Completion Report

Project Number: 48902-012
Technical Assistance Number: 8662
April 2019

People's Republic of China: Improving Clean Bus Operations and Management

Asian Development Bank

TA Number, Country, and Name: TA 8662-PRC: Improving Clean Bus Operations and Management			Amount Approved: $2,315,000 Revised Amount: Not applicable	
Executing Agency: Ministry of Transportation[a]	Source of Funding: Global Environment Facility		Amount Undisbursed: $1,043,128.65	Amount Utilized: $1,271,871.35
TA Approval Date: 9 Jun 2014	TA Signing Date: 16 Jul 2015	Fielding of Consultants Date: 6 Feb 2017	TA Completion Date: Original: 31 Dec 2016	Actual: 31 Dec 2018
			Account Closing Date: Original: 31 Mar 2017	Actual: 18 Feb 2019

Description

In January 2013, the Board of Directors of the Asian Development Bank (ADB) approved a loan program of $275 million for clean bus leasing (CBL) to provide an alternative financing mechanism to accelerate the adoption of clean bus technology for public transport operations in the People's Republic of China (PRC).[b] The capacity development technical assistance (TA) was approved by ADB on 9 June 2014, which targeted to reinforce and enhance the impacts of the CBL program by adding the focus on efficient selection, operation, and management of clean bus operating in urban areas. The TA amount of $2,315,000 was financed on a grant basis by the Global Environment Facility (GEF) and administered by ADB.

Expected Impact, Outcome, and Outputs

The expected impact of the TA was maximized environmental, social, and economic benefits of adopting clean bus technology in the PRC. The expected outcome of the TA was improved selection, management, and operation of clean buses in the urban, suburban, and intercity public transport markets. The TA outputs were (i) guidebook for selecting clean and accessible bus developed; (ii) knowledge materials for energy-efficient, inclusive, and competitive bus operations developed; (iii) systems for energy-efficient bus operations supported; (iv) clean bus performance monitoring program implemented; (v) awareness, training, and knowledge-sharing program developed; and (vi) project management.

Delivery of Inputs and Conduct of Activities

Changes of EA and TA administration. Originally, the PRC's Clean Development Mechanism Fund (CDMF) was the executing agency (EA). However, CDMF changed its function to be the Public–Private Partnership Center of the PRC, which was deemed not able to execute the TA. ADB's related departments (Private Sector Operations Department [PSOD], East Asia Department [EARD], and the PRC Resident Mission) identified the Ministry of Transport (MOT) as the new EA, since the subject TA supports MOT's initiative in promoting public transport. Also, the TA administration was transferred from PSOD to EARD in April 2015. Within EARD, the TA administration was transferred from the Public Management, Financial Sector, and Regional Cooperation Division to the then East Asia Transport Division in October 2015. The EA was again changed within MOT from the Comprehensive Planning Department to the Transport Services Department due to the focus of the TA on public transport services, particularly buses.

Consultant recruitment, implementation schedule, and ADB missions. The planned inputs comprised of 97 person-months of consulting services (16 person-months, international and 81 person-months, national) from May 2014 to December 2016. Due to changes in the TA administrations and interests of the new EA, the implementation arrangements were modified including an update of the terms of reference for the consulting services, revision in consulting requirements, and division of the TA into two phases. Phase 1 was intended to pilot the survey of five cities to determine whether the TA was still relevant for the cities. Phase 2 was intended to extend the surveys and data collection to the rest of the 12 cities included in the CBL program. The TA commenced in February 2017, and the closing date was extended three times from the original date of 31 December 2016 to 31 December 2017, 30 June 2018, and 31 December 2018 to be able to satisfactorily implement the TA and achieve its outputs and conduct knowledge sharing activities. During implementation, ADB conducted one reconnaissance mission in April 2017; five review missions; inception mission in May 2017; and four review missions in January, April, May, and December 2018.

The consultants produced the intended outputs and performed satisfactorily. The consultants prepared and submitted all required reports on time. Results of phase 1 study covers the aspects of selection of clean bus, bus scheduling and dispatching, and clean bus operation and maintenance. Upon the recommendation of the TA team and the concurrence of the EA, phase 2 study commenced. The main tasks of phase 2 included (i) extending the survey to the rest of the 12 cities; (ii) preparing survey report with analysis on features and challenges; (iii) carrying out policy study; (iv) preparing guide books; (v) organizing trainings on bus maintenance and dispatching in Jinan, Fuzhou, and Beijing with more than 550 participants; and (vi) procuring 100 sets of automated passenger counters for the bus operators in Jinan and Fuzhou for monitoring the dynamic flow of

passengers for dispatching. A final TA report was prepared and submitted to ADB in May 2018. A total of three international and seven national consultants were recruited. Total consultant inputs at completion were 41 person-months (16.8 person-months, international and 24 person-months, national).

The performance of ADB and the EA were also rated *satisfactory*. ADB closely monitored the work progress of the consultants and changed arrangements to efficiently implement the TA.

Evaluation of Outputs and Achievement of Outcome

The TA achieved its outcome by improving selection, management, and operation of clean buses. It identified improvements to expand the clean bus usage through the review of international technologies and through the clean bus performance survey of 17 bus companies compared to 15 bus companies planned during TA preparation. The TA also provided tools for measuring the greenhouse gas emissions to the PRC bus administrators and operators. Moreover, the TA had gathered actual first-hand information on electric bus performance, from which clean bus policies were reviewed and recommendations on promoting clean buses were made. Best practice strategy and technologies on clean bus selection, dispatching, and maintenance were proposed, which may be developed into the government's policies and official guidelines. Output 4 was not implemented as envisaged because the bus companies had their own monitoring program for fuel consumption already in place as an integral part of the clean bus procurement. The development of management tools under the small grants scheme, envisaged at appraisal, was also not implemented because bus companies did not want to open their financial data and integrate them with the performance data of buses. However, a tool for greenhouse gas emissions calculation and total cost of bus ownership was developed and shared with the companies. TA savings were incurred due to dropping the small grants scheme. Despite that, there was substantial TA output dissemination. TA results dissemination mainly included (i) organizing an International Forum on Zero Emissions of Urban Transport, which was held in Beijing in 28–29 May 2018 with more than 200 participants; (ii) financing eight participants to attend the Transport Forum in ADB on 12–14 September 2018; (iii) preparing a knowledge product–Sustainable Transport Solutions: Low-Carbon Buses in the PRC,[c] which was translated into Chinese and printed for public usage; (iv) organizing the National New Energy Bus Performance Workshop on 28 November–1 December 2018 in Chongqing with 200 participants; and (v) knowledge sharing of TA results on electric bus selection and charging station requirements to other ADB projects in the PRC. The knowledge product developed (distributed in the national workshop) may become guidelines to support the clean bus development in the PRC and can also be used by other countries.

Overall Assessment and Rating

The TA is *highly relevant* as it is aligned with the government's development plan and ADB's country partnership strategy. Data on clean bus performance from 17 companies is a first of its kind in the clean bus area. This will transform the future clean bus management, operations, and selection of clean energy buses. TA implementation realized its objectives of assisting the PRC to maximize the environmental, social, and economic benefits of adopting clean bus technology. The TA is *effective* because TA outcome has been realized through the TA activities carried out, outputs delivered, and knowledge shared. TA implementation is *efficient* despite the delay caused by administrative change by the EA and subsequent response by ADB. The TA is *likely sustainable* because the selection of clean bus technology and the maintenance and dispatching training conducted has been adopted by the bus companies. Results can also be replicated and shared to other countries. The TA achievements are well recognized and received by the government and the bus operators. The TA is rated *successful*.

Major Lessons

The TA implementation was substantially delayed, which was mainly caused by changing EAs and ADB's TA administration. In the future, for TAs with such circumstances, quick action should be taken among the related ADB departments and units to avoid implementation delays.

Recommendation and Follow-Up Actions

1. The current knowledge product highlights the performance of clean buses which is the first of its kind in the clean energy bus area. It also discusses the process of selection and promotion of clean buses in the PRC which is useful for clean bus operators and policy makers. Lessons can be shared outside of the PRC.
2. ADB to continue engagement with MOT to further develop its clean bus development program.

[a] The executing agency was changed from the Clean Development Mechanism Fund (CDMF) to the Ministry of Transport on 9 April 2015.

[b] ADB. 2012. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan Program for Clean Bus Leasing in the People's Republic of China*. Manila.

[c] ADB. September 2018. *Sustainable Transport Solutions: Low-Carbon Buses in the People's Republic of China*. Manila. https://www.adb.org/publications/sustainable-transport-solutions-peoples-republic-china

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TCR Supplementary Appendix for GEF TA

People's Republic of China: Improving Clean Bus Operation and Management

GEF Project ID: 5627

I. GEF Background

1. In January 2013, the Board of Directors of the Asian Development Bank (ADB) approved a loan program of $275 million permitting accreditation of up to five financial leasing companies for financing of clean buses in the People's Republic of China (PRC).[1] The clean bus leasing (CBL) program was expected to finance the leasing of about 5,000 buses in at least 15 cities in the PRC by 2018. During the preparation of the program, the consultation revealed strong potential demand for the leasing of clean buses and the need for technical assistance (TA) to ensure that the anticipated environmental, social, and economic benefits were fully achieved by public transport operators.

2. The TA was approved by ADB on 9 June 2014, which targeted to reinforce and enhance the impacts of the CBL program by adding a focus on efficient selection, operation, and management of clean bus operating in urban areas.[2] The TA was fully in line with the priorities of ADB's country partnership strategy, 2011–2015 for the PRC, in particular, with the strategy's emphasis on mainstreaming climate change considerations and support for green finance. It was arranged that the TA would be financed by a grant from the Global Environment Facility (GEF) of $2.315 million. The request for GEF CEO Endorsement was submitted to the GEF on 12 November 2013, which clearly described the nature of the TA arrangements.[3] A set of secretariat comments were received on 19 November 2013, which were well responded and incorporated in the TA design and formulation. The GEF grant was endorsed by the GEF CEO on 10 January 2014 as part of the Asian Sustainable Transport and Urban Development (ASTUD) program. The GEF grant agreement was signed on 9 June 2014, the same day of the ADB approval for the TA.

3. At appraisal, it was expected that the baseline project (the CBL program) would increase in the deployment of clean buses in the urban, suburban, and intercity public transport markets. The program was expected to finance the leasing of at least 5,000 clean buses by 2018. From 2019, the program would help avoid greenhouse gas (GHG) emissions of 1.31 million tons per annum through a shift from the use of private cars to the use of public transport and through the use of low emission buses. The program would result in 420 million vehicle-kilometers of service operation by clean buses per annum in the PRC. The proposed GEF-funded activities (the TA) would reinforce the effectiveness of the CBL program by adding a focus on efficient selection, operations and management of the buses operating in urban areas. It would involve development of information resources, training materials and systems aimed at optimizing the in-service performance of the buses in terms of reducing energy consumption/emissions and enhancing the competitiveness of public transport as an alternative of private vehicles. This could be achieved through correct selection of bus type (including inclusive design specifications, e.g. low floor, wheelchair accessible, high visibility handrails, etc.); optimized fleet operations; eco-driving/maintenance, performance monitoring; and associated IT systems. This would both

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1 ADB. 2012. *Report and Recommendation of the President to the Board of Directors (RRP) on a Proposed Loan Program for Clean Bus Leasing in the People's Republic of China*. Manila.

2 ADB. 2014. *Technical Assistant Report on People's Republic of China: Improving Clean Bus Operation and Management*. Manila

3 ADB Memo. 9 December 2013. *GEF CEO Endorsement Request for ADB Capacity Development Technical Assistance (CDTA): Improving Clean Bus Operation and Management*. PSOD

safeguard and expand the GHG reductions and mode shift impacts expected from the CBL program.

4. In addition to the direct GHG reductions from improved selection and energy-efficient operation of buses leased under the baseline CBL program, the GEF-funded activities were expected to have a strong demonstration effect. They would have substantial replication potential more broadly in the PRC bus industry and were expected to catalyze substantial indirect impacts through accelerated deployment and diffusion of principles, techniques and tools for selecting and operating clean buses to achieve maximum energy efficiency/GHG reductions. Total GHG emissions avoided (direct and indirect) were estimated to be some 2.3–3.6 million tons for the GEF-funded activities over the project lifetime.

5. The total TA cost was estimated at $2.315, which would be financed by the GEF grant. In addition, the government would also provide contributions in-kind about $0.700 million equivalent. The expected TA components/outputs were:

(i) Guidebook for selecting a clean and accessible bus developed.
(ii) Knowledge materials for energy-efficient, inclusive, and competitive bus operations developed.
(iii) Systems for energy-efficient bus operations supported.
(iv) Clean bus performance monitoring program implemented.
(v) Awareness, training, and knowledge-sharing program developed.
(vi) Project management.

II. Implementation

6. Executive Agency and TA administrations. At appraisal, the GEF operational focal point for the PRC was the Ministry of Finance (MOF). It was arranged that the PRC's Clean Development Mechanism Fund (CDMF) would be the executing agency (EA) for the TA. However, the CDMF changed its function to be the PPP Center of the PRC, which was deemed not able to execute the TA. The ADB's related departments (PSOD, EARD, and the PRCM) identified the Ministry of Transport (MOT) as the new EA, since the subject TA supports MOT's initiative in promoting public transport. Also, the MOT agreed to take over the role of the EA. Meanwhile in the ADB side, the TA administration was transferred from ADB's Private Sector Operation Department (PSOD) to East Asia Region Department (EARD) in April 2015.[4] Within EARD, the TA administration was transferred from EAPF to EATC in October 2015. After the transfer to EATC, the EA was again changed within MOT from the Comprehensive Planning Department to the Transport Services Department due to the focus of the TA on public transport services, particularly buses. During implementation, ADB conducted one reconnaissance mission in April 2017, one inception mission in May 2017 and four review missions in January, April, May and October 2018.

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7. Consultant recruitment. At appraisal, the TA was adequately formulated, which anticipated that the TA would require international consulting inputs of 16 person-months and national consulting inputs of 81 person-months. Due to changes in the TA administrations and interests of the new EA, the TOR for the consulting service was updated and the consultant requirements were also revised. The consultant recruitment started in late 2015, which was in accordance with ADB's *Guidelines on the Use of Consultants* (2013, as amended from time to time). At the onset,

[4] ADB. Memo. 9 April 2015. *PRC: TA for Improvement Clean Bus Operation and Management – Change of Executing Agency and Transfer of TA Administration from PSFI to EAPF*. PSOD

the consultant recruitment experienced some difficulty to get enough EOIs for certain positions. Eventually, six consultants were recruited including three international and three national consultants, and the contracts were signed in February and March 2017. During implementation, three more national consultants were added as requested by the EA for strengthening the policy study and TA coordination.

8. Implementation schedule. At appraisal, the TA was expected to be implemented from May 2014 to December 2016. Due to changes in the TA administration and difficulty in consultant recruitment, the TA actually commenced in February 2017. The TA was implemented generally by two phases. The Phase I was implemented in February to September 2017 by focusing on the general issues of clean bus status in five cities (Beijing, Fuzhou, Hengyang, Jinan, and Tianjin), including development status and operation and maintenance (O&M) technologies. Due to successful implementation of the Phase I and support from the EA, the Phase II was implemented in October 2017 to June 2018 by focusing on extended surveys to the rest 12 cities,[5] knowledge product preparation, TA output dissemination, and trainings. For facilitating the TA implementation, the TA closing date was extended three times, from original 31 December 2016, to 31 December 2017, and then to 30 June 2018 and 31 December 2018. The last extension was mainly for (i) organizing an international workshop, (ii) completing knowledge product publication and dissemination, (iii) participating in the Transport Forum, (iv) knowledge sharing of the lessons learned about electric buses to the ADB projects in the PRC, e.g., Guizhou Gui'an New District New Urbanization Smart Transport System Development and Jianxi Ji'an project teams, and (v) preparing the Terminal Evaluation Report for GEF.

9. GEF grant management and disbursement. As arranged at project preparation, the grant disbursements for the TA was carried out in accordance with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). Due to changes in the TA scope, the contracted/committed grant allocation was only 47.5% of the total grant. The first disbursement of the grant was made on 22 June 2017. Upon TA completion, total $1,271,871.35 was disbursed, including $652,457 for consultants, $120,260 for equipment procurement, $385,757 for trainings and seminar, and $113,397 for miscellaneous TA administration. The disbursed grant proceed was 55% of the total grant. Upon financial closure of the grant account on 18 February 2019, a total $1,043,128.65 was undisbursed and returned to GEF.

10. Major TA activities and outputs. The TA was implemented generally in four stages with the following major activities and outputs.

(i) *Inception stage*. The main tasks included (i) TA team mobilization, (ii) understanding of the TOR, (iii) coordination with ADB and the EA, and (iv) preparation of working plan including approach and timelines. An inception report was prepared and submitted to ADB in March 2017.[6]
(ii) *Phase I stage*. The main tasks included (i) reviews of international experience, (ii) site visits to five cities, (iii) preparation of analysis reports, and (iv) recommendations on pathways with future expansion of new energy bus in the PRC. An ADB inception mission was fielded in May 2017 to discuss variety issues of the TA implementation. By end of this stage, a Phase I report was prepared and submitted to ADB in September 2017, which covers the aspects of selection of new energy bus, bus scheduling and dispatching, and

[5] At appraisal, 15 cities would be involved in the TA in consistence with the loan program. During implementation, 2 more cities, Beijing and Shanghai, were added.
[6] TA team. 2 March 2017. *Inception Report. TA-8662 PRC: Improving Clean Bus Operation and Management*.

e-bus operation and maintenance.[7] During the surveys conducted in Phase I, it was found out that bus companies had their own monitoring program for fuel consumption already in place as an integral part of the clean bus procurement. Also, during Phase I, the consultants have presented different systems for integrating dispatching, maintenance and operations that may be applied in the PRC; however, the bus companies have developed their own systems for operational management and hesitated to open them for scrutiny to the survey team as it involves financial data and other sensitive information.

(iii) *Phase II stage*. The tasks included (i) extending the survey to the rest 12 cities, (ii) preparation of survey report with analysis on features and challenges, (iii) carrying out policy study, (iv) preparation of guide books, (v) organization of trainings in Jinan, Fuzhou, and Beijing with total participants of more than 550 person-times, and (vi) procurement of 100 sets of automated passenger counters (APCs) for the bus operators in Jinan and Fuzhou. In lieu of the development of systems for bus operations, a set of equipment for efficient operations were presented to the companies and they requested 100 sets of APCs to monitor the passengers' entry and exit for better dispatching schedules. A final TA report was prepared and submitted to ADB in May 2018, which covers many aspects of the TA findings, as well as detailed appendices of city report, bus dispatching, maintenance, and policies on new energy bus development in the PRC.[8]

(iv) *Knowledge sharing stage*. The main tasks focused on TA results dissemination, which mainly included (i) organization of an International Forum on Zero Emissions of Urban Transport, held in Beijing in 28–29 May 2018 with more than 200 participants; (ii) financing seven participants to attend the Transport Forum in ADB headquarter in 12–14 September 2018; (iii) sharing of the lessons learned about electric buses to the ADB project teams in the PRC, e.g., Guizhou Gui'an New District New Urbanization Smart Transport System Development and Jianxi Ji'an Sustainable Urban Transport project; (iii) preparation of a knowledge product – *Sustainable Transport Solutions: Low-Carbon Buses in the People's Republic of China*,[9] which was translated into Chinese and printed for public usage; and (iv) supporting the Electric Bus Performance Assessment Competition and Technology Development Forum in Chongqing in 28 November–1 December 2018 with more than 200 participants.

III. Relevance, Effectiveness and Impact

11. Relevance. At both appraisal and completion, the TA is rated *highly relevant*, as the CBL program and the TA support the sustainable development in the PRC. The PRC government's 13th Five-Year Plan (FYP), 2016–2020, continue to focus on "green development" and setup improving ecology and environment quality as a development priority.[10] The FYP has the tasks of promoting low-carbon development, encouraging energy revolution, accelerating energy technology innovation, constructing clean, low-carbon, and highly efficient modern energy system. The FYP specially indicates to promote low-carbon transport development, increase public transport priority, enhance rail transport, encourage green travel, and implement new energy vehicle promotion plan.

12. In the 2020 vision, the GEF will pursue five strategic priorities: (i) address the drivers of environmental degradation; (ii) deliver integrated solutions; (iii) enhance resilience and adaptation;

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[7] TA team. 30 September 2017. *TA-8662: Cover Report: Improving Clean Bus Operation and Management in China*.

[8] TA team. 31 May 2018. *Project Report. ADB TA 8662-PRC: Improving Clean Bus Operation and Management.*

[9] ADB. September 2018. *Sustainable Transport Solutions: Low-Carbon Buses in the People's Republic of China*. Manila

[10] PCR, 16 March 2016. *Outline of 13th Five-Year Socioeconomic Development Plan of the People's Republic of Chin*a (2016–2020). State Council.

(iv) ensure complementarity and synergies, especially in climate finance; and (v) focus on choosing the right influencing model.[11] In its capacity as a financial mechanism of the United Nations Framework Convention on Climate Change (UNFCCC), the GEF supports countries to make transformational shifts to a low emission development path. In addition, the GEF is helping countries assess their national contributions towards the global agreement that is expected to be reached at COP21 in December 2015. The GEF also supports countries to increase their resilience and adapt to the adverse impacts of climate change. The PRC is a participant of the GEF and received totally grant funding of $1,594.2 million for 201 projects. Among the total funding, about 80% was in the focal area of climate change. ADB is one of the eighteen GEF agencies and has worked closely in related investment projects by incorporating capacity building and technical assistance.

13. ADB's assistance in the PRC supports the government's development priorities, evolving focus areas and flagship initiatives. The ADB Country Partnership Strategy (CPS) for the PRC in 2016–2020 is fully aligned with the government's 13th FYP, ADB's Midterm Review of Strategy 2020, and ADB's approach to supporting upper middle-income countries. The CPS addresses PRC's development challenges in climate change and the environment, inclusive growth, knowledge cooperation, and institution building. Developing clean energy in PRC is a central pillar of ADB's climate mitigation work. Since joining ADB in 1986, the PRC received ADB lending, grant, and TA of total $36.7 million. Among which, 16.16% was in energy sector, 48.25% in transport sector, and 14.13% in water and other urban infrastructure and services.

14. The CBL program was the first non-sovereign program-based lending in the PRC which meets the ADB's Sustainable Transport Initiative objectives. It also achieved ADB's Strategy 2020 goals of supporting environmental sustainability and financial sector development. The CBL program complemented the CPS in strengthening the linkage between public sector and non-sovereign operations by increasing the ADB's private sector operations in the PRC. The program was timely given the ongoing initiative in the PRC to expand clean bus transport through the State Council's Energy Efficient and New Energy Vehicle Industry Development Plan, 2012–2020. The associated TA would maximize the benefits of the program by improved selection, management, and operation of clean buses in the urban, suburban, and intercity public transport markets. Data on clean bus performance from 17 companies, 15 companies during project preparation, is a first of its kind in the clean bus area. This will transform the future clean bus management, operations, and selection of clean energy buses. TA implementation realized its objectives of assisting the PRC to maximize the environmental, social, and economic benefits of adopting clean bus technology.

15. Effectiveness. The TA is rated *effective* by considering the TA activities carried out, outputs delivered, and knowledge shared.[12]

(i) *Major activities*. The TA carried out large scale surveys in 17 cities, which focused on collecting information on the clean bus utilization, performance and challenges. Questionnaires were prepared and provided to the clean bus operators before the surveys. Meetings, consultations, and site visits were carried out during the surveys. Development status and challenges were analyzed. The bus operators in the related cities were well participated in and supported the surveys which brought key issues and analytic approach to the bus operators on the assessment of clean bus development.

[11] GEF. 13 May 2014. *GEF 2020–Strategy for the GEF*. Washington D.C.

[12] An ADB TCR mission visited the public bus operators in Jinan and Fuzhou on 8–12 October to learn the effectiveness, impacts, and sustainability of the TA.

(ii) *Outputs*. The TA delivered a set of reports, including inception report, city reports, and final reports, as well as many working papers and guidebooks. These reports provide a clear picture of the clean bus development in the PRC, including status, challenges and potential development. The guidebooks on dispatching and maintenance provide tools for the bus operators to efficiently manage and maintain the clean buses. Meanwhile, the government policies were reviewed and policy recommendations on promoting clean bus development were provided. Such surveys and studies have provided a foundation for the PRC government and the clean bus operators to make appropriate and efficient development plans. 100 sets of the APCs were procured and used. According to the post-consultations to the related bus operators, the APC equipment was well installed and used. It has provided efficient tools for the bus operators in Jinan and Fuzhou to improve the performance of bus operation and upgrade the bus dispatching systems.

(iii) *Trainings and knowledge sharing*. At early stage of the TA implementation, best international practice and experience in clean bus were reviewed and introduced. Large scale trainings were carried out in Jinan, Fuzhou, and Beijing. The trainings introduced international practice and experience as well as tools for bus dispatching and measuring GHG emissions. The trainings also briefed the bus operators on the general status and road maps of clean bus development, selection, and maintenance. The organization of an International Forum on Zero Emissions of Urban Transport has well disseminated the TA outputs and also provided a platform for the government administrators and the city bus operators to share their experiences in clean bus development nationwide. The publication of knowledge product – Sustainable Transport Solutions: Low-Carbon Buses in the People's Republic of China serves as a guide to the bus operators in the PRC as well as to other similar developing countries. The workshops in Ji'an and Gui'an have well disseminated the TA findings and outputs. The publication was disseminated to bus operators, policy makers, clean bus researchers in the PRC during the Electric Bus Performance Assessment Competition and Technology Development Forum held in Chongqing.

16. Efficiency. The TA is rated efficient by comparing the outputs and outcome with the inputs. The TA was implemented in a cost-effective way by utilizing ADB's in-house capacity to manage the TA implementation. Due to changes in the EA and ADB's TA administration, the TA scope was also updated with a revised TOR for the consulting services and much less budget requirement. During implementation, the TA team members worked efficiently on the tasks specified in the TOR. Upon completion, all tasks in the revised TOR were completed and the anticipated outcomes were achieved. Meanwhile, the actual cost was much less than budgeted at appraisal with large amount of savings about 45% of the original GEF fund available. However, the TA implementation schedule was substantially delayed, and the closing date was extended three times. Output 4 was not implemented as envisaged because the bus companies had their own monitoring program for fuel consumption already in place as an integral part of the clean bus procurement. The development of management tools under the small grants scheme, envisaged at appraisal, was also not implemented because bus companies already had established systems and did not want to open their financial data and integrate them with the performance data of buses. TA savings were incurred due to dropping the small grants scheme. However, a tool for greenhouse gas emissions calculation and total cost of bus ownership was developed and shared with the companies, and 100 buses were fitted with equipment to monitor passenger entry/exit for better bus scheduling and passenger service, maximizing the number of passengers using public transport.

17. Impacts. The impact of the TA is rated *satisfactory* by considering its direct impacts during the TA implementation and potential impacts in a long-term.

(i) *Direct impacts*. The implementation of the TA has direct impacts to the clean bus administrators and operators, including (a) international best practice and technologies introduced; (b) general status and challenges of the clean bus in the PRC studied and summarized; (c) guidelines on clean bus selection, operation and maintenance developed; and (d) substantial TA output dissemination program conducted. These activities have had significant impacts to the bus operators, especially to the bus operators in Jinan, Fuzhou, and Beijing. The installation and utilization of the APCs has provided foundation and tool for the bus operators in Jinan and Fuzhou to improve the performance of bus operation and upgrade their bus dispatching systems.

(ii) *Long-term impacts*. The TA's long-term impacts will be realized and maximized in the near future. It is deemed that (a) the surveys and studies have provided a foundation for the PRC government and the clean bus operators to make appropriate and efficient development strategy and plans; (b) the proposed strategy and technologies might be developed into government's policies and official guidelines, which will certainly contribute to regulate, promote, and facilitate the clean bus development in the PRC; (c) the guidebook on clean bus selection will assist the bus operators to select and use suitable bus types, which will certainly improve the working efficiency and reduce the O&M cost, (d) the trainings on the bus dispatching and maintenance have significantly opened the mind of the trainees to improve their operating efficiency; (e) the procured APCs have brought a foundation for improving the performance of bus operations; (f) the international forum organized has well disseminated the TA outputs and also provided a platform for the government administrators and the city bus operators to share their experiences in clean bus development nationwide; and (g) the knowledge products will become guidelines to support the fast development of the clean bus development in the PRC, as well as other similar developing countries.

IV. Global Environmental Benefits and Catalytic Role

18. At appraisal, an estimate of total and incremental benefits was calculated for the baseline project and GEF-funded activities in terms of GHG emissions avoided. To the extent possible, the calculation used the ASIF (Activity x Share x Intensity x Fuel) approach, and methods and parameters consistent with the *GEF Manual for Calculating Greenhouse Gas Benefits for GEF Transportation Projects* and *Transport Emissions Evaluation Models for Projects (TEEMP)*. Project lifetime is assumed to be 20 years for major infrastructure and 10 years for other interventions.

19. In addition to the direct GHG reductions from improved selection and energy-efficient operation of buses leased under the baseline CBL program, the GEF-funded activities were expected to have a strong demonstration effect. They have substantial replication potential more broadly in the PRC bus industry and were expected to catalyze substantial indirect impacts through accelerated deployment and diffusion of principles, techniques and tools for selecting and operating clean buses to achieve maximum energy efficiency/GHG reduction. At appraisal, it was projected that the total market for clean buses in the PRC (especially hybrid and electric buses) was expected to exceed 500,000 buses over the period to 2020. This is around 100 times the number of buses involved in the baseline project and indicates the substantial market potential and scope for replication. Total GHG emissions avoided (direct and indirect) were estimated to be some 2.3-3.6 million tons for the GEF-funded activities over the project lifetime, or around 10.7-12.0 million tons including the baseline project.

20. However, these figures may under-estimate the full impact of the GEF-funded activities. As described, their purpose is to achieve the dual goals of minimizing the energy intensity of bus operations, while at the same time, maximizing the number of passengers using public transport. The impact of the GEF-funded activities on mode shift to public transport has not been included in the above estimates of GHG reductions, because it was expected that around 15 different cities would participate in the CBL program and each of these cities would have unique local travel conditions and mode choice factors. This makes it is difficult to reliably quantify the likely extent of this mode shift. However, improving the quality and responsiveness of public transport will have an effect on mode choice, and as a result, the full impact of the GEF-funded activities is likely to be greater than shown.

21. It is an innovative approach to maximizing the benefits of accelerated diffusion of low emission and "new energy" buses because it was piggy-backed on to a private sector-led bus leasing program in the world's largest bus market. Instead of targeting GHG reductions from tens or hundreds of buses in a single city or cluster of cities, the CBL program had national reach and was expected to involve around 5,000 buses in at least 15 cities. In addition, by linking the GEF-funded energy/cost efficiency initiatives to the leasing of the bus, participation became industry-led rather than government-led. As a result, there would more likelihood of ownership of and sustained commitment to the program by bus companies.

22. Upon completion, the baseline project was implemented with three loans to the leasing companies under the loan program: (i) Far East Horizon Limited (FEH) for $100 million; (ii) Industrial Bank Financial Leasing Company Limited (IBFL) for $100 million but provided in local currency equivalent; and (iii) Everbright Finance Leasing Company Limited (EFL) for $75 million, together fully utilizing the approved program size. All loans have been fully disbursed—FEH in February 2014, IBFL in November 2014, and EFL in December 2016. The loans to FEH and IBFL have a tenor of 8 years and grace periods of 2.5 and 3.5 years, respectively. The loan to EFL has a tenor of 5 years with no grace period. By September 2016, total 4,259 clean energy buses were procured and leased under the CBL program and it was planned that another 1,413 buses would be leased.[13] The CBL program has increased the deployment of clean buses in the PRC, which is higher than expected at appraisal (5,000 buses). The use of such clean buses has substantially reduced the GHG emission in comparing with traditional energy buses.

23. During 2014–2016, the clean buses funded under the IBFL loan provided 195 million vehicle-kilometers of annual service, while the loan to FEH resulted in 163 million vehicle-kilometers of annual service resulting in 358 million vehicle-kilometers of annual service together under the CBL program. This compares well with the CBL program target of 420 million vehicle-kilometers of annual service by 2019. IBFL and FEH, along with EFL, will help to reach the program target through their incremental annual service between 2017 and 2019. The reductions in GHG emissions from the IBFL-funded clean buses stood at 608,738 tons per annum from 2014 to 2016, and those achieved by FEH-funded clean buses stood at 509,250 per annum.[14] The program target of overall reductions in GHG emissions of 1.31 million tons by 2019 is on track, i.e., the incremental reductions in emissions from 2017 to 2019 by the clean buses funded through ADB loans to IBFL, FEH and EFL will achieve the targeted level.[15]

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[13] ADB, September 2016. *Extended Annual Review Report: Senior Loan – Clean Bus Leasing Program*. PSOD
ADB, September 2017. *Extended Annual Review Report: Senior Loan – Clean Bus Leasing Program*. PSOD

[14] Assuming each clean bus performs at an average speed of 20 kilometers per hour, 12 operating hours per day, and 350 operating days per year.

[15] The use of each clean bus is estimated to avoid an emission of 0.75 tons of greenhouse gases (carbon dioxide equivalent) per day on average. Assuming 350 operating days per year per bus, 5,000 buses avoid 1.31 million tons of greenhouse gas emissions (carbon dioxide equivalent) per annum

24. The GEF funded activities has well supported the initiatives of promoting and facilitating clean buses in the PRC. The approach and criteria of selecting bus types has provided clear guidance to the bus operators in the PRC, which will also have long-term benefits; the trainings on bus operation and maintenance has brought advance concepts and methodology to the related bus operators, which will definitely improve the bus operation and maintenance efficiency; the installation and utilization of the APCs has provided tools for the related bus operators to upgrade their bus dispatching systems and improve efficiency of bus operations; the workshop and forum have provided a platform for the bus operators to share their experience and practice in the technologies of clean bus selection and usage; and the knowledge products will be well spread among the bus operators nationwide, as well as to similar developing countries. The TA has achieved its objectives and brought significant benefits to the PRC as well as to the global environment improvement. Substantial long-term benefits will be realized in the near future.

V. GEF Tracking Tools (where appropriate)

25. At appraisal, a GEF Tracking Tool was developed. Upon completion, the tracking tool was updated with terminal results. The key indicators on global environmental benefits are highlighted below.

Objective 1: Transfer of Innovative Technologies. Under the TA, the general policy framework of clean bus development in the PRC was reviewed and policy recommendation was provided as part of the TA report. The surveys and analysis have well summarized the technology status of clean bus in the PRC. The review and introduction of the international experience, practice and advanced tools have opened the minds of the bus operators. The trainings and forum well demonstrated and exchanged the innovative technologies of clean bus selection and operation in the PRC. All of these will promote and facilitate the technology innovations of the clean bus development in the PRC.

Objective 2: Energy Efficiency. The TA has supported the government in establishing sound policy and regulatory framework. The trainings, forum, and knowledge products have well improved the capacity of the bus operators. The installation and utilization of the APCs has established a foundation for Jinan and Fuzhou to improve their capacity in upgrading dispatching tool and efficiency. More than 5,000 clean buses were procured and used under the CBL program. By using the new energy bus, the energy efficiency is substantially improved in comparing with the buses using traditional energies.

Objective 3: Renewable Energy. Not applicable.

Objective 4: Transport and Urban Systems. It was estimated that the clean buses funded under the CBL program has already provided 358 million vehicle-kilometers of annual service. The improvement in selection, operation and maintenance of clean bus can significant increase the transport efficiency in urban areas. The TA has also supported the project cities to establish sound policy and regulatory framework in urban bus operation and maintenance. Eventually, the TA will contribute significantly to capacity development in urban public transport of the PRC.

Objective 5: Land Use, Land Use Change and Forestry (LULUCF). Not applicable.

Objective 6: Enabling Activities. In the PRC, the urban public transport is developed locally and separately city by city. The TA, especially the forum, provided a platform for the bus operators to exchange their best concepts, technologies, and practice in urban public transport development. The survey and analysis have well identified the potential development of the clean bus in the PRC and also provided a pathway for future improvement. The trainings and knowledge products have enabled the bus operators to access the most advanced concepts, technologies and practice worldwide.

26. An updated GEF Tracking Tool with terminal results is also submitted with this TER report.[16]

VI. Sustainability

27. The sustainability of the TA is rated *likely sustainable* by considering its financial, sociopolitical, institutional framework and governance, and environment risks.

28. Financial risk. There is no financial risk of the TA, but it will reduce the overall bus O&M costs. In the PRC, most of public transport operators are state-owned enterprises with the tariff determined by the city governments. The bus operation is generally not profitable, which is partially supported by local government fiscal subsidies. Purchasing public buses are generally financed by the city governments and/or by the bus operators themselves. The guidance in clean bus selection of the TA has provided a tool for the bus operators to select suitable clean buses, which may increase the operation efficiency and reduce the O&M cost. The trainings on bus operation and maintenance have brought advanced concepts and technologies of bus operators in Jinan, Fuzhou, and Beijing, which will eventually improve the performance of overall bus operations. Such efficiency improvement will certainly alleviate financial pressures of the city governments and the public bus operators themselves. Nevertheless, external financial supports are still essential for the bus operators to improve the bus operation and maintenance efficiency. After the trainings in bus operation, the bus operators in Jinan and Fuzhou express strong expectation in upgrading their bus dispatching system. But, the Canadian bus dispatching system, presented during TA implementation, was deemed too expensive by the bus operators. The Fuzhou bus operator is planning to purchase a domestic-made bus dispatching system, which has incorporated some advanced bus operation concepts and technology, but with much lower cost. External financial support is needed to accelerate the technology upgrading and innovation.

29. Sociopolitical risk. The public transport is considered as part of people's basic necessity for all level governments in the PRC. All city governments have made substantial efforts in improving the public transport, including increasing service areas and improving service quality. For fighting with global warming, reducing vehicle emission, and alleviate urban traffic congestion, the central government and city governments have made huge efforts to promote low-carbon development, encourage energy revolution, accelerate energy technology innovation, construct clean, low-carbon, and highly efficient modern energy system. In the government's FYP, it specially indicates to promote low-carbon transport development, increase public transport priority, enhance rail transport, encourage green travel, and implement new energy vehicle promotion plan. Implementing the CBL program and the TA is consistent with the government's strategy and plan. Improving clean bus operation and management in the public transport of the PRC is an essential and urgent task for all city governments and bus operators. The bus leasing activities under the CBL program confirmed that the bus operators' existing depots were adequate to house the newly procured buses and there was no need to acquire additional land for new

[16] Excel file: *GEF CC Mitigation Tracking Tool - ASTUD Clean Bus Leasing (with terminal results)*

facilities. No indigenous peoples were affected. The expansion of the bus fleets also translated into 200 new jobs. IBFL noted that all bus operators are regulated by the National Transport Commission, which also regulates and monitors their compliance with national laws and regulations, including labor laws. No labor noncompliance by the bus operators was reported to date.

30. Institutional framework and governance. The implementation of the TA helps to improve the institutional framework and governance of the clean bus development in the PRC. Under the TA, the existing government's policies in clean bus development has been reviewed and analyzed. Policy recommendations were provided in the TA report. Such policy recommendations, as well as city surveys, may assist the central and city governments to establish a better institutional and governance framework for the clean bus development in the PRC. The GEF and ADB should continue their dialogue with the government to maximize the benefits of the TA. With the CBL program, the lease portfolios increased at a compound annual growth rate of 18% from 2012 to 2015 for FEH and 19% from 2012 to 2016 for IBFL. Their asset quality remained below 1% of non-performing leases to the gross lease portfolio despite the increase in the portfolio, a decline in gross domestic product, and an increase in non-performing leases. The lease loss provision coverage ratio is above 200–300%. In the absence of independent published data on domestic privately-owned leasing companies in the PRC, the ranking of performance of the FLCs was derived from the client. Based on client feedback, FEH was ranked fourth and IBFL was ranked sixth in terms of total assets. The competition for leasing arises from non-financial and financial companies regulated by the Ministry of Commerce and CBRC-regulated banks.

31. Environment. The implementation of the TA has no environment risk but will contribute to the environmental improvement. The CBL program has enlarged the clean bus market in the PRC. The program target of overall reduction in GHG emissions has been achieved. In addition to the direct GHG reductions from improved selection and energy-efficient operation of buses leased under the baseline CBL program, the GEF-funded activities is expected to have a strong demonstration effect. It has substantial replication potential more broadly in the PRC bus industry and is expected to catalyze substantial indirect impacts through accelerated deployment and diffusion of principles, techniques and tools for selecting and operating clean buses to achieve maximum energy efficiency and GHG reductions. Total GHG emissions avoided (direct and indirect) were estimated to be some 2.3–3.6 million tons for the GEF-funded activities over the project lifetime.

VII. Monitoring and Evaluation (M&E) Framework and Institutional arrangements

32. M&E design. At appraisal, it was arranged that the M&E of project performance would be integrated with project management activities and ADB monitoring of the CBL program and the GEF-funded activities. The TA was also designed to have an output/task of implementing a clean bus performance monitoring program, which would monitor, analyze, and report on the actual fuel and energy performance of as many as possible of the buses leased under the CBL program. The monitoring results would be of broad interest and substantial value for bus operators in the PRC and elsewhere in Asia and the Pacific, and for researchers evaluating the actual performance of clean buses under different operating conditions. The results would also be broadly disseminated through professional and industry media, and the information resources would be fed into the ADB–STI knowledge sharing network and provided to the GEF. Under the TA, a Design and Monitoring Framework (DMF) was designed, which has clear indicators on impact, outcome, outputs, and activities with milestones. However, the indicators of impacts and outcome were mainly on the CBL program. The performance of the buses of the 17 companies

included in the TA were captured through the surveys and an emissions model based on the buses' performance was developed and shared to the companies.

33. M&E plan implementation. It was arranged at appraisal that a small project management team would be established in the CDMF (original EA) for coordinating the monitoring and evaluating process, and knowledge sharing activities. This included managing the monitoring and evaluation of project activities as specified in the DMF and preparing the necessary progress and evaluation reports for submission to GEF and ADB. Due to changes in the EA, such a management and monitoring activities were not conducted. Due to changes in the TA scope, the tasks of the M&E implementation were not well designed in the revised TOR and no related surveys were conducted. It was required that the TA consultant on bus operation and management (originally responsible for the output 4 "Clean bus performance monitoring program implemented") focused mainly on the trainings on bus dispatching and maintenance. In addition, the implementation of the TA was substantially delayed and apart from the CBL program. Nevertheless, the targets on the outcome indicators were substantially achieved and the targets of most output indicators were achieved. The achievements of the outputs are described above.

34. Budgeting and funding for M&E activities. Originally, the budget for the M&E activities was included in TA cost, which is under the category of the Project Management budget of $110,000. The EA would also provide inputs from its staff as part of its in-kind co-financing. Due to changes in the EA and M&E activities were not conducted, the budget allocated to the Project Management, including the M&E program, was not utilized.

35. Monitoring of future impacts. The clean bus development in the urban transport is developing very fast. Both the CBL program and the GEF-funded activities have contributed substantially to its development. An M&E program urgently needs to be designed and implemented to assess the impacts of the CBL program and the TA as well as to overall clean bus development in the PRC. The M&E program needs to be properly designed to be meaningful with clear indicators, which are easy to be monitored and useful for further analysis. Meanwhile, an implementation program should be well prepared by including the objective, institutional arrangement, timelines, and budget. The processing of the data collected and analysis approach should be also considered. Such an M&E program should be jointly designed and implemented with related government agencies to ensure the M&E results to be effectively used in the policy making. The TA team visited totally 17 cities in the PRC, post-visits are needed to learn and assess the impacts of the TA. Follow-up program need to be developed and implemented to maximize the TA benefits.

Annex A - Project Data Sheet

I. Project Identification

GEF Project ID: **5627**
GEF Agency Project ID: **46928**
Countries: **the People's Republic of China (PRC)**
Project Title: **ASTUD: PRC Clean Bus Leasing**
GEF Agency: **Asian Development Bank (ADB)**

II. Dates

Milestone	Expected Date	Actual Date
CEO endorsement		10 January 2014
Agency approval date		9 June 2014
Implementation start	May 2014	February 2017
Midterm evaluation		
TA completion	31 December 2016	31 December 2018
Terminal evaluation completion		30 November 2018
TA closing		31 December 2018

III. Project Framework

Project Component	Activity type (TA or INV)	GEF financing (in $)		Co-financing (in $ million)	
		Approved	Actual	Promised	Actual
1. Guidebook for Selecting a Clean and Accessible Bus	TA	150,000			
2. Promotion of Energy-Efficient, Inclusive and Competitive Bus Operations	TA	700,000			
3. Supporting Systems for Energy-Efficient Bus Operations	TA	805,000			
4. Clean Bus Performance Monitoring Program	TA	180,000			
5. Awareness, Training and Knowledge Sharing Program	TA	370,000			
6. Project Management	TA	110,000			
Total		**2,315,000**	**1,271,871.35**	**275.0**	**275.0**

IV. Co-financing

Source of co-financing	Type	Project Preparation		Project Implementation		Total (in $ million)	
		Expected	Actual	Expected	Actual	Expected	Actual
Host govt' contribution	in-kind						
GEF Agency (ies)	hard loan					275.0	275.0
Bilateral Agency (ies)							
Multilateral Agency (ies)							
Private Sector							
NGO							
Other							
Total co-financing						**275.0**	**275.0**