ASIAN INFRASTRUCTURE INVESTMENT BANK

Sovereign-backed Financing

Project Document
The People's Republic of China
P000660 China: Yunnan Kunming Changshui Airport Expansion and Green Development Project

Currency Equivalents
(As of Mar. 3, 2023)

Currency Unit – Chinese Yuan (RMB)
RMB1.00 = USD0.15
USD1.00 = RMB6.90

Borrower's Fiscal year
Jan. 1 – Dec. 31

Abbreviations

AC	Air Conditioner
ACA	Airport Carbon Accreditation
ACI	Airport Council International
AIIB	Asian Infrastructure Investment Bank
APU	Auxiliary Power Unit
ATC	Air Traffic Control
ATMs	Air Traffic Movements
CAAC	Civil Aviation Administration of China
CBA	Cost Benefit Analysis
CCER	China Certified Emissions Reductions
CO_2	Carbon Dioxide
CORSIA	Carbon Offsetting and Reduction Scheme for the International Aviation
Changi Team	Singapore Changi Airport Group
EIRR	Economic Internal Rate of Return
ENPV	Expected Net Present Value
ESG	Environmental, Social, Governance
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental and Social Policy
ESS	Environmental and Social Standard
EV	Electric Vehicles
FAA	Federal Aviation Administration
FIRR	Financial Internal Rate of Return
FM	Financial Management
FSR	Feasibility Study Report
GDP	Gross Domestic Product
GPN	General Procurement Notice
GRM	Grievance Redress Mechanism
GTC	General Transport Center
HSR	Highspeed Railway
ICAO	International Civil Aviation Organization

IMF	International Monetary Fund
ILS	Instrumental Landing System
IOCT	International Open Competitive Tendering
IOCS	International Open Competitive Selection
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organization
KCA	Kunming Changshui Airport Co. Ltd.
KM Airport	Kunming Changshui International Airport
LTO	Landing Take-Off
LTS	Long-term Strategy
MCT	Minimum Connecting Time
MDB	Multilateral Development Bank
MEP	Medium-term Expansion Plan
MOF	Ministry of Finance
NA	North Asia
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission
NPV	Net Present Value
NTS	Non-Technical Summaries
PA	Paris Alignment
PDCA	Plan-Do-Check-Act
PIO	Project Implementing Office
PIA	Project Implementing Agency
PIE	Project Implementing Entity
PIR	Procurement Instructions for Recipients
PMO	Project Management Office
PP	Procurement Plan
PSC	Project Steering Committee
Runway E1	Eastern Runway #1
Runway E2	Eastern Runway #2
Runway W1	Western Runway #1
Runway W2	Western Runway #2
Runway W3	Western Runway #3
S1	Satellite Terminal #1
S2	Satellite Terminal #2
SA	South Asia
SAF	Sustainable Aviation Fuel
SBF	Sovereign-backed Financing
SC	Specific Assessment Criteria
SEA	Southeast Asia
SPD	Standard Procurement Document
SWOT	Strength-Weakness-Opportunities-Threats
T1	Terminal #1

T2	Terminal #2
TOR	Terms of Reference
US	United States
UC	Uniform Assessment Criteria
WB	World Bank
YAG	Yunnan Airport Group Co. Ltd.
YFD	Yunnan Provincial Finance Department

Contents

1. Summary Sheet

The People's Republic of China
Yunnan Kunming Changshui Airport Expansion and Green Development Project

Project No.	P000660
Project Name	Yunnan Kunming Changshui Airport Expansion and Green Development Project
AIIB Member	China
Borrower	The People's Republic of China
Project Implementing Entity	Yunnan Province
Sector	Transport
Subsector	Civil Aviation
Project Objective	To support the green development of an international hub airport in the southwest of China and improve air connectivity to Southeast and South Asia regions.
Project Description	The major components funded by AIIB loan will comprise: • Component 1: Construction of Airside Infrastructure in the Eastern Part of the Airport. • Component 2: Construction of Aprons and associated lighting system and facilities around Terminal 2. • Component 3: Electrified service vehicles with charging piles, ground power unit and noise monitoring equipment. • Component 4: Technical Support and Capacity Building.
Implementation Period	Estimated Start Date: Jul. 2023 Estimated End Date: Jul. 2028
Expected Loan Closing Date	Jan. 2029
Cost and Financing Plan	The estimated project cost: USD901.8 million Financing Plan: AIIB Loan: USD500 million Government's Counterpart Funds: USD401.8 million
Size and Terms of AIIB Loan	RMB3,450 million[1] (approximately USD500 million equivalent) The loan will have a maturity of 35 years, including a grace period of five years, with standard terms for AIIB sovereign-backed loans.

[1] The Loan amount is denominated in RMB, however, the costs and funding in this report will still be presented in USD with the exchange rate applied of USD 1=RMB 6.9, the exchange rate agreed in the appraisal mission as of Mar. 3, 2023.

Environmental and Social Category	A
Risk (Low/Medium/High)	High
Conditions for Effectiveness	• Subsidiary Agreement by and between the Project Implementing Agency and Project Implementing Unit has been executed on terms and conditions acceptable by to the Bank. • The Commitment Letter has been executed by and between the Project Implementing Agency and the Dianzhong New Area Management Committee under terms and conditions acceptable to the Bank.
Key Covenants	Including but not limited to: • Ensure that the Project is carried out in accordance with the Environmental and Social Impact Assessment, Environmental and Social Management Plan, Environmental and Social Action Plan, Noise Management Framework, Stakeholder Engagement Plan, Abbreviated Resettlement Plan and Resettlement Planning Framework. • Complete and integrate the Green Airport Plan into the business plan and operations of Kunming Changshui International Airport.
Retroactive Financing (Loan % and dates)	Up to 20 percent of the loan amount, for eligible expenditures paid within 12 months prior to the loan signing date.
Policy Assurance	The Vice President, Policy and Strategy, confirms an overall assurance that AIIB is in compliance with the policies applicable to the Project.
Economic Capital (Ecap) Consumption	USD31.31 million

President	Jin Liqun
Vice President	Konstantin Limitovskiy, Investment Operations Region 2
Acting Director General, Department	Gregory Liu, Infrastructure Investment Department Region 2 (INF2)
Team Leader	Anzheng Wei, Senior Investment Officer
Backup Team Leader	Yaxin Yan, Investment Operations Specialist
Team Members	Jingyu Gao, Economic Associate Li-an Zhang, Civil Aviation Consultant Mengmeng He, Finance Officer Pedro Ferraz, Environment Specialist

	Shaojun Chen, Social Development Consultant Siva Rama Krishna Sastry Jyosyula, Senior Social Development Specialist Ting Wang, Counsel Yi Geng, Senior Financial Management Specialist Yunlong Liu, Senior Procurement Specialist Konstantinos Krouskas, Senior Treasury Officer Yuyou Guo, Project Assistant Mingkai Zhang, Operational Service Assistant

2. Project Description

A. Project Overview

1. **Project Objective.** To support the green development of an international hub airport in the southwest of China and improve air connectivity to Southeast and South Asia regions.

2. **Project Description**. The project is part of the Medium-term Expansion Plan (MEP) of Kunming Changshui International Airport (KM Airport). The MEP is the master plan of the expansion of KM Airport, approved by the National Development and Reform Commission (NDRC) in 2021, with targets for the KM Airport to accommodate 95 million person-times and one million tons of cargo per year in medium term[1] future. The MEP's Feasibility Study Report (FSR) was approved in Sep. 2022. The investment of physical activities of the MEP can be split into three main parts: **Part 1-Eastern Part**, including Eastern Runway #2 (Runway E2), cargo terminal and aprons, and aprons around Terminal #2 (T2). **Part 2-Central Part**, including T2 (buildings and equipment); partial civil works of the General Transport Center (GTC) within airport's responsibility and landside working areas. **Part 3-Western Part** including a new runway in the west of the airport, a new aircraft maintenance zone; and other field preparation for the future expansion.

3. **The AIIB project (the project)** is mainly focused on the construction of the airside infrastructure **for Part 1-Eastern Part,** including: (i) Runway E2 and its linked taxiway and navigation system, cargo aprons, drainage and lighting system for Runway E2; (ii) aprons and road and bridge around T2; (iii) electrified service vehicles inside the airport and (iv) noise monitoring equipment. The project also includes project implementation support and institutional capacity building. The implementation support is focused on ES monitoring and evaluation, particularly noise monitoring enhancement. The capacity building is designed to support the green airport development of KM Airport and enhance regional connectivity with South Asia (SA) and Southeast Asia (SEA). The Bank has conducted a technical review of KM Airport's green airport status and included the proposed Green Airport (decarbonization) Plan (the Plan) in the design of the project to address existing gaps.

4. The technical solutions of Part 1 in the FSR have been reviewed and assessed by Bank team as acceptable and implementable. Though the project is part of the MEP, its scope can be clearly identified, and the assets are deemed to be operational and functionally independently after completion. To ensure continuous airport operation, the expansion will be implemented over a staggered schedule. The activities within the project scope have relatively high level of readiness and are expected to be completed in the first five years of the MEP's implementation. The assessments in this Project Document refer to the AIIB project, unless otherwise noted.

5. **Expected Results.** The project is designed with a focus on green development and connectivity. The expected results from green development include: (i) reduced energy consumption per passenger; and (ii) reduced Carbon Dioxide (CO_2) emission per passenger. The expected results for connectivity include: (iii) increased annual volume of passenger throughput;

[1] Medium term is a terminology used in civil aviation capacity planning, it usually refers to 10-15 years.

(iv) increased percentage of transit passengers (both total and international); (v) increased average number of outbound flights per day to destination airports in SA and SEA; (vi) reduced Minimum Connecting Time (MCT) for transit passengers; (vii) increased number of airlines at KM Airport providing air-rail connection service. On the gender aspect, the expected results include (viii) high participation of women staff in Yunnan Airport Group Co. Ltd. (YAG) in the Bank-supported capacity-building program (Component 4.2: the Green Airport and sustainability information disclosure). The results will be monitored through indicators in *Annex 1: Results Monitoring Framework***.**

6. **Expected Beneficiaries**. The project will provide improved airport service with increased capacity, improved transit efficiency, and Low-Carbon operations to both domestic and international passengers and freight customers. The direct beneficiaries will be the passengers, airlines and cargo logistic companies. Furthermore, the tourism industry, industries and businesses that rely on air transportation with close connection to SA and SEA markets will benefit. The value chain of agriculture products from Yunnan with high value and suitable for air transportation such as flowers, tricholoma matsutake, and wagyu beef will benefit. In terms of aviation sector, AIIB support for the green development of such a high-profile project would provide a good model for peer airports in China, and promote the green development concept and practice in the entire industry.

B. Rationale

7. Air transportation plays an important role in promoting economic growth, regional connectivity, and improvements in the people's living standard. China is the second largest aviation market in the world with 660 million boarding passengers in 2019. While the volume is large in total, the quality of the air transportation needs to be improved. At the same time, the yearly boarding per capita remains below world average, the market therefore still has considerable room for further development and growth.

8. Located in the southwest of China, bordering South Asia and Southeast Asia, Yunnan province has served as the gateway of China to the SA subcontinent and Indo-China Peninsula since ancient times. Kunming is at the center of a five-hour aviation circle which covers around half of the world's population. Within a three-hour flight, passengers from Kunming can reach Bangkok, Vientiane, Luang Prabang, Mandalay, Chiang Mai, Hanoi, Phnom Penh, Kathmandu and Kolkata.

9. **Insufficient Infrastructure.** Since operation started in 2012, KM Airport has been among the busiest in China. From 2012 to 2015, KM Airport ranked 7th in passenger volume, its passenger volume grew (13 percent) faster than the national average (10 percent). In 2016, the passenger throughput of KM Airport reached 41.98 million, exceeding for the first time its designed capacity of 38 million. Since then, insufficient capacity of the airport infrastructure started to slow the fast pace of passenger growth at KM Airport. From 2016 to 2019, the passenger growth rate at KM Airport dropped to 4.6 percent, well below the national average (10 percent) over the same period.

10. Air traffic demand is driven primarily by population, wealth effects and the cost of flying. Insufficient capacity would lead to congested airports with inefficiencies, delays, reduced service and higher unit emissions. The infrastructure and facilities at KM Airport have been running beyond its design capacity for years and cannot meet the rapidly growing demand. The expansion and upgrading of KM Airport are therefore deemed essential.

11. **Connectivity.** KM Airport is positioned by the Chinese government as one of the ten international aviation hubs of China, connecting China to SA and SEA nations. KM Airport is already the largest transit airport in China in terms of transit passenger throughput per year, followed by Chongqing and Xi'an. KM Airport has well developed air routes network domestically, both within Yunnan province and national wide. KM Airport has the largest number of international air routes connecting with SA and SEA among peers in China (excluding Hong Kong, China; Macao, China; and Taiwan, China). In 2019, there were 45 destinations in SA and SEA connecting with KM Airport, the most among airports in China (excluding Hong Kong, China; Macao, China; and Taiwan, China), followed by Guangzhou and Shenzhen. Economically, SEA is the second largest trading partner with China while SA represents huge potential in trading and industry collaboration with China in the regional cooperation context. With that, the demand of regional connectivity in this area is expected to grow rapidly, including the air transport connectivity. KM Airport is situated along the air route corridors from China to SA Subcontinent and Indo-China (A581 and A599), that all international flights origins from China or North Asia (NA) to those two directions have to pass over the KM Airport. KM Airport is therefore ideally suited to serve as the regional connectivity hub. Furthermore, KM Airport is actively promoting multi-modal transfer, particularly, the rail-air connection, which is expected to grow further after the airport expansion.

12. In 2019, the total number of transit passengers through KM Airport was around 9.6 million, out of which about 2.1 million were international passengers. With the expansion of the airport, the transit passenger volume is expected to increase. Specifically speaking, with the capacity expansion, improved terminal design and optimized transit procedures, the flight schedule in peak hour is expected to increase from the current 56 flights per hour to 76 flights per hour, and the MCT for international transit passengers is expected to be reduced from around 120 minutes to 80 minutes. With the expanded capacity and improved connectivity, KM Airport will further strengthen its position as a hub connecting NA cities, SA subcontinent and Indo-China Peninsula cities, and to achieve its goal of becoming one of the best international hub airports in the region.

13. **Green Airport**. KM Airport is one of the pioneers in advocating and practicing the green airport concept in China. In 2006, when KM Airport started the preparation of its phase 1 construction, the green airport concept with focus on four dimensions (resources saving, environment friendly, technology enabling, and humanization) was incorporated. Many innovations and good practices at that time have been incorporated in KM Airport as a pilot base in China. Those experience has been exchanged with international institutions and peers, such as the US Federal Aviation Administration (FAA) and International Civil Aviation Organization (ICAO). Since then, the green airport concept has further evolved in China. In 2021, Civil Aviation Administration of China (CAAC) published the "Four Characteristics Airport Development Guideline (2020-2035)" which is a governing document containing the green airport requirements

and guiding the design, construction, operation and management of airport projects, including the KM Airport expansion.

14. In 2020, China committed to CO_2 emissions peak by 2030 and carbon neutrality by 2060. Following the national Low-Carbon pathway, decarbonization and green airport have become a very important topic in the aviation industry. In 2022, China Civil Airport Association has launched the "Airport Carbon Evaluation Stars Certificate Scheme", which involves five levels, from One Star (the lowest) to Five Stars (the highest). It benchmarks against the requirement and standards in Airport Carbon Accreditation (ACA) carbon emission certification system launched by the Airport Council International (ACI). KM Airport has carried out the "Airport Carbon Evaluation" star certificate assessment in Dec. 2022 and been granted as "Three Stars Airport", together with seven other airports, which are the highest rating among all operational airports in China.

15. Energy saving, using electricity to replace gas and oil and increasing the portion of clean energy are the three main pillars to support KM Airport's decarbonization pathway, which is aligned with the national decarbonization strategy, particularly at the consumption end. To reduce the use of fossil fuel, the MEP calls for increased use of electrified service vehicles and power units on the apron to supply electricity to aircraft on the ground. Each boarding bridge is equipped with a 400Hz ground power unit to provide power to aircraft on the ground and therefore reduce aviation fuel consumption. All passenger aprons will be equipped with floor-type aircraft ground air conditioning unit and ground well. The plan of installing small scale of renewable power[2] and energy storage facilities will increase the use of clean power at the airport.

16. **Issues Observed**. Green airport concept and practice are nonetheless still in developing stage in China, and there is yet a well-recognized showcase in the industry. During project preparation, the Bank has identified three common issues: (i) focus on new technical solutions to reduce the emissions, while lack of clear and feasible overarching targets with achievable timelines; (ii) more attention to the physical solution, while lack of systematic thinking and stakeholder engagement with other partners in the overall decarbonization ecosystem; and (iii) lack of well-developed reporting system (such as Environmental, Social, Governance (ESG) reports or sustainability reports), lack of the benchmarking against international good practice and linkage to the global public development goals.

17. With the aim of introducing international good practice to KM Airport, the Bank has engaged the Singapore Changi Airport Group (Changi Team), who is specialized in green airport development, to support the Bank in the design and preparation of green elements of the project. The objectives of the exercise are to develop a green airport evaluation framework that is aligned with the substance and common theme of international standards as well as China's national goals, to provide an assessment of the current standing of KM's Green Airport development and recommend tailored action plans for KM Airport. The evaluation framework has integrated standards from local authorities (i.e. CAAC) and international bodies, including ACI, International Standards Organization (ISO) Plan-Do-Check-Act (PDCA), and ACA evaluation criteria. The exercise also includes benchmarking against four leading peers recognized for their efforts in

[2] AIIB project will not include the renewable power component.

green airport development. An assessment, including a Strength-Weakness-Opportunities-Threats (SWOT) analysis, and tailored recommendations have been prepared accordingly.

18. The assessment found out that KM Airport has well-established energy management system, metering network and green airport design in this expansion program. These designs help ensure that the carbon footprint and environmental impacts of airport operations are reduced right from the start. These efforts have laid a good foundation for KM Airport to advance its green airport development journey to become a leader and role model of a sustainable, Low-Carbon and smart airport in China. The current green efforts put forth by KM Airport focus on physical assets investment, such as managing the energy demand, upgrading airport assets to more efficient ones and putting in place higher efficiency operational controls. However, there is limit in having a long-term and more holistic view, target and plan on carbon management. The areas could be improved include: (i) increase the proportion of renewables in the energy mix; (ii) investigate smaller energy-consuming systems such as baggage handling systems, lifts/escalators/travelators; and (iii) expand beyond current efforts directed at technical aspects, and have wider engagement with airport ecosystem stakeholders including system owners, airport community, business partners and passengers. The assessment recommends that KM Airport will need to go beyond adhering to the targets and directives provided by the authorities, in order to become a leader in green airport development of China. KM Airport should expand on its well established shorter-term green development plans and chart its own pathway to meet longer-term carbon targets. KM Airport can engage external expertise to complement in-house expertise and set up the science based long term targets that tackle Scope 1, 2 and 3 emissions with respect to airports, and identify potential decarbonization pathways that are relevant to Kunming's context, accompanied by enablers in the areas of governance and culture, climate related risk management, review, reporting and audit and the communication and engagement with stakeholders. These findings and recommendations will form a Terms of Reference (TOR) to guide next step implementations. The project subcomponent 4.2 is designed as part of these efforts. More details can be found in the Annex 5. The Bank had extensive discussions with the senior management of YAG and got the high-level commitment in developing this roadmap with the support of the Bank, and eventually have it adopted in operations. Through the support from AIIB, KM Airport will be equipped with knowledge of best practice in the industry on international front to maintain its leading position in China, and fully realize its own potential to serve as a model to other airports.

19. **China's "Dual Carbon Goal".** In 2015, China set its nationally determined action objectives by 2030. By the end of 2019, it had delivered on its 2020 climate action targets ahead of schedule. In 2020, China announced the updated Nationally Determined Contribution (NDC), striving to reach peak CO_2 emissions before 2030 and achieve carbon neutrality before 2060. China adheres to the principle of overall planning and top-level design and spend coordinated efforts in achieving the dual carbon goals. For which a "1+N" policy framework has been put in place. "1" means the guidance and the top-level design which clearly articulate the schedules, road maps and working procedures for implementation of dual carbon plans. Whereas the "N" is the implementation schemes in key areas and sectors, such as energy, industry, urban and rural development, transport, agriculture and rural areas. Meanwhile, all provinces have also had their implementation schemes for the dual carbon plans. As a result, a full-fledged policy system for

achieving the dual carbon goals has been established to ensure the goal has been incorporated into the overall plans of national economic and social development.

20. To accelerate the shift toward a green and Low-Carbon development pattern, China is focusing all its efforts on the following fronts: (i) rapid development of non-fossil fuel energies; around 45 percent of China's annual CO_2 emissions are from power generation and heating. During 2011 and 2022, China has increased 220GW of wind solar installed capacity and it is planned that, by 2025 the percentage of renewable installation in China will climb to 35 percent from 10 percent in 2022; (ii) decarbonization and technology reformation in the energy consumption, particularly in industry, urban and rural development, transport and agriculture sectors. About 40 percent of China's CO_2 emission come from industry sector and 10 percent from transportation sector. There is strong push to increase the usage of green electricity and green hydrogen in the production process, widening the use of green electricity, green hydrogen, geothermal and other Low-Carbon emission technology in transportation and building operations; (iii) further development of the consolidated and enhanced Ecosystem Carbon Sink capacity and performance; and (iv) establishment of an efficient and effective system of policies and regulations to support the national carbon trading market.

21. **Aviation Decarbonization.** Civil aviation represents a small share of the global CO_2 emissions, accounting for around two to three percent of the global total. China's aviation emission accounts for only 0.6 percent of the total national emissions. Within aviation, Intergovernmental Panel on Climate Change (IPCC) estimates that airport emissions account for less than five percent of total aviation emissions, and majority of remaining emissions come from the airlines. According to industry experts, improvement in conventional aircraft design and operation can only mitigate around 20 percent of the emissions by 2050. Therefore, the industry will have to rely on the undeveloped solutions, such as the commercial production and application of Sustainable Aviation Fuel (SAF) and the breakthrough in hydrogen aircraft. Airlines emission can be divided into domestic emission (around 33 percent globally) and international emissions (around 67 percent globally). Domestic aviation emissions are the responsibility of the respective nations, while ICAO are responsible for the reducing of international aviation emissions. China's international emission is around 27 percent, which is much lower than the international average.

22. China is in active discussion with ICAO in developing the reasonable mechanism to deal with the international emissions. China has been providing the international emission data to ICAO as requested and will fully participate Carbon Offsetting and Reduction Scheme for the International Aviation (CORSIA) by 2027. The domestic emissions have been taken into consideration in China's Dual Carbon Goal roadmap. The average age of China's aircraft fleets is relatively young (between five to six years in average), compared to the fleet of major airlines in other countries (e.g. 11 to 12 years in Europe and 14 years above in North American). Younger fleets perform with higher efficiency and less emissions. As aforementioned, the decarbonization of the aviation industry will have to largely be reliant on SAF. SAF is estimated to contribute to a range of 30 percent to 65 percent in the aviation decarbonization pathway in different scenarios. This is a new industry that the development requires significant investment and resources to build the entire value chain. The government's support in strategic planning, formulation of policies, market cultivation and industrial regulations is essential. It would be important for MDBs to closely

monitor and constructively engaged in this sector and if MDBs were to promote the decarbonization.

23. **Smart Runway Technology.** The Runway E2 and its taxiway to be supported under the project will introduce the smart runway concept and technology as an advanced application in China and worldwide. In order to collect and monitor the real-time operation performance of the runway and taxiway, the project will pre-embed sensors and equipment, such as intelligent settlement monitoring, vibrating fibers, sensing network of pavement structure state and load, surface wetness sensing. It will also use the metalogical monitoring network and the airport intrusion prevention system during the runway construction. The focus will be on the settlement, state of structures, state of the slippery, landing weight of the aircraft and birds intrusion. Through the application of Geographic Information System, Building Information Modeling and Hadoop technologies, the system will provide visualized runway operation information and monitoring data to enhance safety and efficiency of the airfield operation and maintenance. According to the feasibility study, through application of this technology in the runway infrastructure, its life-cycle cost is expected to be reduced by 20 percent and manual participation in daily inspection to be reduced by 35 percent to 50 percent.

24. **Strategic fit for AIIB.** The project is well aligned with the Bank's thematic priorities on Connectivity and Regional Cooperation, Green Infrastructure and Technology-Enabled Infrastructure. It also fits almost all priority areas listed in the Transport Sector Strategy, including: (i) Trunk linkages: the project is on the key node of the core aviation network connecting China to SA and SEA; (ii) Cross-Border Connectivity: the project is one of the ten designated international aviation hub of China; (iii) Transport Integration: a new GTC to be constructed to provide the seamless transport across different modes of aviation, metro, rail and road, the project is promoting the air-rail transport connection; (iv) Upgrading of existing infrastructure: the project is to support the expansion of the existing operational airport to improve the efficiency and service meeting the increasing traffic demand.

25. **Paris Alignment (PA).** The PA analysis has followed a preliminary framework under consideration at AIIB, which itself follows the joint MDB methodology for PA which is still under development. China's Nationally Determined Contributions (NDC) does not rule out any airport projects. The project activities are consistent with goals of China's NDC which aim at reducing carbon emissions from the transportation sector, through optimizing efficiency of the transportation network (including civil aviation), promoting clean fuel and implementing smart technologies to improve network operation while reducing carbon emissions intensity. The MEP (the Project) is consistent with the China's Long-term Strategy (LTS) or other similar long-term national economy-wide, sectoral, or regional low-GHG strategies. Neither China's LTS nor the transportation sector long-term strategy has any policy indicating measures of restricting growth of demand to achieve the decarbonization. Instead, these policies encourage, through structure reforming, technical innovation and overarching coordination, to improve transport efficiency and meet country's continuously growing demand in transportation and support the social and economy development.

26. China is in active discussion with ICAO in developing the reasonable mechanism of CORSIA. The China Certified Emissions Reductions (CCER) has been approved by the ICAO Council as one of eligible Emissions Unit Programs to supply to CORSIA. China has been providing the international emission data to ICAO as requested and will fully participate CORSIA by 2027. Separately, China has submitted its first National Action Plan to ICAO in Oct. 2012, as one of the earliest members, and subsequently update it every three years. The latest National Action Plan was submitted in Nov. 2022. The Project is consistent with global aviation sector decarbonization pathways.

27. The PA assessment has reviewed the direct airport operations associated with Scope 1 and 2 emissions, as well as the Scope 3 emissions, including the passenger accessing, utilization of the SAF and the potential for displacement of economically viable lower carbon alternatives, such as highspeed railway (HSR). The Project activities demonstrate low risk of carbon lock-in and do not prevent future development of more Paris-aligned activities.

28. The Project is assessed as economically viable, after taking into account the increased emission as economic cost. A Cost Benefit Analysis (CBA) model has been formulated and the emission impact has included Scope 1, Scope 2 and aircraft movement emissions[3]. The analysis suggested that throughout the project review cycle (2023-2049), total additional Scope 1 and 2 carbon emissions brought by the Project are estimated at 1.03 million tons, the impact on the Economic Internal Rate of Return (EIRR) is negligible. The total additional carbon emissions from the aircraft movement are about 37.30 million tons. It would reduce EIRR by only 0.09 percent point, which is minor given baseline EIRR is 16.53 percent. The Project is assessed as aligned with Mitigation Goals of the Paris Agreement.

29. **Climate Change Assessment and Adaptations**. The screening of the climate change risk has been carried out through the Aware tool with the support from Climate Team of Strategy, Policy and Budget Department. The project's Climate Change Risk is rated medium by the tool. Flood has been identified as the relatively most significant climate risk in the project location, followed by precipitation increase, wind speed decrease, temperature increase. The risk of flood and increased precipitation will be significantly mitigated by the high terrain of the project location and comprehensive drainage system. The smart runway component will effectively enhance the monitoring and warning of the potential risk of climate change. Wind speed risk has been mitigated through the design of the runway layout of the airport. Installation of the class I Instrumental Landing System (ILS) system to the Runway E2 will increase the adaptation of the approaching aircrafts in low visible conditions. All activities under the project are not inconsistent with China's national policies and strategies, or sector or provincial priorities for climate adaptation and resilience. The Infratech application, enhanced monitoring and whole life cycle concepts promoted by the China's National Strategy for Climate Change Adaptation 2035 have been duly considered and integrated into this project. The project is assessed as aligned with Adaptation Goals of the Paris agreement.

[3] Scope 1: emissions from airport-owned or controlled resources; Scope 2: indirect emissions from the consumption of purchased energy by the airport operator. Aircraft movement emissions are emissions released from passenger/freight flights, including emissions from flying per route, landing and taxiing at the Airport, which is much broader scope against Airports Council International (ACI) Scope 3 - indirect emissions from other sources related to the activities of an airport. For more details, please refer to Annex 4 Paris Alignment Assessment.

30. **Value Addition by AIIB.** It is YAG's first MDB financed project. The Bank's participation contributes to promoting the international standards and practices in project preparation and implementation, especially in green airport development, procurement, noise management and environmental and social (ES) standards. In addition, through hiring a senior aviation consultant, AIIB's participation has enhanced the quality of project technical design, including the traffic estimation and alternative options of airport layout. In addition, the Bank has engaged the Changi Team to review and assess the green airport status of KM Airport. With the engagement of Changi Team, the Bank has successfully facilitated transferring of international knowledge, experience and practice of a top tier green airport operator from one AIIB member to another. Based on the result of the assessment, the proposed Plan is expected to address the existing gaps in the YAG's green development, particularly to enhance its managerial and soft capacity. The Plan is not only a report but will guide the Implementing Agency in its green development endeavor. The Plan is expected to include long-term and science-based targets that tackle Scope 1, 2 and 3 emissions of an airport, identify the key decarbonization pathways and create enablers to complement and support decarbonization pathways. Furthermore, the Bank will also enhance the noise management of the project among other ES aspects through financing the provision and installation of the automatic noise monitoring devices.

31. **Value Addition to AIIB.** The project would be one of the Bank's very first investments in the airport sector covering almost all essential infrastructure of the airport. It also provides reasonable space and opportunity for the Bank's involvement and influence in the design and support the development of a green airport. The project will build the Bank's knowledge and capacity in the civil aviation sector. It is also the first airport project of Bank that developed a CBA in the economic viability assessment. Through this project, Bank has been actively engaged in dialogues with the regulatory agencies in China. One of the imminent actions under discussion is to collaborate with the China Academy of Civil Aviation Science and Technology and Energy Foundation to jointly organize an International Forum on Green and Low-Carbon Development of Civil Aviation Industry (the Forum). The Forum is planned to comprise four thematic sessions, including Green Airport Development, Low-Carbon Development of Airlines, Fuel Transition and Technology Innovations. The Forum will invite the speakers and panelists worldwide, including relevant government agencies, manufacturers, airline companies, airport operators, International Financial Institutions (IFIs), think tanks and non-governmental organizations. The Bank is expected to undertake a leading role in the Green Airport Development Theme Session. These activities will contribute to forming our institutional capacity in the aviation sector and demonstrate our influence in promoting the green development of this industry.

32. **Lessons learned.** There are two airport projects Bank has been involved: Türkiye Antalya Airport Project (Non-sovereign-backed Financing) - approved by Board of Directors in Jan. 2023 and the Thailand U-Tapao Airport Expansion Project (Sovereign-backed Financing (SBF)) – appraisal stage. Besides that, China Jiangxi Shangrao Sanqingshan Airport Project (2013-2018) financed by World Bank (WB) has also been reviewed. The lessons learned have been summarized as follows: (i) aviation is growing sector with huge demand in the infrastructure development in the region, while the whole sector is facing challenges in decarbonization; (ii) there are various participators involved in the aviation sector, airport and its operator usually have limited influence on others; (iii) however, it does not mean that there is not much we can do. Within

the airport responsibility scope, there is still reasonable room to further improvement in achieving the green and decarbonization goals; (iv) overall, the decarbonization of aviation brings genuine challenges. As such, government's support in strategic planning, formulation of policies, market cultivation and industrial regulations would be helpful to address the challenges faced by stakeholders in the industry. Given aviation's strong feature as global public good in the connected world, it is important for MDBs like AIIB to participate in this sector (through investment in related infrastructure such as airports) and endeavor to promote the decarbonization of the industry. With lessons above, the Bank has reviewed the KM Airport green development status as part of the assessment and included the Plan and other capacity building support in the design of the project in addressing the existing gaps.

C. Components

33. The project comprises four components:

34. Component 1: Construction of Airside Infrastructure in the Eastern Part of the Airport, including, construction of Runway E2 and its linked taxiway system; cargo aprons (16 stands) in the Eastern part; Air Traffic Control (ATC) and navigation system, Instrument landing system (ILS), navigational lighting and its power supply system, drainage system and firefighter station. It will also include the Smart Runway, installing sensors in the pavement and subbase of Runway E2 and its monitoring system.

35. Component 2: Construction of aprons and related lighting system around T2. Specifically, the construction of aprons (78 stands) around the T2, including subbase treatment, civil works and pavement; the road and bridge in air side, including the construction of northeast underpass, northwest underpass, T2 East underpass and T2 West underpass; lighting, drainage, power supply and firefighter station in airside around T2.

36. Component 3: Provision of equipment. Electrified service vehicles in airside, including special service truck/buses, special vehicle for maintenance and special vehicle for field service. Installation of the charging piles, Aircraft Ground Air Conditioner (AC) system and 400Hz ground power units on the aprons. It will also include the automatic noise monitoring equipment and its installation.

37. Component 4: Technical Support and Capacity Building. There are two subcomponents: one is the project implementation support including environmental and noise monitoring and evaluation; social and resettlement monitoring and evaluation; and other required support to enhance the project implementation quality and efficiency. The other is institutional capacity building, including: (i) Implementing Agency's Green (Decarbonization) Development Plan with the clear target, roadmap and action plans to be adopted; (ii) enhancing Implementing Agency's capacity in reporting and disclosure of ESG, green and sustainability related information; (iii) capacity building to enhance the regional connectivity, for example, the aviation summit with SA and SEA countries, development of the road map in building the best transit international hub airport in the region.

D. Cost Estimates and Financing Plan

38. Based on the draft FSR, the total project cost is estimated at USD902 million. AIIB plans to provide a sovereign-backed loan of RMB3,450 million (approximately USD500 million equivalent). The remaining funding gap will be filled by the government counterpart fund mainly through equity and borrowing from local policy banks. The project cost estimation and the financing plan are shown in the Table 1 below.

Table 1. Project Cost and Financing Plan

Component	Project Cost (USD million)	AIIB (USD million and %)		Govt. (USD million and %)	
Component 1: Construction of Airside Infrastructure in the Eastern Part of the Airport	273.2	260	95.2%	13.1	4.8%
Component 2: Construction of Aprons and associated lighting system and facilities around Terminal 2	505.7	150.0	29.7%	355.7	70.3%
Component 3: Electrified service vehicles with charging piles, ground power unit and noise monitoring equipment	56.0	23.0	41.0%	33.0	59.0%
Component 4: Technical Support and Capacity Building	9.6	9.6	100.0%	0.0	0.0%
Component 1+2+3+4:	**844.4**	**442.6**	**52.4%**	**401.8**	**47.6%**
Fees and interest during constructions	57.4	57.4	100%	0.0	0.0%
Total Project Cost:	**901.8**	**500.0**	**55.4%**	**401.8**	**44.6%**

E. Implementation Arrangements

39. **Implementation Period.** The proposed project implementation period is five years, starting in Jul. 2023 and ending in Jul. 2028.

40. **Implementation Management**. Project Implementing Entity (PIE) will be Yunnan Provincial Government. YAG will be the Project Implementing Agency (PIA). Kunming Changshui Airport Co., Ltd. (KCA), a wholly owned subsidiary of YAG will be the Project Implementing Unit (PIU), who will own and operate project assets after the completion of the expansion. The PIE and PIA will sign the Project Agreement with AIIB. The PIA and PIU will sign the Subsidiary Agreement.

41. YAG was established in 2004 as the only platform responsible for the investing, owning, operating and maintaining the airport assets in Yunnan province. YAG is majority owned by the Yunnan Provincial State-owned Assets Supervision and Administration Commission (SASAC). As the PIA, YAG is responsible for the preparation and implementation of the project, including provision of counterpart funding, project design, ES instruments preparation and implementation, procurement, financial management (FM) and contract management. Dianzhong New Area Management Committee (DNAMC), a local government where the project is located, is assigned by Yunnan Provincial Government to implement the project land acquisition and resettlement activities and potential noise mitigation measures.

42. **Project Implementation Office (PIO)** has been established in YAG with a dedicated professional team. PIO is responsible for the day-to-day preparation and implementation of the project and as the major window to communicate with the Bank. PIO coordinates with the relevant resources and divisions in YAG to manage the technical design (both physical and soft components), procurement, contract management, FM, reporting, preparation and implementation of the ES instruments of the project. The PIO is headed by the Vice President of YAG and consists of the heads and qualified experts from following divisions of YAG, namely: Engineering/Construction division, Procurement division, Environmental and Land division and Finance division. PIO is/will be supported by experienced outsourced consultants on assignment basis in the preparation and implementation.

43. The **Project Steering Committee (PSC)** for the MEP KM Airport has been established under the Yunnan Provincial Government, headed by a Vice Governor of Yunnan province. The PSC comprises representatives from relevant government agencies and institutions. The PSC provides high-level guidance and oversight to the entire MEP implementation, specifically around policy and strategy instructions, cross-sector communication and coordination, consultation and resolution of critical issues to ensure smooth implementation and successful completion of the MEP. The PSC also provides guidance and high-level coordination for the project. The organization chart for project implementation is shown below.

Chart 1. Organization Chart for Project Implementation

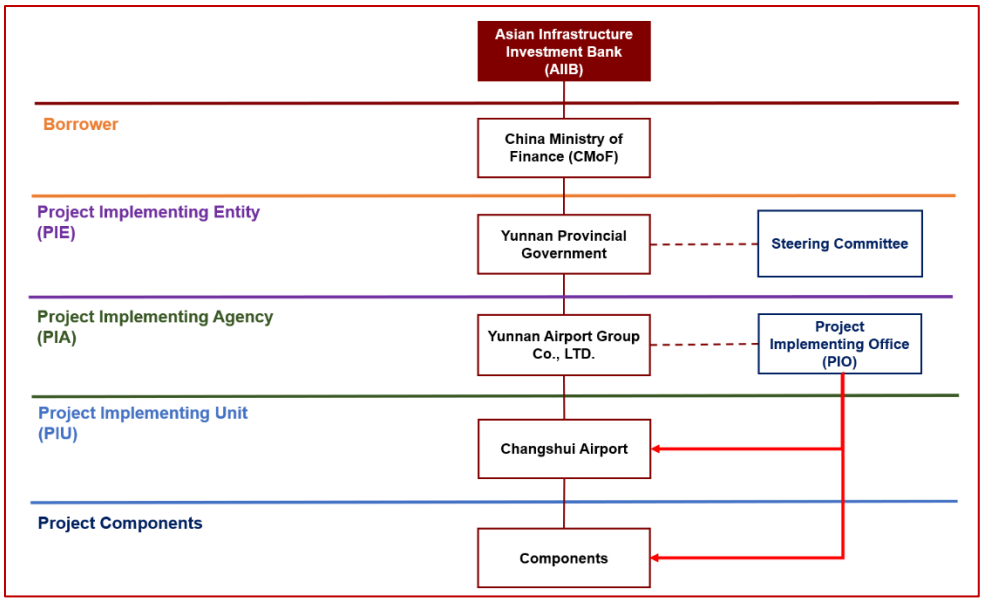


Table 2. Project Implementation Arrangement

Party / Entity	Responsibility
PIE (Yunnan Provincial Government). PIE will sign the Project Agreement with AIIB.	
○ PSC	• The PSC for the MEP KM Airport is established under the Yunnan Provincial Government, headed by a Vice Governor of Yunnan province. The PSC comprises representatives from the relevant government agencies and institutions. • The PSC provides high-level guidance and oversight to the entire MEP implementation, including the AIIB project, specifically in policy and strategy instructions, cross-sector communication and coordination, consultation and resolution of critical issues in order to ensure the smooth implementation and successful completion of the MEP.
PIA (YAG). PIA will also sign the Project Agreement with AIIB. YAG is majority owned by Yunnan Provincial SASAC.PIA owns and operates 18 airports in Yunnan province including KM Airport. The PIA takes full responsibility for the preparation and implementation of the project, including provision of counterpart fund, project design, ES instruments preparation and implementation, procurement, FM and contract management.	
○ PIO	• PIO is established in the PIA and consists of a dedicated professional team, headed by the Vice President of PIA and consisting of the heads and qualified experts from following divisions of PIA: Engineering/Construction, Procurement, Environmental and Land and Finance. PIO is/will be supported by experienced outsourced consultants on assignment basis in the preparation and implementation. • PIO is responsible for the day-to-day preparation and implementation of the project and the primary Project contact of the Bank. • PIO coordinates with the relevant resources and divisions in PIA to manage the technical design (both physical and soft components), procurement, contract management, FM, reporting, and preparation and implementation of the ES instruments of the project.
PIU (KCA). PIU will sign a Subsidiary Agreement with PIA. KCA is a wholly owned subsidiary of PIA. PIU will own and operate project assets after the completion of the expansion. Although PIA takes full responsibility for overall decision-making and implementation management, the contracts under the project will be signed by PIU, payment will be made from the bank account of PIU, invoices will be issued to PIU and disbursement will be processed under the name of PIU.	

44. **Procurement.** Procurement of goods, works and services contracts financed wholly or in part by the Bank loan shall be carried out in accordance with AIIB's Procurement Policy (Jan. 2016, updated from time to time) as well as the Interim Operational Directive on Procurement Instructions for Recipients (Jun. 2, 2016, updated from time to time) (PIR). Given that the PIA and the PIU are public entities as defined per AIIB Procurement Policy, the specific procurement provisions under Section II Procurement of Goods, Works and Services by Public Entities under PIR shall apply to procurement of the project.

45. YAG/PIO is responsible for the procurement and contract management of the project. PIO, established as a permanent existing project execution unit of YAG which is dedicated to project implementation, has sufficient technical and managerial capacity to conduct procurement and contract management of the project, starting from procurement planning, preparation of tender documents, conducting tender evaluations, managing the contract variations, etc. as per the local procurement laws and regulations. The procurement staff of PIO through training sessions have got familiarized with AIIB Procurement Policy requirements. In addition, a procurement agent having experience with MDB financed projects, has been appointed to assist PIO with the procurement process, including providing professional guidance and interpretation on AIIB Procurement Policy, helping PIO prepare tender documents, tender evaluation reports. Project Delivery Strategy (PDS) and Procurement Plan (PP) have been developed by the PIO and have been reviewed and accepted by the Bank at the appraisal stage. The PDS and PP, which will be updated regularly or when/as needed for Bank's review and no objection during project implementation, shall be the basis for PIO to carry out project procurement. In the PDS and PP, contract packaging, cost estimates, procurement method and Bank's review method, as well as specific procurement timelines have been set out.

46. In principle, International Open Competitive Tendering/Selection (IOCT/IOCS) will be the preferred approach. With this approach, the AIIB's currently available Standard Procurement Documents (SPDs) for goods, works and consulting services will be used when the cost estimates of works, goods and consulting services are higher than USD40 million, USD10 million, USD500,000 respectively, unless otherwise sufficiently justified in the PDS as per the relevant AIIB PIR provisions and procurement guidance notes. Procurement of any consulting services contract with a value larger than USD500,000 shall be carried out through IOCS applying Quality and Cost Based Selection procedures and using the AIIB's SPD - Request for Proposals Consulting Services. When AIIB SPDs are not available or unsuitable for a contract which is of peculiar nature or requires special procurement procedural arrangement to meet the procurement objective of the project, such as prequalification, two envelopes, rated criteria/combined scoring method which are proposed to be used for goods and works contracts, the relevant standard bidding documents of other MDBs subject to proper modifications to reflect AIIB special policy requirements may be used. National Competitive Tendering method could be applied in some cases in this project whereby local tendering documents may be used, such as the China Model Bidding Documents respectively for procurement of goods and works under national competitive tendering method which have been accepted by other MDBs and promulgated by China Ministry of Finance (MOF) for use in projects finance by MDBs in China, provided that AIIB special policy provisions will be incorporated into those tendering documents. Retroactive financing will be allowed, subject to the limit of 20 percent of the total amount of the loan and for eligible

expenditure incurred and paid not earlier than 12 months prior to the expected signing date of the loan. Any project activities that are considered for retroactive financing will have to be implemented in accordance with the Bank's Procurement Policy and its Social and Environmental Policies and requirements. According to the envisaged progress of the project and processing timeline, procurement of some works and consulting services might start before the expected loan signing date.

47. According to the local government laws and regulations, the procurement of works and goods will be conducted through local Public Resources Trading Centers while complying with AIIB's procurement requirements. Based on the assessment, the national procurement laws, regulations and rules, public procurement procedures are materially consistent with the Core Procurement Principles of the AIIB's Procurement Policy, except for a few deviations from IOCT method which have been identified and will be rectified in the procurement process.

48. Before starting any procurement, the PIO will prepare the project General Procurement Notice (GPN) as per AIIB's GPN template and submit the GPN to AIIB for review. Subsequently, the GPN will be published in a media of national circulation in China. In the meantime, AIIB will assist with GPN publications on the websites of AIIB and United Nations Development Business.

49. During the implementation, the Bank team will carry out procurement oversight of all contracts to be funded by the AIIB loan through procurement prior review for large value and complex contracts, and post review for all other contracts on a regular basis. The PIO will establish a document record management system to keep all procurement related documents in its office for AIIB's future post review as well as audit by the government agencies.

50. **FM** of the project will follow YAG's prevailing FM practice. Project financial statements will be prepared on an accrual basis, in a timely manner to reflect sources and usage of project implementation status. The interim unaudited project financial statements will be submitted to the Bank as part of the progress report on semi-annual basis. Project audit will be conducted annually by the Yunnan Provincial Audit Office authorized by China National Audit Office, and such audit report will be submitted to the Bank within six months after the end of each year. In addition to issuing an opinion on financial statements, the auditors also review the internal control system and compliance matters to identify any significant issues. These will ensure the proper usage of project funds.

3. Project Assessment

A. Technical

51. The FSR for the entire MEP was cleared by the CAAC and approved by NDRC in Sep. 2022. The Bank had conducted technical review of the FSR and had extensive discussions and exchanges with the YAG's technical team as well as the design institutes during the FSR preparation. Overall, the FSR has been prepared in good quality and assessed as acceptable to the Bank. After the approval of FSR, the review process of preliminary design has commenced. The preliminary design of the airside infrastructure was approved in Apr. 2023. The Bank has reviewed the preliminary design with focus on AIIB project scope. The following paragraphs have

summarized the key assessment, items to be finalized or further refined in the engineering design stage.

52. The Bank has carried out an overall review of the entire MEP, the proposed technical solutions have been assessed as practicable and acceptable. The proposed layout and the design scope in the FSR have been assessed as suitable technical solution. The proposed four parallel runways (two Eastern runways + two Western runways + one more western runway in future) and central terminals layout have been assessed as suitable solutions in order to meet the long-term targeted demand. The proposed investment scope (two runways, aprons, T2, cargo terminal, maintenance area, GTC and working areas, etc.) presented in the FSR is assessed as aligned with the MEP's projected targeted demand in medium-term future.

53. The alternative design options of the round taxiway system in the northern end of eastern runways need to be further analyzed and finalized in the engineering design stage. The installation plan for navigation lighting system (the Class I ILS system) at the northern end of the Runway E2 is yet to be confirmed. It will be finalized together with the final design of northern-end round taxiway system. The current proposed design of elevated lights can be implemented within the existing airport land range.

54. Further optimization is needed for location of the speed exit to the taxiway on the west side of Runway E2. The positions (entry points) of the three speed exits are 1,700 meters, 2,100 meters, and 2,500 meters respectively away from the runway entrance. As KM Airport is at altitude of over 2,100 meters, the distance between first speed exit and the runway entrance is assessed as too short and may be not easier for pilots to use. According to the information from Kunming ATC, the existing speed exits at 1,760 meters and 1,900 meters away from the runway entrance are most frequently used. Considering KM Airport is a plateau airport, the position of the first fast exit would need to be further considered, not less than 1,760 meters away from the runway entrance could be a reasonable option.

55. According to the technical specification requirement of the airside operational protection field, and the gliding platform protection field (in eastern side), the layout of the taxiway centerline and its parallel runway centerline could be further optimized. It will link to optimization and finalization of the layout of cargo apron in the southeast end.

56. Long-life concrete pavement structure of runways and aprons has been proposed in the FSR and is being further considered and refined in designs. It is a pilot technology aiming to improve the durability and resilience of the pavement throughout its entire life cycle by increasing the pavement surface layer thickness to strengthen the bearing capacity of the surface. The technology will enhance the pavement's adaptation to the climate changes and reduce the maintenance and repairing cycle of pavement. It involves the comprehensive improvement and specific requirement in both design and construction phases, such as the design life of the pavement, the performance quality of building materials, the construction technology, the adaptation to the adverse climate change risk impact and the ability to resist fatigue damage. As a pilot technical solution proposed to be applied in KM Airport expansion, the detailed technical solutions, such as using dowel bars for all the joints and the thickness of the enhanced pavement

could be further optimized before engineering design with the consideration of cost efficiency and the implementation timeline.

57. **Smart Runway.** Using intelligent monitoring of the foundation settlement of runway and taxiway, in addition to the displacement and deformation of the airport high fill slope, the system will provide basic data for construction control and dynamic design, as well as providing real time data for maintenance decision-making during the operation period. The runway structure sensing module is to carry out real-time monitoring of the runway structure characters by embedding strain gauge, thermometer, accelerometer, vibrating optical fiber and earth pressure box. The evaluation of pavement surface wetness and slipperiness state is mainly based on the monitoring of water film thickness on the surface using the water level sensor.

58. **Green Airport.** Besides of the physical green components, such as increasing the number of electrified service vehicles in airfield area, Light Emitting Diode (LED) lighting system for both runways and aprons, the installation of automatic noise monitoring equipment surrounded the airport, aircraft ground AC system and 400Hz ground power units, the project will support two essential soft components around KM Airport green development. The sub-component 4.2 (i) is designed to support KM Airport to develop the Plan to guide its decarbonization pathway with baseline, targets, action items, reporting and clear timeline. The Plan will be developed based on the current self-studies of KM Airport, the assessment and recommendations from Changi Team, and inclusion of other international good practice. The Bank will support KM Airport in the process to ensure the quality of the TOR and that final results will be adopted. The development and implementation of this Plan has been included in the project's monitoring framework. The sub-component 4.2 (ii) is designed to enhance the capacity of YAG in its reporting and information disclosure with the focus on the green development, sustainability and social responsibilities.

59. **Climate Change Adaptation**. The Climate Change Risk is rated as medium by the Aware tool. Flood has been identified as the major concern in the project location. The FSR has also carried out comprehensive climate risk analysis as an integrated part of the project design. The flooding risk has been significantly mitigated by the topography of the project location which is on a high ground at an average altitude of 2,100 meters, higher than the vicinity around the airport. Comprehensive drainage system and structures have been integrated into the design to further enhance the project's adaptation to flood. Low visibility coursed by extreme weather situations, such as heavy rain and frog is another climate risk, which will directly affect the movement of the aircraft, particularly to landing. There are about five percent low visibility weather in the project location every year, the project will equip class I ILS to the Runway E2 to increase the adaptation of the approach flights in such low visible weather. The project is located in the plateau area, where ultraviolet light is strong. The smart runway system will effectively enhance the monitoring and warning of the potential risk of climate change. Ultraviolet light will accelerate the aging of organic macromolecular materials and reduce their service life. The design has taken these into consideration and will reduce the usage (or percentage) of easy aging materials such as asphalt and rubber in the construction of runways. According to the Environmental and Social Impact Assessment (ESIA), the extreme heatwaves and increase of annual and maximum temperature will increase the risk of wildfires in the area. The project will construct dedicated firefighter stations on airside for Runway E2 and aprons around T2.

60. **Climate Financing.** According to the breakdown of the project cost estimation, the climate financing amount for mitigation is estimated at around USD72.5 million, accounting for eight percent of the total project cost. It includes provision of electrified service vehicles, aircraft ground AC system and 400Hz ground power units, installation of charging piles, LED lighting and the green airport capacity building. The climate financing amount for adaptation is estimated at around USD112.6 million, accounting for 12 percent of the total project cost. It consists of comprehensive drainage system around Runway E2 and aprons, smart runway, Instrumental Landing System and firefighter stations on airside.

B. Economic and Financial Analysis

61. **Economic Analysis** has assessed the economic viability of the investment under the entire MEP (the Project). A standard CBA for the Project was conducted by comparing with- and without-project scenarios. The analysis assumed seven years of construction during 2023 to 2029, and 20 years of operations from 2030 to 2049. Without-project scenario assumed Airport continues to operate at its current full capacity, and some passengers and freight must take HSR to reach Kunming. With-project scenario considered the benefits associated with expanded airport capacity, with some passengers diverted from HSR in without-project scenario. Benefits calculations relied on traffic projections of passengers/freight through the Airport, which were obtained from FSR then reviewed and adjusted by the Bank.

62. Economic benefits include passenger/freight time savings, foreign tourist income, induced benefits, reduced reefer loss, cost savings and carbon emissions. Note that cost savings and carbon emissions are expressed in negative terms in benefits calculation, reflecting higher air transport cost and more carbon emissions in with-project scenario. Meanwhile, economic costs considered capex and maintenance costs have been adjusted by the Bank. Baseline EIRR was estimated at 16.53 percent, which is within normal range of similar airport expansion projects and above the government threshold of eight percent. EIRR remained robust under extreme circumstances in a sensitivity analysis, with the lowest 12.28 percent when costs are up by 15 percent and traffic projections down by 15 percent. Detailed economic analysis is presented in the *Annex 3: Economic and Financial Analysis*.

63. **Carbon Emission** Expansion of airport capacity will introduce more passenger/freight flows in/out the airport, resulting in higher carbon emissions coming from flights and airport operations itself. However, emissions from aviation industry as share of total global emissions have been very small, around two to three percent. Marginal emissions from a single airport expansion would be minor. According to the economic analysis, the Project will directly and indirectly bring roughly 38.33 million tons of additional carbon emissions over the analysis period (from 2023 to 2049, covering construction and operations), compared to without-project scenario. Most of the incremental emissions come from passenger flights, about 34.10 million tons. Freight flights account for 3.21 million tons of additional emissions, while airport operations will only release 1.03 million ton over the same period as the Project aims to reduce Scope 1 and 2 emissions by various energy-saving measures and action plans. Besides, negative impact from additional carbon emissions has been counted in the economic cost. Overall, the carbon impact

is minor compared to benefits from time savings and foreign tourist income, so it does not affect the economic viability significantly.

64. **Financial Analysis.** Airport revenue can be divided into aeronautical revenue, including the landing fee, aircraft parking fee, passenger service fee and security fee, and non-aeronautical revenue, including terminal facilities rental fee, ground service revenue, freight service fee, franchise fee, parking revenue and other revenues. Based on the current estimation, the Project will continue to generate positive operating cash flows in next 27 years, covering both construction and operations period, which means the revenue could cover the operation and maintenance cost and ensure the sustainability of the assets the Project invested. However, once taking capex and depreciation into consideration, the Project Financial internal rate of return (FIRR) is 0.22 percent. Net present value (NPV) is estimated at USD-4.02 billion (RMB-27.77 billion). The result shows that this Project is not commercially viable and therefore suitable for applying public support, including the Bank's SBF support.

65. **Counterpart Funding**. Due to the strategic importance of KM Airport in the national transportation network and its strong public goods feature, YAG has received strong support from both central and local government as well as policy banks for the entire expansion. The cost estimate for the MEP is RMB64 billion, AIIB project cost accounts for nearly 10 percent of the entire expansion program. 55 percent of the total expansion cost will be financed by equity, and 45 percent by debt. Within the equity, five percent comes from NDRC central government's budget, around 13 percent from the CAAC's aviation development fund, around 18 percent from Yunnan provincial fiscal budget, 13 percent from Kunming municipal fiscal budget, and the remaining seven percent from YAG. The total debt for expansion is around RMB29 billion. Apart from AIIB's loan, the other funds come from policy banks and commercial banks, including China Development Bank, China Exim Bank, Bank of China, Industrial and Commercial Bank of China, Agriculture Bank of China, China Construction Bank and Minsheng Bank. The tenors are 40 years, and the interest rate is lower than the market average.

66. **Financial Analysis of YAG**. Airport is a heavy-asset and labor-intense business. Before the expansion, the 2021 full year audit report suggested that the total assets of YAG was USD8.4 billion, with a debt ratio of around 24 percent. Total revenue was USD520 million and operating cashflow was around USD34 million. Non-aeronautical businesses such as aviation ground services and logistics, contributed more than fifty percent in YAG. Both revenue and operating cashflow were hit by the COIVD pandemic and experienced a sharp drop compared to 2019 (revenue: USD690 million and net operating cash flow: USD194 million respectively). YAG generates positive operation cash flow which can easily support the operation and maintenance cost. The net profit presented as negative is mainly because of the depreciation and amortizations, which account for around 30 percent of the total cost of YAG. With implementation of the expansion, the debt ratio is expected to rise to around 60 percent and the stress is expected after 2032 when the majority of the commercial debt will start principal payment. Besides of the stable positive operating cash flows, YAG has good access to the funding market, and the total amount of unused bank facilities in 2021 was around RMB80 billion. Considering the continuous growth of the economy and aviation market, the strategic importance of the KM Airport to the

transport network, and the government's willingness to provide support as needed, the financial risk of YAG is assessed as low.

C. Institutional Capacity Assessment, Fiduciary and Governance

67. **Institutional Capacity Assessment.** The Bank has carried out assessment on the PIA's professional knowledge and capability for project preparation and implementation during appraisal. The results are summarized as follows: (i) in general, the PIA have good experience, enough capacity and technical knowhow in investment, construction and operation of airport project under the national context; (ii) the PIA does not have experience in managing similar projects funded by MDBs and is not familiar with MDB's policies, standards and requirements; (iii) the PIA's capacity would be further enhanced by engaging qualified and experienced individual consultants or consulting firms to complement its in-house expertise, particularly in procurement, the green airport development and ES aspects; and (iv) the guidance and support from Bank are essential during the project preparation and implementation.

68. **Procurement.** A procurement risk and capacity assessment of the project and the PIA/PIO was conducted during the appraisal mission. All procurement and contract management staff of PIO have experience with public procurement funded by the government. They are also familiar with local public procurement laws and regulations and have empirical knowledge and practices with implementing government funded projects. Given the local procurement laws and regulations are assessed to be substantially consistent with the AIIB core procurement principles and the Bank team is satisfied with the current organizational setup, qualification and competency of the procurement staffing, it could be determined that PIO procurement staff could be able to carry out the procurement of the project as per AIIB Procurement Policy successfully after sufficient training to those staff by the Bank team as well as timely guidance and support from the experienced procurement agent.

69. The procurement staff of PIO have received procurement training on the AIIB Procurement Policy during the appraisal mission. In addition, external professional procurement agent has been employed by PIO in preparation of PDS/PP and draft tender documents to ensure procurement compliance. Construction supervision agencies will also be employed by the PIO to carry out construction management supervision. The PIO also has employed competent technical consultants to carry out the detailed design of the project and prepare the technical input for the tender documents.

70. Based on the assessment of procurement risk and the capacity of the PIO, some procurement related risks have been identified, and corresponding mitigation measures have been put in place. The mitigation measures will help strengthen the procurement capacity of the PIO to ensure procurement compliance, thus, successful project implementation. The project procurement risk level was assessed as Medium. The major risks identified as well as mitigation measures are summarized in the below sub-section E. Risks and Mitigation Measures.

71. **FM.** The Bank's assessment concluded that the project could maintain FM system acceptable to the Bank to ensure bank loan proceeds be properly used with due efficiency and effectiveness.

72. Loan Agreement will be signed between AIIB and the Borrower, represented by China MOF. Loan proceeds will further on lend to Yunnan Provincial Government, through an on-lending agreement between MOF and the People's Government of Yunnan Province, and then an on-lending agreement between Yunnan Provincial Finance Department (YFD), representing the People's Government of Yunnan Province, and YAG, the final debtor. The project assets will be owned and operated by PIU, a wholly owned subsidiary of YAG. The contracts under the project will be signed by KCA, payment will be made from the bank account of KCA, invoices will be issued to KCA and disbursement will be processed under the name of KCA. Although YAG takes full responsibility for overall decision-making and implementation management, the contracts under the project will be signed by KCA, payment will be made from the bank account of KCA, invoices will be issued to KCA and disbursement will be processed under the name of KCA.

73. A dedicated financial team in the PIO has been formed to manage the daily FM and payment work. Through communication during the appraisal mission, it was noted most of the financial staff are familiar with airport construction and expansion, sound internal control and review procedures are in place. To address the weakness of lack of knowledge in IFIs financed operations, the Bank team provided basic FM and disbursement training on AIIB fiduciary requirement and procedures and will continue to provide more hands-on training throughout project preparation and into project startup stage. Additionally, a project FM manual detailing on procedures and requirements will be prepared by YAG and reviewed by YFD to standardize the FM and disbursement work.

74. A project management system integrating project budgeting, contract management, and financial accounting and reporting is currently adopted by PIO. Such system has been widely used in big infrastructure projects including the phase I of KM Airport construction since 2006 and proved as effective and efficient in contract management, accounting (accrual basis), financial reporting and auditing. As Bank's project will be part of the MEP, a sub project profile will be created in the system by PIO to properly reflect the sources and usage of project funds and generate report in the format required by the Bank.

75. **Disbursement.** The loan proceeds will be disbursed in accordance with AIIB's loan disbursement instructions. All disbursement methods will be provided to accommodate the needs of the proposed project, such as direct payment, advance, reimbursement, and special commitment. PIO of YAG on behalf of KCA will compile documents and prepare disbursement applications to be submitted to YFD. Following the prevailing practice in all IFI financed operations, the project Designated Account will be opened and managed by YFD, it will make disbursement to YAG, then to KCA and finally to contractors. The Bank team will closely monitor the disbursement and funds flow arrangement during implementation period to identify any bottlenecks in disbursement efficiency.

76. **Governance and Integrity**. AIIB is committed to preventing fraud and corruption in the projects it finances and will ensure strict compliance with AIIB's Policy on Prohibited Practices (2016). The Bank reserves the right to investigate, directly or indirectly through its agents, any alleged corrupt, fraudulent, collusive, coercive or obstructive practices, and misuse of resources

and theft or coercive practices relating to the project and to take necessary measures to prevent and redress any issues in a timely manner, as appropriate.

D. Environmental and Social

77. **ES Policy and Categorization**. The Bank's Environmental and Social Policy 2022 (ESP), including the Environmental and Social Standards (ESSs) and the Environmental and Social Exclusion List applies to this project. ESS 1 (Environmental and Social Assessment and Management) and ESS 2 (Land Acquisition and Involuntary Resettlement) will be triggered on account of the potential additional land requirements for the project and Associated Facilities. ESS 3 (Indigenous Peoples) will not be applicable to the project as the project affected area does not contain distinct social and cultural group(s) possessing the distinct characteristics as per ESS 3. The project has been assigned Category A, given the potential ES impacts and risks related to the large-scale construction and adverse noise impacts are expected to be substantial.

78. **Instruments**. The YAG prepared an Environmental Impact Assessment (EIA) and Social Stability Risk Assessment (SSRA) report in Chinese language in line with national legislation, which had been approved by Yunnan Government in Dec. 2022 and Jul. 2022 respectively. The SSRA concluded the Social Stability Risk for this overall project as "low risk".[4] An ESIA, Environmental and Social Management Plan (ESMP), and a Stakeholder Engagement Plan (SEP) have been prepared to address the gaps with respect to AIIB's ESP in assessment and mitigation of potential social impacts and risks. All project activities and identified Associated Facilities have been assessed according to the ESP. An Environmental and Social Audit Report (ESAR) for existing operations of KM Airport has been prepared and an ESAP has been agreed to address the mitigation measures in this regard. Similarly, for phase I stage of the existing KM Airport development, land audit/ due diligence is conducted in respect of the land acquisition. An Abbreviated Resettlement Plan (ARP) has been prepared to address the AIIB financed expansion project footprint land acquisition and resettlement (only three Householders (HHs) with 13 Affected Persons (APs)), while a Resettlement Planning Framework (RPF) is prepared for the project activities whose details are not yet fully identified or designs not yet finalized. This RPF also addresses the noise induced relocation aspects.

79. **Associated Facilities (AF)**. This is a large-scale project with several phases and components. The AF assessment is detailed in Annex 7, and based on AIIB's ESF and the outcome of Environmental and Social Due Diligence, T2 and a cargo terminal within the MEP of the airport have been identified as AF and included in relevant ES instruments for ES risk assessment, monitoring and management.

80. **Environmental Aspects**. The major environmental impacts related to air transportation are cumulative noise impact, solid waste (including hazardous waste) and wastewater. Integrated Biodiversity Assessment Tool screening indicates that three Protected Areas are found within a

[4] SSRA is prepared by Yunnan Zhonglu Engineering Survey and Design Co., LTD and approved by Yunnan provincial Political and Legal Commission. The index of the assessment includes eight primary indicators, namely policy planning and approval processes, land acquisition and compensation, technical and economic options, ecological and environmental impacts, project management, economic and social impacts, safety and health and the media dissemination, and 49 secondary indicators.

50 km radius of the project area, including the Dianchi Scenic Area at one kilometer from the project site. However, based on the fauna surveys and the bird monitoring data described in the ESIA, there is no indicative risk of significant migratory birds present, affecting the airport expansion or future operation. For the construction phase, the project will have conventional construction-related risks and impacts manifested through dust emissions, water contamination, noise, removal of construction debris, etc. All these impacts and identified gaps in mitigation measures will be managed through the implementation of ESMP and ESAP.

81. The project's main operational ES risk is related to noise impacts on the residential premises and sensitive receptors close to the airport. Baseline study indicates that the current noise levels are above the national and World Health Organization standards, while predictive study indicates that 79 villages (around 590 households) and 50 sensitive receptors (schools and hospitals) will be exposed to noise levels higher than the national standard in 2030. The estimated noise prevention and control costs involve RMB134.4 million. Therefore, the significance of the predicted impacts demands a proportional mitigation measure.

82. Mitigation measures based on a balanced approach will minimize the potential impacts on residents' health and represent an improvement in the current situation. YAG has committed to implementing an action plan with local authorities based on a Noise Management Framework (NMF) which applies ICAO's Balanced Approach to Aeronautical Noise Management. NMF includes several noise mitigation measures such as land use planning, noise monitoring, operational procedures for landing and take-off, and, as a primary measure, an extensive building insulation program (sound insulation windows) to achieve WHO recommendations (45dBA indoors for moderate sleeping condition quality when exposed to aircraft noise). In addition, based on national regulation, new constructions around the airport area will be limited and shall include noise insulation measures limiting the in-house exposure to operational aircraft noise. The Project Implementing Entity has agreed to ensure that after the Project's closing date, any plan required to be developed in accordance with the RPF or NMF shall continue to be developed, implemented and monitored until the actions under such plan have been completed.

83. **Climate Change Risks and Opportunities.** The project will improve air transport efficiency and the inclusion of Green Airport Elements as renewable vehicles, 400Hz ground power units and capacity building component in green airport roadmap, which are all expected to contribute to the green development. The ESIA includes a Climate Risk assessment addressing mitigation and/or adaptation features. Annex 4 further presents the climate change aspects.

84. **Social Aspects.** Key social risks associated with the project are related to the physical and/or economic displacements by land acquisition and house demolition, noise induced physical displacement.

85. **Land acquisition and resettlement.** The project construction covers a total permanent area of 468.56 hectare, among which 425.55 hectare is state owned land of the airport for which the land use approval has been obtained in 2015. 9.76 hectare of collective forest land is under acquisition. The Associated Facilities involve a total permanent area of 64.63 hectare, including 60.14 hectare of the airport's own land, and 4.49 hectare of collective land. The collective forest

land is free of any settlements. No residential houses will be required to be acquired or demolished for the project works footprint. Among 14.25 hectare land to be acquired, only 0.27 hectare is cultivated land, and most of the others are collective ecological forest land. It is estimated that the land use affects three HHs with 13 APs. This process of land taken in 2015 is reviewed for any outstanding legacy issues during the appraisal through land use due diligence. Land requirement process for the project and potential Associated Facilities is evaluated and appropriate mitigation measures primarily to restore and/or improve the livelihoods of Project-affected people (PAP) has been addressed through the ARP.

86. The ESIA identified legacy issues related to noise impacts that will be managed through the ESIA, NMF, and RPF, with an estimated budget of around RMB226 million, including mitigation measures for soundproof windows, noise monitoring systems, and the institutional arrangements necessary to address the mitigation actions related to resettlement of the affected people.

87. **Relocation induced by Noise impacts.** The increase of flights is expected to contribute to an increase in noise levels in affected communities. Following the assessment of baseline and projected noise assessment, mitigation measures to address adverse noise-related impacts are being developed. The noise relocation data will be finalized at the stage of the project operation through noise measurement. The NMF is prepared as part of the ESMP, and the measures related to relocation are described in the RPF.

88. **Ethnic minorities and application of ESS3.** Based on the consultations with Guandu District Ethnic and Religious Affairs as well as physical visits to the site surroundings by the Bank, it is assessed that population of ethnic minorities in project surrounding areas including Huaqing, Fuxing and Wusi community in Changshui district, and Changshui community in Dabanqiao district is 528 accounting for 6.28 percent of the total population of 8,407 (within the above referred areas). The main ethnic groups are Yi and Miao, Bai, and Hui and reside in scattered locations. The ethnic minority populations have moved to these districts over several decades, because of marriage or work. The project is mainly built in the urban areas, and as such no ethnic minority communities with collective attachments to the project areas are present and accordingly it is determined that ESS 3 is not triggered. As an abundant measure, culturally contextual and appropriate measures are to be followed in ongoing consultations as part of stakeholder engagement process, which are described in SEP. The Bank team provided a brief training and awareness session to the YAG on ESS 3 requirements and shared experiences to further emphasize on appropriately engaging with ethnic minorities in consultations, where necessary.

89. **Gender aspects.** China has issued relevant laws and policies to protect women's rights and interests, such as the Law of the People's Republic of China on the Protection of Women's Rights and Interests and the Provisions on the Labor Protection of Female Employees. YAG has standardized the Special Contract for the Protection of Rights and Interests of Female Employees, which guarantees the rights and interests of labor, personal and educational development of female employees. Measures for the prevention of Sexual Harassment in the construction and operation processes has been strengthened under ESMP. A Gender Action Plan (GAP) has been developed to ensure women’s engagement and development. It includes the following key

measures: (i) 10 percent of skilled and 20 percent unskilled jobs in project construction and operation intended for women; (ii) 30 percent participation by women in public consultation activities with local stakeholders; and (iii) 50 percent participation by women staff in YAG in the Bank-supported capacity-building program on the green airport development and sustainable information disclosure is defined as a key gender indicator under Results Monitoring Framework.

90. **Community, and Occupational Health and Safety (C&OHS), Labor and Employment Conditions.** The proximity of residential properties to the airport has also been examined for aviation safety and risks posed by potential plane crash to residents. The airport operations are compliant with ICAO requirements and national requirements; and to address future risks, as part of the ESAP, a Safety Protection Zone will be proposed to limit the further influx of residents and businesses within the designated area related to take-off and landing operations and to appropriately manage the land surrounding the airport to limit safety risks.

91. The ESIA has identified occupational health and safety (OHS) risks during the construction and Operation and Maintenance phases. Therefore, the OHS requirements will be included in the contractor's site-specific environmental management plans (EMPs). Similarly, issues related to the influx of labor and code of conduct have been addressed in the EMPs. The Implementing Agency and Implementing Unit will require that bidding documents include clauses on those requirements. They will also require that contractors comply with all applicable labor laws and regulations and adopt and enforce codes of conduct for all workers.

92. The ESMP includes measures related to labor and working conditions such as (i) reviewing the YAG supply chain policy to address labor and working condition issues, including the necessary representations and warranties with suppliers and contractors; (ii) reviewing whether YAG has rights to information regarding labor and working conditions in the supply chain, and (iii) reviewing whether YAG has appropriate contractual remedies to avoid / mitigate / address such risks in the project.

93. Concerning airport operation, gaps/actions have also been identified during the ES audit in OHS and labor management. Audit recommendations such as organizing trainings of labor protection (e.g., Sexual Harassment) and creating indicators related to OHS incident under Human Resource Key Performance Indicators were included in ESAP which will be implemented by YAG during the implementation stage. The majority of construction workers reside in rental properties in surrounding communities managed by contractors and dedicated community officers are tasked with migrant resident management.

94. **Institutional arrangement.** A Steering Committee in provincial level with relevant ES government departments, such as Land Resources Bureau, Ecological Environment Bureau is established, which is responsible for the coordination of the ES relevant activities. A social and resettlement focal point under PIO has also been assigned. YAG will take full responsibility for this project ES instrument preparation and implementation although the DNAMC is assigned by Yunnan provincial government to implement the project land acquisition and resettlement activities and potential noise mitigation measures. A commitment letter for the implementation of ES-related work has been signed between YAG and DNAMC. A monitoring mechanism (including

internal and external monitoring) will be set up as per the ESMP to ensure implementation of the relevant ES management plans.

95. **Stakeholder Engagement, Consultation, and Information Disclosure.** Engagement with concerned stakeholders, especially the PAPs is an essential part of the project preparation and implementation. During project preparation, consultations on ES impacts, e.g. land acquisition, noise impacts, community safety and gender issues were conducted in project areas of seven provinces through (i) questionnaire survey with 400 respondents in Huaqing, Changshui, Wuxi and Fuxing communities around the project areas; (ii) meetings with stakeholders, including YAG, DNAMC (including representatives from its Natural Resources Planning Bureau), Guandu District Ethnic and Religious Affairs Bureau, Guandu District Women Federation, etc.; (iii) field visit in the project areas and 14 focus group discussions conducted with around 200 participants, including low-income residents, farmers, women, ethnic minorities, village committee and government representatives. Further community participation plan during the project implementation stage is designed and included in SEP. A coordination/consultation mechanism for ES activities has been established between the Steering Committee/provincial government, YAG and the DNAMC.

96. The SEP provides detailed plan for this process which will also publicize the SEP and the Project-Affected People's Mechanism (PPM). Following ES instruments have been disclosed on the YAG and AIIB's website dated on Apr 10, 2023: (i) English version of ESIA, SEP, RP, RPF, ESAP and their Non-Technical Summaries (NTS) in Chinese; and (ii) national EIA (in Chinese sensitive information redacted) and its NTS in English.

97. **Project-level Grievance Redress Mechanism (GRM).** The existing public and employee complaints mechanisms is reviewed and based on that, a multi-tier project-level GRM, along with a separate mechanism to address workplace complaints and concerns, has been established in accordance with the requirements of AIIB's ESP. Communities and individuals who believe that they are adversely affected by the project will be able to submit complaints to the project-level GRM for their resolution. In addition to the above GRM for addressing complaints from the local community, a GRM will be established at the contractor level for addressing worker grievances. The GRM process and functioning is reviewed by the Bank during field missions and additional improvement measures have been put in place, such as provisions against retaliation and confidentiality. Locally appropriate public consultation and disclosure processes have been used to disseminate information of the GRM.

98. **Project-Affected People's Mechanism (PPM).** AIIB's PPM applies to this project. The PPM has been established by AIIB to provide an opportunity for an independent and impartial review of submissions from project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement the ESP in situations when their concerns cannot be addressed satisfactorily through the project-level GRM or the processes of AIIB's Management. Information on AIIB's PPM is available at: https://www.aiib.org/en/about-aiib/who-we-are/project-affected-peoples-mechanism/how-we-assist-you/index.html

99. **Monitoring and Supervision Arrangements.** The Bank will carry out field-based ES supervision during implementation. YAG/PIA will be responsible for overall coordination,

supervision, and monitoring of the project's compliance with ES matters. In accordance with ES Instruments (ESIA, ESMP, RPF, NMF, and SEP). PIA will submit regular ES monitoring reports to AIIB during project implementation based on agreed format. For the first year of construction stage of project, PIA shall submit quarterly reports, and based on the ES performance and in agreement with the Bank, semiannual reports will be submitted thereafter. Third-party ES monitoring and reporting will be conducted at least once every year during the project period. A third-party ES Audit will be conducted before the Project Close Date, and YAG will follow and implement the recommendations of the Audit and Project Completion Note, especially those related to the RPF and NMF.

E. Risks and Mitigation Measures

100. According to the appraisal assessment, the project has been given a "High" risk rating, mainly because it is a Category A project on account of ES risks. Risks have been identified and analyzed and the related mitigation measures have been proposed, as summarized in Table 3.

Table 3. Summary of Risks and Mitigating Measures

Risk Description	Assessment Ratings (High, Medium, Low)	Mitigation Measures
Technical Risk: 1. The MEP is a huge program involving three parts with the total cost of about USD 10 billion. These parts have different readiness and will be implemented in sequence. 2. The expansion will be implemented while maintaining the normal operation of the large scale of airport. This requires a high quality in the design, construction and work organizations. 3. Green Airport concept is still in a developing stage in China and YAG although has good practice in China but need the experience from the international practice.	Medium	1. It was designed to better use Bank's fund concentrating on Part 1 of the MEP, involving essential infrastructure of the airport in airfield area and could be operational and functional independently. 2. The PIA has engaged capable and experienced design institutes to carry out designs. Contractors will be selected through a well-designed procurement process to ensure the quality. Bank has engaged a senior technical consultant in civil aviation sector in the Bank team to closely monitor the implementation. 3. Changi Team has been engaged as the green airport consultant to support the Bank team in carrying out the assessment on the status of KM Airport, identifying the issues and proposing the recommendations. The assessment and conclusions will be converted into a TOR to develop the Green Airport Plan for the KM Airport funded under the Component.

Risk Description	Assessment Ratings (High, Medium, Low)	Mitigation Measures
Institutional Risk: The PIA has limited experience in MDB financed project.	Medium	The PIA and the key staff in the PIO have good capacity and experience in their respective expertise. The Bank will continue providing guidance and support during the project implementation. The Component 4.1 is designed to support project implementation through engaging external consultant as needed.
Procurement Risk: 1. Staff of PIA are not familiar with AIIB Procurement Policy and SPDs. 2. PIA may insist on using government procurement provisions that could be in conflict with AIIB procurement requirements. 3. PIA proposed the use of rated criteria/merit point system in the evaluation of tenders for goods and works contracts. Technical evaluation criteria may include subjective and unclear standards, which may lead to unfair evaluation results and complaints.	Medium	1. AIIB team will provide continuous procurement training, support and guidance to the PIO throughout the procurement and contract management process. 2. PIA has employed a professional procurement agent with MDB project experiences to support the procurement management. During project implementation, construction supervision consultants will also be employed to carry out contract management and construction supervision. 3. All high value or complex contracts will be subject to procurement prior review by AIIB. 4. The technical evaluation criteria shall be designed to be objective, specific, clear, sufficiently detailed and complete, reasonable and fair, and as quantifiable as possible. Two envelopes procedure will be used to avoid opening financial bids before completion of technical bid evaluation, as the early opening of financial bid may affect the technical evaluation and contract award result.
ES Risks: 1. PIA does not have existing capacity and experience in preparation and implementation of projects according to AIIB's ESP. 2. Communities have been expecting appropriation of land for elements of the airport expansion that are outside of the	High	1. PIA to retain an experienced ES consultant and staff to support assessment, mitigation and monitoring of ES risks and impacts. 2. AIIB will supervise the ES Instruments implementation.

Risk Description	Assessment Ratings (High, Medium, Low)	Mitigation Measures
project scope. Applicability of different mitigation measures may not be well understood by PAPs. 3. Relocation induced by Noise impacts may be implemented beyond the AIIB project period		3. Initiate inclusive stakeholder engagement with the appointment of the PIA's experts. A commitment to implement RPF including noise management framework is confirmed in the form of a commitment letter by the local government

Annex 1: Results Monitoring Framework

Project Objective:	To support the green development of an international hub airport in the southwest of China and improve air connectivity to Southeast and South Asia regions.								
Indicator Name	**Unit of measure**	**Baseline** Data 2019	**Actual Data 2022**	**Target Values for Milestone Year**			**End Target**	**Frequency**	**Responsibility**
				2025	**2028**	**2030**			
Project Objective Indicators:									
Energy Consumption per passenger	kg standard coal	**0.2**	0.45	<0.35	<0.3	<0.3	<0.3	Each milestone year[1]	PIA
CO_2 emission per passenger	kg	**0.81**	1.81	<0.83	<1.16	<1.07	<1.07	Each milestone year	PIA
Annual volume of passenger throughput	million	**48.08**	30.66	>50	>65	>75	>75	Each milestone year	PIA
Percentage of transit passenger	%	**20**	16	17	18.5	>20	>20	Each milestone year	PIA
Percentage of international passengers in the total transit throughput	%	**22**	0.4	13	18	>22	>22	Each milestone year	PIA
Intermediate Results Indicators:									
Percentage of electrified service vehicles in airside	%	**3.86**	17.6	25	>30	>35	>35	Each milestone year	PIA
Percentage of aircrafts using the 400Hz ground power units in new Aprons (T2 and Cargo)	%	**N/A**	N/A	N/A	100	100	100	Each milestone year	PIA
Length of the newly-constructed Runway E2	meters	0	0	4000	4000	4000	4000	Each milestone year	PIA

[1] Milestone years are 2025, 2028 and 2030.

Number of the newly constructed Apron stands	one	0	0	0	>70	>70	>70	Each milestone year	PIA
Number of the newly constructed cargo apron stands	one	0	0	16	16	16	16	Each milestone year	PIA
New purchased electrified service vehicles in airfield	Number	0	0	0	>160	>160	>160	Each milestone year	PIA
Adopting the Decarbonization Airport Development Plan	Yes/No	**No**	No	Yes	Yes	Yes	Yes	Each milestone year	PIA
Average number outbound flights to South Asia and Southeast Asia per day	one	**280**	15	Around 300	Around 400	Around 600	Around 600	Each milestone year	PIA
MCT- minimal connection time for transit passengers	minutes	**120**	120	100	90	80	80	Each milestone year	PIA
Number of airlines at KM Airport providing air-rail connection service	one	**1**	3	5	8	10	10	Each milestone year	PIA
Participation by women staff in YAG in the Bank-supported capacity-building program (in Component 4.2: Green Airport and sustainability information disclosure)	%	**0**	0	Not less than 50%	Not less than 50%	Not less than 50%	Not less than 50%	Yearly based	PIA
Percentage of registered grievances and complaints responded to within 15 working days	%	**N/A**	N/A	75%	80%	90%	90%	Yearly based	PIA

Annex 2: Detailed Project Description

Background

1. **Sector Context.** The Civil Aviation Administration of China (CAAC) is the national administration authority for the civil aviation industry under the Ministry of Transport. In the early days, China's civil aviation industry was highly centralized and both administration and operations were managed by the government. Since 1978, several rounds of restructuring in the civil aviation industry had been carried out and gradually promoted the specialization and enterprise reform. In 2002, six specialized group enterprises were established and transferred from CAAC to the administration of SASAC, as the result of the deepening reform of the civil aviation sector of China in separating administration functions from operational functions. The six group enterprises include three air transport group companies, respectively: Air China International Corp., China Eastern Airlines Group, and China Southern Airlines Group, specializing in carrier of passengers and freights; and three air service companies, including China TravelSky Technology Limited, specializing in tickets booking and sales system management and international settlement services; China National Aviation Fuel Group, dedicated in aviation fuel supply to airlines; and China Aviation Supplies Holding Company, responsible for import and export of aviation equipment (aircraft, engines, etc.).

2. Apart from institutional reforms in airlines and specialized service companies, the civil transport airports' administration has been transferred to local governments (except the Beijing Capital Airport Group and the Tibet Airport). Provincial-level airport groups have been established in most of the provinces and responsible for the investment, construction, operation and management of civil airports assets in provincial level and city levels in the respective province. These airport groups are provincial SOEs under the administration of provincial SASAC.

3. CAAC are mainly responsible for formulating and putting forward the sector strategy and development plan, setting up the related laws, regulations, policies and standards, monitoring flight safety and ground safety, implementing the air traffic management, etc. There are seven regional administrations under CAAC, responsible for the administration and implementation of civil aviation policies and plans in each own geography area. The project is located in Yunnan province, which is under the jurisdiction of CAAC Southwest Regional Administration Bureau.

4. China's civil aviation experienced a significant growth from 1978 to 2003. The total turnover of China's civil aviation in 2003 reached 17.1 billion tonnage kilometers, carrying 87.59 million passengers and 2.19 million tons of cargo and mail, presented an increase of 54 times, 36 times and 31 times over 1978, with an average annual growth rate of 18 percent, 16 percent and 16 percent respectively. The growth rate of total transport turnover was more than three times that of world civil aviation in the same period, and its ranking among ICAO States parties has risen from the 37th in 1978 to the fifth in 2003. Passenger turnover also rose from the 35th to the fifth place. From 2005 to 2019, the development of China' s civil aviation entered into the fast lane. The total turnover of civil aviation in China ranked the second in the world for 15 consecutive years and remained the second largest air transport system in the world.

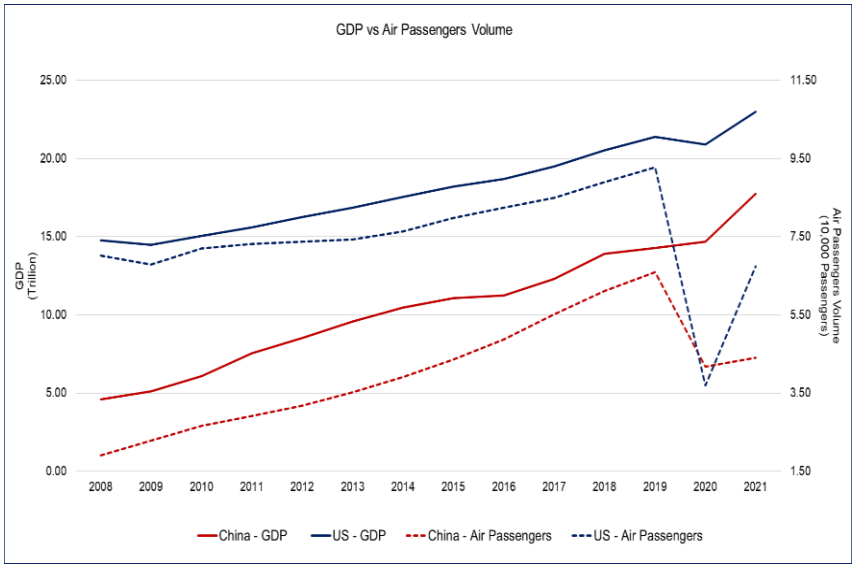
5. China' s civil aviation development entered into the fast lane from 2005 to 2019. Before the outbreak of the COVID-19 pandemic, the number of boarding passengers reached 660 million in 2019, ranked the second globally for 15 consecutive years (following US). While the quantity of China's civil aviation industry is large, the quality needs to be significantly improved. The yearly

number of boarding per capita in China is still in a very low level. In 2019, it was only 0.47 (boarding per capita), much lower than the same of US at 2.85, and also 30 percent lower than the global average of 0.6 in that year. Air transportation plays an important role in the regional connectivity and opening up policy and also represents the people's pursuing to the higher quality of lives. With the continuous growth of China's economy and the increased demand from the rising middle-class, the Chinese government is allocating resources and formulating policy to support the further development of civil aviation industry with focus on both quality and scale.

6. In 2019, before the outbreak of the COVID-19 pandemic, the total transport turnover of the whole industry of China was 129 billion tonnage kilometers. The boarding passenger reached 660 million (the passenger throughput of national civil aviation transport airports reached 1.35 billion); 3,818 transport aircraft of the civil aviation industry were registered; 238 transportation airports are certified and operational in China (excluding Hong Kong, China; Macao, China; and Taiwan, China). Beijing Capital Airport handled over 100 million passengers, ranking the second in the world for 10 consecutive years. The cargo throughput of Shanghai Pudong Airport reached 3.6342 million tons, ranking third in the world for 12 consecutive years.

7. The development of civil aviation sector is closely related to a country's population and level of economic development. Historically, there is a strong correlation between the growth of passenger volumes of air traffic and the growth of Gross Domestic Product (GDP). China's civil aviation market is more similar and comparable to the same of the United States (US). Both countries have vast territorial areas, scattered population layouts, large-scale and diversified economies, steady and huge domestic demands, and closed connectivity with neighboring countries. The relationship between air passenger traffic and GDP for the two countries is as follows. In 2019, the number of China's air passengers was 660 million, accounting for around 70 percent of the US' (940 million), which aligned with the size of economy of two countries. However, the number of boarding per capita in China is still in a low level. It advised that with the continuous economic growth and the improvement of people's living standards, there is huge potential for the continued rapid growth of China's aviation industry.

Figure 1. The Relationship Between GDP and Air Passenger Volume (2008-2021)



8. China's economy development is projected to enter into a new normal with a relatively moderate speed comparing to its fast growth the past decades. It is projected that there is a high

possibility that China's economy could grow as large as US' at round 2035. The economy projections are consistent with the predictions of the air traffic volumes of the two countries. The US FAA predicts that the number of US boarding passengers will reach 1.4456 billion in 2035. It is very close to CAAC's plan of China boarding passengers as estimated in the National Civil Aviation Strategy Outline, which is to achieve one boarding per capita by 2035 (equivalent to 1.5 billion boarding passengers in 2035), which implicate an average yearly growth rate of six percent. The historical data suggested that China's aviation growth rate is higher than its GDP growth rate. Considering the low per capita ratio of China, the six percent annual growth rate till 2035 is assessed as reasonable and achievable.

9. Yunnan province has its unique strategic location and geographical conditions, with that, it was the first region of China carrying out air transport activities and has always been an important aviation hub for China to connect with Southeast Asian and South Asian countries. The terrain of Yunnan is greatly undulating. Compared with other provinces in flat areas, air transportation has relatively comparative advantages to ground transportation. In the new century, due to the rapid growth of its tourism industry, Yunnan has gradually developed into a province with abundant aviation resources and strong market demand in China. By 2021, Yunnan has 15 civil airports, ranking the third of among all provinces and regions in China (the top two are Xinjiang with 25 and Sichuan with 16). KM Airport, as one of the 10 international hub airports, is also an important node in the establishment of a national multi-level civil aviation network. KM Airport is the base airport of many Chinese airlines, including China Eastern Airlines Yunnan Co., Ltd., China Southern Airlines Yunnan Branch, Yunnan Lucky Airline, Sichuan Airlines Branch, Kunming Airlines, and Ruili Airlines. By the end of 2020, there were 375 flight routes in operation, including 316 domestic routes and 59 international routes, which consist of a well-established air transport network connecting to the whole country and four continents.

10. **Yunnan's Economy and Tourism Industry.** The economy of Yunnan province has been growing steadily in the past decades. In 2019, the provincial GDP reached RMB2,322.375 billion, a year-on-year growth of 8.1 percent and a growth rate of 2.0 percent points higher than the national average. As an important tourist and cultural center in southwest China, Yunnan province has abundant tourism resources, renowned for the beautiful mountains, rivers and antique towns in Kunming, Lijiang, Dali and many other rural areas. All these resources contribute to the rapid development of tourism in Yunnan, where tourism is playing a decisive role in economic development of Yunnan. From 2012 to 2018 the proportion of tourism revenue in GDP increased year by year from 16.51 percent (2012) to 50.28 percent (2018). In 2020, the People's Government of Yunnan province issued *Several Opinions on Accelerating the Transformation and Upgrade of Tourism*, proposing to create high-quality tourist attractions, actively build tourist attractions of higher grade, and build international and national first-class characteristic towns. As a mountainous province with inconvenient land traffic, Yunnan will see a promising future with rapid growth in traffic volume, especially the air traffic volume, pushed by the tourism development.

11. **Connection with Southeast Asia (SEA) and South Asia (SA).** Adjoining SEA and SA, Yunnan province has long served as the primary zone trading with the two regions. Countries in SEA and SA with a large population and great market potential, are highly complementary to Yunnan's industries and both sides have a strong desire to deepen the cooperation. The trade volume with ASEAN was RMB114.3 billion, seeing an increase of 25.8 percent, accounting for 49.2 percent of the total trade volume of Yunnan province in 2019, up from 40 percent in 2006,

which is significantly higher than the same of other global regions. With the in-depth maturity of the Lancang-Mekong Cooperation Mechanism and BCIM Cooperation Mechanism, Yunnan will go on a fast track to strengthen its trading tie with Southeast Asia and South Asia.

12. **Air Traffic Volume Forecast.** The development of the economy and tourism industry has a long-term stable and dominant impact on the air traffic volume. According to the following figures and the above analysis, since the 13th Five-Year Plan (2016-2020), the growth of passenger throughput at KM Airport was fast before 2016 but slowed down since 2017. And 2019 even saw a decline in both flight movements and cargo and mail throughput. The main reasons for this dilemma lie in the fact that the airport construction is lagging behind and the capacity of the runway, apron, and terminal has reached or even exceeded their design capacities, bringing the instantaneous capacity of the airport to the ceiling. Compared with the forecast data of the 2008 Master Plan, the actual growth trend of passenger throughput is relatively fast.

Figure 2. Line Chart of Passenger Throughput Growth of KM Airport

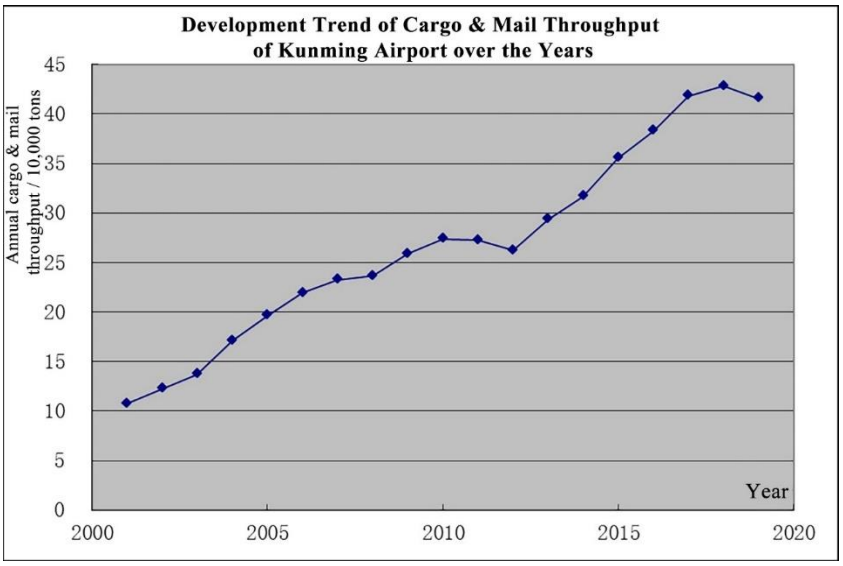


Figure 3. Line Chart of Cargo and Mail Throughput Growth of KM Airport

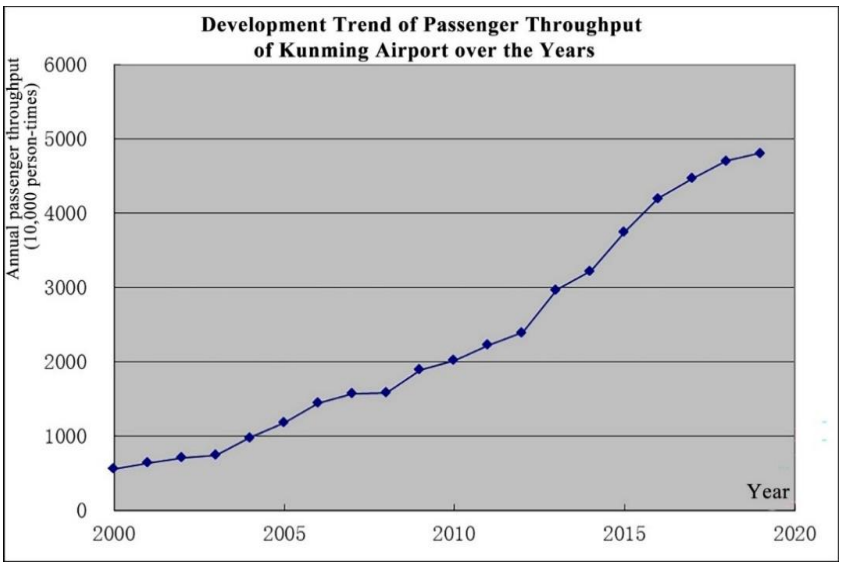


Table 1. Comparison of Forecasted and Actual Passenger Throughput of KM Airport

Year	2008 Master Plan	Actual (10,000 Passengers)
2010	1,800	2,019.2
2011	1,907	2,227.0
2012	2,020	2,397.9
2013	2,139	2,968.8
2014	2,266	3,223.1
2015	2,400	3,752.3
2016	2,631	4,198.0
2017	2,884	4,472.8
2018	3,162	4,708.8
2019	3,466	4,807.6
2020	3,800	3,299.1

13. From 2010 to 2019, Yunnan's GDP growth average rate was 10.3 percent, which was 2.5 percent higher than the country's average growth rate of 7.7 percent. With the consideration of the overall development plan of China's aviation industry, the unique position and the high priority of the KM Airport in the national transport network planning, and its potential in the connectivity with SA and SEA, and tourism resources and industry, it is projected that the passenger throughput at KM Airport will grow at the rate comparable to the national average level.

14. The FSR have applied different methods to review and estimate the air traffic forecast at KM Airport, such as the trend extrapolation (parabolic) method; linear regression between economic growth and passengers; univariate linear regression model depicting the relationship between the passengers and tourism data; and the experts' opinion method, etc. Results of various methods all suggest the passenger throughput at KM Airport will achieve above 95 million per year in 2030. The Bank team has reviewed the analysis in the FSR and is of the view that given the strategic important position of the airport and the economic potential of Yunnan and Kunming to be explored, setting 95 million as the targeted design capacity is reasonable. However, considering the uncertainty in the post pandemic context and the change of the global environment, The Bank team estimated the targeted traffic of 95 million would be achieved in 2035, five years later than the FSR's estimation.

15. A top-down approach has been taken in the traffic forecast using the FSR's estimation as a basis. It is assumed that China will experience a steady and moderate growth rate at an average rate of five percent (GDP) before 2035, and the China's aviation sector will achieve its national strategy target of one boarding per capita by 2035, which implicate an average yearly growth rate of six percent during this period. Yunnan as a western province of China, is expected to experience an economic growth rate higher than the national average. Air traffic forecasts have been categorized into normal traffic, transfer traffic, and induced traffic. Normal traffic represents normal growth of passenger and freight volume passing through the KM Airport. Transfer traffic represents volume diverted to the KM Airport from other routes or transport modes, i.e. other airport, HSR, normal rail and others. In the economic analysis, for the calculation purpose, it is assumed all the transfer passengers are diverted from HSR. Induced traffic represents additional

traffic flows that come from the development of other industries which are resulted from or linked to the KM Airport expansion. Overall, the total passenger and freight volume are estimated to reach the new design capacity gradually over the course of 8 years from 2027, the first year that the expanded airport infrastructure commence its operation (Runway E2) By 2035, the passenger traffic is expected to reach its target volume of 95 million.

16. In terms of growth projection for each traffic segment, the passenger normal traffic is expected to grow at an average rate of four percent, it is a conservative estimation with the consideration of Yunnan overall economic growth rate (including tourism industry), the strategic location of designated position of KM Airport and the national aviation development plan. For passenger transfer traffic, it is projected that the attraction effect is stronger in the early years after airport partial or fully expansion, the transfer traffic will account for around 12 percent from 2027-2031. With the growth of economy and the uplift of the people's live standards, more passengers will become the normal air traffic customers. The transfer traffic will gradually decrease to a modest level till three to four percent by 2035. With regard to passenger induced traffic, the Bank team has discussed with the FSR design institute and accepted five to six percent of total passenger volume which is assessed as a conservative estimation according to the industry experience in China. After 2035 when the airport is operational at its full capacity, it was assumed the normal, transfer and induced traffic will stabilize at a constant value thereafter. The same traffic forecast logic applies for the freight volume.

17. **KM Airport Long-term Expansion Program (LEP).** In 2017, the *Strategic Planning of Kunming International Aviation Hub* (Strategic Plan) has been developed and jointly endorsed by Civil Aviation Administration of China (CAAC) and Yunnan Provincial Government. Based on the analysis of macro-economic development (both domestic and international), civil aviation industry development, regional economic development and other relevant factors, the Strategic Plan projected the capacity ceiling of KM Airport is to accommodate 120 million person-times, 1.2 million tons of cargo and 820 thousand of aircraft movements per year.

18. KM Airport has started its operation at current location since 2012 and has been classified as a 4F airport according to ICAO standards. The current main facilities include two long-distance parallel runways in the east and west of the central terminal area, with a distance in between of 1,950 meters. The Eastern Runway #1 (Runway E1) is 4,500 meters long and the Western Runway #1 (Runway W1) is 4,000 meters long. The existing Terminal #1(T1) building is 548,000 square meters with 137 passenger aircraft stands (73C/41D/20E/3F). The designed capacity of the current airport is 38 million passengers per year. The expanded Satellite Terminal #1(S1) has been put into operation in 2021, providing 47 of additional passenger aircraft stands and increasing the terminal processing capacity to 53 million passengers per year.

19. Unlike other big cities in China, such as Beijing, Shanghai, Chengdu and Guangzhou, due to the unique land and airspace characters and limitations in Kunming, it is assessed as challenging to find another suitable location to build the second airport of Kunming in the near future. It requires the designer to optimize and maximize the use of the land resources around the KM Airport at Changshui, in order to meet the continuous growth of traffic demand.

20. The Strategic Plan (LEP) of KM Airport introduced five parallel runways (two Eastern +three Western) and two central terminals plus two satellite terminals. This layout is preliminary assessed as the most suitable of KM Airport to meet the estimated long-term traffic demand in

the context of the site and air conditions in Changshui. Five parallel runways could be grouped into three independent sets of runways in operation. The Runway W2 and W3 can be grouped as one set, with the distance of 760 meters (according to current design, which will be subject to further finetuning) in between. The existing Runway W1 functions as one set by itself, having a distance of 970 meters to the Runway W2 (according to current design, which will be subject to further finetuning). Runway E1 and Runway E2 are a pair of close parallel runways in the east side of the central terminal area, with a distance of 380 meters in between. Terminals will be located in the central of the airport from south to north. Road and rail systems will connect with terminals. In road part, the terminals will connect to the existing expressway network around the airport with approaching roads, including Airport Expressway, Airport North Expressway, Yinkun expressway and Kunqu Expressway. In the rail part, there are four rail lines will pass through KM Airport. The Yukun HSR line will have a new station in T2; the Subway Line 6 has connected with T1 already and will add one stop in T2; the Subway Line 9 and Light Rail Chongming Line have been included in the master plan and both will have station in T2.

21. **KM Airport Medium-term Expansion Plan (MEP).** In 2021, NDRC approved the MEP targeting to accommodate 95 million person-times and one million tons of cargoes per year. The Feasibility Study Report (FSR) has been developed accordingly. The MEP mainly involves the new construction of two 4000 meters runways (Runway E2 and Runway W3 according to the current design in the FSR) and their corresponding taxiway system; the construction of T2 buildings (730,000 square meters with the processing capacity of 42 million passengers per year); preparatory works for the construction of S2 (130,000 square meters and processing capacity of 15 million passengers per year) in future. The facility and equipment in the T2 main building are equipped for the target of processing 42 million passenger per year. MEP also includes (i) building the cargo terminal (99,300 square meters) in the east part of the airport, with 16 cargo aircraft stands; (ii) demolishing the existing maintenance area (maintenance area of China Eastern Airline and Xiangpeng Airline) and construct the new aircraft maintenance area of 85,000 square meters and 19 maintenance slots in the northwest of the airport; (iii) the civil work of the GTC (80,00 square meters), parking building (309,000 square meters), ground parking areas (78,000 square meters) and auxiliary facility and urban infrastructure in landside working areas. The estimated cost of the current FSR is nearly RMB65 billion (around USD10 billion). The FSR has been approved by NDRC in Sep. 2022.

22. **MEP of KM Airport** is listed as the top priority of 14th Five Year Plan of Yunnan province and required massive amount of investment. It involves plenty of components and will be implemented in phases due to the different readiness of each component and to ensure that the regular operation of KM Airport will not be affected during the construction of the expansion. With the consideration of locations, functions, construction sequence and readiness of each component, investment of the MEP could be split into three main parts.

- **Part 1-Eastern Part**, including Runway E2 and its linked taxiway and system; cargo terminal in the east side of the airport and its cargo aprons; Aprons around T2; and other infrastructure in airfield area, such as drainage/sewage system, firefighter station, lighting, ILS (Instrumental Landing System), security system, and other utilities, etc.

- **Part 2-Central Part**, including T2 (buildings and equipment); other infrastructure in airfield area; Landside infrastructures, such as civils work of the airport part of the GTC, and auxiliary facility and urban infrastructure in landside working areas.

- **Part 3-Western Part** including a new Runway in the west and its linked taxiway and system; new Aircraft Maintenance Zone; and other infrastructure in airfield area.

23. The runway and terminal capacity analysis has been carried out through analogue simulation conducted by an International Aviation Consulting firm-Landrum & Brown and a local consulting firm- CAST Zhong Yu (Beijing) Technology. Both results suggested that the proposed design and investment in the FSR is suitable to meet the estimated traffic demand in MEP. The competition of the runway and terminal infrastructure and connected design capacities in current, MEP and LEP scenarios are shown in table 2 below.

Table 2. Summary of Design Capacity of Runways and Terminals

Type	Items	Descriptions	Design Capacity (per year)					
			Current		MTP		LTP	
			PAX	Aircraft Movements	PAX	Aircraft Movements	PAX	Aircraft Movements
Runways	E1	4500 m	24,000,000	168,000	40,000,000	256,500	44,000,000	256,500
	E2	4000 m	-	-				
	W1	4000 m	24,000,000	168,000	30,000,000	189,000	30,000,000	168,000
	W2	4000 m	-	-	-	-	44,000,000	256,500
	W3	4000 m	-	-	30,000,000	189,000		
Total Runway Capacity:			**48,000,000**	**336,000**	**100,000,000**	**634,500**	**118,000,000**	**681,000**
Terminals	T1	548k sq.m. Apron-137	38,000,000		38,000,000		38,000,000	
	S1	128k sq.m. Apron-46	15,000,000		15,000,000		15,000,000	
	T2	730k sq.m. Apron-78	-		42,000,000		52,000,000	
	S2	130k sq.m. Apron-around 40	-		-		15,000,000	
	T3 (TBD)	TBD	-					
Total Terminal Capacity:			**53,000,000**		**95,000,000**		**120,000,000**	

24. **Green Airport.** China has set up its "Dual Carbon" goals with implementation timelines, which calls for endeavors from all industries, including civil aviation sector. The State Council of China issued the Three-year Championship for the Blue-Sky Protection in Jul. 2018, which was successfully concluded in Feb. 2021. In Jan. 2020, the Four Characteristics Airport Development Guideline (2020-2035) was issued by CAAC. The “Four Characteristics” refer to four dimensions CAAC advocates to promote in the design, construction and operation of an airport, they are safe, green, smart and cultural. The concept of the “Four Characteristics” airport will be integrated into the design, construction, operation and management of the KM Airport expansion.

25. KM Airport considers setting the carbon neutral as its ultimate goal. Saving electricity, optimizing energy structure and using clean energy are the main directions of its pathway in carbon emission reduction. It is planned to increase the use of electrified service vehicles, install the small scale of renewable power and energy storage at the airport. It will also increase the use of ground aircraft auxiliary power unit on the apron, to reduce aircraft’s use of aviation fuel on the ground. All passenger aprons will be equipped with floor-type aircraft ground air conditioning unit and ground well. Each boarding bridge is equipped with a 400Hz ground power unit, the remote power distribution box is equipped with a 400Hz power interface and a mobile 400Hz power supply device is set up to provide ground power to the aircraft. In terms of resource saving,

envisaged targets include reducing the energy consumption per passenger and water consumption per passenger, increasing the utilization rate of non-traditional water resources. In terms of Low-Carbon emission: decreasing the net carbon emissions per passenger year by year; increasing the proportion of new energy in equipment/vehicles in operations. In environmental protection aspect, maintaining the high the sewage treatment rate of the airport sewage plant and maximizing the harmless disposal rate of household and aviation waste.

26. **AIIB Project Scope**. The cost of the entire MEP is estimated at nearly USD10 billion while the proposed AIIB loan amount is USD500 million, accounting for around five percent of the MEP investment. According to the extensive discussion during the first identification mission to Kunming, it was proposed to concentrate Bank's financing on Part 1-Eastern part of the MEP.

27. Part 1 includes the essential infrastructure of the airport in airfield area and could be operational and functional independently after its completion. The proposed technical solutions of Part 1 in the FSR have been reviewed and assessed as relatively mature and implementable. The ES impact and land acquisition scope could be relatively clearly identified. This provides good base for Bank to start the required due diligence and project preparation. The current proposal of Part 2 and 3 in the FSR have been reviewed and identified with more uncertainties, and the proposed technical solutions are less matured and required further analysis. The civil works of GTC and working areas in landside under Part 2 involve coordination with other project operators/companies responsible for rail and metro constructions and cannot be solely decided by the YAG, thus, this part has not been proposed to AIIB for financing. The layout and configurations of west runways under Part 3 have been reviewed and discussed extensively in the FSR preparation. The Bank team is of the view that the current technical proposal requires further analysis and optimization. Any updates in technical solutions may affect the currently proposed land use plan and have implications in ES impacts. It is estimated to take longer time before start of the construction. With all above considerations, both YAG and the Bank team agreed that Part 2 and 3 may not be suitable to involve AIIB financing at this stage.

Project Components

28. The project comprises four components:

29. Component 1: Construction of Airside Infrastructure in the Eastern Part of the Airport, including, construction of Runway E2 and its linked taxiway system; cargo aprons (16 stands) in the Eastern part; ATC and navigation system, Instrument landing system (ILS), navigational lighting and its power supply system, drainage system and firefighter station. It will also include the Smart Runway, installing senses in the pavement and subbase of Runway E2 and its monitoring system.

30. Component 2: Construction of aprons and related lighting system around T2. Specifically, the construction of aprons (78 stands) around the T2, including subbase treatment, civil works and pavement; the road and bridge in air side, including the construction of northeast underpass, northwest underpass, T2 East underpass and T2 West underpass; lighting, drainage, power supply and firefighter station in airside around T2.

31. Component 3: Provision of equipment. Electrified service vehicles in airside, including special service truck/buses, special vehicle for maintenance and special vehicle for field service.

Installation of the charging piles, Aircraft Ground AC system and 400Hz ground power units on the aprons. It will also include the automatic noise monitoring equipment and its installation.

32. Component 4: Technical Support and Capacity Building. There are two subcomponents: one is the project Implementation support including environmental and noise monitoring and evaluation; social and resettlement monitoring and evaluation; and other required support to enhance the project implementation quality and efficiency. The other is institutional capacity building, including: (i) YAG Decarbonization Development Plan with the clear target, roadmap and action plans to be adopted; (ii) enhancing YAG's capacity in reporting and disclosure of ESG green and sustainability related information; (iii) capacity building to enhance the regional connectivity, for example, the aviation summit with SA and SEA countries, development of the road map in building the best transit international hub airport in the region.

33. Project cost and financing

Component	**Project Cost (USD million)**	**AIIB (USD million and %)**		**Govt. (USD million and %)**	
Component 1: Construction of Airside Infrastructure in the Eastern Part of the Airport					
1.1. Construction of Runway E2 and its linked taxiway system.	130.9	126.0	96.2%	4.9	3.8%
1.2. Cargo Aprons (16 stands) in the Eastern part.	14.8	12.0	81.2%	2.8	18.8%
1.3. Air Traffic Control (ATC) and navigation system, Instrument landing system (ILS), navigational lighting and its power supply system, drainage system and firefighter station.	125.4	120.0	95.7%	5.4	4.3%
1.4. Smart Runway, installing sensors in the pavement and subbase of Runway E2 and associated monitoring system.	2.0	2.0	100.0%	0.0	0.0%
Component 1 Subtotal	273.2	260.0	95.2%	13.1	4.8%
Component 2: Construction of Aprons and associated lighting system and facilities around T2					
2.1. Construction of aprons (78 stands) around the Terminal 2, including subbase treatment, civil works and pavement.	187.9	50.0	26.6%	137.9	73.4%
2.2. Road and bridge in air side, including construction of northeast underpass, northwest underpass, T2 East underpass and T2 West underpass.	194.2	50.0	25.7%	144.2	74.3%
2.3. Lighting, drainage, power supply and firefighter station.	123.5	50.0	40.5%	73.5	59.5%
Component 2 Subtotal	505.7	150.0	29.7%	355.7	70.3%
Component 3: Electrified service vehicles with charging piles, ground power unit and noise monitoring equipment					
3.1.1Special service truck/buses, such as trucks for water, sewage and solid waste transportation, passenger shuttle bus, baggage transport, platform lift truck and mobile aircraft landing stairs.	14.6	8.0	55.0%	6.6	45.0%

Component	Project Cost (USD million)	AIIB (USD million and %)		Govt. (USD million and %)	
3.1.2 Special vehicle for maintenance, such as Aircraft tractor, mobile maintenance tool trolley, guide vehicle and emergency response vehicle.	7.0	2.0	28.5%	5.0	71.5%
3.1.3 Special vehicle for field service, such as forklift, road sweeper, runway sweeper, Friction coefficient test vehicle, Navigational light patrol vehicle, patrol car, supporting van and truck.	2.5	1.0	40.6%	1.5	59.4%
3.2 Charging pile	10.3	5.0	48.4%	5.3	51.6%
3.3 Aircraft Ground AC system.	7.4	3.0	40.4%	4.4	59.6%
3.4 400Hz Ground Power Unit.	12.2	3.0	24.5%	9.2	75.5%
3.4 Automatic noise monitoring equipment and installation	2.0	1.0	49.3%	1.0	50.7%
Component 3 Subtotal	56.0	23.0	41.0%	33.0	59.0%
Component 4: Technical Support and Capacity Building					
4.1. Project Management Support, including but not limited to: (i) Environmental and noise monitoring and evaluation; (ii) Social and resettlement monitoring and evaluation; (iii) other needed support to the implementation.	2.9	2.9	100.0%	0.0	0.0%
4.2. **Institutional Capacity Building,** including: (i) YAG Decarbonization Development Plan with the clear target, roadmap and action plan; (ii) enhancing YAG's capacity in reporting and disclosure of ESG, green and sustainability related information; (iii) capacity building in regional connectivity, particularly in the road map of building the best transit international hub airport in the region.	6.7	6.7	100%	0.0	0.0%
Component 4 Subtotal	9.6	9.6	100.0%	0.0	0.0%
Component 1+2+3+4:	844.4	442.6	52.4%	401.8	47.6%
Fees and interest during constructions	57.4	57.4	100.0%	0.0	0.0%
Total Project Cost:	901.8	500.0	55.4%	401.8	44.6%

34. Implementation schedule

Components	Implementation Start	Implementation Completion
Component 1: Construction of Airside Infrastructure in the Eastern Part of the Airport	Jul. 2023	2025 Q2
Component 2: Construction of Aprons and associated lighting system and facilities around Terminal 2	Jan. 2025	2027 Q2
Component 3: Electrified service vehicles with charging piles, ground power unit and noise monitoring equipment	Jan. 2026	2028 Q2
Component 4: Technical Support and Capacity Building	Jun. 2023	2028 Q2

Annex 3: Economic and Financial Analysis

A. Approach and Methodology of Economic Analysis

1. **General.** The Economic Analysis, or CBA has been developed to identify and quantify key economic benefits and costs associated for the Project. The CBA has considered the impact on the entire MEP (the Project) in calculations as it is difficult to separate passenger/freight traffic of specific airport runways or terminals.

2. The CBA was carried out by using the discounted cash flow to obtain the EIRR and net present value (NPV) for the proposed investments linked with the Project. This is followed by a standard sensitivity analysis that tests the viability of EIRR and NPV under optimistic/pessimistic scenarios of traffic and cost projections.

3. **Analytical Framework.** The CBA calculations based on the net benefits and costs, by comparing with and without project scenarios described as below:

- **Without the Project:** This scenario simply means there will be no expansion activities listed under the MEP FSR. KM Airport will be constrained by its current passenger throughout capacity, where a growing number of passengers have no choice but to choose HSRs. Similarly, without the project, KM Airport will be limited by its current air freight capacity, so some goods must be transported by regular cargo trains. Note that assuming HSRs as alternative transport mode in without project scenario has implications on the economic costs. This will be elaborated in Section C. The analysis has not examined the scenarios of overloaded operations of the airport. It has also not considered the flying to other airports and connected to railways as alternative transport mode.

- **With the Project:** In with-project scenario, KM Airport will have higher passenger and freight handling capacity. After the Project is completed, the number of air passengers/freight to Kunming will gradually increase, until it stabilizes at the new design capacity after 8 years of operations. The additional passenger traffic flow mainly comes from the transfer passengers from HSR who preferred to take flights but had no option other than trains previously. For these passengers, flights take much shorter travel time, albeit higher ticket costs relative to bullet trains. Another source of new passengers comes induced passengers, who are attracted to fly to Kunming because of the airport expansion. Besides, the expanded airport will attract more international tourists, bringing increasing foreign tourist income.

4. **Benefits Calculation.** The Project will bring several key positive net economic benefits, including time savings of passengers, foreign tourist income, reduced reefer loss and induced passenger/freight benefits. Meanwhile, the Project will also lead to incremental passenger/freight costs and carbon emissions, which will be counted as economic benefits but in negative terms. In the end, EIRR and Expected Net Present Value (ENPV) are the results of adding all these positive/negative items together.

5. The benefits are identified and quantified based on consultations with the design institute of the FSR, literature review on similar MDBs projects, various databases for essential parameters, and the Bank's estimation to the estimates. The quantified benefits include the following items:

- Time savings - passenger and freight

- Transport cost savings - passenger and freight[1]
- Induced benefits - passenger and freight
- Other benefits - foreign tourist income, reduced reefer loss
- Carbon emissions – Scope 1 and 2 [2] and aircraft movements

6. **Key Assumptions.** The CBA assumed seven years of construction and afterwards 20 years of operations. Below are the other key assumptions used in the analysis:

- Construction will start in 2023 and be competed in 2029.
- Currency exchange rate is 6.9 RMB/USD.
- Social discount rate, or economic opportunity cost, is nine percent, following Bank's guidance on CBA of China projects.
- Shadow price conversion factor is 1.0 as China's domestic market is fully integrated in global economy.
- Traffic forecast. The FSR provided the passenger and freight flights projections based on their own analysis. The Bank further carried out own analysis and adjusted the assumptions and calculations to ensure higher consistency with macroeconomic indicators and sector growth trends.
- Travel distance. Calculating transport cost savings and carbon emissions needs the average travel distance of passengers in/out Kunming, by air or HSR. The Bank adjusted FSR's data input by using actual passenger distribution data from 2019.
- Residual value of assets. After 20 years of operations, the residual value of assets is estimated at around 55 percent of historical capex value. Note that the Project is designed to operate for 50 to 70 years, hence a 55 percent salvage value over 20 years of operations is deemed appropriate for the analysis.

Table 1. Details of Salvage Value Adopted for Analysis (USD million)

Assets-Financial Value	Assets-Economic Value	Value-Economic Salvage Value	Salvage Value (%)
8,558	8,558	4,682	55%

7. All costs and benefits are valued in monetary terms and expressed in economic prices. The result reflects the overall EIRR and ENPV of the airport after the expansion.

B. Passenger/freight Traffic Projection

8. In the with-project scenario, a top-down traffic forecast has been prepared for 2030 to 2049 as a basis for the economic analysis of the Project. Air traffic forecasts have been categorized into normal traffic, transfer traffic, and induced traffic. Normal traffic represents normal growth of passenger and freight volume passing through the KM Airport. Transfer traffic represents volume diverted to the KM Airport from other routes or transport modes, i.e. other airport, HSR, normal rail and others. In the economic analysis, for the calculation purpose, it is assumed all the transfer passengers are diverted from HSR. Induced traffic represents additional

[1] Transport cost savings are in negative terms as air travel has higher unit cost compared to trains.
[2] Scope 1: emissions from airport-owned or controlled resources; Scope 2: indirect emissions from the consumption of purchased energy by the airport operator. For more details, please refer to Annex 4 Paris Alignment Assessment.

traffic flows that come from the development of other industries which are resulted from or linked to the KM Airport expansion. Overall, the total passenger and freight volume are estimated to reach the new design capacity gradually over the course of eight years from 2027, the first year that the expanded airport infrastructure commence its operation (Runway E2). By 2035, the passenger traffic is expected to reach its target volume of 95 million.

9. In terms of growth projection for each traffic segment, the passenger normal traffic is expected to grow at an average rate of four percent, it is a conservative estimation with the consideration of Yunnan overall economic growth rate (including tourism industry), the strategic location of designated position of KM Airport and the national aviation development plan. For passenger transfer traffic, it is projected that the attraction effect is stronger in the early years after airport partially or fully expansion, the transfer traffic will account for around 12 percent from 2027-2031. With the growth of economy and the uplift of the people's live standards, there will be more passengers become the normal air traffic customers. The transfer traffic will gradually decrease to a modest level to three to four percent by 2035. With regard to passenger induced traffic, PT has discussed with the FSR design institute and accepted five to six percent of total passenger volume which is assessed as a conservative estimation according to the industry experience in China. After 2035 when the airport is operational at its full capacity, it was assumed the normal, transfer and induced traffic will stabilize at a constant value thereafter. The same traffic forecast logic applies for the freight volume.

10. In the without-project scenario, air passenger/freight traffic forecasts stay at a constant value throughout the analysis period, which is its current airport design capacity (25.7 million people and 0.24 million tonnages). Note that the total passenger/freight volume in both air and rail in this scenario is estimated the same to the total of normal and transfer volume in with-project scenario. Such assumption reflects the fundamental logic that both normal and transfer passengers/freights in with-project scenario are compared with the volume of passengers/freight using train service in the with-project scenario. Table 2 below presents the projections for a few selected years.

Table 2. Passenger and Freight Projections for Select Years

Scenario	Category	Type	Construction	Operations		
			2027	2030	2039	2049
With-project	Air Passengers (million people)	Normal	31.86	37.95	42.61	42.61
		Transfer	4.75	6.29	1.63	1.63
		Induced	1.92	2.34	3.26	3.26
	Freight (million tonnages)	Normal	0.25	0.31	0.42	0.42
		Transfer	0.02	0.03	0.04	0.04
		Induced	0.02	0.03	0.04	0.04
Without-project	Air Passengers (million people)	Air	25.75	25.75	25.75	25.75
		Railway	10.86	18.49	18.49	18.49
	Freight (million tonnages)	Air	0.24	0.24	0.24	0.24
		Railway	0.00	0.08	0.23	0.23

C. Economic Costs

11. Capex costs were collected based on the FSR's original estimates and spread equally over the seven years construction period.

Table 3. Predicted Economic Cost of Capex Schedule (USD million)

Total Economic Cost	2023	2024	2025	2026	2027	2028	2029
8,558.19	1,222.60	1,222.60	1,222.60	1,222.60	1,222.60	1,222.60	1,222.60

12. **Maintenance costs.** Economic maintenance costs were originally provided by the FSR. The estimates include general items in project maintenance, including staff salary, repair, materials and other maintenance items. The Bank adjusted the maintenance economic costs. This adjustment reflects the differences in the Bank's assumption regarding without-project scenario from that of the FSR. The FSR assumed that in without-project scenario, a regular-speed railway would be built to handle the increasing demand of passenger traffic who choose between air and trains. But the Bank believed that these passengers are more likely to choose between air and HSR, rather than regular trains. Hence, the team made the decision to change without-project scenario to HSR.

- Changing without-project scenario from regular- to HSR decreases maintenance economic costs by 31 percent, compared to the FSR's estimation. This is because building an equivalent HSR system is more costly than a regular one. As a result, the net of with-project and without-project costs, serving as the overall project economic costs, decreased. Specifically, the FSR assumed the costs of building a regular railway system is roughly 30 percent of an equivalent airport according to their study. Using this information and the relative cost of HSR versus regular train, the Bank adjusted the original economic costs by a factor of 0.69.
- Annual maintenance costs will gradually increase from USD52.13 million until it stabilizes at USD77.79 million in the fifth year of the operations (2034).

Table 4. Maintenance Economic Cost (First 4 Years of Operations)

Year	2030	2031	2032	2033	2034
AIIB Adjusted	52.13	60.39	68.94	77.79	77.79
FSR	75.14	87.04	99.35	112.10	112.10

D. Economic Benefits

13. **Time Savings for Passengers and Freight.** Passenger time savings are estimated by multiplying average saved hours, unit time value of working/non-working passengers, and total number of normal/transfer passengers. Saved hours per passenger are around 6.6 hours, comparing average travel time from same places to Kunming via HSR versus flights. Unit time value is proxied by hourly GDP derived from total employed population and total GDP for 2022, which is around 63 RMB per hour[3]. Freight time savings are estimated in similar way but by multiplying freight traffic. Average saved hours for freight are around 23.3 hours, comparing air versus regular cargo train[4]. Unit time value of goods are estimated at 10,274 RMB/hour·ton.

[3] This is for working passengers. Non-working passengers are assumed to have 30 percent of hourly wage of working passengers.

[4] For freight transport, the without project scenario assumed regular-speed train cargo transport. It is unlikely that freight goods would be transported by high-speed trains. Hence, saved hours for freight are longer than passengers.

Table 5. Time Savings for Passenger and Freight (USD million)

Category	Type	2030	2039	2049
Passenger	Normal	627.88	867.79	867.79
	Transfer	323.89	83.98	83.98
Air freight	Normal	0.24	0.65	0.65
	Transfer	0.10	0.14	0.14

14. **Foreign Tourist Income.** More foreign tourist income will also be generated by the Project. The Bank assumed the share of international passengers as of total KM Airport passenger traffic will increase from 11 percent in 2019 to 15 percent after KM Airport starts operating, which is the policy target by KM Airport. Among these international passengers, about 30 percent will enter Kunming and spend, with average tourist spending of 4,800 RMB[5]. Throughout this CBA, foreign tourist income appears to be the most significant positive economic benefits that affect EIRR and ENPV.

Table 6. Increased Foreign Tourist Income

	2030	2039	2049
With-project: foreign tourists (million people)	2.10	2.14	2.14
Without-project: foreign tourists (million people)	0.85	0.85	0.85
Increased foreign tourist income (USD million)	866.92	895.83	895.83

15. **Reduced Reefer Loss.** Goods transported by air have lower reefer loss than railway due to shorter transport time and better facilities. Typically, air freight would reduce reefer loss rate by 2 percent, which is widely used in airport CBA and FSR. Using this assumption and transfer freight volume, benefits from reduced reefer loss were computed as below.

Table 7. Reduced Reefer Loss (USD million)

	2030	2039	2049
Reduced Reefer Loss	28.52	66.08	66.08

16. **Cost Savings for Passengers and Freight.** Cost savings estimated by comparing the total passenger/freight transport cost of air versus trains. Switching from trains to flights will increase transport cost significantly because unit cost of air is much higher than train. As a result, cost savings in this comparison are usually negative, indicating higher costs of air. To calculate cost savings, several important assumptions are needed, including unit passenger/freight cost, average passenger/freight transport distance.

Table 8. Cost Savings for Passenger (USD million)

Category	Type	2030	2039	2049
Domestic Passengers	Normal	-246.18	-340.24	-340.24
	Transfer	-126.99	-32.93	-32.93

[5] Average foreign tourist spending was from 2019 Yunnan Statistical Yearbook. AIIB team assumed a 30 percent international tourist as share of total international passenger volume, such that the derived international tourist arrivals match the actual 2019 data.

Category	Type	2030	2039	2049
International Passengers	Normal	-12.70	-17.55	-17.55
	Transfer	-6.55	-1.70	-1.70

Table 9. Cost Savings for Freight (USD million)

Category	Type	2030	2039	2049
Domestic Freight	Normal	-13.05	-34.96	-34.96
	Transfer	-5.25	-7.44	-7.44
International Freight	Normal	-2.43	-6.52	-6.52
	Transfer	-0.98	-1.39	-1.39

17. **Carbon Emissions.** Carbon emissions are monetarized by multiplying average carbon price in China and total emissions from air versus trains. For air passenger carbon emissions, the Bank used a calculator developed by the ICAO that estimates total emissions of specific flight routes after inputting KM Airport's passenger origin-destination distribution. The team also found out emissions of HSR passenger, freight train and air freight by multiplying average transport distance and unit emissions of these sub-components. Note that carbon emissions with- versus without-project are expressed in negative terms in the CBA. Overall, carbon emissions increase brought by more flights are relatively minor, compared to the time savings and foreign tourist income benefits. Besides, additional carbon emissions from the airport operations other than flights also appear to be minor, computed by the projected per passenger carbon emissions and passenger volume.

Table 10. Passenger Carbon Emissions (USD million)

Scenario	Type	2030	2039	2049
With-project	Air	-36.44	-37.16	-37.16
Without-project	Air	-6.71	-6.71	-6.71
	HSR	-20.15	-20.15	-20.15

Table 11. Freight Carbon Emissions (USD million)

Scenario	Type	2030	2039	2049
With-project	Air	-1.58	-2.20	-2.20
Without-project	Air	-0.03	-0.08	-0.08
	Regular freight trains	-1.03	-1.03	-1.03

Table 12. Carbon Emissions from Airport Operations (USD million)

Scenario	2030	2039	2049
With project	-0.66	-0.67	-0.67
Without project	-0.36	-0.36	-0.36

18. **Induced Benefits.** Induced benefits are associated with economic value brought by domestic induced passengers/freight. It is the net passenger consumption/freight value after deducting the production and transport costs. Data were collected by the FSR based on their field research.

Table 13. Induced Benefits (USD million)

Year	2030	2039	2049
Passenger	152.55	212.77	212.77
Freight	118.68	168.10	168.10

E. Economic Viability and Conclusion

19. Using a social discount rate of nine percent, the baseline ENPV is 4,965.84 USD million (RMB34,242.29 million). Baseline EIRR is about 16.53 percent, close to other similar airport projects by MDBs. Main factors affecting both EIRR and ENPV are passenger time savings, and foreign tourist income.

Table 14. Summary of EIRR and ENPV

EIRR	16.53%
ENPV (RMB million)	34264.32
ENPV (USD million)	4965.84

20. **Sensitivity Analysis.** Additionally, a standard sensitivity analysis was conducted to test the viability of the EIRR using a matrix of cost and passenger traffic percentage changes. EIRR appears to be resilient in most pessimistic scenarios (cost increase and traffic decrease). Even under the most pessimistic scenario when both the costs up by 15 percent and the passenger traffic down by 15 percent, EIRR still stays at 12.28 percent and ENPV remains at USD2,298.52 million. Besides, EIRR reduces to 16.10 percent if carbon price is adjusted to USD 36.3 per ton, which is the global social cost of carbon per unit.

Table 15. Sensitivity Analysis of EIRR

Sensitivity Analysis		**Passenger Traffic**				
		-15%	-10%	0%	10%	15%
Cost	-15%	16.57%	17.45%	19.13%	20.75%	21.53%
	-10%	15.71%	16.56%	18.19%	19.76%	20.52%
	0%	14.18%	14.99%	16.53%	18.01%	18.73%
	10%	12.87%	13.63%	15.10%	16.51%	17.19%
	15%	12.28%	13.02%	14.46%	15.83%	16.50%

Table 16. Sensitivity Analysis of ENPV (USD million)

Sensitivity Analysis		**Passenger Traffic**				
		-15%	-10%	0%	10%	15%
Cost	-15%	4289.52	4846.80	5961.35	7075.90	7633.17
	-10%	3957.69	4514.96	5629.51	6744.06	7301.34
	0%	3294.02	3851.29	4965.84	6080.39	6637.67
	10%	2630.35	3187.63	4302.17	5416.72	5974.00
	15%	2298.52	2855.79	3970.34	5084.89	5642.16

F. Financial Analysis

21. FIRR is positive at 0.22 percent. Net present value (NPV) is estimated at USD-4.02 billion (RMB-27.77 billion), according to FSR. Low FIRR and negative NPV are expected for airport

projects with long return period and significant capex, and these results indicate the Project is appropriate for MDB financing in public sector infrastructure projects.

22. Main operating revenue of the Project will be generated from aeronautical and non-aeronautical businesses. Aeronautical revenue includes charges and fees from flights (e.g. flight parking, landing/take-off), passenger services, and airport security check. Sources of non-aeronautical revenue include airport facilities lease, air freight services charges, parking, and franchise (e.g. advertisements). In the first year of full operation (2030), KM Airport is expected to generate USD1.0282 billion (RMB7.095 billion), largely covering the operating and maintenance costs (USD0.9596 billion or RMB6.621 billion) in the same year. Long-term projections in the FSR indicate that operating and maintenance costs can be covered by the operating revenue.

Annex 4: Paris Alignment Assessment

A. Alignment with the Mitigation Goal of the Paris Agreement

1. **Assessment of the alignment with the mitigation goal of the Paris Agreement.** The Bank has committed that it will fully align its operations with the goal of the Paris Agreement by mid-2023. While the Project[6] is intended to commence implementation ahead of this deadline it is important to consider capturing the potential climate considerations of the airport in accordance with the AIIB PA methodology under development. The analysis captured has followed a preliminary framework under consideration at AIIB, which itself follows the joint MDB methodology for PA. The PA analysis includes the Uniform Assessment Criteria (UC) and following Specific Assessment Criteria (SC).

- SC1: NDC Alignment;
- SC2: Country Long-term Strategy (LTS) Alignment;
- SC3: Sector Low-Carbon Pathway Consistency;
- SC4: Alternatives and Carbon Lock-in Tests; and
- SC5: Economic Viability Assessment.

2. A general screening of alignment with the mitigation goals of Paris Agreement indicates that: (i) **UC1**: The project/economic activity(ies) is not included in the universally "aligned list"; (ii) **UC2**: The project/economic activity(ies) are not included in the universally "non-aligned list".

3. **SC1: NDC Alignment.** In 2015, China set its nationally determined action objectives by 2030 under the UNFCCC. By the end of 2019, it had delivered on its 2020 climate action targets ahead of schedule. In 2020, China announced the updated NDC, namely strive to carbon dioxide peaking before 2030 and achieve carbon neutrality before 2060 (the Dual Carbon Goals), lower its carbon dioxide emissions per unit of GDP by over 65 percent from the 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 25 percent by 2030, increase the forest stock by six billion m^3 from the 2005 level and its total installed capacity of wind and solar power to over 1.2 billion kw by 2030.

4. China's NDC does not rule out any airport projects. The Project activities are consistent with goals of China NDC which aim at reducing carbon emissions from the transportation sector, through optimizing efficiency of the transportation network (including civil aviation), promoting clean fuel and implementing smart technologies to improve network operation while reducing carbon emissions intensity.

5. **SC2: Country LTS Alignment.** A "1+N" policy framework was put in place to achieve the Dual Carbon Goals. This policy framework provides a foundation for China's long-term Low-Carbon strategy by outlining key targets and measures in a wide range of industries and sectors of society. The framework consists of one main policy document acting the country's overarching guiding principles, representing the "1", namely "The *Working Guidance for Carbon Dioxide Peaking and Carbon Neutrality in Full and Faithful Implementation of the New Development Philosophy" ("Working Guidance")* and "*The Action Plan for Carbon Dioxide Peaking by 2030"*

[6] The Project in this annex refers to the entire MEP (the Project).

("Action Plan"), and a series of auxiliary policy documents targeting specific industries, fields, and goals, representing the "N". The "N" policies will include implementation plans for carbon peaking in the fields of energy, industry, transportation, urban and rural construction and others, as well as supporting measures on science and technology, statistical accounting, safeguard policies, financing, pricing methods and others. This full-fledged policy framework ensures the targets are incorporated into the wide spectrum of national economic and social development.

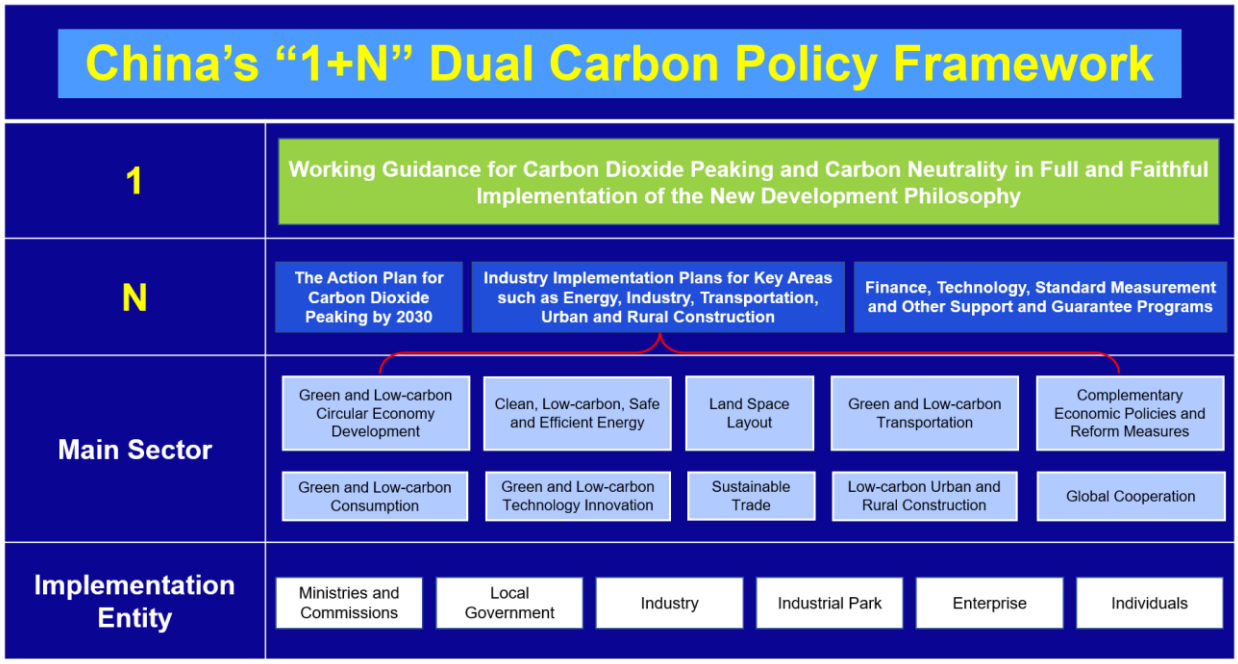
6. As part of framework, transportation sector plays an important role for achieving the Dual Carbon Goals. The "*Working Guidance"* calls for the acceleration of a Low-Carbon transportation system, through optimizing transport structure, promoting energy-saving and Low-Carbon transportation fleets and advocating the Low-Carbon travel. The *"Action Plan"* highlights the importance of formation of green and Low-Carbon transport structure and ensuring that the growth of carbon emissions in the transport sector is within a reasonable range.

7. *"Implementation Note of the Working Guidance"* have been developed and jointly issued by the Ministry of Transport, National Railway Administration of China, Civil Aviation Administration of China and State Post Bureau, which specifies five major tasks in the green transportation development: (i) accelerate the transport structure optimization to promote efficient and green transport system; such as increasing the share of waterways in the entire integrated transportation system and increasing the use of HSRs in freight transportation; (ii) promote energy-saving and Low-Carbon transport fleets and vehicle, such as increasing the percentage of electrified vehicle on road, encouraging the using of LNG in ships, and actively promoting the application of SAF in aviation, constantly reduce the energy consumption and carbon intensity of transportation; (iii) advocate the green Low-Carbon travel, particularly in urban areas; (iv) build green transport infrastructure, such as road, port, airport and logistic hubs, integrate the energy saving and green concept in the infrastructure development; and (v) promote the managerial capacity and mechanism to support the Low-Carbon transition in transport sector.

8. The Project is not inconsistent with the China's LTS or other similar long-term national economy-wide, sectoral, or regional low-GHG strategies. Neither China's LTS nor the transportation sector long-term strategy has any policy indicating measures of restricting growth of demand to achieve the decarbonization, instead, policies encourage, through structure reforming, technical innovation, overarching coordination to improve transport efficiency and meet country's continuously growing demand in transportation and support the social and economy development.

9. In addition, as mentioned in aforementioned sections, the KM Airport expansion project has been identified as one of the national priority major projects in China's 14th Five Year Plan, as well as in the National ***Comprehensive Three-Dimension Transportation Network Plan (2021).*** Both of these two are national overarching strategy policies developed which has already considered the national green development plan and dual carbon goals, which can prove the consistency of the project with the national strategies.

Figure 1. China's "1+N" Dual Carbon Policy Framework



10. **SC3: Sector Low-Carbon Pathway Consistency**.

11. Aviation Carbon Emission. Aviation emissions represent a small share of global CO_2 emissions, only two to three percent of the global total. Within aviation, IPCC estimates that airport emissions account for less than five percent. Although the percentage is very low, airport emissions are a complex system: in addition to aircraft movement emissions, electricity (heat/air conditioner) emissions account for the significant proportion of airport emissions, followed by ground support vehicles. Looking from an energy consumption angle, aviation kerosene that powers aircraft movements account for 94 percent of the energy consumption of the entire aviation industry.

12. China's current carbon emissions are estimated at roughly near 10 billion tons per year, roughly around 45 percent is from power generation and heating, 40 percent from industrial emissions and 10 percent from transportation sector[7]. Within transportation sector, civil aviation emissions (domestic and international) account for only eight percent. Comparing with EU same year data, EU civil aviation emissions (domestic and international) account for almost 15 percent of their transportation sector emissions[8].

13. Aviation emissions are classified into three scopes. Scope 1 and 2 fall under the direct control and influence of the airport, and depend on the energy use of owned stationary (e.g. terminal) and mobile (e.g. buses). Scope 3 emissions are beyond the direct control of the airport and related to emissions from third party users of the airport – airlines, ground-handlers, tenants, passengers and staff.

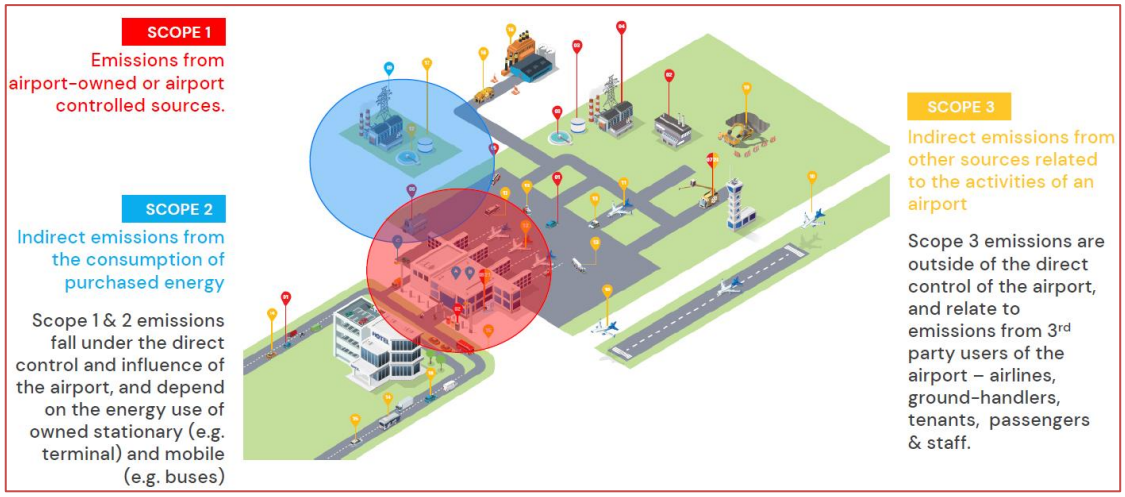
- Scope 1: emissions from airport-owned or controlled resources;

[7] Zhongli Ding, In-Depth Understanding of the Basic Logic and Technical Requirements of Carbon Neutrality, Oct. 22, 2022.
[8] China Aviation and Climate Change: vision and strategy.

- Scope 2: indirect emissions from the consumption of purchased energy by the airport operator; and

- Scope 3: indirect emissions from other sources related to the activities of an airport, such as air traffic movements (ATMs) in airport area[9], passenger travel to / from the airport ("Pax access"), and those of third-party contractors/suppliers.

Figure 2. Overview of Scopes and Emissions (ACI)



14. China National Action Plan. The air traffic emission can be divided into domestic emission (around 33 percent globally) and international emissions (around 67 percent globally). Domestic aviation emissions are the responsibility of the respective nations, while ICAO are responsible for the reducing of international aviation emissions. China's international emission is around 27 percent much lower than the worldwide average[10].

15. China is in active discussion with ICAO in developing the reasonable mechanism of the CORSIA. The CCER has been approved by the ICAO Council as one of eligible Emissions Unit Programs to supply to CORSIA. China has been providing the international emission data to ICAO as requested and will fully participate CORSIA by 2027. Separately, China has submitted its first National Action Plan to ICAO in Oct. 2012, as one of the earliest members, and subsequently update it every three years. The latest National Action Plan was submitted in Nov. 2022.

16. The domestic emissions have been taken into consideration in China's dual Carbon Goal roadmap. The *2022 China Civil Aviation Green Development Policy and Action* has outlined the targets, plans and actions for green development of the aviation sector. Actions and measures include optimizing fleet structure (younger fleet); applying smart aircraft maintenance measures (aircraft cleaning robots); improving operations through airspace optimization; better routings and efficient taxiing, and enhancing sustainability with initiatives such as green building; deployment of renewable energy and SAF. It also sets out the main goals for the near and long-term, include reaching 0.293 kg Jet fuel/RTK, 0.886 kg CO_2/RTK, and 50,000 tons accumulative consumption of SAF by 2025; building a more mature system of green Low-Carbon circular development, realizing carbon neutral growth for flight emissions, gradually peaking airport emissions,

[9] The LTO cycle to a height of 3,000 feet. This includes emissions generated during approach, taxi and ground idle (in), taxi and ground idle (out), take off and climb.
[10] China Aviation and Climate Change: vision and strategy.

conducting more international cooperation on green aviation and growing to be an important contributor to global international sustainable aviation by 2035.

Table 1.1 Green development targets of China's civil aviation by 2025

No.	Goal	Target Value
1	Ton-kilometer fuel consumption (kg/unit: Jet fuel/RTK)	0.293
2	Ton-kilometer CO_2 emissions (kg/unit: CO_2/RTK)	0.886
3	Accumulative SAF consumption (ton)	50,000
4	Energy consumption per passenger at the airport (kg standard coal)	0.853
5	Airport CO_2 emissions per passenger (kg)	0.43
6	Airport water consumption per passenger (liter)	60
7	Proportion of electric vehicles in the airport (%)	25
8	Proportion of airport renewable energy consumption (%)	5

17. Data show that in 2019, China's civil aviation fuel consumption per ton kilometer was 0.285 kg, the energy consumption and CO_2 emissions per passenger decreased by 15.8 percent and 43.2 percent respectively, compared with the average level at the end of the 12th Five-Year Plan Period (2013-2015). In 2021, fuel consumption of civil aviation per ton kilometer was 0.309 kg, with accumulative reduction of 400million tons of CO_2 emissions compared with 2000; airport energy consumption per passenger increased by about 2.3 percent compared with the average level of 2013-2015, and CO_2 emissions per passenger decreased by 22.1 percent.[11]

18. **SC4: Alternatives and Carbon Lock-in Tests.** The Project demonstrates low risk of carbon lock-in and does not prevent future development of more Paris-aligned activities.

19. **SC4a**: **Alternative Test**. The potential for displacement of economically viable lower carbon alternatives is assessed. KM Airport is an international airport and there is no alternative transport mode to provide the comparative service to the international passengers. For domestic passengers, the possible economically viable lower carbon alternative mode could be the HSR.

20. The Bank has assessed the development of the HSR network and is of the opinion that it does not have much impact to this project for following reasons: (i) China Ministry of Transport published Comprehensive Three-Dimension Transportation Network Plan in 2021, which provides overarching planning and coordination for the different transport modes from transport network perspective. KM Airport has been prioritized as an international hub airport with its unique position; (ii) given the location and terrain characteristics of Yunnan province, it is very costly for the rail network development in Yunnan; (iii) the average distance per trip for HSR in China is around 300km and the same for aviation is around 1,200km, which reflects that, in China, HSR and aviation are serving different types of clients and there are not significant competition between these two; (iv) HSR is China has passed its boosting development stage. Most of the major trunk links and rail corridors has already been constructed and operational. The current priority is lying with the last mile linkage. Therefore, most of competition effect from HSR to aviation has already appeared in the market.

21. Nonetheless, the competition in short distance routes (less than 1,000km, or less than 4.5-hour HSR trip) does exist, particularly travels within the province (e.g. from Kunming to Dali and Lijiang) as well as travel to the major cities of neighboring provinces (e.g. from Kunming to

[11] China State Action Plan (2022)

Chongqing, Chengdu, Guiyang and Nanning). However, the long-distance rout travel (over 4.5 hours by HSR), which makes up the major part (around 75 percent) of the traffic in KM Airport, is less effected by HSR. In general, the expansion of the airport is to meet the increasing demand of air travelling customers and will not crowd out other green options with comparable service. The divert traffic has been analyzed and considered in the forecasted traffic and reflected in the economic analysis. Overall, the potential for displacement of HSR of this project is low.

22. SC4b: Lock-in Test. Sources of emissions from the Project include Scope 1 and 2 emissions from airport and ground operations within YAG's control, and Scope 3 emissions from ATMs, passenger travel to / from the airport ("Pax access"), and those of third-party contractors/suppliers. This assessment is conducted against the contributors to emissions: (i) Material Scope 1 and 2 emissions sources of the Airport, (ii) Scope 3 emissions associated with passenger access to the Airport, and (iii) Scope 3 emissions related to ATMs.

(i) *Airport Emissions (Scope 1 and 2)*. KM Airport has been awarded in 2022 the "Three Stars Dual Carbon Airport" certificate, benchmarking to ACA Level 3, recognizing its efforts toward building a green airport: compared to traditional terminals, KM terminal buildings can achieve 27.4 percent energy saving of air-conditioning in summer, eight percent energy saving in lighting; with the upgraded water pipeline network and operation system, the terminal can achieve 27 percent water savings from toilet usage and 12.4 percent from gardening. The design of KM Airport expansion is based on the "Four Characteristics" framework, and highlights energy conservation and efficiency, carbon reduction, environmentally friendly and operations efficiency. In recent years, KM Airport has been promoting the following practices and measures for a greener airport: application of 400Hz ground power units to replace Auxiliary Power Unit (APU), electric vehicles for ground operations, and initiatives to integrate renewable energy, sustainable water management as well as waste and resource management. As of 2022, KM Airport has achieved 100 Percent APU replacement, almost 20 percent EV in airside, and an overall emission of 50,000 ton/year for Scope 1 and 2 together.

(ii) *Passenger access emissions (Scope 3).* Passenger access emissions are an important share of emissions and are anticipated to increase. YAG has proactively engaged with municipality, urban planner, travel agencies and other stakeholders for a greener and more efficient access to the airport. The new GTC to be constructed will provide a seamless multi-model mobility that connects the airport with one electrified HSR (Chongqing to Kunming), three city metro lines (Line 6, Line 9, and Line Chongming) and city road network. To lower possible carbon footprints, KM Airport engages in campaign to promote electric vehicles (EVs) and ensures that electrical charging stations are available. Emissions associated with road fleet emissions (vehicles and buses) are anticipated to reduce over time with road fleet decarbonization. China's electrification of road fleets is well progressed. By end of 2021, China's EVs on road accounted for more than 50 percent of the total number of the world. The percentage of electric buses made up over 66 percent of the city buses in operation. Study on electric vehicle penetration in China suggests that conservatively EVs would account for 35 percent (2030) and 51 percent (2060) of the total number of vehicles. Alongside grid decarbonization, this will lead to significant emissions reductions. The availability of Low-Carbon public transport and a clear pathway for passenger access emissions to be reduced, indicates a low-risk of carbon lock-in.

(iii) *Air Traffic Movement (ATM) emissions (Scope 3).* The vast majority of emissions are Scope 3 emissions associated with aircraft movements – more specifically speaking, the Landing Take-Off (LTO) cycle of aircraft movements to a height of 3,000 feet. As demand grows, Scope 3 emissions will also increase. However, the expansion of airport capacity does not drive overall traffic growth – rather, demand is driven primarily by population, wealth effects and the cost of flying. Especially, before the pandemic, the traffic at KM Airport has already exceeded its designed capacity, the expansion is to resolve the bottleneck of the existing infrastructure. In the absence of airport capacity expansion, some of the demand would spread to less busy times of year or shift to other airports. The latter relies upon other airports in similar destinations having the capacity to absorb the demand. Without the suitable capacity, it would lead to congested airports with inefficiencies, delays and reduced service and higher unit emissions. Whilst constraining demand through direct capacity restrictions are theoretically part of the measures for aligning aviation with goals of the Paris Agreement, no guiding policy or framework reviewed by the Bank has indicated this is a priority measure. Instead, decarbonization roadmaps allow for growth with improvement measures, for example, energy efficiency of aircraft and operations, as well as fuel switching through SAFs are main measures prioritized to align with the goals of the Paris Agreement.

(iv) The age of China's aircraft fleet, five to six years, is much younger than global average, comparing to 11 to 12 years in Europe and 14 years above in North American. Younger fleets perform better with higher efficiency and less emissions. Although hydrogen aircrafts are expected to leapfrog the sector's Low-Carbon pathway, its mass-production is estimated only achievable by 2045. Therefore, the aviation sector decarbonization will have to rely largely on the application of SAF in the near term. International Air Transport Association estimates that SAF could contribute around 65 percent of the reduction in emissions needed by aviation to reach net-zero in 2050. As for airlines, they are also highly motivated to improve fuel consumption efficiency given that fuel cost is the largest operating cost item that strains the profitability of this low-margin industry. The challenge for rolling out SAF is how to upscale production of SAF at a sufficient pace and economical prices. Given its strong global public goods feature and as an area that needs multi-stakeholders' support in strategic planning, MDBs are in a position to play an active role in promoting this promising decarbonization pathway. Through the engagement in the KM Airport project, the Bank has engaged with national regulation authorities, industry operators and thinktanks on aviation decarbonization. It is considered to further collaborate to promote the decarbonization, including advocating of SAF application.

23. The direct sub-operations identified above associated with Scope 1 and 2 emissions (buildings and associated infrastructure) demonstrate low risk of carbon lock-in. YAG proactively maps, reduces, optimizes and offsets Scope 1 and 2 emissions. Passenger access Scope 3 emissions are mostly related to vehicle fleet emissions. The airport does not prevent alternative fuel vehicles to access the site (e.g. EVs), and on the contrary expands charging infrastructure to allow a higher penetration of green mobility. Alternative Low-Carbon passenger access such as electrified HSR and metro lines have been considered and integrated in the design of the airport expansion.

24. The airport as a node for significant Scope 3 emissions related to aircraft emissions is also assessed. As explained in the aforementioned sections, the main route for deep decarbonization

is SAFs. In this respect, two aspects are considered, (i) the readiness of the airport for SAFs; and (2) likelihood of SAF deployment at the necessary scale. SAF is chemically identical to kerosene, and as such does not require new engine / aircraft technology, it therefore can be easily substitute as a drop-in replacement. In terms of readiness for SAFs, it is technically feasible for the fuel farms at the airport to be utilized for use with SAFs, with investment required to achieve this being limited. Whilst it is technically feasible, significant mobilization by a variety of stakeholders is needed for SAFs to be deployed at scale. According to ICAOs Sustainable Aviation Fuel Guide (2017), the main stakeholders include government, aviation equipment manufacturers, fuel producers, and aviation fuel distributors. The economic viability of such fuels will be ultimately driven by government policy, either through increasing the cost of carbon, and or supporting the development of SAF industry through direct financial support and implementing regulatory requirements (such as minimum blending requirements).

25. **SC5: Economic Viability Test**. The operations of the Project will remain economically viable when considering GHG emissions.

26. According to the Corban Audit Report and other information provided by KM airport, the current Scope 1 and 2 carbon emissions are estimated by the airport as around 50 thousand tons per year, which are served as baseline annual Scope 1 and 2 emissions during the construction period 2023-2025. From 2026, total carbon emissions are calculated by multiplying projected total passenger throughput and per passenger Scope 1 and 2 carbon emissions. As part of the Results Monitoring Framework of the Airport, per passenger Scope 1 and 2 carbon emissions are projected to be 1.16 kg per person during 2026-2029 and lowered to 1.07 kg per person from 2030. As a result, additional Scope 1 and 2 carbon emissions are projected to be 0.04 million tons by 2030 per year, compared to without-project scenario. Throughout the Project cycle (2023-2049), total additional Scope 1 and 2 carbon emissions brought by the Project are estimated at 1.03 million tons. The impact on EIRR is negligible.

27. The emissions from the aircraft movements considered in the economic viability test is a much broader category of emission than Scope 3 defined by ACI. It is estimated by calculating the total emissions released from passenger/freight flights, including emissions from flying per route, landing and taxiing at the Airport, while the Scope 3 under ACI includes only LTO cycle of aircraft movements to a height of 3,000 feet. For emissions released during flying, the Bank calculated emissions per flight route connecting Kunming to its major destinations, then multiplying to passenger/freight volume of each destination. Even so, the emissions of Scope 3 (in broader definition) appear to have insignificant impact on the economic viability of the Project in terms of EIRR. Throughout the Project cycle, total additional carbon emissions from the aircraft movement are about 37.30 million tons, compared to without-project scenario. By 2030, annual Scope 3 additional carbon emissions (in broader definition) are expected to be 1.53 million tons[12]. Adding Scope 3 emissions (in broader definition) would reduce EIRR by only 0.09 percent point, which is minor given baseline EIRR is 16.53 percent.

28. It is concluded that the Project is assessed as aligned with Mitigation Goals of the Paris Agreement (BB1).

[12] Roughly two percent of China's total aviation emission. It is a reasonable percentage given that KM Airport's annual volume of passenger throughput is 3.7 percent of national total.

B. Alignment with the Adaptation Goal of the Paris Agreement

29. **Establishment of Climate Risk and Vulnerability Context**. The screening of the climate change risk has been carried out through the Aware tool with the support from Climate Team of Strategy, Policy and Budget department. The Climate Change Risk is assessed as medium, with flooding being the most significant climate hazard in the project location, followed by precipitation increase, wind speed increase and temperature increase. The ESIA has also carried out a climate change risk assessment using a range of relevant climate data from World Bank Climate Change Knowledge Portal (containing the climate data assessed by the IPCC WG1 AR6 report). The scenarios used in the ESIA Climate Risk Assessment is high emissions scenario (SSP5-8.5) for the mid-term (2050s) and long-term (2080s) time horizons. More details on the assessment are available in the ESIA report. Given this is an expansion airport, there are historical data to reflect the climate risk and potential vulnerability related to the airport construction and operations. The project FSR also included a comprehensive climate risk analysis following the relevant specification and standards. It is a part of the overall engineering risk assessment in the FSR used as inputs to determine the project designs. It has been reviewed by the Civil Aviation Technical Consultant and assessed as acceptable.

30. **Definition of the Climate Adaptation and Resilience Measure.** The risk of flood and increased precipitation will be significantly mitigated by the high terrain of the project location, which is on a high ground at an average altitude of 2,095 meters, higher than the vicinity around the airport (2,060 meters). Comprehensive and climate-resilient drainage system and structures has been integrated into the design to further enhance the project's resilience to flood.

31. The project will adopt smart runway system, through pre-embed sensors and equipment such as intelligent settlement monitoring, vibrating fibers, sensing network of pavement structure state and load, surface wetness sensing, to collect and monitor the real-time performance information of the runway and taxiway in operations, with the focus on the settlement, state of structures, state of the slippery. This smart runway system will effectively enhance the monitoring and warning of the potential risk of climate change, and impact assessment. The system will support and guide the operation and maintenance strategy and planning, and ensure the climate resilience of the runway and its linked assets.

32. Wind speed risk have been mitigated through the design of the runway layout of the airport. As an operational airport, the remaining risk is assessed as low. Fog is another climate risk to the airport, which will directly affect the movement of the aircraft, particularly affect the approaching. There is an about five percent probability of low visibility weather in the project location every year, the project will install the class I Instrument Landing System to Runway E2 to ensure the safe approaching of aircrafts in such low visible conditions.

33. The project is located in the plateau area, where ultraviolet light is strong. Ultraviolet light will accelerate the aging of organic macromolecular materials and reduce their service life. The design has taken these into consideration and has reduced the usage (or percentage) of easy aging materials such as asphalt and rubber in the construction of runway. In addition to that, long-life concrete pavement technology is considered to be adopted in the expansion in pilot based. The technology will improve the durability and resilience of the pavement throughout its entire life cycle through increasing the surface layer thickness and strengthen the bearing capacity of the

surface. It helps enhance the climate resilience of pavement and reduce the maintenance and repairing cycle of pavement.

34. **Assessment of Inconsistency with a National/Broad Context for Climate Resilience**. All activities under the project are not inconsistent with China's national policies and strategies, or sector or provincial priorities for climate adaptation and resilience. In Jun. 2022, China launched the National Strategy for Climate Change Adaptation 2035, which sets out the policy guidance and priorities for climate change adaptation through to 2035. The Adaptation Strategy 2035 highlights the monitoring, early warning, and risk management of climate change. The Adaptation Strategy 2035 lays down the following basic principle: active adaptation and prevention first, science-based, systematic and coordinated adaptation featuring priorities to prevention, focus on key areas, joint efforts, and following the law of nature. Regarding major infrastructure projects, the Adaptation Strategy 2035 emphasizes the importance of the application of technology in the improving the risk monitoring and early-warning; integration of the climate adaptation into the design and construction, and the advocating of the entire life cycle concept in infrastructure development. The Infratech, monitoring and whole life cycle concepts have been duly considered and integrated into this project.

35. Based on the consideration of the three key requirements for alignment, it is concluded that the Project is assessed as aligned with Adaptation Goal of the Paris Agreement (BB2).

Annex 5: Assessment of KM Airport's Green Airport Status[13]

1. **Introduction and Objective.** This assessment reviews KM Airport's Green Airport status which includes its current environmental performance, the design of a gateway airport under its expansion plan, and its Environmental and Carbon Management Systems. The objectives of the study are to: (i) develop an evaluation methodology that are aligned with international standards and China's national goals and directives; (ii) provide an assessment of the current standing of KM's Green Airport development including a SWOT analysis; and (iii) recommend action plans tailored for KM Airport to enhance its green development plan so that it can become a good model/example of a sustainable, Low-Carbon and green airport development in China.

2. The scope of the study covers three areas of environmental sustainability – (A) Energy and Emissions, (B) Water and Effluents and (C) Waste Management, with four sub-topics under (A) Energy and Emissions: (A1) Green Buildings, (A2) Energy Efficiency, (A3) Renewable Energy and (A4) Clean Transportation. These focus areas are aligned with the Airport Council International (ACI)'s Environmental Sustainability Framework under Its Sustainability Strategy for Airports Worldwide and China's Four Characteristics Airport Development Guideline.

3. Methodology. The evaluation methodology uses the principles of Plan-Do-Check-Act (PDCA) in International Organization Standards (ISO) management system standards (e.g. ISO 14001 on environmental management system) as the assessment structure. The Airport Carbon Accreditation (ACA) criteria were used as references to develop the criteria for each aspect of PDCA. Using a four-level rating system (Best in class / Good / Average / Can be Improved), the "Green Airport" performance of KM Airport is rated by benchmarking against 4 reference airports – (i) Hong Kong International Airport; (ii) Christchurch International Airport; (iii) Aeroporti di Rome (ADR); and (iv) Changi Airport.

4. ISO – PDCA Approach as "Backbone" of Evaluation. Many airports worldwide have established an environmental management system (EMS) in accordance with ISO 14001. ISO 14001 is established based on the framework of Plan-Do-Check-Act that allows for continued improvement to achieve greater effectiveness over the long-term which is suitable for the nature of climate change mitigation strategies. Hence, the assessment has adopted the PDCA process as the backbone of the assessment approach to guide the review in each aspect of KM Airport's green airport status. Figure 1 shows how the PDCA concept is adapted into the assessment.

Figure 1. Evaluation Criteria following PDCA improvement cycle concept

[13] Changi Airport Consultants has been engaged by the Bank to conduct a review on KM Airport's Green Airport status.

5. Incorporate Airport Carbon Accreditation (ACA) evaluation criteria into PDCA. The ACA is the only institutionally recognized and independent carbon management certification program for airports. Besides ISO PDCA approach, the assessment also referred to ACA to develop the evaluation criteria for this study. Its criteria that assess the various aspects of an airport's carbon management plan can also be classified into (P)-Plan, (D)-Do and (C)-Check while the different certification levels of ACA represent the continuous improvement (i.e. Act of PDCA) of the measures under Plan-Do-Check. Figure 2 below shows how this assessment has mapped ACA criteria into the PDCA assessment approach.

Figure 2. Mapping of ACA criteria in accordance with PDCA assessment approach

Levels of ACA	PLAN		DO	CHECK	ACT
	A1. Goals, Strategies and Governance	A2. Communication & Engagement	B. Measures & Action Plans	C. Monitoring, measurement, analysis & report	
1. Mapping Footprint measurement				(C1) Report Scope 1 & 2 emissions	Continuous Improvement
2. Reduction Carbon Management	(A1) Provide evidence of effective carbon management procedures e.g. carbon reduction policy, senior committee responsible, carbon reduction targets		(B1) Show reduction in the carbon footprint in latest year with specific carbon management measures	(C1) + (C2) Monitoring system of fuel & energy use	
3. Optimisation Third party engagement in carbon footprint	(A1)	(D1) Evidence of engagement with airport partners to reduce wider airport-based carbon emissions	(B1)	(C1)+(C2)+(C3) Report Scope 3 emissions	
4. Neutrality Carbon neutrality for direct emissions by offsetting	(A1)	(D1)	(B1)+(B3) Offset Scope 1 & 2 emissions and business travel emissions with internationally recognised offsets.	(C1)+(C2)+(C3)	
5. Transformation Transforming airport operations and those of its business partners to achieve absolute emissions reductions	(A1)+(A5) Set out a policy commitment to absolute emissions reduction. +(A6) Formulate a long-term absolute carbon reduction target, amount and date aligned with the IPCC 1.5°C or 2°C pathways	(D1)+(D5) Develop a Stakeholder Partnership Plan - third parties to reduce their emissions, either through their own reduction plans or through measures initiated by the airport operator	(B1)+(B5) Develop a Carbon Management Plan to achieve the target – include emission trajectory and implementation.	(C1)+(C2)+(C3)	
6. Transition Compensation for residual emissions with reliable offsets	(A1)+(A5)+(6)	(D1)+(D5)	(B1)+(B3)+(B5	(C1)+(C2)+(C3)	

6. Develop a rating system by referencing other green airports worldwide. With an evaluation framework based on ISO PDCA and ACA evaluation criteria, a four-level rating system (Best in class / Good / Average / Can be Improved) was developed to rank the performance of KM Airport in each aspect under PDCA assessment framework. To conduct the ranking, some form of benchmarking against its peers is required. As such, three leaders recognized for their efforts in green airport development were identified: (i) Hong Kong International Airport; (ii) Christchurch Airport; and (iii) Aeroporti di Roma as "Reference Airports", alongside Changi Airport.

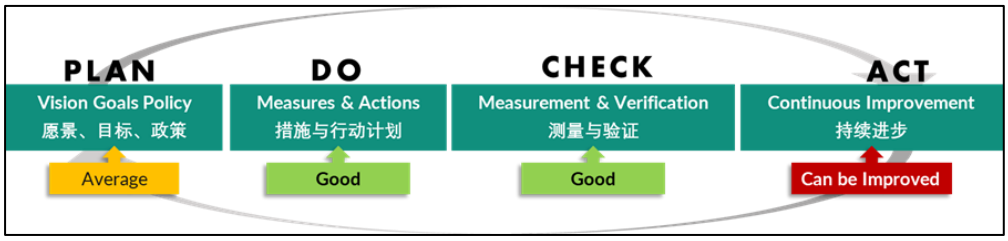
7. They are selected based on the following criteria: (i) Attained highest ACA Level 4 – Transformation or 4+ - Transition (i.e. the airport has aligned its carbon management with global climate goals and compensated for the remaining residual emissions with high quality carbon credits); (ii) Have received green financing (i.e. they have established environmental or carbon management systems that are audited by a third party and approved by financial institutions); and (iii) Have relevance to KM Airport. Table 1 summarizes the background information of the four reference airports.

Table 1. Background information of the four reference airports used for benchmarking against KM Airport

Airport	Hong Kong International Airport	Changi Airport	Christchurch International airport	Aeroporti di Roma
Region / Country	Asia/China	Asia/ Singapore	Pacific/ New Zealand	Europe/Italy
Airport category	> 50 million	> 50 million	5-15 million	15-50 million
Selection rationale	May be meeting similar regulatory requirements or national goals/directives. Similar climatic region.	-- (Consultant)	Smaller airport capacity to serve as good reference for the airport expansion.	Similar capacity. Obtained highest level of ACA accreditation
ACA Level (1-4+) with 4+ being the highest	Level 4 - Transformation	Level 3 - Optimisation	Level 4 - Transformation	Level 4+ - Transition (Highest level)
Green Airport awards	ACI Green Airport Recognition 2022 - Platinum level	ACI Green Airport Recognition 2019 – Green Airport Design	ACI Green Airport Recognition 2022 - Platinum level	--
Sustainability Goals	Reduce carbon emissions by 55% by 2035, compared to 2018 levels Net-zero carbon emissions by 2050.	Zero carbon growth by FY2030, compared to FY2018 levels Net-zero carbon emissions by 2050	Net-zero carbon emissions by 2050.	1. Decrease Scope 1 and 2 emissions (absolute emissions) by 53% by 2027 from 2019 levels. 2. Decrease and scope 3 emissions (in terms carbon emissions per passengers) by 10% by 2027 and by 30% by 2030, from 2019 levels. 3. Zero waste by 2030. 4. 60% of its airport infrastructures to be LEEDS (US) or BREEAM (UK/EU) certified.
Any external verification / Second Party Opinion?	Yes – Sustainalytics, ACI ACA		Yes – Sustainalytics, ACI ACA	Yes – Sustainalytics, ACI ACA

8. **Summary of Findings.** Based on the evaluation methodology developed using a combination of (i) ISO PDCA framework; (ii) evaluation criteria of ACA; and (iii) examples from reference airports, Figure 3 summarizes KM Airport's performance in each aspect of its green airport development plan. The following paragraphs discusses the strengths, weaknesses, opportunities, and threats in its green development plan.

Figure 3. Summary of performance rating of KM Airport



9. Strengths. There is strong push and support from the Chinese government for sustainability in the airports with clear five-year development plans and guidelines, which KM Airport has been adhering to. A strong energy management system has been set up within KM Airport with leadership oversight, governance and working structures, and communication and engagement strategies that are following ISO 50001 standard. In the design and construction of its new gateway airport, KM Airport has also incorporated best practices adopted by airports worldwide. These designs help ensure that the carbon footprint and environmental impacts of airport operations are reduced right from the start. These efforts have laid a good foundation for KM Airport to advance its green airport development journey to become a leader and role model of a sustainable, Low-Carbon and smart airport in China.

10. Weakness. The current green efforts put forth by KM Airport focus on managing the energy demand e.g. through upgrading airport assets to more efficient ones and putting in place higher efficiency operational controls. However, there is limit to the amount of carbon reduction that can be achieved through managing the energy demand. To drastically reduce its carbon emissions, KM Airport will need to increase the portion of renewable alternatives in its current energy sources, including purchasing the renewable energy certificates.

11. Furthermore, there is a wide range of energy-consuming equipment and systems in the airport. Beyond the key energy-consuming systems like air-condition and lighting systems, KM Airport can investigate smaller systems such as baggage handling systems, passenger loading bridges and information technology equipment / servers which may collectively take up a significant amount of the energy use.

12. Lastly, efforts are mainly directed to the "technical aspect" of green initiatives. As airports are complex ecosystems with interrelationship between different system owners, airport community, business partners and passengers, enablers will be required to achieve continual improvement and have wider impact on the air hub. The enablers can be in the form of internal policies (e.g. green procurement policy), change in planning strategies and transformation of upstream and downstream stakeholders. Having a wider outreach, engagement and collaboration approach with the airport community, business partners and passengers may also be required for effective management of carbon emissions in the airport. Strategies for developing such enablers are currently weaker in KM Airport's green airport development approach.

13. Opportunities. To be a leader in green airport development, KM Airport will need to go beyond adhering to the targets and directives provided by the authorities. KM Airport already has a good start with its well-established energy management system, metering network and green airport design, they can expand on these shorter-term green development plans and chart its own pathway to meet longer-term carbon targets. KM Airport can engage external expertise to complement in-house expertise and identify potential decarbonization pathways that are relevant to Kunming's context. With these pathways defined, a bottom-up approach can be used to establish longer-term targets.

14. Threats. To be a leader in the green airport development will generally require the airport to be an early adopter of new green technologies and initiatives. Often, these technologies and initiatives may not reach commercial viability yet. KM Airport would need to be cautious of compromising its business competitiveness because of higher cost but at the same time, it cannot afford to take a backseat while other airports have advanced forward in sustainability.

15. The long-term decarbonization pathway of the airport is highly dependent on the availability of local natural renewable or clean energy. An alternative pathway that KM Airport could consider is to tap on offsite renewable energy (e.g. purchasing of renewable energy certificates and carbon offsets from renewable projects located in other parts of China) to close the gap with its emissions targets. However, that would require conscientious efforts to select credible projects and to balance with considerable onsite efforts to reduce its emissions to avoid perceptions of "greenwashing".

16. Future global black swan events (e.g. another pandemic) could affect international aviation and weaken the airport's ability to invest in sustainability and derail the advancement made

17. **Recommendations**. Overall, KM Airport is well-positioned to advance its green airport journey to the next level which will involve adopting a long-term and more holistic view on carbon management. It can harness its strengths to bridge the gaps identified. There will be threats and challenges in this journey. In this study, four reference airports have been assessed, and similarities across the green efforts as well as the Environmental & Carbon Management Systems of these airports have been identified. Drawing examples from them, a list of tailored recommendations for KM Airport has been prepared.

18. The recommendations can be classified into three key areas: (i) Long term targets; (ii) Long term decarbonization pathways; and (iii) Other enablers.

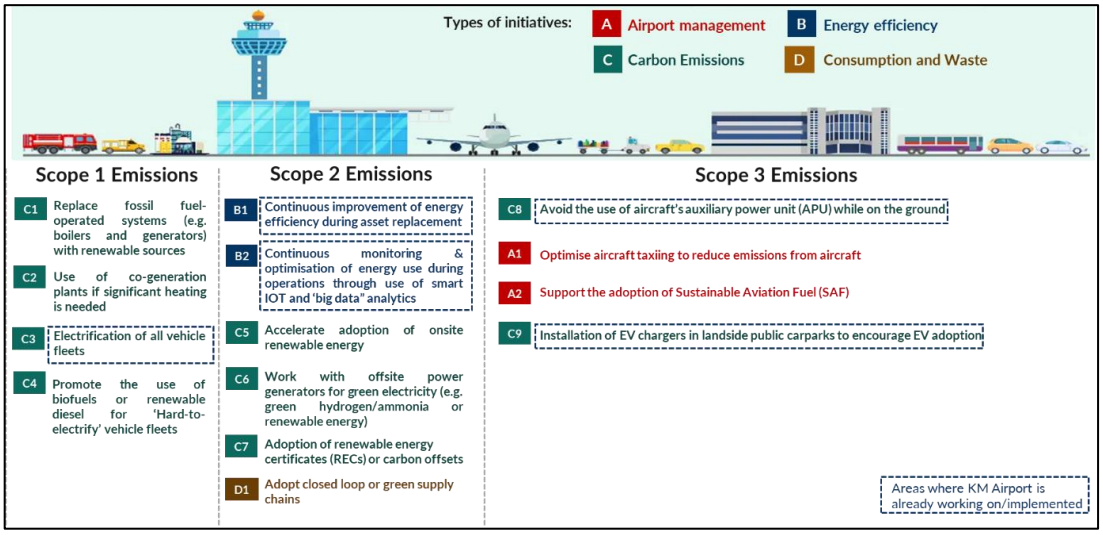
1) **Establish long-term targets that tackle Scope 1, 2 and 3 emissions**: Mid-term targets can focus on Scope 1 and 2 emissions first. Examples of the targets established by the reference airports are provided below:

Table 2. Examples of targets established by the reference airports

Airport:	Changi Airport	Hong Kong International Airport (HKIA)	Christchurch Airport	Aeroporti di Roma
Mid-term goals (2030/2040)	Maintain carbon emission levels at FY18/19 levels by FY30/31	Reduce carbon emissions by 55% by 2035, compared to 2018 levels	Science-based target of 84% reduction in Scope 1 emissions by 2035 (Achieved in 2021 with 90% reduction)	1. Decrease Scope 1 and 2 emissions (absolute emissions) by 53% by 2027 from 2019 levels. 2. Decrease and scope 3 emissions (in terms carbon emissions per passengers) by 10% by 2027 and by 30% by 2030, from 2019 levels. 3. Zero waste by 2030. 4. 60% of its airport infrastructures to be LEED (US) or BREEAM (Building Research Establishment Environmental Assessment Method) (UK/EU) certified by 2030.
Long-term goals (2050 and beyond)	Aspire to meet Net Zero by 2050	Net-zero carbon emissions by 2050.	Maintain net zero for Scope 1 and 2 and achieve absolute zero emissions (including Scope 3) by 2050.	

2) **To establish the long-term targets, key decarbonization pathways need to be studied and identified.** Below are examples of the initiative that other airports have implemented or planned to implement to meet their long-term net-zero targets:

Figure 4. Examples of initiatives that other airports have implemented or planned to implement to meet their long-term net-zero targets



3) **Create enablers to complement and support decarbonization pathways**. The key decarbonization pathways focus on the "technical" initiatives which can be accompanied by enablers to facilitate their implementation. Table 3 below shows the four areas of "Enablers":

Table 3. Four areas of "Enablers"

Areas of Enablers	Objectives	Examples
Governance & Culture	• Emphasize the importance of continuous improvement by strengthening operating structures for review and improvements. • Enhance internal policies and operational structures and procedures that focus on operations' emissions, beyond green design principles.	• Include review and improvement of "enablers" measures as per the governance structure and upward reporting lines. • Consider internal policies and procedures such as green procurement policy: Use of cost-benefits analysis (CBA), performance guarantee contracts, certified green products and suppliers, and internal carbon pricing: shift decision towards lower carbon footprints goods & services. • Innovation Day with funding support: Actively monitor and explore adoption of new technologies and future solutions
Climate-related Risk Management	• Identify the physical and transition risks related to climate change, and their impacts on business operations. • Identify critical environmental sustainability areas that matter most to the airport and prioritize resources towards these matters.	• Conduct climate change risk study to identify acute and chronic climate hazards to strengthen KM Airport's operational resilience and adaptive capacity to a changing climate. • Put in place risk control management framework that includes three main sub-components: risk identification, risk assessment, risk prioritization and the implementation of risk responses. • Board and senior management to get timely information about climate and sustainability risk exposure, and the risk management of operations undertaken. • Re-assess risks in light of any substantial changes to the business context of a firm; risks and priorities should be reviewed and updated periodically and timely for relevance.

Areas of Enablers	Objectives	Examples
Review, Report & Third-party Audit	• Third-party audit or obtaining certification helps to validate efforts and identify rooms for improvements.	• Use globally recognized accreditation program e.g. ACI Airport Carbon Accreditation program to disclose, audit and obtain accreditation for green efforts regularly. • Adopt international framework for reporting and disclosure e.g. Task Force on Climate-related Financial Disclosure statement (TCFD)[14]
Communication & Engagement	• Clearly communicate airport's long-term targets and strategy to reach the targets to all employees, airport partners and other key stakeholders. • Harness collective efforts of the entire airport community towards green airport.	• Conduct airport-wide capacity and awareness building events. • Establish structure comprised of key stakeholders across the airport to tighten partnership and accelerate decision making (e.g. collaborate on trials and pilots)

19. **Assessment of Airport Carbon Accreditation (ACA) Potential.[15]** Using the available information from KM Airport, the study assessed that KM Airport would be able to minimally achieve the ACA Level 2 – "Reduction" certification if they are able to provide documentation of its Scope 1 and 2 carbon emissions and its carbon management plan. The measures that ACA would be evaluating for Level 2- Reduction are as follows:

Table 4. Measures that ACA would be evaluating for Level 1 – Mapping and Level 2 – Reduction

Measures	ACA Level	Already fulfilled by KM Airport
1. Determine the airport's 'operational boundary' and the emission sources within that boundary which are Scope 1 and 2 sources	1 - Mapping	✓
2. Collect data to compile a carbon footprint report		✓
3. Have a Low-Carbon/low energy policy	2 - Reduction	✓
4. Show that a senior committee or body has responsibility for climate change/carbon/energy matters		✓
5. Monitor consumption of fuel and energy		✓
6. Have carbon/energy reduction targets		✓
7. Put in place actions, programs or control mechanisms to ensure operations minimize emissions		✓
8. Consider emissions impact of investments		✓
9. Undertake awareness training about emissions for staff		✓
10. Have a process of self-assessment and auditing to monitor progress towards improvements		✓
11. Communicate emissions performance to relevant stakeholders		Can be improved

20. To achieve a higher certification of ACA Level 3 - "Optimization", in addition to the requirements of Level 1 - "Mapping" and Level 2 - "Reduction", KM Airport will need to widen its reporting of its carbon footprint to include Scope 3 emissions which include (i) landing and take-

[14] Published in 2017, the TCFD provides a framework that guide the reporting and disclosure of material climate-related risks and opportunities (together referred as climate-related issues) within organization's financial filings across all sectors, industries and geographies.

[15] It is important to note that this section is a high-level assessment on the potential ACA certification that KM Airport can achieve. The consultancy was not helping KM Airport to attain ACA certification and the consultants are not accredited verifiers.

off cycle emissions; (ii) surface access to the airport for passengers and staff; and (iii) staff business travel emissions. KM Airport will also need to present evidence of engagement with airport partners to reduce wider airport-based carbon emissions which should minimally include: (i) identification and categorization of stakeholders the airport can guide and those it can influence; (ii) allocation of clear roles and responsibilities for engaging and facilitating partnerships with key stakeholders; and (iii) presentation of a clear implementation plan of the intended approach to engaging with stakeholders including proposed actions and timings.

Annex 6: Country Credit Fact Sheet

A. Recent Economic Developments

1. China is an upper-middle-income country with income per capita of about USD12,556 and a population of about 1.4 billion, as of 2021. Throughout 2020 and 2021, China weathered the COVID-19 pandemic well, with resilient international trade and effective stimulus packages. China's successful containment of Covid in the early days facilitated China's re-opening of domestic economy ahead of others, and mitigated stress on global supply chain when factories elsewhere in the world were closed. As a result, China's GDP expanded by 2.3 and 8.1 percent in 2020 and 2021 respectively.

2. GDP growth slowed to 3.0 percent in 2022, due to massive lockdowns in early months and reopening outbreaks at the end. It was lower than average of developing economies in Asia (3.9 percent). Real estate sector faced headwind from policy tightening, compounded by Covid disruptions in 2021-2022. Private consumption recovery has been, which has led to concerns about sluggish household income growth and insufficient incentives. However, in 2023, high-frequency traffic data shows that the economy is recovering fast since the full reopening. Also, in Jan. – Mar. 2023, manufacturing PMI has remained above 50 percent. Services PMI has also rebounded fast, increasing continuously from 54 to 57 percent in the same period.[16] Both suggest businesses are recovering and planning to expand.

3. Despite inflation hikes elsewhere, CPI inflation in China remained moderate at 1.9 percent in 2022 as demand was weak throughout the year. PPI increased by 4.1 percent in 2022. It hiked in H1 2022 due to the rising global prices, but it quickly decreased in H2 as China was struggling with the pandemic. Low inflation reflected price stabilization policies by the government to ensure sufficient domestic supply of major commodities, and prudent monetary policy throughout the year. In Jan. – Mar. 2023, inflation has remained low and declined to 0.7 percent. PPI growth has been negative for the sixth consecutive month since Oct. 2022, and further declined to -2.5 percent in Mar. 2023. Both price indicators are raising concerns over deflationary pressures.

4. In 2022, China's fiscal policy rightly focused on supporting market entities through tax cut, fee reduction, tax rebates, and tax/fee deferrals, the total amount of which exceeded RMB4 trillion (USD580 billion). China also expanded its financing guarantees and provided more support to SMEs via government procurement. The logic is that if the market entities can weather COVID-19 smoothly with fiscal support, then stability can be achieved in terms of employment, people's livelihood, supply chains and overall prices. As a result, fiscal deficit widened to 6.6 percent of GDP in 2022 from 5.1 percent in 2021[17]. General public debt was estimated to have increased to over 51 percent of GDP[18] in 2022 while external debt remained at 15 percent of GDP in the same year.

[16] See National Bureau of Statistics latest report in Mar. 2023.
[17] According to IMF broader definition of fiscal deficit in IMF Country Report No. 23/67, fiscal deficit widened to 9.4 percent of GDP in 2022 from 6.1 percent in 2021.
[18] Official general government debt estimates. In addition to official estimates, IMF has two broader definitions of China's public debt. The one reported in IMF WEO includes 2/3 local government financing vehicles (LGFVs), addition to official debt statistics. IMF Article IV introduces another broader public deb coverage – augmented public debt, which includes government-guided funds and all LGFVs. IMF augmented public debt estimates indicate China's broad public debt reached over 110 percent of GDP in 2022. See Data from IMF Country Report No. 23/67. For data transparency, the Selected Macroeconomic Indicators table includes all the above three definitions of public debt.

5. The current account has been broadly stable. In 2022, current account surplus increased to 2.3 percent of GDP due to sustaining pandemic-related export goods and still subdued outbound tourism. In 2022, China's export grew by 7.0 percent compared to 2021, reaching record high of USD3.6 trillion and almost 40 percent higher than 2019. Total import grew slightly by 1.4 percent in 2022, about USD2.7 trillion but still 28 percent higher than 2019. As a result, China's current account surplus hit a 14-year high of USD417.5 billion since 2008. In Mar. 2023, China's export surged by 14.3 percent after declines in Jan. and Feb., again beating market expectations.

6. International reserves have been broadly stable, albeit recent decline to pre-pandemic level in Jul. 2022. Reserves are estimated to cover about 17 months of imports, as of 2021, which is more than adequate.

Table 1. Selected Macroeconomic Indicators

Selected Economic Indicators	2020	2021	2022	2023	2024
GDP growth (%) /1	2.2	8.5	3.0	5.2	4.5
Inflation (%) /1	2.5	0.9	1.9	2.0	2.2
Current account balance (% of GDP) /1	1.7	1.8	2.3	1.4	1.1
Fiscal balance (% of GDP) /1	-8.8	-5.1	-6.6	-5.8	-5.2
IMF WEO gross public debt (% of GDP) /1	70.1	71.8	77.1	82.4	87.2
General public debt (% of GDP) /2	45.4	47.2	51.5	56.3	59.3
IMF Augmented public debt (%of GDP) /2	98.8	101.4	110.1	121.9	128.9
External debt (% of GDP) /2	16.2	15.6	15.0	15.6	15.6
Gross official reserves (USD billions) /2	3357	3427	3277	3339	3410
Exchange rate (RMB/USD, end of period) /3	6.53	6.35	6.90	6.88	--

Note: /1 Data from IMF WEO Apr. 2023. /2 Data from IMF Country Report No. 23/67. /3 Refinitiv as of Apr. 17, 2023.

B. Economic Outlook

7. Given the reopening in the end of 2022, IMF upgraded China's GDP growth projection to 5.2 percent for 2023 before stabilizing at 4.5 percent in 2024. Subdued consumption and real estate sector remain major downside risks to China's growth. In the longer term, the GDP growth rate is expected to continue the gradual downward trend, along the rebalancing policy and the transitioning to higher quality and greener economy. The pandemic has also revealed risks in the economy, including sluggish private consumption, financial vulnerabilities as debts have climbed up, and the still uncertain external environment (e.g. geopolitics and technological decoupling). On the domestic side, there are concerns about increasing financial stability risks related to rising vulnerabilities in the nonfinancial corporate sector (e.g. a significantly increase in debt), the highly leveraged property sector, the likely deterioration of credit quality in the banking sector and the delay of further progress on financial de-risking.

8. Risks to debt sustainability in the long term are largely moderate. However, off-budget public investment activities are a source of risk. According to IMF's "augmented" debt definition—that is, including debt of local government financing vehicles, public debt in 2022 increased to

110.1 percent of GDP, and is expected to rise further to over 120 percent of GDP in 2023.[19] Meanwhile, the public debt risks can be mitigated by some factors including small portion of foreign currency denominated debt, low real borrowing cost, and government's positive net financial worth.

9. External debt is projected to remain stable in the medium term, at around 16 percent of GDP. Current account surplus is projected to stabilize at around 1 percent of GDP in 2023-24 as China is moving towards a more consumption-driven growth model.

10. Still, China's sovereign credit rating remains strong, at A+/A1 with a stable outlook. Major rating agencies confirmed positive outlook for the economy despite recent signs of slowing recovery. Fitch Ratings affirmed A+ with stable outlook in Dec. 2022. Similarly, Moody's affirmed A1 with stable outlook in Aug. 2022 and S&P affirmed A+ ratings in Jun. 2022.

[19] See Data from IMF Country Report No. 23/67 and footnote 3.

Annex 7: Associated Facilities

A. Criteria for defining associated facilities

1. "Associated Facility" means facilities or activities not included in the description of the Project as Project Components but intrinsically related to the content of the construction of the Project, defined primarily as: (i) directly and substantially related to the Project; (ii) concurrent or planned with the Project; and (iii) necessary for the viability of the Project and which will not be constructed or expanded if the Project does not exist.

B. Identification of associated facilities

2. **Project Components.** The investment of physical activities of the MEP could be split into three main parts. **Part 1-Eastern Part**, including Eastern Runway #2 (Runway E2), cargo terminal and aprons, and aprons around Terminal #2 (T2). **Part 2-Central Part**, including T2 (buildings and equipment); partial civil works of the General Transport Center (GTC) within airport's responsibility and landside working areas. **Part 3-Western Part** including a new runway in the west of the airport, a new aircraft maintenance zone; and other field preparation for the future expansion.

3. **AIIB project (the project)** focuses mainly on **the Part 1-Eastern Part** of the entire MEP. The project comprises the construction of airside infrastructure in the Eastern Part of the airport, including (i) Runway E2 and its linked taxiway and navigation system, cargo aprons, drainage and lighting system for Runway E2; (ii) aprons and road and bridge around T2; (iii) electrified service vehicles inside of airport and (iv) noise monitoring equipment.

4. The project also includes project implementation support and institutional capacity building component. The implementation support is focusing on ES monitoring and evaluation, particularly the noise monitoring enhancement. The capacity building will focus on the support to the green airport development of KM Airport and the enhancement of regional connectivity with South Asia and Southeast Asia. The Bank has conducted a technical review of KM Airport's green airport status as part of assessment and included the proposed Green Airport (decarbonization) Plan (the Plan) in the design of the project in addressing the existing gaps.

5. Related Facilities in Sep. 2022, the National Development and Reform Commission issued the "Reply on the Feasibility Study Report on the Reconstruction and Expansion Project of Kunming Changshui Airport" (Development and Reform Foundation [2022] No. 1514), according to the feasibility study report, the content of the Kunming Airport Reconstruction and Expansion Project is as follows:

- Airport engineering: two new runways and related taxiways, 730,000 square meters of T2 terminal and 164 aircraft aprons, 80,000 square meters of comprehensive transportation center, 309,000 square meters of parking buildings, 99,300 square meters of cargo facilities, production and living aids and public supporting facilities.

- Air traffic control project: new regional control building, approach control building, west tower, and podium building, renovation of existing towers, supporting the construction of

air traffic control, communications, navigation, surveillance, meteorology, and other facilities.

- Fuel supply project: build the second airport oil depot, three 20,000 cubic meter fuel tanks, the second aviation gas station, supporting the construction of business buildings, laying apron refueling pipelines, etc. According to Table 1 associated facility identification matrix analysis, the associated facilities of this project include T2 terminal and cargo facilities.

Table 1: Associated Facility Identification Matrix

Name of the facility	Criteria for defining associated facilities			Comments
	Directly and substantively related to the project	Concurrent or planned with the project	The project is necessary for its viability, and if it does not exist, the project will not be built or expanded.	
1. Airport engineering				
1.1 West Third Runway and corresponding taxiways	×	√	×	Independent parallel operation
1.2 Terminal 2	√	√	√	The project will build parking spaces around Terminal 2, which is directly related to the project.
1.3 Integrated Transportation Center	×	√	×	Serve the entire renovation and expansion project, and no project will be built.
1.4 Parking Building	×	√	×	Serve the entire renovation and expansion project, and no project will be built.
1.5 Cargo Facilities	√	√	√	It is directly related to the 16 cargo aircraft slots built in this project
1.6 Central substation (110kV).	√	√	×	Serve the entire renovation and expansion project, and no project will be built.
1.7 one water supply station and one sewage treatment station	×	√	×	The amount of water supplied and produced for the operation of this project is small, and the treatment capacity of the existing water supply and wastewater treatment facilities can meet the needs of the project.
1.8 two garbage	×	√	×	Serve the entire renovation and

Name of the facility	Criteria for defining associated facilities			Comments
	Directly and substantively related to the project	Concurrent or planned with the project	The project is necessary for its viability, and if it does not exist, the project will not be built or expanded.	
transfer stations				expansion project, and no project will be built.
1.9 Airport Integrated Operations Building and Information Centre	×	√	×	Serve the entire renovation and expansion project, and no project will be built.
1.10 Emergency Rescue Center	×	√	×	Serve the entire renovation and expansion project, and no project will be built.
1.11 four lower passages	×	√	×	/
1.12 A total of 164 new cameras were created (78 of which were included in this project).	×	√	×	/
1.13 Cooling and heating stations	×	√	×	/
2. Air traffic control engineering	×	√	×	The new west tower mainly serves the west 1st and west 3rd runways, and the existing air traffic control tower can be used for this project.
3. Oil supply engineering	×	√	×	The new No. 2 Airport Oil Depot and No. 2 Aviation Refueling Station mainly serve the West 1 and West 2 runways, and the existing fuel supply project can be used for this project.

C. Introduction to Associated Facilities

6. Terminal 2. The construction area of the T2 is 730,000 m^2, and the T2 equipment pipe gallery is 33,000 m^2. The main building of T2 has two floors below the apron (partial mezzanine, and four floors above the apron, and the main elevations of each floor above ground are 0m, 4.5m, 8.5m, and 17m, respectively. The main structural system of the terminal is a reinforced concrete frame, and the roof is a long-span space steel structure system.

D. Cargo facilities

7. The cargo area is located on the east side of the Runway E2, between the Runway E2 and the Zhenkun Railway. The cargo warehouse is arranged in a column along the direction of the runway and directly opposite the apron, which, together with the current cargo area, can meet the annual cargo and mail throughput demand of 1 million tons. The west side of the cargo warehouse is the airside area, which is mainly connected to the terminal area through the airside underpass passage, and the service lane connecting the airside of the north-south terminal area is also set up; the east side is the landside area, and a cargo landside main passage is arranged on the east side of the cargo area, connecting the north and south work areas. In addition, the passage through the Zhenkun Railway is set up to connect the cargo area and the 320 National Highway. The planned construction area is 99,310 m^2, the parking operation site is 85,300 m^2. And reserve a long-term development land of 72.53m^2 on the southeast side of the freight area.

8. The cargo facilitates include air cargo terminals, domestic cargo warehouses, international cargo warehouses, business and auxiliary rooms, special transport warehouses, vehicle maintenance and repair workshops, fumigation rooms, cargo area doorkeepers, cargo station operation sites, cargo area parking lots, cargo area shift dormitories, freight area canteens, cargo comprehensive management rooms, and other structures.

Figure 1: Schematic diagram of the layout of the cargo area