

Cover Page for CTF Project/Program Approval Request			
1. Country/Region	Vietnam	2. CIF Project ID#	(Trustee will assign ID)
3. Project/Program Title	Ha Noi Sustainable Urban Transport Program		
4. Terms and Amount Requested in million USD equivalent	<b>Public sector</b> Loan/guarantee Harder terms: Softer terms: \$98.95 million Grant: Fee: <b>Total: \$98.95 million</b>  <i>[Note: \$1.05 million allocation was previously approved for project preparation grant and MDB fee.]</i>		
5. Implementing MDB(s)	Asian Development Bank		
6. National Implementing Agency	Ha Noi's Peoples' Committee Transport Agency		
7. Contact Information of MDB Focal Point and Project/Program Task Team Leader (TTL)	Headquarters Focal Point: <i>Mr. Jiwan ACHARYA</i> <i>(jacharya@adb.org)</i>		TTL: <i>Mr. Robert VALKOVIC</i> <i>(rvalkovic@adb.org)</i>
8. Brief Description of Project/Program (including objectives and expected outcomes)			
<p>1. The Ha Noi Sustainable Urban Transport (SUT) program is one of the five major interventions under the Vietnam Country Investment Plan (CIP). The CIP was first endorsed by the Trust Fund Committee in December 2009 and later revised and endorsed again in 2013. The revised CIP reallocates CTF financing to include additional funding of \$50 million to the proposed SUT program on top of its original allocation of \$50 million. The proposed SUT program is fully consistent with the Government of Viet Nam's (GoV) policy framework for climate change, energy security, and environmental management. It is aligned with ADB's Country Partnership Strategy (CPS) for Vietnam with focus on improving institutional, financial and operational efficiency of transport infrastructure, as well as improving road safety.</p> <p>2. The Ha Noi Urban Transport Master Plan's (HUTMP) identifies the development of Ha Noi Metro Line 3 system along with four other metro lines (i.e. MRT Line 1, 2, 2A, and BRT Line 1), as priority interventions that will facilitate access to public transport and improved connectivity to increase the modal share to 40% of demand through low-emissions transport. This will consequently address the transport sector's high share of carbon dioxide (CO<sub>2</sub>) emissions in the country, which almost doubled from 14% in 1980 to 25% in 2011.</p> <p>3. The Ha Noi Metro SUT Program comprises two investment operations:</p> <p>(i) Ha Noi Metro Rail System Line 3: Nhon – Ha Noi station section (Project 1)<sup>1</sup> which will develop a new double track metro rail line in Ha Noi, including stations and depot facilities, and the electrical and mechanical (E&amp;M) systems <i>(as noted in</i></p>			

<sup>1</sup> ADB. 2011. Report and Recommendation of the president to the Board of Directors: proposed Loan and Administration of Loan to the Socialist Republic of Vietnam for the Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section), Manila (L2741-VIE)

*the Additional Cofinancing document*); and

- (ii) Strengthening Sustainable Urban Transport for Ha Noi Metro Line 3 (Project 2), which will implement sustainable transport measures for the effective and sustainable use of the Metro Line 3 *(as noted in the draft Report and Recommendation of the President [RRP])*.

4. The Ha Noi Metro Rail System project (Project 1) was approved on 29 March 2011<sup>2</sup> and became effective on 13 March 2012. The 2009 approved feasibility study estimated the project cost at \$1,077.2 million, when commodity prices were still relatively low in the wake of the global financial crisis. The detailed design was completed in March 2012, and as a result of design adjustments and continued escalation of input prices since 2009, the project costs have increased to \$1,479.8 million. The total cost of civil works and equipment contracts, including taxes and contingencies, increased by \$300.5 million to \$1,176.9 million. Scaling down the project to remain within the original financing is not practical as it would result in significant loss of benefits. On 28 June 2013, the government approved the revised total investment cost. The government is expected to request ADB (including Clean Technology Fund [CTF]), Agence Française de Développement (AFD), Direction Générale du Trésor (DGT) and European Investment Bank (EIB), to provide additional financing to cover the revised cost. The government agreed to include \$50 million financing from the CTF which will be used to partially cover civil works for underground station and tunneling contract. ADB and other project financiers will consider approval of additional financing in 2015<sup>3</sup>. It is estimated that additional loans of \$90 million from ADB, \$95 million from AFD, \$104 million from DGT, \$100.1 million from EIB and counterpart funds of \$12.8 million from the government are needed to finance the remainder of the additional costs. The project progress as of March 2014 is about 16%, with civil works progress ranging from 0% to 87% and no systems contracts awarded. The target project completion date is 31 December 2018.

5. The Strengthening Sustainable Urban Transport for Ha Noi Metro Line 3 (Project 2) concept paper was approved in October 2011.<sup>4</sup> The government in June 2012 signed the CTF project preparation grant of \$1 million for this project. The CTF funds are proposed to cofinance Metro Line 3 accessibility measures, public transport information systems, and sector development and implementation support.

6. The total cost of the Ha Noi Metro Line 3 System Investment Program covering the two projects is almost \$1.54 billion including the components proposed for CTF financing. The indicative financing plan is presented in Table 1 below, which shows that CTF funds are leveraged at about 15:1 overall, and the additional funds endorsed in the 2013 CIP update leveraged at 7:1.

7. The expected impact of the Program will be the establishment of an integrated and sustainable public transport system in six districts of Ha Noi – four urban districts (Cau Giay, Dong Ba, Ba Dinh, and Hoan Kiem) and two sub-urban districts (Tu Liem South, Tu Liem North). The expected outcomes would be competitive metro rail services along the project corridor and improved integration of Metro Line 3 stations with other public and private modes of transport.

<sup>2</sup> ADB. 2011. Report and Recommendation of the president to the Board of Directors: proposed Loan and Administration of Loan to the Socialist Republic of Vietnam for the Ha Noi Metro Rail System Project (Line 3: Nhon-Ha Noi Station Section), Manila (L2741-VIE)

<sup>3</sup> ADB. 2014. Proposed loan for Additional Financing: Ha Noi Metro Rail System Project (Line 3: Nhon – Ha Noi station section). Manila

<sup>4</sup> This refers to the ADB internal concept paper which is prepared during project development, due diligence, and processing.

**Table 1: Financing Plan for Ha Noi SUT Investment Program (\$million)**

Source	Metro Rail System (Project 1)		SUT (Project 2)	Amount
	Original Financing	Additional Financing		
Asian Development Bank (loan)	293.00	0.00	4.20	297.20
Clean Technology Fund (loan)	-	50.00	48.95	98.95 <sup>a</sup>
Agence Française de Développement	143.00	0.00	-	143.00
Direction Générale du Trésor	325.00	0.00	-	325.00
European Investment Bank	95.00	0.00	-	95.00
Government	221.20	352.6	5.80	579.60
<b>Total</b>	<b>1,077.20</b>	<b>402.6</b>	<b>58.95</b>	<b>1,538.75</b>

Source: ADB project documents

Notes: <sup>a</sup> A project preparation grant of \$1 million has been deducted from the overall allocation. A loan administration fee of \$50,000 is applied for a net effective CTF loan of \$98.95 million.

8. The Ha Noi Metro Rail System Project (Project 1) will have two main outputs: (i) Metro Line 3 is operational; and (ii) improved implementation capacity of Ha Noi Metropolitan Railway Management Board (MRB). The Strengthening Sustainable Urban Transport for Ha Noi Metro Line 3 Project (Project 2) will have three outputs:

- (i) Improved accessibility features at Metro Line 3 stations. This will include construction of pedestrian subways and footbridges, bus stops and feeder links, dedicated taxi stands, park-and-ride facilities for two-wheeled vehicles, and waiting areas for other public transport service providers. A station access management system will also be installed to facilitate efficient flow of people and traffic around the metro stations. Enforcement measures will be improved to ensure clear pedestrian access and smooth traffic flow and to manage parking of private vehicles around the Metro stations.
- (ii) Improved public transport system. This will involve introduction of integrated and innovative public transport services and measures connecting metro stations, i.e., providing 52 buses to service bus feeder lines and information system along Metro Line 3.
- (iii) Public transport policy developed. Development of station access management system and enforcement measures, station parking policy, framework on public transport ticketing, pricing of public and private transport in Ha Noi, and capacity development and training to transport agencies in Ha Noi.

## 9. Consistency with CTF Investment Criteria

9. The Ha Noi SUT program features sustainable urban transport infrastructure and integral facilities for access to low-carbon mobility services. It will support the HUTMP implementation by facilitating connectivity and greatly enhancing access to Metro Line 3 stations and bus services for all transport users in Ha Noi, and strengthening urban transport policies and regulations to discourage private vehicle usage. Benefits include reduced travel times, fuel savings, reduced rate of traffic accidents and injuries, reduced GHG emissions and other pollutant emissions with substantial public health benefits as well as global benefits. The program context and rationale for CTF cofinancing are illustrated in Figures 1 and 2 (at the end of this document).

**(a) Potential GHG Emissions Savings.**

10. The direct GHG emission savings attributable to Metro Line 3 including the sustainable transport measures to be financed is estimated at 663,000 tons of carbon dioxide equivalent (tCO<sub>2</sub>e) over 20 years of project lifetime or an average of 33,150 tCO<sub>2</sub>e per year.<sup>5</sup> The GHG analyses concluded that Metro Line 3 would reduce emissions by about 0.08 tCO<sub>2</sub>e per daily rider per year, which increases to about 0.12 tCO<sub>2</sub>e per daily rider per year – a 15% improvement – when the additional benefits of the CTF-funded components are included.<sup>6</sup> The replication and scale up to other MRT lines in the city would result in estimated GHG savings of 60,000 tCO<sub>2</sub>e annually or up to 1.2 million tCO<sub>2</sub>e over 20 years (Table 2).

**Table 2: Estimated GHG Emission Reductions**

Intervention /Activity	Daily demand, 2038	GHG Emission Reduction (tCO <sub>2</sub> e), 2018-2038		
		Per daily passenger/year	Annual average	Cumulative (20 years)
<b>Metro Line 3</b>	411,900	0.07 - 0.11	26,980	539,600
<b>Metro Line 3 with SUT</b>	458,000	0.08 - 0.12	33,150	663,000
<b>Replication and Scale Up in the sector for Ha Noi</b>	2,900,000	0.23	60,000	1,200,000

11. Emissions would be further reduced by introducing policy measures including full integration of MRT and bus lines, a common ticketing system and integrated fares, and limited but comprehensive management of private vehicle demand. These measures could increase the GHG reductions to as much as 7 million tCO<sub>2</sub>e over a 20-year period. Additional replication and scale up potential exists in other cities around the country, mainly via improvements in connectivity between transport modes.<sup>7</sup> Further emissions reductions could be realized from introduction of new vehicle technologies and renewable fuels.

12. Emissions reductions from black carbon (BC) are estimated assuming that GHG reductions result mainly from avoided diesel and gasoline (petrol) consumption.<sup>8</sup> The potential GHG reductions from BC are estimated to be 10.76 million tCO<sub>2</sub>e over the project lifetime. Adding this estimate to the base case of 663,000 tCO<sub>2</sub>e yields estimated reductions of 11.42 million tCO<sub>2</sub>e.

**(b) Cost-effectiveness**

13. The cost effectiveness of CTF funds is CTF\$149.25 ton CO<sub>2</sub>e, calculated as: CTF\$98.95 million / 663,000 tCO<sub>2</sub>e = CTF\$149.25 / tCO<sub>2</sub>e.<sup>9</sup> With replication and scale up to 1.2 million

<sup>5</sup> Emissions reductions have been estimated using the Transport Emissions Evaluation Model for Projects (TEEMP) methodology which calculates GHG emission reductions by assessing the incremental or marginal changes in GHG emissions due to a project intervention relative to a dynamic baseline. Consequently the estimates are considered to validly represent marginal reductions in GHG with the result that a marginal abatement cost is presented. The TEEMP methodology has been endorsed by the Global Environment Facility and is similar to the two approved CDM methodologies for interventions designed to induce modal split from private transport to rapid transit. TEEMP is used for making *ex ante* estimates while the CDM methodologies are applied *ex post*. The TEEMP methodology includes consideration of emissions during construction, energy consumption of the rail system, vehicle emissions factors, and leakage effects (e.g., changes in load factor of buses and taxis). The TEEMP was used for the Ho Chi Minh City sustainable urban transport program, for which CTF cofinancing was approved in 2013.

<sup>6</sup> These findings are consistent with the estimated GHG reductions for the Philippines Cebu BRT project which was approved by the CTF Trust Fund Committee in November 2012.

<sup>7</sup> At present, urban rail systems are proposed only for HCMC and Ha Noi. Bus rapid transit and other modal shifts may be applicable to smaller cities.

<sup>8</sup> There is no specific CTF guidance for BC analyses. The estimates presented here are similar to those made for the Vietnam Ho Chi Minh City Sustainable Urban Transport Program which was approved by the CTF trust Fund Committee in 2013.

<sup>9</sup> These calculations are consistent with paragraph 11 of *CTF Criteria for Public Sector Operations*, dated 9 February 2011 which notes both a simple calculation of CTF\$ per ton of CO<sub>2</sub>e as well as an upper limit of marginal cost of reducing a ton of tCO<sub>2</sub>e of \$200.

tCO<sub>2</sub>e, the cost-effectiveness is CTF\$82.46 / tCO<sub>2</sub>e. The implementation of additional policy measures (noted in paragraph 11) would further increase the cost effectiveness to CTF\$14.14 / tCO<sub>2</sub>e. The proposed projects meet the CTF criteria for cost-effectiveness.

14. If BC is included, cost effectiveness is CTF\$98.95 million / 11.42 million tCO<sub>2</sub>e = CTF\$8.66/ tCO<sub>2</sub>e before replication and scale up.<sup>10</sup> The cost effectiveness of avoided BC with replication and scale up is CTF\$98.95 million / 12.62 million tCO<sub>2</sub>e = CTF\$7.84 / tCO<sub>2</sub>e. With broader policy measures and BC included, cost effectiveness is CTF\$5.04 / tCO<sub>2</sub>e. The cost effectiveness for various scenarios is summarized in Table 3.

**Table 3: CTF Cost Effectiveness**

Case	GHG Reductions (million tCO <sub>2</sub> e)	Cost Effectiveness (CTF\$ / tCO <sub>2</sub> e)
Base case	0.663	149.25
Base case + replication and scale up	1.2	82.46
Base case + replication and scale up + additional policy measures	7.0	14.14
Base case+ black carbon	11.42	8.66
Base case + replication and scale up + black carbon	12.62	7.84
Base case + replication and scale up + additional policy measures + black carbon	19.62	5.04

Source: ADB staff consultants and PPTA consultants

### **(c) Demonstration Potential at Scale**

15. The Metro Line 3 improvement measures are designed to be replicated in other parts of the city to make public transport more sustainable. The successful demonstration of the potential impact on rapid transit patronage and GHG emission reductions along Metro Line 3 would lead to replication to the other four transit lines, which are under early stages of implementation, with proportionately greater impacts.

16. Without the establishment of metro lines, transport energy use and associated GHG emissions in Ha Noi are expected to grow by 190% using the baseline scenario between 2007 and 2020 shown in Table 4.<sup>11</sup> GHG emissions are expected to grow faster than motorization rates due to increasing growth in trip distances and a switch from non-motorized modes to motorcycles. These trends are projected even as public transport's share of trip making is projected to increase due to heavy investment in new rail and bus services in Ha Noi.

17. Replication of the “non-MRT” aspects is also possible in several of Viet Nam's medium sized cities. The SUT program will promote sector-wide improvements in urban transport efficiency across the country, which could also include evolution of vehicle technology, cleaner fuels, urban design to facilitate non-motorized transport, and changes in public behavior.

18. The Program's transformation potential is 1.8. This is based on emission reduction potential of 1.2 million tCO<sub>2</sub>e GHG reduction from replication and scale up in Ha Noi only over the expected GHG emission reduction of 663,000 tCO<sub>2</sub>e discussed above. The potential would be higher if replication and scale up is achieved in other urban areas.<sup>12</sup>

<sup>10</sup> See note at end of this document for additional details on BC estimates.

<sup>11</sup> World Bank 2009. Energy Consumption and Greenhouse Gas Emissions from On-Road Transport in Cities in the East Asian Pacific Region: Results, Methodology and Documentation of Data. Draft Background Paper for EAP Energy Flagship Report, June.

<sup>12</sup> Transformation potential is defined in paragraphs 15 - 17 of the *CTF Investment Criteria for Public Sector Operations* dated 9 February 2009.

**Table 4: Daily Transport Demand by Mode and Associated Energy Use in Ha Noi  
(baseline scenario from 2007 to 2020)**

Attribute	Ha Noi
<b>2007</b>	
Population (M)	3.4 (part of municipal area)
Total motorized person trips/day (M) (unlinked <sup>13</sup> ):	10.4
% by public transport	10%
Total VKT/ day (M) (cars, motorcycles and trucks)	21.0
Energy use per year (ktoe)	293
<b>2020 baseline</b>	
Population (M)	4.5
Total motorized person trips/day (M) (unlinked):	17.8
% by public transport	Not known
Total VKT/ day (M) (cars, motorcycles and trucks)	24.8
Energy use per year (ktoe)	1,106
<b>Baseline Indicators (Ratio of 2020 value/ 2007 value)</b>	
Population	1.32
VKT	1.71
Transport energy use (and GHG emissions)	3.8
Transport energy use per capita	2.9

VKT = Vehicle Kilometers of Travel

19. Sustainable transformation of the urban transport sector requires innovation with respect to: access to mobility services, convenience, security, and connectivity between the various transport modes of walking, biking, motorbikes, buses, rail, and to a lesser extent water (which is important for some bulk freight shipments into and out of the greater Ha Noi urban area). Success requires “end-to-end” infrastructure solutions which address passenger and freight services. For passenger services in particular, the ultimate success depends on changes in public behavior: the Metro Line 3 system must be user-friendly in terms of access, convenience, and security, for the envisioned connectivity between transport modes (walking, biking, motorbikes, buses, etc.) to be realized. The viability and sustainability of public transport system largely depends on accompanying transport policies.<sup>14</sup>

20. The changes in public behavior that are necessary to achieve the modal shift to public transport from private vehicles is difficult to predict considering the recent and ongoing “graduation” from 2-wheel to 4-wheel vehicles<sup>15</sup>. In Hanoi and Ho Chi Minh City, motorcycles are presently the primary mode of transport accounting for 60 – 65% of vehicular trips. Although automobiles account for less than 5% of trips in both cities and ownership is relatively low, automobiles are growing rapidly. In HCMC, the number of registered automobiles increased from 137,000 in 2001 to about 245,000 in 2004 and 294,331 in November 2006; a twofold increase in just a span of six years.<sup>16</sup> In general, road is the heavily favored transport mode in Asia for both passengers as well as freight.<sup>17</sup> The increase in car ownership negatively affects the current

<sup>13</sup> Linked trips are the trips between origin and destination. Unlinked trips are for individual stages of a journey between origin and destination. Hence, data on ticket sales for each mode are also the equivalent of unlinked trips. A mechanized trip is one which has one or more legs using a mechanical mode of transport as opposed to one which has all legs using non mechanized modes such as walk or bicycle. Walk and cycle modes not simulated here except for access to mechanized modes.

<sup>14</sup> Source: Tang, S., Lo, H.K. (2008) The impact of public transport policy on the viability and sustainability of mass railway transit – The Hong Kong experience, Transportation Research Part A 42, pg 563–576

<sup>15</sup> Beirão, G., and Cabral, J.A.S. (2007) Understanding attitudes towards public transport and private car: A qualitative study Transport Policy 14, pg. 478–489

<sup>16</sup> World Bank. Transport in Vietnam.

<http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/EXTAPREGTOPTRANSPORT/0,,contentMDK:20458737~menuPK:2069374~pagePK:34004173~piPK:34003707~theSitePK:574066,00.html>

<sup>17</sup> Economic and Social Commission for Asia and the Pacific (2011) Environmentally sustainable transport, Expert Group Meeting on Preparations for the Ministerial Conference on Transport, Bangkok

carrying capacity of road networks resulting in traffic congestion, effective decrease in road length per vehicle, inefficient use of energy, as well as air and noise pollution<sup>18</sup>.

21. Commuters' choice of transport mode is driven by their personal preferences, perceptions, and experiences. Younger commuters (those aged 18 and above) have a strong preference for private vehicle dependency, while the older population (65 years and above) generally prefer public transport services<sup>19</sup>. Males with private vehicles are less likely to shift to public transport; they prefer using cars or motorcycles compared to women. In Ha Noi, 92% of men and 81% of women use motorbikes as a means of transport to go to the center of Ha Noi, while 60% of students and children use public transport (buses) and 33% bicycles. There is a positive relationship on household size, income and car license ownership on the use of cars. Commuters with private cars are often reluctant to use public transport and they perceive that lack of better options is the main reason why they continue to use cars despite the congestion and heavy traffic they are experiencing<sup>20</sup>. Most of the factors influencing private car users revolve around safety, reliability, accessibility and availability issues:

- Public transport is crowded with unpredictable schedules, resulting in longer travel times;
- Lack of integrated and interconnected public modes of transport makes public transport less attractive;
- Old and deteriorating public transport systems raises safety concerns among passengers (i.e., the systems are perceived as becoming more dangerous with age);
- Security concerns such as pick pockets discourages victims from using public transport;
- Lack of facilities for persons with disabilities and other vulnerable groups make it difficult to access public transport

22. Private cars offer convenience and comfort, flexibility of reaching multiple destinations without a preset or fixed time schedule. Private cars are more convenient and could provide shorter travel time. Readily available parking in central business districts likewise offers convenience for private car users thus it negatively affects the demand for public transport.<sup>21</sup>

23. Public transport needs proper planning and design considering all the factors cited above in order to change commuters' mindset and promote modal shift. It requires integrated and complementary measures with appropriate institutional framework for sound and sustainable solutions. The HUTMP with its objectives of developing a network of MRT lines, improving and expanding the bus and traffic management systems, improving the road system and supporting policy and regulatory measures is intended to facilitate the modal shift and create a "no turning back" urban development trajectory. In this broader urban development context, the urban transport program is not about buying an urban rail line and associated infrastructure; rather it is intended to ensure delivery of the end-to-end transport services required to fulfill the vision and objectives of the HUTMP and facilitate similar transformation in other cities.

<sup>18</sup>Hayashi, Y., Doi, K. Yagishita, M. and Kuwata, M. (2004) Urban Transport Sustainability: Asian Trends, Problems and Policy Practices. EJTIR, 4, no. 1 (2004), pp. 27-45

Khanna, P., Jain, S., Sharma, P., and Mishra, S. (2011) Impact of increasing mass transit share on energy use and emissions from transport sector for National Capital Territory of Delhi [Transportation Research Part D 16, pg. 65–72](#)

<sup>19</sup> This may be due to the fact that many older residents did not have cars while growing up and may not have ever learned to drive.

<sup>20</sup> Transport Forum 2014: Transport in the Asian Century, 15-19 September 2014, ADB Headquarters, Manila Philippines

<sup>21</sup> Jain, S., Aggarwal P., Kumar, P., Singhal, S., and Sharma, P. (2014) Identifying public preferences using multi-criteria decision making for assessing the shift of urban commuters from private to public transport: A case study of Delhi, [Transportation Research Part F 24 pg. 60–70](#) ; Alvinsyah, Soehodho, S. & Nainggolan, P.J. (2005). Public transport user attitude based on choice model parameter characteristics (Case Study: Jakarta busway system). *Journal of the Eastern Asia Society for Transportation Studies*, 6, 480-491

24. The effect of completion of the HUTMP, the addition of measures to develop an integrated, high quality public transport system, plus measures to restrain car use were forecast to be able to reduce total transport related energy consumption at 2020 by about 30% compared to the baseline.

**(d) Development Impact**

25. **Reduced cost of low carbon technologies and practices.** The SUT program will support the development of public transport policies and systems such as multi-modal public transport ticket pricing that is integrated in timetable and ticketing systems, and a pricing framework that will make public transport fares affordable. The pricing framework will examine the overall fare structure mechanism and determine the real “price point” for public transport fares. To support long term (financial) sustainability for public transport, the framework will develop a mechanism and regulations for development of suitable private transport demand and supply constraints that will increase their costs, thereby allowing the cost of fares to be increased but still being priced competitively. Fare increases are expected to be minimized through improved operational efficiency and integration productivity gains, such as the CTF-supported bus information system and transport/traffic modeling tools, as well as other proposed measures like integrated “one ticket” system and rationalization of institutional arrangements under a public transport authority.

26. Using CTF to co-finance a pioneering effort such as Metro Line 3, the program will help mobilize future investments for replication and scale-up that will stimulate economic growth and facilitate the long-term transition to low-carbon development. At present, it is difficult to predict the potential impact of the project on the cost of low-carbon transport systems, as urban rail lines by nature are one-off designs tailored for individual cities, i.e., there is no modular “kit” which can be mass-produced in factories to drive down costs. Learning rates on Metro Line 3 implementation should facilitate future urban rail infrastructure development and operations as the project is expected to promote replication and scale up in other urban areas with positive economic impacts.

27. **Energy security.** Energy security benefits from the project are relatively modest at the Ha Noi and national levels. The expected increase in the transport modal shift towards the use of public transport system will create fuel savings (mainly from gasoline and diesel fuel) among private cars and motorcycle users. The estimated avoided transport fuel consumption would be about 21million liters per year which represents a small fraction of total transport fuel consumption. However, this is still a meaningful outcome as Vietnam is projected to become a net energy importer within the next 20 years, and the energy security impact would be more substantial as urban transport systems are expanded and as other low-carbon transport interventions are implemented.

28. The interventions will address the growth in energy use due to fast expansion of motorized personal transport and the inefficient fuel use in personal vehicles. In 2011, the road sector energy consumption comprised 18% of the total energy consumption in the country.<sup>22</sup> This led to the transport sector contributing about one fourth of energy-related GHG emissions.

29. **Improved enabling policy and regulatory environment for low carbon technologies and practices.** The Program will provide critical support to improve the enabling environment for

<sup>22</sup> <http://data.worldbank.org/indicator/IS.ROD.ENG.Y.ZS>



low-carbon transport. It will directly support the implementation of HUTMP's medium and long term objectives of improving the road system, supporting policy and regulatory measures, and making public transport more financially sustainable. The SUT project, through consulting services, will provide assistance to develop (i) a station access management system and enforcement measures to ensure clear pedestrian access and proper use of public space by vendors around the stations; (ii) a station parking policy to provide for the efficient flow of vehicles to and from the Metro Line 3 stations; and (iii) a policy framework on public transport ticketing, the pricing of public and private transport in Ha Noi to promote a modal shift from private vehicles to the public transport system.

30. The Program will also support institutional capacity building among transport sector agencies. It will provide critical strengthening to Department of Transport (DOT), Ha Noi Metropolitan Railway Management Board (MRB) and Urban Transport Project Management Unit (UTPMU) to ensure timely and successfully implementation of project components. These will include specific transport and traffic demand management tools through computer systems and related capacity building support to enable them to implement and enforce the new policies and regulations and ensure both CTF funded and other proposed pilot measures can be adequately modeled, planned and consulted prior to implementation to ensure higher levels of public acceptance of private vehicle constraints.

31. ***Increase access to public transport.*** The development of Metro Line 3 will accommodate peak loading of 785,000 passenger per kilometer and 5,800 passengers per direction by 2020. The implementation of CTF-funded integrated sustainable transport activities will complement Metro Line 3 works and the measures it will introduce will enhance the attractiveness and competitiveness of the system. The estimated daily demand would be 157,000 passengers per day in 2018 and progressively increase to 458,000 passengers per day in 2038 (Table 5). This increase in ridership is more than 10% of the base case forecast ridership.<sup>23</sup>

**Table 5: Estimated Daily Passenger Demand, 2018 and 2038**

Year	MRT 3 (Base Case)	SUT alone	MRT3 with SUT (Project Case)
2018	141,365	15,635	157,000
2038	411,886	46,114	458,000

32. The main beneficiaries will be existing users of public transit whom majority are likely to be from the poorest 60% of households in Ha Noi and have incomes lower than the city average. The project will especially benefit passengers with mobility restriction, women, elderly people and students who are more inclined to use public transportation. The analysis estimated that up until the Metro Line 3 opens, (i) up to 30% of trips planned by existing public transit users were not made; (ii) 32% were made by bus; (iii) 27% were made by motorcycle; (iv) 5.6% were made by car; and (v) 5.4% were made in taxis.

33. Other assumed benefits from the project will be on perceived travel time savings and associated travel reliability compared to travel by motorbike, car, or bus. The program will reduce weighted average travel time per passenger along project corridor by 25% from 52 minutes (2011 baseline). While, the introduction of sustainability measures will create estimated average perceived travel time saving per forecast Metro Line 3 passenger of about 1.4 minutes to access

<sup>23</sup> Based on feasibility study estimate of a post 2028 traffic growth rate of 3.5% per annum. The demand estimates in terms of the project station entries and exits excluded transfers between other metro lines.

stations and the same to egress stations. The information system will provide real-time bus and train arrival information to make the public transport system more convenient and reliable.

34. **Health co-benefits.** Health benefits will accrue mainly at the local and national level from reduced vehicle accident rates and avoided vehicle emissions of conventional pollutants. The provision of safe pedestrian and wheelchair access / walkways to the rail and subway stations and bus stops, road safety signage, footbridges and pedestrian subways and good traffic control around the stations will mitigate pedestrian safety risks. The transport modal shift will minimize emission of conventional pollutants, including particulate matter (Particulate Matters, including BC), nitrogen oxides (NOX), sulphur oxides (SOX), and other toxic compounds present in petroleum fuels used by cars and motorcycles. Black carbon (BC) emissions will be minimized. BC contributes to the adverse impacts on human health, ecosystems, and visibility associated with ambient fine particles (PM<sub>2.5</sub>). Short-term and long-term exposures to PM<sub>2.5</sub> are associated with a broad range of human health impacts, including respiratory and cardiovascular effects as well as premature death. In the United States, the average public health benefits associated with reducing directly emitted fine particulates (PM<sub>2.5</sub>) are estimated to range from \$290,000 to \$1.2 million per ton PM<sub>2.5</sub> in 2030.<sup>24</sup> Assuming that BC accounts for 10% of PM<sub>2.5</sub>, and considering that health care costs in the US are much higher than most other developed countries, potential BC reductions of 10.76 million tCO<sub>2</sub>e noted above would have future benefits valued at billions of dollars per year.

35. **Employment co-benefits.** The SUT program is expected to create substantial local employment during construction, operation and maintenance stage. Temporary construction jobs will be available during the construction stage; while employment opportunities for bus drivers, ticket takers, and security personnel for each stations will be available during the operation period. Indirect employment opportunities are also expected arising from the improved access to transport services and growth of small businesses surrounding station locations.

36. **Gender and local community co-benefits.** The SUT program will directly and indirectly benefit public transport users and communities in six districts of Ha Noi. The main benefits are derived from improved access to better, safer, cheaper, more reliable, and faster transportation, with additional benefits from road accident cost reduction, deferred capital costs of public transport and reduced road maintenance costs.

37. All infrastructure and facilities of Metro Line 3 systems will have gender-sensitive and universal accessibility features. Connecting public transportation will provide improved access, which will benefit all people in the area, but especially those whose mobility is restricted. The improved public transportation system will generally save passengers' travel time compared to travel by motorbike, car, or bus. The impact is expected to especially benefit workers from the rural and suburban areas, women, elderly people and students who are more inclined to use public transportation.

38. Local economies are expected to improve as a result of business opportunities created through improved and cheaper transport. It will contribute to local economic development and rising living standards among residents, entrepreneurs and the workforce in Ha Noi. Residents will further benefit through improved quality of life resulting from reduced congestion and pollution. The project will particularly benefit the residents/communities of Tu Liem districts which have the highest percentage of poor households (1.9%), highest number of poor female headed households and highest percentage of disabled population. The metro network will also reduce

<sup>24</sup> <http://www.epa.gov/blackcarbon/effects.html>

pressure for housing in the central city.

***(e) Implementation Potential***

39. The executing agency for the Ha Noi Metro Line 3 systems will be the Ha Noi People's Committee (HPC). HPC has established a major projects steering committee for the Metro system development in Ha Noi. Chaired by HPC vice chairman, the steering committee is responsible for project oversight and coordination.

40. For Project 1, MRB is the implementing agency. It is responsible for overseeing the planning, design, implementation and operation of Metro systems in Ha Noi. The implementation capacity of the new MRB management has significantly improved. Project Implementation Division 1, within MRB, was restructured and strengthened to improve day-to-day management and coordination with the districts affected by the Project land acquisition and resettlement (LAR) activities.

41. For Project 2, the implementing agency will be the DOT. The UTPMU, under DOT, will implement the Metro Line 3 station proposed accessibility improvements, public transport system improvement and public transport policy development outputs. UTPMU will establish a project implementation division (PID) for the Project under the Director, which will be responsible for the day to day management and implementation. The PID will ensure compliance with ADB procurement and consulting and disbursement guidelines and ADB safeguard policies. The PID staff will be assisted by experienced engineers, accountants, and other staff from UTPMU, as required. UTPMU was established in 1985. It has strong leadership, a sound organizational structure and has capability to further develop its institutional capacity as the public transport system expands. UTPMU has the capacity and finance and resource management to implement the Project.

42. Capacity development in the form of consulting services, training and urban transport sector development studies to strengthen the capabilities of UTPMU and other city public transport agencies will be provided. The HPC proposes to establish a Public Transport Authority (PTA) with responsibility for planning, developing and regulating all public transport modes in Ha Noi, including the MRT system.

43. The implementation schedules of the two projects are closely aligned, with completion targeted by the end of 2018. The HPC vice-president will be responsible for both projects to ensure high degree of coordination and cooperation.

***(f) Additional Costs and Risk Premium***

44. The technical, environmental, and public health benefits of public mass transit, especially the avoided street-level pollutant emissions, are compelling, but in the case of Hanoi realization of these benefits requires a massive urban infrastructure "retrofit" with upfront costs of billions of dollars. Such investments are not spontaneous in nature, and to be successful require systematic planning, engineering design, institutional development, and – most importantly and most challenging – changes in public behavior (as noted above). The added value of CTF support goes well beyond concessional financing: the proposed use of CTF funds facilitates an enhanced program scope which addresses all of the challenges of urban transport including that of changing public behavior. If the urban transport system is not user-friendly in terms of access, convenience, and security, the envisioned connectivity between transport modes (walking, biking, motorbikes, buses, etc.) will not be realized.

45. The additional cost of introducing sustainable urban transport systems into the Ha Noi development context is the entire cost of the various system investments including the costs of the sustainability measures directly funded by CTF. The additional risks pertain to dependence on timely execution by and coordination with the two proposed projects under Metro Line 3 systems. The capacity of the implementing agency to introduce and implement innovative public transport measures, including the integration of Metro Line 3 and other citywide sustainable transport measures likewise presents additional risks. The CTF allocation of \$98.95 million represents only a fraction of the additional costs and risks of the Metro Line 3 system which has a total cost of almost \$1.6 billion. For large transport infrastructure projects in Viet Nam, experience indicates strong support is required to avoid implementation delays, ensure quality of works are achieved and build sustainable institutions.

46. The Projects will be implemented on a non-commercial basis, i.e., the project costs will not be fully recovered from operating revenues, as public transport services are considered a public good. The additional costs and risk premiums justify use of CTF in accordance with paragraph 20 (b) of the *Clean Technology Fund Financing Products, Terms, and Review Procedures for Public Sector Operations* dated 15 December 2011.

*Additional details are presented in the Project 2 draft RRP, paragraph 22.*

## 10. Stakeholder Engagement

47. The program has been developed under the aegis of the Viet Nam Socio-Economic Development Plan for 2011–2015, which includes major public transport infrastructure investments intended to induce a substantive modal shift from private to public transport modes. Inter-agency dialogue has been ongoing since 2009, when the SUT project was initially proposed for inclusion in the CTF Investment Plan.

48. During project preparation, in compliance with ADB's information disclosure and consultation requirements, a series of public consultations involving affected people have been conducted. Groups that were consulted include the Ha Noi Association of People with Disabilities (DP Ha Noi), Women's Union and student groups as well as with the Ha Noi Department of Labour, Invalids and Social Affairs (DOLISA). The communication and participation plan, which will be prepared, aims to ensure that stakeholders' views are considered into the project design to promote universal access features and usability. These organizations will have key roles during the implementation of this plan as well as support a number of outreach awareness campaigns.

### Coordination with Donors and other Multi-lateral Development Banks

49. Support for the urban transport program, including the proposed Ha Noi Metro Line 3 investment, was the subject of early discussions with major donor agencies and other MDBs during preparation of the CIP. ADB has maintained communication with these stakeholders during project preparation and will continue to liaise with donors and other MDBs during implementation.

## 11. Gender Considerations

50. Both projects are classified as "effective gender mainstreaming" under ADB's Gender Mainstreaming Project Guidelines. Gender Action Plans (GAPs) for the two projects, aligned with Viet Nam's national gender equality policy and commitments, were prepared to ensure that

gender aspects have been integrated into the project design and planning.

51. The Metro Rail System project (Project 1) GAP measures include (i) use of employment targets for women and gender-specific core labor standards for contracts and other employment generation, (ii) consideration of gender-inclusive physical design features in infrastructure, and (iii) mitigation of the gender-related resettlement impacts.

52. Metro Line 3 SUT project (Project 2) proposed GAP measures will involve: (i) accessibility improvement design features such as safe pedestrian access, adequate lighting and installation of CCTV around stations; (ii) priority seating and allocated waiting spaces for women; (iii) allocation of 40% of the unskilled civil works jobs provided to women; (iv) structuring of ticketing and fare pricing to increase affordability and access; (v) pedestrian friendly traffic management and traffic calming measures; and (vi) development of gender-sensitive policies and regulations for the inter-modal public transport. During project construction stage, 40% of the unskilled civil works jobs will be allocated to women. The project will also develop a gender-sensitive capacity development plan and project monitoring and information system (PMIS) with gender related targets. The plan will be implemented by UTPMU and HPC. The UTPMU will assign a Gender Focal within the Project Implementation Division for coordinating the implementation of the plan. A National Gender Specialist Consultant will be hired to ensure the implementation, and monitoring and reporting of the plan.

## 12. Indicators and Targets (consistent with results framework)

Core Indicators	Targets
(a) tCO <sub>2</sub> e reduced or avoided	663,000 tCO <sub>2</sub> e
(b) Leverage factor (increased financing)	~ 1:16
(c) Increased access to public transport	157,000 passengers per day in 2018 and 458,000 passengers per day in 2038

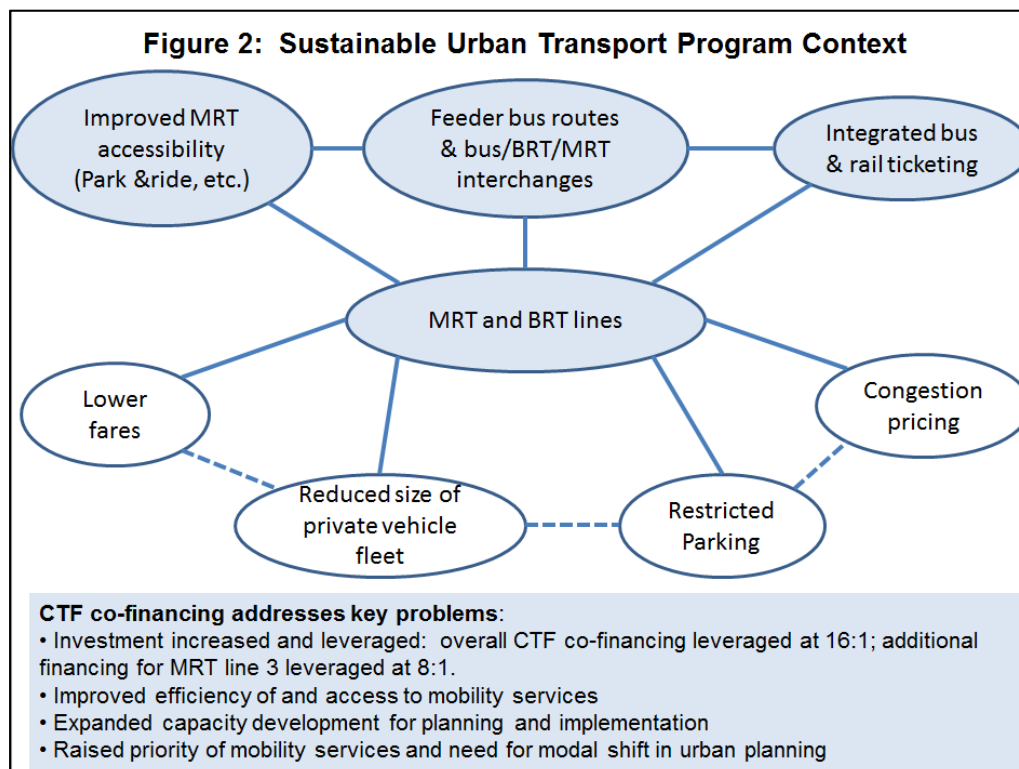
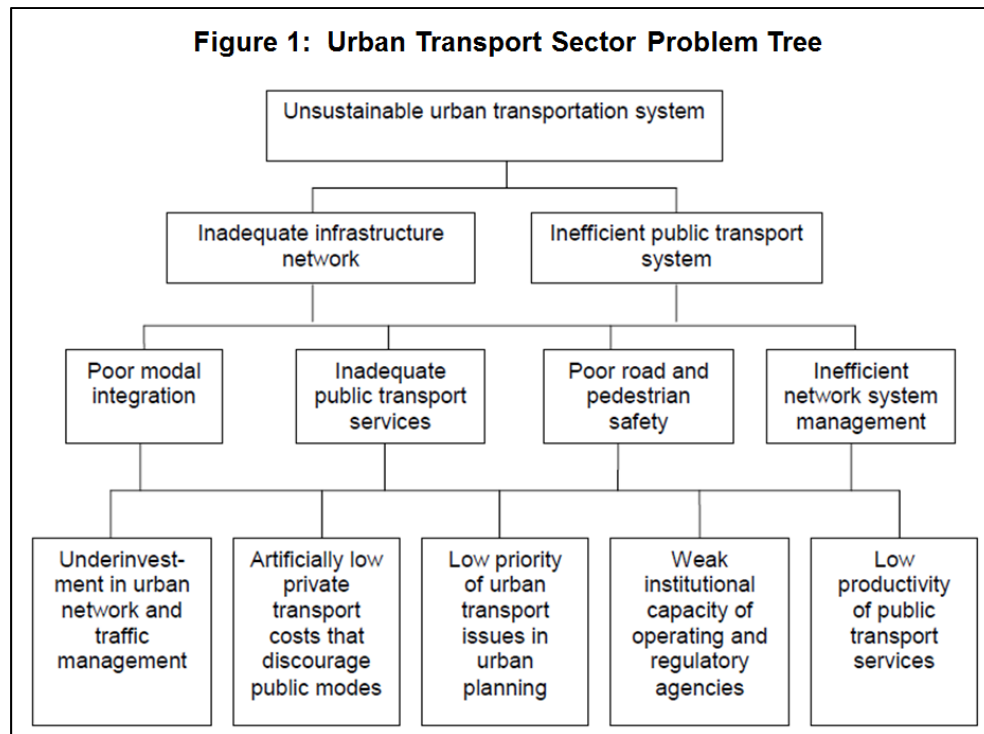
## 13. Co-financing

	Amount (in million USD)
• MDB	297.20
• Clean Technology Fund	98.95
• Agence Française de Développement	143.00
• Direction Générale du Trésor	325.00
• European Investment Bank	95.10
• Government	579.60
<b>Total</b>	<b>1,538.75</b>

## 14. Expected Date of MDB Approval

Metro Rail System Project (Project 1) – Additional Financing: Q3 2015

Metro Line 3 SUT Project (Project 2): Q4 2014



### Notes on Black Carbon (BC) Calculations

There is no specific CTF guidance for BC analyses. The estimates presented use the same formulae and reference data as those made for the Vietnam Ho Chi Minh City Sustainable Urban Transport Program which was approved by the CTF trust Fund Committee in 2013. The estimates are also consistent with those made for the Philippines electric vehicles project which was approved by the CTF Trust Fund Committee in October 2012 and subsequently approved by ADB's Board of Directors in December 2012. The estimates for avoided diesel consumption utilize references which were included in the Revision of the CTF Investment Plan for Indonesia which was endorsed by the Trust Fund Committee in April 2013.

Parameter	Diesel <sup>a</sup>	Gasoline <sup>b</sup>
Avoided fuel (L)	152,957,934	262,934,232
Fuel density (tons / L)	0.000832	0.000719
BC content (tons BC / ton fuel)	0.69	0.075
Global warming potential	1055	1055
GHG reduction from BC (tCO <sub>2</sub> e)	92,639,646	14,958,559
<b>Discounted by factor of 10</b>	<b>9,263,965</b>	<b>1,495,856</b>
Annual average	463,198	74,793
Total BC for project lifetime (tCO <sub>2</sub> e)	10,759,820	
Base case GHG reductions (tCO <sub>2</sub> e)	663,000	
Total for project lifetime (tCO <sub>2</sub> e)	11,422,820	
Base case + Replication & Scale up (tCO <sub>2</sub> e)	1,200,000	
<b>Total with BC + Replication &amp; Scale up (tCO<sub>2</sub>e)</b>	<b>12,622,820</b>	
Potential Public Health Benefits	Low	High
Benefit per ton BC reduced or avoided (discounted by factor of 10) <sup>c</sup>	\$ 29,000	\$ 120,000
<b>Annual benefit</b>	<b>\$15,601,739,659</b>	<b>\$64,558,922,728</b>

Notes:

<sup>a</sup> Carbon content of diesel is from Annex 1 of UK DEFRA reference:

<http://www.defra.gov.uk/publications/files/pb13773-ghg-conversion-factors-2012.pdf>

Black carbon content of diesel is the low-end of range presented in: Tami C. Bond and Haolin Sun. 2005. *Can Reducing Black Carbon Emissions Counteract Global Warming?* Environmental Science and Technology, Vol. 39, No. 16, pp. 5921-5926. The low-end value of BC in diesel is about one-third of the high-end value, thus the estimate for BC emissions presented herein is conservative.

<sup>b</sup> Black carbon content of gasoline is from J. Liggio *et al* at Environment Canada and the National Research Council of Canada, summarized in an article in Chemical and Engineering News in February 2012, which can be found at: <http://cen.acs.org/articles/90/web/2012/02/Black-Carbon-Belchers.html>

The factor of 0.075 kg BC/kg is consistent with the lowest reported value from various studies summarized in the Environment Canada report; see <http://www.greencarcongress.com/2012/02/liiggio-20120229.html>

<sup>c</sup> The benefits for reduced BC are taken from USEPA and discounted by a factor of 10. Additional information is available at: <http://www.epa.gov/blackcarbon/effects.html>.

A forthcoming paper estimates that economic damage caused by PM<sub>2.5</sub> to the US economy is almost 4% of GDP. Hamilton, K. Brahmbatt, M., and Liu, J.M. 2014. Co-benefits and Climate Action. New Climate Economy contributing paper. World Resources Institute, Washington D.C. The synthesis report published on 17 September 2014 is available at <http://newclimateeconomy.report/overview/>.