Project Information Document (PID)

Concept Stage | Date Prepared/Updated: 19-Mar-2021 | Report No: PIDC31216

Public Disclosure Authorized

BASIC INFORMATION

A. Basic Project Data

Country	Project ID	Parent Project ID (if any)	Project Name
China	P175561		Pathways for Decarbonizing Transport towards Carbon Neutrality in China (P175561)
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
EAST ASIA AND PACIFIC	Jul 12, 2021	Sep 15, 2021	Transport
Financing Instrument	**Borrower(s)**	**Implementing Agency**	**GEF Focal Area**
Investment Project Financing	People's Republic of China	Yantai Municipality PMO, Ministry of Transport, Henan Province PMO, Jiangsu PMO	Climate change

Proposed Development Objective(s)

The Project aims to enhance the national policy framework, establish national and sub-national pathways, and pilot emerging technologies, towards decarbonizing transport.

PROJECT FINANCING DATA (US$, Millions)

SUMMARY

Total Project Cost	117.00
Total Financing	117.00
of which IBRD/IDA	0.00
Financing Gap	0.00

DETAILS

Non-World Bank Group Financing

Counterpart Funding	106.91
Borrower/Recipient	106.91
Trust Funds	10.09
Global Environment Facility (GEF)	10.09

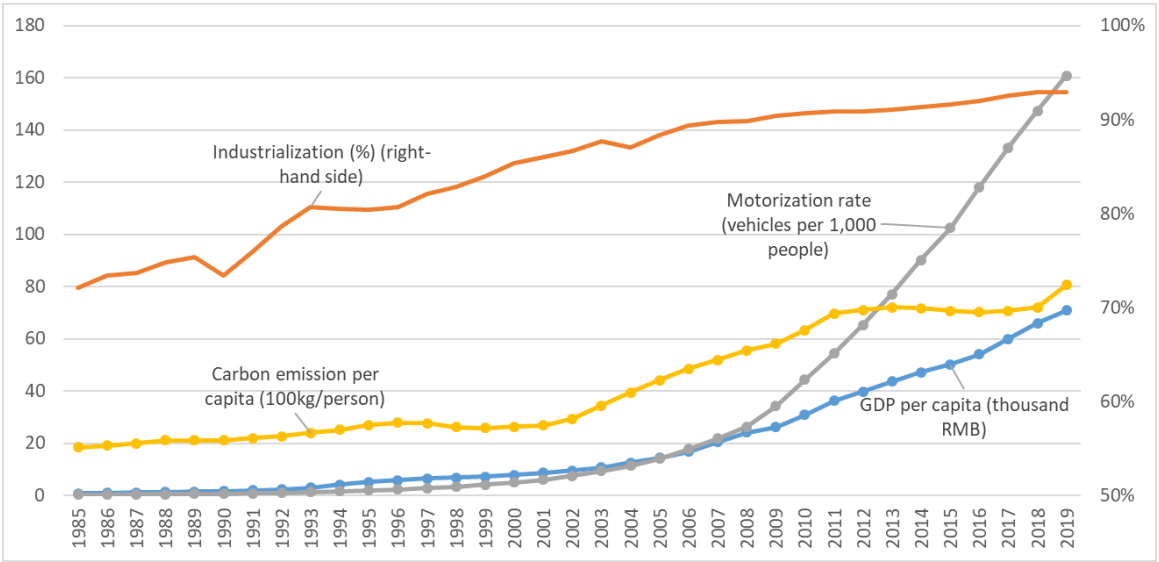
Environmental and Social Risk Classification	Concept Review Decision
Substantial	Track I-The review did authorize the preparation to continue

B. Introduction and Context

Country Context

China's rapid economic growth took place alongside its structural and spatial transformation: from primary to manufacturing and service economies, from agrarian to urbanized society, and from a closed economy to a major participant in global trade and value chains. The share of primary sectors of the GDP decreased from 28.2 percent in 1978 to 9.8 percent in 2018, while that of service sector increased from 23.9 percent to 52.2 percent during the same period. As of 2018, 59.6 percent of the total population lived in urban areas in China, a dramatic increase from 17.9 percent in 1978 when the reform and opening policy initiated. International trade increased from US$20.64 billion in 1978 to US$4.62 trillion in 2018.[1] Such transformation has had a profound impact on the people's lives, with 770 million people lifted out of poverty over the last 40 years.

Figure 1. China's carbon emission alongside GDP growth, industrialization and motorization



Sources: National Bureau of Statistics, Global Carbon Budget 2019; *industrialization is calculated as share of manufacturing and service of GDP

On the other hand, the increasingly urbanized and industrialized China meant a sharp rise in energy use and emissions of greenhouse gases (GHG) and other pollutants. According to the International Energy Agency (IEA), China's total Carbon Dioxide (CO2) emissions grew from 3,540 Mt in 2002 to 9,574 Mt in 2018, at an annual growth rate of 6.4 percent. With about 60 percent of population living in cities, 70 percent of GHG emissions come from urban areas; Air Quality

[1] Ministry of Finance (http://zhs.mofcom.gov.cn) and WITS (https://wits.worldbank.org/)

Index (AQI) in China, especially in large cities and major industrial areas, far exceeds the WHO recommended level. For example, in 2017, Beijing's AQI peaked to 462, the level that is hazardous to human health, and in 2019, the average PM2.5 concentration in Chengdu reached 49 ug/m3, nearly five times higher than the WHO guidelines[2]. The economic growth in China has been resource- and energy-intensive, relying on heavily polluting industries often with heavy use of coal, and has resulted in an explosion in the number of private cars. Combined, these have increased carbon emissions and local pollutants which caused air quality deterioration. Figure 1 shows the trends of GDP growth, industrialization rate, and car ownership and carbon emission per capita in China during 1985-2019.

As the world's top GHG emitter, China has made climate commitments internationally, the achievement of which necessitates scientifically defined decarbonization pathways and a combination of timebound targets, policies, investments and coordination across sectors. The Government of China (GoC) has pledged emissions peaking around 2030 under the Paris climate deal in 2015, which would lead to a 60 to 65 percent reduction in its carbon intensity from the 2005 level. China's Nationally Determined Contribution (NDC) targets, if met, would place GHG emission levels at roughly 14.4 - 16.6 Gt CO2e per year in 2030 and decreasing trends afterwards. The pledge has been lately elevated to carbon neutrality by 2060, as President Xi declared at the UN General Assembly in 2020.

China's national level policy framework to encompass decarbonized development is taking shape, with the issuance of a series of strategies and directives, including: (i) *Revolutionary Strategy for Energy Production and Consumption (2016-2030)* on building a green and low-carbon transport system; (ii) *The 13th Five-Year Plan for Greenhouse Gas Emissions Control* (2016-2020) to promote energy conservation and consumption reduction in the transport among other key sectors on end-user side, while at the same time ramping up industry transmission and energy structure optimization on the supply side; (iii) R*eport of the 19th National Congress of the Communist Party of China (2017)* proposing a strategic goal of building a transport strong country, by developing a green low-carbon, efficient and intelligent modern integrated transport as part of a preliminary modern society by 2035; (iv) the *State Council Guiding Opinions on the Establishment of a Green and Low-Carbon Circular Economy* (February 2021) to roll out green planning, investment, production, transport logistics (including infrastructure, technologies and operation) and lifestyle during the 14th Five-Year Plan period (2021-2025); and (v) *National Planning Outline of a Three-Dimensional Transportation Network* (February 2021), to have transport development serve high-quality economic growth in a more integrated, efficient, and sustainable way. These national policies, together with matching decarbonization programs developed by sub-national and local governments, translate the national targets into disaggregated local benchmarks and specific actions to achieve them.

City clusters and metropolitan regions in China are pools of GHG emissions which offer decarbonization potentials. The metropolitan and city cluster areas in China have contributed a large share of economic and social welfare improvement, and also GHG emissions. After the early phase of rural-to-urban migration resulted in rapid sprawl of individual cities, Chinese cities form growing metropolitan regions and clusters, which sometimes transcends provincial boundaries, as compact economic centers to unlock efficiency and productivity potentials from agglomeration. The concept of 'city clusters' was formally established by the National Development and Reform Commission in 2007; in 2015, the 13th Five-Year Plan has set a plan to build 20 city clusters across China, including four of world-class (Jing-Jin-Ji, Yangtze River Delta, Greater Bay Area and Cheng-Yu), six at national level and nine regional city clusters, alongside a number of metropolitan regions (see Table 1). The *National Planning Outline of a Three-Dimensional Transportation Network* issued in 2021 has confirmed this territorial development layout from transport development perspective in and beyond the 14th five-year period.

[2] Is Air Quality in China a Social Problem? | ChinaPower Project (csis.org)

In the evolving territorial development context, China has classified its land areas into four categories in order to better leverage regional advantages and ease resource limitations. If not properly managed and coordinated across jurisdictions, the growth of city clusters and metropolitan regions may lead to massive expansion of infrastructure, increase in energy consumption, rise in transportation demand, and exacerbation of carbon and pollutant emissions at metropolitan level and beyond. It is thus critical to identify decarbonization strategies for city clusters and metropolitan regions based on their territorial development trends and associated environmental constraints, categorized as below:

- Optimized development area: most industrialized cities but with severe resource and environmental challenges; growth needs to be optimized to ease resource and environmental stresses,
- Prioritized development area: less developed cities to be industrialized without depleting natural resources,
- Restricted development area: large scale arable land acquisition for industrialization purposes should be prohibited, and priority should be given to agricultural function; and
- Prohibited development area: including carbon sinks such as national forests, where industrial activities are not allowed

Table 1. China's City Clusters and Metropolitan Regions and Their Government Programs

	Potential Government Programs
City clusters	Jing-Jin-Ji coordinated development of transportation integration planning
	Inter-city rail transit network plan of the Central Plains city cluster (2017-2030)
	Integrated development plan for higher quality transportation in the Yangtze River Delta
Metropolitan regions	Nanjing Metropolitan Area Integrated High-quality Development Action Plan
	Hangzhou City Circle Development Plan (2020-2035)
	Hefei Metropolitan Area Integrated Development Action Plan (2019-2021)
	Urban Development and three-year construction plan for the Chengdu metropolitan area (2020-2022)
	Spatial Plan of Zhengzhou Metropolitan Area (2018-2035)
	Taiyuan Metropolitan Area Planning (2016-2030)
	Development Plan of the Greater Nanchang Metropolitan Area (2019-2025)
	Spatial collaborative plan of Shanghai metropolitan area
	Guangzhou Metropolitan Area Plan
	Shenzhen Metropolitan Area Plan
	Development Plan of Greater Xi'an Metropolitan Area (2019-2035)
	Land and Space Planning of Changchun Metropolitan Area (2019-2035)
	Wuhan Metropolitan Area Master Plan 2035
	Guiyang metropolitan area plan

Sectoral and Institutional Context

Transport is a major contributing sector of GHG emissions in China and is growing at the highest rate among all sectors[3]. Transport accounts for about 14% of China's total carbon emissions including associated construction activities, and about 11% excluding construction and is identified by the GoC as a key area to promote energy conservation and emission reduction. With rising income, continuing urbanization, soaring motorization and expanding infrastructure, both passenger and freight trips in China are expected to continue growing rapidly, making mitigation in the sector extremely difficult. Moreover, any policy or technology shift towards lower carbon mobility and logistics would entail influencing a vast number of individual consumers and producers, which brings additional challenges. But if unmitigated, the energy-

[3] National Center for Climate Change Strategy and International Cooperation http://www.ncsc.org.cn/yjcg/fxgc/201801/P020180920510030806443.pdf

related CO_2 emissions from the transport sector are estimated to increase from 403 Mt in 2005 to 1,255 Mt to 2030.[4] With other key sectors achieving significant reduction, this would mean the transport sector emission, excluding construction, as share of total would rise from 7.4% in 2005, to 11% in 2020, and to 12.5% in 2030.

Notwithstanding the challenges innate to the transport sector, territorial and technological trends add a new dimension of decarbonization possibilities. A previous study funded by GEF-5 shows that implementing the integrated low-carbon mobility plan in the Jing-Jin-Ji city cluster could lead to GHG emissions reduction from transport by 53% (or 163 $MtCO_2e$) in 2030, compared with the 'business-as-usual' scenario.[5] Many cities have made good decisions followed by investments that enabled lower-carbon and less polluting urban mobility and logistics. According to the latest urban rail development plans approved by the National Development and Reform Commission, by end 2020 more than 30 cities will have more than 100km of operating rail lines, and more than 20 cities will have more than 200km. The "Ten Cities, Thousand Vehicles" program launched in 2019 has rapidly expanded electric vehicle (EV) fleets in Chinese cities, though its initial focus was to electrify public transport. With large investments into battery technologies and heavy subsidies for EV purchasers, EV sales boomed since 2015. The shared non-motorized transport market is on the rise since 2016 and has reached 256 million users in more than 360 cities in 2019. Meanwhile, some 1.6 million shared electric bicycles are placed in streets of the third-tier cities, and this number is expected to grow to 8 million by 2020.[6]

Recent technological advancement offers breakthrough solutions. The emerging technologies — connected, autonomous, shared and electric mobility, or CASE — provide not only more mobility options to users, but also solutions to decarbonize mobility. It is estimated that by 2030, 45 percent of global new car sales would reach at least level 3 in connectivity.[7] China will become the world's largest market for autonomous vehicles, with about 66 percent of total passenger-kilometers in 2040.[8] Connected and automated driving can help ease the demand for land and infrastructures, including parking spaces, which are built under explosive growth of vehicles. By mainstreaming shared mobility, not only in urban cores but for inter-urban and urban-to-rural trips at metropolitan and city cluster scales, vehicle-miles-travelled on the road and associated GHG emissions could be reduced. New energy vehicles (NEV) powered by cleaner fuel such as electricity or hydrogen, would make up about 20 percent of total car sales by 2025 according to the State Council,[9] and can further lower emissions from road transport. Emerging technologies combined with integrated low-carbon mobility programs can significantly reduce GHG emission especially at the city cluster level.

On the other hand, key constraints still exist in decarbonizing the transport sector in China:

First, changing urban forms, due to the growth of metropolitan regions and city clusters as above discussed, have greatly stimulated demand of inter-jurisdictional mobility. While progress towards low-carbon mobility has mostly taken place within higher density urban areas (largely within municipal boundaries), intercity trips in metropolitan regions or city clusters remain largely by fossil-fueled road transport. This is partly due to the lack of coordinated mobility services across jurisdictions, insufficient inter-jurisdictional coordination for investments in low-carbon mobility solutions, and challenges to electrify longer-distance travels. Urban transport in China is under the management of municipal governments with long-established institutions, while intercity transport was managed by multiple modal agencies under Ministry of Transport, including highways, inland waterways, ocean shipping and aviation authorities. Coordination

[4] International Energy Agency (2007), World Energy Outlook 2007 – China and India Insights.
[5] GEF 2016: China City Cluster Eco-Transport Project
[6] iMedia Research. 2020 China shared mobility development research report
[7] Level 3 of automation means that while a human driver is required, they can safely turn their attention away from the driving tasks, e.g., the driver can text or watch a movie. The vehicle will handle situations that call for an immediate response, like emergency braking.
[8] McKinsey report. The future of mobility is at our doorstep.
[9] The Planning for 2021-2035 NEV industry development, issued on November 2 by China's State Council

through higher level government exists but is often carried out in a loose manner. As a result, transport facilities and policies (e.g. highways, rails, stations, airports, and passenger terminals) within the city clusters have mostly been developed by individual modal agencies with inadequate coordination and integration. A lack of an institutional coordination mechanism causes other fragmentations, in infrastructure financing and service provision, including for last mile that connects medium-sized cities (population range 0.5-1 million); establishing a cross-sector financing mechanism faces great difficulty as each jurisdiction within a metropolitan region or city cluster manages its own fund. As a result, it is estimated that the GHG emission from inter-city trips within city clusters and metropolitan regions (of both passenger and freight) will grow from 50 percent of all transport emissions in 2010 to 70 percent in 2050.[10] Also, decarbonization analysis and demonstration often focus on larger and more advanced cities, leaving the diverse challenges of the less developed regions unaddressed. Innovations and finance are needed for mobility and logistics solutions with focus on those interjurisdictional, rural-urban, and lower-density trips.

Second, despite the significant investments in mass transit development over the past decades, public transport modal shares in Chinese cities have stagnated and even been temporarily curtailed during COVID-19. The modal shares of public transport have been difficult to sustain, primarily due to insufficient integration across various modes and low cost of motor-vehicle use which does not reflect its total social and environmental costs, and vehicular congestion continues to rise in Chinese cities. The public transport modal shares in large Chinese cities remain at 40% of total motorized trips, notwithstanding the large investments made into public transport systems over the past decades. The ridership sharply decreased during 2020 as travelers avoided public transport due to the transmission risks of COVID-19. Going forward, decarbonizing transport would thus require ensuring safety of travel from the public health's standpoints, in order to sustain high share of cleaner modes of transport.

Third, emerging and disruptive mobility technologies are motivated by different policy drivers, and synergy is still far to achieve for the overarching goal of decarbonization. Promotion of new energy vehicles have been driven mostly by industrial policies to promote the automotive industry, and the market share of electric mobility is still low at 1.37 percent of total vehicle ownership, mainly due to the high price of vehicles, relatively short driving range, and insufficient charging infrastructure. For now, autonomous driving is regarded as a niche science-technology project being tested in a limited scale. Shared mobility is largely driven by a handful of entrepreneurs, and the currently dominant ride-hailing services operate like taxi services with limited pooling effects and thus limited effect on reducing vehicles on road. The emerging technologies, under development or available in the market, are viewed more as new avenues for businesses to create value. Their decarbonization potential can only be realized when synergy is achieved through, e.g. integration with public transport services or non-motorized transport modes.

Finally, Chinese cities and provinces lack a unified carbon accounting system and capacities that are essential to plan, implement and evaluate low-carbon mobility policies and investments. Currently, official statistics are collected and used primarily for passenger and freight transport services, leaving the emissions by private vehicles largely unaccounted. A coherent bottom-up data platform on various transport modes from individual vehicles and travelers would be critical to model and evaluate impacts of various policies, investments and new technologies on future emissions. The platform would be helpful in the appraisal of green mobility projects, in gauging their emission reduction potentials and mobilizing green financing for qualified projects. In China, the rapid advancement of internet connectivity and mobile-based mobility and logistics services can provide fertile grounds for carbon accounting of the moves of goods and people. Furthermore, real-time monitoring of trips and associated emissions enabled by such a platform can provide useful tools and incentives to travelers and logistics service providers to move towards lower-carbon modes and routes. The potentials of big data

[10] GEF 2016: China City Cluster Eco-Transport Project Summary Report

and mobile technologies are yet to be tapped – to achieve that, policy makers, planners, and tech-tycoons will need to work together. Institutional capacity also needs to be built up to operate the emissions accounting system, and apply results in policy making, planning and investment towards decarbonization.

Going forward, China's transport sector needs a coherent roadmap towards decarbonization, based on the Avoid-Shift-Improve (ASI) framework and enabled both by technological innovations and a comprehensive GHG accounting and evaluation system. The ASI framework, widely endorsed both in advanced and developing countries, consists of three categories of measures. "Avoid" is to minimize need for trips where possible, by co-locating closely linked activities through integrated land-use and transport plans and supporting service delivery via the Internet, such as telecommuting, telemedicine, etc. Avoid measures can shorten or reduce frequencies of recurrent or predictable trips such as commutes and urban deliveries and improve efficiency of supply chains. "Shift" is to change modes of trips away from polluting and energy-consuming modes (e.g., private, single-occupancy cars) and requires high-quality, affordable alternatives to private vehicles, including mass transits, on-demand services, non-motorized solutions such as cycling and micro-mobility. "Improve" is to optimize vehicle, fuel and operational efficiency. Electrification of transport, exploitation of biofuels, hydrogen and other cleaner fuels, as well as operational improvement such as route optimization and cargo consolidation are critical elements to achieve energy efficiency of transport.

Relationship to CPF

The proposed Project is aligned with the World Bank Group's Country Partnership Framework for China (FY2020-2025), primarily its engagement area "Promoting Greener Development". It would help achieving Objective 2.5, "promoting low-carbon transport and cities" and contribute to Objective 2.2, "reducing air, soil, water and marine plastic pollution". The project also supports the World Bank's global agenda on transport, which aims to decarbonize and reduce adverse environmental impacts of transport, while ensuring safe and inclusive mobility solutions for all and supporting connectivity and economic growth.

The Project is also aligned with the GEF-7 Climate Change focal area strategy, specifically objective 1, promote innovation and technology transfer for sustainable energy breakthroughs. First, the Project would promote mainstreaming new energy vehicle technologies and other innovations in transport sector that can improve energy efficiency and help decarbonizing the sector, by setting out coherent national policies and strategy around them. Second, the Project would support development of pathways towards carbon peaking and neutrality in transport sector, through combination of various policy measures and investments, with anticipated long-term systemic impacts on the decision-making, planning and investments, both at national and pilot city/provinces levels. Finally, the Project would help establish technical standards, guidelines and evaluation framework that would mainstream decarbonization goals into transport sector development strategies both at national and pilot levels.

In achieving the above higher level objectives, the Project would be closely coordinated with other World Bank GEF-7 projects in China, namely "Promoting China's Energy Revolution Towards Carbon Neutrality" in energy sector and "China Sustainable Cities – Supporting Green and Low Carbon Urban Development" in urban development sector. The energy sector project supports technology improvement in the energy sector that would enable higher share of renewable energy and breakthrough in new frontiers such as production of clean hydrogen. Decarbonizing transport, one of the most significant energy consuming sectors, will be closely coordinated with such improvements and innovations in energy sector. The urban development sector project would include support for exploring net zero emissions in selected districts and communities, which would need to involve solutions for decarbonizing transport. Lessons from pilots under both projects will be shared to inform relevant policies.

C. Proposed Development Objective(s)

The Project aims to enhance the national policy framework, establish national and sub-national roadmaps, and pilot emerging technologies in selected provinces, towards decarbonizing transport.

Key Results (From PCN)

The project would create foundation for China's transport sector to contribute to the eventual decarbonization goal. The proposed PDO level indicators are as follows:

a. Establishment of a national policy framework to enable decarbonization of transport by 2060
b. Number of roadmaps towards decarbonizing transport at national and in pilot cities/provinces
c. Number of innovative technologies and measures successfully piloted
d. GHG emissions against the business-as-usual (BAU) scenario

The intermediate outcome indicators are proposed as follows:

e. Integrated mobile platform developed in pilot locations
f. Share of new energy vehicles of total public transport fleets in pilot locations
g. Pipeline of projects that would contribute to decarbonization of transport, identified in pilot locations
h. Participation in training and knowledge sharing activities

Additionally, the proposed GEF project would be closely linked to a parallel proposed World Bank financing, "Green Mobility for City Clusters" Program for Results (PforR) Operation (or the "City Cluster PforR Operation", hereafter) in two major ways. First, the GEF project would support development of a national framework of policies and technical standards towards decarbonizing transport, which would be implemented in a selected city cluster or metropolitan region under the City Cluster PforR Operation. Second, the GEF project would assist pilot localities to identify green mobility investments as part of their decarbonization pathway and to implement some innovative measures in pilot scales, effectively identifying investments and other interventions that can be supported under the City Cluster PforR Operation. In the long-term, through developing decarbonization pathways for selected diverse provinces, metropolitan regions and cities, the project would generate good practices and examples that can be scaled in many other similar localities, which in turn can help them decarbonize transport in the long run.

D. Concept Description

As stated above, significant challenges remain for China's transport sector to lower its carbon emission and to contribute to the climate goal of the country – emission peaking in 2030 and carbon neutrality by 2060. At the national level, China has yet to develop a coherent policy framework aimed at mobilizing and coordinating emerging technologies to achieve low-carbon mobility. At sub-national level, Chinese cities, provinces, and metropolitan regions need to set out comprehensive long-term pathways towards decarbonizing transport, corresponding to their level of development, rather than applying piecemeal policies and technology solutions. With the formation of metropolitan regions and city clusters, strategies to decarbonize inter-jurisdictional movements need to be developed through strong institutional coordination. In addition, financing mechanism need to be developed to incentive the adoption of technologies for low-carbon mobility.

Without the proposed Project, carbon emissions from China's transport is expected to continue growing beyond 2030, reaching the peak around 2035 and later than in many other sectors.[11] As discussed above, this is due to several factors: continued growth in motorization as incomes grow, the slow pace at which the electrification is taking place, and the lack of coordination between technology-enabled new mobility services and traditional modes, among others. To advance the peaking point and to eventually decarbonize transport sector, concerted efforts are needed both at national and sub-national levels, through policies, regulations, technological innovations and investments. In order to address these challenges, the proposed Project will include the following components.

Component 1: Policy Framework towards Decarbonizing Transport (proposed GEF grant allocation US$2,591,743 and counterpart fund US$1 million). This component will assess and refine the policy framework to enable transport carbon peaking and eventual decarbonization and comprise the following sub-components.

Sub-Component 1A: **Develop a framework of policies and technical standards to enable decarbonization of transport**. A national-level framework for policies and technical standards can provide foundation for decarbonizing transport in Chinese cities, metropolitan regions, city clusters provinces, specifically to achieve carbon peaking in the transport sector by 2030 and eventual carbon neutrality by 2060. This component would develop, based on a detailed review of the existing policies and standards, previous demonstration projects by MoT, and relevant international experiences, a framework of policies and technical standards for the achievement of carbon peaking in the transport sector. The framework would support decarbonization of urban and inter-urban mobility, road transport and waterborne transport, and resource/energy efficiency and environmental impacts mitigation in construction of highways, ports and waterway infrastructures. Such a framework would include policy measures and standards relevant for city clusters, metropolitan regions and provinces.

Sub-Component 1B: Develop a strategy to achieve carbon peaking in the transport sector through emerging innovations. Emerging technology-driven mobility solutions, such as shared mobility, clean energy application such as biofuel and green hydrogen12, battery swapping for electric vehicles, and on-demand services have been rising in recent years. This sub-component aims to develop a strategy on how Chinese cities, city clusters and provinces can mobilize such emerging innovations to achieve their goal of decarbonizing transport. To that end, various technology solutions and their early applications, both domestic and international, would be studied, including but not limited to: use of technologies for on-demand mobility and logistics services, mainstreaming new energy vehicles, use of technologies to improve energy efficiency, and new business models for shared mobility or shared loading capacity enabled by mobile technologies. Based on the study, key constraints to their broader application—whether institutional, technological, infrastructure-related or financial—will be identified. Specifically, any constraints related to the interjurisdictional coordination that hinder systematic application of innovative mobility solutions at city cluster or metropolitan scale would also be identified. A strategy will be developed to address those identified constraints.

Sub-Component 1C: Develop evaluation framework for transport emissions. This sub-component will develop a Green Transport Development Index (GTI) with a set of core indicators, and further apply as a tool to assess the progress towards eventual decarbonization in diverse regions, helping authorities identify the key issues and gaps for further improvement. The tasks will include (a) a study on life-cycle carbon footprint accounting for transport infrastructure (methods to calculate carbon emission in construction and maintenance, assess carbon neutrality of transport infrastructure); (b) a study on the improvement of the existing transport energy consumption statistical system, which was developed by NEA

[11] According to the scenario analysis carried out by a research team led by Tsinghua University and included the China Academy of Transportation Sciences affiliated with the Ministry of Transport; results were presented in October 2020.
[12] Hydrogen produced using electricity generated from renewable sources such as wind and solar

and does not account for private cars, and development of online energy consumption monitoring platform; (c) development of a comprehensive assessment model for transport energy consumption and emissions; and (d) development of a Green Transport Development Index for use by local governments.

Component 2: Roadmap for Transport Carbon Peaking and Eventual Decarbonization for Diverse Regions (proposed GEF grant allocation US$6.1 million and counterpart fund US$73.4 million). This component would support preparation of roadmaps for decarbonizing transport both at national and sub-national levels, and pilot implementation of selected activities. The roadmaps to be developed would inform priority technology innovations and green mobility investments, which can be supported in the proposed City Cluster PforR Operation with IBRD financing. The activities under each pilot location described below will be further specified during preparation, for close linkage to the proposed City Cluster PforR. Below three pilots were selected jointly by the Bank and Ministry of Transport, from the review of proposals submitted to the MOT and on the basis of their alignment with the project objective, potential contribution to the decarbonization goals, and replicability.

Sub-Component 2A: Develop a national roadmap for transport carbon peaking and neutrality. With focus on the two key milestones (year 2035 and 2050) of China's new "two-step" strategy, this sub-component will investigate and analyze the current situation of regional transport development in China, study the key constraints in the development of new transport service and modes, carry out scenario analyses for decarbonizing transport in different regions, propose decarbonization goals and strategies for diverse regions in 2035 and 2050, and estimate costs of implementation. On the basis of the study on decarbonization of transport for diversified regions, the TA will develop Five-year plans for transport carbon peaking for diverse regions in China, including planning principles, objectives, key tasks, key projects and technical paths towards carbon peaking. Based on this foundation, a longer-term roadmap towards eventual carbon neutrality will be prepared.

Sub-Component 2B: Mobilizing emerging technologies and techniques for decarbonizing transport in Yantai Municipality. Yantai is a port city of Shandong province, which has been pioneering low carbon transport development as a pilot city under the ongoing GEF-6 project and MoT's low-carbon transport system project in 2012, 2014 and 2017. Under these earlier pilot projects, Yantai has improved the public transport systems including through fleet upgrade with new energy vehicles and enhanced energy efficiency of vessel operations. Yantai has also promoted multimodal freight operations across the Bohai Bay to shift road freight transport to waterway transport. Built upon these successes, the municipality aims to embrace new technology innovations, including big data platform, green hydrogen and fuel cell vehicles, and renewable energy integration in transport sector, towards long-term carbon neutrality goal. The pilot would first set out a road map for transport carbon peaking and neutrality for Yantai, based on which key policy measures and investments would be identified. Following the roadmap, specific pilot implementation will be carried out. The indicative list of activities includes development of a big data platform for traffic management, public transport operation and emission monitoring, piloting of green hydrogen application in transport, integrating renewable energy supply in transport sector, and decarbonization of port operation.

Sub-Component 2C: Developing solutions towards decarbonizing rural-urban connectivity in Henan Province. Henan Province has to-date participated in various low carbon mobility pilots, both MoT's and its own initiatives; for example, its county-level city Yongcheng has successfully implemented its public transport priority program during 2018-2020 to promote rural-urban integration through green mobility development. It has upgraded its rural-urban bus fleet with new energy vehicles, introduced electric bike sharing scheme, and implemented an intelligent public transport system. Built upon this success, the province aims to improve the mobility and logistics services in lower density environment, not only in Yongcheng but also in other rural counties that make up Central Plain City Cluster anchored around Zhengzhou

municipality, towards further emission reduction and rural-urban integration. Similar to above, the pilot would first set out a roadmap for transport carbon peaking and decarbonization for Henan Province / Zhengzhou metropolitan region, based on which key policy measures and investments would be identified. Following the roadmap, specific pilot implementation will be carried out. The indicative list of activities includes identifying a strategy for on-demand mobility and logistics services based on detailed demand analysis on rural passenger and logistics, expanding the utilization of new energy vehicles, and developing mobile platform and operating plans for on-demand mobility and logistics services in selected counties.

Sub-Component 2D: Establishing a green financing mechanism and piloting zero-emission port in Jiangsu Province. Jiangsu Province has long maintained a strong focus on energy saving and emission reduction across all sectors including transport. Its Transport Energy Saving Center has developed an emission accounting, monitoring and reporting system, based on sampling of transport operations across all modes including buses, taxis and cargo. It has made significant investments in low carbon mobility solutions including urban rail and intercity railway systems, electric buses, public transport systems and non-motorized transport modes. It has also pioneered many technology-driven transport solutions such as integrated urban transport platforms, autonomous vehicles, smart highways and automated logistics centers. Based on this strong capacity for data collection and analytics, the province aims to create a systematic approach to mobilizing financing for low-carbon mobility investments. Similar to above, the pilot would first set out a roadmap for transport carbon peaking and decarbonization for Jiangsu Province, based on which key policy measures and investments would be identified. Following the roadmap, specific pilot implementation will be carried out. The indicative list of activities includes establishing a green financing mechanism to support low-carbon mobility projects, including new technology applications that entail high commercial risks, developing institutional and implementation arrangement to facilitate cross-jurisdictional low-carbon mobility projects, and piloting a zero-emission port at Jiangyin Port, where comprehensive interventions under the ASI framework will be implemented, potentially including application of green hydrogen technology for truck and/or vessel operation.

Beyond the above pilot activities in the proposed three provinces, additional proposals from other provinces may be identified and considered during preparation, if they are focused on innovative decarbonization or net zero carbon measures (e.g., application of green hydrogen use in transport in Qinzhou Port in Guangxi Province). Assessment and selection of such additional proposals would be carried out by the MoT with technical advice from the Bank.

Component 3: Capacity Building (proposed GEF grant allocation US$800,000 and counterpart fund US$200,000). Provision of technical support for, *inter alia*: (i) knowledge exchange and capacity-building on transport innovations for decarbonization; and (ii) dissemination activities. Under the Project, knowledge on decarbonization strategies, policies and technologies will be created from technical assistance and pilot implementation. These lessons will be organized in appropriate forms, such as reports, workshop presentations, multimedia and graphics, and shared through online platform to be designated by MOT. Dissemination, to be managed by MOT and its affiliated entities, would benefit all provinces and municipalities in China that would develop strategies to decarbonize transport within their jurisdictions. Such knowledge would also benefit investors and financers that are looking for projects to decarbonize transport sector, as there would be clarity on technical standards and implementation guidelines.

Component 4: Monitoring & Evaluation (proposed GEF grant allocation US$200,000 and counterpart fund US$200,000). Provision of support to one national Project Management Office (PMO) and three local PMOs, to be set up in each pilot province/city, to monitor and evaluate the different parts of the Project.

Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Areas OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

The proposed project consists of technical assistance (TA) activities at both national and regional level, and pilot subprojects to be carried out in Yantai Municipality, Henan and Jiangsu province. The overall environmental risk is rated Substantial and the social risk is classified Substantial given the pilot subprojects uncertainty and potential downstream environmental impacts and risks from TA activities. The environmental and social risk classification will be rechecked prior to project appraisal.

The project has overall environmental benefits of promoting clean and low-carbon development and improving the efficiency of transport operation in China and the pilot provinces/cities, and therefore reducing greenhouse gas (GHG) emission, improving air quality, and contributing to climate change mitigation. By undertaking targeted TA work in identifying low carbon transport options, the project will allow specific social development and inclusion aspects also to be fully considered which will in turn improve the social outcomes from subsequent transport and financing proposals.

Implementation of TA studies will not cause any direct adverse impacts but will involve significant stakeholder engagement and potentially have downstream impacts during the implementation of the products/outcomes of TA. As a result of TA recommended strategies or plans, there could be increased infrastructure investments, such as road or bridge rehabilitation, construction of renewable energy generation, storage and transmission facilities, construction or upgrading of logistic centres, bus depots, charging piles, etc. The downstream environmental and social issues and implications associated with the potential infrastructure construction and operation would need to be considered and assessed during the TA studies, including conducting environmental and social risk scoping as part of detailed and alternative analysis. This is supported by building the counterpart capacity for integrating environmental and social objectives into their work, and have the terms of reference (ToRs) reviewed by the Bank team to ensure that the relevant ESSs of the ESF are complied with.

Based on current project design, the pilot subprojects will be largely composed of studies (e.g. regulatory framework and incentive system for onshore electricity, transport and logistics demand, green financing), but may involve small to medium scale civil works and equipment installation associated with dock infrastructure upgrading, battery energy storage systems (BESS), heating system experiments and data platform establishment. The civil works are anticipated to be on existing land or existing buildings, located in urban or suburban area already disturbed by human activities, and unlikely to be in vicinity of any legally protected or customarily recognized cultural heritage. Although, the project design will exclude new construction or rehabilitation that would require large scale land acquisition, TA work will include the preparation of resettlement planning instruments proportionate to the identified risks and scale of acquisition such as resettlement policy frameworks (RPFs) and/or resettlement action plans (RAPs). Similar assessments associated with operational aspects of potential downstream investments such as the asphalt plants which may include community health and safety, labor and other aspects will be defined by the ToR for this work.

The potential adverse environmental impacts during construction phase would mainly include general construction nuisance of dust, noise, soil disturbance, traffic safety, waste disposal, and disturbance to modified habitats, which are

generally temporary, short-term, localized, of small to medium scale, and could be effectively avoided, reduced or mitigated through adopting mature civil work techniques and good management practice. No long-term irreversible adverse environmental impacts are expected. Operation of asphalt producer could bring about environmental impacts such as air emissions, noise, wastewater and waste, and occupational health and safety (OHS) concerns. In domestic practice, the plant owner will be held responsible for conducting operational phase impacts monitoring through engaged external third parties, and are subject to supervision by local environmental authorities. The environmental risks during operation phase are thus expected to be manageable under current domestic regulatory system. Fire and explosion risks during BESS operation can be well controlled by following national design standards with safety considerations, including placement criteria, fire and explosion prevention measures and emergency response requirements. Planning for battery waste management will require the review of current recycling technologies and practices in China. The environmental impacts assessment will compare domestic standards with Good International Industry Practice (GIIP) and determine more stringent performance criteria for the asphalt production, battery operation and disposal.

At the national level, the key counterpart is Ministry of Transport (MOT), and a national Project Management Office (PMO) will be established either under its Comprehensive Transport Division or one of its affiliated agencies. The national PMO will be in charge of day-to-day management of the overall project, including environmental and social (E&S) risk monitoring of the national components. Three local PMOs will be established respectively by the Jiangsu Provincial Transport Department, the Henan Provincial Transport Department and the Yantai Municipal Transport Bureau, which will be in charge of the day-to-day management of their respective parts of the projects. Although this project will be the first for MOT and the three participating provinces/cities to prepare and implement under the new Environmental and Social Framework (ESF), in general, national and provincial/municipal borrowers have the technical capacity to implement the project to meet the objectives of the ESSs, including GIIP. A time-bound capacity development plan will be prepared in the Environmental and Social Management Framework (ESMF) (and key actions will be committed to under the ESCP), through which the capacity of national and local PMOs will be strengthened with regards to ESF implementation. Both national and local PMOs will have dedicated focal points to coordinate E&S risk management for the project, and will hire E&S consultants to support preparing, updating, and implementing relevant environmental and social instruments.

As details of TAs and pilot subproject activities will not be confirmed until project preparation/implementation, the PMO will prepare an ESMF, a Stakeholder Engagement Framework (SEF) and an Environmental and Social Commitment Plan (ESCP) consistent with relevant ESSs prior to project appraisal. Once a pilot and specific subproject activities are known, the PMO will carry out screening to determine their eligibility for financing. The grant applicants will develop appropriate E&S documents proportionate to the risks and impacts of the particular activity, consistent with the ESMF. The E&S documents will provide sufficient details to inform stakeholder engagement and the Bank?s decision making and also establish adequate risk management systems for key aspects such as data use and management. The PMO and the grant applicants will submit to the Bank and disclose the E&S documents as specified in the ESCP.

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