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# A Prosperous Green Recovery for South Africa

**Could green investment bring short-term economic recovery while unlocking long-term sustainable growth?**

*Oxford University Economic Recovery Project, SSEE and Vivid Economics  
in partnership with the United Nations Economic Commission for Africa*

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## Executive Summary

**Green spending could help South Africa address the COVID-19 economic downturn, reduce carbon emissions, and transition to a strong and resilient long-term growth pathway.** Vivid Economics modelling suggests that investment in green initiatives could bring up to ~60% more jobs in the short-term and as much as ~140% greater economic value in the long-term, compared to traditional alternatives. Building on green aspirations contained in President Ramaphosa’s *Economic Reconstruction and Recovery Plan*, there is robust evidence to suggest that South Africa could use bold new green investment to swiftly create jobs, increase GDP, and improve social and environmental prosperity.

**The South African economy has been hit hard by the COVID-19 pandemic, with GDP contracting by 51% in the second quarter of 2020.<sup>i</sup>** Though there were signs of a rebound, a new variant and the beginning of a second wave in December 2020 induced further economic woes, and economists predict that the country may not fully recover until 2025.<sup>ii</sup> Pre-existing inequalities along income, racial, and gender lines continue to worsen as a result. As the world reacts to the climate crisis, South Africa’s heavy reliance on a dying fossil fuel industry may jeopardize its recovery prospects. For South Africa, the most emissions-intense top-50 economy (on a GDP basis), the realities of climate change demand a rapid shift from fossil-fuel driven economies to those that rely on clean energy for growth and resilience.<sup>iii</sup>

**Evidence suggests that green stimulus measures can deliver environmental dividends as well as strong short-term economic gains, sometimes more effectively than ‘traditional’ stimulus approaches.<sup>iv</sup>** Green measures could bring a hat-trick of benefits: capturing economic stimulus effects in the short term, securing new growth pathways in the medium term, and mitigating environmental degradation in the long term. Vivid Economics modelling (fig 1) highlights the short-term strengths of green spending.

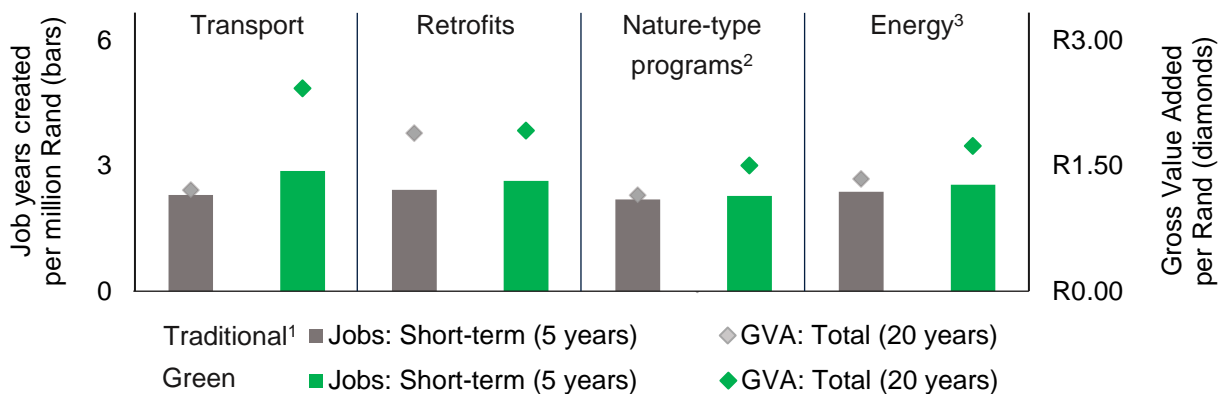


Figure 1. Job and Gross Value Added (GVA) impacts of green spending policies (average) compared to traditional spending measures in South Africa. These are simple average figures; the full policy set is available in Figure 4. Modelling output from Vivid Economics; see Technical Annex.

<sup>1</sup> Traditional investments include road, housing development, water treatment facilities, and coal energy generation. <sup>2</sup> Green nature includes agroforestry and park development, among others (figure 4). <sup>3</sup> Modelling is based on current sector dynamics, rather than projected future dynamics. It is likely to overstate long-term GVA of traditional (fossil) investment and understate GVA of green energy. For fossil spending, stranded asset risk could reduce asset lifespans. For clean investment, cheaper energy is likely to unlock investment in electric transport, sustainable production, and other adjacent sectors.

**This briefing recommends three priority policy areas that are likely to stimulate strong economic growth whilst ensuring a prosperous and sustainable future for the country:**



**Renewable energy:** Investments in renewable energy can deliver high economic multipliers, reduce vulnerability to fossil fuel price volatility, and act as a core enabler of CO<sub>2</sub> reduction efforts in other sectors. Currently, South Africa relies on coal for 90% of its electricity needs. However, as coal generators age, ~35 GW of production will need to be decommissioned.<sup>v</sup> To meet rapidly growing energy demand, now is the time to invest in the renewable transition, targeting localities exposed to high unemployment and seeking private-sector partnerships.



**Low-emissions transport:** Alongside reduced air pollution and climate benefits, investment in low-emissions transport and supporting infrastructure has strong job creation potential. South Africa has existing strength in auto manufacturing, yet the sector has suffered during the pandemic. A transition to electric vehicle production would future-proof the sector. Manufacturing investment incentives could help accelerate electric vehicle production, while incentives to new businesses and consumers could support electric vehicle sales and construction of charging stations.



**Natural Capital Investments:** Nature-based interventions include restoration of habitats, agricultural interventions that sustainably boost productivity, and urban greening. These one-off investments create low-skill jobs and can be deployed quickly. They are not given to investment leakage outside the country, ensuring that stimulus is focused on the domestic economy. These opportunities could bring returns for the badly hit tourism sector, increase the resilience of the economy to future shocks, and support climate change adaptation.

**In 2020 South Africa earmarked 0.3% of GDP for recovery compared to the average of 2.1% among G20 countries (excl. EU) and 1.6% in low- and middle-income countries (LMICs).** By contrast, rescue spending has totalled 11.5% of GDP, compared to 14.2% of GDP across the G20. It is likely that low recovery spending has so far been driven partly by the continuing prevalence of the virus and partly by a lack of affordable borrowing options. The Global Recovery Observatory<sup>vi</sup> from the Oxford University Economic Recovery Project and the Green Fiscal Policy Network<sup>vii</sup> shows that green COVID-19 spending in South Africa is one third of the G20 average and half of the LMIC average.

**Making the swift and sustainable investments needed for green transition will require strong international partnerships and support.** The Government must learn from early successes mobilising domestic and international funds in the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), as the scale of investment required for the green transition is far higher than what has been secured to date.

**Financial innovation can help mobilise the required volume of investment.** Building on opportunities in UNECA's paper *Building Forward Together*,<sup>viii</sup> the government should prioritise initiatives to crowd-in private capital, while international partners must consider significant concessional finance (grants and loans), debt restructuring programmes, and other mechanisms. These initiatives would support both domestic and global interests.





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## 1. The pandemic has intensified pre-existing weaknesses

### 1.1 Pre-pandemic South Africa

Even before the pandemic reached South Africa, the domestic economy was struggling to find its feet, having experienced two recessions in the three years preceding the first recorded case of COVID-19.<sup>ix</sup> The instability of the mining, aviation, and electricity sectors have contributed to persistent weakness in the public balance sheet, growing debt, and falls in the country's credit rating. In 2019, the nation continued to struggle with large healthcare, income, and education disparities, in large part an unwanted legacy from apartheid rule.<sup>x</sup> Unemployment was at 28.7%,<sup>xi</sup> and around half of the adult population lived below the upper bound poverty line.<sup>xii</sup> Corruption also continues to challenge progress, with South Africa ranked 69<sup>th</sup> in the world in the 2020 Corruption Perceptions Index.<sup>xiii</sup>

As evidenced by shrinking markets for coal exports; the continued demise of South Africa's monopolistic energy provider, Eskom; and structural failings at South African Airlines, a fossil-fuel driven economy in South Africa lacks long-term viability.<sup>xiv</sup> Basing growth plans in fossil-heavy initiatives is likely to be ineffectual, bringing economic hardship through stranded assets as well as significant consequences for the environment and for public health. Particularly in South African coal-burning provinces, nitrogen dioxide and sulphur dioxide pollution routinely reach dangerous levels. This pollution contributes to high rates of respiratory disease.<sup>xv</sup> Some efforts have been made by the national government to combat pollution and carbon emissions, but they have not yet resulted in significant changes.<sup>xvi</sup> The government's 2019 carbon tax, hamstrung by generous tax exemptions, has been ineffective in reducing emissions.<sup>xvii</sup> State capacity to deliver bold economic plans that support long-term prosperity will require a whole-of-government approach that is coherent and overcomes regulatory inefficiencies, administrative inefficiencies, and policy uncertainty.

### 1.2 Impact of COVID-19 on South African economy and society

Given pre-existing economic fragility and persistent inequality, South Africa has been hit particularly hard by the COVID-19 pandemic. The IMF's World Economic Outlook recorded an economic contraction of 8.0% in 2020 and an unemployment rate ballooning to 37%.<sup>xviii</sup> The pandemic has pushed thousands of families below the poverty line, particularly female headed households, Black households, and those with lower levels of education.<sup>xix</sup> An August 2020 United Nations Development Program report revealed that inequality was worsening and the country's Gini coefficient, already high, was set to rise significantly.<sup>xix</sup> In December 2020, South Africa experienced a second wave of infection which has yet to abate. Little analysis has been carried out on the possible economic and social consequences of this second wave, though it is likely to worsen the aforementioned impacts.

### 1.3 Policy responses during the pandemic

In response to COVID-19, countries of all varieties have carried out unprecedented fiscal spending to address the immediate health and economic consequences of the crisis and provide stimulus to enable economic recovery. The Global Recovery Observatory (the Observatory), developed by the Oxford University Economic Recovery Project in collaboration with the Green Fiscal Policy Network, has tracked all announced fiscal expenditure by the world's fifty largest economies and assessed policies for economic, environmental, and social impact. **This tool tracked more than ZAR630 billion announced by the South African**



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**government in 2020, of which ZAR612 billion was in the form of short-term rescue measures to keep businesses and people alive and ZAR18 billion was in recovery measures to reinvigorate the economy.**

The bulk of announced spending in South Africa was contained in a single ZAR500bn package released in April 2020, necessarily focussing on short-term rescue-type measures to meet the immediate needs of the crisis.<sup>xx</sup> This included spending to bolster the healthcare system and prevent virus transmission, as well as several supports for individuals and businesses such as tax deferrals, loan guarantees, direct payments to individuals, and unemployment insurance. Also among these measures was a deferral of carbon tax payments.

In October 2020, President Ramaphosa announced the Economic Reconstruction and Recovery Plan,<sup>xxi</sup> which aims to achieve economic recovery largely through infrastructure investment. Projects are expected to cover a variety of sectors including transportation, energy, sanitation, and agricultural development. The Plan provides for a Green Focus, although details on implementation methodology are not yet available.

#### **1.4 Green stimulus to catalyse future prosperity**

Although South Africa has made significant rescue-type investments to address short-term health and economic crises compared to other nations in the region, like most African and developing countries, their recovery-type spending is behind many high-income nations. Figure 1 illustrates the differences in South Africa's recovery spending compared to nations including the UK, France, Australia, China, and India. In part, these differences are explained by significantly lower fiscal space and higher costs of finance in South Africa compared to elsewhere.

Other economies have also devoted much more to a green recovery than South Africa. Yet, there is opportunity for the Government to refocus on sustainability and prosperity in its future stimulus spending. Section 3 of this report details how policies that consider environmental outcomes and aid in the shift away from a fossil fuel-driven economy are likely to be the most effective recovery policies for South Africa.

Of course, for many low- and middle-income nations, an inability to access affordable finance can significantly limit the ability to fund any level of recovery spending. A failure to make these investments not only threatens to exacerbate domestic poverty, but also to limit global growth and prosperity. Domestic resources alone may be insufficient to enable these investments; financial support from international partners and development agencies could help ensure that opportunities are not missed.

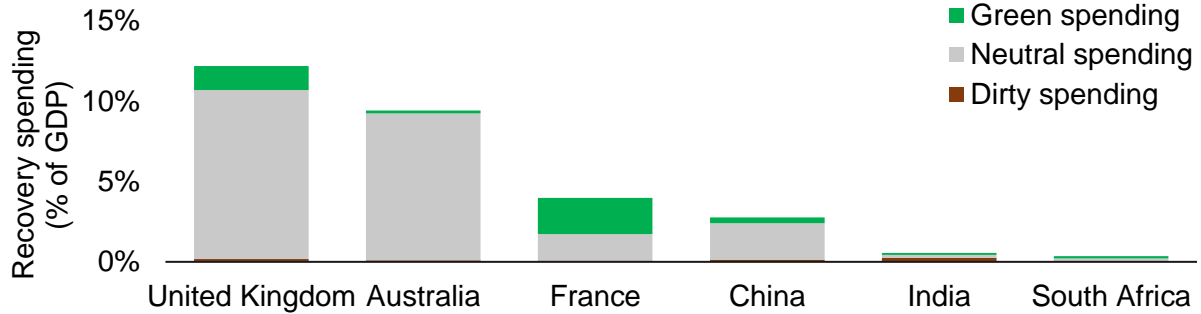


Figure 2. Composition of global recovery spending. Data excerpted from Global Recovery Observatory.

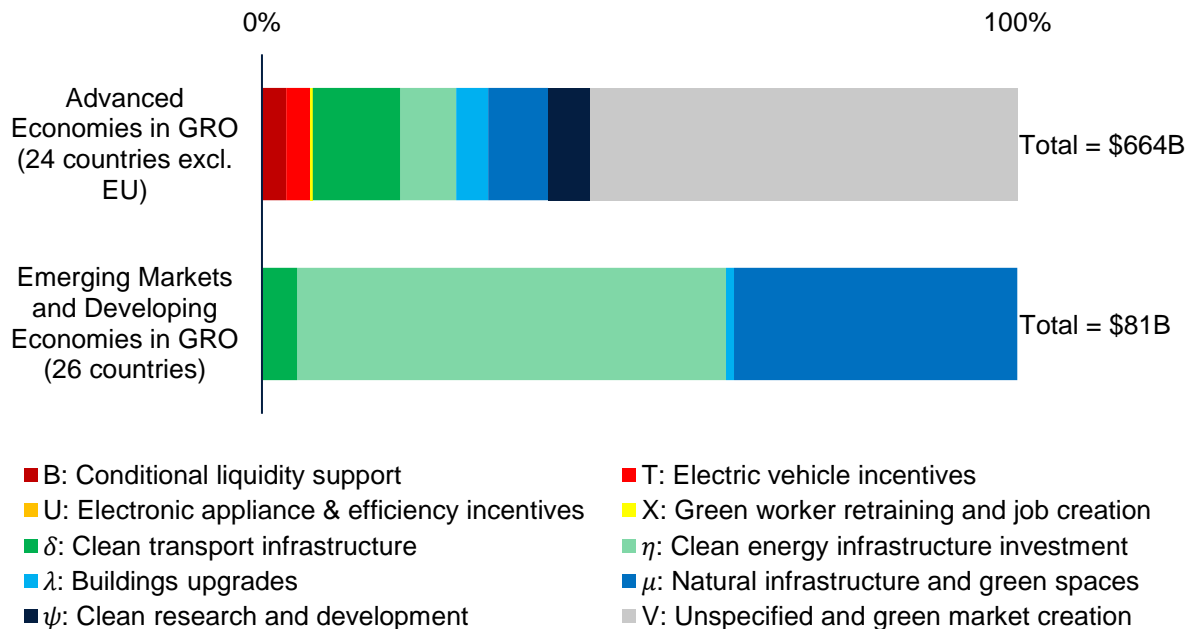


Figure 3. Distribution of green spending in 2020 as tracked by the Global Recovery Observatory.

## 2. Priority policy recommendations

Vivid Economics’ modelling indicates that, by directing spending to green investment initiatives, South Africa could secure a more jobs-intensive recovery while reinvigorating economic growth and making substantial progress against its climate commitments. Figure 4 illustrates the relative job creation potential of different green investment opportunities in the short and long term, as well as impacts on Gross Value Added (GVA). Using input-output analysis, Vivid finds that all modelled policies support economic recovery through the generation of jobs, yet within each sector, green policies deliver greater numbers of jobs within the next 5 years than traditional alternatives. Additionally, these investments enable a greener future by reducing emissions.

With many competing priorities for government spending in South Africa, like healthcare and poverty alleviation, the social co-benefits of green spending are another significant attraction. Transitioning from burning fossil fuels to using renewable energy can dramatically improve air quality, significantly lighten the burden on healthcare providers, and save lives.<sup>xxii</sup> This is true in electricity, transport, and materials production. Additionally, strategic and well-designed green investment can be targeted to low-income households and vulnerable groups, potentially reducing poverty and cutting inequality.<sup>xxiii</sup> Global action against climate change can reduce disaster risk and environmental system-change, both of which disproportionately impact the poor.<sup>xxiv</sup> Finally, green investments can and should be paired with health and education infrastructure programs, as well as agriculture support initiatives. For example, a rollout of new school infrastructure should include rooftop solar solutions for provision of electricity, and agricultural uplift activities should promote efficient and sustainable farming practices.

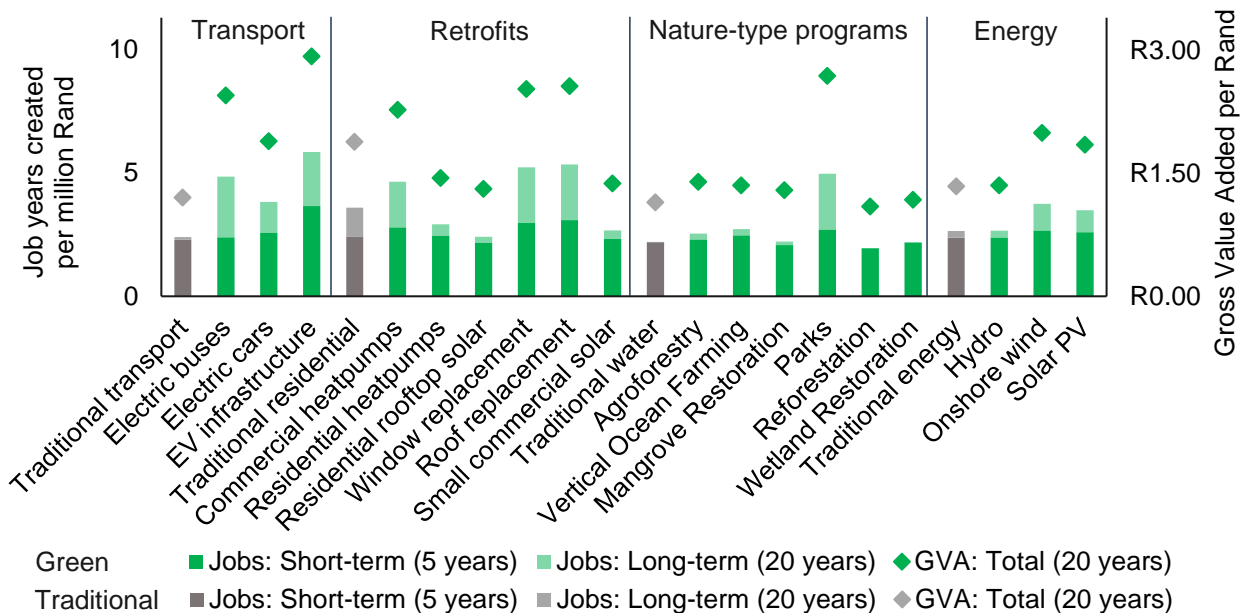


Figure 4. Job and Gross Value Added (GVA) impacts of green spending compared to traditional spending in South Africa for all modelled policies. Modelling output from Vivid Economics; see Technical Annex.

Note: Modelling is based on current sector dynamics and is therefore likely to significantly overstate the long-term GVA of traditional (fossil) investment and understate the GVA of green energy. For fossil investment, stranded asset risk could significantly reduce the asset lifespan, and for clean investment, new cheap clean energy is likely to unlock new investment in adjacent areas like electric transport, artificial proteins, and sustainable material production. Finally, even if fossil assets were to serve a full working life, continued reliance on coal would support unacceptable levels of carbon emissions.

Traditional investments are defined as follows: transport includes improvements to the road network, including laying new road and constructing accompanying road infrastructure, such as interchanges and bridges; residential includes housing development, including the building and maintenance of traditional housing stock; nature includes water treatment facilities, including the construction and operation of waste-water treatment facilities; and energy includes ultra-supercritical coal energy generation without any carbon capture technology.



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**Using these findings as a starting point, wider analysis suggests three priority investment opportunities to be closely considered in 2021, discussed below.** Compared to traditional stimulus investments, 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 supplementary social and environmental benefits.

Alongside these core recovery policy proposals, we suggest close consideration of a comprehensive green skills training program to combat unemployment and empower the local labour force to meet the needs of large-scale green investment programs.

Apart from recovery spending, South Africa could encourage green innovation in the immediate term by tying specific green and governance conditions to any bailout programs. For instance, any support of South African Airways could include requirements for the airline to make regular progress towards medium- and long-term sustainability targets, like net zero by 2050.<sup>xxv</sup> Similar conditions have been included in airline bailouts from nations including France, the Netherlands, and Belgium.<sup>xxvi</sup> According to the World Business Council on Sustainable Development, increased global awareness of the real-world impacts of climate change are likely to make adherence to sustainability targets a key component of market competitiveness.<sup>xxvii; xxviii</sup> In other words, setting measurable and ambitious requirements could expedite investment in new technologies, creating an economic boost.

**Similarly, there is strong economic rationale to announce a commitment to net-zero greenhouse gas (GHG) emissions and/or an intent to implement a carbon pricing mechanism.** Using these moves, policymakers could simultaneously (i) garner the favour of Development Finance Institutions (DFIs) who prioritise climate objectives in their concessional finance distributions and (ii) catalyse new private sector investment into low-carbon technologies as institutions prepare to meet new standards. Both could manifest in strong short-term economic impacts, thereby assisting with recovery efforts.

**By spending on green programs, South Africa could also avoid some of the long-term economic, social, and environmental dangers of spending on fossil-intensive programs.** New fossil spending, and continued fossil subsidies, can be dangerous in that they direct scarce resources to assets that are at significant risk of being stranded by current trends in global energy use. Asset stranding can lead to increased debt burdens, as loans cannot be repaid by asset-related income and bring reductions in tax revenue, leading to broader social consequences. In short, governments cannot expect the same economic returns from fossil energy investments as may have been possible three decades ago. As discussed below, fossil-intensive spending can also accentuate pollution, leading to lethal health implications; threaten energy security, and make climate action more challenging and expensive.

The three priority green investment opportunities are:

## 2.1 Renewable energy investment

The South African energy system is heavily reliant on coal, which generates 90% of the country's electricity. A shift toward renewable generation is already underway, but at an insufficient pace. The Renewable Energy Independent Power Producer Programme (REIPPP), established in 2011, led to the procurement of 3,625 MW of large-scale renewable capacity,<sup>xxix</sup> yet this only touches the surface of the country's energy needs. The National Development Plan 2030 requires the decommissioning of 35 GW of old coal plants (out of 42





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GW currently operating), while also ensuring that growing energy needs are met by increased renewable provision, with at least 20 GW of new renewables needed by 2030.<sup>xxx</sup>

Managed well, the energy transition could generate new jobs and sustainable, inclusive growth. Modelling from Vivid Economics suggests that South African investment in renewable energy can bring more jobs in the short-term than investment in traditional energy projects. This short-term advantage is particularly relevant in the context of economic recovery. The modelling suggests the same trend for renewable investment in terms of Gross Value Added (GVA) in the short-term. Renewable energy investments that displace coal assets are also likely to bring significant health benefits through reduced air pollution, enhance social wellbeing through load-shedding and fewer blackouts, and reduce electricity costs in the long term if a least-cost roadmap is followed.<sup>xxxii</sup>

However, these benefits will not come automatically. Policymakers must be targeted in their efforts to secure a just transition that addresses questions of fairness in labour market change and regional change. For instance, in Mpumalanga, policymakers must consider how to transition the more than 80,000 workers who are directly supported by the coal industry,<sup>xxxiii</sup> leading to significant potential adjustment issues as workers need to move across sectors and locations. This was recognised in both the 2017-19 National Planning Commission on Just Transition and South Africa's 2015 Nationally Determined Contribution: "an inclusive and just transition requires time and well-planned low-carbon and climate resilient development."<sup>xxxiii</sup>,<sup>xxxiv</sup> Changes could be supported with investments in human capital. In this regard, targeted training programmes could ensure that recovery spending supports a just energy transition and a long-term shift towards sustainable growth.

Renewable energy industries would benefit from significant public support in forthcoming stimulus packages. An expanded renewable energy asset base could bring significant additional benefits beyond its contributions as economic stimulus. Shifting from coal and towards renewable electricity production could significantly reduce air pollution, bring energy market security, and ensure long term price stability. Investments in nuclear energy are not advised in a recovery context, as they are hamstrung by long planning cycles, meaning that real economic benefits would be minimal in the COVID-19 recovery timeframe. Investments in wind and solar have a comparatively fast rate of implementation. Investments in hydrogen technologies could supplement renewable generation investments and support the development of a domestic industry using South Africa's significant platinum reserves in hydrogen fuel cells for export.

Stronger public incentives for renewable energy investment could catalyse both international and domestic finance. Private capital managers both inside and outside the country have a quickly growing appetite for the clean and utility-style returns of renewable energy investments. In South Africa, this has precipitated four rounds of oversubscribed REIPPPP bid windows since 2011. To date, 80% of REIPPPP investments have been made by domestic players and interest in a fifth bid program is strong.<sup>xxxv</sup> International finance could come through similarly interested private institutions and/or DFIs who may be particularly relevant for funding newer or unproven technologies with higher perceived risk due to weak domestic credit and/or capital markets.

## 2.2 Electric vehicle investment

Investments in electric vehicles (EVs) and related infrastructure, such as charging stations, could deliver strong returns for South Africa, providing swift economic stimulus effects coupled with environmental and social co-benefits. The Automotive Masterplan 2020 seeks to grow the nation's automotive sector into a regional hub, doubling employment from 120,000 to 240,000, and increasing domestic vehicle production to 1% of global output, of which 20% will be EVs, by 2030. Increased global ambition in the EV transition suggests that the 20% target should be increased significantly. Although the COVID-19 pandemic has introduced pressures to slow the introduction of the plan, recovery spending provides the ideal opportunity to renew this focus.

A few key policy adjustments may help accelerate the transformation of the South African automotive industry. First, existing investment incentives for firms to direct capital to EV production are based on pre-pandemic production numbers. The last year of economic woes has threatened balance sheets; the size of incentives should be reassessed to ensure that firms are able to invest in new technologies and deliver on the growth targets. Second, EVs are costly for consumers at present, limiting the size of the market for producers. Taxes on internal-combustion-engine (ICE) vehicles, or the purchase of electric buses to replace old stock, would serve to increase the relative size of the local electric vehicle market, supporting manufacturers through greater demand. Finally, electric vehicles rely on local charging infrastructure, including sufficient and reliable charging stations. Dense urban areas can support the early roll-out of such infrastructure, particularly for buses. These programs may require private partnerships and potentially co-financing with local/regional governments.

## 2.3 Natural capital investment

Investment in natural capital and green spaces could bring significant benefits for South Africa across economic, environmental, and social dimensions. The tourism sector, which provides 3% of GDP, has been one of the worst affected industries during the COVID-19 pandemic. Investment in green spaces and environmental restoration has the potential to bolster this industry significantly in the long term. Compared to traditional stimulus opportunities, natural capital investments also tend to create a high number of jobs per dollar invested and can usually be implemented relatively quickly, providing immediate stimulus for the economy. These policies tend to have low leakage of funds outside the domestic economy, as imports are minimal and labour spending is high. Investment in green spaces, afforestation efforts, and environmental restoration have also been shown to improve air quality and improve health outcomes.

Options for investment in South Africa include:

- **Agroforestry:** introduction of trees into existing or potential pastureland to raise livestock or the creation of areas for foraging in a manipulated forest environment. Agroforestry and habitat restoration can decrease the likelihood and severity of droughts by improving soil water retention, slowing water loss, and regulating water flow. Agroforestry efforts can also improve shading, decreasing livestock loss due to heat stress.
- **Wetland restoration and mangrove restoration:** rehabilitation of mangroves and wetlands includes planting, hydrologic restoration, and dredging/filling of existing mangrove forests, or expanding the extent of mangroves inland, creating water control structures, and reversing drained wetlands. This stabilises coastlines, buffers against



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extreme weather events, and reduces the risk of soil erosion, while also sequestering carbon.

- **Reforestation:** re-establishing natural forests, planting more native species, or increasing the density or extent of an existing forest. Well-managed, consultative, and participatory reforestation can enhance wildlife habitats, support biodiversity, protect water supplies, develop recreational opportunities, and address numerous issues associated with climate change, including through carbon sequestration.
- **Vertical ocean farming:** a sub-category of aquaculture, combining plants (seaweed and sea vegetables), fish, and molluscs into the same system of production in saltwater through floating or bottom-attached farms. Supply chain interventions like agroforestry and vertical ocean farming can improve food security and resilience to food shortages and disruptions. They diversify production and can shorten the length of supply chains.

### 3. Conclusion

**Vivid Economics modelling suggests that investment in green solutions, compared to traditional alternatives, could bring significantly more jobs (up to ~60% more in the short-term for select projects) and greater gross economic value (up to ~140% the return for select projects) to South Africa, while also lowering emissions and bringing social co-benefits.** To avoid the worst long-term economic impacts of the COVID-19 pandemic, South Africa must urgently invest in a sustainable economic recovery plan, to be implemented once the virus is under control. To maximise the effectiveness of recovery, as measured by high-value job creation and gross value added, South Africa must prioritise green spending measures like clean energy investment, clean transport initiatives, and natural capital opportunities. Compared to corresponding traditional measures, these can create significant jobs and produce high economic multipliers within short timeframes. Additionally, investment in green measures can help to decouple the South African economic system from fossil fuel emissions, while also bringing air pollution and natural capital benefits.

However, without significant international support and appropriate access to concessional finance, public financial constraints are likely to prevent South Africa from making necessary recovery investments. The effects of inaction could be dire, increasing poverty and erasing recent humanitarian progress. International partners must directly support South Africa, and other nations across the continent, to ensure that essential recovery investments are made swiftly and sustainably. Increased grant and concessional finance, discounted debt financing, and/or debt forgiveness programs all have an important role to play. There is a significant and rational opportunity to use international support programs to specifically prioritise green spending projects and thereby simultaneously mitigate poverty and climate change.



## Endnotes

- <sup>i</sup> <https://www.sanews.gov.za/south-africa/gdp-contracts-51-under-lockdown>
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- <sup>v</sup> <https://www.iea.org/articles/south-africa-energy-outlook>
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- <sup>vii</sup> The Green Fiscal Policy Network (GFPN) is coordinated by the United Nations Environment Program, the International Monetary Fund, and Germany's Gesellschaft für Internationale Zusammenarbeit (GIZ).
- <sup>viii</sup> <https://www.neeca.org/archive/publications/building-forward-together>
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- <sup>xvi</sup> <https://repository.up.ac.za/handle/2263/74623>
- <sup>xvii</sup> <https://climateactiontracker.org/countries/south-africa/>
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- <sup>xix</sup> [https://www.za.undp.org/content/south\\_africa/en/home/library/socio-economic-impact-of-covid-19-on-south-africa/](https://www.za.undp.org/content/south_africa/en/home/library/socio-economic-impact-of-covid-19-on-south-africa/)
- <sup>xx</sup> ZAR130bn of this value was the result of a reprioritisation of existing funds.  
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- <sup>xxi</sup> <https://www.gov.za/speeches/president-cyril-ramaphosa-south-africa%E2%80%99s-economic-reconstruction-and-recovery-plan-15-oct>
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- <sup>xxxii</sup> <https://www.climateworks.org/report/achieving-a-just-and-sustainable-economic-recovery/>
- <sup>xxxiii</sup> <https://oneworldgroup.co.za/oneworld-projects/pathways-to-a-just-transition-in-south-africa-2017-2019/>
- <sup>xxxiv</sup> Government of South Africa Nationally Determined Contribution, 2015. "Why a just transition is crucial for effective climate action", Vivid Economics, 2019
- <sup>xxxv</sup> [https://www.greencape.co.za/assets/RENEWABLE\\_ENERGY\\_MIR\\_20200330\\_WEB.pdf](https://www.greencape.co.za/assets/RENEWABLE_ENERGY_MIR_20200330_WEB.pdf)





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## ABOUT THE OXFORD UNIVERSITY ECONOMIC RECOVERY PROJECT

OUERP is the world’s hub for developing and communicating long-term economic perspectives on recessionary fiscal spending. The project develops leading original research, as well as core advisory services to governments, multilaterals, businesses, and non-profit institutions. Core initiatives include tracking of global COVID-19 government recovery spending, assessment of spending effectiveness, and development of core perspectives on how to incorporate long-term economic, social, and environmental objectives into immediate stimulus action.

The project is generously supported by the Children’s Investment Fund Foundation, ClimateWorks Foundation, Green Fiscal Policy Network (United Nations Environment Program, International Monetary Fund, and GIZ), and University of Oxford Social Sciences Division.

The OUERP is housed within the Smith School of Enterprise and the Environment (SSEE). The SSEE was established with a benefaction by the Smith family in 2008 to tackle major environmental challenges by bringing public and private enterprise together with the University of Oxford’s world-leading teaching and research.

For more information on OUERP, please visit <https://recovery.smithschool.ox.ac.uk/>, and for more information on SSEE please visit: <http://www.smithschool.ox.ac.uk>



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## ABOUT VIVID ECONOMICS

Vivid Economics is a leading strategic economics consultancy with global reach. We strive to create lasting value for our clients, both in government and the private sector, and society at large. We specialise in understanding the policy-commerce interface and resource- and environment-intensive sectors. The success we bring to our clients reflects a culture of strong partnerships, the application of ground-breaking analytics and modelling, and an understanding of strategic imperatives and political economy. From our beginnings in 2006, we have become well recognised and trusted in our field and known for our uncompromising quality.

Vivid has an extensive track record in analysing the economic, environmental, and social impacts of policies and public investments, including COVID-19 rescue and recovery packages:

- Our Green Recovery Roadmap work, including modelling the impacts of announced and alternate recovery measures on the economy and environment of ten countries worldwide, is funded by the ClimateWorks Foundation. We are also working with the Children's Investment Fund Foundation to model further recovery policies.
- Our flagship 'Greenness of Stimulus Index' (funded by the MAVA foundation) assesses the effectiveness of COVID-19 stimulus efforts in ensuring an economic recovery that takes advantage of sustainable growth opportunities and is resilient to climate and biodiversity.
- We are experts in assessing the economic, environmental, and social benefits of government interventions to be included in national strategies, working with Nigeria, Indonesia, Belize, Lebanon, Colombia, Jamaica, and others to prioritise policies and investments for inclusion in their intervention plans.
- We are working with SystemIQ to develop an assessment of the economic and climate mitigation and adaptation impacts of global stimulus packages and assess the benefits of a greater emphasis on investment in nature-based solutions

For more information on Vivid Economics, please visit <https://www.vivideconomics.com/>

## Technical Annex from Vivid Economics

The objective of the modelling is to estimate the economic and environmental impacts of different stimulus policies. As Figure A.1 shows, there are four steps in the analysis:

- **Coordinate background policy analysis**
  - o The existing COVID-19 spending policies were mapped using Vivid Economics tracking and Oxford’s Global Recovery Observatory. Policies included rescue-type spending such as household and job support programmes, as well as non-targeted business support. To consider recovery-type investment policies, a set of reference investments across core sectors was established.
  - o Vivid Economics designed a series of indicative green recovery policies to form a potential green recovery package. This package is tailored to the national context, while drawing on international best practice for designing green stimulus policies.
- **Prepare model inputs.** Each intervention is translated into a ‘shock’ for use in the I3M model. As a Leontief multiplier input-output (I/O) model, model shocks are changes in sectoral final demand.
- **Conduct economic modelling.** The shocks are input to 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 solar power will directly increase jobs in the renewable energy sector, and indirectly bring upstream supply chain impacts.
- **Conduct emissions modelling.** The economic modelling outputs predicted the emissions impact of each shock. Using emissions factors, Vivid Economics calculates the total change in CO2 emissions to demonstrate the mitigation benefits of a green recovery.

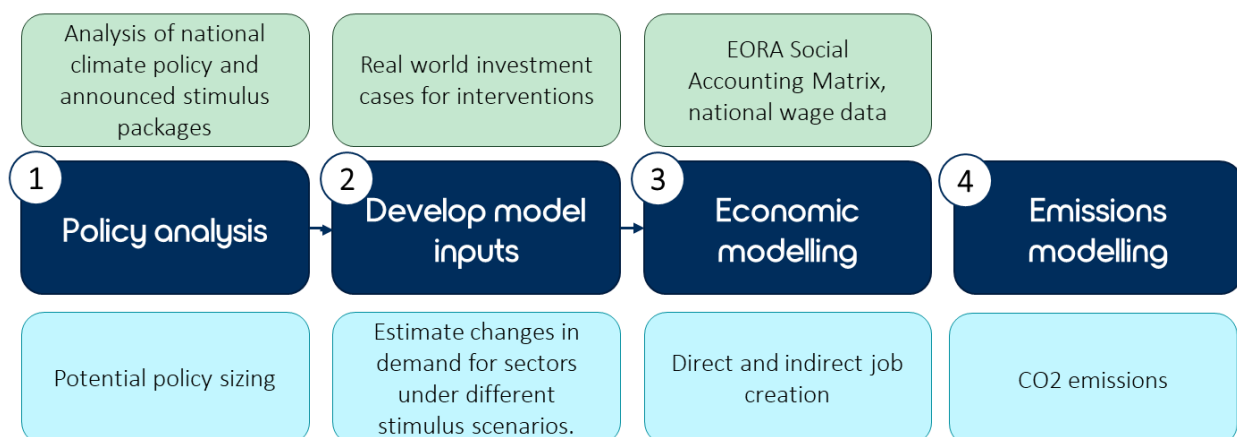


Figure A.1. Overview of modelling approach. Dark blue boxes summarise the steps in the analysis, green boxes indicate inputs at each stage, and light blue boxes indicate outputs.



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### A.1.1 Economic modelling: How does the model estimate direct and indirect economic impacts?

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

Vivid's I3M model has been applied to assess the impacts of investment in green solutions, as compared to 'reference stimulus' packages deployed by countries in response to the COVID-19 pandemic. The I3M model uses an input-output framework to estimate the short- and long-term impacts of investments and other interventions. To define the inputs to the I3M model, the interventions (both green solutions and reference) are characterised in terms of changes to the final demand for the output of specific sectors within the Eora26 classification scheme.<sup>1</sup> The I3M modelling framework estimates a 'per unit' impact of each intervention, which is then multiplied by the total amount of investment allocated to the intervention. This technical note details the methodology for modelling both the investment green solutions and the reference stimulus.

#### Input-output tables

I3M is an input-output modelling framework which can be calibrated to work with any input-output data source. This work was drawn from the Eora multi-region input-output table (MRIO). The MRIO 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. A simplified version of the table is represented in Figure A.2.

#### Impact modelling

I3M works by modelling the impacts of investments and other interventions as shocks to final demand in specific sectors. The flowchart in **Error! Reference source not found.** shows how the MRIO is used to calculate the matrix of Leontief multipliers. Multiplying a shock vector (a change in final demand for every sector) by the Leontief matrix produces the increase in sectoral output needed to satisfy the increase in final demand. Relationships between sectoral output and variables such as GVA, employment, and GHG emissions, determined from the Satellite accounts of the Eora database, are used to calculate the impacts of the shock. The shock vector itself determines the 'direct' impacts, while the additional impacts on sectoral output are used to calculate the 'indirect' impacts.

<sup>1</sup> <https://worldmrio.com/eora26/>. The modelling for the USA uses the IMPLAN data platform <https://implan.com/>



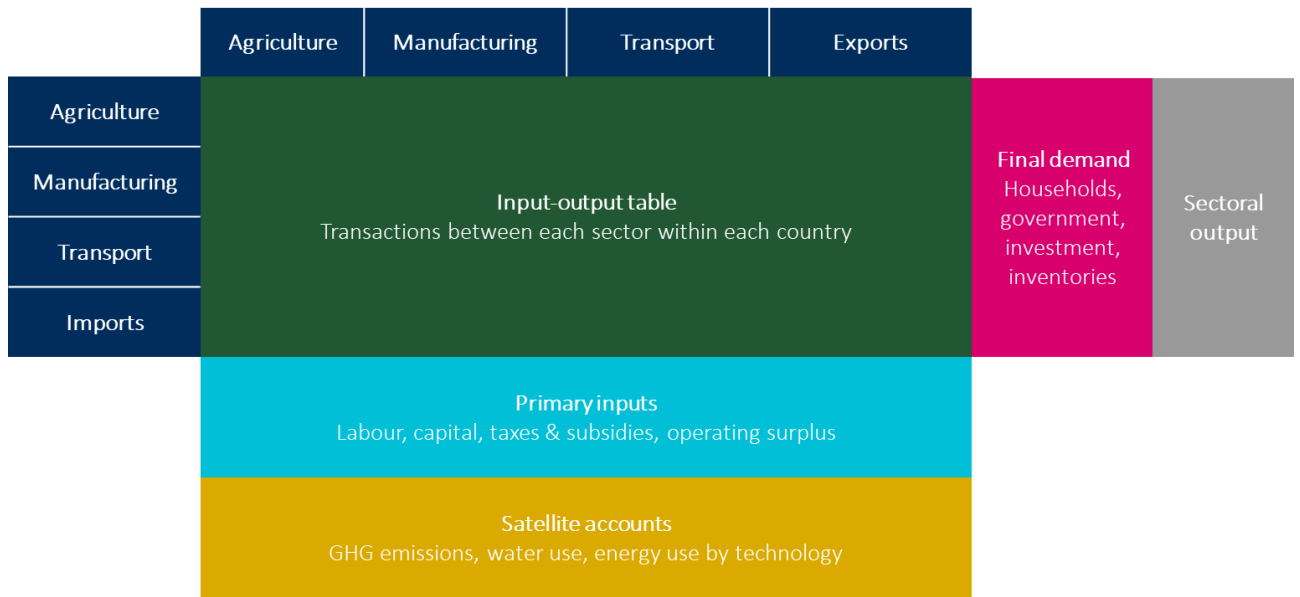


Figure A.2. Simplified representation of the Eora MRIO.

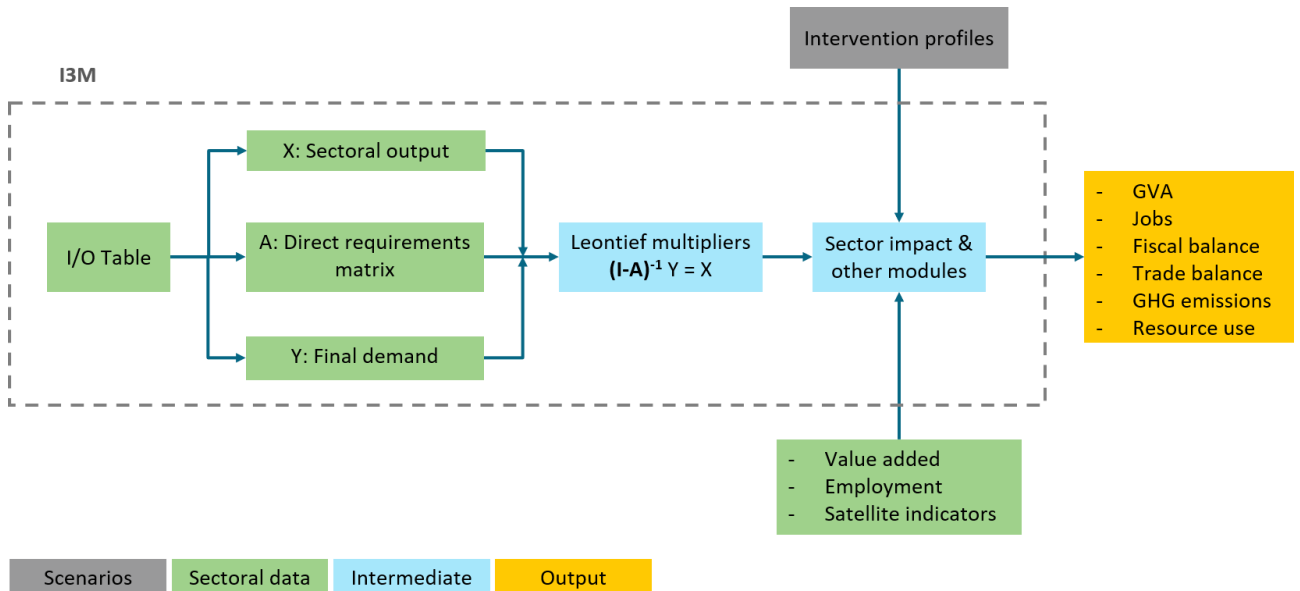


Figure A.3. Representation of the I3M system.



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Since the I3M system is fundamentally linear, the per-USD benefits can be calculated before knowing the final allocation. This means that the steps were taken in the following order:

1. Determine the capital expenditure (CAPEX) and operational expenditure (OPEX) spending profiles associated with each stimulus policy.
2. Estimate the per-USD impacts on GDP within the country.
3. Determine the allocation of investment in green solutions for each intervention.
4. Multiply the allocation by the per-USD impacts for each intervention within the country.

### Job Impacts

**Labour is a key input to production.** The economic shock, as modelled by I3M, leads to increased demand for inputs both from the impacted sector and from indirectly affected sectors. The increase in labour demand that results from this is expressed in monetary terms.

**To translate the monetary value of increased labour demand into job years, the total labour spending increase, per year, is divided by the average existing wage in the economy.**

### ‘Short-term’ vs. ‘long-term’

**The ‘short-term’ impacts of interventions are defined as those that result from the CAPEX associated with the intervention.** The ‘long-term’ impacts result from the operation phase of the intervention, i.e., the OPEX. In this case, the long-term impacts are calculated on an annual basis.

### Assumptions

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.



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### **A.1.2. 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 are the costs of manufacturing, constructing, or installing the technologies, such as installing a wind farm or building a power plant. Recovery stimulus is assumed to directly translate to CAPEX rather than OPEX. The 'operational' phase consists of OPEX, including on inputs (such as fuel) and maintenance.

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 and environmental impacts of like-for-like investment. For instance:
  - o The model analyses the expected cost of expanding solar generation, which could be borne by state-owned enterprises or private sector firms.
  - o 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.
- Each of these interventions is 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.