How green will China's 'New Infrastructure' post-COVID-19 stimulus spending be?

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Governments across the world are considering how to revitalize economies beyond the immediate wage subsidies and unemployment schemes that are being drawn up to deal with the more immediate pains of the rapid economic downturn caused by COVID-19. The European Council recently adopted a declaration that argues for a recovery plan that integrates elements of "green transition and the digital transformation", although the Czech Republic, Hungary and Poland, each heavily reliant on coal-fired power generation, have rather argued that the current crisis should mean the EU's Green New Deal should be postponed or cancelled. The International Energy Agency has stressed that investments in clean energy technologies will have "twin benefits of stimulating economies and accelerating clean energy transitions". In the US, a group of economists, academics and policymakers sent a letter to congress asking for a long-term Green Stimulus plan that would spur jobs and growth, amongst others through fully decarbonizing the economy. The $2 trillion rescue package approved by congress did not bail out the oil & gas industry as initially suggested, but offered no help for renewables, either.

Much of how global emissions will rebound as a result of this upcoming stimulus will depend on decisions made in China, which was responsible for circa 28% of global carbon emissions in 2018. If previous experiences are any guide, emissions are bound to swing upwards when China starts to pour stimulus funds on its economy. China's stimulus in response to the Global Financial Crisis, colloquially 'the 4 trillion' (四万亿) after the amount of money in RMB invested over 2009 and 2010, on a list of 10 items including affordable housing projects, highways, bridges, and airports. Central and provincial governments contributed circa RMB¥ 1.2 trillion each, with another 1.6 trillion made available through bank lending. The focus of the stimulus on traditional infrastructure sharply inflated consumption of cement and steel, propped up carbon dioxide emissions, and resulted in heavy air pollution. Similar government responses, albeit smaller in scale, and with similar effects on emissions, followed the Asian Financial Crisis in 1997 and the SARS outbreak in 2002.

This time around, the concept of 'New Infrastructure Construction' (新基建) is a buzzword. The Politburo Standing Committee, which sets headline economic and political strategy, held a meeting on COVID-19 epidemic control measures in March, and stated that the envisioned route to economic recovery would be through accelerated investment in 'New Infrastructure construction'.

The concept of New Infrastructure started as a list of information and communication technologies, but has since been expanded to include transport and energy. It covers investment in 5G networks, Data centers, Artificial Intelligence, the Industrial Internet of Things, as well as Ultra High Voltage power transmission, high-speed rail, and electric vehicle charging infrastructure.

A thinktank under the Ministry of Industry and Information Technology (MIIT) recently [published a research note](#) assessing the investment required to achieve current stated policy goals for these seven fields by 2025, likely with the idea that the suggested 'accelerated investment' would mean that these investments would be brought forward as part of the stimulus package. Those investment estimates to achieve current stated policy goals are:

- High speed rail: RMB 4,500 billion for 30,000 km of new rail lines
- 5G: 2,500 billion for 5 million 5G base stations
- Big data: 1,500 billion for 2.2 million server racks
- Industrial Internet of Things: 650 billion in production capacity for equipment and services
- UHV: 500 billion for ca. 30 UHV lines
- AI: 220 billion for chip manufacturing capacity and peripheral services
- EV: 90 billion for 2,250,000 charging points

The table below the text explains how the MIIT thinktank derived these estimates, and gives estimates for further indirect investment or sectoral growth expected to result from these investments.

The total investment anticipated for these seven fields is thus RMB 10 trillion for the six year period from 2020 through 2025, which would allow for a low-carbon stimulus package comparable in size to the one following the global financial crisis. The suggestion to accelerate this, however, has not yet been backed up by central government expenditure, possibly because [Beijing's coffers are not nearly as full](#) as they were when the Global Financial Crisis hit. Presumably much of the investment would have to come from provincial level governments, and through encouraging lending.

Many provincial-level governments [have incorporated New Infrastructure projects](#) in their [recently updated investment plans](#). 23 provincial-level governments are planning a [total of RMB 45.8 trillion](#) of multi-year investments. These 23 provinces are responsible for 89% of national GDP, so we might expect to see a total of 51.3 trillion of long-term investment plans, up [about 4.3 trillion](#), or around 9%, up from last year. Annual expenditure is up 7.4% for a selection of these provinces, suggesting an annual spending increase of about 660 bn for all provinces. These plans have been drawn up as the COVID-crisis unfolded, so exactly what share of this reflect short-term stimulus spending, or whether further increases are to follow, remains unclear.

Guangdong province, which produces 11% of China's GDP, has the largest of these [investment plans](#). New Infrastructure projects make up 50.2 bn, or 7.2% of its 2020 investment budget, with 31.5 bn of investments in high-speed rail, 14.8 bn in 5G projects, 1.8 bn in UHV lines, and 1.2 bn in Big Data centres. Its list of projects in preparatory phases, for which no start date or 2020 budget is yet assigned, contains 75.5 bn of high-speed rail projects, 10 bn AI projects, and 5.0 bn in 5G projects. The total budget for these projects in preparatory phases is RMB 34 trillion, with 90.5 bn, or just 0.3% for New Infrastructure projects. Assuming all provinces were to reserve 7.2% of their 2020 budget for New

Infrastructure construction, this would amount to RMB 0.6 trillion from all provincial-level budgets, well short of the roughly 1.6 trillion per year required to achieve the 10 trillion goal to 2025 set out by MIIT.

What types of investments would dominate 'New Infrastructure'? In both the Central government's and Guangdong Province's blueprints, high-speed rail is the single largest category, followed by 5G internet base stations and big data centres. High-speed rail can lower carbon emissions by displacing domestic flights, though construction requires steel and concrete. UHV lines are meant primarily to transport renewable electricity from wind, PV, and hydropower bases in China's Northern and Western regions, to industrial centres in coastal provinces. IT infrastructure such as 5G and Big Data centers have low emissions intensity per unit of investment and support service industry growth, but do create additional electricity demand. Just how low-carbon these investments are will therefore depend on continued greening of China's electricity mix.

Alongside this, however, massive investments in 'old' infrastructure continue. Restrictions on construction of new coal-fired power plants were widely loosened in February 2020, perhaps in an early attempt to generate new investment. A total of 206 GW of coal-fired plant capacity, requiring investment of roughly RMB 1.1 trillion, are in early planning or construction stages. Such additions would be consistent with an increase of China's current 1,100 GW cap on coal fired generation capacity to 1,300 GW suggested for the upcoming 14th FYP period.

It is currently still unclear whether the 'new infrastructure' construction projects would do much to reorient economic growth patterns in China. More will need to be done to achieve a decisively 'green' stimulus package overall. Beijing's more limited capability to spend means that old-style infrastructure investment may be seen as largely sufficient for now.

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Estimates of investment required to meet current policy objectives for the seven 'New Infrastructure' fields

Field	Direct investment	Indirect investment
5G	On the basis of the current number of 4G base stations and considering the range of 5G base stations, it is estimated there will be about 5 million 5G base stations in China by 2025. On the basis of the bid placed by China Mobile in a tender for 5G base stations of 500,000 RMB/station, the direct investment for this number of 5G base stations will reach circa 2.5 trillion RMB.	The 5G industry chain encompasses a wide range of industries, and the 5G base station infrastructure will drive rapid market growth for many types of downstream industries such as Artificial Intelligence, virtual reality, and high-definition video. It is estimated that between now and 2025 , the investment related to the 5G industry chain will exceed 5 trillion RMB.
UHV	According to data from the State Grid, there are currently 16 UHV line projects under construction or pending approval, with an estimated total investment of 257.7 billion RMB.The investment cycle for UHV projects is 2-3 years, and total investment is expected to exceed 500 billion RMB between now and 2025.	By driving growth in the fields of equipment manufacturing, technical services, construction and installation, etc., and by promoting the accelerated development of smart grids such as smart power grids and distribution networks, it is expected that between now and 2025, indirect investments will exceed 1.2 trillion RMB.
Intercity high-speed rail and urban rail transit	According to data from China Railway, by the end of 2019, China's high-speed rail network length was circa 35,000 kilometers. On the basis of an average addition of 5000 kilometers per year, and assuming an investment of 150 million RMB per kilometer, the volume of investment between now and 2025 is expected to be about 4.5 trillion.	By driving accelerated development of industries such as railroad track and road construction, electrical grids, equipment manufacturing, train cars and components, and by promoting economic development through urban tourism, personal skill development, and people's livelihood, it is expected that between now and 2025 , indirect investment will exceed 5.7 trillion RMB.
Electric vehicle charging piles	According to data released by the China Electric Vehicle Charging Infrastructure Promotion Alliance, as of January 2020, a total of 531,000 public charging piles have been installed.On the basis of an annual increase of 150,000 public charging piles and 300,000 private charging piles, and investment costs of public charging piles at 50,000 RMB each and private charging piles at 25,000 RMB each, it is estimated that investment between now and 2025 will reach 90 billion RMB.	By driving the accelerated development of charging piles/charging station components, by charging business becoming more rationalized, and through increasing number of new energy vehicles, it is expected that between now and 2025, indirect investment will exceed 270 billion RMB.

Big data centers	According to the "National guidelines for the commercial development of data centers", by the end of 2017, China's data centers had a total of 1.66 million racks, at an annual growth rate of 33.4%.Assuming a constant growth rate, 2.2 million racks will be added by 2022, and when assuming a cost of 700,000 per rack, total investment is estimated at 1.5 trillion RMB.	Big data centers are the infrastructure that are the driving force that will drive the accelerated development of cloud computing and the Industrial Internet of Things, with indirect investment expected to exceed 3.5 trillion RMB between now and 2022.
Artificial Intelligence	According to data by IDC, China's AI chip market in 2019 was worth 12.2 billion RMB.Assuming an average growth rate of 45%, it is estimated that between now and 2025, investment in AI chips will be about 100 billion RMB：Additional investment in machine vision and other sensors, and in cloud platforms/data services/OS driven by AI will exceed 120 billion yuan, with total additional investment in artificial intelligence infrastructure of circa 220 billion RMB.	The construction of artificial intelligence infrastructure will drive accelerated progress in technologies such as machine vision and natural language processing, etc., and promote the accelerated development of smart healthcare, smart transportation, smart finance and other industries.It is estimated that the core industry for artificial intelligence will exceed 400 billion RMB between now and 2025.
Industrial Internet of Things	According to the "Plan of action for the development of the Industrial Internet of Things" and the "2018 Work plan of the Special Working Group for the Industrial Internet of Things" of the Ministry of Industry and Information Technology, by 2025, a basic network infrastructure for the Industrial Internet of Things covering all regions and all industries will essentially be finalized.On the basis of the size of the Industrial Internet of Things in 2019 of 611 billion RMB, and a compound annual growth rate of 13.3%, it is estimated that the additional investment between now and 2025 will exceed 650 billion RMB.	Industrial Internet of Things infrastructure will energize traditional industries, allowing transformation and upgrading to smart manufacturing. It is expected that indirect investment between now and 2025 will exceed RMB 1 trillion.

Source: White paper on the development of "New Infrastructure Construction", Research institute for Information Technology of the CCID Think Tank, March 2020. Partial translation via China Energy Portal.