

**Recovery stage policy should target a rapid return to full employment by increasing investor confidence and consumer spending consistent with a green transition.** A mix of fiscal measures and non-fiscal measures can support recovery. Fiscal tools include direct subsidies, tax breaks for low-carbon investments, incentive mechanisms like feed-in tariffs and Contracts for Difference, equity investments and blended finance options. Institutions like Green Banks should be used where they exist, and where they do not, targeted Funds should be rapidly established to funnel capital towards projects with strong fiscal multipliers and employment benefits. The removal of fossil fuel subsidies – particularly where fuel prices have fallen – together with feebates, development and issuance of private sector green bonds, and public procurement standards that account for environmental impact can support a transition without increasing public debt.

**Reinforcing a green recovery will introduce additional tools that deliver sustainable productivity gains and fiscal consolidation.** Taxes, charges and reforms which redirect capital towards climate-positive investments are key. Standards and taxonomies, such as the TCFD, TNFD, carbon reporting and disclosure processes can increase transparency and measure and communicate risk. New financing institutions, such as green investment banks, alongside green banking tools for commercial banks, should be considered. Carbon pricing, including emissions trading schemes, carbon taxes and carbon border taxes can penalise pollution.

### 3.2.2 Fiscal headroom

**A country's fiscal headroom shapes its response to significant economic disruption.** Wealthy countries with low borrowing costs can more easily afford grants, loans, bailouts, subsidies, incentives and structural reforms. Countries with limited fiscal headroom are especially threatened by the outsized spending requirements that the health response has demanded, and the economic disruption caused by lockdowns and a reduction in global economic activity. They need grant funding at scale to avoid defaulting on debts and must devise schemes that leverage private sector resources to catalyse economic growth and create jobs (IDA, [2020](#)).

**Governments can expand their fiscal headroom through revenue-raising activities that also support a green recovery.** Market-based mechanisms such as carbon taxes or cap and trade systems incentivise GHG abatement by imposing a price on carbon.

**Hypothecated taxes set aside tax revenues for a specific purpose, can serve to safeguard tax receipts for green investment and hence provide more certainty in the levels of public investment that are likely to be available for green sectors.** Fees levied on non-green activities, such as using new or increased 'congestion pricing' or other vehicle charges to fund green investment, or by allocating additional fees levied on higher-emitting vehicles or industrial activities, can be hypothecated for green investment.

**Governments can also raise investment capital through sovereign debt, including green bonds.** Green bonds are typically subject to additional scrutiny to verify how funds are spent. To formalise the instrument and bring consistency and transparency to the market, the EU developed the Green Bond Standard and the EU Taxonomy through legislation as part of its Sustainable Action Plan (European Commission, [2021b](#)). Costs of servicing debt may be high for countries with weaker fiscal positions or that are not able to borrow in their domestic currency and so face exchange rate risks (UN/DESA, 2020).

**For countries with lower fiscal headroom, green stimulus investment can be supported through several low-cost international finance avenues, facilitated by international development partners or institutions.** Low- and middle-income countries that are eligible for Official Development Assistance (ODA) may be able to access concessional development finance, including grants, loans or guarantees through the World Bank, regional multilateral development banks (MDBs), bilateral development partners or specific international funds like the Climate Investment Fund. While foreign aid delivered in 2020 was 3.5% larger than the previous year, non-COVID-19 spending fell (Marchant, [2021](#)). Countries that are not eligible for ODA support may also be able to access support from regional development bodies, for example through the European Union's regional development initiatives or its regional green stimulus recovery fund.

**Table 1 offers an indicative framework for governments with different fiscal space and in different stages of policy response.**

Table 1: Tools to accelerate green investment

		Stage		
		Rescue <i>Boost liquidity</i>	Recovery <i>Encourage investment</i>	Transform <i>Embed structural change</i>
Fiscal headroom	Large	Conditional bailouts, grants	Subsidies, feed-in tariffs, financial intermediary funding	Innovation investment, ecological fiscal transfers
	Medium	Emergency loan guarantees, subordinated debt, preferential loans	Project guarantees, Tax breaks, blended finance, equity, feebates	Green investment bank
	Limited	Tax policies incl. deferrals	Reduce fossil fuel subsidies, tax reform including carbon taxes, green public procurement policies	Green bonds, green taxonomy, reporting & disclosure e.g. TCFD, green financial sector reform

### 3.2.3 Technology maturity

**The maturity of technologies and their associated risk profile affects the balance between public and private investment.** Those investments that have lower commercial returns but high potential for social and environmental impact should be publicly supported, as should nascent, higher-risk technologies. Blended finance options that use public money to leverage private investment should be applied to transitioning technologies to reduce their risk profile and attract private capital. For mature technologies, public sector interventions and non-financial tools that facilitate private investment should be used, like standards and technical assistance.

**Public investment in innovation can prepare economies for long-term transformation.** Governments have a crucial role to play in all stages of the innovation journey. Governments should provide significant support for innovations that have uncertain or near commercially viable but still need to be accelerated and more broadly adopted, such as atmospheric and ocean carbon removal, seasonal heat storage, future materials, fusion power, building retrofits, district heating and cooling and climate-smart agricultural techniques. Governments should play a facilitating role for technologies that are commercially viable with developed markets, and provide targeted support to gain competitive advantage. Examples include zero-energy buildings, clean cooking from renewable energy and super-efficient appliances (IRENA, [2018](#)).

### 3.2.4 Bailouts and business grants

**Bailouts keep firms solvent by turning private sector liability into public sector debt or equity stake, or a risk-sharing stake through government guarantee.** In the case of COVID-19, bailouts can be rationalised by the fact that the acute economic pains on certain sectors like travel and aviation were inflicted by government-ordered lockdowns, and so merit government support. The benefits of bailouts include continuity of service for hard-hit sectors and avoidance of job losses and bankruptcies in sectors whose business models are likely to become viable following the pandemic. But bailouts carry risks, including distortions to competition through the transfer of ownership from the private to the public sector.

**Box 6** Conditional and unconditional bailouts of out the airline industry

Bailouts with green conditions have gone to airlines in France and Switzerland, though the strength of their conditionality has been questioned. France has extended a USD 7.7bn deal to Air France, as part of an EU-approved deal between the Netherlands and France to bail out the airline.<sup>1</sup> The extension of the funding includes USD 4bn in a loan and the remaining amount available in guarantees. The French government has introduced two major environmental conditions: the reduction of emissions by 50% by 2030, and a minimum standard of 2% renewable fuel by the same time period.<sup>2</sup> Air France has also announced it will reduce its domestic flights as requested by the government to ease competition with train routes.<sup>3</sup> However, the stringency of French conditional bailouts has been questioned, which could threaten their effectiveness in promoting positive environmental outcomes.<sup>4</sup> Switzerland offered Lufthansa a USD 1.4bn loan guarantee on the condition that the airline develops climate objectives in cooperation with the country's Federal Council. The non-binding environmental regulations imposed on the airlines are a step in the right direction, though many environmentalists feel that stronger, binding conditions are required.<sup>5</sup>

Other countries like Germany, Italy, South Africa, Spain and the US have bailed out airlines without any conditions, and countries like South Korea, Turkey and the UK bailed out airlines and other industries unconditionally. With no attachment of green conditions, these loans are providing direct support to highly environmentally-intensive industries.

**Emergency financing programmes in rich countries generally took the form of government-backed loans to businesses at record low interest rates, and successfully prevented mass firm closures in 2020.** In March 2020, the EU took the unprecedented step of suspending state aid rules to allow member states to target loans or equity purchases to failing businesses (European Commission, 2020). Germany's emergency assistance programme offered businesses loans with interest rates as low as 1%, which could be accessed through commercial banks (KfW, 2020). In the US, emergency business assistance accounted for approximately USD 800bn of the USD 2.3tn spending package in the CARES act, a significantly larger share of spending than unemployment assistance (IMF, 2021a). Similarly expansive schemes were rolled out in the UK, Switzerland, Italy, Spain and Australia (Markotoff, 2020; Storbeck, Miller, & Arnold, 2020). In total, the G20 group of wealthy states spent approximately 11% of combined GDP on emergency business assistance in 2020 (IMF, 2021b):

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<sup>1</sup> New York Times (2020). <https://www.nytimes.com/2020/04/25/business/air-france-klm-bailout.html>

<sup>2</sup> Routes Online (2020). <https://www.routesonline.com/news/29/breaking-news/291047/air-france-told-by-government-to-dramatically-cut-domestic-flying/>

<sup>3</sup> RFI (2020) <http://www.rfi.fr/en/wires/20200527-air-france-cut-40-domestic-flights-after-bailout>

<sup>4</sup> Transport Environment (2020) <https://www.transportenvironment.org/publications/air-frances-bailout-climate-conditions-explained>

<sup>5</sup> The Swiss Parliament (2020). <https://www.parlament.ch/press-releases/Pages/mm-fk-n-s-2020-05-02.aspx?lang=1033> , Platform 2020 Redesign (2020). <https://platform2020redesign.org/countries/switzerland/> , The Economic Times (2020). <https://energy.economicstimes.indiatimes.com/news/renewable/swiss-environmentalists-demand-green-recovery-after-coronavirus/75535506>

**As the pandemic progressed in 2020, wealthy countries increasingly rolled out assistance schemes specifically targeted at SMEs and saw business insolvencies decline.** Germany rolled out supplementary schemes offering 100% guarantees to bank loans for SMEs (Storbeck et al., 2020), while the UK provided emergency financing of up to GBP 50,000 for smaller firms with 100% guarantees (Markotoff, 2020). France, Italy and Spain offered similar guarantees of EUR 300bn, EUR 350bn and EUR100bn, respectively (Storbeck et al., 2020), while Australia's scheme supported SME lending of up to AUD 40bn (Australian Government Treasury, 2020).

**Developing economies also implemented emergency financing programmes for businesses, but with more limited duration and scope.** 20 middle-income countries surveyed by the IMF could only spend a combined 2.5% of GDP on such programmes, compared to 11% in the G20 group of wealthy nations. The IMF further notes that emergency financing in poorer countries would necessarily be time-limited to the immediate aftermath of March lockdowns, rather than the full duration of 2020 (Georgieva, 2020). Fiscal constraints severely limited poorer countries' ability to provide business finance, a strikingly similar experience to their experience with job retention schemes when compared to wealthy countries.

**Emergency bailouts and financing can limit firm closures, though their cost makes them most viable for countries with large fiscal headroom, and they run the risk of propping up unviable firms.** Although wealthy nations successfully prevented mass insolvencies in 2020, the indiscriminate nature of available financing suggests that potentially unviable firms may have been saved by these schemes. In emerging markets, fiscal constraints resulted in limited financing and stricter eligibility requirements, which compounded an already sizeable bureaucratic burden on states with limited capacity.

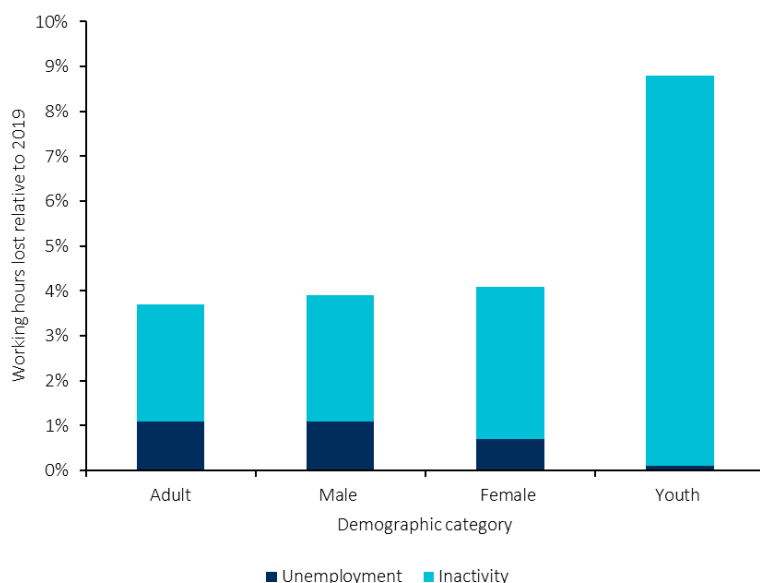
### 3.2.5 Furlough, unemployment and cash transfers to households

**To prevent wide-scale job losses, governments around the world have offered grants to businesses to safeguard jobs.** Worker retention schemes sustain employees in their work contracts, allow businesses to retain talent, enable firms to quickly ramp up activity when restrictions are lifted and minimise the need to search for and hire new staff. Job retention schemes have supported at least 50mn jobs across the OECD during the COVID-19 pandemic, nearly 10 times more than in the 2008-09 global financial crisis (OECD, 2020). The nature of job retention schemes varied between countries. Germany's *Kurzarbeit* Short-Time Work Benefit (BFA, 2021), the UK's Coronavirus Job Retention Scheme (HMRC, 2021) and France's Partial Unemployment Scheme (MINEFI, 2021) all offer payments for hours not worked. Other schemes, like Australia's JobKeeper Payment (ATO, 2021) and the Netherlands' Emergency Bridging Measure *NOW* (Ondernemersplein, 2021), offer wage subsidies for hours worked and can also be used to top up earnings for workers whose hours have been reduced.

**Job retention schemes need to target jobs that are likely to be viable in the short-to medium-term.** The OECD recommends that governments support firms to offer training for furloughed employees training, to improve the job prospects of furloughed workers if their firm does not survive the pandemic (OECD, 2021a). As shown in Figure 3 **Error! Reference source not found.**, furlough schemes are also limited by fiscal headroom, with only high-income countries having the fiscal base to provide economy-wide wage subsidies. Although some developing countries have used wage subsidies to protect key industries, these have generally been much more limited in scope. In Indonesia, for instance, employers in the garment industry were permitted to furlough employees with ILO assistance, but only for one

month's payroll between March 2020 and February 2021. However, in general fiscal constraints have limited the expansion of unemployment benefits in poorer countries. According to the ILO, low-income States experienced a 50% lower loss in working hours than high-income states in 2020 (ILO, 2021b).

Figure 3 Decomposition of employment losses into changes in unemployment and inactivity (world)



Note: Youth = 15-24 years; Adult = 25+ years

Source: Vivid Economics, reproduced from ILO (2021b)

### 3.2.6 Tax relief and deferrals

In the wake of global lockdowns in early 2020, short-term stimulus packages were generally geared to assisting households and businesses with their immediate cash flow requirements (KPMG, 2021). Governments offered one-off special measures, including tax relief and deferrals, which directly reduced government revenues by approximately USD 3.3tn in government revenue was lost from April 2020 to tax cuts (IMF, 2020).

**Short-term tax measures for households and businesses ease the liquidity crunch, with deferrals offered by cash-constrained governments and tax cuts from governments with more fiscal space.** Tax relief measures have been short-term, even in rich countries. The US has implemented active tax relief measures for low-earning individuals under the CARES Act, including the expansion of tax-free allowances for childcare and rebates for people earning less than GBP 75,000 a year (US Senate Committee on Finance, 2020). These have been coupled with various temporary tax measures geared to assisting businesses through the crisis, including tax credits for employees on sick leave, and government assistance in mandatory Medicare payments (IRS, 2020). Germany temporarily decreased the highest rate of VAT from 19% to 16% for six months and offered tax relief to firm owners reinvesting in their business until the end of 2021 (German Federal Ministry of Finance, 2020; KPMG, 2020c). Businesses were also offered the opportunity to declare losses of up to EUR 5m against the prior year's tax return, resulting in immediate, short-term tax refunds.

**Developing countries have adopted similar strategies to rich nations, but with stricter limitations on the duration of and eligibility of firms for tax relief.** Because developing

countries entered the pandemic with high-debt levels and weaker tax bases, they have been relied more heavily on short-term tax deferrals than absolute tax cuts. A brief survey of tax policy in developing countries suggests that fiscal constraints limited the feasibility of tax relief, despite urgent cash flow problems for firms and households. Argentina waived mandatory employer social security contributions for 90 days in April 2020, but firms could only claim tax relief if they could show their economic activities were “critically affected” by the pandemic (KPMG, 2020a, 2020b). Its centre-left government intends to finance these measures through a wealth tax on individuals with assets larger than ARP200m (~USD 3.5m), rising to 5.25% for assets outside the country (BBC, 2020). South Africa, meanwhile, implemented a temporary fast-tracking of VAT refunds, and a four-month freeze on VAT payments and employer contributions to the country’s skills development fund. It also temporarily suspended its carbon taxation system, which only came into existence in June 2019 (South African Revenue Service, 2020). Bolivia, Chile and Costa Rica were likewise forced to strictly limit the duration of various tax relief measures (KPMG, 2020b).

### 3.2.7 Loans and equity for infrastructure

**Investment in infrastructure projects is a key driver of economic growth.** The majority of infrastructure is debt-financed, and overwhelmingly by the private sector (Tyson, 2018). In the early 1990s, international financial institutions (IFIs) rapidly mobilised private sector funds for infrastructure investments in developing countries, seeing the share of private sector infrastructure financing climb from to over 70% in 1995, up from just 26% six years earlier (Dailami & Leipziger, 1998). This trend has continued into the 21<sup>st</sup> century, despite the global financial crisis (GFC) (Della Croce & Gatti, 2014). States can tap into international debt and equity markets to raise finance for infrastructure projects. Nonetheless, demand for infrastructure finance continues to outstrip supply, making this a key priority for developing country governments, particularly in the wake of the COVID-19 pandemic. The COVID-19 pandemic has had a significant, depressing effect on both equity and debt financing for infrastructure projects globally (Global Infrastructure Hub, 2021, S&P, 2020).

**By leveraging the investment instruments outlined in the rest of this section, infrastructure investment can help drive recovery from the coronavirus disease pandemic.** A rich literature on the GFC shows that public spending is a core component of recovery from economic crises (Auerbach & Gorodnichenko, 2013). Specifically, investment in infrastructure can kickstart growth, create important short-term employment and improve labour productivity (Bivens, 2017; Jotzo, Longden, & Anjum, 2021; Lin & Doerte, 2012). The public mood appears to support infrastructure spending in COVID-19 recovery plans: in a survey of approximately 20,000 people conducted by the Global Infrastructure Association, 79% of respondents believed that infrastructure spending would create jobs and boost local economies (Global Infrastructure Association, 2020). The World Bank has warned, however, “money needs to flow into the real economy quickly and to small and medium enterprises and the self-employed”, rather than to large capital projects unlikely to deliver returns in the short term (Abadie, 2020).

### 3.2.8 Guarantees and insurance

**Guarantees have been deployed in response to COVID-19 to support a range of activities, from large infrastructure projects to small businesses support.** To support infrastructure, India, Brazil and China have provided guarantees to state-owned enterprises to mitigate risks for large projects. To support small businesses, the South African government launched an USD 11 billion loan guarantee fund to assist enterprises with operational costs,

such as salaries, rent and the payment of suppliers.<sup>6</sup> Around the world, guarantees are seen as effective mechanisms to reduce risks, mobilise private finance, and boost liquidity when needed.

**Guarantees enable project-based investors to transfer risks to the public sector.** These include full or partial credit guarantees, political risk insurance and currency swaps.<sup>7</sup> Guarantees can be provided at the project level or institution level. Time-limited use of guarantees can create enabling conditions for new markets or new institutions. For example, guarantees can be used to secure debt for new financial institutions like Green Investment Banks until they build a track record of returns, or to de-risk demonstration projects.

**Guarantees significantly contribute to the mobilisation of private finance directed towards development.** An OECD study showed that 44% of the money mobilised from the private sector as a result of development finance interventions was from guarantees (OECD 2018b). This was the highest share of any intervention, more than double the next largest blended finance instrument (syndicated loans and credit lines). However, guarantees have not typically been widely used, for example they have typically made up only 5% of multilateral institutions' overall development commitments (Tonkonogy et al., 2018). Organisations face a number of challenges to using guarantees, including that development finance institutions commonly account for guarantees on balance sheets for the full value of the guarantee, as if they were loans, which discourages their use relative to loans, and also because their exclusion from OECD ODA statistics may disincentivise their provision (Tonkonogy et al., 2018).

### 3.2.9 Blended finance

**Where investments are not commercially viable, blended finance can crowd in private investment.** Like guarantees, blended finance de-risks and/or increases returns through tools such as performance guarantees or first-loss investments, or through the appropriate use of low-cost debt or equity or guarantees of returns. Public finance can enter on preferential terms with lower interest rates or for a longer duration than commercial capital, or through specialist structures such as subordinated capital or first loss capital where other investors have priority for repayment in the event of repayment issues with investments. This may be particularly valuable for early-stage technologies or where the market does not fully repay investors for public good returns from green investments.

**Offering blended finance to low-carbon investments signals a government's commitment.** Such blended finance may be provided by existing financing bodies or may involve setting up new institutions to support investment. For example, the UK established the Green Investment Bank following the 2008 financial crisis and deployed/offered direct co-investment to support green recovery projects, using financing tools including loans or equity investment. The UK Green Investment Bank's substantial support for the offshore wind sector in the early 2010s contributed significant capability around technical risk assessment, which gave private sector investors' confidence to accept appropriate rates of return.<sup>8</sup>

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<sup>6</sup> World Bank. (2021).. Infrastructure financing in times of COVID-19: A driver of recovery. <https://thedocs.worldbank.org/en/doc/424911600887428587-0130022020/original/InfrastructurefinancingintimesofCOVID19Adriverofrecovery.pdf>

<sup>7</sup> For example, the World Bank Group offers a mix of Political and credit risk guarantees to borrowers (World Bank Group, 2017).

<sup>8</sup> Vivid Economics. 2018. The role and impact of the EIB and GIB on UK infrastructure investment. Available at: <https://nic.org.uk/app/uploads/Vivid-Economics-Final-report-Analysis-of-EIB-and-GIB-projects-050718.pdf>.



### 3.2.10 Corporate tax holidays/accelerated capital cost depreciation

**Tax relief and accelerated capital cost depreciation measures have supported short-term investment in new machinery and equipment in the wake of the crisis.** These policies temporarily adjust mandatory capital depreciation schedules by allowing firms to claim a greater share of capital expenditure to be deducted as a business expense than the statutory norm (Wen, 2020). This reduces the firm's taxable income and incentivises investment in capital equipment. Variants of this policy (which, at their extreme, allowed 100% of capital depreciation to be accounted for in the first year of investment) have been applied in many wealthy countries as a short-term stimulus measure (KPMG, 2021). While it is difficult to disentangle the effects of these measures from record low borrowing costs, national accounts data indicates that gross fixed capital formation has returned to pre-crisis levels in developed economies (OECD, 2021b). This is not true for developing countries, however, where such policies proved to be less feasible.

**Tax incentives can be applied to provide both individual and corporate tax relief in return for investment in green projects, assets or technologies.** For example, a number of US states and the US Federal Government offer tax incentives to electric vehicle manufacturers and to vehicle purchasers.<sup>9</sup>

**Targeted tax relief has encouraged investment in the immediate aftermath of the coronavirus disease pandemic.** The IMF supports tax incentives to stimulate the recovery from COVID-19 provided that they are temporary in nature and strictly circumscribed towards investment in productive assets (Wen, 2020). The policy has been widely used in wealthy countries. In Germany and Australia, statutory depreciation rates were increased by factors of 2.5 and 3 respectively for the first year of new asset purchases during the pandemic (Asen, 2020; Inland Revenue New Zealand, 2020). The CARES Act in the US also includes changes to depreciation schedules (IMF, 2021b), while similar measures have been rolled out in Canada and Austria (Asen, 2020; EPR Maple Ridge Langley, 2020).

**Accelerated depreciation schedules have become even more popular in developing countries after the pandemic.** India and South Africa were already using accelerated depreciation to encourage investments in renewable energy before the coronavirus disease pandemic (Mandy, 2020; Solarmaxx, 2020). However, the measure was not as widely used as a tool for economic recovery in 2020 as in wealthy countries. A KPMG database of tax policy changes in response to COVID-19 flags only Malaysia and Myanmar as countries that accelerated depreciation schedules to boost investment. Malaysia increased its accelerated capital allowance to 40% from approximately 20%, while in Myanmar statutory depreciation rates were temporarily increased by 125% across the board (KPMG, 2020d, 2021).

### 3.2.11 Price guarantees and feed in tariffs

**Subsidies and price guarantees can offset heightened risk and slack capacity, and in the medium term to encourage technology deployment.** Governments can incentivise investment by providing contractual support for investments by augmenting or helping to guarantee sources of revenue, for example through the provision of 'feed in tariffs' (FITs). The use of 'contracts for difference' (CfDs) or 'regulated asset base' (RAB) models also support investment into various renewable energy technologies. These types of tariffs, contracts and

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<sup>9</sup> US Department of Energy Alternative Fuels Data Center Federal and State Laws and Incentives database, available at: <https://afdc.energy.gov/laws/search>

preferential pricing approaches can all make investment in green technologies more attractive for private actors, including both households and businesses.

### 3.2.12 Subsidy reform

**Governments may reform subsidy systems that support environmentally-harmful activities, especially fossil fuel subsidies, and agricultural or land-use practices that are environmentally damaging.**<sup>10</sup> Whilst suppressed fuel prices may provide the opportunity for reform, adjusting prices at times of volatility should be done sensitively so as not to exacerbate household or enterprise liquidity concerns.

**Removing or reducing fossil fuels subsidies can both reduce high emissions and spur investment in climate action.** While the exact size of fossil fuel subsidies is unclear, estimates put it on the scale of USD 1-5 trillion globally (McCulloch 2017). Subsidies are predominantly provided for coal (44% of subsidies) and petrol (41% of subsidies), with the remainder of subsidies supporting natural gas (10%) or electricity (4%).

### 3.2.13 Tax reform

**Carbon taxes can discourage unsustainable production, but should be used cautiously in recessions, favouring instead tax reform that encourages investment-led recovery.** Carbon taxes use price signals to discourage the use of fossil fuels while promoting innovation and investment in cleaner, more efficient technologies. During recessions, however, levying new taxes can be politically unpalatable and may be economically unwise if they punish firms or individuals already under significant strain.

**Where substitutes exist, environmental taxes can be effective at spurring green investment while dissuading high-carbon investments.** While these new taxes may inhibit economic activity in the specific areas they target, the effect may be net positive if they steer investment into green alternatives. Taxes can also stimulate new investment into activities that limit exposure to tax regimes by incentivising private investment in efficiency enhancements or R&D, or by providing clear signals about government intentions and priorities that reduce uncertainty around green investment opportunities.

**Governments can reduce taxes on capital or labour to offset potential resistance to reforms due to increased costs of fuel for home use or as an industrial input.** This may include policies to support firms to offset or reduce burdens on high-emitting sectors and policies to ease the impact on households (for example, by providing more targeted support for low-income groups), and gradual implementation of taxes to avoid shocks within the economy (Pigato 2019). Supporting policies can also be used to offset the risk of 'carbon leakage', whereby emissions-intensive activities might shift from a country with a carbon tax to a country without one. Trade policies like border-carbon adjustments or international policies like an international carbon price floor can reduce the risk of both leakage and reductions in international competitiveness.

### 3.2.14 Policies, standards and regulations

**Standardised definitions and methodologies for the underlying physical assets and for measuring results from green activities can also support investment-led green recovery.** Providing set taxonomies, lists or approaches to determining what investments and

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<sup>10</sup> Heine & Blank. 2019. Benefits Beyond Climate: Environmental Tax Reform. <https://elibrary.worldbank.org/doi/pdf/10.1596/978-1-4648-1358-0ch1>

assets can be classified as green can reduce investor uncertainty. This can also provide reassurance that projects' investors pursue are aligned with other schemes to incentivise action, such as green lending targets. Establishing set approaches to measuring and reporting results from green investments provides investors with clarity on how to assess results consistent with national regulations – though it is also important to put in place reporting requirements to drive the measurement and communication of green results. A package of broader reforms can support a shift in the way the private sector allocates funds towards sustainable investments in the longer term:

**Measuring and reporting climate risk improves transparency in the financial sector and helps to build the resilience of the financial system.** Disclosure of climate risks encourages investors to diversify their portfolios away from assets with high climate risk and attracts buyers of low-carbon assets. This serves the dual purpose of preventing a large-scale collapse in asset prices when climate risks are realised, while also potentially discouraging investments in high-carbon or non-resilient assets and spurring climate positive investment. Additionally, it provides transparency to investors concerned about the environmental and social impacts of their investments. The potential efficacy of this mechanism has led some academics to identify it as a possible 'sensitive intervention point' in encouraging a rapid transition to a low-carbon economy (Farmer, J. D. 2019). The Financial Stability Board's **Taskforce for Climate-Related Financial Disclosure (TCFD)**, which was set up to review how the financial sector can take account of climate risks, has recommended that financial disclosure of climate risks should include:

- Governance: Disclosing organisational governance of climate-related risks and opportunities at the board level and by management.

Strategy: Disclosing actual and potential impacts of climate-related risks and opportunities on the organisation's businesses, strategy, and financial planning where such information is material.

Risk Management: Disclosing how the organisation identifies, assesses, and manages climate-related risks.

Metrics and targets: Disclosing the metrics and targets used to assess and manage relevant climate-related risks and opportunities where such information is material (Financial Stability Board's Task Force on Climate-Related Financial Disclosures, 2017).

**By mandating climate risk disclosures into financial filings, regulators can increase transparency, motivate businesses and investors to attend to climate impacts and reduce systemic risks in the financial sector.** Inertia in integrating climate risks into decision making can be overcome by mandating disclosure in financial filings or other actions. Preparing disclosure documents requires careful and methodical consideration of these risks vis a vis the company's business and operating environment. Governments can support disclosure by providing tools to help investors understand and report risk (discussed further below). Given the clear risks to financial systems from climate change, financial regulators can promote financial stability by incorporating climate into their activities to safeguard against climate risks and encourage activities to reduce climate-related risks.

**Prudential regulation like climate stress tests can improve financial sector stability and transparency.** Climate stress tests allow financial institutions and private lenders to assess their level of vulnerability to climate risk and provide information on the adequacy of risk management practices. These tests can be an important internal tool to benchmark performance and can also act as an advanced form of disclosure when results are shared

publicly with shareholders and customers, as well as helping regulators assess market-level risks and trends. Moreover, if the tests are conducted by an independent third party, they can also provide an impartial assessment of climate readiness across institutions in the same market. Climate stress tests require significant institutional capacity, which might be limited in developing or emerging markets.

**Regulators can also update or clarify the duties expected of both investors and company directors to include a strengthened focus on climate risk management and support long-term transformation.** Governments can encourage a shift toward a longer-term focus in investments and asset management and increase awareness of climate risk by explicitly incorporating climate change and sustainability into the duties set out for investors and company directors to manage investments and their companies (EU High-Level Expert Group on Sustainable Finance, 2018). A number of low- and middle-income Countries that are members of the Sustainable Banking Network are among the leaders in developing roadmaps and frameworks to closely integrate sustainability into financial sector design and regulation (IFC, 2019).

**In the longer term, the public sector can also facilitate green financial sector reform to help ensure a well-functioning financial sector that can enable green private sector investment.** Improvements to the enabling environment for green investment, including setting policies and regulations to enable new forms of investment and new asset classes like green bonds, green loans or green mortgages, that provide new instruments for investors and new means for raising capital for green investments and broader support to help develop and deepen financial markets. Standardising the definition of green bonds, streamlining the process of certification, and issuing guidelines for disclosure can facilitate the provision of these instruments, reducing the transaction costs of certification and shoring up investor trust. While these instruments are less likely to be critical during the early stages of a recovery, they are important for ensuring long-term investment is aligned with a green recovery, even after near-term more active support for green investment ceases.

**Green assets, and green bonds in particular, play an important role in catering to customers for whom ESG investment is critical, improving market transparency and instigating cultural change in the financial sector.** Green bonds are potentially a strong tool in supporting financial sector reform. In addition to providing innovative opportunities for investors to channel investment capital into green and climate activities, they can also provide transparency and develop awareness within financial institutions, investors, issuers and the wider public. They can also support broader reform by catalysing discussions around climate transitions within financial institutions and stimulate policy innovation as government look to build on the success of green bond initiatives. The development of green bonds has also spurred the expansion of a market for green loans through the application of similar frameworks and systems that supported the expansion of green bonds. Green loans may have particularly strong potential to support sustainable finance in markets where local financing needs are largely met by the local banking industry, as in many emerging and developing markets. Similarly, sustainability bonds or loans also offer support for a broad set of sustainability goals or sustainable development goals (SDGs) beyond climate change, typically supported by external validation or certification as with green bonds and loans.

**Governments should use the disruption of COVID-19 to build forward better by reorienting public procurement criteria to include sustainability metrics, thereby supporting companies selling the low-carbon products and services required to achieve a green recovery.** Governments can leverage their enormous spending power to support emissions mitigation in activities they finance or support. A 'shadow price of carbon' is used by

multilateral development banks and various national governments (World Bank Group, 2019), and procurement rules can grow the market size for low-carbon products such as LED light bulbs or more efficient buildings. For example, in 2017, the California state government passed legislation requiring the state to use its procurement power to ensure purchases of a range of infrastructure inputs (steel, glass and insulation) to comply with set maximum performance standards for emissions (Pigato 2019). Best practices for green public procurement include introducing environmental standards into technical specifications for purchases, into procurement selection and award criteria, and into contract performance clauses (OECD 2015a). Effective green or climate-sensitive procurement needs to be planned alongside an understanding of market capacity and available solutions, and can be used to raise awareness of green products and solutions among other buyers, business and broader society (OECD 2015a).

**Green Banks ‘crowd-in’ additional private investment in energy efficiency and renewable energy projects, with an average investment multiplier of 2.4.** Green Banks ‘crowd-in’ additional private investment in Green Bank projects by responding to local needs and barriers to investment. Private investors can include commercial banks, local lenders, private equity, hedge funds, pension funds, asset managers, and social impact investors.

**Financial intermediary funding can overcome specific access to finance barriers associated with reaching SMEs and can help support the recovery by providing access to capital in underserved markets where large players have trouble assessing risks and contextual factors.** Financial intermediary funding can be particularly valuable in overcoming financing barriers among small-and medium-sized firms where international public actors (MDBs or development partners) or national governments would find it difficult to provide support directly due to the large transaction costs of dealing with large numbers of small organisations. By partnering with local financial institutions, including banks and microfinance institutions, international public actors can expand their reach and provide investment financing to sectors that they would otherwise not be able to support, such as local-level off-grid energy projects, including solar home systems and mini-grids. Financial intermediary funding is particularly valuable in creating network effects that enable future private investments. Financial intermediary funding may include providing funding for institutions to establish specific lines of credit for climate investment. It can also include providing credit guarantees to commercial banks that can reduce the burden on public finance institutions and reduce the cost of borrowing for micro, small or medium enterprises, which has the knock-on effect of freeing up capital for further investment in other activities (UNEP, 2016).

**In addition to financing, financial intermediary funding can support deal flow generation and lack of knowledge by complementary technical assistance.** Most financial intermediary funding programmes comprise local and international experts providing support to participating local financial institutions and their clients. This supports a range of activities, such as training staff in promoting the new financial product and how to recognise technically-eligible projects, marketing of the facility, providing technical advice and studies, and supporting the development of standards for environmental due diligence.

**Financial intermediary funding has been successful in delivering immediate climate impacts and supporting longer-term transitions within markets.** For example, a successful implementation of this is the EBRD’s Sustainable Energy Finance Facility, which provides finance for sustainable energy projects in two key areas: energy efficiency and small-scale renewable energy. Local financial institutions on-lend the funds they have received from the EBRD to their clients, including SMEs, corporate and residential borrowers, and renewable

energy project developers. These partnerships directly support deal flow generation as more finance flows towards investment opportunities in these two areas (EBRD 2016).

### 3.3 Pillar 3: Institutional support and capacity building

**In addition to policy design and access to finance, good governance and sufficient capacity are essential to deliver a green recovery.** This pillar outlines four key areas where institutional support and capacity need to be developed to support effective green recovery:

- **Domestic institutions and governance** – Strategies for governments to take the lead in delivering a coordinated approach to green recovery.
- **Government capacity and skills** – Ensuring that the government has the expertise required for effective policy design and implementation.
- **Private sector skills and capacity** – Methods for addressing skill gaps in both current priority green sectors and future green focus sectors to quickly identify and address shortfalls.
- **International networks** – Approaches to facilitating effective cross-border collaboration between the public and private sectors to share knowledge and build momentum for change.

**Countries should develop governance arrangements which are appropriate for their institutional structure and which address the specific challenges they face.** Not all the suggestions outlined below will be appropriate for all countries, as governance arrangements are inherently context-specific. Furthermore, specific governance arrangements for a green recovery are in the nascent stages of development. The suggestions outlined below draw on both some emerging good practice, as well as lessons learnt from broader governance responses to climate change and past economic downturns. The intention is to provide some initial considerations for how to ensure that a strategic vision for a green recovery can be successfully implemented.

#### 3.3.1 Domestic institutions and governance

**Delivering a green recovery requires strong leadership and effective coordination across both the private and public sectors.** The multidimensional aspect of green recovery opportunities poses unique challenges to effective domestic governance, and will require creative responses.

**Within the public sector, strong leadership and effective coordination is required to develop a coherent green recovery strategy and deliver against that strategy.** Setting out a strategic vision will require effective coordination between government leaders at the highest level in order to manage competing priorities, for example through a specific inter-ministerial body such as a Climate Change Emergency Committee (Allan et al., 2020). Furthermore, robust governance arrangements will be needed to implement such a strategy. A green recovery presents an opportunity to explore innovative governance arrangements, with Box 7 outlining one proposal. All governments should consider how to streamline expertise and coordinate between departments to ensure that policies and programmes are well designed and that different activities neither duplicate nor contradict each other. This is likely to require formal coordination mechanisms between departments and clarity on governance arrangements. These coordination mechanisms or units may themselves evolve from ad hoc

green recovery initiatives such as inquiries, committees, or response teams like the Indian National Taskforce for COVID-19. Box 8 provides an example of how novel governance arrangements have been used to support policy coordination in Poland.

#### Box 7. Green recovery delivery unit

A cross-cutting delivery unit could support a green recovery by coordinating work across governmental departments. This muscular administrative body would support the development of green recovery policies, coordinate actions across different departments and deliver a green recovery through effective programme management. The ultimate objective of such a unit would be to ensure policy coherence: facilitating collaboration and coordination across departments and different levels of government to capitalise on policy synergies and avoid trade-offs (OECD, [2019](#)). From this perspective, the priority for such a body would be to undertake a detailed policy mapping across government of all activities which support or hinder a green recovery strategy. This mapping would become a ‘live’ document and a useful reference point for avoiding duplication or conflict between activities.

To be effective, such a unit would require:

- Expertise to design effective policy responses, and provide a central point for expertise, data and information,
- Clout and authority to ensure a coherent policy response across departments and resolve policy conflicts, potentially through being positioned within the Prime Minister’s Office (or equivalent),
- Convening power to engage effectively with external stakeholders.

Such a body or committee can be considered an ‘internal policy entrepreneur’ that leads on initiatives within the public sector.

#### Box 8. Case study: Mainstreaming the Social Economy in Poland

A National Committee for the Development of the Social Economy was established to explicitly incorporate social economy considerations into national and regional public policies, and to institutionalise dialogue between government and civil society. The Committee is an inter-ministerial/inter-sectoral social dialogue council that was set up through an Order of the Prime Minister and is funded by the Ministry of Labour and Social Policy. The committee includes a range of government ministries, academics, the Statistics Office and the Public Benefits Council. Key functions include national coordination and consultation; development, tracking and reporting of Key Performance Indicators (KPIs); initiating change and monitoring implementation; issuing opinions and recommending proposals (both legislative and financial) and identifying potential partners to consult and monitor implementation.

**The multifaceted nature of a green recovery necessitates effective communication with stakeholders outside of government.** There are a diverse set of stakeholders whose involvement is critical for an effective green recovery, including businesses and the private sector, civil society, experts and academics and local government. To support a successful



green recovery, the government should aim to leverage and broaden platforms for social dialogue, with this engagement being iterative so that lessons can be drawn from successes and failures (Meadowcroft et al, [2005](#)).

**Engaging with the diverse set of stakeholders requires effective social dialogue structures which forge consensus for a green recovery.** Establishing independent, sector- or issue-specific intermediaries (councils or committees) can be an effective way to govern the interaction between government and the private sector. Such intermediaries can serve to solicit and organise input from stakeholders, create a unified and more powerful voice in public policy decisions, and boost the legitimacy of policies when released. The intermediary can also help the government monitor implementation and feedback on progress or challenges to inform interim policy reviews. The most effective intermediaries are those which are considered inclusive, independent, influential and capable. Communication between the government and the intermediary, for example, providing an explanation when recommendations are not implemented, is critical to ensuring transparency and trust.

Box 9. Case study: Electric vehicle governance framework in the UK

Gemserv, a UK professional services firm and respected interlocutor between government and civil society, launched an Electric Vehicles (EV) Governance Consultation to develop a framework to inform the UK government's EV strategy. Gemserv brought together market participants across local authorities, utilities, equipment manufacturers, charge point operators, data protection and privacy experts, academics, standards bodies, regulators, and consultancies to establish an ad hoc EV governance forum. The informal partnership helped develop an understanding of market needs, identified, and ranked challenges, proposed solutions, and organised a joint industry response to a government consultation on policies to accelerate EV roll-out. Its recommendations were shared with the government and the forum was later institutionalised as a taskforce chaired by a quasi-government entity, the Energy Systems Catapult.

**The government should also engage effectively with experts and academia to ensure cutting-edge insights can feed into policy responses.** For the health response to the COVID-19 pandemic, national science advisory mechanisms have successfully supported governments in taking informed decisions, as with the UK's Scientific Advisory Group for Emergencies (SAGE) support for government response to the COVID-19 pandemic.<sup>11</sup> Learning from this, experts from across science, economics and other disciplines should be effectively consulted by the government to support policy development for a green economic recovery.

**Central government needs to engage effectively with subnational governments on the green recovery. However, this will look different depending on devolution.** In some countries, national climate targets are followed by the allocation of additional targets to provinces (Belgium, China), in others, subnational governments are expected to develop their own climate action plans (India, France), and in still others, climate policy in subnational governments can advance national policy (California in the US) (IPCC, [2014](#)). However, there

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<sup>11</sup> See <https://www.gov.uk/government/organisations/scientific-advisory-group-for-emergencies>

are some important areas where the central government can empower subnational governments to support a green recovery (ADEPT, [2020](#); LEDS, [2014](#)):

- Ensuring adequate funding and financing for local action, including through innovative mechanisms such as Community Municipal Bonds.
- Providing clear mandates and ownership to subnational governments, ensuring clear division of responsibility between institutions while incentivising action and improving integration and coordination.
- Equipping subnational governments with the data, guidance, and evidence to effectively deliver green recovery interventions.
- Developing information management systems to support monitoring and reporting, for example, by developing common standards for carbon accounting.
- Addressing capacity and skills barriers, for example, through providing manuals for infrastructure planning and procurement.

**Green recovery can be incorporated into policy design, budgetary, and monitoring and evaluation frameworks to improve policy coherence and transparency.** In policy design, criteria for a green recovery, such as those relating to job creation and sustainability, should be transparently embedded into decision-making. The weight given to these criteria should be clearly communicated to ensure ministries understand how to prepare proposals that are compliant with the green recovery. National priorities, which may vary according to the stage of the recovery, are likely to determine the stringency with which green criteria are applied. In order of most to least strict, new spending proposals may need to: demonstrate how they contribute to green objectives; demonstrate that they do no harm to green objectives; be assessed using green criteria that are weighted and scored amongst other priorities. The clear and measurable criteria used in policy design can also be fed into frameworks for regular monitoring and evaluation, which can help ensure consistency and facilitate learning. With regard to budgeting, Box 10 outlines a suggestion for how Integrated National Financing Frameworks could be repurposed for a green recovery.

**Box 10. Using Integrated National Financing Frameworks (INFF) to support a green recovery**

Integrated National Financing Frameworks (INFFs), which are geared towards developing and emerging countries, strive for strategic coherence of finance to support sustainable development objectives. INFFs seek to develop an integrating financing strategy to achieve prioritised Sustainable Development Goals (SDGs). Much of this is informed by four building blocks: 1) governance and coordination, 2) assessment and diagnostics, 3) financing strategy, and 4) monitoring and review. This approach can be adapted to support a strategic, integrated and aligned green recovery from the pandemic.

**The processes for monitoring and evaluating the green recovery policy response will need to be sensitive to the uncertainty of the pandemic.** The uncertainty of the pandemic means that changes to advisory bodies and governance processes should be expected and planned for. Checkpoints should be defined to review governance processes and evaluate the effectiveness of any inter-ministerial committees, civil society platforms, and strategic responses to the crisis.

### 3.3.2 Government skills and capacity

**Governments will need to ensure they have the skills and capacities required to develop, implement, and manage green recovery strategies and policies.** The capacity of governments to integrate sustainability into recovery plans varies widely at both national and sub-national levels. For example, additional expertise relating to both green investment and recovery planning may be needed to deliver effective green recovery initiatives. Some have comprehensive action plans for addressing climate change and skilled staff, while others do not. Skills and capacity gaps can result in poorly designed, duplicative, or misaligned policies. The need for capacity development can be particularly strong among emerging markets and developing economies (EMDEs), and it is essential that advanced economies and multilateral groups work alongside EMDEs to build capacity, now more than ever.

**Governments should conduct a skills assessment to understand capacity gaps and to develop plans to cultivate or bring in needed skills.** An initial assessment can identify what skills are needed within government, if and how these skills can be marshalled among existing staff across different government departments or public bodies, and where additional skills need to be developed or brought into government institutions.

**Following the identification of needs, public bodies should plan to develop the required skills and capacities.** This may include temporary or permanent staff re-assignments within government, capacity-building programmes to upskill government workers (as in the example outlined in the box below), and recruitment plans to bring in staff with the required skills. Where skills to support time-sensitive recovery planning or action are not available within governments, and capacity-building or recruitment interventions would take too long to deliver, governments should consider how to leverage the expertise of academics or consultants, through establishing supporting committees or through direct procurement of expertise.

#### Box 11. Case study: Green government skills in Vietnam

A multiyear programme in Vietnam sponsored by UNDP and USAID helped key ministry officials develop capacity and governance structures to mainstream green policies into decision-making. The programme guided officials on how to monitor and evaluate the country's Green Growth Strategy and Action Plan, integrate green targets into planning, budgeting and spending processes, conduct policy and financial analysis on financing and investing, and mobilise funds for green growth and climate change (UNDP, [2020](#)).

### 3.3.3 Private sector skills and capacity

**Skills will need to be built in the private sector so that national and local recovery plans and policies can be translated into action.** Specific skills may be required to deliver green recovery investments in practice, for example, technical expertise in green energy technology manufacturing and installation. These skills may not be widespread among private companies or individuals, or not at the scale or in the locations needed to support green recovery investment ambitions. In addition to developing private sector skills to support immediate green investment, countries can use capacity-building efforts to align skills with green jobs of the future, to help orient future economic activity with a low-carbon green growth pathway.

**Where economies need to shift, an initial needs assessment of reskilling needs should be carried out and targeted programmes should be developed to mitigate transitional**

**friction.** This evaluation should assess the extent to which the skills of those re-entering the labour market (including those previously employed in carbon-intensive industries) are applicable to the green industries of the future, and where skills gaps exist. Focused job placement programmes and platforms can help match capabilities to skills (OECD, [2020](#)). Re-training and skill programmes can effectively address skill gaps. Close cooperation between industry and Technical and Vocational Education and Training (TVET) institutions can help to develop an understanding of the skills required by industries today and how rapid technical innovation will affect skill needs in the future. Financial and technical investments in TVET institutions can improve the quality of training by ensuring teaching staff are well qualified and equipment is up to date. Accreditation of programmes can also help to ensure smooth transition into green workplaces.

**The private sector can play an important role in identifying skill needs, supporting data collection, and supplementing gaps in national policies.** The private sector has a role as the client of training providers. In this capacity, the private sector can be engaged in ensuring that courses offered by TVET institutions match the skills they need. Employers are directly exposed to the changing skills environment and skill needs and are best placed to identify knowledge gaps in formal training programmes (ILO, [2019](#)). Collaboration between TVET institutions and the private sector on curricula development can ensure training programmes are well-matched to employers' needs. The private sector typically plays a part in financing training programmes, with the share varying by programme and participant type. However, the private sector also has a role as a training provider through on-the-job training. This may be blended with TVET-based learning, for example, in the case of apprenticeships, and it may or may not be assessed and certified. While engaging in on-the-job training may benefit some firms (through lower trainee wages, well-matched skill development and employee loyalty), small- and medium-sized enterprises (SMEs) may lack the capacity to deliver skills training in-house.

**Retraining must happen quickly to meet the needs of large-scale projects where skill gaps exist.** The opportunity cost of education, training, and retraining is lower during recessions and periods of high unemployment, as it is less likely to displace workers from productive activities. Public support to higher education and TVET should be extended to reduce the number of people not in employment, education or training, which can have long-term effects on an individual's prospects and productivity. Approaches that have proven to be successful for other purposes, like training for ex-offenders to re-enter the workforce, could be modified for unemployed workforces resulting from COVID-19 and applied to close green skills gaps. Special sectoral training taskforces can be established to develop and certify short courses designed to develop specific skills, for example, training to effectively renovate buildings with insulation improvements, targeted upskilling of electricians to install rooftop solar photovoltaic installations or retraining automotive mechanics to maintain electric vehicles.

**The financial damage of COVID-19 is a burden shared across the global economy, and efforts to recover stand to gain from close international policy collaboration.** The unbounded impact of CO<sub>2</sub> emissions (a ton of CO<sub>2</sub> being felt equally regardless of the location of the emission) should provide a strong imperative for countries to use international forums for dialogue and aligning action. Existing or new cooperation platforms offer opportunities for information, knowledge and experience exchange and can facilitate negotiations of strategic agreements for continued or deepened cooperation. Exploring similar avenues around the design of a green recovery can offer immediate and long-term opportunities, for instance around innovation and technological advances. Bilateral or multilateral cooperation on a green recovery can also serve to exert pressure on other countries to follow suit.

**International interest in a green economic recovery has strengthened as multilateral initiatives take shape.** During the Global Financial Crisis of 2008-10, the coordinated response of the G20 countries set ambitious recessionary stimulus spending as a bar for global crisis response (Barbier, 2010). Such initiatives can be a powerful tool to lower thresholds and mitigate resistance by enabling dialogue and promoting consensus, as seen in current initiatives related to the COVID-19 pandemic crisis and associated recovery efforts:

- **In April 2020, the European Commission launched the Green Recovery Alliance, with participation from MEPs, civil society, businesses, the European trade union federation, and NGOs (EC, 2020).** The Green Recovery Alliance advocates for post-pandemic ‘stimulus transformation plans’ that put climate action and reversing biodiversity loss at the centre of Europe’s economic policy.
- **The Platform for Redesign 2020 is emerging as an information sharing space that currently consolidates 73 national green recovery initiatives from COVID-19.**<sup>12</sup> The initiative includes an online platform where countries are invited to share the policies and processes they are using to build back better. The platform has actions from 73 country governments, and is organised using six categories (Climate mitigation measures; Climate adaptation measures; Cross-cutting measures; Other environmental measures; International cooperation; Others) and three time frames (Response: Short-term emergency measures; Recovery: Medium-term socioeconomic measures to build back better; and Redesign: long-term paradigm shifts to redesign current socioeconomic and sociocultural systems to be sustainable and resilient).

**Information sharing programmes facilitate collaboration and may accelerate effective and efficient crisis response.** International collaborative platforms offer leaders and policymakers an opportunity to learn from others in similarly unique situations, which few may have experienced before.

- **The Green Climate Fund (GCF) is helping countries articulate and share the tools and options that are available to move from ambition to implementation.** The Green Climate Fund convened a forum on 9 July 2020 to accelerate the green recovery in developing countries. Held on the sidelines of the annual SDG stocktake, it brought together over 500 policymakers, climate change experts, development specialists and representatives from UN agencies, civil society organisations, research institutes and the private sector (GCF, 2020a; GCF, 2020b). The forum affirmed the need to pair climate measures with social development and economic recovery investments. Its insights helped to progress discussions in the High-Level Initiative on Financing for Development in the Era of COVID-19 and Beyond, co-convened by Canada, Jamaica, and the United Nations. The GCF is also supporting countries in identifying and developing financing approaches to integrate climate-positive actions into their recovery plans, through a *Menu of Options for Financing Development in the Era of COVID-19 and Beyond* (UN, 2020). The organisation has faced criticism over its consensus-based governance model, though, with concerns raised over the efficiency of its consensus-based decision-making, as well as its lack of transparency or accountability mechanisms. (Nature, 2015; FT, 2019)
- **Alignment around international approaches to and support for non-financial disclosures can also strengthen international learning and sharing.** For example,

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<sup>12</sup> <https://platform2020redesign.org>

the GCF-supported *Menu of Options* suggests that countries develop and agree to non-financial reporting and sustainability-related disclosure norms and reporting frameworks, including developing digital reporting platforms and integrating non-financial metrics into financial decision-making. This is in line with the Enhanced Transparency Framework (ETF) under the Paris Agreement, which aims to strengthen measurement, reporting and verification systems to ensure the transparency of mitigation and adaptation actions. These activities can build on the International Public Sector Accounting Standards, and private sector initiatives including the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), the International Integrated Reporting Council (IIRC) and the International Accounting Standards Board (IASB) (UN, [2020](#)). This can also extend the work done by the Inter-agency and Expert Group of SDG Indicators on Measurement of Development Support, which is developing valid and feasible indicators, methodologies, reporting standards and monitoring recommendations to measure development (UN, [2020](#)). The Paris Agreement's Enhanced Transparency Framework mandates how/what/when Parties should report against individual commitments and circumstances in reporting global climate finance through the UNFCCC (UNCC, [2021](#)).

**Policy collaboration can also help harmonise standards, taxation, and other regulation mechanisms, ultimately reducing global emissions.** Countries can draw on existing networks to align with global standards and norms. In turn, this helps to achieve more consistent measurement and reporting of climate-related financial disclosures. For example, countries can build on established taxonomies, targets and metrics through the G7-OECD-UNDP SDG Alignment Initiative and promote these standards through platforms like the G20 and the International Platform on Sustainable Finance. Similar collaboration on sustainability-related disclosure and reporting frameworks could build on established initiatives. For example, reporting risk using the Taskforce for Climate-Related Disclosures, and developing shared sustainability metrics based on the OECD's Total Official Support for Sustainable Development framework (OECD, [2019](#)). Similarly, common methodologies for carbon pricing can support emission reductions. The Carbon Pricing Leadership Coalition strengthens collaboration among government, the private sector, academia, and civil society by sharing carbon pricing experiences and expanding the evidence base for the most effective carbon pricing systems and policies (CPLC, [2020](#)). International carbon markets can also efficiently reduce emissions and achieve net zero, and the International Emissions Trading Association's governing council released a Net-Zero Climate Ambition document affirming its commitment to carbon pricing government by international standards to efficiently direct resources to achieve net zero. It supports using the rules and accounting standards outlined under Articles 5 and 6 of the Paris Agreement, as well as the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) (IETA, [2020](#)).

### 3.4 Core co-considerations

As economic recessions will always vary in nature, the optimal design of recovery strategies, from policy, to finance, to institutional support, will differ among different crises. This is especially true for the COVID-19-induced recession, which is entirely unprecedented in both nature and scale. As such, this particular crisis calls for a unique set of core co-considerations when designing stimulus packages.

### 3.4.1 Packages should include policies with different time frames

Economic recovery should ideally be characterised by a smooth, rather than stepped, growth curve. Smooth growth could help to ensure that investment creates long-term demand and industrial capability, as opposed to simply shifting tomorrow's demand to today. In order to achieve a smooth curve, policy packages should incorporate policy types of varying speed.

**Timeliness has historically been emphasised as an important factor in lessening the magnitude of an economic downturn** (Elmendorf and Furman, [2008](#); Summers, [2008](#); Taylor and Castillo, [2015](#); Steel and Harris, [2020](#)). On this topic, economists emphasise the importance of (i) legislating tax cuts and spending increases and (ii) effectively distributing the cash associated with this to economic actors. While the former is in the hands of legislators, the latter can vary in the shovel-readiness of projects. Policies of existing programmes that can be further funded, or where there is a backlog of planned projects, are considered shovel-ready, allowing for quick deployment and job creation. Natural capital solutions, retraining initiatives, and green efficiency retrofits are identified as policies that exhibit these features. Fast implementation of these can help the immediate recovery, creating jobs and kickstarting economic growth.

**Longer-acting policies are also crucial to a well-constructed recovery package.** These policies will smoothen the growth curve by building demand and industrial capability over time. While these policies are unlikely to immediately stimulate demand, they often bring about higher economic multipliers (Hepburn et al., [2020](#); Bowen et al., [2009](#)). Public spending on relevant policies, such as new infrastructure projects and R&D programmes, can stimulate private investment, thereby preventing the persistent output losses and associated productivity shortfalls that occurred following the 2008 GFC (Chen et al., [2019](#)).

However, the COVID-19 pandemic is unique in its uncontained global spread, meaning that national economies are subject to the ebbs and flows of virus transmission. As a result, governments must impose restrictions, often in a reactionary manner, that will cause significantly more uncertainty in the duration and nature of economic strains in this recession than in the past. Timing policy against restrictions is crucial to preventing policies from adding instability to the economy, which would risk deepening the recession (Elmendorf and Furman, 2008; Friedman, 1953). This will require policy flexibility.

**To maximise flexibility, recovery strategy design should begin immediately**, if it has not already. Designs should allow for flexibility in programme start dates and allow for variation in the expected duration of existing programmes. If policymakers do this, recovery initiatives can be implemented when economic conditions and forward economic projections are deemed appropriate, so that recovery can be smooth.

### 3.4.2 Fast-acting policies should consider COVID-19 safety

In the short term, governments may be forced to implement some level of mobility restriction for a considerable number of months, even as the economic recovery progresses. Policies that are designed to kickstart the recovery in the initial stages, mainly those with high speeds of implementation, should incorporate COVID-19-safety principles such as social distancing, to mitigate virus spread while generating economic gains. Such policies can keep people in work, reducing the magnitude of the economic impact of mobility restrictions.

**Some green policies are particularly suited to these COVID-19-safety measures.** Natural capital spending, in sectors like forestry, meets social distancing guidelines (UN, [2020](#)) and

the rural nature of these policies reduces risk otherwise borne from urban public transport use. To mitigate this, investment into public transport capacity could promote social distancing, while creating jobs and reducing car use (OECD, [2020](#)). This would promote COVID-19-safety for fast-acting policies that are more urban, such as energy efficiency retrofitting.

For countries with a lower virus case-count, policies should incorporate COVID-19 relevant safeguards and worst-case planning, considering the risk of growing community transmission. This will protect initiatives from having to cease completely if the virus case-count does suddenly accelerate.

Even within countries, vaccines may be introduced and developed heterogeneously across a nation. This may allow different sectors and regions to resume economic activity at different rates. Recovery policies should correspondingly take COVID-19-safety considerations into account for varying sectoral and regional vaccination levels. Earlier spending may be targeted at areas that have a wider vaccine roll-out.

### 3.4.3 Equity should be integrated into every stage of strategy design

The COVID-19 pandemic exacerbated inequalities in both health and economic measures in its first year and is expected to continue to do so for years to come (Coronini-Cronberg et al., [2020](#); Blundell et al., [2020](#); Marmot and Allen, [2020](#)). Financial strain is highest on those in the lowest income brackets, and progress on SDGs has stalled, and often, been reversed. (ILO, [2020](#); UN, [2021](#)). Meanwhile, disadvantaged communities are likely to be harmed disproportionately by the climate crisis due to their low resources for mitigation and investment in adaptation (Dercon, [2014](#)). While a green recovery and energy transition is likely to create jobs for these communities, it will also be disruptive to labour markets and industries. In this context, the importance of targeting equity in policy design is of even greater importance than usual.

**Practically, governments should incorporate equity concerns by both designing specific policies to target the worst-hit groups and ensuring that other policies incorporate particular emphasis on social co-benefits.** In short, governments should aim to ensure that those who are most disadvantaged enjoy a disproportionate amount of the benefit from a policy to mitigate historic and growing inequities.

**To do so, policy making must be based on just transition principles.** A comprehensive set of these has been set out at the ILO ([2015](#)), while further work has been done on this elsewhere since (e.g. see Heffron and McCauley, [2018](#); Stevis and Felli, [2020](#)). Key considerations include employment rights, inclusive opportunities, and catching those who ‘fall through the cracks’ during economic restructuring.

Alongside these principles, policymakers should consider, at a minimum:

#### Questions for understanding disproportional impact

- How have different communities and sub-communities been impacted by the COVID-19 pandemic and which groups have come under the greatest pressure? How have these negative pressures intersected with existing vulnerabilities and ingrained inequalities?
- Which communities have benefitted and been harmed by government responses to COVID-19 pandemic? To what degree?



- How has COVID-19 influenced human capital across communities and vulnerable groups? How have policy makers addressed and/or exacerbated this?
- How have the negative physical impacts of climate change and pollution already impacted vulnerable communities and how are these impacts expected to grow in the future?
- How might ongoing and future green industry transitions impact and displace existing parts of the labour force and how might this displacement impact adjacent communities? Which groups are well-placed to manage these changes and which groups are likely to struggle to do so?
- Are local and diverse voices being heard in policymaking at each level of government? Which voices are not being heard? Why are those voices not apparent?
- What conscious and unconscious biases may be affecting policy making at each level of government?

#### Questions for integrating justice to green investment

- How might new COVID-19 investment best support vulnerable communities and address, rather than exacerbate, existing inequalities?
- How could COVID-19 investment be used to grow human capital and shift skillsets to ready workers for the green jobs of the present and of the future? What might a focus on green human capital mean for worker training and retraining systems?
- How can policy makers use their COVID-19 economic responses to provide early and consistent signals to people and businesses regarding changing industrial and economic landscapes?
- How might the government use COVID-19 spending to create jobs targeted at individuals and communities negatively impacted by the green transition? How might efforts to fill new job vacancies prioritise those who are recently without work?
- How can policy makers incentivise and otherwise compel businesses to proactively prepare workers for future employment? How can this be done as a part of COVID-19 responses?
- How can policy making be conducted with the direct input of local community members and representatives of vulnerable communities at every stage of development?
- What needs to happen to ensure that active and informed social partners are participants at every stage of policy development?
- What are policy makers doing to support other nations which are facing even more urgent and trialling challenges? How could they significantly increase support for the most vulnerable nations and their people? What reasons are driving reticence to fulfil moral and international legal obligations to support developing nations, in particular in dealing with and combatting climate change?

Recovery packages designed in accordance with just transition principles, and that prioritise social welfare, could mitigate both climate and inequality risks in tandem, while boosting the political popularity of green fiscal policy. It remains crucial to tune adherence to these principles with national contexts, as the nature and extent of existing inequalities is likely to vary. For example, a country with rural-urban inequalities may prioritise policies with high rural uplift potential, such as energy efficiency retrofits for rural areas or sustainable agriculture, while a country with inequalities between industrial and service sectors may focus on policies that regenerate old industrial hubs, such as clean energy infrastructure.

**Where policies do not directly come with equity-related co-benefits, the just transition principles should be employed to design supplementary policies that will ensure equity at all stages.** For example, stronger labour market regulation of working environments can ensure that jobs are of high quality, in green industries or otherwise. This may come about through green policies, like regulation on air quality, or through more conventional interventions, like guaranteed sick leave. In either case, where green policies fall short on directly promoting equity, governments should actively engage in ensuring that economic restructuring does not result in adverse effects.

## 4 How to quantify the benefits of green recovery

**In this chapter, we introduce a rapid input-output modelling approach that analyses and compares the potential economic, social, and environmental impacts of alternative fiscal investments.** Using the Intervention & Investment Impact Model (I3M) from Vivid Economics, the objective of this modelling exercise is to provide a high-level comparison of the benefits of green stimulus relative to continued investment in coal. The modelling is based on generalised policy scenarios, which will differ from the policy interventions which governments will implement. China, India and Poland are used as case studies to ascertain the relative potential advantages of investing in packages of green infrastructure instead of coal infrastructure.

The body of this chapter explains the technical approach to the modelling, highlights key assumptions, and summarises the modelling results for each of the three countries. Figure 4.1 summarises the key modelling results across all three countries. A more detailed presentation of both the stimulus packages modelled and the modelling results can be found in the country-specific roadmap chapters: India in Section 4, China in Section 5, and Poland in Section 6.

### 4.1 Major findings across case studies

**Based on findings in China, India and Poland, we find that green fiscal investment in COVID-19 recovery can provide strong short-term economic stimulus and job creation, while supporting a transition to a more sustainable future.** The results indicate that compared to coal investment, a successful green stimulus can offer higher short-term economic benefits and higher mitigation and health benefits.

**Short-term job creation emerges as one of the core strengths of investing green.** In China, the representative green stimulus package would generate 9.5% more jobs in the short-term 'investment phase' than the coal alternative. In India, the job creation benefits are more modest, with the green package outperforming coal by 2.6% in terms of job creation. If an additional EUR 1.75bn of Just Transition Funds were directed towards green stimulus, the analysis suggests employment could be boosted by 46,000 job-years. This short-term employment boost is critical given the scale of the global downturn, with the IMF projecting a global GDP growth rate of -4.4% in 2020 (IMF, 2020)

**The green recovery packages are shown to strongly support long-term progress on emissions reduction.** In China, announced support to coal generation is expected to increase CO<sub>2</sub> emissions by 24Mt in each year of the operational phase. This policy could further lock the economy into high-carbon production patterns (Vivid Economics, [2020](#)). In contrast, a green stimulus package presents an opportunity to reduce carbon emissions by up to 50Mt per year over the first ten years and unlock new economic opportunities through the availability of clean energy.

**Tens of thousands of lives saved is just one of the numerous health and social benefits discovered by shifting investment away from coal and toward green assets.** Based on extensive health evidence, less coal-fired electricity generation can lead to significant improvements in air quality, bringing strong positive implications for both adult and child health.

Combining results from the China and India analysis, announced 2020 support to the coal sector in response to COVID-19 could result in 94,000 additional deaths over the next decade and 340,000 additional birth complications.

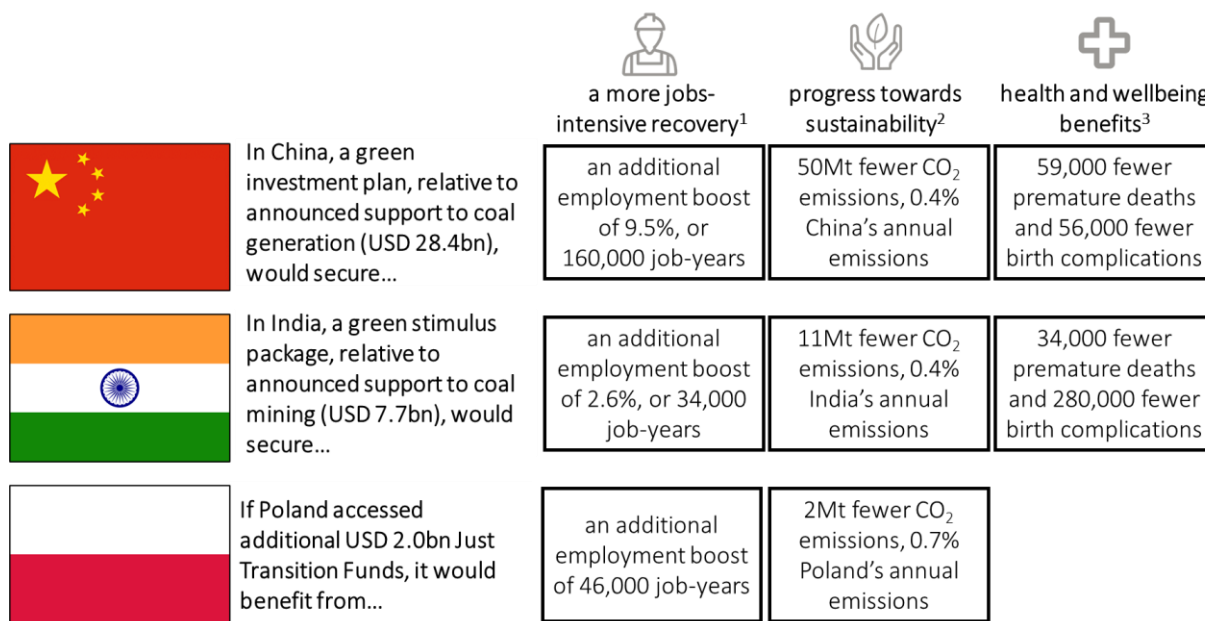


Figure 4.1 Benefits of a green recovery in China, India, and Poland. Note: the following indicates the time frame of the results: <sup>1</sup> Total during the investment phase; <sup>2</sup> For a given year during the operational phase; <sup>3</sup> Over the first ten years of the recovery. In the case of Poland, the analysis did not include a coal stimulus package, which means that there were negligible health benefits of a green stimulus. Source: Vivid Economics.

## 4.2 The modelling framework

The modelling conducted in this report aims to examine the economic, environmental, and social benefits of ambitious green recovery stimulus relative to a high-carbon or 'dirty' alternative stimulus package. For each country, an investment in coal infrastructure is directly compared to an equivalent investment in a green stimulus package. Vivid Economics designed stylised representative green stimulus packages by assigning a fixed volume of capital investment across seven green interventions: sustainable reforestation, hydropower, wind power, solar power, building efficiency, industrial energy efficiency, and electric vehicles. While not a policy prescription, the design draws on known country priorities (as evidenced by existing stimulus announcements, Nationally Determined Contributions (NDCs) and other climate policies), as well as on emerging best practices in the green recovery literature (IEA, 2020b; IRENA, 2020b; RMI, 2020; Vivid Economics, 2020; WEF, 2020). In China and India, the volume of capital investment was determined by a 'bottom-up' assessment of announced stimulus support to the coal sector up to August 2020. In China, support has been targeted towards expanding coal-fired electricity generation capacity, while in India the focus has been developing the domestic coal mining industry. For China and India, the modelling compared the impact of announced coal stimulus with the stylized representative green stimulus package. In Poland, due to relatively light targeted support for the coal sector, the modelling instead investigated the benefits of committing to a 2050 Net-Zero emissions target, which would enable Poland to access an additional EUR 1.75 billion from the European Commission's Just Transition Fund.

**Vivid Economics used its proprietary Intervention & Investment Impact Model (I3M) to analyse the economic and employment impacts of the different stimulus packages.** I3M uses an input-output modelling framework to explore how changes in final demand for one sector impact upstream sectors, with a ripple effect throughout the economy. The key input to the modelling was the EORA database, which contains multi-region input-output tables with matching environmental and social satellite accounts for 190 countries. The modelling analysed the ‘investment’ and ‘operational’ phases separately. The modelling assumes that stimulus packages finance capital expenditure, which goes towards the cost of manufacturing, constructing, or installing the intervention during the investment phase. The operational phase then begins once the intervention becomes active (for example, when the power plant begins generating electricity). I3M results include increased employment and economic benefits.<sup>13</sup> Employment is measured in job-years for both direct jobs (resulting from the investment itself, through construction or ongoing maintenance and operations) and indirect jobs (created throughout supply chains).

**I3M modelling included analysis of the environmental and health impacts of the different stimulus packages.** While some of the emissions impacts associated with the interventions could be extracted from the model, others needed to be estimated based on changes in demand for fossil fuels (an I3M output) and their associated emissions factors. In terms of health, the analysis focused on premature mortality and infant morbidity related to changes in the concentration of fine particulate matter (PM2.5). The analysis estimated how changes in sector activity would impact each sector contribution to PM2.5 pollution and drew on well-established dose-response relationships to estimate the associated health impacts of different stimulus packages.

**The technical appendix details each stage of the modelling approach in additional detail.** Box 12 summarises the key assumptions used in the modelling.

Box 12. Guidance for interpreting I3M results

The modelled green stimulus package is not a policy prescription. The modelled green packages are hypothetical representative options which draw on known country priorities and emerging best practices.

The economic modelling using I3M relies on assumptions that mean that the results are most helpful for understanding economic impacts over a short time period. These include conditions that are less likely to be true the further into the future the model considers:

- Constant returns to scale as production increases – this means that if demand for a sector doubles, demand for all of its inputs doubles as well;

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<sup>13</sup> Economic benefits refer to a combination of gross value added (GVA) and energy savings. Non-monetised benefits such as job creation, emissions reductions and health benefits are not included.

- Slack capacity in both the labour and input markets means that there is sufficient underutilised capacity in the economy so that if demand for a sector increases, activity is not constrained by the unavailability of labour or other inputs;
- Fixed prices for all goods and factors of production. This means that prices do not increase in response to an increase in demand for a sector;
- No induced impacts – the impact on consumption patterns through changes in household wealth is not included in the model.

The model does not account for different sources of investment in different ways. The modelling does not distinguish between interventions funded by the private or public sector. It may be the case that green interventions are able to attract greater private co-investment than investment in coal. For example, green banks have found that for USD 1 of public green investment, the private sector invests USD 2.5 (Vivid Economics, [2020](#)). The modelling does not account for the differing ability of interventions to attract private co-investment, suggesting the numbers presented here may be conservative.

The health modelling relies on assumptions that relationships between pollution and health impacts are the same within whole countries and over time. These assumptions include:

- A sector's contribution towards PM2.5 concentration increases proportionally with sector activity – this means that if a sector contributes  $10\mu\text{g}\text{m}^{-3}$  to the annual concentration of PM2.5 and demand increases by 10%, national average annual population-weighted concentration of PM2.5 increases by  $1\mu\text{g}\text{m}^{-3}$ 
  - For this assumption to hold, the new sector activity must use similar technological processes as existing activity, and the geography of sector activity (proximity to large urban centres) should be relatively unchanged.
- The risk of increased PM2.5 concentration on health outcomes remains the same across countries (taking into account national baseline PM2.5 concentration) and across different sources of PM2.5 emissions;

Constant rates of mortality and morbidity in baseline health estimates.

### 4.3 Summary of results in India

**A green recovery package in India could secure short-term employment benefits while also supporting the transition to a more sustainable economy.** In India, the analysis compared announced support to coal mining, including market restructuring, up until August 2020 with a representative green stimulus package of the same level of capital expenditure. Figure 4.2 summarises the model results for the different interventions. The results show that if India reoriented its stimulus expenditure away from coal and into green alternatives, it could secure:

- **A more jobs intensive recovery** – a green recovery could generate 2.6% more jobs during the investment phase for the same level of investment;

- **Progress towards its climate commitments** – investment in a green recovery could result in 11Mt fewer CO<sub>2</sub> emissions, equivalent to 0.4% India's annual emissions;
- **Improved air quality with associated health outcomes** – over the first ten years of the recovery, investment in a green alternative could result in 34,000 fewer people dying prematurely from air pollution, and 280,000 fewer birth complications.

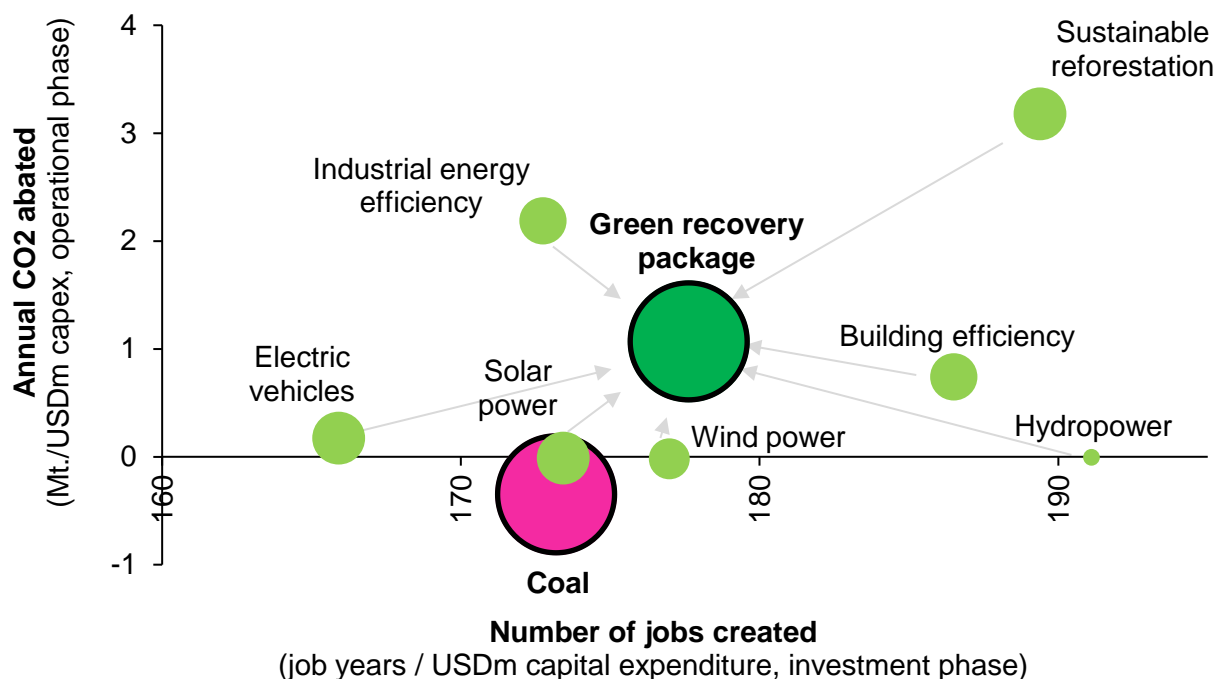


Figure 4.2 Benefits of a green recovery in India. The size of the bubbles indicates the scale of capital investment modelled for each intervention. Source: Vivid Economics.

#### 4.3.1 Stimulus packages

The modelling analysis compares a stimulus package based on announced support to the coal sector in India with an alternative representative green stimulus package. The capital expenditure in both stimulus packages modelled is the same, to provide a like-for-like comparison of impacts for the same volume of investment. The scale of this investment was determined by a 'bottom-up' assessment of announced support for the coal sector in India. As part of the COVID-19 stimulus effort, USD 6.8bn support has been allocated towards coal-enabling infrastructure for Coal India, of which 36% is assigned to investment in mechanised coal transfer from mines to rail transport (OSEE, 2020). In addition, market reform to enable commercial coal mining has resulted in 41 coal blocks being auctioned under a revenue-sharing mechanism. In-country experts expect that only one-third of blocks will be sold, of which half will be developed in the next five years. This is expected to boost private investment in coal mine development by USD 0.8bn in the short term. In the alternative representative

green stimulus package, this USD 7.7 billion was allocated across seven interventions according to the interventions’ alignment with known country priorities and emerging literature. Figure 4.3 summarises the distribution of investment across interventions, showing that the package is oriented towards electric vehicles, sustainable reforestation, and solar power. Table 4.1 explains some of the considerations behind the allocation of capital expenditure.

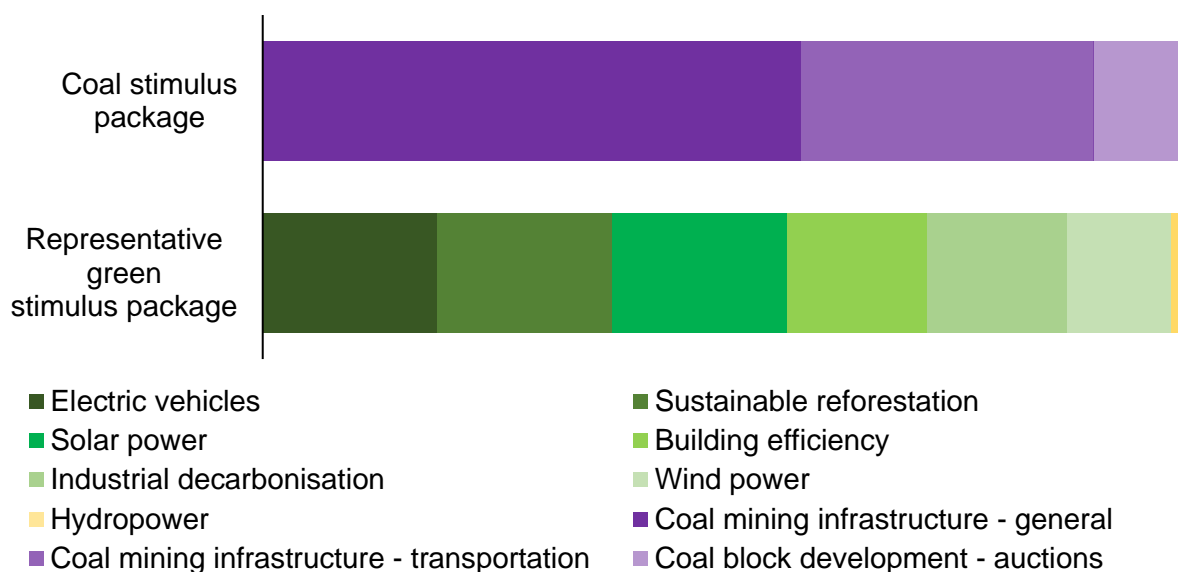


Figure 4.3 Distribution of capital expenditure towards different interventions in each stimulus package, India. Source: Vivid Economics.

Table 4.1 Allocation of investment in representative green stimulus packages. Note: the information in this table is based on a cross-country literature review. The information reported will not match exactly with the findings from the bespoke analysis reported below. This is for several reasons, including: (1) the literature review typically consisted of case studies of specific investments, while the modelling analysis is a more stylised analysis of sectoral impact; (2) by being based on case studies, the literature does not account for the full set of indirect (supply chain) impacts, which are captured by the modelling and reported in the analysis; and (3) the modelling is bespoke to each country context, whereas the literature review was based on international evidence. Source: Vivid Economics.

Green Stimulus Area	Rationale
Electric vehicles	The international literature suggests investment in electric vehicles has been described as timely, with strong potential for providing employment to those who have been displaced by the COVID-19 crisis. In addition, low-emissions vehicles are a relatively cost-effective way of reducing emissions (IEA, 2020b). In India, there is a target of 30% share of electric vehicles in new sales by 2030, in line with being a member of the intergovernmental EV30@30 campaign.



Green Stimulus Area	Rationale
	<p>The Faster Adoption and Manufacturing of Electric Vehicles was introduced in 2019 to incentivise electric vehicle purchase and ensure adequate charging infrastructure (Climate Action Tracker, <a href="#">2020b</a>). There has not been nationwide support for electric vehicles in response to COVID-19, but states have made individual commitments – for example, in Delhi, the government has committed to increasing electric vehicles to 25% of all new vehicle registrations by 2024 (Vivid Economics, <a href="#">2020</a>).</p>
Sustainable reforestation	<p>Investment in afforestation programmes, restoration of wetlands and forest management investments have been noted as highly job-intensive, quickly scalable and critical for achieving long-term environmental objectives (Vivid Economics, <a href="#">2020</a>). India’s draft National Forest Policy, released 2019, ambitiously calls for one-third of India’s total geographical area to be under forest or tree cover by 2030 (Climate Action Tracker, <a href="#">2020b</a>). In response to COVID-19, India has channelled USD 780m through the Compensatory Afforestation Management and Planning Authority (CAMPA) fund for an afforestation programme designed to stimulate the rural and semi-urban economy while providing essential ecosystem benefits (Vivid Economics, <a href="#">2020</a>).</p>
Solar power	<p>Investment in solar power produces a relatively high number of jobs per million invested, although from an international perspective, it is a less cost-effective way of reducing emissions than other green alternatives (IEA, <a href="#">2020b</a>). In India, large-scale auctions have contributed to swift renewable energy deployment, and the National Solar Mission was scaled up in 2015 to target 100 GW solar installed capacity by 2022 (Climate Action Tracker, <a href="#">2020b</a>). In-country experts emphasised that solar deployment is seen as an important vehicle for job creation, particularly decentralised rooftop solar. In response to COVID-19, the Indian government has introduced measures to support renewable energy. In particular, it has waived charges for interstate transmission of wind and solar power until December 2022 (Vivid Economics, <a href="#">2020</a>). Other support to the sector includes the Government of Andhra Pradesh announcing 9 hours of free solar power during the daytime to farmers (Energy Policy Tracker, <a href="#">2020</a>).</p>

Green Stimulus Area	Rationale
Building efficiency	<p>Building efficiency interventions are recognised in the literature as being job-intensive and as having high abatement potential (IEA, <a href="#">2020b</a>). In India, the focus is improving the energy efficiency of new buildings, with limited ambition to retrofit older buildings. For example, the 2017 Energy Conservation Building Code prescribes the energy performance standards for new commercial buildings. There have been no additional policies announced in response to COVID-19 to support the sector.</p>
Industrial energy efficiency	<p>Investment in industrial energy efficiency produces a relatively high number of jobs per million invested, and as an energy-saving mechanism has an important role in improving economic productivity (IEA, <a href="#">2020b</a>). India has prioritised energy efficiency in industry through the Perform, Achieve and Trade (PAT) scheme, which has been in place since 2012. There have been no additional policies announced in response to COVID-19 to support the sector.</p>
Wind power	<p>Investment in wind power produces relatively fewer jobs per million invested, and from an international perspective is a less cost-effective way of reducing emissions than other green alternatives (IEA, <a href="#">2020b</a>). Large-scale auctions have contributed to swift renewable energy deployment, and the National Solar Mission was scaled up in 2015 to target 60 GW wind installed capacity by 2022 (Climate Action Tracker, <a href="#">2020b</a>). In response to COVID-19, the Indian government has introduced some measures to support renewable energy. In particular, it has waived charges for interstate transmission of wind and solar power until December 2022 (Vivid Economics, <a href="#">2020</a>).</p>
Hydropower	<p>From an international perspective, investment in hydropower produces relatively fewer jobs per million invested (IEA, <a href="#">2020b</a>). In India, there is a modest ambition to deploy small-scale hydropower, but historically this sector has attracted lower levels of investment than other forms of low-carbon power investments (IEA, <a href="#">2020</a>). There have been no additional policies announced in response to COVID-19 to support the sector.</p>

### 4.3.2 Economic benefits of a green recovery stimulus

**During the initial investment phase, the representative green stimulus package could create 2.6% more jobs than the coal stimulus package.** The coal stimulus package is estimated to boost employment by 240,000 job years directly, and 1,100,000 job years indirectly (through supply chains) during the investment phase. In contrast, the green stimulus package would support employment by 550,000 job years directly and 820,000 job years indirectly. Within the green stimulus package, there is limited variation in the number of jobs different interventions create. Of the seven interventions modelled, the analysis suggests that hydropower is best for short-term job creation, boosting employment by 191 job years during the investment phase for every USD 1 million invested. However, the intervention which creates the least jobs (electric vehicles), boosts employment by 166 job years during the investment phase for every USD 1 million invested, suggesting relatively limited variation. Figure 4.4 summarises these results.

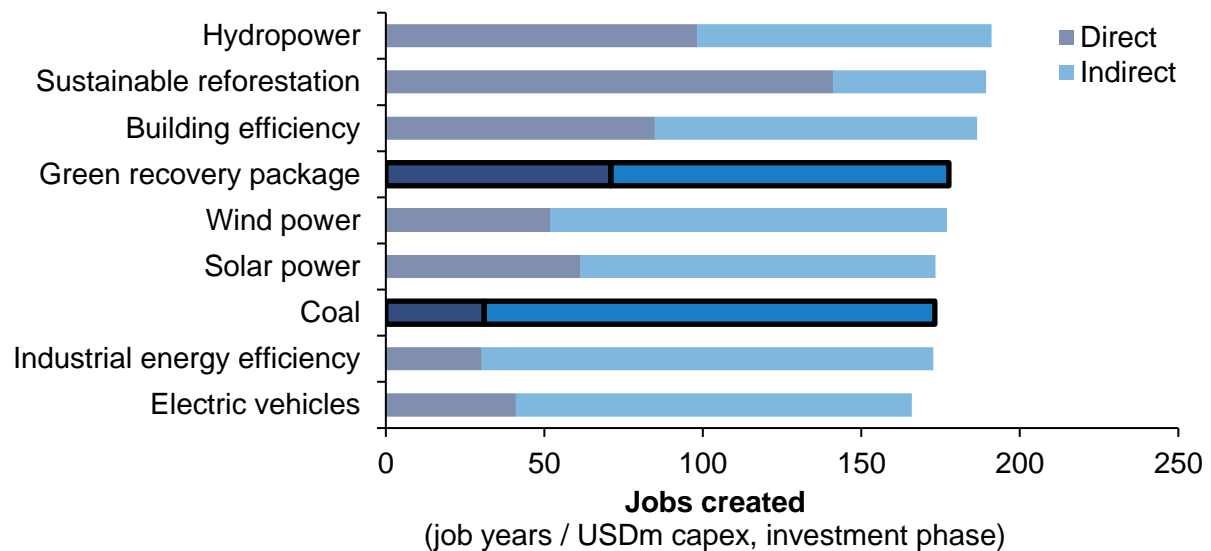


Figure 4.4 Job creation for USD 1 million capital expenditure by intervention, investment phase, India. Source: Vivid Economics.

**Over a five-year initial recovery period, a green recovery package provides greater overall economic benefits than a coal recovery, with particularly strong benefits during the first year of the recovery.** In the first five years of the recovery, a coal stimulus package would create USD 6.6 billion economic benefits, while the green recovery package USD 6.7 billion.<sup>14</sup> However, as investments in the green recovery package can be delivered and scaled faster, the green recovery portfolio results in a quicker economic stimulus across the economy in year one of the recovery period, as Figure 4.5 shows.

<sup>14</sup> Economic benefits refer to a combination of gross value added (GVA) and energy savings. Non-monetised benefits such as job creation, emissions reductions and health benefits are not included.

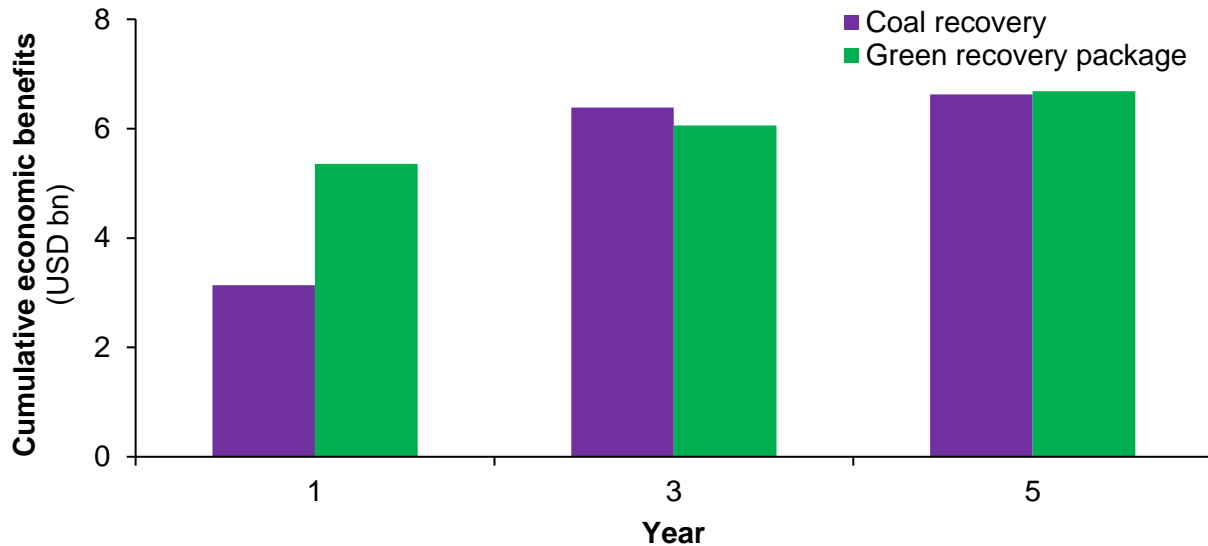


Figure 4.5 Economic value of green and coal recovery options for India. Source: Vivid Economics.

#### 4.3.3 GHG emissions benefits of a green recovery stimulus

**Over the first ten years of the recovery, the alternative green stimulus package would result in 86Mt less CO<sub>2</sub> being released into the atmosphere.** The modelling results include both the direct emissions (emissions generated by the activity itself), and indirect emissions (those generated within the supply chain). While the CO<sub>2</sub> emissions during the manufacturing, construction and installation of the investments is similar for the green stimulus package as coal (12Mt and 13Mt respectively),<sup>15</sup> the mitigation benefits of the green recovery are clear during the operational phase. While the expansion in coal mining is expected to increase CO<sub>2</sub> emissions by 3Mt a year during the operational phase, the alternative green stimulus package would provide mitigation benefits of 8Mt. The mitigation benefits of green interventions vary, as Figure 4.6 shows.

<sup>15</sup> The modelling was unable to capture the fact that a green stimulus package may rely more heavily on green manufacturing processes, which would mean the CO<sub>2</sub> emissions during the investment phase for the green recovery package are likely to be an overestimate.

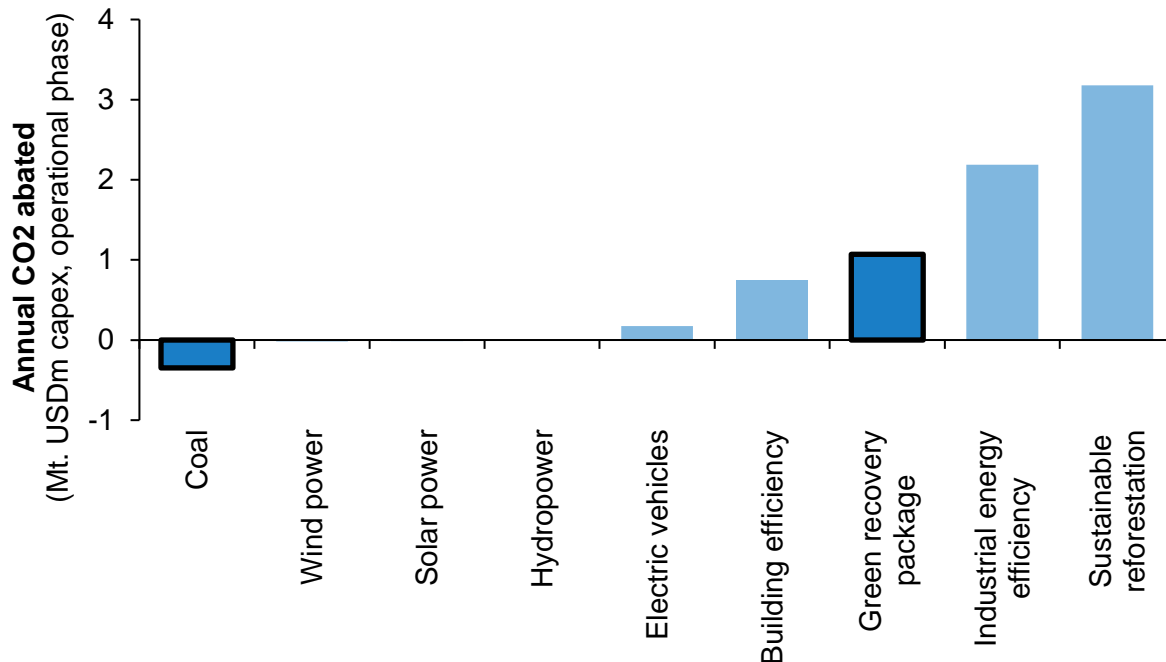


Figure 4.6 Annual changes in CO2 emissions for USD 1 million capital expenditure by intervention, operational phase, India. Note: The renewable energy interventions do not account for their displacement of the existing high-carbon approach to power generation. Source: Vivid Economics.

#### 4.3.4 Health benefits of a green recovery stimulus

**Shifting from coal to a green investment would reduce air pollution, resulting in 34,000 fewer deaths and 280,000 fewer birth complications over the next ten years.** For a given year during the investment phase, the expansion in coal mining, with associated increase in PM2.5 emissions, is expected to result in an additional 4,100 premature deaths from pulmonary disease, lung cancer, stroke and heart disease among adults. Exposure to PM2.5 is also linked to adverse pregnancy outcomes including low birth weight (defined as live birth weighing less than 2,500g) and preterm birth (defined as birth before 37 weeks of gestation). The expansion in coal mining is expected to result in an additional 17,000 babies with low birth weight and 16,000 preterm births each year of the operational phase through exposure to air pollution during pregnancy. The reduction in energy usage associated with the green recovery, in contrast, would reduce PM2.5 emissions and result in modest improvements in infant health outcomes. Furthermore, preterm birth is the second largest direct cause of child deaths in children younger than 5 years (Blencowe et al, [2012](#)). The increased incidence of preterm births associated with expansion in coal generation could, therefore, increase infant mortality by 1,000 deaths each year.

#### 4.4 Summary of results in China

**Increased green investment in China would secure more short-term employment benefits than spending on coal, while also supporting the transition to a more sustainable economy.** In China, the analysis compared announced support to coal-fired electricity generation from January 2020 to August 2020 with a representative green

investment package of the same level of capital expenditure. Figure 4.7 summarises the model results for the different interventions. The results show that if China reoriented future expenditure away from coal and into green alternatives, it would secure:

- **Greater employment creation** – for the same level of investment, green investment can generate 9.5% more jobs during the investment phase;
- **Progress towards its 2060 Net-Zero target** – investment in green infrastructure could result in 51Mt fewer CO<sub>2</sub> emissions, equivalent to 0.4% of China’s annual emissions; and
- **Improved air quality with associated health outcomes** – over the next ten years, investment in green alternatives to coal would result in 59,000 fewer people dying prematurely from air pollution, and 56,000 fewer birth complications.

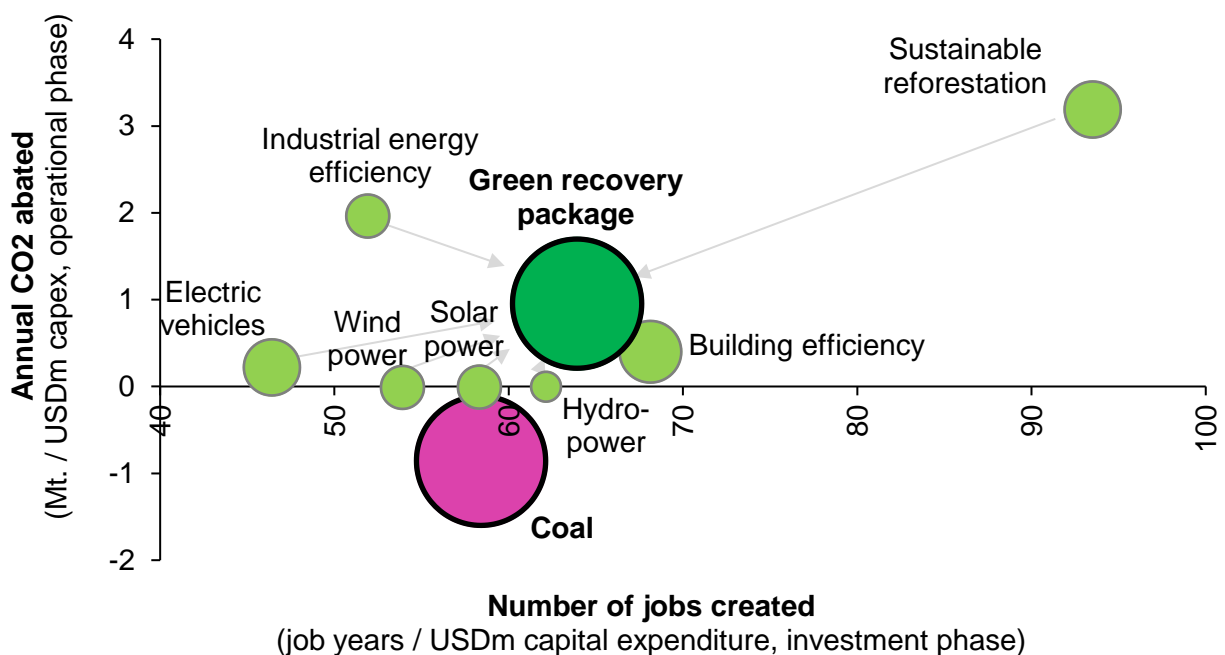


Figure 4.7 Benefits of a green recovery in China. Note: The size of the bubbles indicates the scale of capital investment modelled for each intervention. Source: Vivid Economics.

#### 4.4.1 Stimulus packages

**The modelling compares announced support to the coal sector in China with green alternatives.** The capital expenditure in both packages is equivalent to provide a like-for-like comparison of impacts, based on a ‘bottom-up’ assessment of announced support for the coal sector in China. As part of the COVID-19 stimulus effort, as of August 2020, there was expected to be an accelerated coal energy construction of 57.8GW for the year, at an anticipated expense of USD28.4 billion (OSEE, 2020). In the green investment package, USD28.4 billion was allocated across seven interventions based on alignment with country priorities. Figure 4.8 summarises the distribution of investment across interventions, showing that the package is oriented towards building efficiency, sustainable reforestation, and electric

vehicles. Table 4.2 explains some of the considerations behind the allocation of capital expenditure.

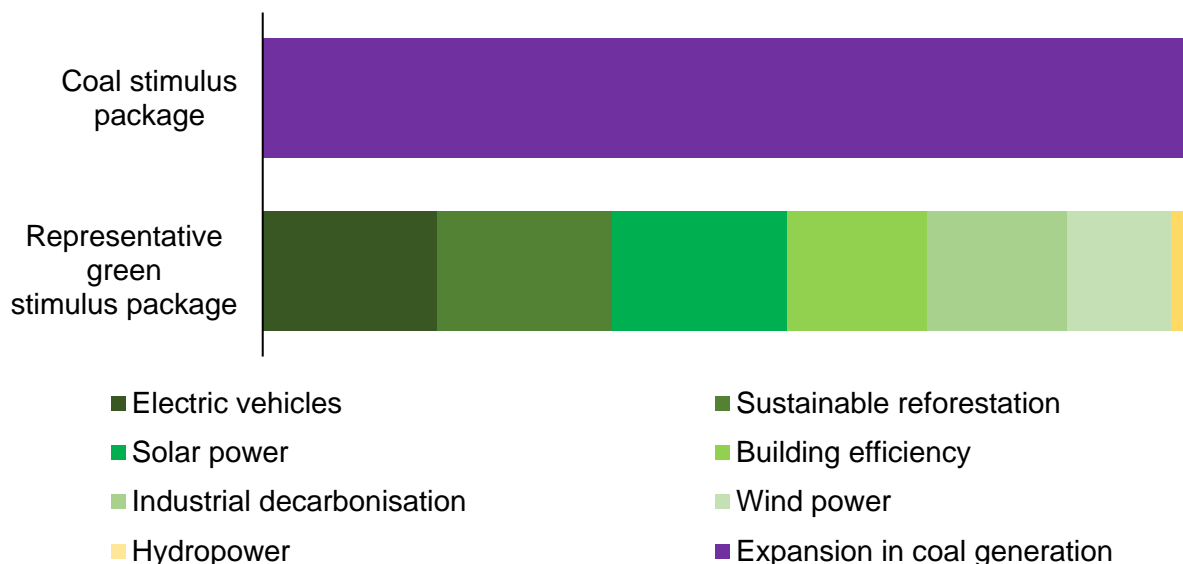


Figure 4.8 Distribution of capital expenditure towards different interventions in each stimulus package, China. Source: Vivid Economics.

Table 4.2. Allocation of investment in representative green stimulus package. Note: The information on job creation reported in this table is based on a cross-country literature review. The information reported does not match exactly with the findings from the bespoke analysis reported below. This is for several reasons, including: (1) the literature review typically consisted of case studies of specific investments, while the modelling analysis is a more stylised analysis; (2) by being based on case studies, the literature does not account for the full set of indirect (supply chain) impacts, which are captured by the modelling and reported in the analysis; and (3) the modelling is bespoke to each country context, whereas the literature review was based on international evidence. Source: Vivid Economics.

Green Stimulus Area	Rationale
Building efficiency	Building efficiency interventions are recognised in the literature as being job-intensive and as having high abatement potential (IEA, 2020b). In China, there has been significant focus on improving energy efficiency standards in new buildings (Climate Action Tracker, 2020). Improving energy efficiency in buildings will need to be a moderate investment focus for China to meet its NDC (Commit, 2015). In response to COVID-19, the government committed USD7.7 billion towards the renovation of older residential buildings, including energy efficiency improvements (Vivid Economics, 2020).

Green Stimulus Area	Rationale
Electric vehicles	<p>Investment in electric vehicles has been described as timely, with strong potential for providing employment to those who have been displaced by the COVID-19 crisis. In addition, low-emissions vehicles are a relatively cost-effective way of reducing emissions (IEA, <a href="#">2020b</a>). In China, transport sector policies have prioritised low-carbon and electric vehicle fleets (Climate Action Tracker, <a href="#">2020a</a>). In response to COVID-19, the government extended its subsidy programme for electric vehicles (at an expected cost of USD 1.6 billion) and committed USD1.42 billion towards electric vehicle charging infrastructure.</p>
Sustainable reforestation	<p>Investment in afforestation programmes, restoration of wetlands and forest management investments have been noted as highly job-intensive, quickly scalable and critical for achieving long-term environmental objectives (Vivid Economics, <a href="#">2020</a>). China is a champion of nature-based solutions and has ambitiously committed in its NDC to increase forested area by 40 million ha by 2020 above 2005 levels (Climate Action Tracker, <a href="#">2020a</a>), which will require significant investment (Vivid Economics, <a href="#">2020</a>). In response to COVID-19, the government committed USD 1.4 billion towards a Green Development Fund, including for environmental protection (Vivid Economics, <a href="#">2020</a>).</p>
Solar power	<p>Investment in solar power produces a relatively high number of jobs per million invested, although from an international perspective, it is a less cost-effective way of reducing emissions than other green alternatives (IEA, <a href="#">2020b</a>). In China, the 13th Five-Year Plan targeted 120GW solar power capacity by 2020. To achieve the targets outlined in China’s NDC, solar power will need to be a moderate investment focus (Vivid Economics, <a href="#">2020</a>). In response to COVID-19, the government increased its renewable energy subsidies, including CNY42.84 billion on solar projects (Global Recovery Observatory, <a href="#">2021</a>).</p>



Green Stimulus Area	Rationale
Wind power	Investment in wind power produces relatively fewer jobs per million invested, and from an international perspective is a less cost-effective way of reducing emissions than other green alternatives (IEA, <a href="#">2020b</a> ). In China, the 13 <sup>th</sup> Five-Year Plan targeted 200GW wind power capacity by 2020. To achieve the targets outlined in China’s NDC, wind power will need to be a moderate investment focus (Vivid Economics, <a href="#">2020</a> ). In response to COVID-19, the government increased its renewable energy subsidies, including CNY35.69 billion on solar projects (Global Recovery Observatory, <a href="#">2021</a> ).
Industrial energy efficiency	Investment in industrial energy efficiency produces a relatively high number of jobs per million invested, and as an energy-saving mechanism has an important role in improving economic productivity (IEA, <a href="#">2020b</a> ). In China, the Industrial Green Development Plan is intended to support green supply chains, but progress in hard-to-abate sectors such as steel and cement has been limited (Climate Action Tracker, <a href="#">2020a</a> ). Furthermore, since the COVID-19 pandemic, the government has reduced industrial energy costs by 5% (Global Recovery Observatory, <a href="#">2021</a> ).
Hydropower	Investment in hydropower produces relatively fewer jobs per million invested (IEA, <a href="#">2020b</a> ). In China, the 13 <sup>th</sup> Five-Year Plan targeted 340GW wind power capacity by 2020. However, this is from a position of existing high capacity, so to achieve the targets outlined in China’s NDC, hydropower will need to be a relatively low investment focus (Vivid Economics, <a href="#">2020</a> ). There has been no announced support to the sector in response to the COVID-19 pandemic.

4.4.2 Economic benefits of a green investment plan

**During the initial investment phase, the green investment plan would create 9.5% more jobs than coal investments.** Spending on coal is estimated to boost employment by 750,000 job years directly, and 910,000 job years indirectly (through supply chains) during the investment phase. In contrast, the green investment plan would support employment by

700,000 job years directly and 1,050,000 job years indirectly. Within the green package, different interventions create different numbers of new jobs for a given level of investment due to differences in the intensity of labour in production. Of the seven interventions modelled, the analysis suggests that sustainable reforestation is the most employment-boosting, creating 95 job years during the investment phase for every USD 1 million invested (Figure 4.9).

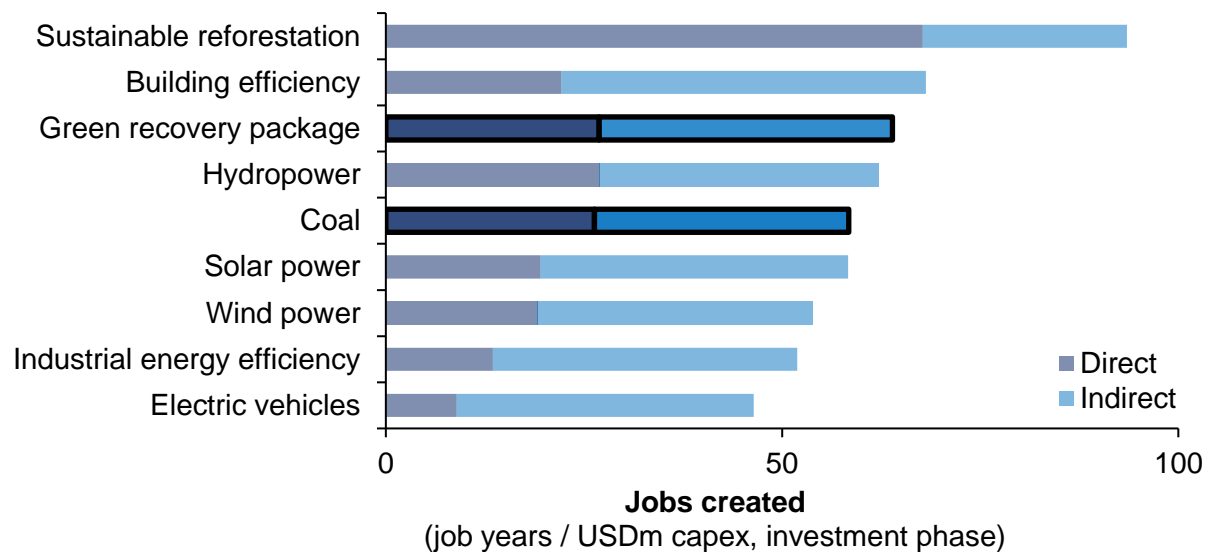


Figure 4.9 Job creation for USD 1 million capital expenditure by intervention, investment phase, China. Source: Vivid Economics.

**Over a five-year period, the green investment plan and the coal package provide comparable overall economic benefits – but this does not include significantly higher induced benefits from green investment. Furthermore, a green investment plan delivers benefits more quickly.** Both the green package and the coal package would provide USD 25.4 billion value to the economy over the first five years of the recovery.<sup>16</sup> However, as investments in the green package can be delivered and scaled faster, the green portfolio results in a quicker economic stimulus across the economy, as Figure 4.10 shows.

<sup>16</sup> Economic benefits refer to a combination of gross value added (GVA) and energy savings. Non-monetised benefits such as job creation, emissions reductions and health benefits are not included.

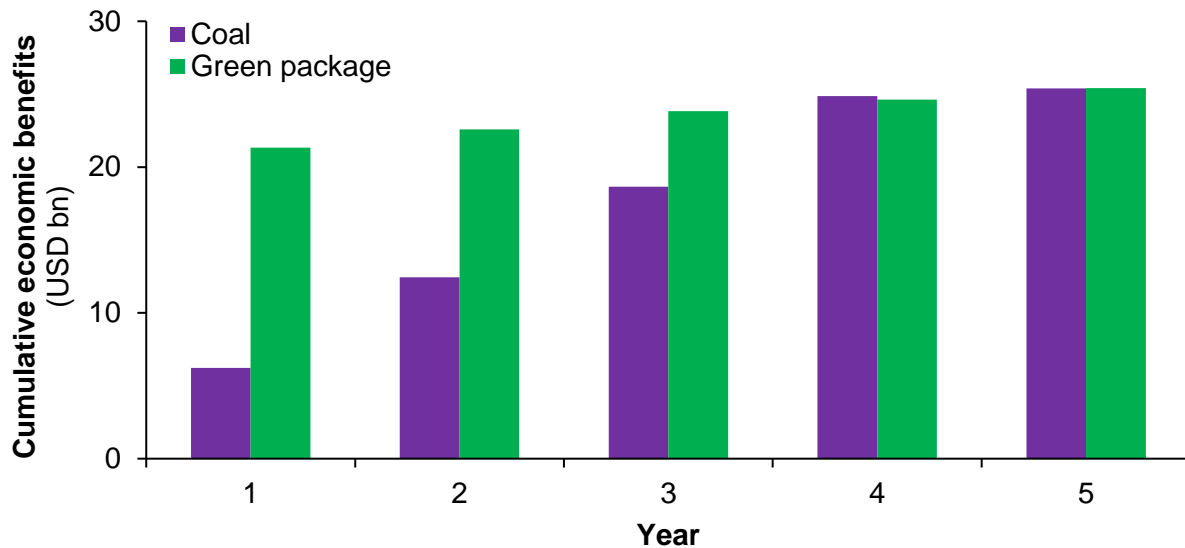


Figure 4.10 Economic value of green and coal recovery options for China. Source: Vivid Economics.

#### 4.4.3 GHG emissions benefits of a green investment plan

**Over the next ten years, the green package would result in 350Mt less CO<sub>2</sub> being released into the atmosphere.** The modelling results include both the direct emissions (emissions generated by the activity itself), and indirect emissions (those generated within the supply chain). While the CO<sub>2</sub> emissions during the manufacturing, construction and installation of the investments is similar for the green package as coal (30Mt and 24Mt respectively),<sup>17</sup> the mitigation benefits of the green investment are clear during the operational phase. While the expansion in coal generation is expected to increase CO<sub>2</sub> emissions by 24Mt a year during the operational phase, the alternative green stimulus package would provide mitigation benefits of 27Mt. The mitigation benefits of green interventions vary, as Figure 4.11 shows.

<sup>17</sup> The modelling was unable to capture the fact that a green stimulus package may rely more heavily on green manufacturing processes, which would mean the CO<sub>2</sub> emissions during the investment phase for the green recovery package are likely to be an overestimate.

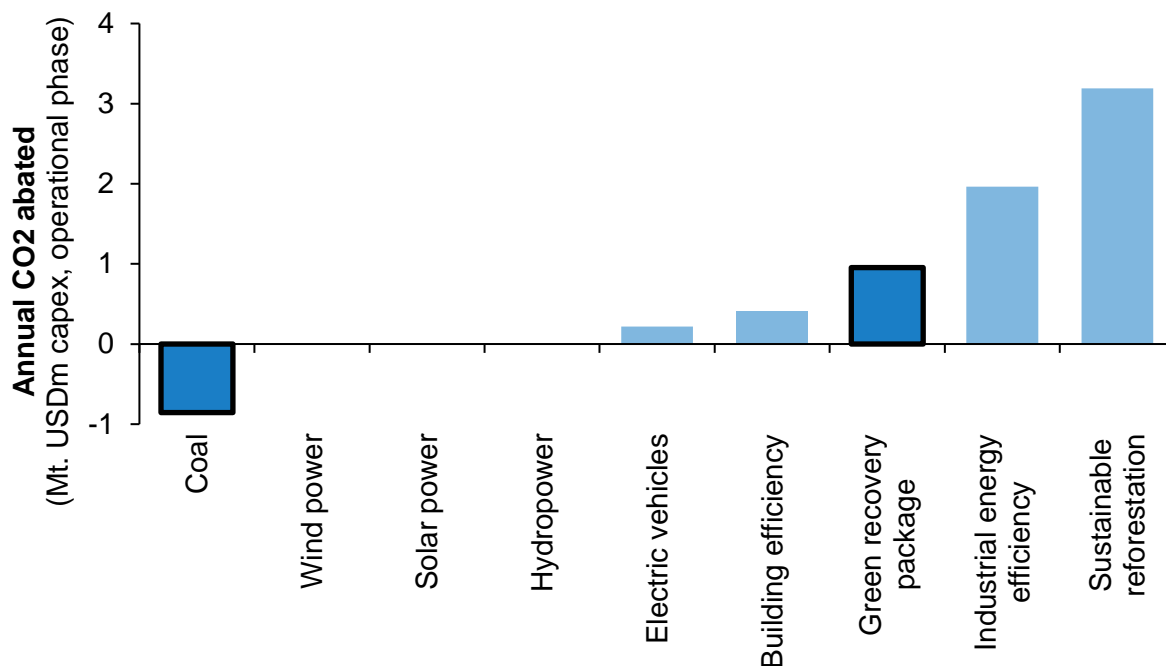


Figure 4.11 Annual changes in CO2 emissions for USD 1 million capital expenditure by intervention, operational phase, China. Note: The renewable energy interventions do not account for their displacement of the existing high-carbon approach to power generation. Source: Vivid Economics.

#### 4.4.4 Health benefits of a green investment plan

**Shifting from coal to a green investment reduces air pollution, resulting in 59,000 fewer deaths and 56,000 fewer birth complications over the next ten years.** For a given year during the investment phase, the expansion in coal generation, with associated increase in PM2.5 emissions, is expected to result in an additional 11,000 premature deaths from pulmonary disease, lung cancer, stroke, and heart disease among adults. Exposure to PM2.5 is also linked to adverse pregnancy outcomes including low birth weight (defined as live birth weighing less than 2,500g) and preterm birth (defined as birth before 37 weeks of gestation). The expansion in coal generation is expected to result in an additional 3,300 babies with low birth weight and 5,900 preterm births each year of the operational phase. The reduction in energy usage associated with the green investment plan, in contrast, would reduce PM2.5 emissions and result in modest improvements in infant health outcomes. Furthermore, preterm birth is the second largest direct cause of child deaths in children younger than 5 years (Blencowe et al, [2012](#)). The increased incidence of preterm births associated with expansion in coal generation could, therefore, increase infant mortality by 360 deaths each year.

## 4.5 Summary of results in Poland

**By directing an additional EUR 1.75 billion from the EU's Just Transition Fund to green recovery investment, Poland could benefit from short-term employment benefits while also transitioning to a more sustainable economy.** In Poland, the analysis estimated the

stimulus benefits of an additional EUR 1.75bn towards green recovery projects, funded by the EU Just Transition Fund. Figure 4.12 summarises the modelling results for different green intervention options, as well as a representative green recovery package. The results show that if Poland accessed an additional EUR 1.75 billion through the EU Just Transition Fund, it would secure:

- **A more jobs-intensive recovery** – the additional investment in green recovery projects would boost employment by 46,000 job years during the short-term investment phase; and
- **Progress on its climate commitments** – investment in a green recovery could result in 2Mt fewer CO<sub>2</sub> emissions, equivalent to 0.7% of Poland's annual emissions.

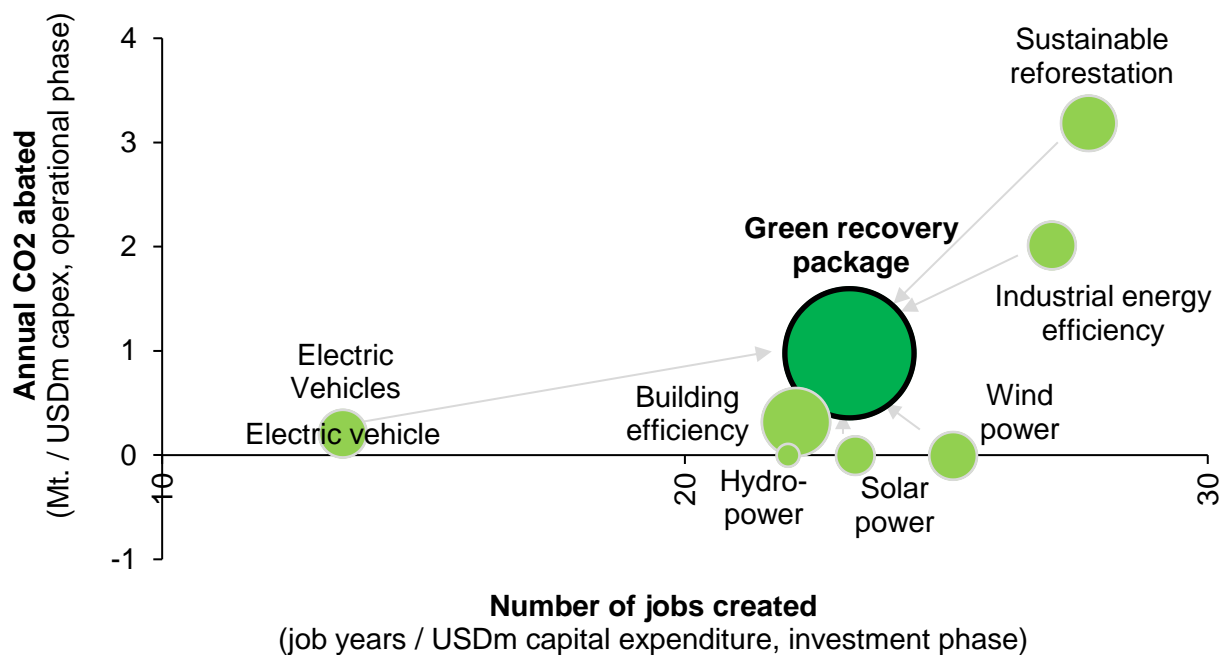


Figure 4.12 Benefits of a green recovery in Poland. Note: The size of the bubbles indicates the scale of capital investment modelled for each intervention. Source: Vivid Economics.

#### 4.5.1 Stimulus packages

**The modelling analysis estimates the benefits of an additional EUR 1.75 billion towards green recovery projects.** This package is based on the premise that the European Commission's recovery plan includes a EUR 17.5 billion Just Transition Fund targeted towards lower-income and higher-emissions EU member states, and Poland is earmarked 20% of the total Just Transition funding (equivalent to EUR 3.5 billion). Under the conditions of the Just Transition Fund, members are only entitled to 50% of their allocated funds if they have not committed to a 2050 Net-Zero emissions target (OSEE, 2020); however, it might be that the additional EUR1.75bn is made available even without the investment. This report proposes directing these funds to a green recovery package, with investment allocated across seven interventions according to the interventions' alignment with known country priorities and emerging literature. Figure 4.13 summarises the distribution of investment across

interventions, showing that the package is oriented towards building efficiency and sustainable reforestation. Table 4.3 explains some of the considerations behind the allocation of capital expenditure.

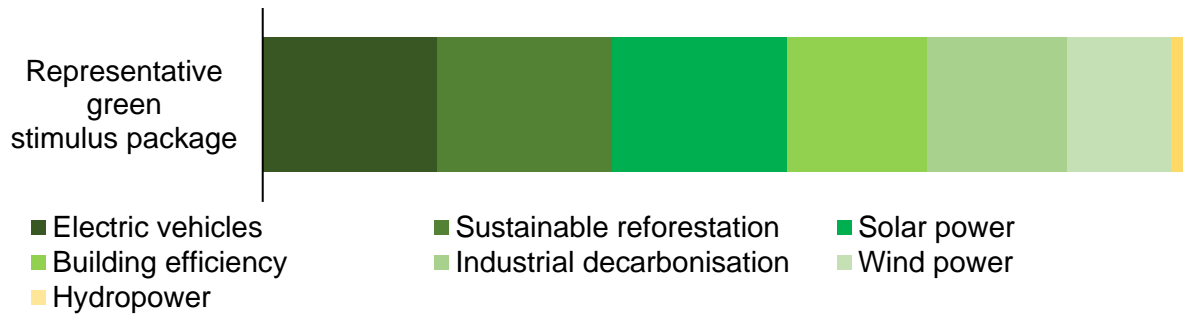


Figure 4.13 Distribution of capital expenditure towards different interventions, Poland. Source: Vivid Economics.

Table 4.3 Allocation of investment in representative green stimulus package. Note: The information in this table is based on a cross-country literature review. The information reported will not match exactly with the findings from the bespoke analysis reported below. This is for several reasons, including: (1) the literature review typically consisted of case studies of specific investments, while the modelling analysis is a more stylised analysis of sectoral impact; (2) by being based on case studies, the literature does not account for the full set of indirect (supply chain) impacts, which are captured by the modelling and reported in the analysis; and (3) the modelling is bespoke to each country context, whereas the literature review was based on international evidence. Source: Vivid Economics.

Green Stimulus Area	Rationale
Building efficiency	Building efficiency interventions are recognised in the literature as being job-intensive and as having high abatement potential (IEA, 2020b). In Poland, constructing energy-efficient housings and thermal upgrading of residential and commercial buildings are important policy priorities, with a target of reaching a 70% share of insulated residential buildings in total housing stock (IEP, 2018). In response to COVID-19, the government has made 475 million USD available to Clean Air 2.0, which provides households with subsidies for replacing heat sources and improving the energy efficiency of buildings (Energy Policy Tracker, 2020). Improving building efficiency is also a key goal for the European Union, which has stated an ambition to ‘at least double’ the annual renovation rate of existing building stock (Carbon Brief, 2020).

Green Stimulus Area	Rationale
Sustainable reforestation	Investment in afforestation programmes, restoration of wetlands and forest management investments have been noted as highly job-intensive, quickly scalable and critical for achieving long-term environmental objectives (Vivid Economics <a href="#">2020</a> ). Poland has a long-standing National Programme for Increasing the Forest Cover, which aims to increase forest cover to 33% by 2050. There have been no additional policies announced in response to COVID-19 to support the sector.
Electric vehicles	Investment in electric vehicles has been described in the international literature as timely, with strong potential for providing employment to those who have been displaced by the COVID-19 crisis. In addition, low-emissions vehicles are a relatively cost-effective way of reducing emissions (IEA, <a href="#">2020b</a> ). In response to COVID-19, the government has committed USD 9.36 million towards accelerating the uptake of electric vehicles (Energy Policy Tracker, <a href="#">2020</a> ). It has also allocated USD 17.47 million towards enterprises producing electric vehicle components and charging infrastructure and USD 41.17 million towards installing 5,000 charging points. Additional support has been announced for electric school buses, vehicles for commercial use and taxi services.
Industrial energy efficiency	Investment in industrial energy efficiency produces a relatively high number of jobs per million invested, and as an energy-saving mechanism has an important role in improving economic productivity (IEA, <a href="#">2020b</a> ). In Poland, improving energy efficiency in industry has been prioritised, with actions including the development of energy and heat production from gas cogeneration in industry and heating, development of energy-efficient heating and cooling systems, and improvement of energy efficiency in the industry sector (IEP, <a href="#">2018</a> ). There have been no additional policies announced in response to COVID-19 to further progress on this ambition.

Green Stimulus Area	Rationale
Wind power	<p>Investment in wind power produces relatively fewer jobs per million invested, and from an international perspective is a less cost-effective way of reducing emissions than other green alternatives (IEA, <a href="#">2020b</a>). Historically commitment to renewable energy deployment in Poland has been relatively weak (WWF, <a href="#">2019</a>), although contracted wind power capacity increased by 3.4GW since 2016 (Kurtyka, <a href="#">2020</a>). However, since COVID-19, there have been announced auctions for renewable energy deployment which will further expand wind capacity by 0.8 GW. In-country experts noted strong potential for both onshore and offshore wind deployment but noted that changes in legislation are required to remove height restrictions.</p>
Solar power	<p>Solar power investment creates a high number of jobs per million invested, although from an international perspective, it might be less cost effective for reducing emissions than alternatives (IEA, <a href="#">2020b</a>). Historically commitment to renewable energy deployment in Poland has been weak (WWF, <a href="#">2019</a>), although contracted solar power capacity increased by 1.7GW since 2016 (Kurtyka, <a href="#">2020</a>). Since COVID-19, there have been announced auctions for renewable energy deployment which could expand wind capacity by 1.5 GW.</p>
Hydropower	<p>From an international perspective, investment in hydropower produces relatively fewer jobs per million invested (IEA, <a href="#">2020b</a>). Historically, commitment to renewable energy deployment in Poland has been relatively weak (WWF, <a href="#">2019</a>), and the availability of water resources is limited. There have been no additional policies announced in response to COVID-19 to support the sector.</p>

4.5.2 Economic benefits of a green recovery stimulus

During the initial investment phase, the additional EUR 1.75 billion towards green recovery projects would boost employment by 46,000 job years. The package is estimated to boost employment by 25,000 job years directly and 21,000 indirectly (through



stimulating the supply chain) during the investment phase. There are substantial variations in the number of jobs created by different interventions, as Figure 4.14 shows. Of the seven interventions modelled, the analysis suggests that sustainable reforestation is best for short-term job creation, boosting employment by 28 job years during the investment phase for every USD 1 million invested. In contrast, electric vehicles generate the least number of jobs, boosting employment by 13 job years during the investment phase for every USD 1 million invested.

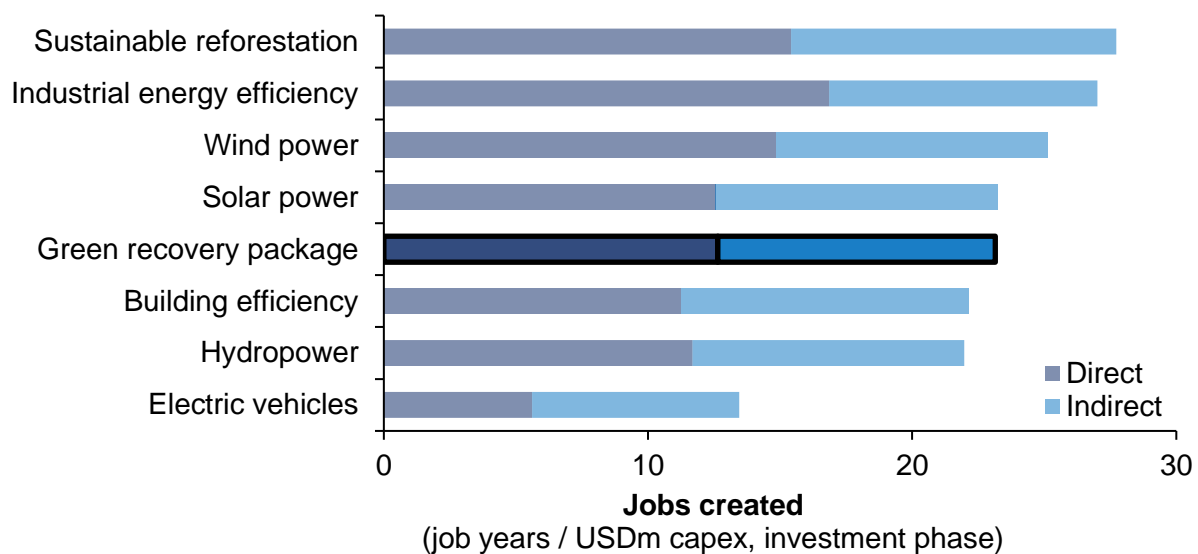


Figure 4.14 Job creation for USD 1 million capital expenditure by intervention, investment phase, Poland. Notes: 'Green' refers to the green recovery stimulus package on whole. Source: Vivid Economics.

**During a five-year initial recovery period, the additional EUR 1.75 billion towards green recovery projects would also support substantial economic growth.** In the first five years of the recovery, an additional EUR 1.75 billion towards green recovery projects would create USD 1.5 billion in economic benefits (Figure 4.15).<sup>18</sup>

<sup>18</sup> Economic benefits refer to a combination of gross value added (GVA) and energy savings. Non-monetised benefits such as job creation, emissions reductions and health benefits are not included.

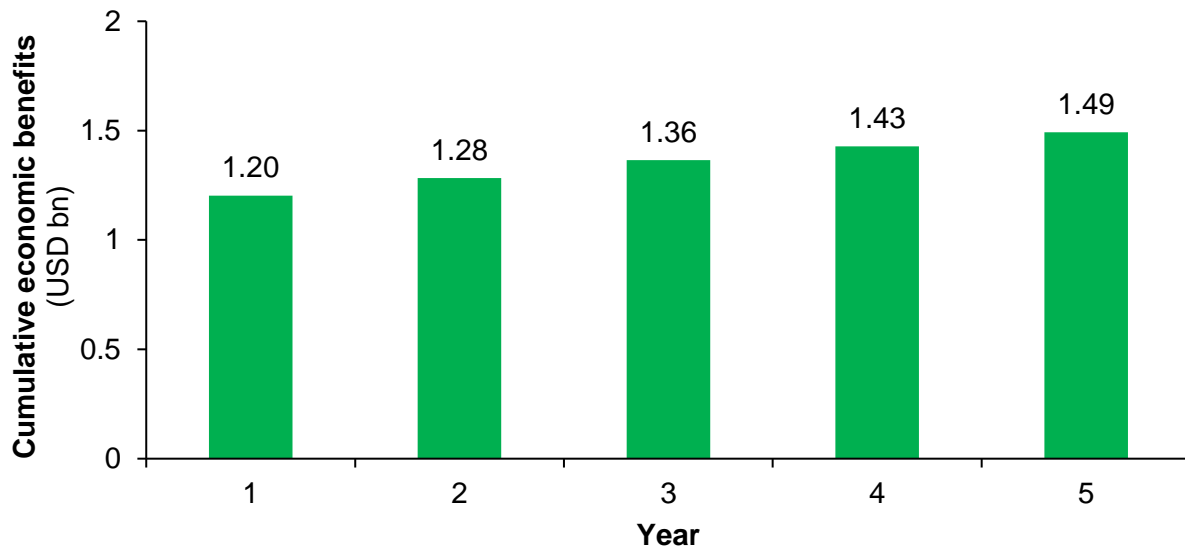


Figure 4.15 Economic value of additional funding towards green recovery by year, Poland. Source: Vivid Economics.

#### 4.5.3 GHG emissions benefits of a green recovery stimulus

**Over the first ten years of the recovery, the additional EUR 1.75 billion towards green recovery projects would result in 14Mt less CO<sub>2</sub> being released into the atmosphere.** The modelling results include both the direct emissions (emissions generated by the activity itself), and indirect emissions (those generated within the supply chain). While 1Mt CO<sub>2</sub> emissions would be released during the manufacturing, construction, and installation of the investments,<sup>19</sup> the mitigation benefits of the green recovery become apparent during the operational phase. The additional mitigation interventions funded by the EUR 1.75 billion would reduce Poland's CO<sub>2</sub> emissions by 2Mt each year, equivalent to 0.7% of total emissions. The mitigation benefits of green interventions vary, as Figure 4.16 shows.

<sup>19</sup> The modelling was unable to capture the fact that a green stimulus package may rely on green manufacturing processes, which would mean the CO<sub>2</sub> emissions during the investment phase for the green recovery package are likely to be an overestimate.

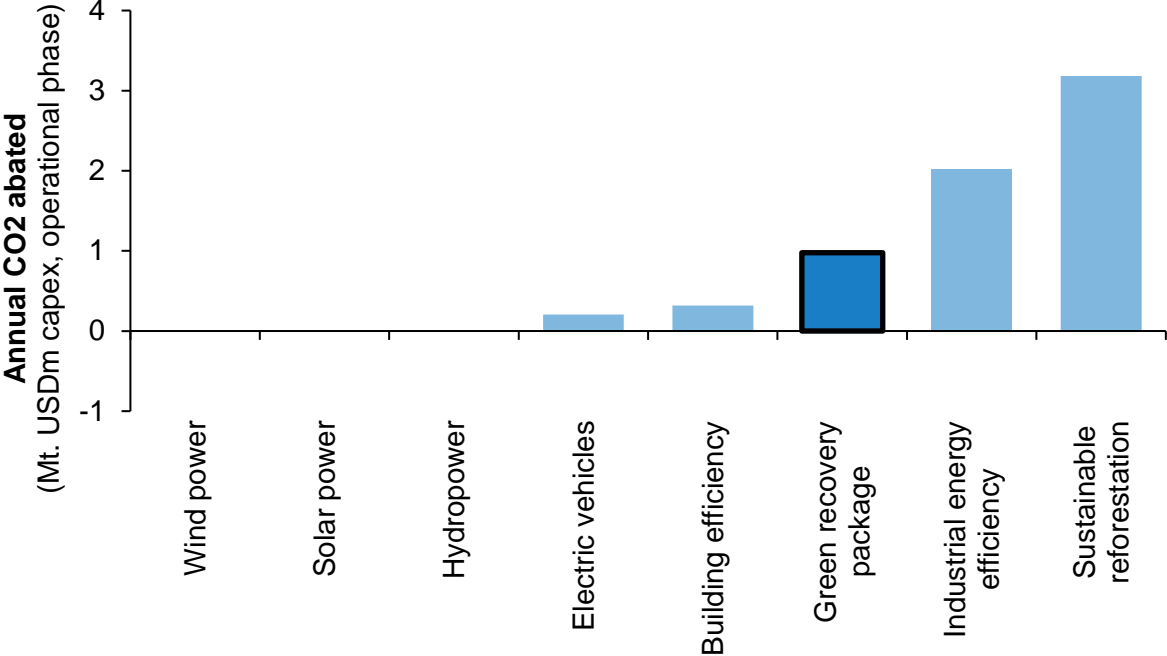


Figure 4.16 Annual reduction in CO2 emissions for USD 1 million capital expenditure by green intervention, operational phase, Poland. Note: The renewable energy interventions do not account for their displacement of the existing high-carbon approach to power generation. Source: Vivid Economics.

## 5 Case Study A: Green Recovery for India

### 5.1 Executive Summary

We find that green recovery investments in the wake of COVID-19 are likely India’s strongest fiscal option for a strong, sustainable, and future-oriented recovery.

India’s development has been a success story in many ways, yet it is a work in progress. Over the last fifty years, poverty rates have declined significantly, access to electricity has expanded, and sanitation has improved. However, a shaky domestic financial sector combined with a turbulent mining industry made India particularly vulnerable to the impacts of COVID-19. The country faced a recession beginning in Q2 of 2020 and throughout the crisis has struggled with a high case load but inadequate healthcare infrastructure.

**Through its recovery from the pandemic, India can secure future prosperity with strategic investments that prioritise economic, environmental, and social goals.** There are plenty of opportunities for high-growth green industries that can simultaneously address India’s economic concerns and the looming threat of climate change, which is expected to hit India’s agriculture-dependent economy particularly hard. Investment in these industries provide some of the best options for stimulating the economy, creating jobs, addressing environmental concerns, boosting health outcomes and addressing inequalities.

**Supporting modelling from Vivid Economics suggests that compared to coal spending, green investments could create up to 10% more jobs and abate up to 3.2 megatons of CO<sub>2</sub> per million dollars invested (Figure 5.1).**

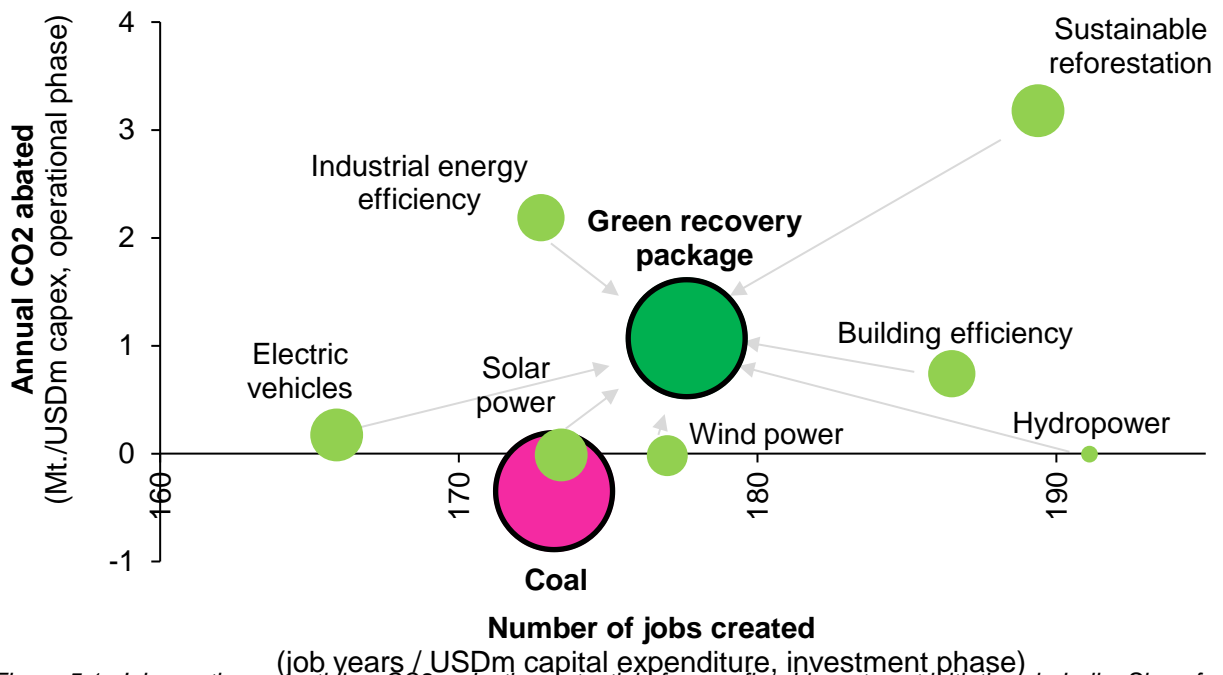


Figure 5.1. Job creation potential vs CO<sub>2</sub> reduction potential of green fiscal investment initiatives in India. Size of bubbles indicate the scale of capital investment modelled for each intervention. Source: Vivid Economics.

**For an illustrative green recovery package, the direct economic benefits over one year could be up to 71% higher than a comparative coal package.** Over a five-year period, the direct benefits of a green package over coal are about 1% higher; however, the induced benefits of green spending are projected to be far higher given the stranded assets risk of coal infrastructure and the size of new green industries opened by clean energy.

**This roadmap explores 5 key policy areas for a green recovery that prioritises future growth.** Each industry reflects opportunities to secure environmental and social outcomes alongside strong economic growth and job **creation**.



**Electric transport:** The Indian government has already taken bold steps to expand domestic manufacturing and uptake of electric vehicles, and further investments in this area are likely to boost domestic growth, create many jobs, and help address the air pollution crisis. Expansion of renewable energy generation and upgrades in electricity distribution and transmission will also be vital for maximising the climate returns of such policies.



**Clean cooking:** Indoor air pollution is a major cause of respiratory illness in India and replacing old cooking technologies with clean solutions is an opportunity both for economic stimulus and for improving health and environmental outcomes. The country has existing programs that could be built upon, though consistent messaging and community involvement will need to be implemented to ensure broad uptake.



**Renewable energy:** With the global coal market becoming increasingly unstable and the price of delivered clean electricity dropping rapidly in India, expansions in renewable energy generation capacity could create jobs and contribute to the economic boost that India is looking for. Several supports are already in place for increasing generation capacity which could be strengthened. Supplementary infrastructure for transmission, distribution, and storage would benefit significantly from further government investment.



**Natural capital investment:** In recent years, India has suffered badly from more frequent natural disasters including flooding and droughts, incurring significant losses of lives and livelihoods at an enormous economic cost. Strengthening the country's natural capital including mangroves and forests is likely to address many of India's concerns simultaneously by creating low-skill jobs, building resilience against future natural disasters, and ameliorating air pollution issues.



**Sustainable agriculture investment:** A major contributor to India's air pollution in both rural and urban areas is the agricultural practice of stubble burning, particularly in the Northern region of the country. Community-driven solutions including repurposing paddy straw for animal feed or other manufacturing have shown promise in some regions and could benefit significantly from government stimulus support.

The impact of investment in these five areas could be enhanced by applying the financing and governance recommendations discussed in Section 2, and applied in Sections 5.5 and 5.6. Crowding-in private investment is a key method for increasing the impact of public spending, allowing for policy impact while reducing the debt burden on the government. Sovereign green bonds and green financial incentives are also likely to be effective financing tools. A

comprehensive green recovery programme will require an all of government approach, with streamlined communication among government agencies and between the government and the public. Targeting policies towards vulnerable populations, including policies that act on a range of time frames and safety considerations surrounding COVID-19, is also crucial for achieving a balanced recovery that sets the stage for future Indian prosperity.

## 5.2 Introduction

After decades of development gains including lowered poverty rates, increased access to electricity, and improvements in sanitation (Datt et al, [2016](#); IEA, [2020](#)), COVID-19 has threatened to reverse much of the progress made. The Indian population has suffered deep economic woes, with a GDP contraction of 23.9% in the second quarter of 2020 (Ministry of Statistics and Programme Implementation, 2020a) and remaining below trend to Q2 2021. India is also seeing the dangers of climate change first-hand, alongside nature loss and air pollution, even as it makes some efforts to transition its coal-driven economy towards a sustainable future.

The need for a swift recovery in India is clear, and there is strong evidence to suggest that investments in green industries will maximise growth and future prosperity. This roadmap explores the key statistics of pre-pandemic India and how COVID-19 devastated lives and livelihoods in the country. We present modelling suggesting that green investments may optimise job creation and GDP impacts, and lay out five key policy areas for investments that can simultaneously address economic, environmental, and social concerns. Options for funding and financing are highlighted, noting India's significant debt constraints and the need for concessional finance and cooperation with international partners. Strategies for governance, implementation, and other co-considerations are also described. The roadmap demonstrates that strategic investment in high-growth clean industries is likely the strongest option for India to achieve a sustainable and stable economy that is resilient to the challenges of the coming decades.

## 5.3 Economic context for green recovery spending

### 5.3.1 Pre-pandemic India

India entered 2020 on a relatively strong economic platform, supported by five decades of accelerating and resilient growth (P. Gupta & Blum, 2018). Some of the country's most astounding recent progress has seen ~700 million people gain access to electricity in just twenty years (IEA, 2020a) and significant improvements in sanitation, literacy, and digital access (Curtis, 2019; Kawoosa, 2020; World Bank, 2019). Poverty rates also declined substantially, with extreme poverty at 13.3% in 2015, down from 21.2% four years earlier (NITI Aayog, 2020). Despite these positive trends, the Global Financial Crisis (GFC) battered the Indian economy and though it partially rebounded, it never fully recovered (Subramanian & Felman, 2019). Unemployment rates in the country have been high for the region, and rising since 2017, reaching 8.1% in November 2019 (CMIE, 2020). Youth have been particularly badly affected, with an unemployment rate of 37% among those aged 20-24, rising to 60% among university graduates in that same age bracket (Vyas, 2020). India's GDP growth was in decline before the pandemic, in part due to weak growth from rural incomes and an export market reeling from the GFC (World Bank, 2020). On the whole, India has reflected a strong development story, yet, like many others, the country is plagued with multifarious challenges, including significant economic inequalities (Mishra et al., 2019), grim religious and ethnic conflicts (Maizland, 2020), and a severe lack of environmental accountability (Sen et al., 2011). On wealth inequality, the top 1% of the population received 73% of the wealth generated in 2017 (Oxfam International, 2019). Gender inequality, particularly in education, remains significant (Batra & Reio, 2016). Finally, the country suffers from some of the most severe air pollution in the world, with ~1.24 million deaths attributable to air pollution in 2017 alone (Balakrishnan et al., 2019).

Prior to the 2020 pandemic, almost half of India's commercial energy supply came from coal (Tongia & Gross, 2019). Coal India Limited, which is 66% government controlled (Financial Express, 2020), holds a monopoly over Indian coal mining and provides nearly 85% of coal output. Coal dominates both production and consumption of electricity in India. The country is the second largest consumer of coal and 76% of Indian electricity production in 2017 was coal-based (Timperley, 2019). Despite its scale, domestic coal mining is insufficient to meet the nation's energy needs, rendering India the second largest importer of coal in the world. Oil demand is also rising and contributed to more than a quarter of energy consumption in 2019 (IEA, 2020c).

The 18 subsidies in place for coal mining and coal power generation as of 2017 are evidence of the industry's heavy reliance on public support, primarily in the form of tax breaks and capital investments (IISD, 2017). Government funding for domestic coal mining, supply, and distribution increased marginally in the 2020/21 budget (released March 2020), providing INR18,467 crore of direct SOE capital investment support, INR883 crore for administrative overheads, and over INR13,000 crore in taxation subsidies (Ministry of Finance, 2020a). The Ministry of Power (MoP) budget for 2020/21 provides a total of INR49,969 crore in support of the state-owned power generation and distribution facilities (99.8% of which comes through the Internal and Extra Budgetary Resources (IEBR) program) (Open Budgets India, 2020).

At the same time, India's renewable energy sector is booming, reflecting plummeting costs of solar PV among other driving factors (Timperley, 2019). India has installed 89 GW of renewable energy capacity as of August 2020, predominantly in wind and solar (IBEF, 2020), supported through substantial public measures (Deloitte, 2018).<sup>20</sup> Despite its continued dependence of fossil fuels, India has announced emissions reduction targets compatible with a 2°C warming target, including reducing the emissions intensity of GDP by 33% to 35% below 2005 levels by 2030 (CAT, 2020) and a goal of 60% renewable electricity penetration by 2030.

### 5.3.2 Impact of COVID-19 on Indian economy and society

India is one of the most severely affected countries in the COVID-19 pandemic. Its high population density, combined with a chronically underfunded healthcare system (Kasthuri, 2018; Tikkanen et al., 2020), is resulting in a high death rate (WHO, 2020a). The Indian economy is suffering, reporting a 23.9% decrease in GDP in the quarter ending June 2020 (Ministry of Statistics and Programme Implementation, 2020a). With further negative growth in the September quarter (Ministry of Statistics and Programme Implementation, 2020b), India is facing its first recession in four decades. Downturns in tourism, transport and trade have left the services sector among the worst affected. The agricultural sector experienced export-driven growth but critical supply chain issues have harmed the industry (A. Kumar et al., 2020). Air quality in the country somewhat improved as a result of lockdowns (Gautam et al., 2020; Shehzad et al., 2020), but existing pollution directly inflated mortality rates (A. Gupta et al., 2020). Combined, these factors have devastated the Indian economy and society.

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<sup>20</sup> Supporting policies include a 2016 revision of Tariff Policy which requires major electricity consumers and power distributors to use a certain proportion of clean energy, as well as waiving transmission taxes for renewables (Timperley, 2019).



### 5.3.3 Policy responses during the pandemic

India has faced a high COVID-19 caseload compared to other nations, particularly in Asia (WHO, 2020b). In an effort to protect lives, livelihoods, and businesses, the majority of announced government spending (INR24.7tn) up to December 2020 was devoted to short-term rescue-type measures.<sup>21</sup> Spending on long-term recovery-type measures to reinvigorate economic growth has been much lower at INR3,172bn (O'Callaghan et al., 2020).

Some support for coal has been featured among these recovery-type policies. The Indian government allocated INR50,000 crores towards coal-enabling infrastructure development for Coal India, with INR18,000 crores (36%) assigned to investment in mechanised coal transfer (i.e., conveyor belts) from mines to rail transport (Ministry of Finance, 2020c). This targeted subsidy aims to enable a coveted decrease in coal imports in favour of domestic production and to facilitate evacuation of record high coal stocks at Coal India (Modi, 2020). In May, a significant announcement by Prime Minister Narendra Modi confirmed that commercial coal mining will soon be permitted in India, with up to 50 new coal blocks (later revised to 41) to be auctioned under a revenue-sharing mechanism (Clean Coal Centre, 2020; Ministry of Finance, 2020c; Pakrasi, 2020). This is expected to raise significant new revenue for state and federal governments in the medium term; however, given long construction and deployment lead times, it is unlikely that any new revenue will help to finance COVID-19 relief. Furthermore, in-country experts consulted during our study expect that only one-third of blocks will be sold, of which half will be developed in the next five years.

Contrary to their climate-positive messaging, the Indian government is yet to announce large climate-friendly recovery measures. Minor policies include an afforestation programme worth INR60bn (Ministry of Finance, 2020b), an extended waiver of transmission charges for solar and wind (Kazmin, 2020), and a plan to roll out 670 electric buses and 241 charging stations (ET Energy World, 2020). There has been some clean energy investment in biogas, though it is unclear what proportion of this investment is public or private (O'Callaghan et al., 2020).

Importantly, announced fiscal spending measures have been limited in size compared to other emerging market nations, reflecting a constrained public balance sheet and high debt servicing costs (Goyal, 2020; Jose et al., 2020). However, some commentators point to opportunities for expanding fiscal space by (i) relying on higher bank deposit rates and strong post-pandemic growth to induce banks to buy more bonds (Dugal, 2020), (ii) selling public assets including state-owned enterprises (Goyal, 2020; G. Singh, 2020), or (iii) engaging the Reserve Bank of India (RBI) to apply modern monetary theory (MMT) by monetizing government debt and then forgiving that debt (Bajaj & Datt, 2020). Others suggest opportunities to increase fiscal space through the sale of public assets.

### 5.3.4 How green stimulus could catalyse future prosperity

As India's desperate need for recovery support collides with fiscal space limitations, future fiscal stimulus spending is unclear. It is evident, however, that to ensure a stable and prosperous future, any fiscal stimulus that does go ahead should have a strong focus on climate-positive policies. There are tremendous opportunities for India to create sustainable

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<sup>21</sup> Spending refers to federal measures announced publicly in which a dollar value was specified. A number of policies that did not have values announced are not included here.

jobs quickly whilst meeting their climate targets, addressing social issues, and developing international credibility as an exemplar for ‘building forward better’.

Vivid Economics finds strong economic and environmental benefits associated with green stimulus investment. For example, models of the economic and environmental impacts of a green stimulus package vs a coal stimulus in India find that a relatively modest USD7.7bn green package (Figure 5.2) would generate 34,000 more job years than a coal package worth the same amount (Figure 5.3). By investing in a strong green recovery, India could save lives through reduced air pollution, while accelerating progress to its net-zero climate ambitions and establishing a strong platform for growth beyond 2020.

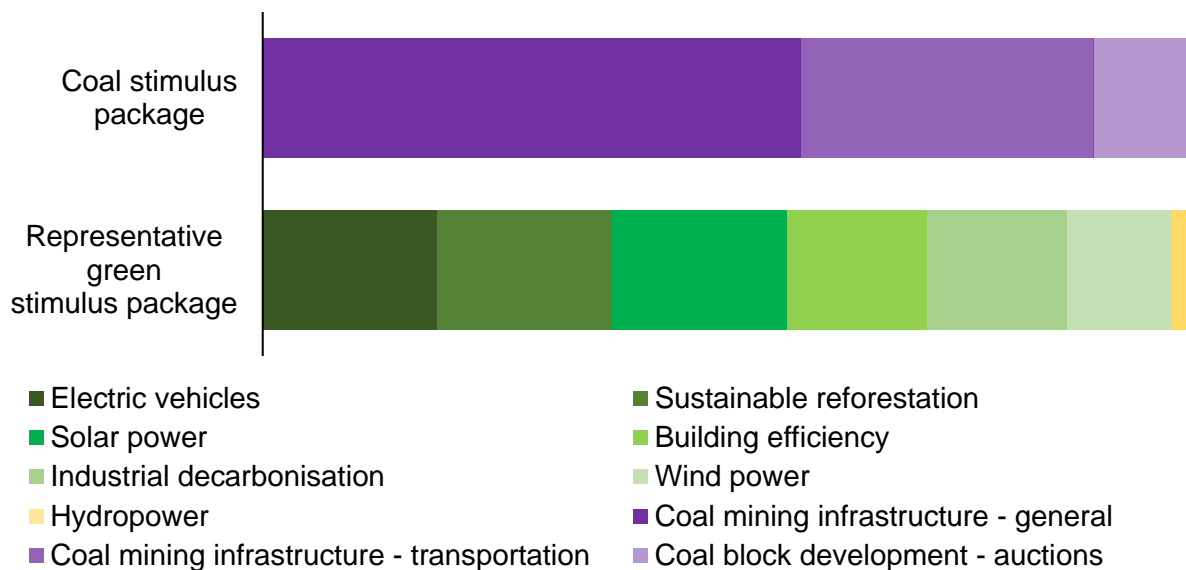


Figure 5.2 Distribution of capital expenditure towards different interventions in each stimulus package, India. Both packages are illustrative with composition justified in Table 4.1. Source: Vivid Economics. Figure 5.1 highlights high relative job-creation potential and GHG-reduction potential for several green investment opportunities in India compared to coal. As in Figure 5.4, investment in green industries could create more jobs, favour direct jobs, and facilitate more jobs distributed towards the immediate investment phase, when they are most relevant to a COVID-19 recovery. The same is true for cumulative economic impact in the form of Gross Value Added (Figure 5.5).

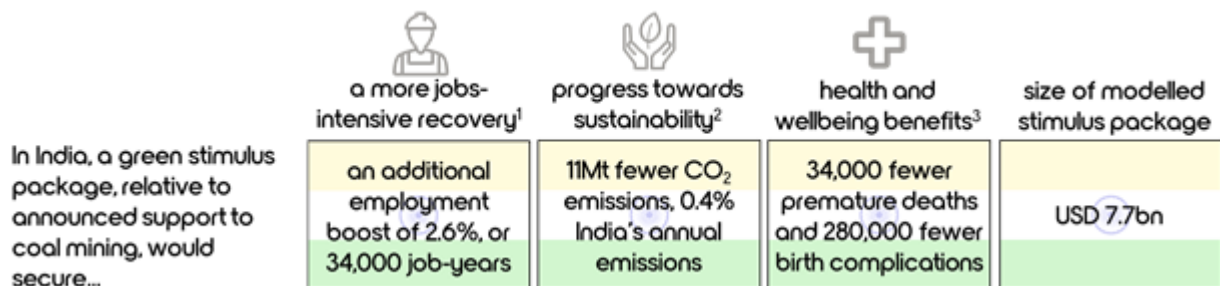


Figure 5.3 Benefits of a green recovery vs a coal recovery in India. Note: The superscripts indicate the time frame of the results: 1 Total during the investment phase; 2 For a given year during the operational phase. Source: Vivid Economics.

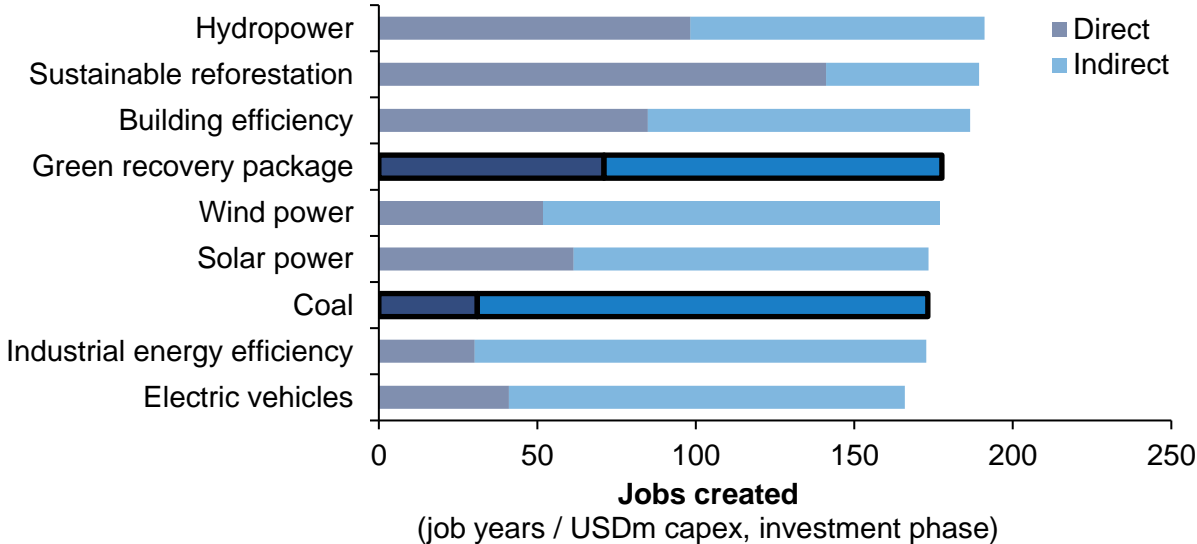


Figure 5.4. Job creation for USD 1 million capital expenditure by intervention, investment phase, India. Source: Vivid Economics.

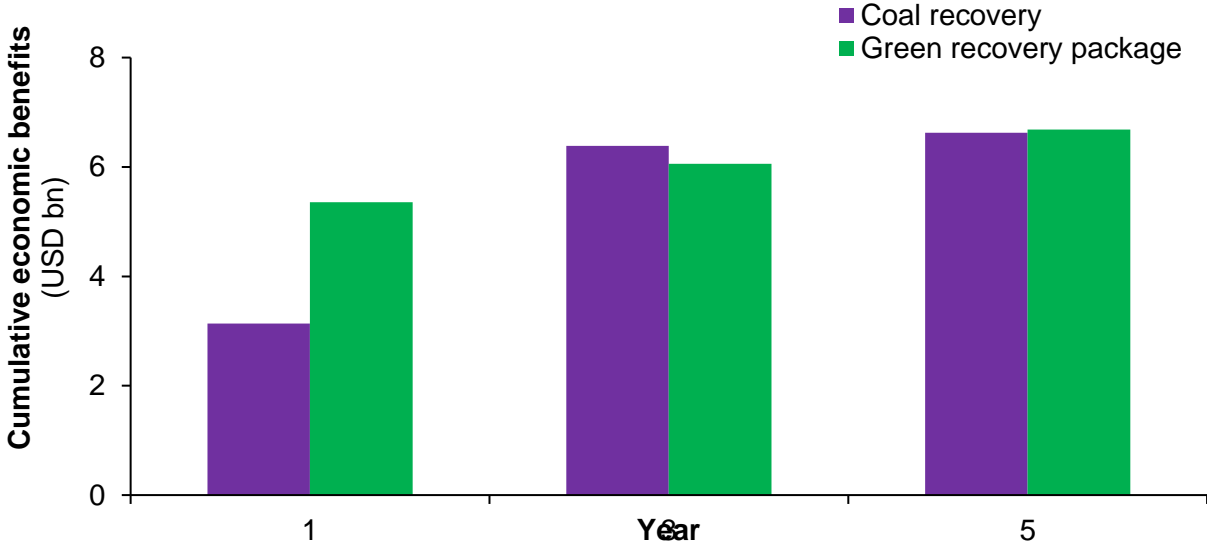


Figure 5.5 Economic value of green and coal recovery options for India. Source: Vivid Economics.

Driven, in part, by constraints on borrowing additional debt, India is yet to invest significantly in economic recovery measures. In the little spending that it has allocated to COVID-19 response, the nation has focused primarily on short-term rescue policies to protect lives and livelihoods. In this respect, it has fallen behind several of the world’s largest nations, and further spending will be necessary to keep up with global counterparts (Figure 5.6). Green recovery

spending globally has thus far been relatively small, though advanced economies have been able to make more green investments both in magnitude and diversity (Figure 5.7).

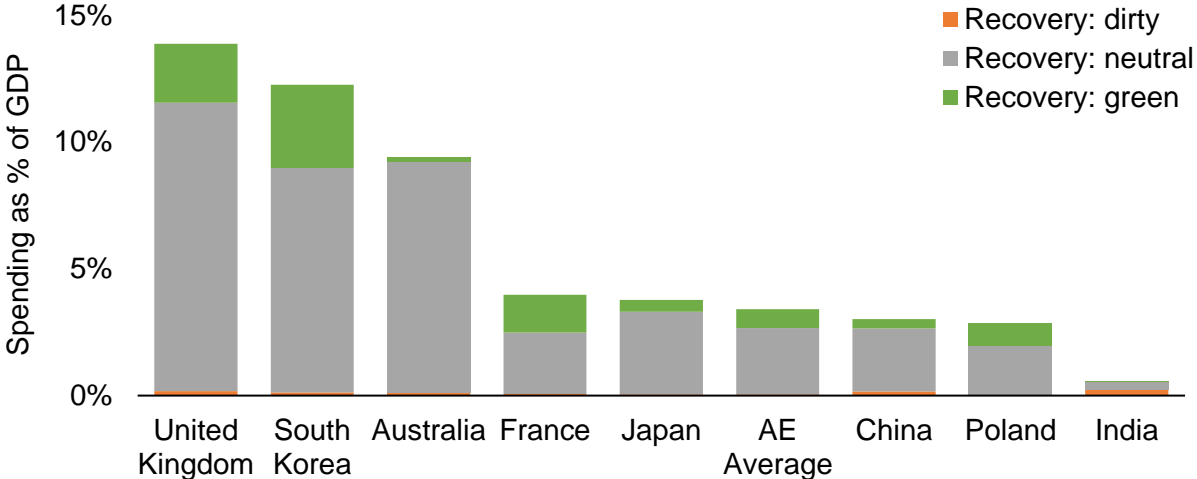


Figure 5.6. Composition of recovery investment in key geographies to May 2021. AE average: Advanced Economy average weighted by GDP. Source: Global Recovery Observatory.

The following sections describe five priority policy areas for Indian fiscal stimulus: renewable energy investment, electric transport investment, clean cooking, afforestation programs, and agricultural investments to manage stubble burning. Investment in these policy areas is expected to bring strong and jobs-rich economic recovery, while reducing social inequalities, boosting environmental and social well-being, and enabling a smooth transition to a green inclusive economy (Hepburn et al., 2020). Such a plan could position India as a global leader in green recovery. A responsible recovery spending pathway could also win international support, aiding the green transition.

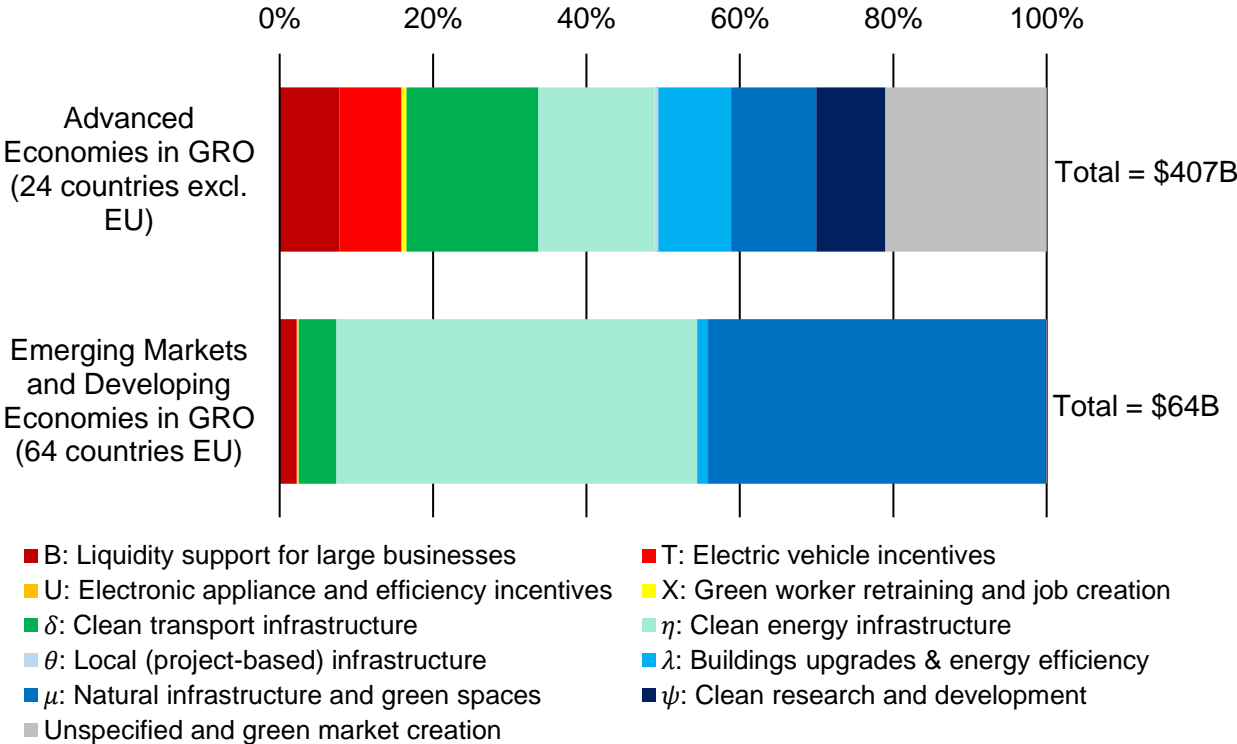


Figure 5.7. Distribution of green spending to May 2021. Source: Global Recovery Observatory.

### 5.4 Policy Recommendations

Vivid Economics modelling indicates that investment in a green recovery in India could secure a more jobs-intensive recovery while reinvigorating economic growth and bringing significant health co-benefits (Figure 5.1). Using these findings as a starting point, wider literature analysis and expert consultation suggest five priority investment opportunities to be closely considered in 2021. These are each discussed in the subsections below. These policies are expected to bring strong and jobs-rich economic recovery, while reducing social inequalities, boosting environmental and social well-being, and enabling a smooth transition to a green inclusive economy (Hepburn et al., 2020). Such a plan could position India as a global leader in green recovery. A responsible recovery spending pathway could also win international support, aiding the green transition.

#### 5.4.1 Electric transport investment

A study released in December 2020 revealed that electric vehicles (EVs) represent an enormous opportunity for the Indian economy, but significant public investment is required to realise the potential of EVs (V. P. Singh et al., 2020). India’s automobile industry is one of the fastest growing globally, and directing this capacity towards the production of EVs, particularly two- and three-wheelers, could position India as a global leader in EV manufacturing. The government has already set a target of 30% EV adoption by 2030, and in the face of the pandemic, stimulus funding directed at the EV industry will likely be necessary to reach that target (World Economic Forum, 2019). India’s automotive sector has been deeply affected by

the pandemic (Hertzke et al., 2020), and an expansion of existing production subsidies for electric vehicles could facilitate the clean transport transition in addition to providing relief for workers who were badly impacted by the pandemic. As up to 30% of air pollution is derived from vehicle exhaust in some parts of the country (Guttikunda et al., 2014), hastening the production and consumption of EVs through fiscal stimulus is likely to bring benefits well beyond its contributions to employment and economic growth.

In addition to personal vehicles, India also has an opportunity to expand on the significant gains it has made in the past decade on electrified public transport. In heavily populated urban centres, congestion is simultaneously a safety concern, an environmental concern, and a source of economic inefficiency that may be mitigated through additional public transport capacity (Bharadwaj et al., 2017; Vigneshkumar & Vijay, 2014). Electrification of any new public transport is essential to progress India's green agenda and reduce transport-based air pollution (Ghate & Qamar, 2020; Khandekar et al., 2018). India benefits particularly from electrification in busses because of the high capacity of these vehicles to displace oil demand, allowing the country to lessen its dependence on oil imports with volatile prices (Mario, 2020). In 2020, India has already introduced funding for 670 electric buses and 241 charging stations as part of the FAME India scheme (ET Energy World, 2020), and an expansion of these measures would help to support a burgeoning new industry (U. Gupta, 2020) while reducing mobility inequalities in urban centres. In addition to the electric vehicles themselves, it is imperative that the Indian government implement supporting policies to ensure that EVs can be integrated smoothly into the country. This includes focussing on charging infrastructure, investing in electricity transmission and distribution, and investigating options for EV battery recycling facilities.

#### 5.4.2 Clean cooking investment

As in most developing countries, the population of India remains heavily reliant on burning biomass for cooking. This practice releases significant carbon emissions, as well as substantial indoor air pollution, leading to a gamut of health consequences including pneumonia, tuberculosis, chronic obstructive pulmonary disease, low birthweight, cataract, and cardiovascular disease (Fullerton et al., 2008). Biomass cooking is most prevalent in rural areas that lack strong healthcare infrastructure, leading to high mortality rates (Kasthuri, 2018; Patnaik & Tripathi, 2017). Though the Indian government has made attempts to expand access to clean cooking solutions, uptake has been slow, especially in comparison to overall increases in electricity access (IEA, 2020b). Despite subsidies, clean cooking technologies are still unaffordable for many and cultural norms around biomass cooking remain strong (Patnaik & Tripathi, 2017).

A fiscal stimulus programme could double down on efforts to increase access to clean cooking, generating substantial economic, environmental, and social benefits. To maximise returns, such a programme would need to provide highly generous subsidies for the technologies, favour domestic manufacturing and, crucially, prioritise consistent messaging and community involvement to tackle norms and increase uptake. Applying subsidies to a wide range of clean cooking technologies may also help to increase uptake as households gain more autonomy to choose a solution that works well for them (Patnaik et al., 2019). Many existing programs have made use of piped natural gas or liquefied petroleum, and while electricity-based solutions are gaining traction, further electricity infrastructure is required before these technologies become an effective solution (Koshy, 2019). Historically, there have been barriers to uptake of clean cooking incentive programs due to a lack of consistent messaging and communication

surrounding the programs, as well as a prevalent belief that burning firewood is better for health (Zahno et al., 2020). A clear and simple messaging campaign, as well as the direct involvement and participation of community leaders (particularly in rural areas) could significantly increase uptake and ensure that cooking solutions are tailored to the communities that they are implemented in.

### 5.4.3 Renewable energy investment

Investments in renewable energy infrastructure had been a glaring omission from Indian recovery expenditure as of October 2020, though some measures were taken in November to support the domestic manufacturing of solar modules and advanced chemistry cell batteries (Scully, 2020). While coal-fired electricity generation supports 74% of electricity demand, dramatically falling prices of wind and solar photovoltaic (PV) technologies make them an attractive option for private investors looking to profit from rising Indian demand for electricity (ETEnergyWorld, 2019). However, compared to other markets, renewable energy is only just beginning to accelerate in India. Additional strong and targeted public investment could crowd-in the significant amount of private investment necessary to propel the country to meeting its renewable energy target of 175 GW by 2022 (IRENA, 2017). As shown by Vivid Economics modelling (both within this document and elsewhere), solar and wind generation can be strong job creators, and these job opportunities also come very quickly in comparison to those created by fossil fuel investments (IRENA, 2017). Higher renewable energy penetration, when appropriately supported by transmission infrastructure, could also reduce domestic electricity prices in the long term and simultaneously strengthen energy security (Valentine, 2011).

Renewable energy policies have historically received support from many Indian political parties and the expansion of existing renewable energy production incentives have the potential to quickly provide employment opportunities and solidify India's path towards a clean energy future. The rapid expansion of renewables in India will also be an essential component in the success of its electric vehicle strategy. To meet the increased electricity demand spurred both by the increased prevalence of EVs and by widespread increases in living standards, renewable capacity will need to be increased, in addition to strategic investments in storage, transmission and distribution. Domestic manufacturing of renewable energy capital has been a focus of the Indian government, and a continued focus will be necessary to maximise the economic benefits and job impacts of these policies (Pyper, 2021). Whilst renewables have been on the rise in India, coal production has also been increasing despite the instability of the industry. Renewable energy policies are expected to be the most effective environmentally and economically when coupled with policies designed to phase out coal production. Government support of continued coal production in India has proven to be both expensive and very risky, particularly during the pandemic, with the industry losing its global stronghold on energy production.

### 5.4.4 Natural capital investment

India has a long history of afforestation programmes and natural capital restoration. Expanding on these programmes could be one of the strongest fiscal tools available to the Indian government for COVID-19 recovery. Natural capital projects have enormous potential economic, environmental and social benefits. These projects can often create relatively low-skill jobs, which can be targeted to vulnerable sectors of the population (Edwards et al., 2013). Making use of a natural carbon sink in this way can both contribute to greenhouse gas emissions reduction as well as mitigate hazardous air pollution and its subsidiary health

impacts (Yang et al., 2005). In May of 2020, the government announced INR6,000 crore to increase funding for the CAMPA programme to go towards afforestation and plantation, including in urban areas (Ministry of Finance, 2020b). Such a programme could be expanded as part of a fiscal stimulus programme to include restoration projects for mangroves, which have also been effective in the past (Thivakaran, 2017). Flooding events have been a fixture in many parts of India for decades, but global climate change has led to many more extreme rainfall and flooding events in recent years. One study found a three-fold increase in flooding across India from 1950-2015 (Roxy et al., 2017). These have affected both rural and urban areas, with even large cities like Mumbai experiencing some of their most severe flooding in 2020, coming at an enormous economic cost for the already economically-strained country (Deshpande, 2020). Natural capital investment in mangroves may be one of the most effective ways to reduce the impact of flooding in coastal areas and could save the government from enormous disaster relief payouts in the long term, in addition to creating jobs and fortifying those sectors of the economy that are particularly at risk during extreme weather events (Menéndez et al., 2020).

In implementing an afforestation or nature restoration programme, care must be taken to ensure the appropriate plants are planted, as monoculture-type afforestation has been shown to devastate biodiversity, affect soil quality and contaminate groundwater (Wang et al., 2019). Sensitive approaches to land ownership are also essential for garnering public support for an afforestation or restoration programme, and ideally creating new direct economic opportunities (Seidler & Bawa, 2016). Benefits can also be maximised by investing in programmes that make use of natural capital as a mitigation strategy for natural disasters including for areas prone to drought and flooding (Kousky, 2010).

#### 5.4.5 Agriculture investment, particularly addressing stubble burning

Stubble burning is the process of setting agricultural waste alight after a harvest to clear the land. The practice has become increasingly widespread, particularly in Northern India, as for many farmers it is the only economically viable way to clear their land (N. Gupta, 2019; Shyamsundar et al., 2019). Stubble burning is responsible for a sizable portion of Indian PM2.5 air pollution and carbon dioxide emissions, not only in the rural areas in which it is burned, but in urban centres across the country. In New Delhi, the practice can account for 58% of air pollution at the peak of the season (Beig et al., 2020). The resulting emissions and air pollution have devastating health consequences, both for the farmers who engage in it and for proximate city dwellers (Cusworth et al., 2018). Regional governments have attempted to curb the practice through fines or alternative technologies (Abdurrahman et al., 2020), though these have been slow and expensive (N. Gupta, 2019).

One solution that has been effective in southern regions is repurposing paddy straw as animal feed or using it to manufacture paper or cardboard (P. Kumar et al., 2015). Scaling community-centric solutions like paddy straw repurposing could deliver strong returns. For instance, a stimulus programme could construct facilities in northern India that purchase and refine paddy straw, providing farmers with an economic incentive not to burn (MSSRF, 2018). This programme could have high potential as fiscal stimulus since early stages of such projects would involve labour-intensive construction. These jobs could be targeted towards groups that are particularly vulnerable, with the added benefit of maximising the economic multiplier. Once facilities are operational, they have the potential to provide a permanent new revenue stream for farmers whose livelihoods have been threatened by the pandemic and will continue to be put at risk as a result of climate change (C. Singh et al., 2018).



## 5.5 Funding and financing recommendations

As a result of previous and anticipated stimulus action in India the country is facing large fiscal deficits, with an updated targeted deficit for the financial year ending on 31 March 2021 reaching 9.5%, almost three times higher than previously anticipated, with much additional spending coming from substantial unanticipated public borrowing (Ministry of Finance, 2021; Sharma, 2021; The Hindu, 2021). This strain on the government's financial position may limit the practical approaches available to the government in directly financing green stimulus through government central revenues or borrowing, and emphasises the need to mobilise additional private and international finance. To support a robust COVID-19 recovery it will therefore be important for the Indian government to implement approaches that enable scaled-up public spending as well as incentivising and enabling investment across the private sector and households. Indian policymakers should consider (i) issuing sovereign green (recovery) bonds, (ii) providing green financial incentives, (iii) supporting international private climate investment and (iv) using 'green banking' tools to promote domestic and household investment.

### 5.5.1 Sovereign green (recovery) bond issuance

A range of public and private actors in India have explored and issued green bonds since the first Indian green bond issuance in 2015. State-owned companies and financial institutions have been leaders in this space, (Agarwal & Singh, 2018) with the State Bank of India (SBI) issuing climate bonds in 2018 (Joshi, 2020). India could build on these approaches to raise funding to support public investment in specific green recovery programmes. However, investors have raised concerns around the projects support by previous green or climate bonds and in some cases have halted investment in the assets – as with key international investors' withdrawal from SBI climate bonds in late 2020 due to links into coal investments (Kirakosian, 2020). Given this recent history, Indian public bond issuers may need to take action ahead of any issuance to first provide assurance to investors on the appropriate allocation of funds to green recovery projects, for example, through greater emphasis on green project definitions by bond issuers and through verification and/or certification by trusted international actors using well-known standards and processes, though these steps may reduce the relative speed of issuances or increase the cost of the bond to the issuer.

### 5.5.2 Green financial incentives

India should consider a range of incentives to catalyse and accelerate private investment in the energy sector. This could include domestic auctions for renewable Contracts for Differences (CfDs) or the expansion of feed-in tariffs (FITs). India could also consider adjustments or expansions of incentives for state-level public investments into forestry and land use. India's system of ecological fiscal transfers (EFTs) established in 2015 were intended to support state action on forestry, but some analyses have found that uncertainty and inefficient design of EFTs may have led to decreases in state-level expenditure in forestry budgets (Busch et al., 2020). India could adjust the approach to administering EFTs to improve their effectiveness by addressing design issues that led to budget decreases among recipients and could scale up the scope of EFTs to cover a broader range of green sectors or technologies to provide resources to state-level actors while also incentivising decentralised investment in a green recovery.

### 5.5.3 Large-scale co-financing opportunities

A recent review of climate finance flows suggests that a relatively low share of international private investment supported climate projects in India – around 5% of total climate investment and one-third of international investment came from international private investors between 2016 and 2018 – whereas almost two-thirds of domestic financing came from the private sector (Acharya et al., 2020). This amounted to USD1bn or ~1% of total foreign direct investment (FDI) in India. Overwhelmingly, the investment was directed to the clean energy sector. The Indian government could support greater inflows of green FDI through tools that provide confidence to private interests, notably through de-risking instruments such as policy or technology guarantees to reduce the risks from policy changes or from underperformance of new technologies that impact returns from green investments, or through foreign exchange hedging tools to reduce investor exposure to foreign exchange fluctuations that may limit investees' ability to repay dollar-denominated debts or reduce the relative value of equity investments. Policymakers could also consider the use of co-investment-blended finance tools such as 'junior debt' or 'first loss' investments to provide additional assurance to international investors. In this scenario, relevant investors are repaid first in the event of default or bankruptcy.

### 5.5.4 Direct grant programmes

Public financial institutions could use a range of 'green banking' tools to enable domestic and private investment into critical green sectors. For India, particularly interesting opportunities include green building finance for both commercial and residential sectors. Public actors can catalyse investment by supporting the rollout of green building loans to both businesses and households and by providing aggregation and securitisation services to enable investment from larger private investors into a basket of small investment that would otherwise not be large enough to attract investment. New retail green savings and investment products can also support investment into residential clean cooking technologies and into consumer electric vehicles. However, the high price of these technologies relative to non-green alternatives means public grants or subsidies may still be needed in the near term until the cost gap between green and traditional technologies closes. A range of 'blended finance' green banking tools can also be used to direct support to technology developers of green products and services such as electric vehicles and clean cooking manufacturers and charging infrastructure developers. These tools include direct investment equity stakes in businesses, low-cost debt financing, more complex investment structures that reduce investment risks for investors and a range of guarantee approaches.

## 5.6 Governance Recommendations

Given the large number of national and subnational actors involved in COVID-19 response and in supporting green investments in India, it is crucial that a green recovery programme for India emphasises a coordinated response and consistent messaging. In addition to supporting governmental interactions across national and state levels, streamlining interaction with domestic and international private investors can help to ensure that goodwill and intention are not lost. India's limited commitment to green recovery thus far and a relatively weak commitment to climate action relative to its potential to contribute to future emissions suggests that national and state government actors are likely not currently best-positioned to administer a large-scale green recovery programme.

Additionally, coordination of green recovery action across such a large, populous and diverse country is likely to pose novel challenges. Given these challenges to coordination and action, India would likely benefit from a dedicated task force on green recovery to help coordinate policies and actors. This task force could also help maximise the range of economic, environmental and social impacts from green recovery investments. The task force could also be responsible for communicating policy details to the public and coordinating dealings with private investors and subnational entities. Such a task force would benefit from the expertise of local and international academics and experienced consultants to help guide policy considerations.

## 5.7 Co-considerations

Three high-priority considerations are examined here: policy time frames, targeting and equity and considerations specific to COVID-19.

1. **Policy time frames.** While it is tempting to focus on policies that will generate the greatest benefits in the shortest amount of time, longer acting policies are crucial for a smooth transition away from fossil fuels and can also garner high long-run multipliers (Hepburn et al., 2020). For India, this means a mix of approaches within priority policy areas to deliver both near-term ‘quick wins’ and longer term ‘big wins’ and a mix of funding and financing approaches to deliver investment in the immediate recovery and to align long-term investment frameworks with a transition to a low-carbon future.
2. **Targeting and equity.** In India, COVID-19’s impacts on tourism, transport and trade have hit services particularly hard, while supply chain issues have caused damage in the agriculture sector. Policy actions to support a green recovery through land-use and transport sector interventions therefore offer particularly high potential for supporting harder-hit groups in the recovery. At the same time, climate change is likely to have a particularly negative impact on lower income and marginalised groups, and it is incumbent upon the Indian government to ensure that any green recovery investments are just and inclusive, meeting the needs of all members of Indian society. Targeting incentive-based policies towards low-income groups is also likely to generate the highest economic benefits due to the high marginal propensity to consume of such communities (Jappelli & Pistaferri, 2014). For example, this could include designing interventions in the land-use and agriculture sectors to support low-income groups and subsistence farmers, and designing clean transport interventions to support access for new clean transport modalities for public and low-cost shared private transport users as well as for wealthier owners of private vehicles. A just transition focus could also include supporting workers in India’s coal sector in retraining for new green sectors and opportunities.
3. **COVID-19 considerations.** India has suffered particularly badly from the COVID-19 pandemic compared to many other nations, particularly within Asia. While cases and deaths have declined substantially from their peak in September 2020, it is vital that stimulus policies incorporate COVID-19 safety protocols to avoid any contribution to a resurgence of the virus in the country. Best-practice approaches to manage and reduce risk of COVID-19 transmission will vary across different types of activities such as green infrastructure construction, green technology manufacturing, agriculture and forestry and green financial service provision, but could include maintaining distance between workers, limiting the frequency and duration of contact with co-workers and/or

customers (particularly when indoors), use of personal protective equipment to reduce the risk of airborne transmission and maintaining clean shared equipment or facilities. These protocols may be needed both in places of work, and also for shared work-related transportation or accommodation (CDC, 2020, 2021a, 2021b, 2021c). Where new opportunities stimulate within-country migration to new centres of employment, green employers may also need to encourage appropriate measures to mitigate COVID-19 spread, such as periods of self-isolation before incoming employees commence work.

## 5.8 Conclusion

**By pursuing a green recovery in response to COVID-19, India has a clear opportunity to reduce GHG emissions and improve public health, while also boosting job creation and delivering critical economic growth.** The green recovery options and impacts discussed in this roadmap demonstrate that Indian policymakers do not need to choose between targeting green and social outcomes and targeting a robust economic response to the economic crises brought on by COVID-19. By targeting green infrastructure, technologies and projects, India can pursue a recovery that delivers strong economic, environmental and social impacts.

**The policy, funding, financing and governance approaches set out in this report provide a potential roadmap for India to secure a green recovery while also accelerating its transition towards a longer term low-carbon development pathway.** By targeting the broader environmental and social benefits delivered alongside critical economic recovery outcomes, a green recovery approach can deliver near-term benefits while also helping shift India's economic development trajectory towards a sustainable future. The recommendations presented demonstrate India's options to broaden the engagement of international investment flows and to implement new funding approaches to provide sustainable long-term support for this green future, and its options to ensure that the benefits from a green economy are shared by all.

## 6 Case Study B: Green Recovery for China

### 6.1 Executive Summary

**China could resume its path of economic growth and accelerate its green transition by investing in a green recovery to COVID-19 and avoiding any new investment in coal-fired electricity generation.**

In September 2020 President Xi Jinping committed China to carbon neutrality by 2060. This ambitious commitment is only achievable with bold government action. China is the world's largest producer and consumer of coal. Economic recovery in the wake of the COVID-19 pandemic has reinforced existing imbalances, with growth in coal-fired heavy industry contrasting anaemic recovery in private consumption. In the face of a faltering global economy, this is the time for China to accelerate the low-carbon transition.

Unlike other major economies, China has experienced a strong economic rebound from the initial COVID-19 shock. This success has been attributed to strict containment of the virus, robust macroeconomic and financial policy response as well as additional export opportunities from pandemic-related demand for healthcare and home office products. However, China has experienced a two-speed recovery, with swift growth in investment, construction and industrial production contrasting slow recovery in private investment, with retail sales below pre-crisis levels (IMF, 2021a). China also faces a more challenging external environment, due to a slow recovery in other major economies, deteriorating geopolitical relationships and accelerated regionalisation of supply chains.

Continued imbalances in China's economy threaten the achievement of the 2060 Net-Zero target. Continued investment in high-carbon infrastructure will further lock in high emissions, making it harder to achieve this ambitious target. In the short term, it is critical to shift investment towards forward-looking green investments that support China to achieve its economic, environmental and social goals. These green investments can simultaneously stimulate the economy, reduce carbon emissions and save lives.

**Supporting modelling from Vivid Economics shows that green investments can support continued economic recovery, while also accelerating decarbonisation (Figure 6.1).** The modelling compared announced support to coal-fired electricity generation up until August 2020 with a representative green stimulus package of the same level of capital expenditure. The results show that if China reorients its stimulus expenditure away from coal and into green alternatives, it could secure:

- **More jobs-intensive recovery** – for the same level of investment, a green recovery could generate 9.5% more jobs during the investment phase
- **Progress towards its 2060 Net-Zero target** – investment in a green recovery could result in 51Mt fewer CO<sub>2</sub> emissions, equivalent to 0.4% China's annual emissions
- **Improved air quality with associated health outcomes** – over the first ten years of the recovery, investment in a green alternative could result in 59,000 fewer people dying prematurely from air pollution, and 56,000 fewer birth complications

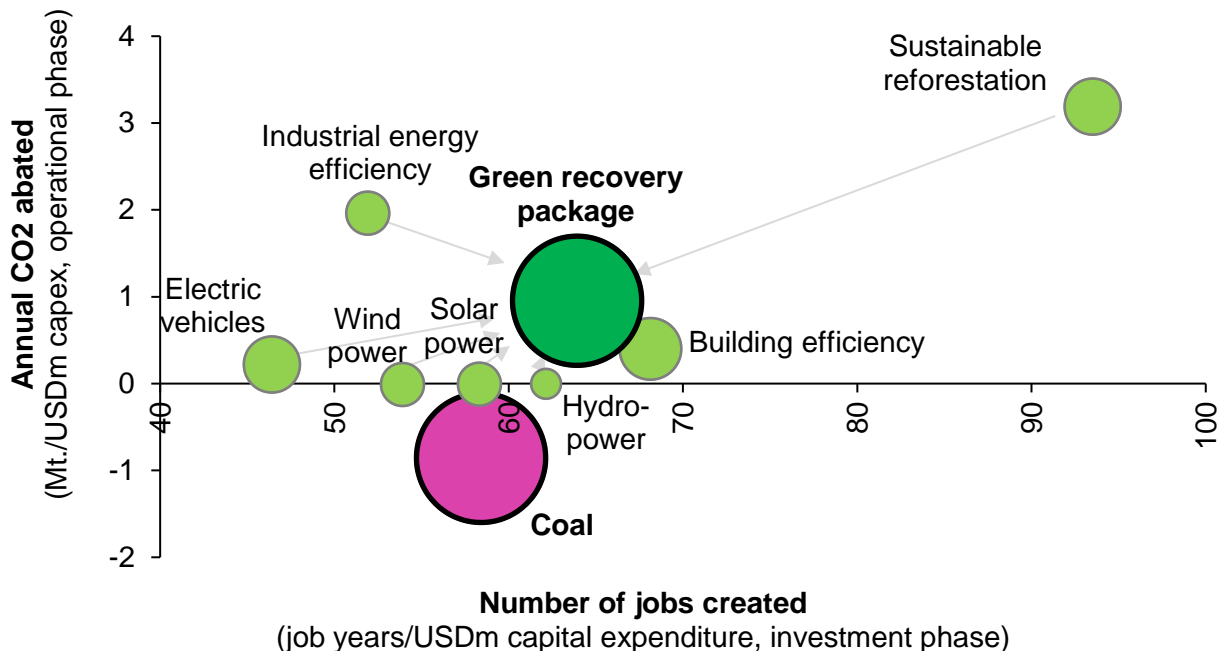


Figure 6.1. Modelled benefits of a green recovery in China vs. a coal-fired recovery. Note: the size of the bubbles indicates the scale of capital investment modelled for each intervention. Source: Vivid Economics.

Three key policy recommendations for a green recovery are highlighted in this roadmap. The policy areas provide an opportunity to secure a swift economic recovery while making progress towards existing social and environmental priorities:



**Energy transition:** To meet its decarbonisation objectives, China must prioritise widespread electrification while increasing the share of renewables in electricity supply. In 2019, coal accounted for 70% of China’s carbon emissions (He et al, 2020). Accelerating the energy transition could support immediate job creation, decrease climate risk and dramatically improve health outcomes.



**Green urbanisation:** Premier Li Keqiang has called for a new model of domestic urbanisation which is high-quality, sustainable and efficient. Building efficiency, urban greening and transport infrastructure are key for supporting economic recovery, slowing emissions, building resilience to climate hazards and improving the liveability of cities for resident’s well-being. Modelling from several sources indicates that this investment can support rapid economic recovery too.



**Ecosystem restoration:** Addressing environmental degradation and establishing an ‘ecological civilisation’ are key policy priorities for China. Investments in ecosystem restoration are highly labour-intensive and can provide important long-term boosts to nature-dependent sectors, including agriculture and tourism. They can support the delivery of ecosystem services, such as air and water quality, with important environmental and social benefits.

To maximise the green impact of public COVID-19 recovery spending, the Chinese government should primarily target the effective (re-)allocation of public spending at national and subnational levels, at the same time as building towards shifts in the financial system to encourage and enable private green investment in the near and long term. Chinese policy-makers should consider (i) direct public investment in green infrastructure through government bodies or state-owned enterprises, (ii) recycling revenues from carbon pricing initiatives, (iii), city-level environmental tax and charge policies and reforms and (iv) enabling private green investment through blended finance and green financial sector reform. China's capacity for long-term industrial planning and strong commitment from senior leadership are critical components in its ability to deliver a green transition. However, further efforts are needed to ensure coherence across all branches of national and local government and state-owned enterprises. Mainstreaming the Net-Zero 2060 target into the 14<sup>th</sup> Five-Year Plan will be an important next step in demonstrating long-term policy commitment.

## 6.2 Introduction

Unlike other major economies, China has experienced a strong economic rebound from the initial COVID-19 shock. This success has been attributed to strict containment of the virus, robust macroeconomic and financial policy response as well as additional export opportunities from pandemic-related demand for healthcare and home office products. Nevertheless, economic growth has been unbalanced across sectors. Furthermore, with the introduction of a Net-Zero target, this is a critical moment for a green transition in China. Since the initial COVID-19 downturn, economic growth has been relying strongly on heavy industry (cement, steel) driven by coal power. However, in September 2020, President Xi Jinping announced a 2060 Net-Zero target. Continued investment in high-carbon infrastructure will further lock in high emissions, making it harder to achieve this ambitious target. In the short term, it is critical to shift investment towards forward-looking green investments that support China to achieve its economic, environmental and social goals.

## 6.3 Economic context for green recovery spending

### 6.3.1 Pre-pandemic China

China has experienced decades of rapid, investment-led economic growth. In the forty years following the 1978 economic reforms, China averaged a growth rate of 9.5% per year (Congressional Research Service, 2019). China's economic growth has been significantly driven by investment in physical capital (Hepburn, Stern, Xie and Zenghelis, 2020). The use of central and regional growth targets have brought 'high speed' rather than 'high quality' growth, with a proliferation of investment in projects with low financial returns. As a case in point, China introduced the largest stimulus package in the world in response to the 2008 Global Financial Crisis (Wong, 2011), which resulted in an unprecedented boom in heavy industry and construction and the largest three-year increase in CO<sub>2</sub> emissions for any country (Carbon Brief, 2020b). However, there was significant wasted investment, particularly in real estate, with vacancy rates of urban housing now exceeding 20% (RMI, 2020).

In May 2020, the 'dual circulation strategy' was first mentioned at the Politburo. This represents a broader ambition of the Chinese government to rebalance the economy and shift from investment to consumption, increase the importance of the service sector relative to the manufacturing sector and focus on domestic demand rather than exports (S&P Global, 2020). Although domestic consumption has increased due to the growing middle class, it is

significantly lower compared to other emerging economies and has declined from a peak of 67.4% of GDP in 1983 to 55% in 2018 (Grieger, 2018). As of 2019, services had overtaken manufacturing as the largest contributor to GDP (World Bank, 2019). In addition, China's exports are becoming increasingly refined, and high-technology-manufactured products amounted to 30% of China's exports in 2017.

Coal has played a particularly important role in China's economic development. China is both the world's largest producer and consumer of coal; coal accounted for 57.7% of primary energy consumption in China in 2019 (Carbon Brief, 2020a). China's coal sector is subject to public support, both in the form of financing from state-owned banks for new coal capacity and support for household consumption. In 2017, state-owned banks financed over CNY 53.3 billion in new domestic coal-fired generation and CNY476mn was provided to support household consumption of coal-generated energy, predominantly through budgetary transfers and tax exemptions (Chen and Gencsu, 2019). This continued government support of the sector is misguided, given the challenges the sector faces.

The Chinese coal sector is grappling with a large overcapacity issue, leading to diminishing returns on investments in coal power (Carbon Tracker Initiative, 2016). In 2018, China's coal-fired power plants averaged operation at under 50% of capacity and as of 2020, it is estimated that China's excess coal-fired capacity amounts to 400 GW (GEM/CREA, 2020). Despite this, China is continuing to expand its coal capacity. As of June 2020, China had 249.6 GW of coal-fired capacity under development and an additional 40.8 GW had been proposed (GEM/CREA, 2020). The decision to expand coal capacity is taken at the provincial level, where provincial authorities accelerate coal plant construction as an economic development strategy in order to achieve short-term GDP targets. Efforts by the central government to curtail this, importantly the introduction in 2016 of a traffic light system which halted new coal plant approvals in provinces deemed to have insufficient environmental capacity, resource capacity or electricity demand to absorb new coal plants have relaxed over time (Hove, 2020). In addition to domestic investment in coal, China is investing in coal internationally, predominantly through the Belt and Road Initiative (BRI). In 2019, 52% of China's BRI energy investments was in fossil fuel projects (Grieger, 2020).

Continued prioritisation of coal over renewables has important implications for population health and stranded asset risk. The dominance of coal-fired power plants has caused air pollution in China to reach high levels, creating severe health problems (Sandalow, 2019; Wu et al, 2019). Each year, air pollution is estimated to contribute to 1.6 million premature deaths (Sandalow, 2019). In terms of stranded asset risk, while policymakers see coal as cheap and secure, falling renewables costs and improved storage is likely to make coal plants obsolete (Hove, 2020). In 2016, a study found that all coal expansion planned under the 13<sup>th</sup> Five-Year plan was unnecessary and would result in USD 490 billion wasted capital investment (Carbon Tracker, 2016).

China is also the world's largest deployer of renewable energy. In 2018, 43% of global new renewable capacity was in China (Sandalow, 2019). The 13th Five-Year Plan set targets to increase the share of renewables in primary energy consumption, targeting 340 GW of hydropower capacity, 200 GW of wind power, 15 GW from biomass and 120 GW of solar power (later upwardly revised to 213GW), as well as 58 GW of nuclear capacity (Climate Action Tracker, 2020a). In the immediate period before the COVID-19 crisis, however, renewables deployment had slowed. Wind installations in 2019 were 26 GW, down from a 2015 peak of 33GW, and solar photovoltaic installations were 30GW down from a 2017 peak of 53 GW



(Hove, 2020). This slowdown has been attributed to the phasing out of feed-in tariffs, which began in 2018 with the aim of zero-subsidy instalments by 2021.

In 2017, China announced a national emissions trading scheme (ETS), which began operating in February 2021 for the power sector, although will eventually expand to seven other sectors to become the world's largest ETS, covering one-seventh of global CO<sub>2</sub> emissions from fossil fuel combustion (IEA, 2020). The ETS is expected to encourage coal plants to improve the emissions intensity of generation and the earlier retirement of less-efficient older plants. As the ETS will only cover coal and gas plants, it is not expected to reduce the share of coal power in the total generation mix.

### 6.3.2 Impact of COVID-19 on Chinese economy and society

Despite being the epicentre of the pandemic, China has experienced a partial economic recovery – certainly, compared to other major economies, its recovery has been rapid. China's GDP decreased by 6.8% in Q1 2020 relative to the same period in 2019, but GDP over the full annual year grew by 2.3%, and in 2021 it is predicted to grow 8.1% (IMF, 2021). The Chinese economic recovery was enabled by an early and strict lockdown and closed borders which allowed China to contain the virus. In addition, China's manufacturing sector has benefitted from a surge in demand for pharmaceutical equipment and home office equipment (Grieger, 2020). Policy has also supported recovery, both through public investment and central bank liquidity support (IMF, 2021a).

**There are, however, threats to China's continued recovery.** Economic recovery has so far been highly unequal across sectors. The two-speed recovery has seen swift growth in investment, construction and industrial production, driven by heavy public investment. In contrast, the recovery of private consumption has been anaemic, with retail sales below pre-crisis levels (IMF, 2021a). Furthermore, slow recovery in other major economies is likely to lead to lower demand for exports from China (Grieger, 2020). China's geopolitical relationships have deteriorated during the pandemic. Tensions around trade with the US, border clashes with India, deteriorating relationships with the UK and Canada over Huawei and frictions with Taiwan and Hong Kong around human rights issues have created a more hostile international environment (Grieger, 2020). More broadly, the COVID-19 crisis has prompted concerns about the resilience of global supply chains, accelerating the regionalisation of supply chains. Given China's leading role in global value chains, these global trends make the external environment more challenging (IMF, 2021a).

### 6.3.3 Policy responses during the pandemic

As of July 2021, the Chinese government has announced stimulus measures amounting to RMB 4.9 trillion (USD 758 billion) (IMF, 2021). This stimulus package is significantly lower than in response to the 2008/09 global financial crisis, but the focus on investment-led growth continues.

The evaluation of the impact of China's stimulus package on climate and the environment is mixed (Climate Action Tracker, 2020a). The Greenness of Stimulus Index classifies China's stimulus package as having an overall negative impact on the environment (Vivid Economics, 2020a). Stimulus to fossil fuel projects and, in particular coal, plays an important role in China's recovery process, both by the continuation of existing support and by targeted stimulus to the coal industry. The stimulus has in part been directed to new coal plants, through faster coal permit approvals, increases in local lending quotas and through increases in available credit

and central government support (GEM/CREA, 2020; Vivid Economics, 2020). Support has also been directed towards coal-to-chemical plants, oil refineries and other high-carbon capacity.

However, China’s recovery measures include some green stimulus, such as investment in new technology-based forms of infrastructure, an aim to ensure investment in traditional infrastructure that supports green and energy-efficient urbanisation and by promoting green consumption (RMI/ETC, 2020). In addition, subsidies to electric vehicles have been extended. The scheme was originally set to end in 2020, but Government has extended incentives to 2022 (Bloomberg, 2020).

Using figures from Oxford University’s Global Recovery Observatory, compared to other nations, China is lagging in recovery spending and in the portion of spending allocated to green initiatives (Figure 6.2). This is not for lack of options. Green spending in response to COVID-19, tallied to May 2021, has totalled USD407bn in advanced economies and USD64bn in emerging markets and developing economies. As illustrated in Figure 6.3, public funds have been directed to a wide variety of green investment areas, indicating a widespreading in economically attractive options.

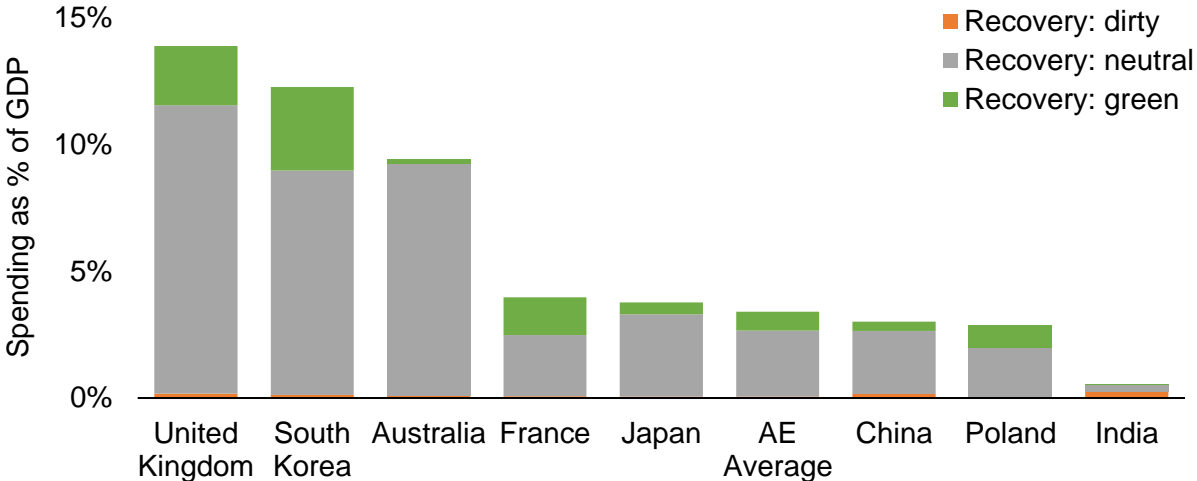


Figure 6.2. Composition of recovery investment in key geographies to May 2021. AE average: Advanced Economy average weighted by GDP. Source: Global Recovery Observatory.

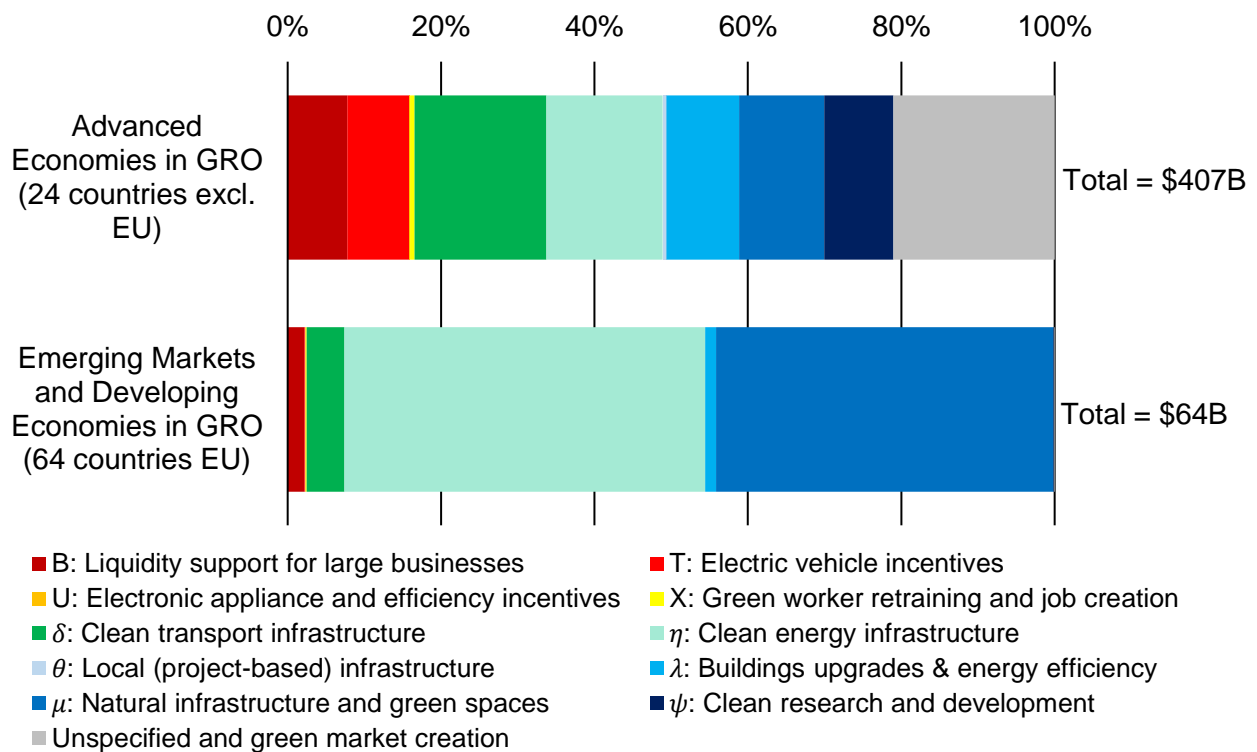


Figure 6.3. Distribution of green spending to May 2021. Source: Global Recovery Observatory.

#### 6.3.4 How green stimulus may catalyse future prosperity

In September 2020, China announced an aim to achieve carbon neutrality by 2060 (Climate Action Tracker, 2020a). Neither China's pre-pandemic performance nor its announced stimulus to date are consistent with this ambitious commitment. It is essential, therefore, for further government support to accelerate the low-carbon transition, as well as build economic resilience and address structural imbalances.

Modelling by Vivid Economics demonstrates how green investments can support continued economic recovery, while also supporting decarbonisation. The modelling compared announced support to coal-fired electricity generation up until August 2020 with a representative green stimulus package of the same level of capital expenditure. Figure 6.1 summarises the model results for intervention options. The results show that if China reorients its stimulus expenditure away from coal and into green alternatives, it could secure:

- **More jobs-intensive recovery** – for the same level of investment, a green recovery could generate 9.5% more jobs during the investment phase
- **Progress towards its 2060 Net-Zero target** – investment in a green recovery could result in 51Mt fewer CO<sub>2</sub> emissions, equivalent to 0.4% China's annual emissions
- **Improved air quality with associated health outcomes** – over the first ten years of the recovery, investment in a green alternative would result in 59,000 fewer people dying prematurely from air pollution, and 56,000 fewer birth complications

**During the initial investment phase, the representative green stimulus package could create 9.5% more jobs than the coal stimulus package.** The coal stimulus package is estimated to boost employment by 750,000 job years directly, and 910,000 job years indirectly (through supply chains) during the investment phase. In contrast, the green stimulus package would support employment by 700,000 job years directly and 1,050,000 job years indirectly. Within the green stimulus package, different interventions create different numbers of new jobs for a given level of investment due to differences in the intensity of labour in production. Of the seven interventions modelled, the analysis suggests that sustainable reforestation is the most employment-boosting, creating 95 job years during the investment phase for every USD 1 million invested (Figure 6.4).

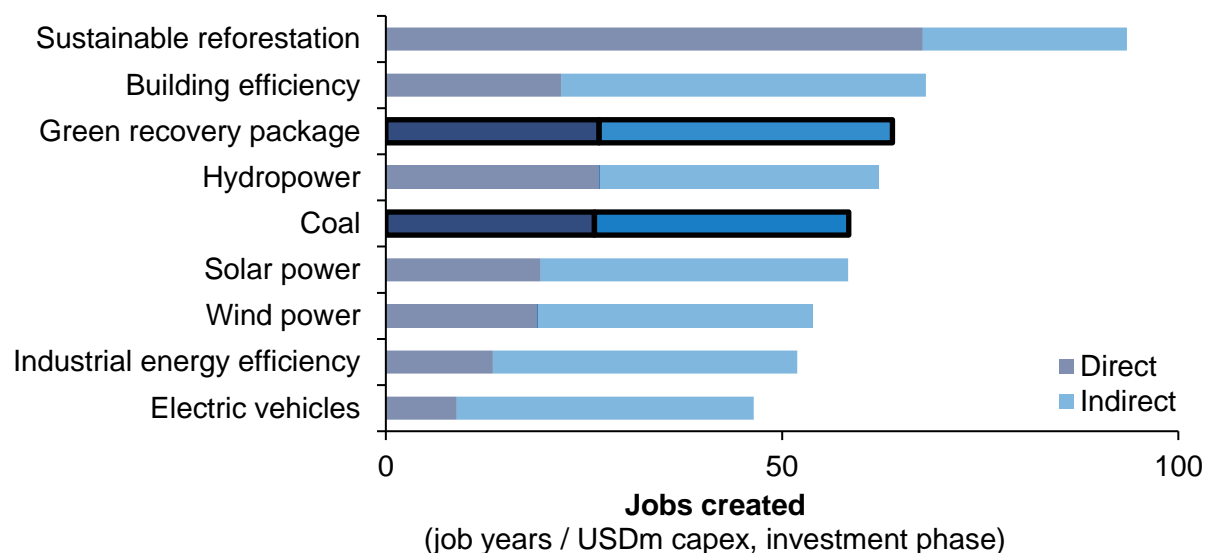


Figure 6.4 Job creation for USD 1 million capital expenditure by intervention, investment phase, China. Source: Vivid Economics.

**During a five-year initial recovery period, the representative green recovery and the coal package provide comparable overall economic benefits – but a green recovery delivers benefits more quickly during initial years of the recovery.** Both the green recovery package and the coal stimulus package would provide USD 25.4 billion value to the economy over the first five years of the recovery.<sup>22</sup> However, as investments in the green recovery package can be delivered and scaled faster, the green recovery portfolio results in quicker economic stimulus across the economy, as Figure 6.5 shows.

<sup>22</sup> Economic benefits refer to a combination of gross value added (GVA) and energy savings. Non-monetised benefits such as job creation, emissions reductions and health benefits are not included.

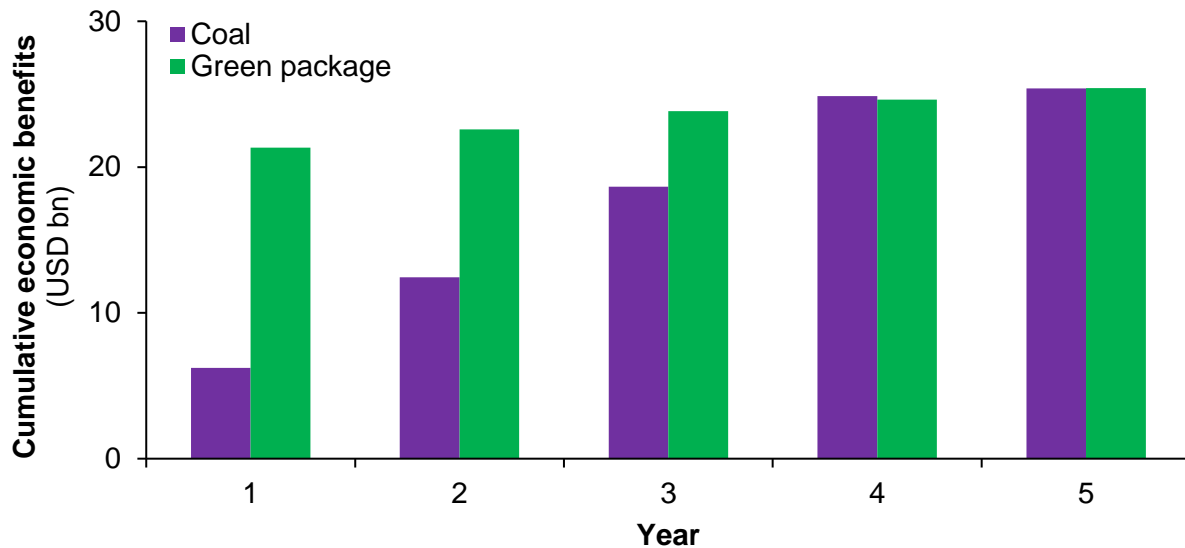


Figure 6.5 Economic value of green and coal recovery options for China. Source: Vivid Economics.

**Over the first ten years of the recovery, the alternative green stimulus package would result in 350Mt less CO<sub>2</sub> being released into the atmosphere.** The modelling results include both the direct emissions (emissions generated by the activity itself), and indirect emissions (those generated within the supply chain). While the CO<sub>2</sub> emissions during the manufacturing, construction and installation of the investments is similar for the green stimulus package as coal (30Mt and 24Mt respectively),<sup>23</sup> the mitigation benefits of the green recovery are clear during the operational phase. While the expansion in coal generation is expected to increase CO<sub>2</sub> emissions by 24Mt a year during the operational phase, the alternative green stimulus package would provide mitigation benefits of 27Mt.

**Shifting from coal to a green investment reduces air pollution, resulting in 59,000 fewer deaths and 56,000 fewer birth complications over the next ten years.** For a given year during the operational phase, the expansion in coal generation, with associated increase in PM<sub>2.5</sub> emissions is expected to result in an additional 11,000 premature deaths from pulmonary disease, lung cancer, stroke and heart disease among adults. Exposure to PM<sub>2.5</sub> is also linked to adverse pregnancy outcomes, including low birth weight (defined as live birth weighing less than 2,500g) and pre-term birth (defined as birth before 37 weeks of gestation). The expansion in coal generation is expected to result in an additional 3,300 babies with low birth weight and 5,900 pre-term births each year of the operational phase. The reduction in energy usage associated with the green recovery, in contrast, would reduce PM<sub>2.5</sub> emissions and result in modest improvements in infant health outcomes. Furthermore, pre-term birth is the second largest direct cause of child deaths in children younger than 5 years (Blencowe et al, 2012). The increased incidence of pre-term births associated with expansion in coal generation could therefore increase infant mortality by 360 deaths each year.

<sup>23</sup> The modelling was unable to capture the fact that a green stimulus package may rely more heavily on green manufacturing processes, which would mean the CO<sub>2</sub> emissions during the investment phase for the green recovery package are likely to be an overestimateoverestimation.

## 6.4 Policy Recommendations

The government of China should act now to begin the transition towards a low-carbon, sustainable economy. Injecting support for this green transition would protect the economy from global tailwinds and shift the economy to a path consistent with a Net-Zero 2060 commitment. In the short term, policy recommendations focus on three areas: (1) the energy transition, (2) green urbanisation and (3) investment in ecosystem restoration.

### 6.4.1 Energy transition investment

Transitioning China's energy system from fossil fuel driven production to low-carbon alternatives is critical to meeting the goal of economy-wide carbon neutrality (S&P Global, 2020). This transition also offers significant economic and environmental co-benefits, making it a triple win in the short term. Priority investments include in wind and solar capacity, ultra-high voltage transmission lines, energy storage solutions and the advanced forms of grid management required to integrate renewable energy resources (RMI/ETC, 2020).

For China to achieve its decarbonisation objectives, there needs to be widespread electrification, with all additional electricity supply coming from zero-carbon sources (RMI/ETC, 2020). Such a transition is both technically and economically feasible. In China, new wind and solar capacity instalments outcompete new coal on a cost basis and energy storage costs have also fallen (He et al, 2020). China is the world's largest manufacturer of wind turbines and solar panels, and economies of scale have significantly reduced the cost of these technologies (Zhou, 2019). According to the Carbon Tracker Initiative (2020), in 2020 it was cheaper to build new wind energy capacity than operating existing coal power plants. A recent study found that if China generated 62% of its electricity from non-fossil sources by 2030, the overall cost would be 11% lower than a business-as-usual approach (He et al, 2020).

Continued investment in coal also hinders China's ability to reach its ambitious Net-Zero 2060 commitment. In 2019, coal accounted for 70% of China's carbon emissions (He et al, 2020). Modelling output from Vivid Economics shows that announced support to the coal sector before August 2020 is expected to increase CO<sub>2</sub> emissions by 24Mt a year once the increased capacity is online. Furthermore, coal's dominance in China's energy mix has had significant public health consequences. In 2017, outdoor air pollution contributed to an estimated 1.2 million premature deaths, and indoor pollutants resulting from Chinese households burning coal caused 750,000 deaths from respiratory diseases (He et al, 2020). Vivid Economics' modelling shows that announced expansion in coal generation will result in an additional 11,000 premature deaths each year.

Compared to spending on coal, investment in clean energy programmes could bring more jobs in the short term while decreasing climate risk and dramatically improving health outcomes. The investment needs to support decarbonisation in the energy sector are high, and government coordination and policy reform is needed to support private as well as public investment in the sector. In China, annual investment in energy infrastructure will need to increase by USD 250 billion to hit a two-degree-compatible target (Myllyvirta, 2020), equivalent to 1.5-2.0% of China's annual GDP. Additional investment will be required in both centralised (such as renewable generation, transmission and distribution infrastructure and CCS capacity) and decentralised (such as small-scale generation, storage and charging and refuelling infrastructure) new energy technologies. To support the deployment of capital for new energy infrastructure, the government should focus on:

- **Legislating long-term climate commitments and targets to demonstrate commitment to transitioning the energy system.** The announcement of the 2060 Net Zero commitment is an important first step, but to encourage private sector investment, more steering from the government is needed on energy sector policy. This will provide the private sector with long-term certainty on revenues, which is essential for large capital outlays
- **Efficient market design and flexibility options, which reduces the overall need for new energy generation infrastructure.** For example, aggregating distributed energy resources under a single entity allows for optimal utilisation of existing energy infrastructure, with even greater benefits when intermittent renewable energy infrastructure is also integrated. Implementing market design and flexibility options requires high-level coordination across the energy system, meaning that national governments are best placed to carry these policies and regulations forward. However, subnational governments can play an important role in supporting implementation on a more localised level
- **Establishing clear funding models by completing markets through carbon prices, subsidies, tax offsets and other revenue sources.** The emissions trading scheme for the coal sector is an important first step, but expansion to further sectors will be important for guaranteeing revenue streams for new energy infrastructure as well as encouraging better utilisation of existing infrastructure

#### 6.4.2 Green urbanisation investment

Efficient investment in green urbanisation initiatives could provide significant economic and social value following the COVID-19 pandemic. China continues to urbanise at pace – in 1980 19.4% of China’s population lived in urban areas, in 2020 this had increased to 61.4%, and by 2050 it is forecast to be 80.0% (UN DESA, 2018). This means that over the next 30 years, Chinese cities are expected to accommodate an additional 255 million residents. However, Chinese cities today face major challenges resulting from this rapid expansion, challenges which need to be addressed if urbanisation is to continue to support economic transformation and prosperity. Urban population growth has exceeded the development of basic infrastructure and services, resulting in traffic congestion and shortages in education, healthcare and social support (Stern and Ye, 2020). The rapid pace of urbanisation has put pressure on the natural environment, this is set to worsen with climate change. More than 95% of China’s megacities experience water shortages, and in 2018 only 121 of China’s 338 cities at the prefecture level or above met the country’s ambient air quality standards (Ye et al, 2020). The development of coastal hubs has been a key driver in China’s export-led growth; however, this has resulted in 130 million urban residents living in coastal areas less than 10 metres above sea level now threatened by climate change induced sea level rise (Ye et al, 2020).

The COVID-19 recovery presents China with an opportunity to address its emerging urban challenges while supporting employment and decarbonisation. Premier Li Keqiang recently called for a new model of domestic urbanisation (RMI/ETC, 2020), one which is high-quality, sustainable and efficient. The China Council for International Cooperation on Environment and Development have called for a “nature-loving” city model, where biodiversity and ecosystem services are integrated into planning (CCICED, 2020). Ye and Stern argue that the dual circulation strategy described in Section 4.2.1 can be enhanced through the shift from coastal mega hubs to smaller, well-contained clean, compact and connected cities in the interior (Stern

and Ye, 2020). Three priority areas for urbanisation are building efficiency, urban greening and transport infrastructure.

Improving building efficiency in China would deliver both strong environmental and economic benefits. Modelling by Vivid Economics shows that, in China, investments in building efficiency can create 68 job years in the short term for every USD 1mn invested, significantly higher than the equivalent employment boost for coal investments (58 job years). Investments in energy efficiency could have important mitigation benefits, by 2016, China's building sector accounted for 20% of total energy consumption and 25% of greenhouse gas emissions (C40, 2018). China has mandatory energy efficiency codes for urban residential and commercial buildings, and promotes voluntary energy efficiency codes for rural residential buildings. However, there is scope for acceleration on retrofitting. Changning District in Shanghai has been a leader in coordinating local action on retrofitting in commercial spaces, through offering subsidies to incentivise private action and rolling out a retrofit programme across half of the district's public commercial floor space. This programme has demonstrated the environmental, economic and social benefits of retrofitting (Ye et al, 2020). Environmentally, the programme has reduced energy use in the public commercial floor space by 20-30% and a study has shown that extending the programme across Shanghai would save nearly nine metric tonnes of CO<sub>2</sub> equivalent, the same as removing three million cars from the road. The programme has had good financial returns, with a payback period of four years. In addition, co-benefits have included improved indoor conditions for building users, new green jobs, higher real estate values and better local air quality.

Addressing urban challenges in China also requires improving local environmental quality to deliver liveable green cities. Urban greening interventions, such as site clean-up, the reintroduction of simple ecosystems, urban tree planting and sitting new parks, can offer large economic and health benefits for urban areas (Vivid Economics, 2020c). These interventions can also improve urban drainage and bolster flood resilience. In China, the Sponge City Programme was launched to reduce urban flood risks in 16 pilot cities, encouraging the adoption of measures such as absorptive roads and permeable pavements; green infrastructure, such as rain gardens, parks and wetlands; and built-environment measures such as green roofs and rainwater reuse facilities. The nature-based approach adopted in Wuhan, in Hubei Province, not only delivered cost benefits relative to grey infrastructure, but supported improved air quality, biodiversity, conservation, public health and increased land value retrofitting (Ye et al, 2020).

As cities grow, well-designed transportation systems are key to delivering economic efficiency and addressing air pollution challenges. To support decarbonisation, China should continue to prioritise low-carbon mobility such as walking, cycling, public transport and continued rollout of electric vehicles. In urban centres, a key challenge can be to reverse historical auto-centric development to encourage the adoption of active modes and public transport. Key actions for a comprehensive and financially sustainable policy support package in this space include:

- **Efficient urban design which incentivises alternative transport.** For example, in Paris, the introduction of "15-minute neighbourhoods" will encourage self-sufficient communities where people's everyday needs (shops, parks, schools, etc.) can be met with just a short walk or bicycle ride. Similarly, enhanced and protected spaces for cyclists and pedestrians not only reduces emissions and air pollution, but supports public health



- **Deterring traditional car use, including through city centre bans, congestion pricing and low-emission or low-transport zones.** China is considering testing a ban on gasoline-powered vehicles in certain parts of the country
- **Incentivising neighbourhood electric vehicles (NEVs).** While China is already a global leader in NEVs, deployment can continue to be supported through politically ambitious targets, regulation on the supply side (such as through emissions obligations), sales phase-out and the large-scale deployment of interoperable infrastructure. Recently, Hainan became the first province to confirm a ban on ICE vehicle sales by 2030 (Roskill, 2020), action which could be extended into other Chinese provinces or cities

### 6.4.3 Ecosystem restoration investment

Addressing environmental degradation in China is a major public priority. Over the next 15 years, ecosystem restoration will be one of China's major development goals, with priorities including: achieving a "Beautiful China", addressing air, water and soil pollution concerns, and tackling problems of solid waste (Energy Foundation, 2020, Stern and Ye, 2020). These aspirations are key to China's commitment to building an 'ecological civilisation', an aspiration re-emphasised during President Xi's visit to Shaanxi Province in April 2020 (Hepburn, Stern, Xie and Zenghelis, 2020). China is a global leader on this, being a co-leader of the Climate Action Summit's Nature Based Solutions action area.

Investment in ecosystem restoration is an important building block for a green recovery due to its economic, environmental and social benefits. Afforestation and reforestation, wetland and coastal restoration and soil and water decontamination are all highly labour-intensive. Vivid Economics' modelling suggests that sustainable reforestation is the most job-intensive of all interventions modelled, boosting short-term employment by 94 job years for every USD1mn invested. As well as the initial implementation benefits, ecosystem restoration can provide a long-term boost in existing and new sectors. A WEF report found that that USD 2.7 trillion of China's GDP is exposed to nature loss (WEF, 2020). In the late 1990s, the "Grain for Green Programme" was established in China's Loess Plateau to restore agricultural land and combat soil erosion through sustainable farming practices. The programme lifted 2.5 million people out of poverty through enhanced agricultural productivity and employment diversification (World Bank, 2007). A further 12 million jobs in China could be created in new sustainable agriculture opportunities (Nature4Climate, 2020). Tourism is another key sector which can be strengthened through ecosystem protection and restoration. In China, forest-based recreation and tourism in forest parks generates about USD 3.3 billion in entry fees (Nature4Climate, 2020).

There are a diverse set of environmental and related social benefits associated with ecosystem restoration and nature-based solutions for climate change. Vivid Economics modelling suggests that there could be 3.2 Mt CO<sub>2</sub> average annual abatement for every USD1mn invested in sustainable reforestation. In addition to mitigation benefits, these investments would protect nature, stemming biodiversity losses and supporting the recovery of important ecosystem services such as air and water quality (Vivid Economics, 2020c). Climate resilience is another important benefit, in western China's Upper Yangtze River Basin flood mitigation benefits from forestry annually reduce storm and flood damages by USD 1 billion, and mangroves in coastal areas protect 800,000 people and USD 19 billion of property damage each year (Nature4Climate, 2020).

## 6.5 Funding and financing recommendations

To maximise the green impact of public COVID-19 recovery spending, the Chinese government should primarily target the effective (re-)allocation of public spending at national and subnational levels, at the same time as building towards shifts in the financial system to encourage and enable private green investment in the near and long term. Chinese policy-makers should consider (i) direct public investment in green infrastructure through government bodies or state-owned enterprises, (ii) recycling revenues from carbon pricing initiatives, (iii), city-level environmental tax and charge policies and reforms and (iv) enabling private green investment through blended finance and green financial sector reform.

### 6.5.1 Direct public investment in green infrastructure

Despite the additional financial strains from the COVID-19 crisis and associated economic challenges, China retains substantial ability to directly finance national infrastructure investment, given high demand for Chinese sovereign debt and increasing attractiveness relative to other mature bond markets (Cheng, 2021). The Chinese government and/or state-owned enterprises could deliver substantial economic, environmental and social value through direct investment into green recovery projects and assets. Direct public spending has the advantage of being able to deliver benefits rapidly, without the need for other actors to be brought in or incentivised to deliver investments. However, investment activity through SOEs should also bear in mind the potential future challenges from high corporate indebtedness which may constrain future investment or economic development options – a challenge which has been seen following high SOE debt following responses to the 2008 economic crisis (Koty, 2020).

### 6.5.2 Recycling revenues from carbon pricing initiatives

China has run several successful ‘pilot’ subnational emissions trading schemes (ETSs) since 2013 and in 2015 announced plans to develop a national ETS, which was launched for the power sector in February 2021. Depending on the success of the power ETS and ongoing design of other facets of a multisectoral ETS, the system could generate new revenue streams to support green investment – for example, through auctions of emissions allowances to participants (IEA, 2020). While initial allocations under the ETS are free to participants, the expectation is that auctioning will be introduced as the scheme progresses (ICAP, 2021; Jia, 2021). This revenue can be used to support green investment – but importantly also offers an opportunity to help ensure a Just Transition by re-investing to support workers or communities that may lose from economic realignments during a low-carbon transition. This spending could include worker retraining support, support for new climate and green entrepreneurship and innovation and/or greater social safety nets (Stern et al., 2020). Analysis of potential design options for the ETS suggest that revenue recycling through the ETS could support substantial renewable energy investment, but also suggests high benefits from using a portion of revenues to support social benefits (Lin & Jia, 2020; Huang et al., 2019).

### 6.5.3 City-level environmental tax and charge policies and reforms

Chinese cities could introduce a range of tax and charge policies and reforms to both incentivise low-carbon activities and investments within cities and to provide transparent and stable revenue streams to support city-level public investment in green recovery projects (Stern et al., 2020). These revenue options may include local taxation reform, vehicle congestion charging, emissions- or pollution-based charging for vehicles and local industrial

polluters and ‘fee-bate’ models where fees from non-green activities are automatically recycled to support green investments, such as electric vehicles.

#### 6.5.4 Enabling private green investment through blended finance and green financial sector reform

Green finance has developed rapidly in China over recent years, supported and driven by directives from the central government, including the 2016 guidelines for *Establishing the Green Financial System*. While Chinese banks have adopted a range of green incentives and instruments to support investments, the overall level of green investment remains relatively low (for example, at around 10% of overall credit balances) (Choi et al., 2020). Additionally, several challenges remain to the effective scaling up of green finance and the integration of green policies and processes across the financial sector. Reform of the financial sector to support, encourage or mandate green investment can support the continued expansion of non-government green investment in the near term and the long-term alignment of financial flows with a low-carbon sustainable future. Priority reforms include increased support for transparency across the financial sector and the adoption of sound green banking standards and green regulation – particularly the development of climate risk modelling and management – and the development of stronger financial incentives for banks to prioritise green investment (Hepburn et al., 2020; Choi et al., 2020).

### 6.6 Governance Recommendations

Strong leadership and coordination will be essential to leverage stimulus spending to deliver the green transition required by China's Net Zero 2060 commitment. Relative to other major economies, China has greater capacity for long-term industrial planning. Nevertheless, the productive priorities of some voices within the central government may face stiff resistance from vested interests in provincial governments, State-Owned Enterprises and certain national ministries. For example, despite long-standing national commitments to reduce coal expansion, in 2020, Inner Mongolia approved power and industrial facilities with annual energy demand equivalent to 80 million tonnes of coal and approved 10.1GW new coal-fired power stations (Lo, 2021). Incentives to maximise short-term economic activity have encouraged local governments to deliver economic rebound, even at the cost of high emissions. Similarly, State-Owned Enterprises such as the State Grid Corporation have historically been resistant to power sector reforms. Recently, the Central Environmental Inspection Team (CEIT) criticised the National Energy Administration (NEA) for failing to limit coal expansion and promote low-carbon energy (Carbon Brief, 2021). The inspection reported that the NEA failed to prioritise environmental protection in its approval, verification, supervision and regulation of all the nation's energy-related assets, and has failed to support President Xi's “war on pollution”. The CEIT report has been described by commentators as a “highly encouraging development” and a signal of top-of-government support for an energy transition (Carbon Brief, 2021).

To ensure alignment on green stimulus, the central government will need to demonstrate strong commitment and leadership. The mainstreaming of the Net Zero 2060 commitment within the 14<sup>th</sup> Five-Year Plan, to be released in March 2021 will be important for demonstrating policy leadership and clearly outlining plans to all stakeholders on government action (for example, the development of complementary infrastructure). CEIT has an important role exposing the vested interests which perpetuate investment in high-polluting industries at the institutional level. CEIT boosts the Ministry of Environment and Ecology (MEE) by enabling

them to enforce environmental laws and regulations and hold actors accountable. Further boosting the MEE with human and financial resources and increasing its administrative authority could be an important next step (Carbon Brief, 2021).

## 6.7 Co-considerations

Three high-priority considerations are examined here: policy time frames, targeting and equity and considerations specific to COVID-19.

1. **Policy time frames.** While it is tempting to focus on policies that will generate the greatest benefits in the shortest amount of time, longer acting policies are crucial for a smooth transition away from fossil fuels and can also garner high long-run multipliers (Hepburn et al., 2020). By investing in policies with a range of effective durations, China can ensure a short-term growth curve that smoothly transitions into a long-term curve. This reflects a focus on using short-term stimulus to support long-term plans to achieve carbon neutrality for the Chinese economy by 2060.
2. **Targeting and equity.** COVID-19 has disproportionately impacted more vulnerable citizens, particularly those in rural areas and workers on lower incomes, due to both the incidence of economic impacts and the weakness of social safeguards (Hernandez, 2020). At the same time, climate change is also likely to be particularly harmful for lower income and marginalised communities (Roberts, 2001). These groups have the most to gain from effective stimulus policy, and it is incumbent upon the Chinese central and provincial governments to ensure that the recovery in China is equitable, poverty-reducing, just and inclusive. Additionally, targeting incentive-based policies towards low-income groups is also likely to generate the highest economic benefits due to the high marginal propensity to consume of such communities (Jappelli & Pistaferri, 2014). For example, this could include designing ecosystem restoration interventions to support low-income groups and communities that directly rely on ecosystems for subsistence living or their livelihoods. A key focus for a Just Transition in China is likely to be supporting workers in the countries' coal industry and in coal-reliant high-carbon industries, where support could include retraining for new green sectors and opportunities.
3. **COVID-19 considerations.** While China has seen a relatively stronger and faster recovery from the initial COVID-19 crisis relative to other major economies, the potential for outbreaks remains – particularly given the increasing spread of novel COVID-19 variants with increased transmissibility. Given the potential for such outbreaks and associated pandemic management responses such as tight lockdowns to derail the anticipated economic recovery, it is important that stimulus policies in China incorporate COVID-19 safety protocols. Best-practice approaches to manage and reduce risk of COVID-19 transmission will vary across different types of activities such as green infrastructure construction, green technology manufacturing, agriculture and forestry and green financial service provision, but could include maintaining distance between workers, limiting the frequency and duration of contact with co-workers and/or customers (particularly when indoors), use of personal protective equipment to reduce the risk of airborne transmission and maintaining clean shared equipment or facilities. These protocols may be needed both in places of work, and also for shared work-related transportation or accommodation (CDC, 2020, 2021a, 2021b, 2021c). Where new opportunities stimulate within-country migration to new

centres of employment, green employers may also need to encourage appropriate measures to mitigate COVID-19 spread, such as periods of self-isolation before incoming employees commence work.

## 6.8 Conclusion

**By pursuing green investments in response to COVID-19, China has a clear opportunity to build on its emerging economic rebound while also improving public health and addressing structural economic imbalances to reduce GHG emissions to support its 2060 carbon neutrality goal.** The green recovery options and impacts discussed in this roadmap demonstrate that Chinese policymakers do not need to choose between targeting green and social outcomes and prioritising economic growth in the aftermath of the economic crisis brought on by COVID-19. By targeting a low-carbon energy transition, green urbanisation and ecosystem restoration, China can pursue a green investment pathway that delivers strong economic, environmental and social returns.

**The policy, funding, financing and governance approaches set out in this report provide a potential roadmap for China to embed green priorities within its continued economic recovery while also accelerating its transition towards a longer term low-carbon development pathway.** By targeting the broader environmental and social benefits delivered alongside critical economic recovery outcomes, a green recovery approach can deliver near-term benefits while also helping shift China's economic development trajectory towards a sustainable future in line with its target of carbon neutrality by 2060. The recommendations presented demonstrate China's options to broaden the engagement of international investment flows and to implement new funding approaches to provide sustainable long-term support for this green future, and its options to ensure that the benefits from a green economy are shared by all.

## 7 Case Study C: Green Recovery for a Prosperous Poland

### 7.1 Executive Summary

**We find that government recovery investment in green initiatives in Poland could simultaneously stimulate the economy, reduce carbon emissions and save lives. This could be done with the direct financial support of the European Commission.**

Crippled by the COVID-19 pandemic, the Polish economy contracted by 2.7% in 2020, with its projected growth of 4.8% in 2021 not fully wiping out this damage (EC, [July 2021](#)). Poland's two decades of relatively strong economic growth and falling unemployment prior to the pandemic have effectively been reversed. Yet, coming into 2020, some sectors of the economy were already underperforming, chief amongst them, the coal sector. While Poland enjoyed economic windfalls from coal mining and coal-fired electricity production in the 20th century, increasing production costs and rapidly declining profits mean that there is no longer a future for coal in the country.

**Economic recovery from COVID-19 provides the chance for Poland to prioritise future prosperity.** One of the greatest chances to do so is by leveraging economic opportunities in future industries, many of them green, allowing Poland to both ameliorate its pandemic-induced hardships and prepare its economy to capitalise on growing green industries. Investment in the clean energy transition and other clean industries has the potential to provide significant immediate stimulus benefits, generate long-term jobs and growth and boost health outcomes.

**Supporting modelling from Vivid Economics suggests that a Polish green stimulus package funded purely by an additional EUR1.75bn unlocked from the EU Just Transition Fund could generate 46,000 job years and save 2Mt in CO<sub>2</sub> emissions per year (equivalent to 0.7% of total emissions).** Of the six modelled investment initiatives (Figure 7.1), sustainable reforestation measures present the highest job creation figures, followed by industrial energy efficiency and various renewable energy investments.

**Five key policy recommendations for a green recovery are highlighted in this roadmap for further investigation.** These policy areas provide an opportunity to secure a swift economic recovery while making progress towards existing social and environmental priorities:



**Residential energy retrofits:** Green retrofits are known to be some of the most effective fiscal stimulus policies when they are targeted towards low-income individuals. Residential rooftop solar, as well as the replacement of coal-fired heating and cooking systems, could create jobs quickly and make much needed improvements to indoor air pollution, with positive health consequences.



**Electric vehicle investment:** Poland has already made large investments in electrifying its vehicle fleet through domestic manufacturing, and a further expansion of these investments could be a key driver of future growth. Investments in electric public transport could also help address air pollution and increase accessibility for underserved communities.



**Renewable energy investment:** It is clear that Poland’s once booming coal industry is rapidly declining, and the necessary shift to renewable energy has the potential to create many sustainable jobs in both the short and long term. With renewed ambitions in electric vehicle production and use, expansions in solar and wind electricity generation will be crucial for meeting increased electricity demand.



**Natural capital and green spaces investment:** Investments in reforestation efforts across Poland could be a powerful generator of new jobs, while reducing air pollution and increasing resilience to climate change. Existing afforestation programmes could be bolstered to speed the process, although biodiversity must be prioritised.



**Green worker retraining programmes:** Poland is facing an enormous shift in the composition of its economy, and the gap between the skills of today and those required for growing green industries may present a barrier for future growth. A strong green skills training programme, especially in regions reliant on fossil fuel jobs will be necessary to meet the demand for new skills whilst improving employment outcomes for low-skilled workers.

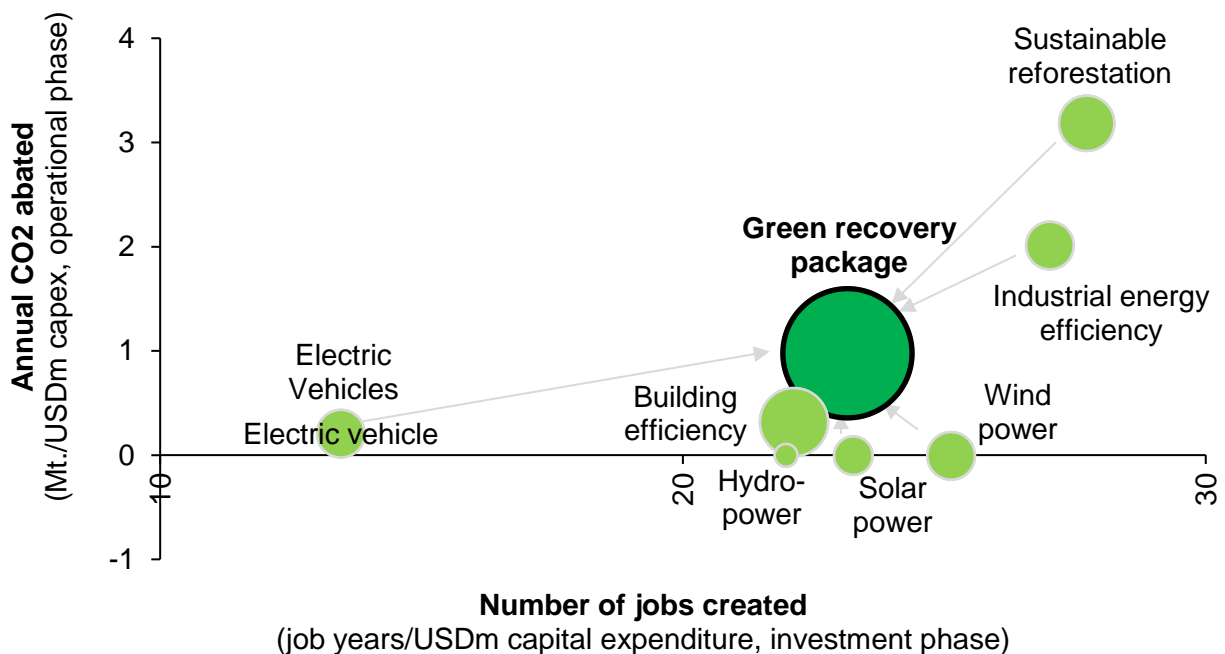


Figure 7.1. Job creation potential vs. CO2 reduction potential of green fiscal investment initiatives in Poland. Size of bubbles indicate the scale of capital investment modelled for each intervention. Source: Vivid Economics.

**Financing, governance, and worker retraining recommendations described here could help support a green Polish recovery and maximise the impact of spending in the five priority policy areas.** Crowding in private investment should be a policy design priority; co-financing projects with local and regional governments is likely to maximise both the economic multiplier and the effectiveness of these policies in addressing other social and environmental concerns. Setting a net-zero emissions target could be a valuable strategy for Poland to secure additional funding through the European Commission and enhance domestic prosperity. A dedicated task force for coordinating green recovery efforts is also recommended to coordinate messaging and communication with private investors and maximise economic impact.

## 7.2 Introduction

After three decades of positive economic growth, the Polish economy slipped into a pandemic-induced recession in Q3 2020 (World Bank, 2020). Continued weakness in the country's once flourishing coal industry aligns with increasing federal recognition that the industry must be phased out. A landmark agreement signed by Polish coal labour unions in September 2020 establishes a pathway for closing all coal mines by 2049.

In this context, there is vast evidence to suggest that Poland's strongest option for a swift and sustainable economic recovery is one that prioritises future prosperity by creating jobs in the clean energy transition and long-term high-growth pathways in other clean industries. This report explores the context in which Poland will make its recovery policy decisions and details five key policy recommendations with high economic impact potential and other environmental and social benefits. Options for funding and financing are highlighted, as well as suggestions for implementation strategies and important co-considerations. This roadmap demonstrates the capacity for green policies to enhance recovery efforts and configure a future-oriented stable and sustainable Polish economy.

## 7.3 Economic context for green recovery spending

### 7.3.1 Pre-pandemic Poland

Headline economic figures have followed a positive trend in Poland for several years (Statistics Poland, 2020). However, several structural weaknesses were already plaguing the nation prior to the pandemic. Despite some positive policy efforts, inequality in Poland has been persistent and rising over the last few decades. This has manifested in disparate health and well-being outcomes between high- and low-income earners (Tashin, 2020), as well as differences in opportunities for education and income inequality (Bukowski & Novokmet, 2019). Although net national unemployment has followed a downward trajectory since 2014, there are large regional and demographic disparities in this trend. In 2019, unemployment stood at 2-3% in the regions of Poludniowy and Północno-Zachodni, but neared 5% in eastern region of Wschodni (Eurostat, 2020b). This discrepancy predicts similarly unequal general health and well-being outcomes (OECD, 2018). Youth unemployment continues to exceed the national average, with Wschodni exhibiting the highest regional youth unemployment of all regions at 16.2% in 2019. Due to its reliance on fossil fuels, Poland has the worst air pollution of any country in the European Union, containing 36 of the 50 most polluted cities in the EU (World Bank, 2019). In addition to other behavioural factors, this has led to high prevalence of respiratory illness within the country, with approximately 48,000 individuals dying prematurely due to ambient PM2.5 air pollution annually (WHO, 2017; Zielonka, 2018).

Poland is the coal giant of Europe, accounting for ~95% of hard coal production across the European Union in 2019 (Eurostat, 2020a). The coal industry dominates electricity production and consumption in the country. Approximately three quarters of Polish electricity is produced from coal (Macuk, 2020) and the country accounts for over one-third of total EU hard coal consumption (Eurostat, 2020a). Despite this, the cost of coal mining in Poland has increased in recent years and the unsustainable practice is showing cracks, with many major coal companies facing significant losses in 2019 (Kość, 2020). High domestic production costs have precipitated significant coal imports despite the domestic surplus.



Public subsidisation of conventional coal and gas power generation over the period 2013-18 averaged PLN4.8bn per year, the far majority of which was funded under the EU ETS (Stoczkiewicz, & Śniegocki, 2020). Subsidies for existing coal generation in 2021 are expected to total PLN5.4bn, including EU-funded capacity payments at a cost of PLN3.9bn. These payments are set to continue until at least 2025, at which point new EU exclusions prohibiting support of power generation with >550g CO<sub>2</sub>/kWh emissions will come into place (European Commission, 2019). Other forms of Polish coal generation subsidies include free CO<sub>2</sub> permits, reserve payments and non-compliance with air pollution limits (Śniegocki, 2017).<sup>24</sup>

Renewable energy has historically played a minimal role in the Polish energy system (IEA, 2020a). Over the last decade, however, Poland has seen some investment in renewable energy systems such as wind power through significant private investments supported by federal subsidies (Gnatowska & Wąs, 2017). Poland is the only EU member not to have set a net-zero emissions target; establishing such a target is likely to assist Poland in fostering a more mutually positive relationship with the EU.

### 7.3.2 Impact of COVID-19 on Polish economy and society

Like most economies around the world, Poland has experienced economic hardships due to the COVID-19 pandemic. It is on track for a deep recession after decades of relative economic stability (World Bank, October 2020). Sectors that have been particularly badly impacted include construction (SPECTIS, 2020, as cited in Jones, 2020) and tourism (Korinth & Ranasinghe, 2020), though Poland's relatively diverse economy has cushioned some of the worst effects of the pandemic. Despite the country's relatively weak healthcare system, as evidenced by the low share of doctors per population (Laszek & Visio Institute, 2020), early and stringent lockdown measures have shielded Poland from COVID-19 outbreaks of the magnitude seen in other areas of Europe early in the pandemic. However, the effects of large outbreaks in October and November 2020 are still being felt in 2021, and the magnitude of their impacts on the Polish economy, while not yet completely clear, is expected to be significant. COVID-19 has also highlighted regional disparities, with some areas experiencing relatively little change in unemployment rate and others with increases of up to 5.2% year on year (OECD, 2020).

### 7.3.3 Policy responses during the pandemic

The Polish government has employed significant fiscal measures during the pandemic to support the welfare needs of citizens, carry the liquidity requirements of businesses and keep the domestic economy afloat. Total rescue-type spending has totalled PLN349bn, many multiples higher than the PLN32bn so far directed to longer term recovery measures (O'Callaghan et al., 2020). Other nations have begun spending significantly on recovery, setting a pathway which Poland might also follow (Figure 7.2).

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<sup>24</sup> A now outdated 2017 WiseEuropa study projected that without significant reform Polish subsidy of coal-fired electricity generation may reach PLN5.4bn per year over the period 2017-30, including PLN2.9bn on capacity payments, PLN2.3bn on free emission allowances and PLN0.16bn on reserve power costs (Śniegocki, 2017).

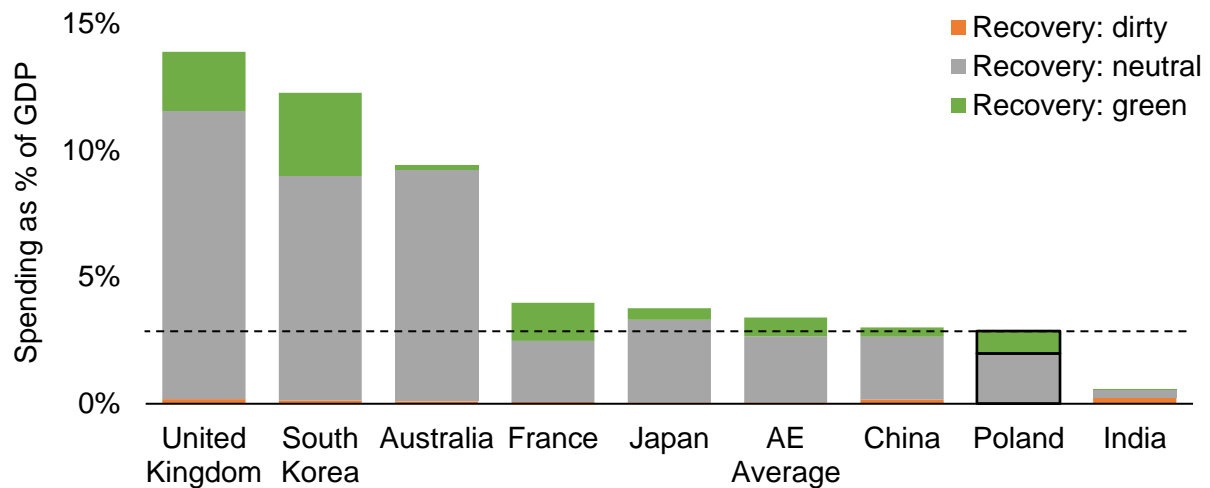


Figure 7.2. Composition of recovery investment in key geographies to May 2021. AE average: Advanced Economy average weighted by GDP. Source: Global Recovery Observatory.

So far, targeted coal sector COVID-19 support has been relatively light, mostly due to (i) limitations on the use of tied European Commission (EC) funding for fossil investment, (ii) a complex and shrinking coal mining industry and (iii) a widespread acknowledgement of the economic fallibility of new coal-fired generation following PKN Orlen's announcement that Poland's supposed 'final coal plant' will now be gas-fired (Walstad, 2020). The extent of announced COVID-19 coal mining support has so far been limited to PLN1.75bn in preferential credit to enable the JWS mining group to maintain liquidity (Polityka Insight, 2020).

With increasing federal recognition that the coal industry is losing economic viability; some recent Polish recovery spending has been directed at facilitating a transition to clean energy. This includes a green investment package announced in June with significant measures to support the manufacturing of electric vehicles in Poland (PLN70mn), expanded charging infrastructure (PLN165mn) and incentives for individual consumers and businesses to invest in electric vehicles (NFOSIGW, 2020). There have been investments in both offshore and onshore wind farms of at least PLN368mn (European Commission, 2020b), and a PLN100mn expansion of a residential solar installation programme (CIRE, 2020).

#### 7.3.4 Green stimulus to catalyse future prosperity

Large-scale COVID-19 vaccination programmes may allow Polish policymakers to shift focus from fiscal rescue-type spending to recovery-type spending. Over the coming months, policymakers must consider how to reinvigorate the domestic economy; the optimum response will consider social, environmental and economic impacts to maximise future prosperity. To meet these simultaneous objectives, attention should be directed to policies that both create jobs and support the decarbonisation of the country.

Vivid Economics model the economic and environmental impacts of a green stimulus package funded purely by the EU's Just Transition fund. By directing an additional EUR1.75b from the Fund to green investment, Poland could benefit from short-term employment benefits while also transitioning to a more sustainable economy. Investing Just Transition Funds into a green recovery (see for Figure 7.3 package composition) could realise an additional employment

boost of 46,000 job years in the investment phase, and 2 million tons less CO<sub>2</sub> emissions per year over the operational phase (Figure 7.4).

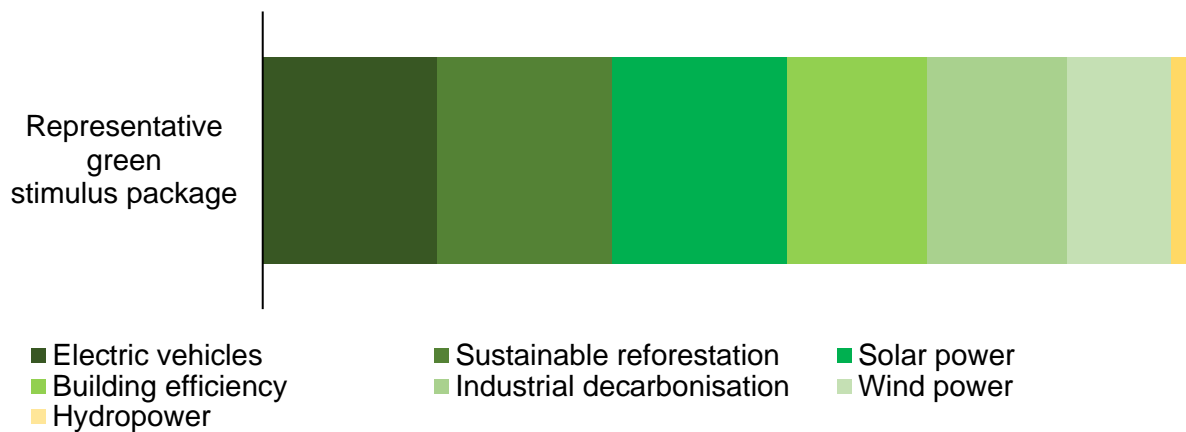


Figure 7.3 Distribution of capital expenditure towards different interventions in illustrative green stimulus package, Poland. Both packages are illustrative with composition justified in Table 4.3. Source: Vivid Economics.

	a more jobs-intensive recovery <sup>1</sup>	progress towards sustainability <sup>2</sup>	size of modelled stimulus package
If Poland accessed additional Just Transition Funds through a Net Zero commitment, it would benefit from...	an additional employment boost of 46,000 job-years	2Mt fewer CO <sub>2</sub> emissions, 0.7% Poland's annual emissions	USD 2.0bn

Figure 7.4 Benefits of a green recovery in Poland. Note: The superscripts indicate the time frame of the results: 1 Total during the investment phase; 2 For a given year during the operational phase. Source: Vivid Economics.

Vivid Economics' modelling indicates that not only can green investments reduce carbon emissions, but they could also secure significant economic and social benefits. Select green investments could create up to 28 job years per million dollars spent, and an illustrative balanced green recovery package, which brings together many green investment initiatives, could create 23 job years per million dollars spent (Figure 7.5). Supplementary research indicates that compared to traditional forms of spending, green investment can deliver substantially more jobs as well as economic products (Hepburn et al., 2020; O'Callaghan et al., 2021a; O'Callaghan et al., 2021b).

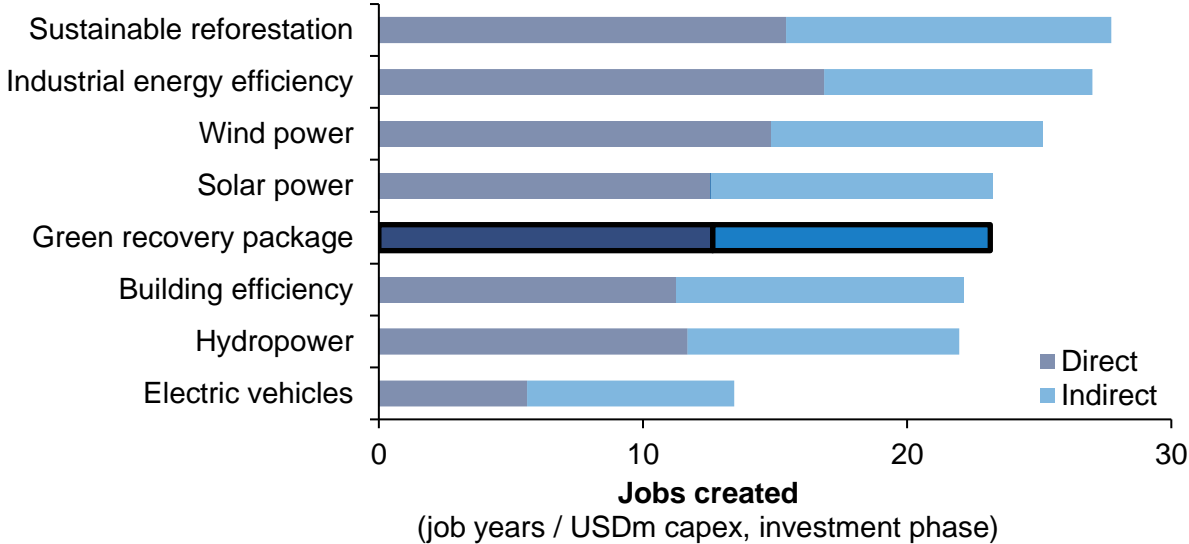


Figure 7.5 Job creation for USD 1 million capital expenditure by intervention, investment phase, Poland. Notes: 'Green' refers to the green recovery stimulus package on whole. Source: Vivid Economics.

Although coal served Poland well in the past, the sector is now in its final days; many Polish coal-fired power plants were built half a century ago with limited lifespans (International Trade Administration, 2020), and any new investment in new coal-fired power plants would be loss-making due to the price of coal in comparison to other energy sources (Walstad, 2020). This factor, among many others, supports the case for a green stimulus as perhaps the most economically attractive pathway for ensuring long-term energy security and social prosperity. With respect to long-term recovery spending, Poland is yet to make investments of significant magnitude in comparison to many of its European and global neighbours (Figure 7.2). Some early green spending, especially in electric transport is testament to policymakers understanding the value of a recovery driven by green investments in Poland. Further spending will be necessary to keep up with global counterparts. Though much is still to come, some nations have already begun making significant investments in green recovery, though green spending among advanced economies is greater both in magnitude and in diversity of policy types (Figure 7.6).

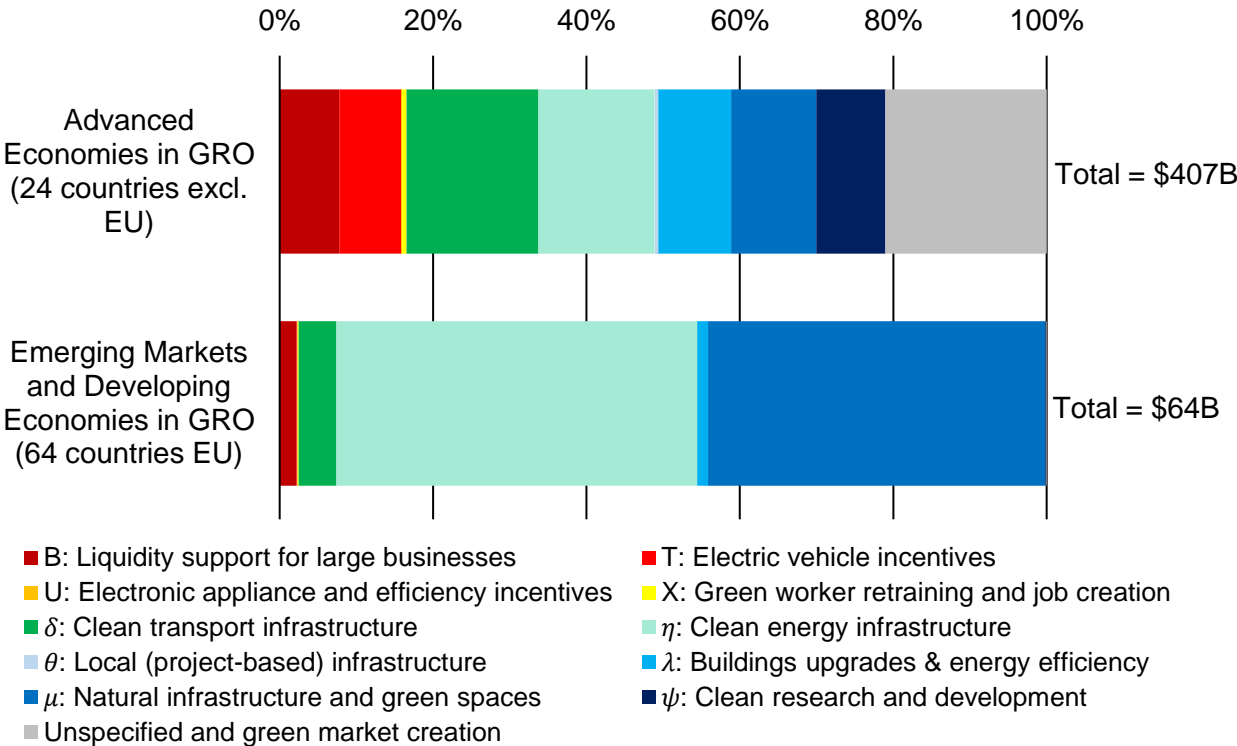


Figure 7.6. Distribution of green spending to May 2021. Source: Global Recovery Observatory.

Poland has itself made several positive green investments in recovery already, totalling USD5.26bn by May 2021. However, this pales in comparison to USD65bn in the UK and USD57bn in France. As a percentage of total recovery spending, several nations have directed over 70% of recovery funds to green investments. Polish green recovery highlights include EUR 286m on their Green Public Transport programme, under which hydrogen-powered buses were purchased; USD178m on electric vehicles in a June 2020 green investment stimulus package to promote their production and uptake; and USD100m on wind farms to develop renewable energy (O’Callaghan and Murdock 2021; EC 2020). Further commitments to green investment could support these early moves and help Poland establish a strong, green path to post-COVID-19 prosperity.

**7.4 Policy Recommendations**

Vivid Economics modelling indicates that Polish investment in a green recovery could secure a more jobs-intensive recovery while reinvigorating economic growth and making substantial progress against its climate commitments. Figure 7.1 illustrates the relative job creation potential and greenhouse gas reduction potential of different green investment opportunities. Using these findings as a starting point, wider literature analysis and expert consultation suggests five priority investment opportunities to be closely considered in 2021. These are each discussed in the subsections below. These policies are expected to have large long-run economic multipliers, create sustainable jobs, assist in the decarbonisation of the economy and bring about many social and environmental benefits (Hepburn et. al, 2020). This stimulus trajectory is also likely to aid in stabilising relations with the European Commission, which will be an important source of support and funding for recovery efforts.

Despite its positive performance in Vivid Economics' modelling and positive prospects, industrial energy efficiency policies are not explored as an immediate priority given the breadth of the policy item and possible implementation challenges on a short time scale.

#### 7.4.1 Residential energy retrofits

Residential energy retrofitting programmes are among the most effective stimulus tools available to governments (Build Up EU, 2020). In addition to being a vital part of the decarbonisation process, these programmes can reduce residential energy bills through insulation, better windows, and more efficient lighting among other measures (Udhir et al., 2020). Similar programmes have been implemented in stimulus packages around the world during the pandemic and in previous financial crises (O'Callaghan et al., 2020), and have been shown to quickly create more jobs per dollar of investment than alternative non-green policies (IEA, 2020b).

Energy efficiency retrofitting programmes are likely to be most effective when targeted at low-income households, as these households stand to benefit the most from lower energy costs and have the highest marginal propensity to consume (Allcott & Greenstone, 2012). Therefore, their saved energy costs are likely to be funnelled back into the broader economy, providing further stimulus effects. This policy makes particular sense for Poland given rising electricity consumption per capita (IEA, 2020a) and some of the highest energy prices in the EU (Macuk, 2020). Rooftop solar installations are also an attractive policy option for Poland, and have shown huge potential in the past. For instance, the *Mój Prąd* programme to subsidise PV installations has shown success, with funds for the programme expanded this year (CIRE, 2020). Further expansions of this programme could provide significant stimulus benefits to the country, facilitate the clean energy transition and reduce electricity costs.

Another key focus area for Poland should be retrofitting residential heating and cooking appliances that rely on coal. The solid fuel boilers that exist in many Polish homes bring significant indoor air pollution, leading to adverse health outcomes for already at-risk residents (World Bank, 2018). The Clean Air Programme was launched in 2018, providing grants and loans for the thermal modernisation of households throughout Poland (Ministry of Climate and Environment, 2019). As part of Poland's economic recovery, the government should consider a significant expansion of this programme to increase the rate at which homes are modernised. Building on this existing programme will reduce administrative costs and implementation timelines significantly in comparison to designing a new programme from the ground up. The involvement of commercial banks may have been the missing link that has limited the success of the programme to date, and it will likely be necessary to achieve a substantial scaling-up of the programme (Piñerúa, 2019). Care should be taken to ensure that the programme reaches the individuals who are the most at risk from particulate air pollution and from the high cost of fuels. This may involve more robust outreach programmes than have been implemented in the past. To reach low-income individuals, it is important that subsidies are prioritised over rebate-style measures. Subsidies help to reduce the upfront cost of investment and the lack of this has proven to be a prohibitive barrier in past subsidy programmes globally. It is likely that the EU could assist Poland in funding this programme, providing a further incentive for the country to make a net-zero commitment to access the EU Just Transition Fund.

### 7.4.2 Electric vehicle investment

Investments in electric vehicles and related infrastructure such as charging stations could deliver strong returns for Poland, providing swift economic stimulus effects coupled with environmental and social co-benefits. Poland's vehicle fleet is badly ageing (ACEA, 2019); the government has recognised the need for upgrades as well as the associated opportunity to establish Poland's place as a leading producer in the growing global electric vehicle market. The Polish government had already made progress in this area before the pandemic, as demonstrated by the announcement of the Electromobility Development Plan in 2016 (Ministry of Energy, 2016). Policies implemented during the pandemic have also been significant, including measures for both the production and consumption of electric vehicles as part of PLN7.8bn in green investments for 2020. Building on these investments may strengthen Poland's position in the global electric vehicle market and provide high-quality domestic jobs. In this process, a few key policy adjustments may help accelerate participation beyond the slow uptake seen so far (Wilczek, 2020). Policies could be designed to subsidise vehicle purchases at the time of sale rather than after the fact as a rebate, as high-initial costs may be prohibitive for lower-income consumers and could present higher psychological barriers (Diamond, 2009). As Poland's previously implemented incentives have been lower in value than other comparable European measures (Wilczek, 2020), increasing the size of the subsidy could also provide greater incentive, leading to higher uptake. Additionally, for production to be sustainable, governments must ensure that progress in EV production does not come at the cost of other climate and natural priorities. The government should consider brownfield sites for production, particularly if the counterfactual is the destruction of natural ecosystems. Finally, the skill composition of existing workforces and their willingness to retrain must be considered in determining where new production is located.

State-owned ElectroMobility Poland recently announced plans for the domestic manufacturing of EVs, providing a much-needed boost to the struggling Polish auto-parts industry (Charlish & Kahn, 2020). Plans have also been introduced to build an electric vehicle factory in Silesia, an area that is home to many coal mines and coal workers (Euractiv, 2020). Positioning new investments in electric vehicle manufacturing in areas where workers are at risk of losing their jobs in the unstable coal industry has many potential benefits provided that it is coupled with comprehensive job training programmes targeted at individuals whose livelihoods are at risk, either due to the pandemic or due to the phase-out of coal. Further investments of this type by the Polish government could help to ensure that the renewable energy transition aids workers while boosting economic growth in at-risk regions of the country.

Investment beyond electric passenger vehicles could prioritise the electrification of Polish public transport. In addition to creating jobs and contributing significantly to reducing greenhouse gas emissions (Buekers et al., 2014), an expansion of public transport infrastructure is likely to reduce the impact of geographical isolation for vulnerable communities. These programmes may require private partnerships and potentially co-financing with local and regional governments.

### 7.4.3 Renewable energy investment

The Polish energy system is heavily reliant on the coal resources of the country's southern region. In recent months, however, the Polish government has shown some willingness to embrace renewable energy technologies. At least PLN368mn in 2020 has been directed to wind power, and intentions for significant nuclear generation have also been made clear

through an agreement with the US government (Department of Energy, 2020). Renewable energy industries, on the other hand, are still in their infancy in Poland and would benefit greatly from significant public support in any future stimulus packages. While nuclear energy has been considered by the Polish government, any investment here is likely to be hamstrung by long planning cycles, meaning that real economic benefits would be minimal for the COVID-19 economic recovery. Investments in wind and solar have a comparatively fast speed of implementation, as well as high support from the private sector and the public (Dunai & De Clercq, 2019). Funding for new photovoltaic solar and wind capacity could be drawn from the European Commission's Just Transition Funds, which are not available for nuclear projects (European Commission, 2020a). Investment and subsidies must be paired with urgent updates to regulations so that projects with financial backing may move forward expediently. Throughout 2020, several investments in new wind farms and small-scale solar have been supported by the European Investment Bank (EIB, 2020). Partnerships with this and other external institutions could provide the way forward for renewable energy in Poland.

An expanded renewable energy asset base could bring significant additional benefits beyond its contributions as economic stimulus. Poland has set clear targets for rapidly expanding the presence of electric vehicles in the country, and if these goals are to be achieved, a significant expansion of electricity generation capacity is required. By some estimates, EVs alone will increase domestic energy demand by 40% (Kłos et al., 2019). With the coal market showing weaknesses that are only set to deepen in the coming years, it is crucial that Poland makes investments in renewables to meet the electricity demand of a new electric vehicle fleet on top of the rising energy demands of residents. Shifting away from coal and toward renewable energy production could also significantly reduce air pollution (C-PREE, 2019), which could be especially beneficial for Poland given the country's persistently poor air quality in urban areas (World Bank, 2019). Furthermore, increased domestic renewable energy capacity may make Poland less vulnerable to price volatility in imported energy, such as Russian natural gas pricing (Yermakov & Sobczak, 2020). Significant expansions in renewable energy generation in Poland may also pave the way for future initiatives, including green hydrogen, which could play a large role in countless hard-to-abate sectors (IRENA, 2019).

#### **7.4.4 Natural capital investment**

Investment in natural capital and green spaces could bring significant benefits for Poland across economic, environmental, and social dimensions. The Polish tourism sector, which provides 6% of GDP, has been one of the worst affected industries during the COVID-19 pandemic (Korinth & Ranasinghe, 2020). Investment in green spaces and environmental restoration has the potential to bolster this industry significantly in the long term. Natural capital investment projects tend to create a high number of jobs per dollar invested and can usually be implemented relatively quickly, providing immediate stimulus for the economy (Rudee, 2020). Investment in green spaces, afforestation efforts, and environmental restoration have also been shown to improve air quality appreciably and therefore improve health outcomes (Abhijith et al., 2017).

Poland has a history of afforestation which could be used as a basis for the country's further economic recovery. After losing much of its forest cover during World War II, Poland made strides in reforestation, bolstered by the National Programme for Increasing Forest Cover, funded through a loan from the World Bank in 1992. This programme sought to increase forest cover to 33% by 2050, and though progress was significant in the early years of the programme, it has since slowed significantly (Banach et al., 2017). Another example of an



existing natural capital project that could offer learning is the Green Karkonosze programme, which aimed to foster Polish tourism through environmental investment and was successful both in bolstering tourism and increasing the quality of life for its inhabitants (European Commission, 2018). Expanding such programmes could drive economic growth in regions where there is a lack of highly skilled workers. Monoculture-type afforestation programmes have been attempted before in Poland, but although these may be less costly to implement, monoculture programmes can have significant negative impacts on biodiversity and result in soil degradation that is very difficult to reverse. Consulting with environmental experts on biodiversity will be an important contributor to the success of such a programme.

#### **7.4.5 Worker retraining programmes**

Poland is on the brink of a seismic shift in its energy landscape, driven by a phase-out of coal and a phase-in of future-oriented clean industries. Although this is set to bring a wide range of economic, environmental, and social benefits to the country, current coal dependence means that a portion of the Polish labour force will need support in retraining for new job opportunities. A lack of opportunities for retraining amongst adults, combined with low existing education levels in older age groups, has been a significant barrier to growth in the last several decades and has constrained employment opportunities for those individuals (OECD, 2019).

Worker retraining programmes can provide stimulus through the financial support of those who may be out of work, while enabling the development of new clean industries which would otherwise face a skills-shortage. To maximise economic and social benefits, retraining programmes should be targeted at: (i) those whose livelihoods are tied to the weakening coal industry and who are likely to be affected by the phase-out of Polish fossil fuels and (ii) youth and women, who are disproportionately carrying the burden of employment loss during the pandemic (ILO, 2020). A strong worker retraining programme is expected to reduce structural barriers to economic opportunities (Cavaco et al., 2013) and therefore ameliorate some of the regional disparities in unemployment present in Poland. Low uptake has historically been an issue in Polish worker training programmes (OECD, 2019). In order to reach the individuals for whom the programme would be the most beneficial, it is vital that outreach considerations are central to the design of the programme. For adult learners, some additional flexibility in the programmes such as part-time options may be necessary to achieve the desired levels of participation. Involving community members and local government leaders in every stage of programme development can help increase the visibility of the programme and ensure that maximum benefits are achieved.

### **7.5 Funding and financing recommendations**

To maximise the impact of public spending, it is in the interest of the Polish government to design policies that elicit investment from the private sector. This is especially relevant for investment in new renewable energy facilities, where Poland has already seen strong private sector interest (Baca-Pogorzelska, 2020). Polish policymakers should consider (i) setting a net-zero greenhouse gas emissions target to access additional EU funds, (ii) developing and using new green financial instruments, (iii) pursuing large-scale co-financing opportunities, and (iv) prioritising direct grant programmes over loan guarantees or other investment risk mitigation measures.

### 7.5.1 Net-zero greenhouse gas emissions target

There are several benefits that Poland could capitalise on if it were to implement a target of net-zero greenhouse gas emissions by 2050, in line with neighbouring EU countries and many others around the world. A clear target could reduce uncertainty for Polish businesses, incentivising domestic innovation into enabling low-carbon technologies. This new private investment could provide an economic boost. Increased innovation spending is likely to bring new jobs, and the more ambitious the target, the greater the incentive for companies to innovate in the short term.

### 7.5.2 Green financial instruments

To partially fund recovery spending, Poland should consider the issuance of additional green sovereign bonds and, for State Owned Enterprises, green corporate bonds. As the first nation to issue green sovereign bonds in 2016, Poland garnered significant international support and EUR750m in funds (Nordea, 2020). Two subsequent issuances in 2019 were priced without a premium to the secondary market, down from an 8-basis point premium in 2016 and a 3 basis-point premium in 2018. In total, Poland has issued EUR3.75bn in green bonds to date (Nordea, 2020). Polish energy holding company, Tauron, issued PLN1bn in sustainable development bonds in October 2020, demonstrating the potential of corporate green debt instruments to support Poland's energy transformation (Tauron, 2020). Having already established market familiarity, Poland has a firm basis from which to expand its international green debt programmes. There is also an opportunity to issue zloty-denominated debt, targeted at the domestic market to mobilise local institutional investors.

To help catalyse clean private investment, Poland should consider an expansion of domestic auctions for renewable Contracts for Differences (CfDs). Currently, CfDs are auctioned for offshore wind capacity in Poland and for various other renewable energy and other non-energy applications around the world (Edie, 2020).<sup>25</sup>

### 7.5.3 Large-scale co-financing opportunities

For projects relating to the electrification of public transport, energy system investment, clean research and development, or natural capital investment, there may be significant opportunities for the federal government to co-finance projects with local and regional governments. In addition to reducing the fiscal burden on the federal government, this type of collaboration is likely to result in higher quality outcomes by providing agency to regions as they implement projects that meet their specific needs. Beyond subnational partnerships, there is also scope for large-scale public-private partnerships (PPP) in these types of projects. Analyses of Dutch and US PPP projects suggest that these contracts are more cost-effective than alternatives (Chasey et al., 2012; Verweij & Meerkerk, 2020).

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<sup>25</sup> The model helps to bring certainty of returns to new investments, by guaranteeing that generators will always receive a certain return for every MWh of generation, thereby reducing the cost of capital. The instrument ensures that the additional costs are not passed on to consumers but are rather borne by the government (which has a much lower cost of capital).

## 7.6 Governance Recommendations

In delivering an efficient green recovery programme in Poland, a coordinated response with consistent messaging is essential. Streamlined interactions with regions and private investors can help to ensure that goodwill and intention are not lost. Given Poland's historical resistance to green policy action, incumbent government agencies may not be optimally prepared to administer a large-scale green recovery programme. For these reasons, it is likely that Poland will benefit from a dedicated task force on green recovery that coordinates these policies and ensures optimisation of economic, environmental and social impacts. The task force could also be responsible for communicating policy details to the public and coordinating dealings with private investors and subnational entities. Such a task force would benefit from the expertise of local and international academics and experienced consultants to help guide policy considerations.

Given the political sensitivities of green and nature-based policies in Poland, to maximise benefits, the Polish government must prioritise strong and uniform messaging. Involving a diverse group of community members, corporate stakeholders, and other subnational entities in the early stages of policy development will assist in increasing public support of the policies and ensure that they incorporate social considerations beyond immediate economic impact. Furthermore, robust monitoring processes will also be needed to maximise benefits and ensure that programmes achieve their intended effects. Enhanced monitoring processes will also help in the long term with the design of future policies in similar areas. However, the level of monitoring must be carefully balanced as excessive monitoring can be overly intrusive, restricting progress and causing significant delays that are especially undesirable in conditions of economic crisis.

## 7.7 Co-considerations

Three high-priority considerations are examined here: policy timeframes, targeting and equity, and COVID-19-specific considerations.

1. **Policy timeframes.** While it is tempting to focus on policies that will generate the maximum benefits in the shortest amount of time, longer acting policies are crucial for a smooth transition away from fossil fuels and can also garner high long-run multipliers (Hepburn et al., 2020). By investing in policies with a range of effective durations, Poland can ensure a short-term growth curve that smoothly transitions into a long-term curve. This reflects a focus on using short-term stimulus to solidify long-term Polish industry transitions.
2. **Targeting and equity.** COVID-19 pandemic has disproportionately impacted lower-income and marginalised groups in Poland (World Bank, 2020), and the looming climate crisis is set to do the same (Roberts, 2001). These groups have the most to gain from effective stimulus policy, and it is incumbent upon the federal government to ensure that their recovery is a just and inclusive one, meeting the needs of all members of Polish society. Targeting incentive-based policies to low-income groups is also likely to generate the highest economic benefits due to the high-marginal propensity to consume of such communities (Jappelli & Pistaferri, 2014). This is especially relevant for electric vehicle incentives and incentive-based residential energy retrofits. Examples include ensuring that incentives decrease the upfront cost of investment rather than rebates, scaling the value of the incentive based on income level and, in

the case of tax rebates, imposing an income threshold above which the rebate is unavailable or diminished. Care must be taken to ensure that targeting processes are streamlined and relatively simple, as complex processes for programme qualification may present a barrier for uptake.

3. **COVID-19 considerations.** Though Poland handled the early months of the pandemic with relative success, outbreaks in October and November 2020 have put strains on the healthcare system (Martewicz, 2020), continuing into 2021. Poland does not have the capacity to handle large surges in cases, and it is therefore vital that stimulus policies incorporate COVID-19 safety protocols. For instance, outdoor natural capital projects may be safe enough to implement early on, but residential energy retrofits may not be possible until after the vaccine rollout. It may also be important to include provisions for PPE and additional staff to ensure virus restrictions are met.

## 7.8 Conclusion

**Through its recovery from the pandemic, Poland has an opportunity to use strategic investments in growing green industries to increase economic growth, boost job creation, and secure several social and environmental co-benefits.** Polish policymakers must prioritise the future prosperity of the nation by ensuring that economic, social, and environmental priorities, as well as the interactions of these, all filter into decision-making processes. Polish businesses should demand policy certainty so that investments in innovation and redirection of resources can begin as early as possible.

Alongside a significant health burden, the COVID-19 pandemic has brought considerable economic pain to Poland. These pains have manifested in damage to lives, livelihoods, and businesses. The economic recovery represents a chance for the country to accelerate its already underway clean energy transition, as well as catalyse new green growth in a host of other emerging clean industries.

The recommendations of this report consider policy, funding, financing, and governance mechanisms to build long-term prosperity in Poland through a green recovery. In addition to traditional economic priorities, the proposed stimulus policies also consider social and environmental priorities to strengthen Polish society in the years to come. These recommendations act to counter pre-existing inequalities and areas of economic weakness to ensure that vulnerable communities are protected through the recovery process and that Poland's future is prosperous and sustainable.

# Appendix A: Fiscal policy taxonomy

Reprinted from O’Callaghan et al., 2021.

*Fiscal policy archetypes and sub-archetypes function to categorise fiscal interventions. The Oxford archetype list (Global Recovery Observatory list) intends to be collectively exhaustive, such that any fiscal policy intervention can be categorised into an archetype family. Naturally, given the variation in policy approaches across geographies, a small subset of fiscal interventions could reasonably be placed within multiple archetype families. In this instance, we suggest that policies are allocated to the most specific relevant archetype.*

*Table 0.1 List of Oxford University fiscal intervention archetypes used in the Global Recovery Observatory. Archetype names in bold. Sub-archetype names preceded by shaded circular bullets. Examples are for illustrative purposes only and are guided by policies from the Global Recovery Observatory. These are in italics and preceded by hollow circular bullets. Archetype typologies (a, b, c) are denoted by sections.*

<b>Recovery: Incentive Measures</b>	
<b>R.</b>	<b>Targeted recovery cash transfers</b>
	<p>Recovery-type direct cash transfers to individuals to promote spending and restore consumer demand. Does not include cash transfers designed to meet basic needs due to COVID-19 pandemic.</p> <ul style="list-style-type: none"> <li>• R1. Payments targeted to families</li> <li>• R2. Payments targeted to low-income individuals</li> <li>• R3. Payments targeted to individuals (other)</li> <li>• R4. Indirect payments through social programmes</li> </ul>
<b>S.</b>	<b>Tourism and leisure industry incentives</b>
	<p>Government subsidies for consumers of leisure activities and measures to promote leisure participation.</p> <ul style="list-style-type: none"> <li>• S1. Incentives for tourism             <ul style="list-style-type: none"> <li>○ <i>Reduced fees on public transport routes that directly serve tourist activities</i></li> </ul> </li> <li>• S2. Incentives for hospitality services             <ul style="list-style-type: none"> <li>○ <i>50% off all meals Monday through Wednesday</i></li> <li>○ <i>Discounts for individuals using hotels</i></li> </ul> </li> <li>• S3. Incentives for arts and cultural activities             <ul style="list-style-type: none"> <li>○ <i>Discounts for going to the theatre</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• S4. Measures to promote leisure participation               <ul style="list-style-type: none"> <li>○ <i>Tourism marketing support</i></li> <li>○ <i>Arts and culture sector support</i></li> </ul> </li> </ul>
<b>T.</b>	<b>Electric vehicle incentives</b>
	<p>Support for electric vehicle production and consumption, including schemes like Cash-for-Clunkers, aimed at replacing the vehicle fleet with electric vehicles.</p> <ul style="list-style-type: none"> <li>• T1. EV transfer programmes               <ul style="list-style-type: none"> <li>○ <i>Fleet exchange programme for new EVs</i></li> </ul> </li> <li>• T2. EV subsidies               <ul style="list-style-type: none"> <li>○ <i>Electric and hybrid car purchase subsidy</i></li> </ul> </li> </ul>
<b>U.</b>	<b>Electronic appliance incentives</b>
	<p>Incentives for individuals to purchase appliances, specifically with energy efficiency conditions, through transfer schemes or subsidies.</p> <ul style="list-style-type: none"> <li>• U1. Electronic appliance-specific ‘cash for clunkers’ programmes</li> <li>• U2. Electronic appliance subsidies               <ul style="list-style-type: none"> <li>○ <i>Energy-efficient home appliances partial refunds</i></li> </ul> </li> </ul>
<b>V.</b>	<b>Green market creation</b>
	<p>Investments promoting the development of green markets and promoting participation in green markets. For instance, investments that prompt the integration of more renewable energy generation into electricity markets, or investments which catalyse new green transitional industries.</p> <ul style="list-style-type: none"> <li>• V1. Increased clean energy market participation               <ul style="list-style-type: none"> <li>○ <i>Cutting the renewable energy levy on electricity bills</i></li> <li>○ <i>Allow major energy users to be rewarded for scaling down demand during peak periods</i></li> </ul> </li> <li>• V2. Modernisation and transition investments               <ul style="list-style-type: none"> <li>○ <i>Establishment of an Emissions Reduction Fund, supporting workers and reducing emissions in the oil and gas sector, with a main focus on methane</i></li> <li>○ <i>Promoting more efficient aircraft fleets</i></li> <li>○ <i>Promoting modernisation of shipping, including traffic innovation and support for renewing government vessels</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Funding to clean up orphan and inactive oil and gas wells</i></li> <li>○ <i>Support for auto industry transformation</i></li> <li>● V3. Capacity investments             <ul style="list-style-type: none"> <li>○ <i>Building an industrial cluster for green tech</i></li> <li>○ <i>Promoting low-carbon manufacturing by building an energy- efficient testing platform in smart industrial complexes</i></li> <li>○ <i>Support for regional innovation clusters</i></li> </ul> </li> </ul>
W.	<b>Other incentive measures</b>
	<p>Incentive measures that are not covered by archetype R, S, T, U or V.</p> <ul style="list-style-type: none"> <li>● W1. Other incentive measures</li> </ul>
<b>Recovery: Investment Measures</b>	
X.	<b>Worker retraining and job creation</b>
	<p>Measures designed to train and retrain workers for new and growing industries.</p> <ul style="list-style-type: none"> <li>● X1. Green worker retraining and job creation             <ul style="list-style-type: none"> <li>○ <i>Investing in green jobs for long-term unemployed</i></li> <li>○ <i>Retraining for green transition</i></li> </ul> </li> <li>● X2. General and other worker retraining and job creation             <ul style="list-style-type: none"> <li>○ <i>Investing in training workers in innovative industries</i></li> <li>○ <i>Retraining fund for general reskilling</i></li> <li>○ <i>Subsidising jobs for young people</i></li> </ul> </li> </ul>
Y.	<b>Education investment (non-infrastructure)</b>
	<p>Injections to fund improved teacher training, in-classroom and online materials, and other education capital for pre-primary, primary, and secondary; increased support for tertiary sectors in high-productivity sectors. Includes scholarship funding.</p> <ul style="list-style-type: none"> <li>● Y1. Education capital and equipment             <ul style="list-style-type: none"> <li>○ <i>Funding for placement of teachers and teaching assistants</i></li> <li>○ <i>ICT and equipment funding</i></li> </ul> </li> <li>● Y2. Scholarship funding             <ul style="list-style-type: none"> <li>○ <i>Introduction of new arts scholarships</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>• Y3. Staff funding             <ul style="list-style-type: none"> <li>○ <i>Increased non-research university staff</i></li> <li>○ <i>Increased school administration staff</i></li> <li>○ <i>Funding for new teachers</i></li> <li>○ <i>Funding for new research posts</i></li> <li>○ <i>Support to nurses and carers in education</i></li> </ul> </li> </ul>
Z.	<b>Healthcare investment (non-infrastructure)</b>
	<p>Non-emergency, non-infrastructure investments in the healthcare system, including mental health, aged care and technological upgrades.</p> <ul style="list-style-type: none"> <li>• Z1. General medical investment</li> <li>• Z2. Mental health investment</li> <li>• Z3. Aged care investment</li> <li>• Z4. Healthcare capital investment             <ul style="list-style-type: none"> <li>○ <i>Purchase of IT systems</i></li> </ul> </li> </ul>
α.	<b>Social and cultural investment (non-infrastructure)</b>
	<p>Non-emergency, non-infrastructure investments in social and cultural sectors including non-profits.</p> <ul style="list-style-type: none"> <li>• α1. Support for arts and culture sector             <ul style="list-style-type: none"> <li>○ <i>Establishing a new institute of music</i></li> </ul> </li> <li>• α2. Support for social care</li> <li>• α3. General and other non-profit investment</li> </ul>
β.	<b>Communications infrastructure investment</b>
	<p>Policies designed to expand existing communication infrastructure or develop new infrastructure, including provisions for remote learning and broadband. Soft infrastructure including digital programmes and cybersecurity are also included.</p> <ul style="list-style-type: none"> <li>• β1. Broadband investment             <ul style="list-style-type: none"> <li>○ <i>Simplify fibre broadband expansion</i></li> <li>○ <i>5G infrastructure acceleration with focus on remaining white spots</i></li> </ul> </li> <li>• β2. Remote working infrastructure investment             <ul style="list-style-type: none"> <li>○ <i>Production of equipment to ensure telework modality</i></li> </ul> </li> </ul>



	<ul style="list-style-type: none"> <li>○ <i>Buying new computers to improve connectivity in education</i></li> <li>• <math>\beta</math>3. Civil cybersecurity programmes             <ul style="list-style-type: none"> <li>○ <i>Cybersecurity implementation funding</i></li> </ul> </li> <li>• <math>\beta</math>4. Implementation of digital programmes             <ul style="list-style-type: none"> <li>○ <i>AI networks implementation funding</i></li> </ul> </li> </ul>
$\gamma$ .	<b>Traditional transport infrastructure investment</b>
	<p>Spending on traditional infrastructure including road upgrades, airports, ports infrastructure.</p> <ul style="list-style-type: none"> <li>• <math>\gamma</math>1. Road construction             <ul style="list-style-type: none"> <li>○ <i>Funding for road upgrades</i></li> <li>○ <i>Funding for new highways</i></li> <li>○ <i>Funding for bridge repairs</i></li> </ul> </li> <li>• <math>\gamma</math>2. ICE engine automobile support             <ul style="list-style-type: none"> <li>○ <i>Relief for road transport passengers</i></li> <li>○ <i>Loans for autoparts industry</i></li> </ul> </li> <li>• <math>\gamma</math>3. Aviation infrastructure             <ul style="list-style-type: none"> <li>○ <i>Purchase of air routes</i></li> <li>○ <i>Establishing new airports</i></li> <li>○ <i>Manufacturing new airplanes</i></li> </ul> </li> <li>• <math>\gamma</math>4. Port and ship construction             <ul style="list-style-type: none"> <li>○ <i>Funding for upgrading ships</i></li> <li>○ <i>Funding for port repairs</i></li> </ul> </li> <li>• <math>\gamma</math>5. Rail construction and capacity             <ul style="list-style-type: none"> <li>○ <i>Expansion of rail network and system</i></li> <li>○ <i>Building new trains</i></li> </ul> </li> </ul>
$\delta$ .	<b>Clean transport infrastructure investment</b>
	<p>Investment in new or expanding public transport systems, including increasing capacity and transport digitalisation, in cycling and walking infrastructure, and in electric vehicle (EV) charging infrastructure.</p> <ul style="list-style-type: none"> <li>• <math>\delta</math>1. New public transport systems or line expansions</li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Investment in major public infrastructure programme aiming to expand and improve city metro, bus, and tram services</i></li> <li>• δ2. Existing public transport capacity expansions             <ul style="list-style-type: none"> <li>○ <i>Funding to increase frequency and capacity</i></li> </ul> </li> <li>• δ3. EV charging infrastructure             <ul style="list-style-type: none"> <li>○ <i>All petrol stations to be required to offer EV charging points</i></li> <li>○ <i>Investment in JET EV charging</i></li> </ul> </li> <li>• δ4. Public transport digitalisation efforts             <ul style="list-style-type: none"> <li>○ <i>Improved internet access on metro services</i></li> </ul> </li> <li>• δ5. Cycling and walking infrastructure             <ul style="list-style-type: none"> <li>○ <i>Investments in bike lanes, wider pavements, safer junctions</i></li> </ul> </li> <li>• δ6. Efficiency initiatives to improve dirty transport</li> </ul>
ε.	<b>Traditional energy infrastructure investment</b>
	<p>Investment into fossil fuels and related infrastructure.</p> <ul style="list-style-type: none"> <li>• ε1. New or refurbished power plants             <ul style="list-style-type: none"> <li>○ <i>Finance for restarting coal power projects</i></li> </ul> </li> <li>• ε2. New or refurbished refineries             <ul style="list-style-type: none"> <li>○ <i>Construction of new oil refineries</i></li> </ul> </li> <li>• ε3. New or refurbished coal mine and oil/gas fields             <ul style="list-style-type: none"> <li>○ <i>Expansion of existing coal mines</i></li> </ul> </li> <li>• ε4. New or refurbished infrastructure for transport and transmission of fossil energy             <ul style="list-style-type: none"> <li>○ <i>Building rail capacity for the sole purpose of coal transport</i></li> <li>○ <i>Increasing transmission capacity to allow for higher fossil fuel use</i></li> </ul> </li> </ul>
η.	<b>Clean energy infrastructure investment</b>
	<p>Increased spending in clean electricity, and heat generation and storage; upgraded transmission or hydrogen infrastructure.</p> <ul style="list-style-type: none"> <li>• η1. New or refurbished renewable energy-generation facilities             <ul style="list-style-type: none"> <li>○ <i>Abolishing the national solar capacity cap</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Raising expansion target for offshore wind; raised and removal of restricting the development of onshore wind within 1,000m of homes</i></li> <li>○ <i>Investment in offshore windfarms and hydropower infrastructure</i></li> <li>● η2. New or refurbished nuclear energy-generation facilities</li> <li>● η3. New biofuel and other renewable fuel infrastructure</li> <li>● η4. Upgraded (or new) transmission infrastructure             <ul style="list-style-type: none"> <li>○ <i>Funding to extend the national electricity grid and support a high voltage transmission line</i></li> </ul> </li> <li>● η5. Upgraded (or new) distribution infrastructure including smart grids             <ul style="list-style-type: none"> <li>○ <i>Establish a State Power Grid and Study Programme to invest in and develop responsible grid infrastructure</i></li> </ul> </li> <li>● η6. Hydrogen infrastructure             <ul style="list-style-type: none"> <li>○ <i>Develop new domestic supply chains, export infrastructure and to help grow domestic demand for hydrogen</i></li> <li>○ <i>National hydrogen strategy backed by investment in domestic hydrogen production, transport</i></li> </ul> </li> <li>● η7. Battery and storage infrastructure             <ul style="list-style-type: none"> <li>○ <i>Procuring large-scale battery system to help balance the local electricity grid</i></li> <li>○ <i>Advancement of geothermal and lithium battery projects</i></li> <li>○ <i>Utility customers will be able to access "Community Power Banks," or neighbourhood batteries that store solar energy and help neighbourhoods balance the grid</i></li> </ul> </li> <li>● η8. Carbon capture and storage/utilisation</li> <li>● η9. Other initiatives to clean dirty energy assets</li> </ul>
θ.	<p><b>Local (project-based) infrastructure investment</b></p>
	<p>Funding for schools, hospitals, social housing, and local councils to improve local asset bases.</p> <ul style="list-style-type: none"> <li>● θ1. Urban development programmes             <ul style="list-style-type: none"> <li>○ <i>Smart City' programme, which targets sustainable and integrated urban development (including linkage of information and communication technologies to coordinate energy, buildings, traffic, sewage, and water)</i></li> </ul> </li> <li>● θ2. General new housing investment</li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Social housing building</i></li> <li>• <math>\theta 3</math>. Clean new housing investment</li> <li>• <math>\theta 4</math>. Public building investment             <ul style="list-style-type: none"> <li>○ <i>Building schools</i></li> <li>○ <i>Renovating courts of justice</i></li> </ul> </li> <li>• <math>\theta 5</math>. Local utility investment             <ul style="list-style-type: none"> <li>○ <i>Financing gas, electric, and sanitary infrastructure</i></li> </ul> </li> </ul>
$\lambda$ .	<b>Buildings upgrades and energy efficiency infrastructure investment</b>
	<p>Increase thermal efficiency through improved insulation, improved energy efficiency of appliances, and clean heating (heat pumps or heat networks).</p> <ul style="list-style-type: none"> <li>• <math>\lambda 1</math>. Green retrofitting programmes (including daylighting, electricity and electrification, insulation)             <ul style="list-style-type: none"> <li>○ <i>Funding for a CO<sub>2</sub>-focused building renovation programme</i></li> </ul> </li> <li>• <math>\lambda 2</math>. Rooftop solar support             <ul style="list-style-type: none"> <li>○ <i>Financial support scheme for household solar procurement</i></li> <li>○ <i>Enacts new feed-in tariffs for solar projects in order to stimulate solar power development.</i></li> </ul> </li> <li>• <math>\lambda 3</math>. Other building upgrade support</li> </ul>
$\mu$ .	<b>Natural infrastructure and green spaces investment</b>
	<p>Upgrading public parks, green spaces, national parks, tree planting and biodiversity protection, ecological conservation initiatives, ecological system services.</p> <ul style="list-style-type: none"> <li>• <math>\mu 1</math>. Public parks and green spaces investment</li> <li>• <math>\mu 2</math>. Tree planting and biodiversity protection             <ul style="list-style-type: none"> <li>○ <i>Funds for the conservation and sustainable management of forests</i></li> </ul> </li> <li>• <math>\mu 3</math>. Ecological conservation initiatives             <ul style="list-style-type: none"> <li>○ <i>Support for smaller municipalities to access the national climate protection initiative</i></li> </ul> </li> <li>• <math>\mu 4</math>. Waterway protection and enhancement</li> <li>• <math>\mu 5</math>. Agricultural uplift</li> </ul>
$\pi$ .	<b>Other large-scale infrastructure investments</b>

	<p>Investment into large-scale construction projects.</p> <ul style="list-style-type: none"> <li>• <math>\pi</math>1. Large-scale urban projects             <ul style="list-style-type: none"> <li>○ <i>Finance for stadiums</i></li> <li>○ <i>Construction of major government buildings</i></li> </ul> </li> <li>• <math>\pi</math>2. Large-scale regional infrastructure (dams, non-coal mines, etc.)             <ul style="list-style-type: none"> <li>○ <i>Dam construction</i></li> <li>○ <i>Non-coal mining</i></li> <li>○ <i>Land reclamation activities</i></li> </ul> </li> <li>• <math>\pi</math>3. Large-scale space infrastructure</li> </ul>
$\sigma$ .	<p><b>Armed forces investment</b></p>
	<p>Funding for armed capacity and arsenals.</p> <ul style="list-style-type: none"> <li>• <math>\sigma</math>1. Arsenal funding             <ul style="list-style-type: none"> <li>○ <i>Financing for purchasing military equipment, such as tanks, bombs, and planes</i></li> <li>○ <i>Expanding police capacity through purchasing police vehicles</i></li> </ul> </li> <li>• <math>\sigma</math>2. Administration funding             <ul style="list-style-type: none"> <li>○ <i>Expanding armed forces and police administration networks</i></li> <li>○ <i>Military digital technology investment</i></li> </ul> </li> </ul>
$\tau$ .	<p><b>Disaster preparedness and capacity-building investment</b></p>
	<p>Cash spending in preparation for future pandemics, fires, floods, cyclones, and other extreme events.</p> <ul style="list-style-type: none"> <li>• <math>\tau</math>1. Future epidemic reaction capabilities             <ul style="list-style-type: none"> <li>○ <i>Investment in production facilities of pharmaceuticals, medical devices, PPE</i></li> <li>○ <i>Stocking pharmaceuticals, medical devices, PPE</i></li> </ul> </li> <li>• <math>\tau</math>2. Disaster-response infrastructure (shelters, food-stocking, water supplies)</li> <li>• <math>\tau</math>3. Anti-flood, fires, and other climate adaptation measures             <ul style="list-style-type: none"> <li>○ <i>Fire backburning</i></li> <li>○ <i>Flood protection walls</i></li> </ul> </li> </ul>

<i>φ.</i>	<p><b>General research and development investment</b></p>
	<p>Cash support for technology-agnostic research and development programmes and innovative businesses.</p> <ul style="list-style-type: none"> <li>• <i>φ1. Health and science programmes</i> <ul style="list-style-type: none"> <li>○ <i>Budget reallocation for health and science projects</i></li> <li>○ <i>Coronavirus-related R&amp;D</i></li> </ul> </li> <li>• <i>φ2. Digitisation and AI programmes</i> <ul style="list-style-type: none"> <li>○ <i>Funding start-ups and SMEs in technology industries</i></li> <li>○ <i>Cybersecurity research investment</i></li> <li>○ <i>Quantum research investment</i></li> </ul> </li> <li>• <i>φ3. Space programmes</i> <ul style="list-style-type: none"> <li>○ <i>Support for innovation in satellite telecommunications, earth observations, and nanosatellite technologies</i></li> </ul> </li> <li>• <i>φ4. General and other programmes</i></li> </ul>
<i>ψ.</i>	<p><b>Clean Research and Development investment</b></p>
	<p>Cash support for R&amp;D in green technologies, including electrolysis, heat pumps, energy storage, plant genetics, and greenhouse gas removal.</p> <ul style="list-style-type: none"> <li>• <i>ψ1. Energy sector R&amp;D programmes</i> <ul style="list-style-type: none"> <li>○ <i>Focus on digitalisation and "sector coupling"</i></li> <li>○ <i>Supporting vehicle manufacturers and the associated supply industry by means of a bonus programme.</i></li> <li>○ <i>Accelerating digitalisation in forestry, including investment in modern operating machines and devices</i></li> <li>○ <i>Investing in R&amp;D on electromobility and batteries</i></li> <li>○ <i>Support the development of hydrogen transport options</i></li> </ul> </li> <li>• <i>ψ2. Agriculture R&amp;D programmes</i> <ul style="list-style-type: none"> <li>○ <i>Investments to develop a more secure and sustainable forestry sector</i></li> <li>○ <i>Launching an agricultural flexibility programme meant to support the agriculture sector as it adapts to new pressures</i></li> </ul> </li> <li>• <i>ψ3. Industrial R&amp;D programmes</i></li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>R&amp;D of low-carbon manufacturing, such as developing an energy-efficient testing platform in smart industrial complexes</i></li> <li>• <math>\psi</math>4. Other sectoral R&amp;D programmes             <ul style="list-style-type: none"> <li>○ <i>Investment in R&amp;D of CCS technology</i></li> </ul> </li> </ul>
<b>Rescue: Temporary Liquidity Measures</b>	
<b>A.</b>	<b>Liquidity support for subnational public entities</b>
	<p>Transfer of funds from the national government to provinces, municipalities, federal states, state-owned enterprises, etc., for indiscriminate use.</p> <ul style="list-style-type: none"> <li>• A1. Support for states/regions             <ul style="list-style-type: none"> <li>○ <i>Federal aid to states to combat coronavirus</i></li> <li>○ <i>Loans to states</i></li> </ul> </li> <li>• A2. Support for localities             <ul style="list-style-type: none"> <li>○ <i>Ring-fenced funding for municipalities</i></li> <li>○ <i>Restructuring cities' debt</i></li> <li>○ <i>Finance for provinces</i></li> <li>○ <i>Transfer of funds to autonomous communities</i></li> </ul> </li> </ul>
<b>B.</b>	<b>Liquidity support for large businesses</b>
	<p>Government support for banks to rapidly provide liquidity to large corporations on terms favourable to the government, including emergency grants to particular sectors.</p> <ul style="list-style-type: none"> <li>• B1. Support for agriculture, forestry and fishing (no green conditions)             <ul style="list-style-type: none"> <li>○ <i>Agricultural bank equity investment</i></li> </ul> </li> <li>• B2. Support for agriculture, forestry and fishing (with green conditions)</li> <li>• B3. Support for airlines and other transport (no green conditions)             <ul style="list-style-type: none"> <li>○ <i>Loan guarantees for airlines</i></li> </ul> </li> <li>• B4. Support for airlines and other transport (with green conditions)             <ul style="list-style-type: none"> <li>○ <i>Loans to airlines conditional on carbon offsets</i></li> </ul> </li> <li>• B5. Support for energy (no green conditions)             <ul style="list-style-type: none"> <li>○ <i>Support for electricity distribution companies</i></li> </ul> </li> <li>• B6. Support for energy (with green conditions)</li> <li>• B7. Support for holiday and leisure (no green conditions)</li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Emergency funds for entertainment industry</i></li> <li>• B8. Support for holiday and leisure (with green conditions)</li> <li>• B9. Support for retail (without green conditions)             <ul style="list-style-type: none"> <li>○ <i>Emergency cash grants for businesses in retail</i></li> </ul> </li> <li>• B10. Support for retail (with green conditions)</li> <li>• B11. Support for specified other industry (without green conditions)             <ul style="list-style-type: none"> <li>○ <i>Support for exporting industries</i></li> </ul> </li> <li>• B12. Support for specified other industry (with green conditions)             <ul style="list-style-type: none"> <li>○ <i>Support for car manufacturer on condition of participation in battery development programme</i></li> </ul> </li> <li>• B13. Support for unspecified industry             <ul style="list-style-type: none"> <li>○ <i>Direct equity stakes in companies</i></li> </ul> </li> </ul>
<b>C.</b>	<b>Liquidity support for start-ups and SMEs</b>
	<p>Government support for banks to rapidly provide liquidity to start-ups and small-/medium-sized businesses on terms favourable to the government.</p> <ul style="list-style-type: none"> <li>• C1. Support for agriculture, forestry and fishing             <ul style="list-style-type: none"> <li>○ <i>Direct support for fishing businesses</i></li> </ul> </li> <li>• C2. Support for energy</li> <li>• C3. Support for holiday and leisure             <ul style="list-style-type: none"> <li>○ <i>Credit line for tourism SMEs</i></li> </ul> </li> <li>• C4. Support for retail             <ul style="list-style-type: none"> <li>○ <i>Direct support for small retailers</i></li> </ul> </li> <li>• C5. Support for specified other industry             <ul style="list-style-type: none"> <li>○ <i>Compensation for childcare businesses</i></li> </ul> </li> <li>• C6. Support for unspecified other industry             <ul style="list-style-type: none"> <li>○ <i>Co-lending programme for SMEs</i></li> </ul> </li> </ul>
<b>D.</b>	<b>Liquidity support for not-for-profit organisations</b>
	<p>Government support for banks to rapidly provide liquidity to not-for-profit organisations on terms favourable to the government, including emergency grant programmes.</p> <ul style="list-style-type: none"> <li>• D1. Support for arts and culture</li> </ul>



	<ul style="list-style-type: none"> <li>○ <i>Emergency funds for cultural institutions</i></li> <li>• D2. Support for social care             <ul style="list-style-type: none"> <li>○ <i>Support for self-help groups</i></li> </ul> </li> <li>• D3. Support for education and research institutions             <ul style="list-style-type: none"> <li>○ <i>Funding for specific universities and research offices</i></li> </ul> </li> <li>• D4. General non-profit support             <ul style="list-style-type: none"> <li>○ <i>Emergency cash grants for charities</i></li> </ul> </li> <li>• D5. Support for animal services</li> </ul>
<b>E.</b>	<b>Temporary waiver of interest payments for businesses</b>
	<p>Holidays on interest payments or other relief on commercial rent and loans.</p> <ul style="list-style-type: none"> <li>• E1. Commercial rent interest relief             <ul style="list-style-type: none"> <li>○ <i>Loan principal payment deferrals</i></li> <li>○ <i>Loan payment delays for struggling companies</i></li> <li>○ <i>Suspension of interest payments for tourism industry</i></li> </ul> </li> <li>• E2. Automotive interest relief             <ul style="list-style-type: none"> <li>○ <i>Motor finance and high-cost credit support</i></li> </ul> </li> <li>• E3. Utility payment interest relief (i.e., electricity, gas, water)             <ul style="list-style-type: none"> <li>○ <i>Increased flexibility for utility payments</i></li> <li>○ <i>Postponement of collection of electricity and natural gas consumption fees</i></li> </ul> </li> <li>• E4. Microcredit interest relief             <ul style="list-style-type: none"> <li>○ <i>Support for small companies using credit</i></li> </ul> </li> <li>• E5. Rural investment interest relief             <ul style="list-style-type: none"> <li>○ <i>Postponement of farmer’s debt without interest</i></li> </ul> </li> <li>• E6. General and other             <ul style="list-style-type: none"> <li>○ <i>Reduction in interest rates for borrowers</i></li> <li>○ <i>Reduced interest rates for small taxpayers</i></li> </ul> </li> </ul>
<b>Rescue: Temporary life and livelihood measures</b>	
<b>F.</b>	<b>Direct provision of basic needs</b>

	<p>Direct funds to the immediate local production and distribution of essential goods such as food, health, and transport, irrespective of whether these are part of the formal or informal economies.</p> <ul style="list-style-type: none"> <li>• F1. Nutrition support             <ul style="list-style-type: none"> <li>○ <i>Food banks support</i></li> <li>○ <i>Indigenous food support</i></li> </ul> </li> <li>• F2. Shelter support             <ul style="list-style-type: none"> <li>○ <i>Housing the homeless</i></li> </ul> </li> <li>• F3. Social services support             <ul style="list-style-type: none"> <li>○ <i>Exploitation prevention fund</i></li> <li>○ <i>Funding for children in care</i></li> </ul> </li> <li>• F4. Utility access support             <ul style="list-style-type: none"> <li>○ <i>Allocation to social water funds</i></li> <li>○ <i>Free cooking gas cylinders to poor families</i></li> <li>○ <i>Covering heating costs</i></li> </ul> </li> <li>• F5. General and other support             <ul style="list-style-type: none"> <li>○ <i>Subsidising basic needs</i></li> </ul> </li> </ul>
<p><b>G.</b></p>	<p><b>Targeted welfare cash transfers</b></p>
	<p>Direct cash transfers targeted to individuals and families, or in terms of a bonus to COVID-19 essential workers. Wage increases for those with government-controlled wages (public sector, minimum wage).</p> <ul style="list-style-type: none"> <li>• G1. Payments targeted to families             <ul style="list-style-type: none"> <li>○ <i>Payments to families with children</i></li> <li>○ <i>Payments to families with COVID-19 deaths</i></li> </ul> </li> <li>• G2. Payments targeted to low-income individuals             <ul style="list-style-type: none"> <li>○ <i>Bill exemptions</i></li> </ul> </li> <li>• G3. Payments targeted to individuals (other)             <ul style="list-style-type: none"> <li>○ <i>Payments to out-of work individuals with (suspected) COVID-19</i></li> <li>○ <i>Payments to self-employed workers</i></li> <li>○ <i>Payments to workers with reduced hours/remuneration</i></li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Payments to COVID-19 emergency workers</i></li> <li>○ <i>Payments to workers who have been made redundant/furloughed</i></li> <li>○ <i>Extending/increasing unemployment benefits</i></li> <li>○ <i>Increase in government-controlled wages</i></li> <li>● G4. Indirect payments through social programs             <ul style="list-style-type: none"> <li>○ <i>Insurance expansion/reduced payments</i></li> <li>○ <i>Pension support</i></li> </ul> </li> </ul>
H.	<b>Job continuation support</b>
	<p>Schemes to continue employment in declining sectors, including furlough schemes and related incentives.</p> <ul style="list-style-type: none"> <li>● H1. Job continuation subsidies             <ul style="list-style-type: none"> <li>○ <i>Furlough schemes</i></li> <li>○ <i>Credit for salary payments</i></li> </ul> </li> <li>● H2. Job continuation incentives             <ul style="list-style-type: none"> <li>○ <i>Firm payouts for bringing back furloughed workers</i></li> </ul> </li> </ul>
I.	<b>Temporary waiver of interest payments for individuals</b>
	<p>Permitted delays in individual payments relating to rents, mortgages, student loans and other individual payments.</p> <ul style="list-style-type: none"> <li>● I1. Mortgage interest and rental relief             <ul style="list-style-type: none"> <li>○ <i>Foreclosure and eviction moratorium and mortgage restrictions</i></li> <li>○ <i>Mortgage support, including six-month mortgage payment deferment</i></li> <li>○ <i>Business rent reductions in special zones</i></li> <li>○ <i>Delay rent payments and debts for households and SMEs</i></li> </ul> </li> <li>● I2. Student debt interest relief             <ul style="list-style-type: none"> <li>○ <i>Removal of tax on employer student loan repayment benefits</i></li> <li>○ <i>Suspending repayment and interest on student and apprentice loans</i></li> </ul> </li> <li>● I3. General and other relief             <ul style="list-style-type: none"> <li>○ <i>Allowed deferral of payments on credit and interest</i></li> </ul> </li> <li>● I4. Automotive interest relief</li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>3-month payment freeze on car loan repayments</i></li> </ul>
<b>J.</b>	<b>Healthcare services support</b>
	<p>All emergency health measures designed to manage the effects of the COVID-19 pandemic, and to develop treatments and vaccines.</p> <ul style="list-style-type: none"> <li>• J1. General medical equipment/services spending (including PPE)                             <ul style="list-style-type: none"> <li>○ <i>Expanding stockpile of flu drug</i></li> <li>○ <i>Purchases of masks and medical equipment</i></li> </ul> </li> <li>• J2. Mental health support                             <ul style="list-style-type: none"> <li>○ <i>Funding for mental health phone line</i></li> </ul> </li> <li>• J3. Aged care support                             <ul style="list-style-type: none"> <li>○ <i>Funding for aged care facilities</i></li> </ul> </li> <li>• J4. General medical personnel support                             <ul style="list-style-type: none"> <li>○ <i>Medical insurance for frontline workers</i></li> </ul> </li> <li>• J5. Vaccine and COVID-19 pandemic research, manufacturing and application                             <ul style="list-style-type: none"> <li>○ <i>Funding for vaccine development programme</i></li> </ul> </li> </ul>
<b>K.</b>	<b>Emergency services (disaster management) support</b>
	<p>Measures to facilitate the management of the COVID-19 pandemic beyond the healthcare industry.</p> <ul style="list-style-type: none"> <li>• K1. Pandemic administrative support                             <ul style="list-style-type: none"> <li>○ <i>Funding for media campaigns regarding COVID-19 pandemic-safety</i></li> </ul> </li> <li>• K2. Equipment procurement</li> <li>• K3. Infrastructure support (short-term shelters, food-stocking, water supplies)</li> </ul>
<b>Rescue: Temporary tax and payment relief measures</b>	
<b>L.</b>	<b>Income tax cuts</b>
	<p>Reduction in marginal income tax rates, increase in tax-free thresholds, or expanded deductions.</p> <ul style="list-style-type: none"> <li>• L1. Reduction in marginal rates (including increases in tax-free thresholds)                             <ul style="list-style-type: none"> <li>○ <i>Reduced rates for lowest income tax bracket</i></li> </ul> </li> <li>• L2. Expanded deductions</li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Tax deductions for childcare household spending</i></li> <li>○ <i>Tax credit for taxpayers spending on accommodation, food, and non-alcoholic beverages</i></li> <li>• L3. New tax exemptions             <ul style="list-style-type: none"> <li>○ <i>Income tax exemption for health and security personnel</i></li> </ul> </li> <li>• L4. Permitted delays in payment             <ul style="list-style-type: none"> <li>○ <i>Relaxation of tax payment schedules</i></li> <li>○ <i>Temporary suspension of payments for over 65s</i></li> </ul> </li> </ul>
M.	<b>VAT and other goods and services tax cuts</b>
	<p>Reduction in the rate of regressive value-added taxes (VAT) or goods and service taxes (GST) on consumption, e.g., taxation of alcohol. Includes changes to taxes on specific goods, as well as adjustments to import tariffs.</p> <ul style="list-style-type: none"> <li>• M1. VAT reductions             <ul style="list-style-type: none"> <li>○ <i>Reduction of VAT by 15%</i></li> <li>○ <i>Taxable sales income of 3% exempt from VAT</i></li> <li>○ <i>30% reduction in auto sales tax</i></li> <li>○ <i>Increase in stamp duty threshold</i></li> </ul> </li> <li>• M2. VAT deferrals             <ul style="list-style-type: none"> <li>○ <i>Deferral of VAT payments for 3 months</i></li> <li>○ <i>Extend payment deadline of import duties</i></li> </ul> </li> <li>• M3. Non-discretionary payment relief             <ul style="list-style-type: none"> <li>○ <i>ATM charge suspension</i></li> <li>○ <i>Toll road charge suspension</i></li> <li>○ <i>License fee waivers</i></li> </ul> </li> <li>• M4. Reduced taxes for emergency medical imports             <ul style="list-style-type: none"> <li>○ <i>Duty and tax exemption for emergency medical imports</i></li> </ul> </li> </ul>
N.	<b>Business tax cuts</b>
	<p>Temporary or permanent reductions in business tax, changes to tax-free thresholds, or expanded deductions.</p> <ul style="list-style-type: none"> <li>• N1. Reduction in rates</li> </ul>

	<ul style="list-style-type: none"> <li>○ <i>Corporate investment tax discounts</i></li> <li>• N2. Expanded deductions             <ul style="list-style-type: none"> <li>○ <i>Tax deductions for materials in production during the pandemic</i></li> </ul> </li> <li>• N3. New tax exemptions for clean investments</li> <li>• N4. New tax exemptions for general and other investments             <ul style="list-style-type: none"> <li>○ <i>Tax waivers for hoteliers and restaurants</i></li> </ul> </li> </ul>
O.	<b>Business tax deferrals</b>
	<p>Deferral of payment of corporate taxes or strengthen carry-back provisions in tax loss offsets.</p> <ul style="list-style-type: none"> <li>• O1. Tax deferrals for dirty industries             <ul style="list-style-type: none"> <li>○ <i>Freezing fees and charges for coal and gas explorers</i></li> </ul> </li> <li>• O2. Tax deferrals for other industries             <ul style="list-style-type: none"> <li>○ <i>General business tax deferrals</i></li> </ul> </li> </ul>
P.	<b>Reduced prices for centrally-controlled products and services</b>
	<p>Any measures that reduce the price of goods and services controlled by a federal government.</p> <ul style="list-style-type: none"> <li>• P1. Public service payments</li> <li>• P2. Fuel prices (oil and gas)</li> <li>• P3. Utility prices (electricity and water)             <ul style="list-style-type: none"> <li>○ <i>Electricity cost cuts for businesses</i></li> </ul> </li> </ul>
Q.	<b>Other tax cuts and deferrals</b>
	<p>Any tax-related measures not covered by archetypes L, M, N and P.</p> <ul style="list-style-type: none"> <li>• Q1. Other tax cuts and deferrals</li> </ul>

## Appendix B: Technical annex

### Summary of the modelling approach

**The objective of the modelling was to estimate the economic, environmental and health packages of different stimulus packages.** There are five steps in the analysis:

- **Policy analysis.** For each country, Vivid Economics designed an indicative green COVID-19 pandemic recovery package. This package is tailored to the national context, while drawing on international best practice for designing green stimulus policies. For China and India, the green recovery package is compared to the announced coal stimulus policies.
- **Preparing model inputs.** Each intervention is translated into a ‘shock’ to the I3M model. As a Leontief multiplier input-output model, model shocks are changed in sectoral final demand.
- **Economic modelling.** The model shocks are inputted into the model to estimate the direct and indirect economic impacts of the different stimulus scenarios. The direct economic impacts are those within the sector where demand has changed, for example, an increase in demand for coal will directly increase jobs in the coal mining sector. Indirect economic impacts refer to upstream supply chain impacts.
- **Emissions modelling.** The economic modelling reports changes in sector emissions, as well as changes in demand for different fossil fuels. Using emission factors, Vivid Economics calculated the total change in CO<sub>2</sub> emissions to demonstrate the mitigation benefits of a green recovery.
- **Health modelling.** Air pollution poses a major threat to human health, and PM2.5 has been found to be the most consistent and robust predictor of mortality in long-term exposure studies. Drawing on relationships established in the literature, Vivid Economics estimated the likely increases in premature mortality associated with stimulus packages in China and India, as well as changes in infant health outcomes.

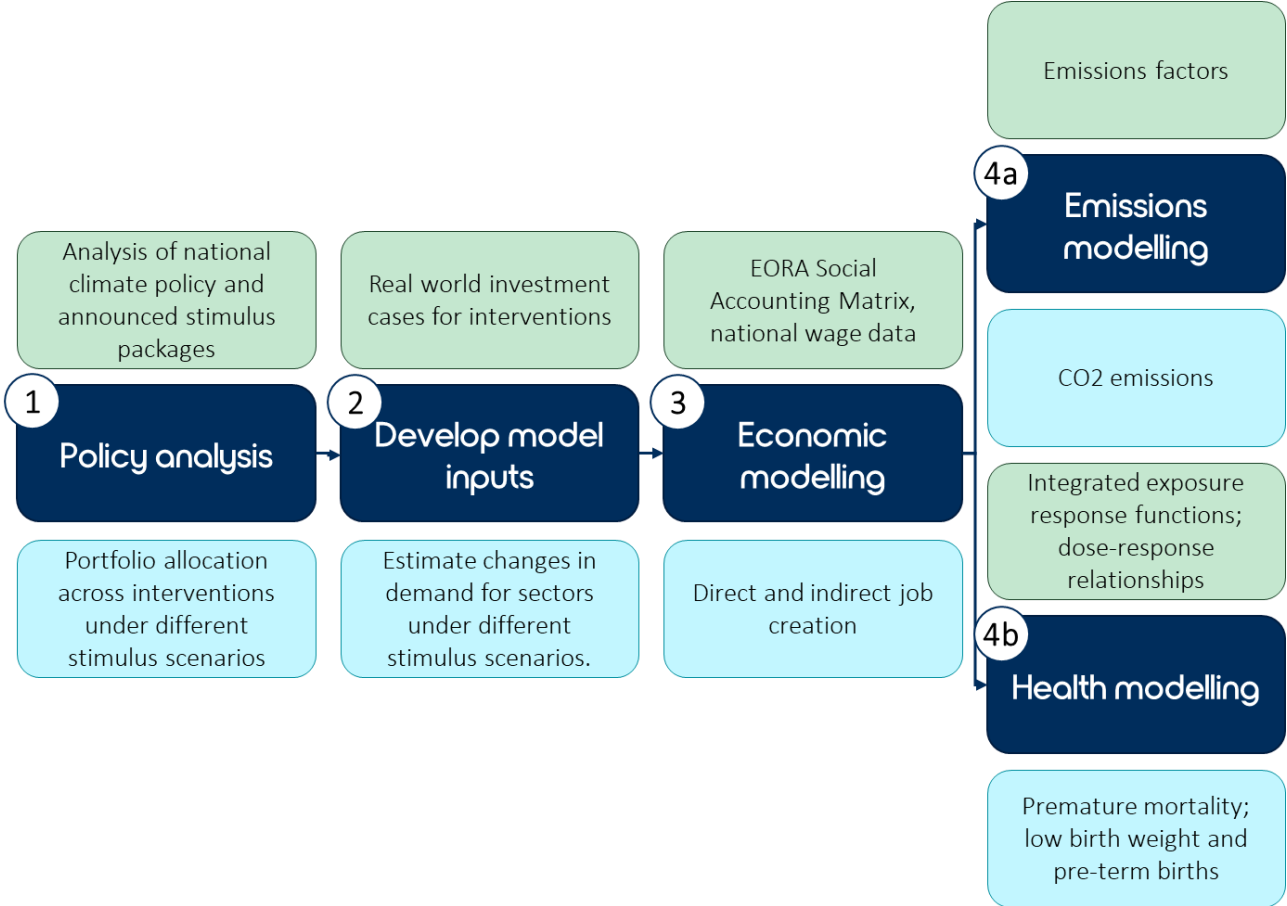


Figure 0.1 Overview of modelling approach. Note: Blue boxes summarise the steps in the analysis, green boxes indicate inputs at each stage, turquoise boxes indicate outputs. Source: Vivid Economics.

**Policy analysis: Which stimulus packages are modelled in the analysis?**

The first step in the modelling process was deciding *which* stimulus packages to model. For China and India, the modelling compares the economic, environmental and health implications of a coal stimulus package with an indicative green alternative package of the same level of investment. In Poland, targeted coal sector support has been relatively light. Instead, the modelling estimates the economic and environmental implications of green stimulus funded through the European Commission’s Just Transition Fund, where Poland is expected to receive an additional EUR1.75 billion if it commits to a 2050 Net-Zero emissions target.

The Smith School drew on government announcements, news articles and targeted stakeholder consultation to identify coal stimulus support in China and India. In China, policy relaxation would suggest an acceleration of coal generation construction of 57.8MW. In India, support has included infrastructure expansion for State-Owned Enterprise Coal India, and the auctioning of 41 coal blocks for commercial mining (which in-country experts suggest will result in about seven coal blocks being developed in the next five years).

Taking the scale of investment as given, Vivid Economics designed an indicative green stimulus recovery package focused on mitigation interventions. For China and India, the



size of the investment was determined by the coal stimulus (USD 28.4 billion and USD 7.8 billion, respectively), while in Poland the size of the investment is its allocated share of the Just Transition Fund (EUR 3.5 billion, USD 4.0 billion). This investment is split among seven mitigation interventions (sustainable reforestation, hydropower, wind power, solar power, building efficiency, industrial energy efficiency, and electric vehicles). The share of the investment was allocated to each intervention on a country-specific basis, according to the following three factors:

- International best practice in designing green stimulus – there is an emerging literature on which green interventions can offer the best social returns in economic downturns;
- Alignment with existing national priorities – as demonstrated in countries' Nationally Determined Commitments and other plans or policies;
- Alignment with announced stimulus.

**These three factors were combined to develop a representative green recovery stimulus package for each country.** Feedback from in-country experts informed and validated the allocation of investment to the seven interventions in the indicative green stimulus package.

#### **Box TA1. Policy analysis: Key assumptions and guidance for interpreting modelling results**

The green stimulus package is neither a description of reality nor a policy prescription. Governments will develop their own green stimulus packages, likely drawing on a wider range of interventions, which best suit their country's contexts and available resources. Section 2 of the main text outlines some key considerations for governments as they design stimulus packages. The indicative green stimulus package developed in this work is simply a hypothetical representative option which draws on known country priorities and emerging best practices.

#### **Develop model inputs: How do stimulus packages become model inputs?**

**The analysis draws on real-world investment cases to translate the interventions into model inputs.** Model inputs are the changes in expected demand for different sectors over time, which are captured in spending profiles for the 'investment' and 'operational' phases. The investment phase consists of capital expenditure, which is the cost of manufacturing, constructing, or installing the technologies – such as installing a wind farm or building a power plant. The recovery stimulus is assumed to go into capital expenditure. The 'operational' phase consists of operational expenditure, including on inputs (such as fuel) and maintenance. To illustrate this, consider an expansion in coal-fired power generation capacity. In the investment phase, there is increased demand for the construction sector, as well as for power plant machinery and equipment to build and equip the plant. In the operational phase, there is an increased demand for coal to produce power. The length of the investment phase varies by intervention, as Figure 0.2 shows. Table 0.1 **Error! Reference source not found.** summarises inputs to the model.

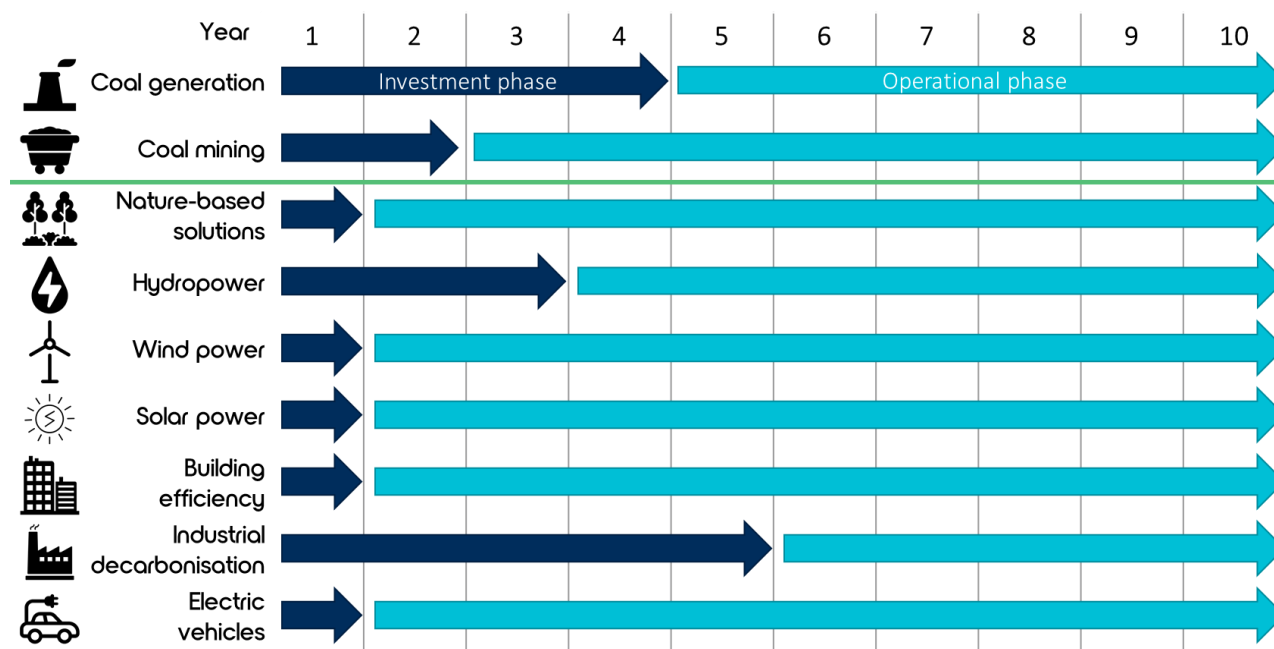


Figure 0.2 The length of the investment phase varies by intervention. Source: Vivid Economics.

Table 0.1 Summary of modelled interventions. Note: (1) Energy efficiency interventions result in cost savings, which is why these are negative. Source: Vivid Economics.

Intervention	Description	Length investment phase	Length operational phase	Key sources
China – increase in coal generation	Expected expansion in coal-fired generation capacity of 57.8GW.	4	30	EIA, 2020; WNA, 2017
India – coal mining infrastructure and development of new coal blocks	Infrastructure spending, with a focus on transportation. Development of 7 coal mining blocks	2	30	Camm, 1991
Sustainable reforestation	Re-establishing natural forests, planting more native species or increasing the density or extent of existing forest.	1	50	World Bank, 2017

Intervention	Description	Length investment phase	Length operational phase	Key sources
Hydropower	A hydroelectric power plant with a total project capacity of 100 MW is the reference investment.	3	50	EIA, <a href="#">2020</a> ]
Wind power	An onshore wind power project with a total project capacity of 200 MW is the reference investment.	1	25	EIA, <a href="#">2020</a>
Solar photovoltaic	A solar photovoltaic (PV) facility with a total project capacity of 150 MW is the reference investment.	1	30	EIA, <a href="#">2020</a>
Building efficiency	The reference investment is a deep energy retrofit of a commercial building.	1	25	Bleyl et al, <a href="#">2018</a>
Industrial energy efficiency	Given the diverse nature of industrial energy efficiency interventions, this is not based on a reference investment, but a cross-industry decarbonisation pathway using Best Available Technologies.	5	30	ICF, <a href="#">2019</a>
Electric vehicles	Acquisition of fleet of electric vehicles.	1	10	Qiao & Lee, <a href="#">2019</a> ; Liu et al, <a href="#">2019</a>

**Box TA2. Develop model inputs: Key assumptions and guidance for interpreting modelling results**

There are three key points to note about this phase of the work:

- The model is agnostic to the source of the expenditure and does not account for any multiplying effect government investment can have. The modelling compares the economic, environmental, and social impacts of like-for-like investment in the coal sector relative to green interventions. To illustrate this:

- the model analyses the expected cost of expanding coal generation in China, which will be borne by state-owned enterprises;
  - in India, commercialisation of coal mining will likely lead to investment in coal mine development by domestic industry conglomerates;
  - the model analyses the costs of implementing energy efficiency improvements in the building sector – this type of intervention is often part-funded by government through subsidies.
- All these three interventions are treated in the same way: the total cost of the investment is modelled without regard to the source of the expenditure.
  - The spending profiles are developed from real world investment cases from both national and international sources.

### **Economic modelling: How does the model estimate direct and indirect economic impacts?**

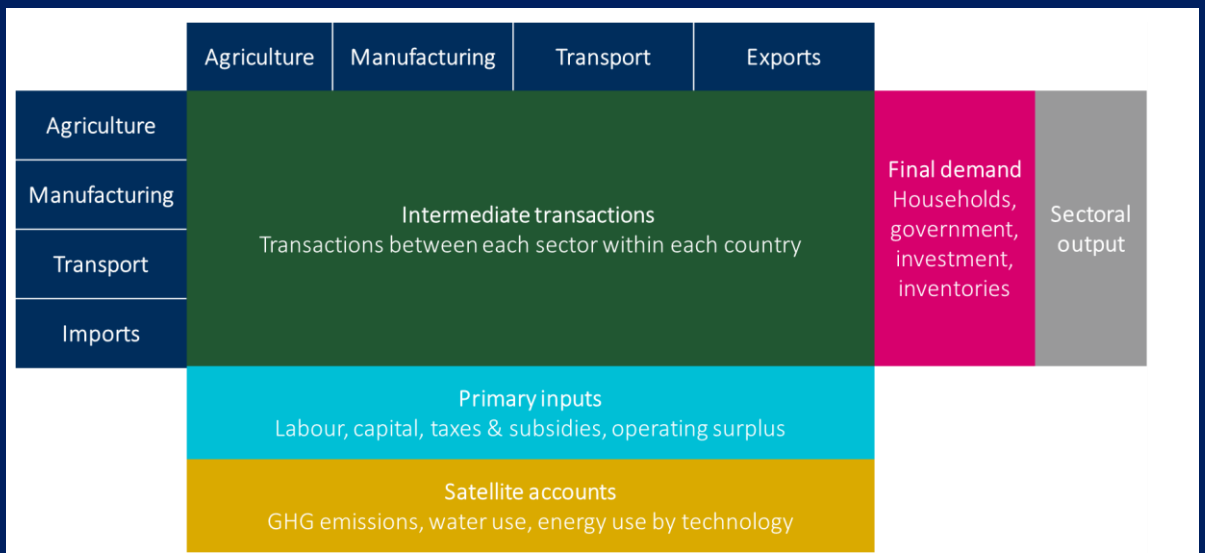
#### **The analysis leveraged Vivid Economics' Intervention & Investment Impact Model (I3M) to estimate the direct and indirect economic impacts of different stimulus packages.**

The analysis fed the investment and operational phase spending profiles into the I3M input-output model to obtain estimates of changes to sectors' gross value added and labour costs. Box TA3 provides a summary of the principle of input-output modelling and its use in this exercise.

#### **Box TA3. Introduction to input-output modelling**

Input-output models provide insight into the interdependencies between different economic sectors – using an input-output model the analyst can trace how changes in demand or output in one sector impacts other sectors, with a ripple effect through the national economy.

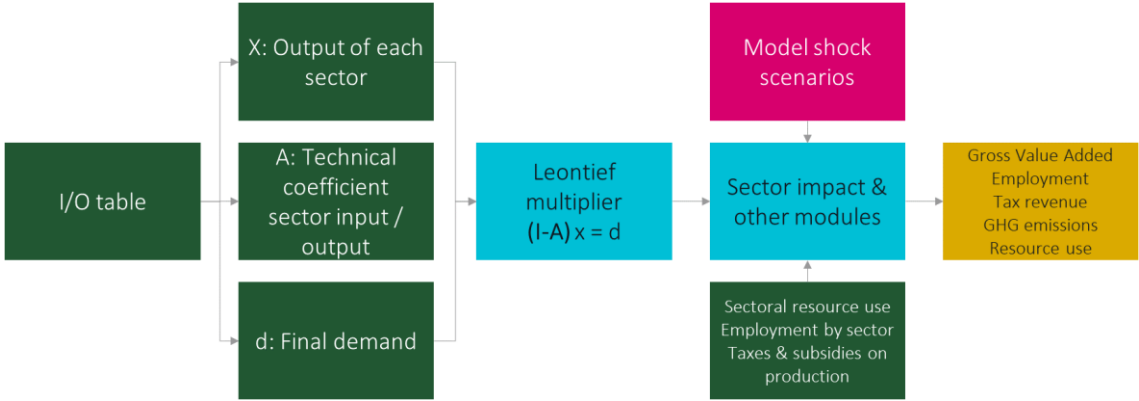
The base of all input-output models is an Input-Output (I/O) table which describe all flows of economic transactions within an economy. The I/O table is a square matrix that represents the intermediate transactions between all sectors in all countries. In addition, the final demand of households, government purchases and other agents within each country for the output of all sectors is represented in the Final Demand block. Correspondingly, the primary inputs to sectoral production (labour, capital, etc.) are represented in the Primary Inputs block. The diagram below shows a simplified representation of an I/O table.



This modelling exercise relied on the EORA database, which contains a multi-region input-output table with matching environmental and social satellite accounts for 190 countries.

The I/O table is translated into a matrix of Leontief multipliers that give detailed breakdowns of how increased final demand for a given sector requires inputs from its supply chain, creating transactions that increase economic activity and employment in supporting sectors.

The diagram below summarises the structure of an input-output model. The green boxes represent inputs from the Social Accounting Matrix, the blue boxes indicate modelling steps, the pink box is the model shock, and yellow boxes are possible model outputs.



**I3M estimates the first and higher order impacts of changed demand in one sector on its inputs, both in terms of upstream sectors and factors of production.** For example, an investment in coal generation capacity will increase demand for labour in the electricity sector. It will also increase demand for inputs produced by upstream sectors. There are also higher

order effects as those upstream sectors also increase demand for their inputs, creating a ripple effect through the economy. All outputs are reported in value (USD) terms.

**To calculate job creation, the model draws on EORA reporting of employment associated with each sector in the I/O tables.** The jobs per output ratio is implicitly calculated by the model and jobs associated to any sectoral output increase computed based on them. EORA employment figures are derived from the International Labour Organisation (ILO). Job creation is measured in job-years for both direct and indirect jobs.<sup>26</sup>

#### **Box TA4. Economic modelling: Key assumptions and guidance for interpreting modelling results**

- There are four key assumptions in I3M:
  - **Constant returns to scale as production is increased.** In other words, the empirical technology observed in the I/O table is assumed to be the same at any level of production.
  - **Slack capacity.** There is enough underused capacity in the economy to scale up production without requiring additional investment. This is considered reasonably valid in the context of an economic downturn.
  - **Fixed prices.** The model does not allow for price adjustments. This assumption is critical, as the model does not consider substitution effects between inputs, but rather assumes they will always be used in the same proportions. In the short run, this is a reasonable assumption, but in the longer run, prices will reflect the increase in demand through an upward movement.
  - **No induced impacts.** The model excludes the mechanism by which increased household wealth prompts greater consumer spending.
- The assumptions mean that the estimates of job creation in a green recovery are likely to be highly conservative. For example, one green intervention modelled is building efficiency, which reduces consumption of electricity and gas. For businesses, this represents a cost which they may pass on to consumers in the form of lower prices – boosting sales. The intervention is likely to result in a transfer of economic activity from the power sector to the beneficiary businesses. It is unclear whether the overall economic impact is positive or negative. However, the static nature of the model means that the boost to businesses cannot be captured.

<sup>26</sup> Job-years refer to years of work created under a new job and is a helpful measure as it captures the total job creation impact across different types of jobs and to enable comparison with estimated job impacts from other interventions or investments.

**Emissions modelling: How are model outputs used to estimate changes in emissions?**

The Eora I/O table provides a detailed account of greenhouse gas emissions in each sector. The approach to estimating greenhouse gas emissions is similar to the approach taken for employment: the emissions per output ratio is implicitly calculated within the model, with these ratios used to compute emissions associated with changes to sectoral output.

To estimate the mitigation benefits of a green stimulus package, some additional calculations need to be made. While the EORA database includes satellite accounts for greenhouse gas emissions, the fixed price assumption behind the model allows for no substitution effects. This is not always the case. For example, a shift to electronic vehicles means that the transportation sector will consume less petrol and more electricity, which will reduce emissions. Sectoral emissions are also driven by the sector definitions from EORA. Sometimes the sectors are quite broad, including a wide range of different production technologies, of which only the average emissions are reported. This is most visible in the power sector: if coal generation capacity increases by 58GW, then this will be more polluting than if capacity in the electricity sector had increased by 58GW across all sources proportionately. Yet, the power sector is reported as a single sector. Adjustments need to be made to I3M outputs to take this into account. Consequently, the analysis applied the appropriate emissions factor to the estimated change in demand for different fossil fuels (an output from I3M) to estimate the reduction or increase in emissions associated with the intervention.

**Box TA5. Emissions modelling: Key assumptions and guidance for interpreting modelling results**

- I3M emissions outputs correspond to the emissions associated with each increase in output, for each sector, using the national average production technology.
- Qualitative and quantitative research of emissions associated with the specific interventions imposed in the model drive the emission adjustments.
- Adjustments to emission outputs are reported below:

Intervention	I3M emissions output	Model adjustments
Coal power generation	Emissions associated to average electricity mix – not only coal.	Emissions replaced by the coal CO <sub>2</sub> content of the increased in coal demanded
Renewable energy	Emissions associated to average electricity mix – including fossil fuel sources	No emissions associated with renewable energy production
Decrease in demand for fossil fuels due to energy efficiency	Sector emissions for fossil fuel sectors only include emissions produced by the extraction and processing of	Adjustment considers the emissions associated with the combustion of fossil fuels, and therefore the additional

improvements (building & industry).	fossil fuels – not their combustion.	mitigation benefits of energy efficiency.
Sustainable reforestation	No mitigation benefits calculated.	Sequestration benefits of sustainable reforestation added.

**Health modelling: How are health benefits estimated through the model?**

**Exposure to outdoor fine particulate matter (PM2.5), household air pollution and ozone have been linked with adverse morbidity and mortality outcomes.** Of these air pollutants, PM2.5 has been found to be the most consistent and robust predictor of mortality in long-term exposure studies (Health Effects Institute, 2019). Exposure to PM2.5 is also linked to adverse pregnancy outcomes including pre-term birth (defined as birth before 37 weeks of gestation) and low birth weight (defined as live birth weighing less than 2500g). Figure 0.3 summarises the approach taken to estimating the health impacts associated with different stimulus scenarios. Note the analysis restricts the assessment of premature mortality to four causes: stroke, ischemic heart disease (IHD), chronic obstructive pulmonary disease (COPD) and lung cancer.

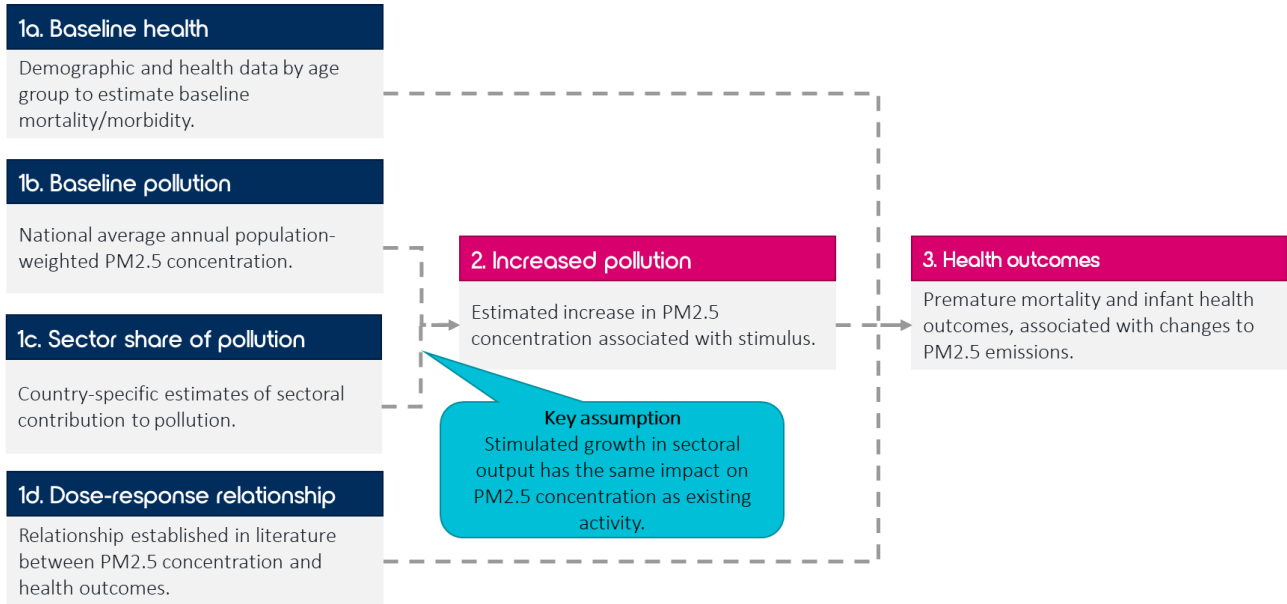


Figure 0.3 Overview of health modelling approach. Notes: Dark blue boxes indicate external data; pink boxes indicate modelled outputs. Source: Vivid Economics.

**Baseline mortality and morbidity estimates are forecast using demographic data and health data on incidence within the population.** Demographic data and health data by age group are used to calculate baseline mortality. Baseline mortality figures are compiled using UN population data out to 2050 and the rate of incidence of death (per 100k of the population)



for the four main causes of mortality associated with PM<sub>2.5</sub> exposure (stroke, IHD, COPD and lung cancer).<sup>27</sup> For all causes, the latest available rate of incidence of death is taken and held constant out to 2050 to estimate deaths per year for each cause.<sup>28</sup> For COPD and lung cancer, population and health data are obtained for the total adult population (aged >25 years). For stroke and IHD, population data and health data are obtained for the total adult population aged 25 by age group (5-year intervals). Baseline morbidity is estimated using UN population data and data on incidence in the total population. Demographic data for all calculations is sourced from the UN World Population Prospects. The incidence of mortality from all causes and the incidence of pre-term births are sourced from the Global Health Data Exchange (GHDx), a database compiled by The Institute for Health Metrics and Evaluation, an independent global health research centre at the University of Washington. Incidence of low-birth weight is sourced from UNICEF-WHO through the World Bank Data database.

**A baseline national level of PM<sub>2.5</sub> concentration is obtained and country-specific estimates of sectoral contributions to overall concentration are taken from studies to calculate estimates of additional concentration due to coal or green interventions.** Average annual population weighted PM<sub>2.5</sub> (µg/m<sup>3</sup>) is sourced from the Health Effects Institute's State of Global Air 2019. National estimates of sectoral contributions to national PM<sub>2.5</sub> concentration are sourced from country-specific studies. To estimate the changes in PM<sub>2.5</sub>, bespoke calculations were used to estimate the increase in PM<sub>2.5</sub> concentration directly associated with the coal intervention. To estimate the indirect impacts, and for the green stimulus packages, I3M outputs for the changed output in the transport, industry and power sectors were used to proportionally increase the relative PM<sub>2.5</sub> concentrations.

**Mortality due to long-term exposure is estimated using the relative risks obtained from the integrated exposure response functions (IERs) developed for the Global Burden of Disease study** (Burnett et al, [2014](#)). In light of the few studies investigating mortality impacts from sustained exposure to high levels of PM<sub>2.5</sub> concentration, the IERs developed by the Global Burden of Disease Study, include evidence from studies that considered PM<sub>2.5</sub> mortality due to active smoking, second-hand smoke and household air pollution to approximate risks at higher concentration levels. Evidence suggests that stroke and IHD mortality dominate total mortality from exposure to PM<sub>2.5</sub> (accounting for roughly 70% of total associated mortality) and exhibit supralinear response functions, increasing most sharply at low concentrations and exhibiting diminishing effects as the concentration rises. For COPD and lung cancer, the response functions are close to linear (Apte et al, [2014](#)). The use of IERs is the approach recommended by the World Health Organisation as the most appropriate for worldwide analysis, as well as for comparison across countries and risk factors as it covers relevant exposure ranges on a global scale and considers only specific causes of death, beneficial for countries where all-cause mortality may capture a large degree of infectious diseases (WHO, [2018](#)). The analysis draws on the relative risks associated with the IERs developed for the GBD study. Burnett et al. represent each cause- and age-specific IER relationship using a common function and provide a distribution of 1000 point estimates of the parameters for each of those relationships. The analysis uses the look-up table provided by Apte et al (Apte et al, [2014](#)). These look-up tables provide the mean relative risk for each 0.1

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<sup>27</sup> Deaths from tracheal, bronchus and lung cancer are used to estimate deaths from lung cancer. Latest health data estimates are for 2017.

<sup>28</sup> 2017 is the latest available data point for all causes of mortality.

$\mu\text{g}/\text{m}^3$  incremental increase in PM2.5 concentration for each cause and age specific IER relationship over the concentration range 1 to 410  $\mu\text{g}/\text{m}^3$ .

**Relative risks for morbidity linked to exposure to PM2.5 are estimated from pooled odd ratios obtained from meta-data analysis.** Linear relationships have been estimated for low-birth weight and pre-term births due to PM2.5 exposure. Due to small sample sizes and to avoid basing results on one study, relative risks obtained from meta-data analysis where various studies are considered are preferable. For the relationship between low birth weight and exposure to PM2.5, the odds ratio is taken from Sun et al (Sun et al, [2016](#)). They conduct a meta-data analysis of global studies to put forward an odds risk which we use to approximate the relative risk.<sup>29</sup> For pre-term births, the analysis draws on the pooled odds ratio from Sun et al (Sun et al, [2015](#)) who provide a global meta-data analysis for studies investigating the link between exposure to PM2.5 and the incidence of pre-term births. Furthermore, preterm birth is the second largest direct cause of child deaths in children younger than 5 years (Blencowe et al, [2012](#)). The analysis draws on reference tables exploring the link between pre-term birth and infant mortality outcomes to estimate additional infant deaths (Katz, 2013).<sup>30</sup>

#### **Box TA13. Health analysis: Key assumptions and guidance for interpreting modelling results**

The analysis relies on three assumptions:

- **Constant rate of incidence.** The latest available rate of incidence of mortality and morbidity is held constant in projections of baseline health estimates.
- **Proportional increase in PM2.5 due to increase in sector activity.** The analysis assumes a proportional increase in PM2.5 from an increase in sector activity. This assumes limited change to technologies, and a similar geographical spread. The sectoral contribution to national PM2.5 is assumed to stay constant.
- **Consistent risk ratio across countries and sources of PM2.5 pollution.** The relative risks associated with the integrated response functions are based on mass concentration. Some studies suggest that relative IERs may vary depending on the source of emissions. In this analysis, the IERs do not change with the emission source.

<sup>29</sup> Using an odds ratio to estimate a relative risk will overestimate effect.

<sup>30</sup> Infant is defined as being from birth to 365 days.

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