Green Economic Recovery for the Arab Republic of Egypt

Could green investment accelerate the COVID-19 recovery while at the same time making progress on climate change?

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

Public investment in green initiatives could simultaneously bolster Egypt's economic recovery from the pandemic while also enhancing environmental sustainability. Recent global economic studies suggest that there is no longer a trade-off between economic impact and environmental progress; effective green spending can secure both greater growth and a greener future. Vivid Economics modelling suggests that in select cases, green investments could create ~55% more jobs and ~150% more in long-term economic value, compared to alternative traditional spending measures.

Over the second quarter of 2020, the global COVID-19 economic slowdown led to a 1.7% contraction in the Egyptian economy and 2.7 million jobs lost. Fortunately, lower comparative rates of COVID-19 infection in Egypt meant that a full lockdown was avoided in 2020 and the domestic economy has already partially rebounded. Egypt is one of the few countries that have maintained positive GDP growth in 2020. However, despite a comparatively quick recovery, the long-term effects of the pandemic are large and threaten to exacerbate inequalities and intensify human capital loss and existing skills shortages, particularly in younger age demographics.

In 2020 Egypt allocated 3.8% of GDP to COVID-related spending with 0.4% of GDP for long-term recovery spending. This is compared to the G20 (excl. EU) average of 18.5% of GDP for COVID spending and 2.3% for recovery, and in low- and middle-income countries (LMICs), 10.6% of GDP spent on the pandemic and 1.6% for recovery. Egypt's green COVID-19 spending was 0.0% of GDP compared to the G20 average of 0.4% and the LMIC average of 0.2%. A list of all policies, and their characteristics, is reported in the Global Recovery Observatory from the Oxford University Economic Recovery Project, supported by the Green Fiscal Policy Network (UNEP, IMF, and GIZ), and UNDP. A recurrent theme among African countries in relation to stimulus is the limited access to affordable financing mechanisms for large scale interventions as compared to OECD countries that have access to low interest public financing.

There is growing evidence to suggest that green fiscal spending can provide a short-term economic boost through increased industrial consumption and job creation while also catalysing long-term economic prosperity and progressing environmental goals. In Egypt, Vivid Economics modelling demonstrates the short-term job creation potential of green spending as well as long-term Gross Value Added (GVA) (figure 1).

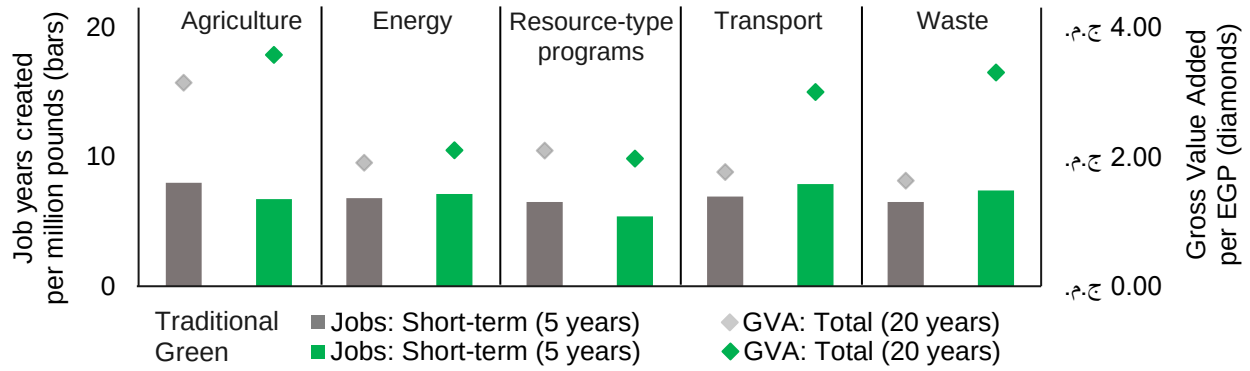

Figure 1. Job and Gross Value Added (GVA) impacts of green spending policies (average) compared to traditional spending measures in the Arab Republic of Egypt. These are simple average figures; the full policy set is in Figure 4. Modelling output from Vivid Economics; see Technical Annex.

Notes: 1. Traditional investments include, sequentially, traditional gravity irrigation systems, coal energy generation, support to the mining sector, road construction, and water treatment facilities. 2. Green policies include solar irrigation systems, resilient seed programs, a solar desalination facility, waste recycling systems, and transport investments including a BRT, electric buses, and cycle infrastructure, amongst others (figure 4). 3. Modelling is based on current sector dynamics, rather than projected future dynamics. It is likely to overstate long-term the GVA of traditional (fossil) investments and understate the GVA of green investments. 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 green policy areas with potential to both stimulate nic growth in Egypt and enable a sustainable future for the nation:

Renewable energy: Investments into renewable energy can benefit from large economic multipliers while also reducing reliance on fossil fuels and decreasing CO_2 emissions in several sectors. Egypt benefits from a strong renewable energy endowment: further investment in wind and solar is particularly attractive. Support of these technologies fits an existing domestic push to diversify the energy mix. Alongside targeted electricity generation investment, the government could direct spending to key sectoral enablers, like transmission and distribution infrastructure as well as storage facilities, to enable grid reliability at high rates of renewable energy penetration.

Agriculture and sustainable water usage: Egypt's agricultural sector is threatened by severe water scarcity, which is likely to be exacerbated by climate change. The nation should direct attention to investments in large-scale desalination and water treatment projects alongside micro-level efforts to promote efficient water usage by supporting farmers to invest in more water-efficient technology. Support for the targeted development of bio-fertilisers and other technologies could reduce water scarcity and promote a more sustainable and circular domestic economy.

Clean transport: green investment in the transport sector could help major cities like Cairo accommodate a growing urban population while reducing the health risks of increased pollution. The promotion of low-carbon transport, such as public transport, cycling, and electric vehicles, could enable greater connectivity, lower health burdens, and promote sustainable economic growth. To encourage the purchase of electric-power vehicles, Egypt could invest in domestic incentive measures, phase out fuel subsidies in line with announced government intentions[1], and relax regulations that make it difficult to purchase electric vehicles (EVs).

Investment in green initiatives should be supported by green training programs to meet labour needs and prepare workers for the future economy. These programs, and associated policies should direct particular attention to training young people, who face high unemployment, a feature of a number of economies in the MENA region.

Foreign governments and international organisations must work with Egypt to ensure it has sufficient access to finance to fund an ambitious green recovery. Grants and sustainability-linked financing agreements could support Egypt's investment in the green economy by enlarging the nation's fiscal space. Through these partnerships, Egypt could become a global leader in the green recovery and embark on a prosperous sustainable development pathway.

[1] https://www.reuters.com/article/us-egypt-economy-imf-idUSKCN1RI032

1. The pandemic has intensified pre-existing weaknesses

1.1 Pre-pandemic Egypt

Although the Egyptian economy saw strong economic growth in the 5 years preceding the pandemic with GDP growth averaging 4.72%, the nation faces several ongoing economic challenges.[1] Despite high GDP growth, unemployment remains high (averaging 11.5%), although this has begun to fall in recent years. Additionally, persistently high levels of poverty are a burden on national welfare; 32.5% of the population live in extreme poverty according to national statistics and 60% of the population is poor or vulnerable according to the World Bank.[2,3] This is reflective of the unequal nature of Egypt's recent growth. Like much of the continent, the country faces fairly high levels of government debt worth 90.2% of GDP at the end of FY2019.[4]

The Egyptian labour force is likely underprepared for the jobs of the future.[5] A significant skills shortage has been induced by a mismatch between job requirements and the qualifications of the youth, evidenced by very high rates of unemployment among university graduates.[6] This has contributed to youth unemployment in Egypt of 26.5%.[7] The skills mismatch in the Egyptian economy is particularly prevalent in the green economy.[8] Yet, several positive remediating initiatives are underway. The Ministry of Education and Technical Education is working with USAID on the Workforce Improvement and Skill Enhancement (WISE) project to improve technical secondary education to equip students for the needs of the job market.[9] This includes developing a scheme to train solar and wind energy technicians.[10]

Egypt is already witnessing first-hand the effects of climate change with rapid desertification. The loss of tens of thousands of hectares of agricultural land each year threatens local food supply, exacerbating Egypt's already significant dependence on food imports.[11] In the early 2010s, Egypt suffered from an energy crisis, with frequent power cuts due to the country's inefficient power generation infrastructure.[12] This has prompted Egypt to invest in renewable energy to diversify its energy mix through the Integrated Sustainable Energy Strategy announced in 2015.

1.2 Impact of COVID-19 on the Egyptian economy and society

Compared to other nations, Egypt has seen relatively low rates of reported COVID-19 infection. This allowed the government to avoid a full lockdown during the first wave of the virus.[13] However, the combination of the partial lockdown and the collapse of the tourism sector caused a contraction in GDP of 1.7% in the second quarter of 2020.[14] Yet, the Egyptian economy seems to have rebounded quickly with the IMF forecasting that the economy will grow by 2% in FY 2020/21.[15] Although this is significantly less than pre-pandemic growth, the economy is expected to rebound to those growth rates by 2022.

The long-term impacts of COVID-19 could increase the human capital challenges that Egypt already faces. During the second quarter of 2020, 2.7 million jobs were lost. This rise in unemployment, combined with the school closures, is likely to increase underemployment and force people into working 'the wrong' jobs.[16] These impacts are likely to disproportionately impact

young people,[17] threatening the long-term future of the economy if the new generation of workers does not have the skills to improve long-term domestic competitiveness.

1.3 Policy responses during the pandemic

Countries globally have responded to the COVID-19 pandemic with unprecedented levels of fiscal spending. This includes spending on rescue policies to mitigate the immediate health and economic impact of the pandemic, as well as recovery policies to enable economic recovery through stimulating new jobs and economic growth. In collaboration with the Green Fiscal Policy Network, the Oxford University Economic Recovery Project has developed the Global Recovery Observatory.[18] This tracks the announced fiscal expenditure of 89 economies, including the world's largest 50. The tool tracked almost EGP180bn (USD11bn) of fiscal stimulus spending announced by the Egyptian government in 2020, of which EGP160bn was rescue-type spending and EGP19bn was recovery type spending.

The bulk of Egypt's announced spending is part of a fiscal stimulus package announced in March 2020.[19] This EGP110bn package included spending to support the healthcare system, as well as social programs to support the vulnerable, for example through increased spending on social housing. There were little to no spending policies in the package that were explicitly green. Within this package, there was also EGP3.5bn allocated to extend natural gas pipelines and support worth EGP5mn for the aviation and tourism industries.

In September 2020 Egypt became the first Arab country to issue green bonds.[20] USD500mn of the USD750mn issuance will fund 5 key environmentally friendly projects: a desalination plant, three wastewater treatment facilities, and a monorail project[21].

In response to COVID-19, in 2020 Egypt spent ~USD110 per person, compared to an average in advanced economies of ~USD11,000 per person and ~USD640 in emerging market and developing economies (data covers 50 largest economies only). Emerging market spending was driven overwhelming by China.

1.4 Green stimulus to catalyse future prosperity

As one of the few countries in the world to exhibit positive GDP growth in 2020, Egypt is in a strong position to focus its fiscal spending on recovery packages that support long-term industrial and economic growth. However, to truly prepare Egypt for long-term sustainability, policymakers must understand that during this recovery there is no need to trade-off economic prosperity for environmental progress. Hepburn et al. (2020) lead a growing body of evidence that suggests that green fiscal spending not only advances progress towards the UN's Sustainable Development Goals but is also able to deliver stronger economic returns than traditional spending.[22] Green policies can do so through large economic multipliers and quick job creation compared to traditional policies.

To best take advantage of the benefits of green spending, and catch up to other nations (Figure 2 and Figure 3) Egypt should focus on inclusive green policies in the energy, transport, and agricultural sectors. Egypt must combine this with continued support for the education and training of young adults, with a specific focus on preparing them for the green jobs of the future. Additionally, improving access to finance for green start-ups would enable stronger enterprise and employ more Egyptians.

To extend current economic growth, Egypt would benefit from access to international support in the form of concessional finance. Given Egypt's high debt to GDP ratio and high-interest rates associated with new borrowing, significant additional green spending will be difficult without the support of international partners. Multinational institutions and foreign governments must act with long-term support of the African Continent, and a hope to catalyse long-term sustainable growth. This could be achieved through a combination of climate-linked discounting of debt financing, greater grant access, and perhaps debt forgiveness. A promising approach could be through sustainability-linked bonds which reward governments for achieving certain sustainability targets, such as making progress towards the UN's Sustainable Development Goals.[23] The new issuance of SDR's recently agreed by G7 nations, can also be a useful source of liquidity for countries such as Egypt and can catalyze growth of invested particularly in green sectors.

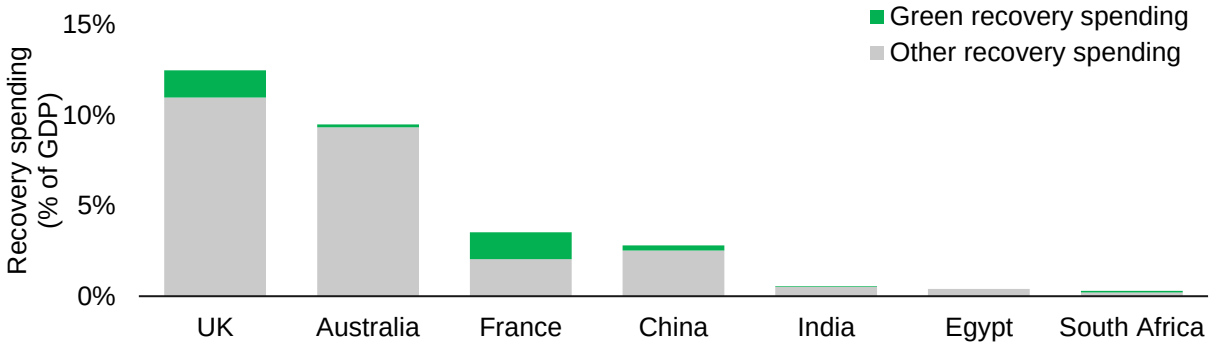

Figure 2. Composition of global recovery spending in 2020. Data from Global Recovery Observatory.

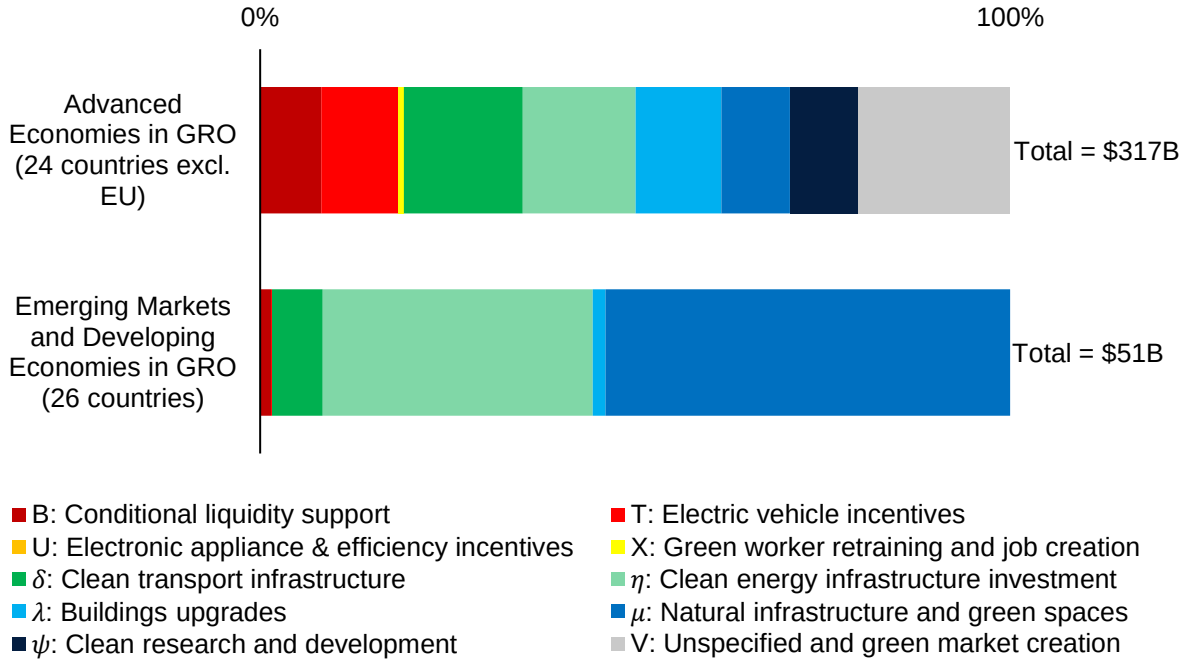

Figure 3. Distribution of green spending in 2020 as tracked by the Global Recovery Observatory.

2. Priority policy recommendations

Provided ample investment, Vivid Economics modelling suggests that green investment initiatives could spur a robust economic recovery and place Egypt on a path of sustainable long-term growth. Different green investment opportunities, along with their potential job creation impacts and Gross Value Added (GVA) are illustrated in figure 4. Vivid's input-output modelling finds that over the next five years green policies are likely to deliver more jobs per dollar in comparison to traditional alternatives. Successful green investments could reduce poverty, increase the resilience of the Egyptian economy to climate change and deliver substantial health benefits for the urbanising population. It is viable to achieve positive economic and social outcomes while also making progress to the Sustainable Development Goals.

Desirable recovery policies for Egypt would prioritise employment opportunities especially for the youth[24] and in the formal sector,[25] address water scarcity while improving agricultural outcomes[26], boost entrepreneurship, and tackle pollution.[27] Green investments have high prospects of addressing each of these priorities.

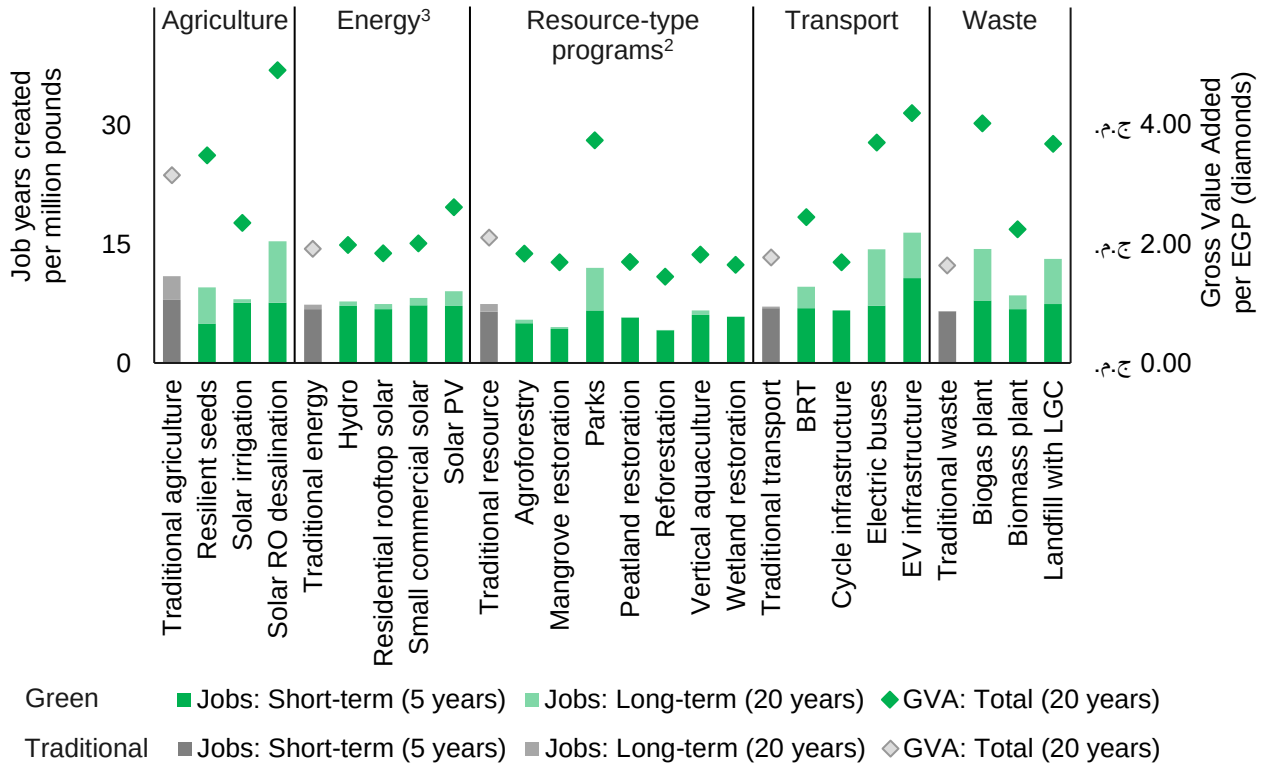

Figure 4. Job and Gross Value Added (GVA) impacts of green spending compared to traditional spending in the Arab Republic of Egypt, all modelled policies. Modelling output from Vivid Economics; see Technical Annex.

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 investments. 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.

Traditional investments are defined as follows: agriculture includes a traditional gravity based irrigation system; energy includes ultra-supercritical coal energy generation without any carbon capture technology; agriculture includes a traditional gravity based irrigation system; resource-type investments include investing in mining support, which extracts resources often to the detriment of the environment; transport includes improvements to the road network, including laying new road and constructing accompanying road infrastructure, such as interchanges and bridges; and waste investments include water treatment facilities, including the construction and operation of waste-water treatment facilities.

On green skills and green jobs

Green expenditure can create more jobs compared to traditional fiscal spending during periods of economic recession.[28] Green jobs demand a diverse range of skills, unlocking opportunities for the educated Egyptian youth who currently lack job prospects – here lies the potential to re-establish the link between economic efficiency and education.[29] Job creation in green industries could shift employment from the informal to the formal economy. This would enable better job security and less income volatility amongst the general population while boosting taxation revenue. Significant investment in green jobs could prove a reinforcing feedback loop where a better-skilled green labour force could deliver greater green entrepreneurship, and in turn, more green jobs.

On water scarcity

Egypt faces a water scarcity crisis, which is likely to worsen from climate change.[30, 31] While targeted investment to improve water resource availability is underway, including through large desalination projects[32], emphasis needs to be placed on efficient usage and sustenance of clean water circulation. This is crucial for maintaining the agricultural sector and securing an affordable food supply. Quite simply, the domestic agricultural sector faces significant climate risk and must build resilience to avoid extreme volatility. Failing to build resilience would increase dependence on food imports, leaving citizens to deal with the impacts of high price variability. There is strong evidence that such a setting would disproportionately impact the most vulnerable.[33] The issue is likely best addressed at the root – there is a pressing need for efficient agricultural reforms and investment in sustainable irrigation practices. Moreover, there is space for improving waste management by adopting circular economy practices in farming.

On pollution

Pollution in Egypt, in particular air and water pollution, threatens the health and well-being of all populations, and especially the growing urban population. Avoiding the worst impacts of pollution in many urban centres requires the development of sustainable transport, shifting to clean energy, and drastically improving recycling and circular waste practices. Policies in these areas carry substantial benefits of creating entry-level job opportunities and easing the severe pressure of high unemployment in urban areas affected by the recent loss of tourism revenues.

Green investment enablers

Three key enablers could help the government fully realise the economic, social, and environmental potential of concerted green investment.

First, the recovery must be supported by a dynamic private sector with easy access to finance. Reducing difficulties in accessing capital for Micro, Small, and Medium Enterprises (MSMEs) should be a priority of the government.[34] The rapid growth of these businesses could help accelerate economic development. Ongoing initiatives from the National Bank of Egypt (NBE), Micro, Small and Medium Enterprise Development Agency (MSMEDA), and the Social Fund for Development (SFD) point in the right direction. The success of sustainability-oriented MSMEs

could play an outsized role in bringing long-term growth; appropriate tax, subsidy, and other incentives should be used to encourage green entrepreneurship.

Continued emphasis on uplifting financially excluded youth with targeted loan programs is also attractive, as demonstrated by the Youth in Business Programme of NBE.[35] Commentary from the European Bank for Reconstruction and Development (EBRD) suggests that international organisations and private micro-finance institutions may be eager to support such initiatives.[36]

Second, the financing of state-led programs must be secured. Egypt has already made meaningful strides to increase funding for its green transition and the 2030 Vision, notably by exploring green fiscal policies and financial instruments, including green bonds.[37] There is scope to expand these programs.

Lastly, market distortions, in particular fuel subsidies, that encourage the unchecked growth of engrained high-carbon industries should be phased out with an accelerated timeline. Petroleum subsidies represent the lion's share of government expenditure while offering minimal support for the populations that most need it.[38] At the same time, these subsidies impair efforts toward achieving several of the health-, environment-, and economy-oriented Sustainable Development Goals and undermine existing green investments.

The three priority green investment opportunities are:

2.1 Renewable Energy Investment

Egypt's energy sector is heavily dependent on natural gas which generates almost 80% of the country's electricity.[39] An inability to service ongoing gas procurement costs following the Egyptian revolution of 2011 contributed to frequent power outages during the early 2010s.[40] This led to the Egyptian government announcing its 2035 ISES plan, which aims to diversify Egypt's energy mix and reduce ongoing operating costs.[41] The plan set out clear targets and a plan for increasing the proportion of renewable energy sources to 20% of the energy mix by 2022 and 42% by 2035.

Beyond the ambitions of the ISES plan, the International Renewable Energy Agency predicts that Egypt could increase its supply of renewable energy to 53% of its energy mix with the investment of USD6.5bn. Largely enabled by private capital, this would reduce the country's total annual energy cost by USD900mn and the reduction in air pollution would lead to health and social benefits equivalent to countless lives saved and USD4.7bn in economic value.[41]

Egypt is not starting from naught; the nation has already made major investments in renewable energy, for example through the Benban solar park which, at the time of announcement was the largest solar park in the world.[42] The USD823 million investment to establish the solar park created 6,000 jobs in the early project construction phase alone.[43] However, significantly more investment will be needed to ensure that the full solar and wind potential of the nation is captured.[44]

The COVID-19 recovery provides an opportunity for Egypt to accelerate its planned renewable energy investments, with targeted government support to incentivise much larger private investment. Modelling from Vivid Economics suggests that Egyptian 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 long-term.

Targeted public spending and revision of electricity market regulations could incentivise private investment. Feed-in tariffs were successfully used to raise funds for the Benban project and incentivise both foreign and domestic investment.[45] However foreign investors were highly critical of the requirement for investors to source 15% of funding from local banks.[46] If this restriction again proves to be a hurdle, it may be worth reconsidering the requirement and decreasing the complexity of the administrative process associated with financing green energy projects.[47] To support and encourage green energy start-ups, policymakers should consider mechanisms for improving access to finance, for instance, through government-funded or guaranteed loan schemes.[48] Support for early- to mid -stage ventures can create a reinforcing ecosystem of innovation and job creation. There are several such examples already supporting the Egyptian economy, for instance a venture that uses waste cooking oil to make biodiesel while consuming less water than traditional methods.[49,50] The Egyptian government should work with international partners to extend and reinforce existing green business financing schemes run by the European Bank for Reconstruction and Development (EBRD), the European Union (EU), and the Green Climate Fund (GCF) as well as establish new support programs for early- to mid – stage ventures.[51]

To maximise the job creation potential of the green energy transition, policymakers must support the just transition of fossil fuel workers to new work. In ideal circumstances, workers can be retooled to support emerging green industries.[52] For instance, Togo recently implemented a re-skilling program to support out-of-work technicians to transition to the solar energy sector.[53] COVID-19 recovery policies to train workers for green jobs have also been implemented by Sweden, France and Spain.[54,55,56] Investing in such training and education could incentivise foreign investment as projects will be able to take advantage of a skilled labour force. Egypt must also continue to improve and modernise its electricity transmission and distribution infrastructure, to (i) better service rural areas that have little to no existing infrastructure, (ii) support higher renewable energy penetration while linking rural green energy investments, and (iii) address pre-existing grid instability. Investments could include cross-border transmission infrastructure to allow the export of clean energy across northern Africa. Such investments are labour intensive and depending on material sourcing supply chains can provide a strong economic boost.

2.2. Agriculture and sustainable water usage

The Nile basin area is highly subject to the negative impacts of climate change and Egypt is the most prone country in the region.[57] Egypt is vulnerable to both the effects of sea-level rise and greater volatility in the volumetric flux of the Nile river. As more intense agricultural production continues, the impact of reduced water supply will be exacerbated by increased water requirements, ultimately triggering reduced crop yields.[57, 58] Considering that agriculture accounts for 11% of national GDP and contributes 29% of jobs, the impacts of water scarcity are mammoth.[59] The urgency of the situation is compounded by a growing population.

Egypt has already initiated several large-scale projects to bolster the water supply. In the eastern and western parts of the country, private-public partnerships are being used to finance desalination plants.[60] Additionally, ongoing investment in wastewater treatment plants is on track to increase the circularity of water in heavily farmed areas.

These capital-heavy efforts should be complemented with incentives to improve micro-level irrigation efficiency.[61] Pilot projects from the Ministry of Water Resources and Irrigation have showcased the potential of understanding and using ground humidity to avoid mistimed irrigation

and increase crop yields.[62] A dense and rich informational network could be developed by equipping local authorities with hardware to collect data on water levels and presenting data to farmers in a regular and easily accessible format. Incentives to support solar-powered irrigation could support jobs and enable more productive sustainable agriculture, as demonstrated in El-Souria.[63, 64] Yet, there is a risk that access to cheaper electricity leads to more intensive modes of production, in turn requiring even more water.

Bio-fertilisers are a form of eco-friendly fertilizer that contain living organisms designed to enhance primary nutrient supply to crops. As an emerging agro-industry, these fertilizers present another potential source of natural and sustainable economic value in Egypt following the COVID-19 economic crisis. Compared to manufactured fertilisers, bio-fertilisers bring little water pollution, easing stress on the waste-water infrastructure.[65] Firms engaging in the production of bio-fertilisers often source materials locally. This can enable circular economy, limit waste, and catalyse enterprise in the local community. The job impacts are also significant: supporting farmers with such investments helps with cash-constraints during the economic crisis and supports long-term job protection in the sector by enhancing resilience and productivity. The viability of bio-fertiliser investment is showcased by the success of Baramoda, an Egyptian company, transforming agricultural waste into bio-fertilisers.[66]

2.3. Clean transport

Without sufficient complementary investment, a growing and urbanising population have led to a substantial transport infrastructure gap in Egypt.[67] Extreme levels of urban congestion in Cairo and limited modes of inter-city and inter-region transport suggest that improved connectivity could bring substantial social benefits and improvements to economic productivity. While, several recent announcements from the Ministry of Transport (وزارة النقل والمواصلات) suggest that investment in new electric train infrastructure is a priority for the nation, other spending has been suggested for large scale road initiatives without supporting electric vehicle infrastructure.

Given the significant health and environmental costs of internal combustion vehicles, as well as clear automotive market trends, any future infrastructure investment should factor in significant electric vehicle uptake . Given Egypt's growing urban population, substantial efforts must be made to enhance the efficiency of the transportation system, but these must be green and not worsen air and noise pollution.[68, 69] Both forms of pollution already have substantial health impacts on Egypt's urban populations, particularly those in Cairo and surrounding satellite cities.[70]

A shift to cleaner and more efficient urban transport, enabled by more public transport, more EVs, better road infrastructure, and more non-motorised transport, could decrease excess mortality and increase economic returns (enabled by less time spent in unnecessary traffic congestion amongst other factors).[72, 71] Better and cleaner transport, whether non-motorised, public or private introduces employment mobility, unlocks access to vital goods and services and protects the health of the population. As such, several ongoing and planned municipal infrastructure projects, including the enlargement of the Cairo metro and numerous train lines connecting remote points of Greater Cairo, are applaudable.[72]

High value sustainable public transportation initiatives could include further metro expansions, investments in electric buses, and enhanced inter-city train services as have been discussed for many years. Outside of public transport, priority investments could include incentives for EV manufacturing and purchase, incentives to encourage investment in EV infrastructure like charging stations, and infrastructure to support non-motorised transport

While the government and the private sector have both introduced several projects to encourage EV use, including the installation of numerous charging stations in major cities, current regulations make it difficult to purchase such vehicles.[73] For instance, Egypt lacks a permanent framework for licensing imported EVs. Substantial subsidies, easier registration and import procedures could usefully incentivise demand. Initiatives to target taxi owners may be particularly attractive as hybrid and fully electric vehicles are low maintenance and have low running costs in stop-and-go traffic over short distances.[74] To ensure an internally consistent approach to the low-carbon transition of transport and to limit the risk of EV incentives disproportionately favouring the rich, fuel subsidies must be phased out over an accelerated timeline.

Moreover, there may be scope to capitalise on existing production infrastructure to manufacture EVs, including buses, domestically. This could be done in various forms, including state-led or in a private-public partnership.[75] The recent partnership of the National Organisation for Military Production and a private Chinese company to produce a substantial quantity of electric buses is one such example.[76] To take full advantage of the growing demand for cars in Egypt, state-led automotive firms can engage with foreign entities operating in the EV sector, gaining the financing and know-how needed to kick start the domestic production of small EVs.[77] The ongoing partnership between El Nasr Automotive and Dongfeng company, aiming to launch the first Egyptian-build EV in 2022 illustrates the willingness of the private sector to set up operations in the expanding Egyptian market.[78]

3. Conclusion

To support long-term economic, social, and environmental outcomes, Egypt must urgently invest in a green economic recovery, and limit support of initiatives which further the nation's high-emissions status quo. To maximise the effectiveness of recovery, as measured by job creation and gross value added, Egypt should prioritise well-designed green spending measures in clean energy, clean transport, and sustainable agriculture and irrigation. Vivid Economics modelling suggests that in comparison to traditional spending alternatives, green investments of this type could deliver 1.55 times more jobs and 2.5 times higher gross economic value while securing lower emission levels and delivering social benefits.

While Egypt has made some positive strides forward, in the absence of significant global support and appropriate access to concessional finance, a lack of fiscal space is likely to act as a handbrake against Egypt's sustainable investment needs. The effects of inaction could be significant, with economic, social, and environmental consequences. International partners must prioritise long-term partnership with the African continent to ensure that essential green investments are executed urgently. Swift action could support short-term economic recovery needs as well as longer-term climate outcomes and other environmental outcomes. In this context, 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 attractive opportunity to use international capital alongside domestic investment to prioritise green spending projects and shift Egypt onto a more sustainable long-term growth pathway. Concerted action could both mitigate domestic poverty and global climate change.

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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 and 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.

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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

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Technical Annex from Vivid Economics

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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**
    - 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.
    - 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.

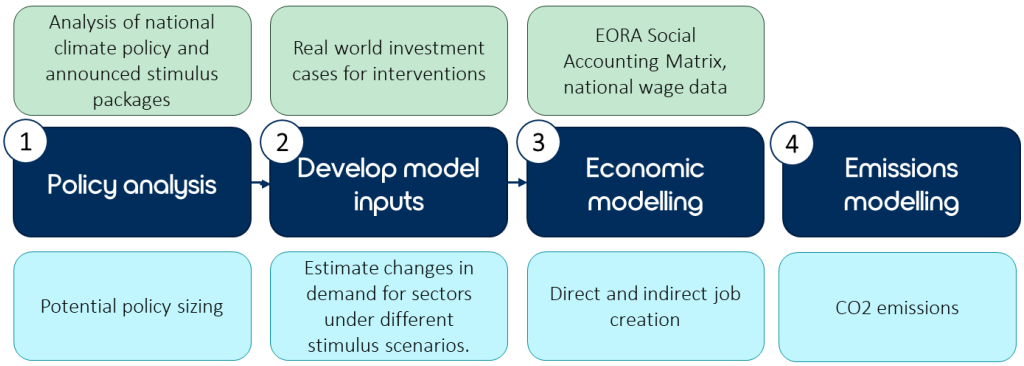

Figure A.1. Overview of modelling approach. Dark blue boxes summarise the steps in the analysis, green boxes indicate inputs at each stage, and light blue boxes indicate outputs.

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.[2] 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.

[2] https://worldmrio.com/eora26/. The modelling for the USA uses the IMPLAN data platform https://implan.com/

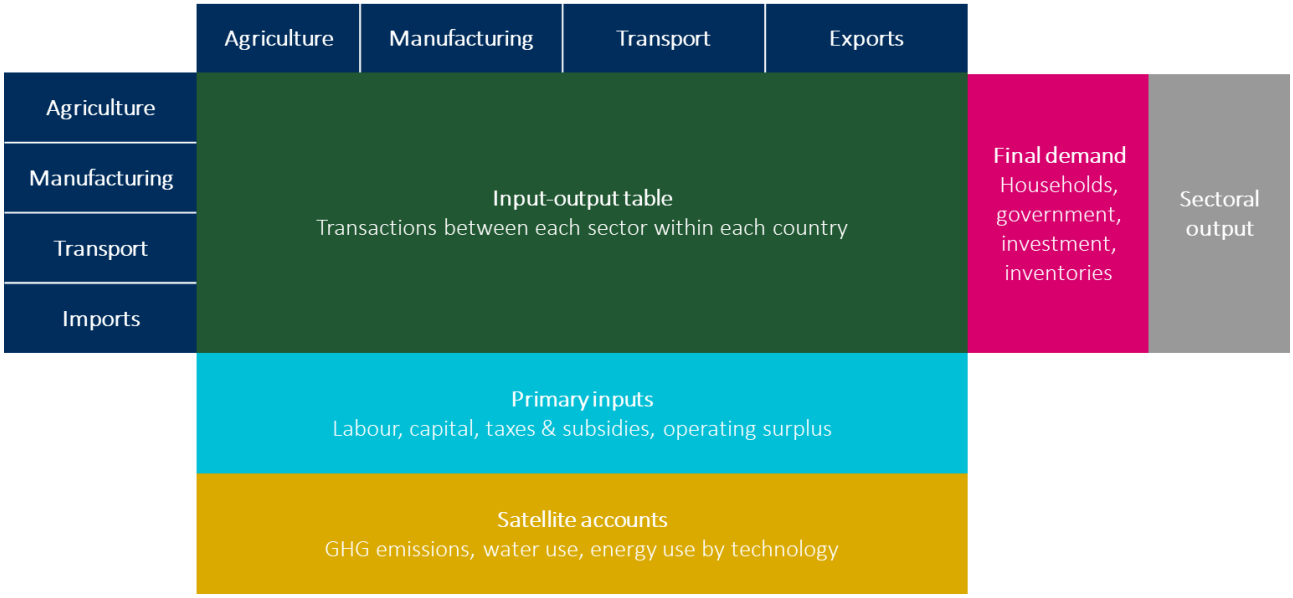

Figure A.2. Simplified representation of the Eora MRIO.

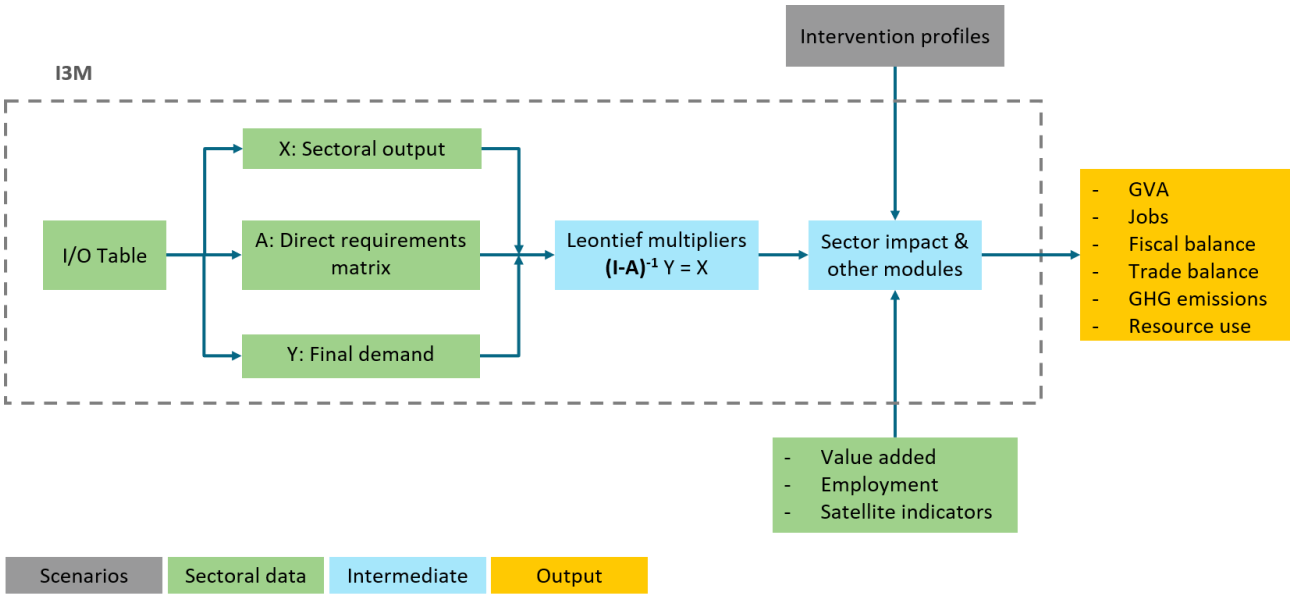

Figure A.3. Representation of the I3M system.

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.

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:
    - The model analyses the expected cost of expanding solar generation, which could be borne by state-owned enterprises or private sector firms.
    - 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.