PROJECT IDENTIFICATION FORM (PIF) [1]
PROJECT TYPE: Full-sized Project
TYPE OF TRUST FUND:GEF Trust Fund

PART I: PROJECT IDENTIFICATION

Project Title:	Accelerating the Development and Commercialization of Fuel Cell Vehicles in China		
Country(ies):	China	GEF Project ID:[2]	5728
GEF Agency(ies):	UNDP	GEF Agency Project ID:	PIMS 5349
Other Executing Partner(s):	Ministry of Science and Technology of the People's Republic of China (MOST)	Submission Date: Resubmission Date:	7 March 2014 21 March 2014
GEF Focal Area (s):	Climate Change	Project Duration (Months)	48
Name of parent program (if applicable): • For SFM/REDD+ ☐		Agency Fee ($):	782,188[3]

A. FOCAL AREA STRATEGY FRAMEWORK[4]:

Focal Area Objectives	Expected FA Outcomes	Expected FA Outputs	Trust Fund	Indicative Grant Amount ($)	Indicative Co-financing ($)
CCM-4	Sustainable transport and urban policy and regulatory frameworks adopted and implemented.	Cities adopting in low-carbon programs	GEFTF	2,083,560	4,750,000
CCM-4	Increased investment in less-GHG intensive transport and urban systems.	Investment mobilized	GEFTF	6,150,000	48,750,000
		Total Project Cost		8,233,560	53,500,000

B. PROJECT FRAMEWORK

Project Objective: Facilitation of the commercial production and application of fuel cell vehicles in China

Project Component	Grant Type	Expected Outcomes	Expected Outputs	Trust Fund	Indicative Grant Amount ($)	Indicative Co-financing ($)
Improvement of Local Fuel Cell (FC) and Fuel Cell Vehicle (FCV) Production and Application	TA	Increased investments in the local production of FCVs for transport applications in Chinese cities	• Completed comparative study on current technical features and operating performances of locally manufactured FCs and FCVs in China and those in other FCV producing countries • Completed studies on the applicable improvements that can be cost-effectively done in the current locally manufactured FCs and FCVs in China • Completed capacity development and technical assistance for local transport vehicle manufacturers on the design and manufacturing of FCVs in 4 cities	GEFTF	750,000	500,000

[1] It is very important to consult the PIF preparation guidelines when completing this template.
[2] Project ID number will be assigned by GEFSEC.
[3] This is the Agency Fee for the project and does not include the Agency Fee for the PPG Exercise
[4] Refer to the reference attached on the Focal Area Results Framework when filling up the table in item A.

			• Published and disseminated information on improved FC and FCV design and production, including the results and evaluation of the completed FCV operations demonstrations.			
	Inv	Cities are deploying FCVs in their public passenger transport fleets.	• At least 4 completed demonstrations of design and manufacturing using improved FC stacks[5] • Completed demonstrations of FCV operations performance (various FCVs)[6]. 101 demo FCVs (13 GEF-funded, 88 co-financed)		5,850,000	45,050,000
Improvement of Hydrogen Production and Refueling Systems	TA	Increased investments in the FCV industry and its associated value chain businesses	• Completed studies on improvements that can be cost-effectively applied in the design, construction and commercial operation of H_2 refueling facilities for FCVs in China • Completed business promotional campaigns and survey for prospective investors on commercial H_2 transport fuel production for FCVs, and commercial H_2 refueling stations • Completed capacity development and technical assistance for prospective investors on commercial H_2 transport fuel production for FCVs, and commercial H_2 refueling stations in 4 selected cities • Published and disseminated information on the commercial H_2 transport fuel production for FCVs, and commercial H_2 refueling stations, including the results and evaluation of the completed H_2 production and refueling demonstrations.	GEFTF	150,000	500,000
	Inv	Local government and private sector entrepreneurs in cities build and operate H_2 production	• At least 4 completed demonstrations of the application of feasible and cost-effective H_2 production technologies[7] • At least 4 completed demonstrations of the commercial operation of H_2 refueling facilities[8]		100,000	3,300,000

[5] This will build on the government's program announced in early 2013 that funds 4 billion yuan (around $650 million) to help car companies strengthen new-energy vehicle design, batteries and other related technologies.

[6] The demonstrations will be for various FCVs under various driving conditions, environment and climatic conditions in four typical cities: (Beijing, Shanghai, Zhengzhou and Foshan). The Beijing demonstration will feature 9 FC Buses and 6 urban delivery vehicles, covering a combined travel distance of no less than 460,000 kms. The Shanghai demonstration will feature the operation of FCVs within the Jiading International FCV Demonstration Area, and involves no less than 80 FCVs (buses, taxis and cars) used by businesses and urban postal FC vans. The total distance covered will be about 1,400,000 kms. In Zhengzhou, the operation of 3 FCBs, which collectively will travel about 400,000 kms will be demonstrated. The operation of the same number of FCBs will be demonstrated in Foshan, and the total travel distance will be 150,000 kms. These demonstrations will be mainly to determine the technical and economic performances of the FCVs (e.g., kg H_2/passenger-km or kg H_2/ton-km, FC power density, FC operating hours, cost-effectiveness, etc.). The demonstrations are also linked to researches on fuel cell durability and environment-adaptability to determine improvements in reliability and safety, and develop standard procedures for the, operation and maintenance of FCVs, as well for reducing costs and longer service time of FCVs. Total 101 Demo FCVs (13 GEF-funded, 88 co-financed)

[7] This can include improved petroleum fuel (liquid or gas) reforming and syngas technologies, or the electrolysis of water using renewable energy-generated electricity. This can be in partnership with chemical and petrochemical plants that have waste gas streams that can be reformed to produce H_2 gas. On board H_2 generation may also be demonstrated.

		facilities and refueling stations				
Policy and Regulatory Frameworks for the Application and Commercialization of FCVs	TA	Effective enforcement of policies and regulatory frameworks on supporting the application and commercialization of low carbon transport, e.g., FCVs and other alternative energy vehicles (AEVs)	• Completed research studies on the required enabling conditions for the widespread application and commercialization of FCVs in the transport sector in China[9] • Completed policy research study (including feasibility) on the establishment and support of a local FCV market in China[10] • Formulated FCV support policies including the relevant implementing rules and regulations (IRRs) • Established FCV and H_2 production facilities technical and energy performance standards including testing and certification systems • Formulated and approved national FCV development master plan and supportive infrastructure roadmap and institutional framework supportive of low carbon transport development and applications (e.g., FCVs)	GEFTF	300,000	500,000
	TA	Effective enforcement of policies and regulatory frameworks on supporting the application and commercialization of FCVs in the transport sector	• Designed pilot schemes for the application of formulated and recommended policies supportive of FCVs[11]: • Completed pilot schemes, and published and disseminated pilot scheme implementation, results and evaluation • Completed promotion and advocacy work on the approval of revised FCV policies and IRRs • Approved FCV support policies and IRRs	GEFTF	200,000	400,000
Enhancement of Information	TA	Enhanced public acceptance of	• Established and operational domestic and foreign academic exchange	GEFTF	200,000	350,000

[8] This will, among others, test the effectiveness of the demonstrated H_2 refueling network design, the standard protocols for complying with the operational, safety, health, and environmental (OSHE) procedures/requirements to be applied to H_2 refueling facilities.

[9] This will be on (a) FCV product quality standards and certification (including fuel cell stacks); (b) FCV support facilities particularly the H_2 refueling systems and infrastructures; and, (c) H_2 production facilities (including onboard production, safety features)

[10] Includes impacts of various factors influencing FCV commercialization, economic incentives and corresponding measures for FCV economics (fiscal, taxation and financial policies, such as current tax and fee reduction and potential policy instruments such as carbon tax and environment tax); as well as possible financing schemes for FCVs for financing commercial production of FCV components or entire FCV units. The studies include also that for different hydrogen (H_2) production technologies and application options, as well as business models for H_2 production and sales depending on regional resources for H_2 production. The feasibility and requirements for the use of abundant renewable energy resources for H_2 production will also be investigated as well as the business models for the commercial operation of such H_2 production schemes.

[11] The piloting of FCV policies is mainly meant to test the effectiveness of various schemes, and select the best scheme for integrating the FCVs into the city day-to-day operations and city life. Schemes for, FCV sharing, FCV rental, FCV test driving for the public and FCV maintenance service can be tested and evaluated on a demonstration basis. A FCV marketing/sales center that can facilitate the initial import sales of FCVs without having to go through cumbersome customs procedures can also be part of the demonstrations. This center can also provide business related advice to FCV manufacturers in issues such as alignment of interests and agenda of stakeholders, technology sharing, confidentiality, exclusivity clauses, and horizontal competition. Different business models for the sales or dealership of FCVs can also be studied, in the pursuit of finding the best way to have a viable FCV market. Improved policy instruments like incentives and subsidies that are currently in place under the GOC's New Energy Vehicle (NEV) Industry Development Plan (2011 – 2020) can also be tested as part of the demonstration.

Dissemination and Awareness about FCV Transport Systems		FCVs for transport systems and services	networks on fuel cell, FCV and H_2 production technologies, as well as on commercial FCV production and business operations. • Completed riding public education and awareness-raising campaigns on FCV transport systems and operations in at least 4 cities • Established and operational FCV transport system performance and FCV market monitoring system[12] • Sustainable follow-up plan for the replication of the FCV transport systems in other cities			
FCV Technology Capacity Development Program	TA	Increased local technical capacity and knowhow in the research and development, operation and maintenance of FCV technologies and the FCV industry Strengthened market demand for cost-affordable FCVs for both public and private uses	• Designed, conducted and completed training programs for FC and FCV operation, repair and maintenance; and safe and cost-effective operation of H_2 production and cost-effective commercial operation of FCV transport systems and H_2 refueling stations. • Established and operational FCV value chain businesses such as the FCV service industry (e.g., design, construction, repair and maintenance of FCV infrastructures) • Developed business models for local financial institutions to support FCV manufacturing, as well as in the sales of FCVs to supplement the government's New Energy Vehicle Industry Development Plan (2011-2020) • Proposed financing scheme for FCV purchases for private transport users	GEFTF	291,490	350,000
			Sub-Total		7,841,490	50,950,000
			Project Management Cost[13]	GEFTF	392,070	2,550,000
			Total Project Costs		8,233,560	53,500,000

C. INDICATIVE CO-FINANCING FOR THE PROJECT BY SOURCE AND BY NAME IF AVAILABLE, ($)

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Amount ($)
Local Government	Science & Technology Commission (Shanghai Municipality)	Grant	5,000,000
Local Government	Beijing Municipal Science & Technology Commission	Grant	5,800,000
Local Government	Zhengzhou Science and Technology Bureau	Grant	2,000,000
Local Government	People's Government of Nanhai District, Foshan	Grant	2,233,300
Local Government	People's Government of Nanhai District, Foshan	In-kind	2,566,700
GEF Agency	UNDP	In-kind	400,000
Private Sector	Selected Enterprises (e.g., SAIC, Yutong)	Grant	35,500,000
Total Co-financing			53,500,000

[12] This will also include the monitoring of the new developments in FCV technologies and applications worldwide for information dissemination.
[13] Same as footnote #3

D. GEF/LDCF/SCCF Resources Requested by Agency, Focal Area and Country[1]: N.A.

[1]In case of a single focal area, single country, single GEF Agency project, and single trust fund project, no need to provide information for this table
[2] Please indicate fees related to this project.

E. Project Preparation Grant (PPG)[14]

Please check on the appropriate box for PPG as needed for the project according to the GEF Project Grant:

	Amount Requested ($)	Agency Fee for PPG ($)
• No PPG required.	-- 0--	-- 0--
• (up to) $50k for projects up to & including $1 million		
• (up to) $100k for projects up to & including $3 million		
• (up to) $150k for projects up to & including $6 million	150,000	14,250
• (up to) $200k for projects up to & including $10 million		
• (up to) $300k for projects above $10 million		

F. PPG Amount requested by agency(ies), focal area(s) and country(ies) for MFA and/or MTF Project only: N. A.

MFA: Multi-focal area projects; MTF: Multi-Trust Fund projects.

PART II: PROJECT JUSTIFICATION

A. Project Overview:

A.1.1. *Global Environmental Problems, Root Causes and Barriers that Needs to be Addressed:*

China is currently among the world's largest energy consumer and producer. Since the 1990s, increasing economic wealth amongst the population has resulted in an increased demand for relatively cheap coal-based electricity and private and public transport. Since the turn of the century, the major urban centers of the country have suffered from severe air pollution from a growing number of vehicles that creates smog, which is among the worst in the world. This is a similar situation in many newly industrialized countries, and because of this the demand to develop clean vehicle technologies has been mounting. Bulk of the transport fuel consumption is petroleum based. The country's oil reserves are limited. Since 1993, the country has become a net crude oil importer and from that time on the annual oil imports have increased to 122.7 million tons a decade after – an increase of almost 75%, as Chinese consumption has continued to surge higher particularly to meet industrial and transport sector energy demands. The electricity and heat production sector accounts for almost half of the CO_2 emissions of the country (mainly from coal utilization), and the industrial sector contributes about a third, the CO_2 emissions from the transport sector accounts for about 7%. About 77% of the annual transport sector CO_2 emissions are from road transport.

The Chinese government sees this sector very important in promoting to energy users the importance of energy efficiency since mobility is something that is a common daily economic, business and everyday living activities of people in a country. Addressing the high transport energy consumption in the country and the demand for more energy efficient transport vehicles and alternative fuel vehicles (AEVs) in China has been driven by the Chinese government's desire to reduce air pollution, particularly in urban centers. China has six of the world's 10 most-polluted cities.

[14] On an exceptional basis, PPG amount may differ upon detailed discussion and justification with the GEFSEC.

Among the AEVs that are of interest to China are the fuel cell vehicles (FCVs). Transportation is considered to be the most important initial market for fuel cells (FC) in China, and about 74% of the application of FCs in China focuses on transportation. About 54% of FC technology in the country is based on proton exchange membrane fuel cell (PEMFC), the most prominent FC technology for transportation applications worldwide. Bulk of the FCV initiatives in China has been through the government[15]. There hasn't been much private investment on FCVs, and so far only a handful of private Chinese companies are working on this type of AEV. However, China has seen vast investments from major car and bicycle manufacturers, some of which are already working with local research institutions on FC applications. Hydrogen (H_2), the fuel used in FCVs however poses several daunting technological hurdles that must be overcome before FCVs can help solve the transport energy challenges and pollution. The cost of FCs is still extremely expensive and in transportation applications FCs are still very fragile. Storing and distributing H_2 is still difficult, because as a gas it contains very little energy by volume, hence, must be either liquefied or stored under extreme pressure to deliver significant amounts of energy. Also, H_2 itself must be extracted from other fossil fuels, or manufactured using electricity and water.

China's ample market and the relatively limited FCV development indicate a lucrative market to both local and foreign investors interested in the AEV business. The main opportunities for FCVs in China are in the development of FC engines and for FCV refueling stations. Chinese transport authorities are looking for well-designed FCVs (particularly buses) that suit their individual local environments, maintenance staff training and a high level of service.

A project that will further facilitate FCV development in China is envisioned and is presented in this project proposal. There have been initiatives carried out in the past in China aimed towards to commercialization of fuel cell technology in transportation. One of these was the previous GEF-funded project in China, Demonstration for Fuel-Cell Bus Commercialization in China (Phase I & Phase II). That 2-phased project specifically showcased the application of fuel cell bus technology in the public bus transport systems in Beijing and Shanghai. Important lessons learned from this project, particularly on the logistical and administrative requirements of the implementation of the demonstrations will be taken into account and put to good use in the design of the proposed project. Annex 1 show the differences between these previous projects and the project envisioned in this proposal. While the GEF evaluation comments on this project are by and large admissible during the time of the evaluation (2011), several changes have happened in the past 3 years that would somehow indicate improvements from the conditions that were described in the evaluation conclusions[16]. For example, the current support in terms of financial incentives that the Government of China has provided since the 11th Five Year Plan and the current one have created a much better future for fuel cell vehicle (bus, car and utility) development in China. With the current program, the population of new energy vehicles (or alternative energy vehicles – AEVs) that include hybrid, electric and fuel cell vehicles, in China is targeted to increase to half a million by 2015, and the commercialization of FCVs is expected to happen anytime during the period 2020-2030. While the level of support of the government has increased, this is mainly focusing on the technical and financial aspects of FCV development. With this still limited support, it would be timely now to assist the government in facilitating the way towards commercialization of FCV. The chances of success of

[15] In October 2012, the Ministry of Finance (MOF), Ministry of Science and Technology (MOST, and Ministry of Industry and Information Technology (MIIT) jointly announced the launch of new energy automotive industry technology innovation projects, incentives to support FCVs and other alternative energy vehicles (AEVs) and two types of battery research and development projects, and to support the implementation of 50 FCV demonstrations. In September 2013, the MOF, MOST, MIIT and National Development & Reform Commission (NDRC) jointly started a new incentives program (2013-2015) for AEVs, and continue to support large scale demonstration of these including FCVs through subsides and other policies.

[16] This earlier "proof-of-concept" project has been regarded as not successful in view of the very limited direct GHG emission reductions that these generated, and that its limited outcomes and benefits of GEF were not achieved. The evaluation pointed out that the FCB technology that was promoted by this project was not locally accepted as safe and useful, sustaining did not take place, and that these projects did not really lead to mainstreaming due to the technology's lack of maturity, like establishments of product specifications and standards.

implementing a project now that will involve a set of activities that will supplement the current significantly up-scaled support program of the country in accelerating the commercialization of FCVs is far greater than 3 years or a decade ago. Such project will not only expedite FCV commercialization but will, in so doing, also influence the commercialization of other AEVs. The implementation of such supplementary set of interventions will be designed taking into consideration the lessons learned and experience gained in the previous FCB project to ensure successful creation of the necessary enabling environment and foundations for FCV commercialization.

A.1.2. ***Baseline Scenario and Any Associated Baseline Projects:***

In September 2013, the MOF, MOST, MIIT and NDRC jointly launched and implemented a support program for new energy vehicles providing incentives for the commercialization of FCVs. Under this program, subsidies for FCVs are as follows: Fuel cell cars - 200,000 RMB (US$ 32,500); and Fuel cell bus - 500,000 RMB (US$ 82,000). In 2014, the subsidy support provided under the program is reduced by 5%, and will be reduced by 10% in 2015[17]. In 2013, the production and sales of automobiles both exceeded 20 million, a world record. Moreover, China is the world's largest producer and user of buses. Chinese auto makers are keen on FCV R&D and have formulated long-term development strategies.

In 2013, the local government of Zhengzhou issued its New Energy Vehicle Demonstration and Industrial Development Action Plan (2013- 2015), and specified the development direction for new energy vehicles, including carrying out the technology and development of FCVs. With that action plan that involves the demonstration of the operation of 4-10 fuel cell buses during the period 2015-2020, it is expected that fuel cell bus commercialization in the city would happen by 2020-2030 with the deployment of 1000 FCBs in the city's local transport fleet. In the same year, the city government of Foshan launched the implementation of a FCV demonstration project, with the purpose of developing an industry for the research and development (R&D), and production of fuel cell system parts & components. It involves R&D and demonstration of the production and operation of FC buses as means for building a domestic production base for new energy vehicles.

Despite the progress made so far in FCV R&D and technical demonstrations in China[18], there are still several barriers to the widespread application of FCVs in the country's transport sector, and in particular in the commercialization of FCV. Removing such barriers will facilitate or at least create the enabling environment for FCV commercialization and widespread deployment in China, and ultimately contribute also to the application of FCV transport systems globally.

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[17] Passenger car subsidies are pegged to the technology's price premium and range. For battery electric vehicles (BEVs), the largest subsidy is for cars with ranges of over 155 miles at 60,000 RMB (US$ 9,800). A car with over 90-mile range receives around US$ 8,100, and a BEV at 50 mile range receives around US$ 5,700. Fuel cell vehicles are eligible for up to 500,000 yuan (US$ 81,670). The scheme is intended to help China meet its own aggressive goals for clean vehicle production and adoption. Under China's New Energy Vehicle (NEV) Industry Development Plan (2011-2020), the country aims to have 500,000 NEVs on the road by 2015. By 2020, the projected production capacity is 2 million NEVs with cumulative production and sales of 5 million vehicles – including FCVs.

[18] There have been several R&D work, tests and demonstrations of FCV technologies in China. These include, among others, the operation of FC buses, and a special hybrid system comprised of extended range fuel cells and lithium batteries for FCVs with enhanced braking energy feedback. The consumption of H_2 fuel has improved from about 9.3 kgs/100 kms to less than 8.5 kgs/100 kms. The manufacturing cost for the currently produced FCVs has been greatly reduced but not for producing the relatively advanced FCVs that are being produced in the developed countries. There have been significant achievements made in the R&D of critical materials and components of fuel cell systems for vehicles. Currently, the focus is on enhancing the durability and performance of fuel cell stacks and on the environment adaptability of fuel cells. At present, the main technical performance of locally made FC buses is as follows:

Parameter	Value	Parameter	Value
Maximum speed (/km/h)	≥ 85	Stack lifetime (h)	2500 to 3000
Acceleration	0~50 km/h in < 25 secs.	Stack working temperature (℃)	-10 to 45
Hydrogen fuel consumption, kgs/100 kms	9	Unit cost (US$)	700,000
Range per H_2 fueling (kms) including AC	300	Ave. breakdown interval mileage (kms)	1000

Barriers to FCV Deployment and Commercialization

1. FCVs are relatively expensive in China - *Due to the high cost of FC stacks, FCVs are still not competitive compared with conventional internal combustion engine (ICE) vehicles in terms of purchasing price. Even with subsidies from the central and local governments, the price for example of a locally made FCB ranges from USD 0.45 million to USD 0.7 million. That is about 5 to 7 times the price of a conventional diesel bus with similar configuration and performance in China's vehicle market. Because of the subsidy programs, alternative energy vehicles (AEVs) such as FCVs that have been purchased so far have been used for public transport rather than private use. This indicates a weak market demand for these AEVs among private consumers.*

2. Lack of promotion and demonstration of locally made FCVs - *Compared to their foreign counterparts, Chinese FCVs don't seem to appeal to the potential users (mid- and high-income consumers) due to their rather inferior performance, which is crucial for market penetration. The much needed demonstration of the application of new and improved energy efficiency features in FCVs are lacking to enable local transport vehicle manufacturers learn more on how to make the performance of their products aligned with international FCV standards. The local manufacturers can learn more from such demonstrations how to improve the service life and durability of fuel cell engines in order to improve the performance and reliability.*

3. The local FCV technologies lag behind those in developed countries - *Presently, few local FCV component suppliers can meet the requirements of FCV manufacturers in terms of cost balancing, quality, and delivery reliability. This is the reason why the current FCV market penetration is low. This is further complicated by technology transfer issues such as alignment of interests and agenda of stakeholders, technology sharing, confidentiality, exclusivity clauses, and horizontal competition. China has initiated R&D of FCV technologies almost at the same time with other countries, but the scale of prototype FC engine design and development and testing are relatively limited.*

4. FCV support infrastructures are inadequate – *The necessary infrastructures are not yet adequate to support the widespread application of FCVs in China. Among these is the necessary network of* H_2 *refueling stations, as well as* H_2 *production facilities. In addition, more FCV production facilities have to be built. The involvement of the private sector (local and foreign) would be essential in the provision of these infrastructures. Failure to address this will mean not meeting the government's planned FCV market targets and potential demands.*

5. The pertinent support policy and regulatory frameworks are inadequate – *The government's rather unclear and vacillating policy signals have made it difficult for the local FCV industry and market to develop. Lacking industrial standards and policy certainty about relevant technology roadmaps, the local transport vehicle manufacturers are not encouraged to invest low carbon transport vehicles and on the much needed infrastructures for these. Hence, a wait-and-see attitude prevails until clearer policy guidance and roadmaps become available. Following policy guidance for customer needs will also help local FCV manufacturers focus on market demands, which could be the main drivers for commercialization.*

Even though in the recent years ambitious targets and strong government support have contributed to the local FCV development, the industry's future is unclear, unless the government can smartly address the above stated barriers/issues.

A.1.3. ***Proposed Alternative Scenario (Brief Description of Components of the Project and Expected Outcomes):***

The alternative scenario that this proposed project will facilitate features a higher level of FCV development and deployment in China by 2020. While in the baseline scenario the forecast is for FCV commercialization will only happen anytime during the period 2020-2030, the proposed project will bring about an alternative scenario of FCV commercialization by 2019-2020. Hence, the objective of the proposed project is the facilitation of FCV commercialization in China. To achieve this, the identified barriers to the effective promotion and extensive application and local manufacturing of FCVs that are at par with international FCV performance standards have to be removed or at least, significantly minimized.

In 2013, China's auto production and sales volumes are both more than 20 million. It is forecast that car ownership in China will be more than one hundred million, and these vehicles emit large quantities of carbon dioxide (CO_2) and pollutants, e.g., nitrogen oxides (NO_x) and particulate matter (PM) each year[19]. It is predicted that from 2000 to 2030 years, the number of large and medium bus (7m -18 m) will increase at a rate of 5% per year and reach 720,000 in 2030. If 30% of the bus (about 200,000) are FC buses in 2030, the annual transport CO_2 emissions can be reduced by about 1 million tons[20] (@ 200 kms/day; 300 days/year). Based on the car production and sales data in 2013 are both about 15 million, if 30% of cars (about 4.5 million) are based on FCV technology, the annual transport CO_2 emissions will reduce 5.7 million tons. If the growth of car population is taken into consideration, the effect of reduction will be more pronounced, and the exhaust emissions of NO_x and PM will also be significantly reduced. The successful implementation of the project will accelerate the industrial development and commercialization of FCVs in China, providing a new economic growth point for the community and businesses, and realizing substantial social and economic benefits. The commercialization of FCVs will also open up opportunities for high income generating jobs for both men and women both in the production floor and in the management and support areas.

The proposed project intends to facilitate the realization of the potential CO_2 emission reductions (aside from the reduction in the emission of other air pollutants) by removing the identified barriers that up until now has prevented China from realizing substantial GHG emission reductions that would contribute to the achievement of the countries climate change mitigation targets. The project will address current problems in the FCV industry in China, which focuses on the improvement of the efficiency and durability of the FC engine, FC stacks, and overall FCV operating performance, as well as improvements in the main support infrastructures – H_2 production facilities and H_2 refueling facilities. The proposed project will focus on removing a number of key barriers in the local AEV initiatives of the country, particularly the FCV industry. A combination of "technology push" and "market pull" activities will be employed to enhance the overall performance levels of locally produced FCs and FCVs by facilitating/enabling the effective promotion and application of FCV production and application technologies and techniques, as well as that for the H_2 production and H_2 refueling facilities.

Component 1: Improvement of Local FCV Quality and Performance – This component is meant to address the barrier regarding the relatively inferior quality and performance of locally made FCVs compared to international FCV standards. It is expected that with the interventions that will be carried out under this component, there will be increased investments in the local production of FCVs for transport applications in Chinese cities, and cities are deploying FCVs in their public passenger transport fleets. The activities that will be carried out under this component will be in cooperation with the local transport vehicle manufacturers that are interested in venturing into the production and sales of improved FCVs, as well as those that have already been producing FCVs in the country. The activities that will be carried out

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[19] In 2012, the estimated annual total transport vehicle nitrogen oxides (NO_x) was around 6.4 million tons (about 25% of overall NO_x emissions in the country), while the particulate matter (PM) emissions was about 621,000 tons.

[20]This is assuming 83 g CO_2/km emissions from a diesel ICE bus that will be substituted by a FC bus.

under this component will also be coordinated with ongoing projects/programs on AEVs in the country. In particular, the technical capacity development for local transport vehicle manufacturers and those that are currently availing of the government AEV manufacturing financial support (particularly on FCV) will be coordinated to make use of the potential synergies. The major capacity development activities will be on the demonstrations of the application of improved FC application and FCV design and manufacturing. This will involve the provision of technical assistance to selected FCV manufacturers and new transport vehicle manufacturers venturing into the FCV business on the design and manufacturing of high performance (e.g., FC engine and FC stack life and durability, H_2 fuel economy, etc.), the prototype production of selected FC engine designs, including FC engine product testing and FCV on the road test runs on a demonstration basis. The activities that will be carried out whose results will contribute to the realization of the anticipated outcomes are: (a) Conduct of a comparative study on current technical features and operating performances of locally manufactured FCs and FCVs in China and those in other FCV producing countries; (b) conduct of studies on the applicable improvements that can be cost-effectively done in the current locally manufactured FCs and FCVs in China; (c) Design and conduct of FCV capacity development and technical assistance program for local transport vehicle manufacturers on the design and manufacturing of FCVs; (d) Design and conduct of capacity development and technical assistance program for local FC manufacturers on the design and manufacturing of improved FC stacks for use in locally manufactured FCVs; and, (e) Design and implementation of demonstrations on improved FC stack design and manufacturing; (f) Design and implementation of demonstrations on FCV design and manufacturing; and, (g) Publication and dissemination of information on improved FC and FCV design and production, including the results and evaluation of the completed FC and FCV demonstrations.

Component 2: Improvement of Hydrogen Production and Refueling Systems – This component is meant to address the barrier regarding the inadequate FCV support infrastructures particularly on the H_2 fuel supply, as well as the need to improve the quality and performance of existing facilities. With the interventions that are envisioned to be carried out under this component, it is expected that there will be increased investments in the FCV industry and its associated value chain businesses, and that local government and private sector entrepreneurs in cities build and operate H_2 production facilities and refueling stations. The activities that will be carried out under this component will be in cooperation with the local industrial gas and chemicals/petrochemicals companies that are interested in venturing into the production and sales of H_2 for FCVs, as well as those that have already been producing commercial H_2 gas in the country. The activities that will be carried out under this component will also be coordinated with ongoing projects/programs on FC technologies in the country. In particular, the technical capacity development for local FCV service providers (e.g., engineering consultants, transport vehicle manufacturers) that would like to venture in the developing FCV industry and market in China will be coordinated to make use of the potential synergies. The major capacity development activities will be on the demonstrations of the application of improved H_2 production technologies (based on available and feasible H_2 sources) and in design and safe operation of H_2 storage, handling and refueling technologies. In summary, the envisioned activities that will be carried out whose results will contribute to the realization of the anticipated outcome are: (a) Conduct of comparative study on technical features and operating performance of existing H_2 refueling facilities and the H_2 production technologies in China and those in other FCV producing countries; (b) Conduct of studies on the applicable improvements that can be cost-effectively applied in the design, construction and commercial operation of H_2 refueling facilities for FCVs in China; (c) Design and implementation of business promotional campaigns and survey for prospective investors on commercial H_2 transport fuel production for FCVs, and commercial H_2 refueling stations; (d) Design and conduct of capacity development and technical assistance for prospective investors on commercial H_2 transport fuel production for FCVs, and commercial H_2 refueling stations; (e) Design and implementation of demonstration on the application of feasible and cost-effective H_2 production technologies; (f) Design and implementation of demonstrations on the commercial operation of H_2 refueling facilities; (f) Publication and dissemination of information on the commercial H_2 transport fuel production for FCVs, and commercial H_2 refueling stations, including the results and evaluation of the completed H_2 production and refueling demonstrations.

Component 3: Policy and Regulatory Frameworks for the Application and Commercialization of FCVs – This component will address the barrier related to the inadequate policies and regulatory frameworks that support the promotion, application and commercialization of FCVs in China. A situation wherein there will be effective enforcement of policies and regulatory frameworks on supporting the application and commercialization of low carbon transport, e.g., FCVs and other alternative energy vehicles (AEVs), and effective enforcement of policies and regulatory frameworks on supporting the application and commercialization of FCVs in the transport sector are the expected outcomes from the envisioned activities under this component. These will include: (a) Conduct of research studies on the required enabling conditions for the widespread application and commercialization of FCVs in the transport sector in China (e.g., FC and FCV product quality standards and certification; FCV support facilities particularly the H_2 refueling systems and infrastructures; and, H_2 production facilities); (b) Conduct of policy research study (including feasibility) on the establishment and support of a local FCV market in China; (c) Formulation of FCV support policies including the relevant implementing rules and regulations (IRRs); (d) Establishment of FCV and H_2 production facilities technical and energy performance standards including testing and certification systems; (e) Formulation and approval of a national FCV development master plan and supportive infrastructure roadmap; (f) Establishment of institutional framework supportive of low carbon transport development and applications; (e.g., FCVs); (g) Design and implementation of pilot schemes for the application of formulated and recommended policies supportive of: (1) FCV application and commercialization; and, (2) Commercial H_2 transport fuel production and business operation; (h) Publication and dissemination of pilot scheme implementation, results and evaluation; (i) Conduct of promotion and advocacy work on the approval of revised FCV policies (incorporating results and recommendations from pilot activities) and IRRs.

Component 4: Enhancement of Information Dissemination and Awareness about FCV Transport Systems– This component will consist of "market pull" activities, which are aimed at removing barrier concerning the low level of awareness about, and lack of accessible information on, technologies and techniques in the design and production of advanced FCVs. The successful completion of the envisioned activities under this component will contribute achieving an enhanced public acceptance of FCVs for transport systems and services. To achieve the pertinent outputs that will contribute to the realization of this outcome, the following envisioned activities will be carried out: (a) Design, establishment and operationalization of a domestic and foreign academic exchange networks on fuel cell, FCV and H_2 production technologies, as well as on commercial FCV production and business operations; (b) Conduct of riding public education and awareness-raising campaigns on FCV transport systems and operations; (c) Design, establishment and operationalization of a FCV transport system performance and FCV market monitoring system; (d) Publication and dissemination of local FCV market and FCV transport system product performance in print media and through the internet; and, (e) Preparation of a sustainable follow-up plan for the replication of the FCV transport systems in other cities. The establishment and operationalization of a FCV transport system performance and FCV market monitoring system will involve the monitoring of the prices, sales volume, and availability of the different types and brands of FCVs and other AEVs sold in the market, and their corresponding market shares. This system will be formally adopted and implemented by a designated government agency such as the MOST or MIIT. The information that will be derived from the market monitoring activities, as well as the technical and energy performance specifications of the various tested FC products and FCV units in the market will also be disseminated to enable consumers to choose the appropriate FCV (or other AEV) brands. These monitoring and information dissemination activities will also be coordinated with relevant ongoing projects in China that also monitor local and regional markets for energy efficient consumer products. The sustainable follow-up action plan that will be developed for replicating the project interventions in other Chinese cities, targets other cities with considerably large riding public and possibly for freight transport.

As in other energy efficient or environment-friendly consumer products, since the target energy savings and GHG emission reductions will come from transport vehicle users that would be influenced by the results of this project, and by the support frameworks that this project will establish, it is imperative to include the private sector (e.g., transport vehicle manufacturers and passenger/freight transport system operators) in the design and implementation of such plan.

Component 5: FCV Technology Capacity Development Program – This component is primarily aimed at addressing the need to enhance the technical capacity of the local transport vehicle manufacturing industry to enhance their knowledge and skills in the development of advanced FCs and FCVs. With an enhanced capacity to develop and manufacture better, relatively lower cost but still quality FCs and FCVs that are at par with international standards, it is expected that the market demand for cost-affordable FCVs will strengthen for both public and private transport uses. The activities that will be carried out under this component will be in cooperation with the local transport vehicle manufacturers that are interested in venturing into the production and sales of FCVs, as well as the existing FCV producers. Some of the activities that will be carried out will be coordinated with responsible central government agencies for the implementation of the New Energy Vehicle Industry Development Plan (NEVIDP 2011-2020), as well as local financial institutions that may be interested in financing FCV manufacturing initiatives as well as FCV sales/dealership and FCV consumer financing schemes. The envisioned activities that will be carried out whose results will contribute to the realization of the anticipated outcomes are the following: (a) Design and conduct of training programs for FC and FCV operation, repair and maintenance; as well as on the safe and cost-effective operation of H_2 production and cost-effective commercial operation of FCV transport systems and H_2 refueling stations; (b) Design and implementation of enabling requirements for the establishment and operationalization of FCV value chain businesses such as the FCV service industry (e.g., design, construction, repair and maintenance of FCV infrastructures); (c) Training of selected personnel of government transport planning and regulatory agencies on: (1) Coordinated low carbon transport policy making, investment planning research and development, and implementation (e.g., FCV); and, (2) Transport policymaking, planning, and regulation of low carbon vehicles; (d) Design and operationalization of a FCV technology and application monitoring system; (e) Establishment of a center of excellence to support local capability and expertise on, and promotion of, new AEV developments and applications; (f) Conduct of techno-economic feasibility analyses and the preparation of the action plan for financing FCV initiatives of local car/bus/truck manufacturers and dealers; (g) Development of business models for local financial institutions to support FCV manufacturing, as well as in the sales of FCVs to supplement the government's NEVIDP (2011-2020); and, (h) Design of a financing scheme for FCV purchases for private transport users.

The coordinated implementation of the various activities within and among the project components is expected to deliver all the anticipated outputs that will bring about the expected outcomes that will contribute to the realization of the objective of this proposed GEF project. The MOST expects that by the end-of-project, at least 50% of the local car/bus/truck manufacturers in China will produce FCVs that are at least at par with international FCV standards. The average H_2 fuel economy for example for FCBs would have already improved to, at the most, 9.0 kgs/100 kms by that time. About half of the 28 cities that were targeted for "green vehicles" promotion in 2013 of by the central government are anticipated to have operational FC buses in their public transport fleets, totaling about 10,000 FCBs in operation in the country by 2020. The anticipated population of other FCVs by that time is expected to be at a modest level of 11,000 units (FC cars = 10,000; FC vans/trucks = 1,000). For the project, it is also expected that by end-of-project, there will be a total of at least 101 FCVs in the 4 demonstration cities and there will be a total of 6 H_2 refueling stations operating in China. By end-of-project, FCVs in the country will have a modest market share (5%) in the local AEV market in China. The proposed project intends to facilitate/influence, and contribute to the achievement of these targets of the MOST by removing the barriers that are presently hindering their realization.

A.1.4. ***Incremental/Additional Cost Reasoning and Expected Contributions from the Baseline, the GEFTF, LDCF/SCCF and Co-Financing***

With the existence of the current barriers to the widespread production and application of FCVs in the transport sector of China, the commercialization of this zero emission type of transport vehicle will not be realized, or if at all will happen, will be much delayed – perhaps even beyond the anticipated 2020-2030 period. The previous interventions that the government (central and local) have done since the early 2000s proved to be inadequate in spurring the development of the local AEV industry (which include FCVs) and most conspicuously had only stimulated a rather weak participation of the private sector. Aside from the barriers, with the current AEV program of the government somehow tilting towards electric vehicles[21], the FCV commercialization process may further be slowed down. As a result, the typical ICE vehicles will remain dominant in the country's transport sector in the absence of this proposed GEF project. If the proposed GEF project will not happen, the GOC's NEVIDP will continue up to 2015 but will be something that simply give subsidies for vehicle purchases and will not encourage the R&D capabilities of the country's main automakers. This is also the overall view of the local automotive industry observers.

With the proposed project that will bring about the removal of the current barriers to the widespread production and application of FCVs, the start of commercialization phase of this type of AEV will be realized even before 2020. The GEF's intervention through this proposed project help spur interest among the local automotive manufacturers to carry out AEV R&D activities on their own or in collaboration with either or both local and foreign manufacturers. The current government funding in the current 12th Five Year Plan focuses also on R&D to advance domestic fuel cell technology. This project can help in further encouraging the manufacturers to avail of such assistance from the government. Furthermore, this GEF project will also supplement and assist the GOC's achievement of its NEVIDP targets and enable the realization of an alternative scenario wherein future vehicle population in major Chinese cities includes AEVs (particularly FCVs) that are not just funded by some government-subsidized environment improvement or transport pollution control programs, but also private-owned FCVs and commercially operated FCV fleets. With the facilitated market transformation from using the traditional ICEVs to AEVs (particularly FCVs), the potential significant energy saving and energy cost savings from the transport sector will be realized, including the co-benefit of reduced negative environmental quality impacts.

Although there have been some policies issued and actions done to promote FCV production and application in the country, these rather limited and general actions are not sufficient to remove the identified barriers, create and sustain enabling environments, and facilitate or at least influence the increased investments of the private sector in FCV manufacturing and spur commercialization. Without GEF support for funding the incremental cost for removing the barriers that this proposed project will address, the expected potential additional global environmental benefits (in terms of avoided CO2 emissions linked from the petroleum fuels that will be saved from the operation of ICEVs) would not be

[21] The current NEVIDP supports hybrid, electric and fuel cell vehicles. There have been a debate among experts whether EVs are much better than FCVs or are more favored over FCVs. Basing on the financial incentives that are being provided (EV car = RMB 60K, EB bus = RMB 500K, FC car = RMB 200K, FC bus = RMB 500K) one may think that incentives for FC cars are higher because they may not be so popular compared to the battery electric car. For bus the incentives are the same for both electric and fuel cell variety. The US and European car makers in China favor the electric variety while the Japanese car makes favor fuel cell technology, since FCVs are a more viable alternative to gasoline-powered cars than electric vehicles, mostly because they have a far better range. FCVs are regarded as the real zero emission vehicles since EVs are still using an energy form (electricity) that is produced in China mainly with coal. In that perspective, and in view of the objective of the government to improve air quality and reduce CO2 emission reductions, the government (central and local) tend to favor FCVs over EVs. Many EV manufacturers are also facing problems related to the batteries and also complaints from the power utilities that have to install additional generating capacities to serve EV charging stations. Comparing EB and FCB, the unit prices are more or less the same, but the running costs differs. FCBUS and EBUS are comparable in running cost at the same 200 kms travel distance. If the travel distance is below 150 kms, the EBUS has more advantage in terms of running cost. Refer to Annex 2. While electric cars are on the road to becoming mainstreamed in the U.S. and Europe, they are still far from reaching that point in China. They have started to gain some modest traction only recently, but the electric car market continues to be pretty slow, and the government is trying to give it a boost by offering generous incentives to everyone who decides to buy an alternative energy vehicle. The government incentives programs cover hydrogen-powered cars, which are more environmentally friendly.

realized. Without this proposed project, China would have limited success in promoting the widespread utilization of AEVs, especially FCVs; in increasing the use and commercialization of FCVs. Such efforts will be at a relative low level, and in so doing, the potential contribution to the country's GHG emissions reduction targets as well as the country's aim to conserve energy and protect both the global and local environment (particularly in transport-intensive urban centers of the country) will not be fully realized. With the GEF support for the incremental cost needed to create the much needed market pull and technology push to remove the barriers that will in turn facilitate the increased share of FCVs (and potentially other AEVs) in the local transport vehicle market. This GEF project will help realize for China the expected global environmental benefits of reduced GHG emissions from the energy savings that will be derived from the widespread use FCVs.

A.1.5. *Global Environmental Benefits (GEFTF, NPIF) and/or Adaptation Benefits (LDCF/SCCF):*

This proposed GEF project will facilitate the realization of the expected outcomes through barrier removal and other capacity development and technical assistance activities. The major direct CO2 emission reductions that are attributable to the project will come from the FCV operation demonstrations that will be carried out in the planned demonstration cities of Beijing, Shanghai, Zhengzhou and Foshan. There are also expected CO_2 emission reductions from other FCV application replications that will be implemented during the implementation period of this GEF project. Potential CO_2 emission reductions can also be realized from the improved H2 production technologies that will be showcased under the project (e.g., improved steam reforming and syngas production, water electrolysis using RE-generated electricity). All of these will be, at various levels will be facilitated through the barrier removal activities and other capacity building and technical assistance activities that will be implemented. A major co-benefit from the project is the reduction of air pollution from cities where FCVs will be used.

The lifetime direct CO_2 emission reductions that will be derived from the project will come at least from the FCV operations demonstrations that will be carried out. From the initially planned demonstrations in 4 project sites, the estimated lifetime CO_2 emission reductions is about 130,000 tons (assuming average lifetime of FCV is 6 years). This translates to a modest unit abatement cost (UAC) of about US$ 63.4/ton CO_2 (i.e., GEF$ per ton CO_2). This could be much lower if the direct post project CO2 emission reductions will also be accounted for, and in that regard, this measure of the project's cost effectiveness (i.e., UAC) will be tracked using a monitoring and evaluation system that the proposed project will be developed during the project. This UAC figure will be regularly re-evaluated and updated during the project implementation particularly in quantifying the potential energy savings from projected replications, and in coming up with the CO_2 emission reduction estimates.

Cost-effectiveness in terms of GHG emission abatement will definitely favor the AEVs that are less costly to purchase and operate. Comparing an electric bus (EB) and FC bus (FCB), their unit prices are more or less the same, but their running cost differs. FCBs and EBs are comparable in running cost at travel distance of up 200 kms. If the travel distance is below 150 kms, an EB has more advantage in terms of running cost. On a passenger-km basis, more GHG emissions are released from the use of EBs. In regards to cars, the unit price of a fuel cell car (FCC) is much higher than that of an electric car (EC). The running cost of an EC is lower (@ 16 – 18 RMB/100 kms) than that of a FCC (@ 22 RMB/100 kms). But at longer distances, the same conclusion can be drawn when comparing the running costs of an EB and a FCB. With the favorable enabling conditions and increased technical capacity and knowhow that the proposed project will facilitate, the unit cost of the more environment-friendly FCC would by 2019 (end-of-project) be very competitive compared to an EC. In that case, the cost-effectiveness of FCCs compared to ECs will be higher. In regards to buses, currently the cost effectiveness of the electric and fuel cell variety are almost the same. But by end-of-project, FCBs will be more cost effective. The estimated cost effectiveness will be verified and confirmed during the project preparation stage i.e., PPG exercise).

A.1.6. ***Innovativeness, Sustainability and Potential for Scaling Up:***

Innovation: The proposed project is intended to supplement the efforts of the GOC to promote a transport technology that is considered innovative in China. And since it is still evolving even in the developed world, it would require substantial demonstration of its viability as a means of saving energy used in transport and consequently reduce GHG emissions from the Chinese transport sector. The application of this innovative technology is also very timely since its major co-benefit is environmental quality conservation – something that is very important in many of China's big and still expanding urban areas. The inclusion of interventions focusing on the major support infrastructures for the FCV market, which are the facilities for H2 production and H2 refueling are among the innovations in this proposed project. The participation of the private sector in improving the sales and use of FCVs to transform the market from the current government-supported programs to a market dominated by FCV use for private transport is also among the innovative features of this project. Also, a clear innovation in the project is the fact that the demonstrations will be linked to ongoing and planned researches on fuel cell durability and environment-adaptability to determine improvements in reliability and safety, and develop standard procedures for the, operation and maintenance of FCVs, as well for reducing costs and longer service time of FCVs.

Sustainability: The proposed project will be sustainable not only because of the Chinese government's policy and long term development plan for FCVs, but also because the expected outputs that will be delivered are meant not only to provide the enabling conditions for cohesive efforts to sustain and guide the commercial development of the industry. In this regard, the proposed project is essential for the local transport vehicle manufacturing industry development. The strategy to continuously facilitate the effectiveness of these enabling conditions involves their development, establishment and institutionalization, and in so doing also sustain them. The demand for mobility by people, the necessity of transport for socio-economic development, the current efforts of the government (central and local) to develop and support, and the need to address current transport-based air pollution are the major drivers for the sustained development efforts towards the commercialization of AEVs, in general, and FCVs, in particular. To ensure avoidance of the recurrence of the barriers and the continuance of the enabling environments that will be created and/or facilitated by the project, appropriate sustainable follow-up actions will be planned as part of the project activities. Such action plan will be implemented after the project as per the institutional arrangements that will be developed for such purpose.

Potential for scaling up: The project will focus on 4 of the 28 cities that were identified by the GOC to use AEVs. The 4 cities will serve as the demonstration for the development and application of the interventions intended for the removal of barriers to FCV commercialization that will be carried out under the project. Several of the project interventions can be replicated in the other 24 cities, as well as in other regions of the country where the citizens and/or local governments are keen in the application of FCV technologies for private transport and public transport, or where interest and potential for local FCV manufacturing is present. The policies and implementing rules and regulations that will be developed under the project and adopted in these other cities can be replicated or further enhanced to further enhance the efforts to promote the utilization of FCVs and other environment friendly transport systems. Also, the planned demonstrations can be scaled up to involve more local transport vehicle manufacturers, and transport vehicle distributors and retailers in the promotion efforts.

A.2. ***Stakeholders: (Identify key stakeholders, including civil society organizations, indigenous people, gender groups and others as relevant, and describe how they will be engaged in project preparation):***

This project will involve the pertinent entities in the national and local governments in the areas of Science & Technology, Transportation and Industrial Development; as well as those in the private sector (transport vehicle manufacturers, industrial chemicals and gas manufacturers, oil companies, petroleum products producers, transport companies, etc.), academe, transport industry and technology research and development institutions.

Stakeholder	Roles and Responsibilities in Project Preparation
Ministry of Science and Technology	Communication and coordination with MOF and UNDP, liaison with local governments, project development management, and project development financial management.
Ministry of Industry and Information Technology	Provision of assistance in the identification and design of demonstrations for the promotion of the production and application of FCVs and H_2 production
Beijing Science and Technology Commission and Shanghai Science and Technology Commission	Provision of assistance in the identification and design of demonstrations for the promotion of the production and application of FCVs and H_2 production
Science and Technology Bureau of Zhengzhou	Provision of assistance in the design of activities on the development of pilot schemes for the AEV/FCV policies and regulations, and policy instruments
Development and Reform Commission of Guangdong	Provision of assistance in the design of activities on the development of pilot schemes for the AEV/FCV policies and regulations, and policy instruments
Pilot Enterprises on FC and FCV production	Design of the incremental technical assistance and activities for the FC and FCV manufacturing demonstrations
Pilot Enterprises on H_2 refueling	Design of the incremental technical assistance and activities for the H_2 refueling demonstrations
Pilot Enterprises on the H_2 production	Design of the incremental technical assistance and activities for the H_2 production demonstrations
Transport vehicle industry association	Provision of information regarding research work on transport vehicle manufacturing , particularly on AEVs
Beijing Public Transportation Corporation	Provision of information (including on AEV initiatives of the company) for the design of FCV operation demonstrations
Shanghai Jiading Bus Company	Provision of information (including on AEV initiatives of the company) for the design of FCV operation demonstrations
Tsinghua University	Design of the incremental technical assistance and capacity development activities of the project
Tongji University	Design of the incremental technical assistance and capacity development activities of the project
China Automotive Technology and Research Center)	Provision of information for the design of the activities on the development of AEV (particularly FCV) technologies, as well as in the design of technical training programs on the application and design of FCVs.
Industrial and Commercial Bank of China, Bank of China and Bank of Communications.	Provision of technical advice in the potential financial policies and instruments that can be considered to support FCV commercialization in China.
SAIC, FOTON, GAC Bus, General Motors, YUTONG, etc.	Provision of information for the design of the activities on the development of AEV technologies, as well as in the design of technical training programs on the application and design of FCVs.
BP, UTC, Ballard, etc.	Provision of information for the design of the activities on the development of FCs, as well as in the design of technical training programs on the application FCs for transport.
Air Liquide, China Petrol, Sunrise Power, Shanghai Shen-Li, SinoHytec, SFCV, etc.	Provision of information for the design of the activities on H2 production, storage, handling, distribution and dispensing, as well as in the design of technical training programs on the safe and proper operation of H_2 production and refueling facilities.

It should be noted that in the design and preparation of this project, adequate consideration shall be accorded to women and indigenous people if there are opportunities to involve them.

A.3. Risk: ***Indicate risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, propose measures that address these risks to be further developed during the project design (table format acceptable)*****:**

During the project implementation, the risks that might prevent the project objectives from being achieved are listed as follows:

Risk	Level of Risk	Mitigating Actions
1. FCV operations demonstration activities will encounter the same implementation problems in the FCB Demonstration Project (Phases I & II)	Low	The demonstrations will be designed by addressing all the necessary permits and requirements from the city authorities. This work to comply with pre-requisites will be accorded sufficient time to ensure smooth and seamless transition to the actual demonstration activities.
2. Local transport vehicle manufacturers as well as other stakeholders in the local and central governments may have conflicting objectives about FCVs preventing the effective coordination of their participation and support of the project	Low	The project implementing partner will closely coordinate the project design with the project partners putting to good use its experience implementing UNDP-GEF projects. Moreover, apart from establishing an effective project team that will comprise of competent local and international experts in transport systems and technologies will also make use of its good working relationship with the transport vehicle industry in the previous UNDP-GEF FCB demonstration projects.
3. The private sector will not be interested in investing in AEVs, in general, and in FCVs, in particular	Medium	The project will include information dissemination and promotion to ensure end-users better understanding about the use and benefits of using FCVs. The project will also include interventions aimed towards improving the local technical capacity to manufacture FCVs that are at least at par with international FCV standards, as well as other interventions that will help influence the production of cost-affordable but high quality FCVs that are expected to encourage private sector-led transport systems using FCVs.
4. Transport vehicle manufacturers may favor electric vehicles rather than FCVs.	Medium	The project will work together with transport vehicle manufacturers to come up with arrangements that would ensure that FCVs are complementing rather than competing with other AEVs (particularly BEVs and PHEVs) in supporting the government's objective of promoting new energy vehicles in Chinese cities.
5. Recommended policies may not be approved by the relevant authorities, or may be approved but not effectively enforced.	Low	The project will include the piloting of the application of the support policies for FCVs to gauge the effectiveness of said policies. That will help guide the relevant government authorities in the finalization, approval and effective enforcement of such policies.
6. The Government's set targets on AEV population under the NEVIDP will not be met.	Medium	During the project design/preparation stage the NEVIDP will be tracked and studied as to the factors that are affecting its performance. These factors, where appropriate, will be addressed by the project inasmuch as the project is for facilitating FCV commercialization.
7. The level of co-financing amount may not support the project implementation promptly and sufficiently.	Low	The project team shall secure central government funding prior to project launching. During project implementation, the project team will closely monitor and ensure co-financing is available by project partners and co-financers promptly and at least as per their respective committed amounts.

Risk	Level of Risk	Mitigating Actions
8. The pace of investments for the FCV support infrastructure may not be in sync with the growth of the FCV market	Medium	The project will carry out activities that will include comprehensive studies on other alternative cost effective and safe production of hydrogen that will be favored by investors, possibly those that will be RE-based.
9. Sustaining the outcomes and benefits of GEF investment on the activities implemented will not be fully sustained.	Medium	Sustainable follow-up plan for the replication of the FCV transport systems in other cities. The plan has to be supported (financed) by the local governments.

The overall risk level is medium.

A.4. ***Coordination: Outline the coordination with other relevant GEF financed and other initiatives:***

The design of the proposed project will fully coordinate with the other projects implemented in China that are related to energy efficient transport systems.

1. Guangdong Green Freight Demonstration Project Motor Challenge Program (MCP) – This ongoing project is a WB/GEF project is aimed at demonstrating the global and local environmental benefits to the application of energy efficiency vehicle technologies and operating techniques to more than 500,000 truck operators in Guangdong Province; and, supporting the improvement of energy efficiency and reducing greenhouse gas emissions in the road freight transport sector in Guangdong Province. The project development team will interact and consult with the implementers of this project (particularly those working on the energy efficiency capacity development activities) in designing and implementing the technical and information barrier removal activities under Components 1 and 2 of this proposed GEF project.

2. Demonstration for Fuel-Cell Bus Commercialization in China (Phase I & Phase II) – These were UNDP-GEF projects specifically on showcasing the application of fuel cell bus technology in the public bus transport systems in Beijing and Shanghai. Lessons learned from these 2 projects will be taken into account and put to good use in the design of the proposed project. MOST was also UNDP's implementing partner for these 2 GEF-funded projects.

3. New Energy Vehicle Demonstration Projects – These are funded by the MOST and MOF, and some of the demonstrations are targeted to be subsumed into this proposed GEF project.

4. FCV Demonstrations – These are planned FCV demonstrations funded by the MIIT; FC cars and vans demonstrations in Shanghai funded by the MOST; and FC trucks demonstrations funded by the Beijing Science and Technology Commission. These are among the targeted demonstrations that will be subsumed as baseline activities into this proposed GEF project.

The project development team will also coordinate with the relevant departments of the city governments in Beijing, Shanghai, Zhengzhou, and Foshan on their ongoing/planned activities and projects that are relevant to the proposed GEF project in order to explore and possibly make use of potential synergies, and ensure complementarity and building on best practices and lessons learned. The establishment of links with the relevant agencies and ongoing projects/programs is expected to help in identifying the relevant activities that will build on their respective achievements. The project will be developed in close cooperation with its stakeholders as well as with the UNDP-Asia Pacific Regional Centre in Bangkok. The UNDP country office in China will be fully involved in the project development through its participation in the various stakeholder and co-financing consultation meetings and technical workshops during project development, and in the multipartite review meetings. Consultations will also be done with UNDP-GEF, New York during the project development phase.

B. DESCRIPTION OF THE CONSISTENCY OF THE PROJECT WITH:

B.1. *National Strategies and Plans or Reports and Assessments under Relevant Conventions, if Applicable, i.e. NAPAs, NAPs, NBSAPs, National Communications, TNAs, NCSAs, NIPs, PRSPs, NPFE, Biennial Update Reports, etc.:*

The proposed project is consistent with China's national energy strategy and planning since the mid-2000s. It is in response to China's National Medium and Long-Term Science and Technology Development Plan (2006 - 2020), in which low energy consumption and new energy vehicles is stated as one of the 68 priorities in the 11 focal areas of national economic and social development. As a follow-up to the previous UNDP-GEF Fuel Cell Bus Demonstration Projects, this project is clearly in line with all AEV support programs of the government (e.g., 2009 State Council issued Readjustment and Reinvigoration Plan for Automobile Industry; 2012 State Council published Accelerating the Cultivation and Development of Strategic Emerging Industries; 2012 Energy Saving and New Energy Automotive Industry Development Plan; and, 2013 New Energy Vehicles Industry development Plan (NEVIDP 2012-2020). The project will build on the activities of the most recent NEVIDP 2012-2020. This project is also in line with the Chinese government's new energy technology demonstration projects, particularly the Ten Cities-Thousand New Energy Vehicles program where the use of hybrid-electric, all-electric and fuel cell vehicles in the public transport sector in many cities will be carried out in a modular manner.

The proposed project is in line with China's several plans on the development of climate technologies, such as that being developed under the WB/GEF project on Technology Needs Assessment[22]. While the country China has yet to meet the technological standards of OECD countries, the Chinese government continuously stresses the role of advanced technologies for both climate change mitigation and adaptation to meet its sustainable development goals in a timely manner and at a minimum cost that does not threaten economic development and poverty alleviation. Both the transfer of best available global technologies (in this case FCV and H_2 production and distribution/dispensing) to China and the enhancement of the local science, technology, innovation capacity and diffusion are necessary to make the most relevant and advanced technologies widely available for deployment. The project is also in line with the plans and recommendations set out in the country's national communications to the UNFCCC. The most recent national communications (i.e., Second National Communications), mention the vigorous development of new energy industries, focusing on, among others, the deployment of plug-in hybrid vehicles, electric-drive and fuel cell vehicles.

B.2. *GEF Focal Area and/or Fund(s) Strategies, Eligibility Criteria and Priorities:*

This proposed project is in line with the GEF Climate Change strategic objective to promote energy efficient, low-carbon transport and urban systems (CCM-4). As a sustainable energy technology advocator, GEF supports the implementation of FCV (particularly fuel cell buses) in selected developing countries like China. By supporting interventions to facilitate the widespread and sustainable application of FCVs in China's transport sector, GEF can help the developing countries to acquire early experience and knowledge in the application and local manufacturing of this type of energy efficient and environment friendly transport vehicles.

[22] The ongoing WB-GEF project on technology needs assessment supports China's efforts to assess climate change mitigation and adaptation technology needs and adopt corresponding global best practices. Said project will, among others, identify barriers to technology transfer, and also design one or more technology transfer mechanisms that would accelerate the ultimate deployment of prioritized climate change mitigation and adaptation technologies.

B.3. ***GEF Agency's Comparative Advantage for Implementing this Project:***

One of the primary outcomes stated in the UNDAF 2011-2015 for China is - Environmental protection, climate change, and natural resource management on Environment and Sustainable Development. This proposed project is designed to contribute to the realization of this outcome, since addressing the emissions issues in the transport sector will contribute to the reduction in the country's GHG emissions but also reduce air pollution. The project is also directly in line with the UNDP EITT's signature program on low carbon emission urban and transport infrastructure, specifically focusing on GHG emissions reduction from transport systems. With its country presence, UNDP-China is well-positioned to implement this proposed project as it has, and currently have, a proven track record of successful implementation of energy efficiency projects in the country, not to mention those in other developing countries in Asia. UNDP-China, in partnership with MOST has already implemented several GEF projects in China, which include the first and second phases of China FCB Commercialization Demonstration Project. In jointly implementing that project, as well as other CCM projects in the past, UNDP and MOST have already established a very good and cooperative working relationship. UNDP has already gained a comprehensive understanding of China's current fuel cell vehicle development and energy saving and emission reduction targets that will be useful in the design and implementation of this new proposed GEF-assisted project that would further promote the commercialization of FCVs in China.

UNDP also has sufficient staff complement that can effectively supervise the design and implementation of this project. The fact that it is one of the leading UN agency in China supporting the GOC in addressing climate change issues in the country; its staff members' substantial experience in the successful implementation of GEF-funded projects in the country; and its overall substantial experience and expertise in working in partnership at the decentralized level with local communities, private sector, policy makers and civil society, justify its capacity and qualification to implement this proposed project. Moreover, for this project, UNDP-China will be backstopped by technical expertise available in the UNDP Asia-Pacific Resource Centre (APRC) in Bangkok, Thailand.

PART III: APPROVAL/ENDORSEMENT BY GEF OPERATIONAL FOCAL POINT(S) AND GEF AGENCY(IES)

A. RECORD OF ENDORSEMENT OF GEF OPERATIONAL FOCAL POINT (S) ON BEHALF OF THE GOVERNMENT(S):

NAME	POSITION	MINISTRY	DATE
Wensong Guo	GEF Operational Focal Point	International Dept., Ministry of Finance	5 March 2014

B. GEF AGENCY(IES) CERTIFICATION

This request has been prepared in accordance with GEF/LDCF/SCCF policies and procedures and meets the GEF/LDCF/SCCF criteria for project identification and preparation.					
Agency Coordinator, Agency Name	**Signature**	**DATE**	**Project Contact Person**	**Telephone**	**Email Address**
Adriana Dinu UNDP – GEF Executive Coordinator and		March 21, 2014	Manuel L. Soriano Sr. Tech. Advisor Energy, Infrastructure, Transport &	+66-2-3049100 Ext 2720	manuel.soriano@undp.org

Director a.i.			Technology		

Annex 1

Comparison of Activities of the FCB I & II Projects and the Proposed DevCom FCV Project

<table>
<tr><th colspan="2">Demonstration on the Application of Improved FCV Technologies</th></tr>
<tr><th>FCB I & II Projects</th><th>DevCom FCV Project</th></tr>
<tr><td>• Demonstration of the operational performance of FCBs (Phase 1: 3 imported FCBs); Technical feasibility evaluation of the operation of FCBs and of H2 refueling infrastructure
• Demonstration of the operational performance of FCBs (Phase 2: 6 locally produced FCBs but using imported FC stacks); Technical feasibility evaluation of the operation of FCBs and of H2 refueling infrastructure
• Main performance parameters measured were: (1) Specific fuel consumption of Demo FCBs; (2) Running cost; and, (3) Supply capacity and performance of Demo H2 refueling station
• Capacity building for FCB drivers and mechanics in both demonstration cities
• Capacity building for H2 refilling station operators in both demonstration cities
• FCB and H2 refilling station operational guidelines for both demonstration cities</td><td>• Demonstration on the Application of Improved FCV Technologies - Demonstration of the application of improved FC application and FCV design (FC engine and FC stack life and durability, H2 fuel economy, etc.) and manufacturing in local transport vehicle manufacturers through:
▪ Direct technical assistance to manufacturers on improved FCV vehicle design (e.g., power train, fuel system, power train control system)
▪ Prototype production of selected FC engine designs
▪ Prototype FC engine product testing and FCV on the road test runs
• Demonstration of Operating Performance of Improved FCVs and the Commercial Applications of FCVs
▪ Beijing FCV Demonstration – demo of operation of new generation FCVs. Demo of FCV fleet operations – public bus transport, government general services and transport fleet, fixed-route delivery truck fleet. 15 FCVs (bus and utility vehicle)
▪ Shanghai FCV Demonstration - demo of operation of new generation FCVs, demo of FCV fleet operations - buses, taxi and car rental fleet, and government general services transport fleet. 80 FCVs (bus, taxi, car)
▪ Zhengzhou FCV Demonstration - demo of operation of new generation FCB in local passenger transport sector. 3 FCBs (new generation locally and foreign made units)
▪ Foshan FCV Demonstration - demo of operation of new generation FCB in local passenger transport sector. 3 FCBs (new generation locally and foreign made units)
• Demonstration on the Application of Feasible and Cost-Effective H2 Production Technologies and Commercial Operation of H2 Refueling Facilities
• Construction of 2 new and enhancement of 2 existing H2 production facilities for purposes of H2 refueling
• Commercial operation of existing and new H2 refueling stations operated by partner companies showcasing:
▪ Feasible improvements in petroleum fuel (liquid or gas) reforming and syngas technologies for H2 production, or the electrolysis of water using renewable energy-generated electricity.
▪ Enhanced storage, handling, distribution and dispensing of hydrogen gas</td></tr>
</table>

<table>
<tr><td></td><td>▪ Safe and proper operation of hydrogen production and refueling facilities
Commercial operation of H2 refueling facilities and to test the effectiveness of the demonstrated H2 refueling network design, the standard protocols for complying with the operational, safety, health, and environmental (OSHE) procedures/requirements to be applied to H2 refueling facilities.</td></tr>
<tr><th colspan="2">Capacity Development on the Application and Commercial Operation of FCVs and Associated Infrastructures</th></tr>
<tr><th>FCB I & II</th><th>DevCom FCV</th></tr>
<tr><td>• “FCB value chain" research reports
• Established FCB Certification program
• Technical information and promotional campaign materials on FCBs and FCB systems
• "Well-to-Wheel" Life Cycle Analysis of the FCB system in both demonstration cities
• Information and knowledge uptake on the potentials, reliability, failure modes, opportunities for improving design and reducing costs of FCBs in China and Chinese public responses to FCBs
• Capacity building for public transport policy makers and planners at the national and local levels on policy and planning for the application of new, energy efficient and environment-friendly transport technologies, particularly on the adoption and integration of the required infrastructure and operations in local public transport and management systems.</td><td>• Enabling effective enforcement of policies and regulatory frameworks on supporting the application and commercialization of FCVs in the transport sector
▪ Completed pilot schemes for the application of formulated and recommended policies supportive of FCVs
▪ Approved FCV policies (incorporating results and recommendations from pilot activities) and IRRs
• Enhancement of public acceptance of FCVs for transport systems and services
▪ Domestic and foreign academic exchange networks on fuel cell, FCV and H2 production technologies, as well as on commercial FCV production and business operations.
▪ Riding public education and awareness-raising campaigns on FCV transport systems and operations in at least 4 cities
▪ FCV transport system performance and FCV market monitoring system
▪ Sustainable follow-up plan for the replication of the FCV transport systems in other cities
• Enabling increased local technical capacity and knowhow in the research and development, operation and maintenance of FCV technologies and the FCV industry
▪ Training programs for FC and FCV operation, repair and maintenance; as well as on the safe and cost-effective operation of H2 production and cost-effective commercial operation of FCV transport systems and H2 refueling stations.
▪ Established and operational FCV value chain businesses such as the FCV service industry (e.g., design, construction, repair and maintenance of FCV infrastructures)
▪ Developed business models for local financial institutions to support FCV manufacturing, as well as in the sales of FCVs to supplement the government's New Energy Vehicle Industry Development Plan (2011-2020)
▪ Financing scheme for FCV purchases for private transport users</td></tr>
</table>

Annex 2

Comparative Analysis: Electric Bus vs. Fuel Cell Bus

City Bus Characteristics:
12m length, 14t weight, 70 passengers, max speed = 80 km/h; travel range = 200 kms

(1) **Material Cost of Construction of Electric Bus (EBUS)**:

a) Vehicle chassis and body's cost without powertrain: 600,000 RMB
b) Cost of battery system: 300 kWh battery, (energy consumption is about 120kWh/100km, and consider the SOC range is 80% [from 10% to 90%]. Battery capacity = 300 kWh.
Battery system market price = 4 RMB/Wh) Total cost = 300,000 * 4 = 1,200,000 RMB
c) Traction motor and inverter @ 120 kW (180 kW peak power) = 200,000 RMB;
d) Control system of powertrain = 100,000 RMB
e) Total price of EBUS is: 600,000 + 1,200,000 + 200,000 + 100,000 = 2,100,000 RMB
The typical Pure EBUS (Type K9 from BYD Company) = 2.4 ~ 2.7 million RMB
The battery lasts after about 1000 to 1200 charging cycles, so this means about 3 years to replace a new battery system

(2) Material Cost of Fuel Cell Bus:

a) Vehicle chassis and body's cost without powertrain = 600,000 RMB
b) Cost of Fuel Cell system: @ 50kW, 15,000 RMB/kW ($2,500/kW). Total cost is 50 * 12,000 = 600,000 RMB. This price can be confirmed by both local Fuel Cell manufacturers and international fuel company such as Hydrogenics.
c) Cost of hydrogen storage system: 200 km range, fuel consumption is about with 8 kgs/100kms; total H2 storage should exceeds 25 kg. This would require 6 units 35 MPa H2 Tank (Each tank about 144 lits volume); each tank cost is 30,000 RMB. The total tank cost is about 6 * 30,000 = 180,000 RMB, plus the valves of H2 system, which is about 120,000 RMB (20,000 for each tank). Total 300,000 RMB
d) Battery: @ 40kWh; 40,000 Wh * 4 RMB/Wh = 160,000 RMB;
e) DCDC convertor @ 60kW = 60,000 RMB;
f) Traction motor and the inverter @ 120kW (180kW peak power) = 200,000 RMB;
g) Control system of powertrain = 100,000 RMB
h) The total price of FC BUS is: 600,000 + 600,000 + 300,000 + 160,000 + 60,000 + 200,000 + 100,000 = 2,020,000 RMB. Currently the price of a Fuel Cell Bus is about 2.7 million to 3 million RMB due to small quantity and more service time.
The durability of FC BUS is far better than the EV.

(3) Running cost of EBUS:

Electricity consumption is about 120kWh/100km; @ 1.2 RMB/kWh price
The running cost of EBUS is 120 * 1.2 = 144 RMB/100 kms

(4) **Running cost of FCBUS**:

The cost of Hydrogen (by-product Hydrogen from industry) is about 18 RMB/kg; Fuel consumption is about 8 kgs/100 kms.
The running cost of FCBUS is 8 * 18 = 144 RMB/100 kms

Conclusion: FCBUS and EBUS are comparable in running cost at the same 200 kms travel distance. If the travel distance is below 150 kms, the EBUS has more advantage in terms of running cost. If the travel distance is greater than 200 kms, the FCBUS is has lower running cost. Because the FCBUS has the advantage of a shorter refueling time than the charging time of EBUS, the local governments of big cities plan to develop both short range EBUS and long range FCBUS. Being both zero emission vehicles, both are supported and encouraged by the central and local governments. However, a FCBUS is regarded as a real zero emission vehicle since EBUS use electricity that is generated in China using coal.

Fuel Cell Car

- Vehicle chassis and body = 70,000 RMB (same as that for an ICE passenger car)
- Cost of Fuel Cell system: @ 35 kW, 15,000 RMB/kW * 35 kW = 525,000 RMB (data based on Shanghai Automobile Industry Company, SAIC's FCV)
- Cost of hydrogen storage system: >200 km range, fuel consumption is about with 1.2 kgs/100kms; total H2 storage should exceed 3.4 kg. This would require 2 units 70 MPa H2 Tank; each tank cost is 25,000 RMB. The total tank cost is about 2 * 25,000 = 50,000 RMB, plus the valves of H2 system, which is about 50,000 RMB (25,000 for each tank). Total = 100,000 RMB
- Battery: @ 5kWh; 5,000 Wh *4 RMB/Wh = 20,000 RMB
- DCDC convertor @ 40kW = 40,000 RMB
- Traction motor and the inverter @ 60kW (90kW peak power) = 50,000 RMB
- Control system of powertrain = 50,000 RMB

- The total price of FC car is 745,000 RMB, about US$ 122,000. According to SAIC they expect to lower the cost of their FC car to about 500,000 RMB in 2015~2016 year.

Running Cost of FC car: At about 1.2kg/100km, and H2 price of about 18 RMB/kg, the running cost is about 22 RMB/100 kms.

Running Cost of Battery Electric Car:

Currently about 13~15kWh per 100km, about 1.2 RMB/kWh, the price for 100 kms is about 16 to 18 RMB. The problem is the cost of battery is still high and mileage per charge is still shorter than 200 kms.

Running Cost of Plugin Hybrid Car: Based on 50% fuel and 50% electricity; fuel consumption = 6L/100 kms; Electricity consumption = 14 kWh/100 kms. Total cost per 100 kms = 6*8*0.5 +14*1.2*0.5 = 32.4 RMB.