

**CLEAN TECHNOLOGY FUND  
REVISED INVESTMENT PLAN FOR THE PHILIPPINES**

**July 2012**

## ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
BRT	Bus Rapid Transit
CIP	CTF Country Investment Plan
CIP-R	Revised CTF Country Investment Plan
CCC	Climate Change Commission
CTF	Clean Technology Fund
DOE	Department of Energy
DOF	Department of Finance
DOTC	Department of Transport and Communications
EE	Energy Efficiency
EEEVs	Energy Efficient Electric Vehicles
FIT	Feed-in Tariff
GHG	Greenhouse Gas
GoP	Government of the Philippines
IBRD	International Bank for Reconstruction and Development
ICE	Internal Combustion Engine
IFC	International Finance Corporation
LGU	Local Government Unit
MtCO <sub>2</sub> e	Million tons of carbon dioxide equivalent
NCCAP	National Climate Change Action Plan
NFSCC	National Framework Strategy on Climate Change
PV	Photovoltaic
RE	Renewable Energy
RPS	Renewable Portfolio Standard
SCS	Solar charging station
WBG	World Bank Group

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## **EXECUTIVE SUMMARY**

The Government of the Philippines (GoP) is pleased to provide a revised Clean Technology Fund (CTF) Country Investment Plan (CIP) which has been updated from the version which was endorsed by the Trust Fund Committee (TFC) in December 2009. This document has been revised pursuant to discussions with the CTF Trust Fund Committee held in Washington, DC on 4 November 2011, and it also takes account of subsequent comments received and additional stakeholder consultations, superceding revisions submitted in January and June 2012.

The revisions support the Department of Energy's (DOE) continuing efforts to improve energy security, reflecting recent regulatory developments creating investment incentives in renewable energy (RE) as reflected in the Philippine Energy Reform Agenda, with its three pillars: (i) ensuring energy security, (ii) achieving optimal energy prices, and (iii) developing sustainable energy systems. The CIP revisions are also consistent with other adjustments and refinements made to national policies and priorities since the time of the original CIP, including establishment of the National Framework Strategy on Climate Change in April 2010 and an accompanying National Climate Change Action Plan, approved in April 2011 after extensive inter-departmental and stakeholder consultations.

These adjustments notwithstanding, the overall context and objectives of the original CIP remain unchanged. No changes are proposed to the use of CTF resources for projects and programs to be implemented in partnership with the World Bank Group. However, several changes are proposed with respect to CTF resources for public sector investments implemented in partnership with the Asian Development Bank (ADB). Table ES1 summarizes the indicative financing plan as endorsed by the CTF Trust Fund Committee in December 2009. Table ES2 presents the indicative financing plan associated with the revised CIP, as proposed.

With the electric power industry — generation, transmission and distribution — fully owned and operated by the private sector, there is little room for large public investment in the energy sector. This is especially true for the generation subsector, as incentives under the Renewable Energy Act of 2008 have stimulated significant interest in expanded renewable energy capacity. Among remaining alternatives for low-carbon investments are those in large-scale electric vehicle deployment, which have the potential to bring transformative change by fundamentally altering the fuels used for public transportation in the country. E-vehicles are particularly attractive given limits on large-scale use of natural gas or other cleaner fuels, which are constrained by the lack of availability of fuel and of pipeline and distribution infrastructure.

Under the revised CIP, the Government proposes to use CTF resources in support of cleaner and more energy efficient transport through an Energy Efficient Electric Vehicles (EEEVs) Project, while continuing renewable energy promotion through a revised Solar Energy Development Project. The previous funding request for an Energy Efficient Appliances Project has been withdrawn, though the Government plans to pursue this idea in modified form, subject to the availability of alternative financing. The EEEVs Project responds to the Government's emphasis on investing in end-use energy efficiency for public transport systems and initiating a range of market transformation efforts via publicly-led investment and technology transfer. The market transformation envisaged under the project aims to (i) provide access to and commercialization of technology; (ii) transform service delivery arrangements; (iii) introduce publicly available charging stations for e-vehicles; and (iv) indigenize an e-trike industry.

The potential availability of CTF financing to support a large-scale expansion of electric tricycles for the country's public transport system has already allowed the Government to "think big" in this regard, making significant commitment to initiate and implement the necessary transformations necessary to establish new complete value chain for a locally made electric vehicles industry. A commitment to deploying 100,000 locally made electric vehicles by 2016 would remove perceived new technology risks and help to put in place the public infrastructure needed for broader adoption of electric vehicles through private initiatives. This would constitute the largest commitment by any Asian country to the introduction of e-vehicles (EVs), and it would be comparable to the US commitment to have 1 million EVs by 2015, France's target of deploying 2 million EVs by 2020, Germany's goal of having 1 million EVs by 2020, Ireland's plan to have 350,000 EVs by 2020, Israel's introduction of 100,000 EVs annually from 2012, Japan's targeted 20% market share for EVs by 2020, and the UK's target of 1.2 million EVs by 2020.

The revised Solar Energy Development Project, as proposed, plans to transform the solar rooftop market and also to create a new market for solar charging for e-vehicles without direct public subsidies. These interventions would be outside of the new feed-in tariff (and its 50 MW cap) while also supporting the development of net metering in the country. It is estimated that this can be accomplished through an investment of roughly \$100 million, requiring only \$20 million in CTF resources. This takes account of the new solar feed-in tariff<sup>1</sup> having created large interest from the private sector for investments of as much as 300 MW.

Electricity consumers in the Philippines pay some of the highest tariffs in the world, but because of off-take risks and lack of a demonstration project for solar charging of electric vehicles, the private sector is unlikely to invest in Solar charging stations. Therefore, the proposed EEEVs project includes a request for a \$4 million grant to: (i) demonstrate technical viability of solar charging station with Lithium-ion batteries, and (ii) develop a mechanism to aggregate individual drivers' daily electricity demands to support a guaranteed Power Purchase Agreement capable of reducing the off-take risk of private investors.

Thus, use of CTF resources to support the expansion of electric vehicles in the country will not only contribute to the country's low-carbon development objectives but will also help reduce the country's reliance on imported energy sources for the transport sector. Other developmental benefits will include better health for drivers, passengers and urban residents generally through improved air quality, new skills development, job creation, and establishment of a vehicle and spare parts supply industry. The proposed EEEVs project also includes provision for the testing of solar charging stations from e-vehicles, which is expected to create an enabling environment for related private sector investments and technology risk sharing. Further, the additional net income of EV drivers and owners should largely be poured back into the participating communities.

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<sup>1</sup> On 27 July 2012, the Electricity Regulatory Commission approved a P9.68/kWh feed in tariff (USD 23 cents per kWh at the current exchange rate) – about half the level of P17.95/kWh which had been proposed by the National Renewable Energy Board in 2011. This is an absolute tariff (i.e., not additive) and is on the low side, considering the average feed-in tariff range seen in other countries of 14.2 to 53.4 c/kWh.

**Table ES1: Indicative Financing Plan Endorsed in December 2009 (\$ million)**

Financing Source	Renewable Energy (WBG)	Urban Transport (WBG)	RE and EE (ADB)	Total
CTF	75	50	125	250
GoP / DBP	180	50	50	280
IBRD Loans	250	250	0	500
IFC Loans	250	0	0	250
ADB Loans	0	0	400	400
Private sector	750	0	350	1,100
<b>Total</b>	<b>1,505</b>	<b>350</b>	<b>925</b>	<b>2,780</b>

Source: CTF Investment Plan for Philippines 2009

ADB=Asian Development Bank, CTF=Clean Technology Fund, DBP=Development Bank of the Philippines, EE=energy efficiency, GoP=Government of the Philippines, IBRD=International Bank for Reconstruction and Development, IFC=International Finance Corporation, RE=renewable energy, WBG=World Bank Group

**Table ES2: Indicative Financing Plan After Reallocation (\$ million)**

Financing Source	Renewable Energy (WBG)	Urban Transport (WBG)	Energy Efficient Electric Vehicles (ADB)	Solar Energy Development (ADB)	Total
CTF	75	50	105 <sup>a</sup>	20 <sup>a</sup>	250
GoP / DBP	180	50	99	20	349
IBRD Loans	250	260	0	0	510
IFC Loans	250	0	0	0	250
ADB Loans	0	0	300	80	380
Private sector	750	0	(tbd) <sup>b</sup>	(tbd) <sup>b</sup>	750
Other cofinancing (AFD loans)	0	245	0	0	245
<b>Total</b>	<b>1,505</b>	<b>605</b>	<b>504</b>	<b>120</b>	<b>2,734</b>

Source: MDB teams

ADB=Asian Development Bank, AFD=Agence Française de Développement, CTF=Clean Technology Fund, DBP=Development Bank of the Philippines, EE=energy efficiency, GoP=Government of the Philippines, IBRD=International Bank for Reconstruction and Development, IFC=International Finance Corporation, RE=renewable energy, (tbd)=to be determined, WBG=World Bank Group

Notes:

<sup>a</sup> For the EEEVs project, a CTF grant of \$1 million is requested for fine-tuning of technology options, technology transfer, local industry support and capacity building (implementation support, including monitoring and evaluation activities will be financed by the ADB loan). For the Solar Charging Systems component a CTF grant of \$4 million is requested to ensure its technical viability and whether solar charging could be implemented within the current tariff of about \$0.20/kWh; see discussion in main text and concept paper in Appendix 2 for further details.

<sup>b</sup> Private sector entities will participate in project implementation via supply of goods and services. For the EEEVs project, private sector investment is expected during replication and scale-up, and as such no private sector cofinancing is shown in Table 4. Private sector cofinancing for the Solar Energy Development project has yet to be determined.

During stakeholder consultations with non-government and civil society organizations (NGOs, CSOs) conducted in Manila in May 2012, a number of key issues were highlighted, with subsequent adjustments made to the CIP (see Appendix 1 for further information):

- (i) a range of issues and alternatives were put forward regarding design of the EEEVs Project, including those relating to the funds flow model, where civil society organizations emphasized the need for transparency, especially in light of the upcoming local elections, and it was clarified that manufacturers would receive direct funding;
- (ii) participant contributions also influenced the proposed EEEVs Project design with respect to warranty issues, disposal options, and the e-trike design;

- (iii) it was noted that there have been significant price reductions in the cost of solar power, especially in the last year, so a solar rooftop project with net metering could be developed without subsidies provided by way of the feed-in tariff – and plans for investment in expanded solar power were incorporated into the revised CIP, albeit at a more modest scale than conceived in 2009; and
- (iv) civil society and renewable energy representatives expressed strong interest in promoting the use of solar energy to charge electric vehicles, without imposing any additional financial burden to the drivers and end users, and a proposal for such a pilot project was incorporated into the CIP that is meant to encourage private investors to provide such services and broaden support for electric vehicles with the lowest possible carbon footprint.

The adjustments made in this revised CIP are based on feedback received through wide-ranging stakeholder engagement covering CSOs, NGOs, local government units, industry representatives, and public transport owners and operators – especially with respect to design of the EEEVs Project. The proposed CIP revisions are expected to achieve a better balance between supply-side and demand-side investments, without crowding out private sector investment in renewable energy while fully supporting the Philippines energy reform objectives to promote affordable and sustainable energy security. The proposed projects will result in greater and more cost-effective GHG emissions than proposed in the original CIP, with enhanced development impacts.

DOE and ADB are committed to continuous and thorough consultation during implementation of the proposed EEEVs Project. As a result of stakeholder engagement and consultations, principles and broad guidelines have been developed to address some of the risk factors identified — including involvement of LGUs, collection from drivers, and selection of recipients of e-Trikes. Within this umbrella framework, DOE and ADB will work with a range of stakeholders to develop detailed plans specific to each location for project implementation. Since public consultations conducted on 21-23 May 2012, DOE and ADB have continued to consult with tricycle drivers, associations of tricycle drivers and owners, and other stakeholders in (i) Puerto Princessa, (ii) Boracay, (iii) Quezon City, and (iv) Cabanatuan to continue dialogue and firm up understanding regarding the demand for e-Trikes in these locations. Further engagement with these and others will take place through Working Groups to be established for this purpose, once it is clear that the project will move forward (see Appendix 1).

DOE and ADB plan to invite all stakeholders including civil society to actively participate in these Working Groups, with plans to send invitations as soon as investment endorsements and approvals have been granted by the CTF Committee and ADB's Board. Invitations will be posted on a dedicated website ([www.adb.org/etrike](http://www.adb.org/etrike)) and on the ADB Facebook page. Detailed implementation arrangements will be developed as the project moves forward and will take account of local conditions and learning from each stage of implementation. A flexible approach will be maintained within the umbrella framework, with an initial focus on Puerto Princessa and Boracay, which may be the only two cities to receive any e-trikes prior to the local government elections scheduled for May 2013. Plans for other areas will develop slowly based on knowledge developed in these first two areas, and an assessment of lessons will be carried out after distribution of the first 20,000 e-vehicles to guide any necessary adjustments to the project or associated enabling policies and institutions.

## I. INTRODUCTION

1. The Philippines Clean Technology Fund (CTF) Country Investment Plan (CIP) was endorsed by the Trust Fund Committee (TFC) in December 2009, with an envelope of \$250 million in CTF cofinancing. The original CIP comprised clean energy and transport sector investments in both the public and private sector.

2. The Government of the Philippines (GoP) wishes to propose changes to the CIP that will reallocate funds for public sector investments to be implemented in partnership with the Asian Development Bank (ADB). The changes proposed are consistent with the long-term objectives of the original CIP, with the overall context and objectives of the CIP remaining unchanged. The revised CIP (CIP-R) is a business plan owned by the Government of the Philippines (GoP), and is a dynamic document with the flexibility to consider changing circumstances and new opportunities.

3. No changes have been proposed to the CTF allocations for the International Bank for Reconstruction and Development (IBRD) and International Finance Corporation (IFC). Therefore, this document primarily covers the proposed changes and program to be implemented in partnership with the Asian Development Bank (ADB), and is organized as follows:

- Section I – Introduction to the Philippines revised CTF CIP;
- Section II -- Review of the status of implementation of the original investment plan;
- Section III -- Explanation of the circumstances and rationale for revising the investment plan and making changes to the projects or programs included;
- Section IV -- Description of the proposed changes, i.e., proposed reallocation of funds as requested by the GoP;
- Section V -- Assessment of the potential impact of the proposed changes on achieving the objectives and targets of the original investment plan;
- Appendix 1 – Summarizes stakeholder engagement and consultations relating to the proposed changes to the CIP; and
- Appendix 2 and 3 – Concept papers for the revised investments proposed for CTF support.

## II. STATUS OF ORIGINAL INVESTMENT PLAN IMPLEMENTATION

4. The status of program and project development and approvals is presented in Table 1 and discussed below.

**Table 1: Processing Status of IBRD and IFC Investment Programs and Projects**

Project	TFC Approval Date	CTF Amount (\$ million)	Leveraged Funding (\$ million)
IFC Renewable Energy Accelerator Program	September 2010	20	330
IFC Sustainable Energy Finance Program	February 2011	10	209
IBRD Renewable Energy/Energy Efficiency Project	December 2012	45	200
IBRD Urban Transport (BRT) Project (Cebu)	September 2012	25	170
IBRD Urban Transport (BRT) Project (Manila)	September 2013	25	385
<b>Total IBRD, IFC and Leveraged Investments</b>		<b>125</b>	<b>1,294</b>

Source: MDB project teams.

**IBRD Renewable Energy Program**

5. The IBRD/CTF operation would support investments in renewable energy (RE) generation and in utility-level energy efficiency (EE). The operation would build on IBRD projects that are active in these sub-sectors. In RE, the focus will be on leveraging private sector investment in the context of the emerging policy and regulatory framework for renewables, and ensuring that CTF is used strategically to leverage as much private investment as possible. In EE, the goal is to scale-up the efforts of electric cooperatives (ECs) to continue to reduce losses, as one key input for enhancing the financial strength of these service providers. Stronger ECs will be better able to expand their customer bases, contributing to critical access objectives, and to serve those new customers with an increasing proportion of clean energy.

6. While the Philippines has an advanced framework for private participation and for attraction of private financing, there are significant barriers to the scale-up of RE and utility-led EE. For example, for administrative ease, the country has opted for a single, national feed-in tariff (FIT) rate per technology; but supply chain and other costs vary widely in the country, so some economically beneficial projects will not be financially viable under the FIT mechanism. Specific FIT rules are still to be finalized and made effective. The FIT regime will also not extend to certain renewable technologies (e.g., geothermal), nor will it cover off-grid generation. CTF will be used to provide critical additionality and leverage such that more, good projects will be financed, especially in regions of the country that might not otherwise see much activity. In the EC sector, there are 119 service providers but only about half are currently rated credit-worthy, and investment flows are falling well short of requirements even for the credit-worthy. CTF is targeted at both the supply side – by leveraging the flow of private credit to support investments – and at the demand side, by establishing programmatic eligibility criteria that will help incentivize more ECs to become credit-worthy.

7. GoP has made its formal request for project preparation funds from the CTF, and project preparation work is set to accelerate. The project appraisal is upcoming, and presentation to the IBRD Board is scheduled in mid-2013.

**IBRD Urban Transport Program**

8. The Program comprises investment and advisory services components to support the implementation of Bus Rapid Transit (BRT) projects in Cebu and Manila. The advisory services component includes support for implementation of the National Environmentally Sustainable Transport Strategy (NESTS). Since the Philippines CIP was prepared in December 2009, there have been a few minor changes made to the scope and design of the urban transport component. These adjustments are outlined below.

9. Through project preparation work undertaken since the initial CTF investment proposal, it has become evident that to ensure successful implementation of a BRT system in the Philippines, substantial capacity and institution building work will be necessary. To this end, it has been agreed with the counterparts that the BRT program would be undertaken in two phases, beginning with a Phase I demonstration project in Cebu City, from which lessons learned and institutional structures derived would be applied to Phase II, the development of a BRT in Manila. Given the substantive social and political hurdles involved in the Manila phase, the counterparts agreed that a successful demonstration in Cebu would facilitate more rapid implementation in Manila.

10. Also, for Phase I, to maximize greenhouse gas emissions mitigation benefits, as well as safety, gender, and poverty impacts, the program scope has been slightly expanded to also include upgrading the existing SCATS area traffic control system to better manage traffic and non-motorized transport (NMT) flows, not only on BRT corridors, but for the entire transport network. Further, Phase I will include significant training and capacity building work not just for the local government, but also relevant stakeholders, such as the jeepney operators.

11. Finally, since the initial CTF proposal, a parallel Sustainable Urban Energy Program (P125401) has been undertaken by the IBRD in Cebu City, through which it was determined that the greenhouse gas emissions from the transportation sector were 721,000 tons CO<sub>2</sub>e in 2010, about 40 percent of Cebu's total greenhouse gas emissions. While this figure will be verified and refined during the CTF project preparation, the estimate provides a basis upon which to develop preliminary greenhouse gas emissions reduction targets that may be attributable to Phase I in Cebu, versus Phase II in Manila. Through the expanded project scope, a range of 100,000 to 150,000 tons CO<sub>2</sub>e emissions reductions per year may be a reasonable estimate for Phase I, with more substantive emissions reductions to be expected in Manila, which is many times the size of Cebu City and has a much higher motorization rate. The success of Phase I is critical to expanding the scope to Phase II. However, in addition to CO<sub>2</sub>e emissions reductions, it is expected that the Phase I demonstration project would have considerable impact on improving access to the poor, providing safer and more effective transport services to all residents, and influencing changes in land use design with a long-term impact on the city's ability to address climate change related issues.

12. Since the program will be undertaken in two phases, rather than one, funding allocations have been adjusted accordingly, as shown in Table 2. Further, additional financing and technical assistance funding has been secured from the Agence Française de Développement (Afd), which is also reflected in the revised figures. The CTF funds will continue to be needed to cover part of the additional costs of BRT systems compared to conventional bus networks.

**Table 2: Revised Financing Plan for IBRD Urban Transport Program (US\$ million)**

Funding Source	December 2009 Original Proposed Contribution	October 2011 Revised Proposed Contribution	
		Phase I	Phase II
Government of the Philippines	50	15	35
IBRD	250	110	150
Clean Technology Fund	50	25	25
Agence Française de Développement	0	45	200
<b>Total</b>	<b>350</b>	<b>195</b>	<b>410</b>

Source: IBRD.

Notes: \* To be confirmed during preparation.

13. Overall progress is shown above in Table 1. Project preparation work is proceeding well, and 4 missions have been undertaken since April 2011. The Government has made a formal request for project preparation funds from the CTF. QER for the project are set for July 2012, and appraisal is targeted for September/October 2012, with presentation to the Bank's Board in March 2013.

**IFC Programs**

14. As of October 2011, two private sector program proposals have proceeded: \$20 million was approved in September 2010 for the IFC Renewable Energy Accelerator program, and \$10 million was approved in February 2011 for the IFC Sustainable Energy Finance program.

**IFC Renewable Energy Accelerator Program (REAP)**

15. IFC would provide appropriate incentives for qualified solar, wind, and biomass developers to accelerate the implementation of RE projects. These projects would provide immediate GHG reduction impact and provide valuable information on the types and amounts of incentives required to catalyze RE development in the country. IFC will continue to develop projects with CTF support in close coordination with the GoP and the policies that govern private sector growth. The rationale is the same as envisioned in the original CIP. IFC continues to work with project developers and refining financial structures in the development of projects. Overall progress is shown above in Table 1.

**IFC Sustainable Energy Financing Program (SEFP)**

16. The program supports the scale up of sustainable energy finance projects in Philippines. It aims to contribute to increasing private sector involvement, support captive and grid-tied RE development, EE market transformation, and enhance energy savings. The CTF funds will continue to be needed to incentivize local financial institutions to undertake financing in lower carbon emitting technologies. The rationale is the same as envisioned in the original CIP. IFC continues to work with various stakeholders in developing projects under the program. IFC has a pipeline of projects that are at various stages of development that would fully utilize IFC's CTF allocation.

**III. CIRCUMSTANCES AND RATIONALE FOR INVESTMENT PLAN REVISION****Policy Directions**

17. The overall rationale for CTF intervention in the energy and transport sectors as articulated in the original Investment Plan remains valid. The proposed revisions reflect recent adjustments and refinements to relevant national policies and priorities, including the establishment of a National Framework Strategy on Climate Change (NFSCC) in April 2010 and an accompanying National Climate Change Action Plan (NCCAP), approved in April 2011 after extensive inter-departmental and stakeholder consultations. The National Environmentally Sustainable Transport Strategy (NESTS), and the Philippine Energy Reform Agenda have also been agreed, the latter having three pillars: (i) ensuring energy security, (ii) achieving optimal energy prices, and (iii) developing sustainable energy systems. While maintaining the CIP elements implemented in partnership with the World Bank and IFC, the GoP requests that the ADB allocation be revised to accommodate (i) an Energy Efficient Electric Vehicles (EEEVs) Project, and (ii) a Solar Energy Development Project, which are both consistent with the priority sectors identified in the original CIP and more recent policy directions. The evolving policy context is discussed below at paragraphs 23-29.

18. Major changes in circumstances since 2009 that have contributed to this adjustment include:

- (i) The GoP remains fully committed to implement the Renewable Energy (RE) Law of 2008. However, specific rules for the Renewable Portfolio Standard (RPS) and net metering have yet to be finalized and become fully effective, and there is no fixed deadline for finalization.
- (ii) In late July 2012, the Energy Regulatory Commission approved the feed-in tariffs (FIT) pursuant to the RE Law of 2008. The approved FIT are limited to a total of 750 megawatts (MW) of new capacity: 250 MW of run-of-river hydro, 250 MW of biomass, 200 MW of wind, and 50 MW of solar power, which is limited to ground-mounted installations over a 3-year period.<sup>2</sup>
- (iii) The approved solar feed-in tariff of US\$0.23 per kilowatt-hour (kWh) is lower than originally proposed, in line with recent rapid decreases in solar photovoltaic system costs.<sup>3</sup> The approved FIT remains slightly higher than retail electricity tariffs, and new solar generation projects covered by the FIT are expected to be taken up by the private sector. Considering that the FIT has limited reach with respect to long-term RE development targets, RE development still entails higher initial capital costs than fossil fuel alternatives, and the retail market for solar power does not exist in the Philippines, concessional financing will be needed during the foreseeable future to accelerate RE market transformation with the long-term objective of achieving grid parity and market-driven expansion of RE capacity. Further, strong stakeholder support remains for continued public sector investment in RE development, consistent with both energy security and low-carbon development objectives.<sup>4</sup>
- (iv) Increases and volatility of fossil fuel prices since 2009 point to the need for additional investments in energy end-use efficiency, especially in the transport sector, which accounts for the bulk of energy imports. GoP has continued to review the various energy and transport sector options consistent with the energy security and climate change objectives outlined in the NFSCC, NCCAP, NESTS, and the original CIP.
- (v) Given the country's vulnerability to petroleum imports and rapidly evolving electric vehicle technology, the GoP is now placing greater emphasis on deployment of purely electric vehicles since endorsement of the original CIP. To this end, one among several pilot tests of EEEVs<sup>5</sup> was initiated in 2010 with ADB grant support. The pilot test of e-trikes has provided extensive lessons and inputs regarding EEEVs technology as well as critical market development issues. Within the context of the original CIP, NESTS, and NCCAP, a new EEEVs project was formulated

<sup>2</sup> The proposed 10 MW of ocean energy was not included in the approved FIT.

<sup>3</sup> The FIT for other resources are: \$0.14 / kWh for hydro, \$0.16 / kWh for biomass, and \$0.20 / kWh for wind (based on late July 2012 exchange rate).

<sup>4</sup> Presentations from key stakeholder consultations are available at the following links:

<https://www.dropbox.com/sh/5q2tobxqsovqp1l/xJKQYjJ90>

<http://www2.adb.org/Projects/eTrike/events.asp>

<sup>5</sup> The vehicles are motorcycles with side cars which provide taxi services, known locally as "tricycles"; the various tricycle designs are somewhat unique to the Philippines. The pilot-tested EEEVs are also referred to as "e-trikes." The transport services provided by tricycles are similar to auto-rickshaws utilized in other Asian countries including Bangladesh India, Indonesia, and Thailand. Hence the potential for replication and scale-up is regional in scope.

beginning in late 2010 for consideration of CTF cofinancing. This project is ready for scale up, and has support from the highest levels of the Government of the Philippines.

19. Based on circumstances (i), (ii), and (iii), it has been assessed that the net metering project using distributed solar power proposed in the original CIP may still be relevant, but the project concept needs to be reformulated based on new regulatory framework and market realities. Given the private sector interest to develop solar projects under the new FIT and RPS (limited to 50 MW of ground-mounted installations), and current installed costs for solar PV systems, FIT-supported investments in solar power are not expected to require concessional financing. However, outside of the FIT envelope, concessional financing will be needed in the near term if solar market development is to be accelerated and to establish a new use of solar power: off-grid solar charging for electric vehicles. Therefore, a Solar Energy Development Project to be implemented in partnership with ADB is retained in the CIP, albeit with a reduced scope, with the details to be developed by early 2013.

20. Taking account of circumstances (iv) and (v), the GoP believes that the bulk of concessional financing offered from CTF could be better utilized in the near term to begin converting the public vehicle fleet to EEEVs. GoP has assessed the various transport sector options identified in the NESTS, NCCAP and original CIP, and it has concluded that the shift to EEEVs is inevitable and would be the best transport sector option with respect to climate change as well as co-benefits generated, including energy security and urban air quality (discussion of options is presented at paragraphs 35-43). Introduction of electric and hybrid vehicles is being complemented by other alternative and cleaner fuel development, including domestic production of renewable diesel and ethanol to meet mandated blending requirements, as well as other transport initiatives, including public transport projects supported by IBRD (discussed in Section II).<sup>6</sup> The IBRD and IFC programs will focus on RE and energy efficiency investments intended to reduce demand and add clean energy generation capacity to reduce current and future reliance on fossil fuels.

21. Given the need for sustainable energy convergence between climate change and energy security objectives, GoP proposes to shift part of the original \$125 million of CTF resources slated for the solar net metering concept, and re-direct \$105 million to the EEEVs project, including a \$4 million grant for demonstrating solar charging stations and a \$1 million grant for project implementation support (fine-tuning of technology options, technology transfer, local industry support and capacity building). The balance of \$20 million is proposed to support financing of a Solar Energy Development Project centered on rooftop PV applications as discussed above. The prospective investments are appropriate for CTF support given their transformational nature and the replication and scale-up potential. The shift of some CTF resources to demand-side investments is fully consistent with GoP energy and transport policies as outlined in the NCCAP and the original CIP. A summary of stakeholder engagement during preparation of the revised CIP is presented in Appendix 1. The proposed projects are discussed briefly below and in Appendices 2 and 3.

22. The changes in the proposed projects to be implemented in partnership with ADB are based on broad stakeholder engagement, including with government agencies, civil society organizations (CSOs), non-government organizations (NGOs), local government units (LGUs), industry representatives, and public transport owners and operators. Consistent with the

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<sup>6</sup> For the sake of brevity, an exhaustive discussion of transport sector interventions, including demand management and other “avoid and shift” prospects, is not included here. A detailed discussion is presented in the original CIP.

National Framework Strategy on Climate Change, which recognizes the principles of subsidiarity — i.e., encouraging involvement of least-centralized competent authority — and the role of local governments as front-liners in addressing climate change (paragraph 2.12<sup>7</sup>), the EEEVs project involves the LGUs to facilitate implementation at the local level. The engagement process, including consultations conducted in May 2012, provided for discussions on a range of ideas and suggestions about the CIP, the proposed EEEVs project, and RE development. Participants at the stakeholder consultations raised a range of issues and provided alternatives for ADB and DOE to consider, and these are reflected in the updated program and EEEVs project design. Civil society representatives advocated for a more transparent funds flow model — especially in light of the 2013 local elections — and were pleased to see that the project would be funding manufacturers directly. Other aspects where participant contributions influenced the CIP-R and proposed project design include warranty issues, disposal options, and design of the e-trike itself. The consultation process also led to the decision to retain the rooftop solar concept proposed in the original CIP, albeit with a more modest budget (with specific components still to be determined). A summary of adjustments to the CIP-R and EEEVs Project design emanating from the May consultations may be found in Appendix 1.

### **Policy Context Affecting Revisions to the CTF Investment Plan**

23. The Philippines climate change policy framework has evolved since the original CIP was prepared and endorsed in 2009. Major actions include approval of the Climate Change Act of 2009 (RA 9729), adoption of The National Framework Strategy on Climate Change (NFSCC) in April 2010, formulation of the National Climate Change Action Plan (NCCAP), which outlines the country's agenda for adaptation and mitigation for 2011 to 2028.

24. The Climate Change Act of 2009 (RA 9729) includes provisions for establishing the Climate Change Commission (CCC) as an independent and autonomous body with the same status as that of a national government agency. The CCC is under the Office of the President and is the “sole policy-making body of the government which shall be tasked to coordinate, monitor and evaluate the programs and action plans of the government relating to climate change.” The CCC comprises the President of the Republic of the Philippines as Chairman plus three Commissioners appointed by the President, one of whom serves as Vice Chairperson. Local government units (LGUs) are identified as frontline agencies in the formulation, planning and implementation of climate change action plans in their respective areas, and are charged with formulating their Local Climate Change Action Plans, consistent with the provisions of the Local Government Code, the NFSCC, and the NCCAP. An emphasis is placed on inter-local government unit collaboration in the conduct of climate-related activities.

25. The NFSCC includes principles covering the full spectrum of issues, including *inter alia* mitigation, adaptation, and capacity development. While giving the CCC oversight responsibility in formulating and implementing national climate change policies and programs, the NFSCC also recognizes (i) the roles of other Government agencies and their respective mandates as provided by law; (ii) the principle of subsidiarity and the role of local governments as front-liners in addressing climate change; and (iii) the value of forming multi-stakeholder participation and partnerships in climate change initiatives, including partnerships with civil society, the private sector and local governments, and especially with indigenous peoples and other marginalized groups most vulnerable to climate change impacts. The NFSCC further states that policy and

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<sup>7</sup> The original text states: “The Framework recognizes the roles of agencies and their respective mandates as provided by law. The Framework also recognizes the principle of subsidiarity and the role of local governments as front-liners in addressing climate change.”

incentive mechanisms to facilitate private sector participation in addressing adaptation and mitigation objectives shall be promoted and supported.

26. The NCCAP identifies 7 priorities as strategic directions for 2011 to 2028: (i) food security, (ii) water sufficiency, (iii) environmental and ecological stability, (iv) human security, (v) climate-friendly industries and services, (vi) sustainable energy, and (vii) knowledge and capacity development. The NCCAP prioritizes the following relevant energy and transport section outcomes (per Table 12):

- Promotion and implementation of energy efficiency and conservation nationwide
- Enhancement in the development of sustainable and renewable energy, which includes developing a national RE program, increasing generation capacities of RE systems, and increasing research and development on RE.
- Promotion and adoption of environmentally sustainable transport, which includes implementing a clean fleet program, formally adopting a socially equitable and integrated land-use and transport planning processes at the national and local levels; and implementing energy efficiency labeling for new vehicles. With respect to EEEVs, the NCCAP also notes the need to “conduct studies (economics, adaptability, impacts, etc.) on the use of hybrid transport systems such as electric and hydrogen fueled vehicles.”
- Climate-proofing and rehabilitation and improvement of energy system infrastructure.

27. A specific quantitative outcome for sustainable energy is a 10% reduction in energy consumption in all sectors [mainly electric power, transport, and other industries] which would result in GHG emission reductions of 7.5 M t/year in 2015 and 12.4 M t/year by 2030.

28. With respect to the framework for the Government’s partnering with multilateral development banks (MDBs) for the identification, development, approval, and implementation of programs and projects, the institutional framework has remained largely unchanged for many years. The counterpart agency for the MDBs is the Department of Finance (DOF), with Department of Energy (DOE) and Department of Transport and Communications (DOTC) as the relevant departments for these major GHG emitting sectors. LGUs are directly involved in project development and implementation, depending on the nature of the project or program intervention and its design. As noted, the CCC now serves as a policy-making body charged with coordinating, monitoring, and evaluating plans and programs relating to the country’s climate change policies. The National Economic Development Authority (NEDA) approves all MDB-supported projects. DOE is the designated lead agency for clean fuels development, which includes electric vehicle technology, though DOTC has an obvious role to play in planning and implementing such interventions as they related to the transport sector.

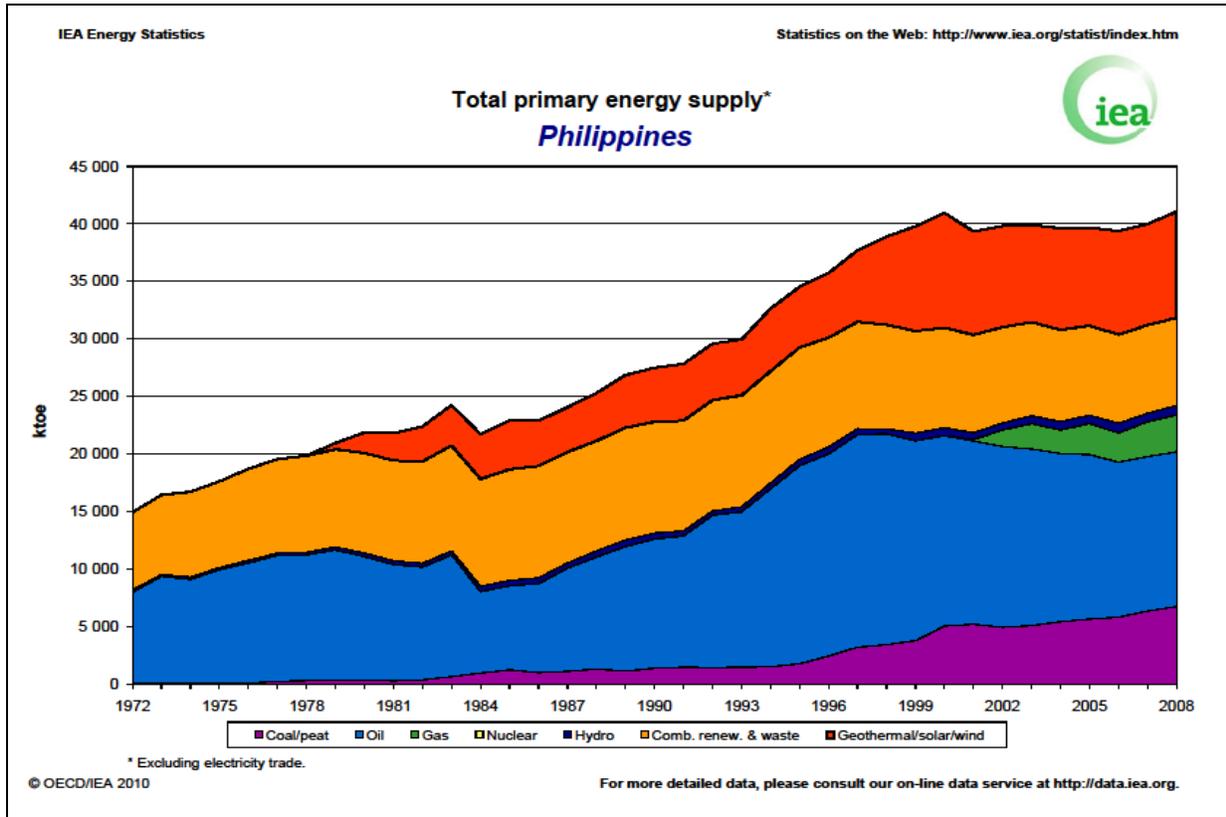
### ***Priority Sectors for GHG Emission Reductions***

29. Figure 1 illustrates trends in total primary energy supply, indicating that coal and natural gas have displaced oil for power generation, while the relative share of renewable energy sources has not increased substantially during the past several years. The trend of increasing coal use is of particular concern with respect to both GHG emissions and energy security (about three-fourths of coal is imported). Figure 2 shows that “clean energy”, comprising natural gas and renewable sources, accounts for about 66% of power generation and around 39% of total primary energy.<sup>8</sup> Based on business as usual trends, GHG emissions from the electric power

<sup>8</sup> Figure 2 reflects the current situation with oil dominating the transport sector, which presents a tremendous opportunity for end-use efficiency gains via electric vehicles.

sector are expected to increase by more than 400%, from 26 MtCO<sub>2</sub>e/year in 2007 to 140 MtCO<sub>2</sub>e/year by 2030. For the transport sector, if dependence on petroleum continues to rise, emissions will increase by more than 200%, from 37 MtCO<sub>2</sub>e/year in 2007 to 87 MtCO<sub>2</sub>e/year in 2030.<sup>9</sup>

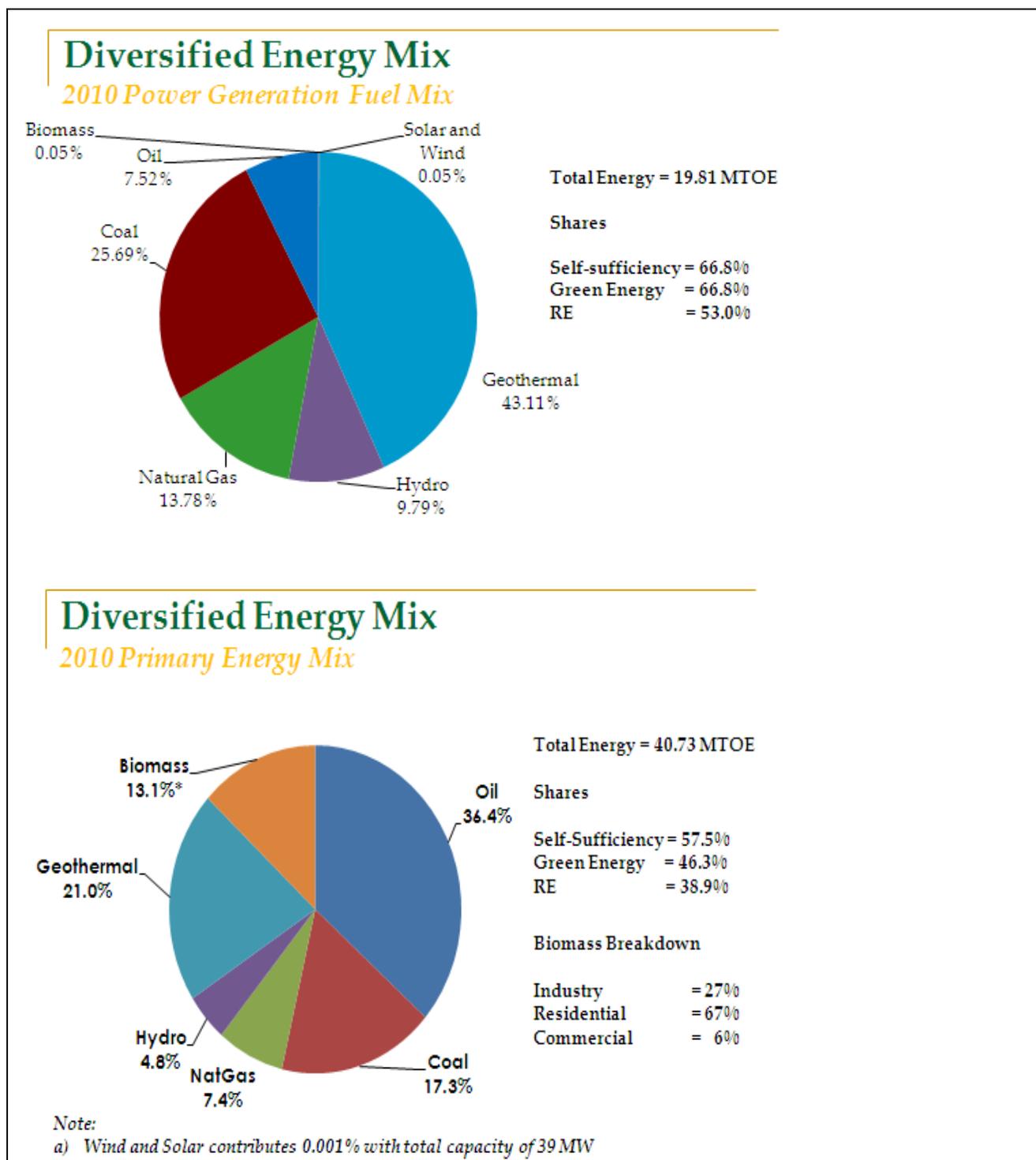
**Figure 1: Trends in Total Energy Supply**



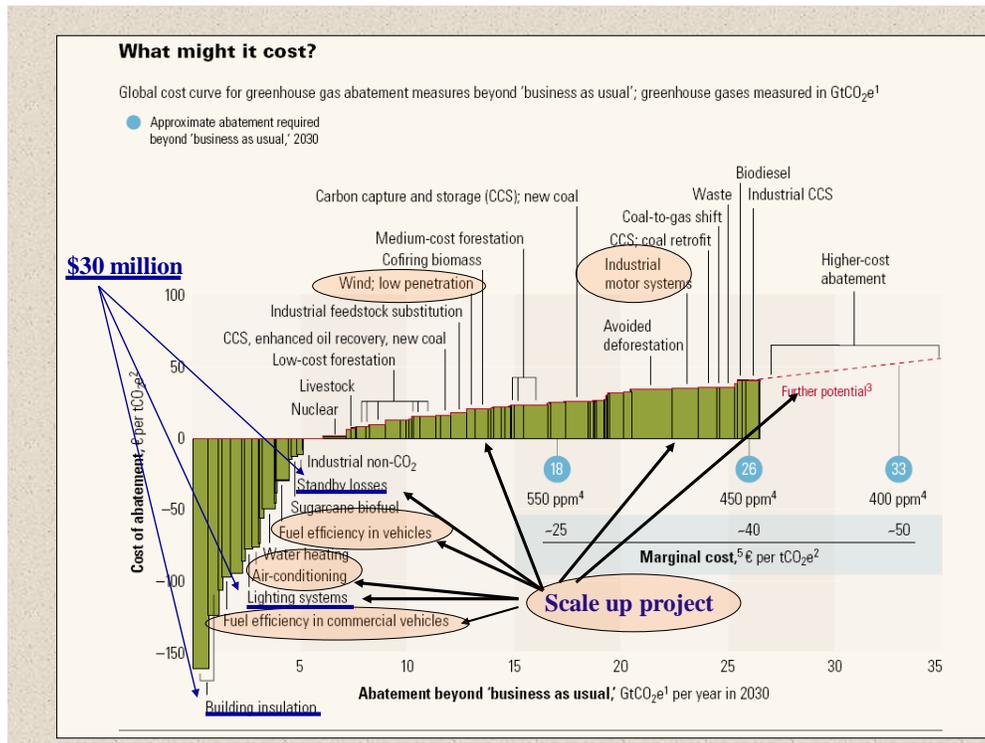
Source: IEA, accessed on 11 August 2011 from: [http://www.iea.org/stats/pdf\\_graphs/PHTPES.pdf](http://www.iea.org/stats/pdf_graphs/PHTPES.pdf)

<sup>9</sup> Source: NCCAP, page 26. The data are taken from: World Bank. 2010. *Abatement Cost and Cumulative Abatement Potential for the Power and Transport Sectors, 2008-2030*. Washington, D.C.: The World Bank, 2010.

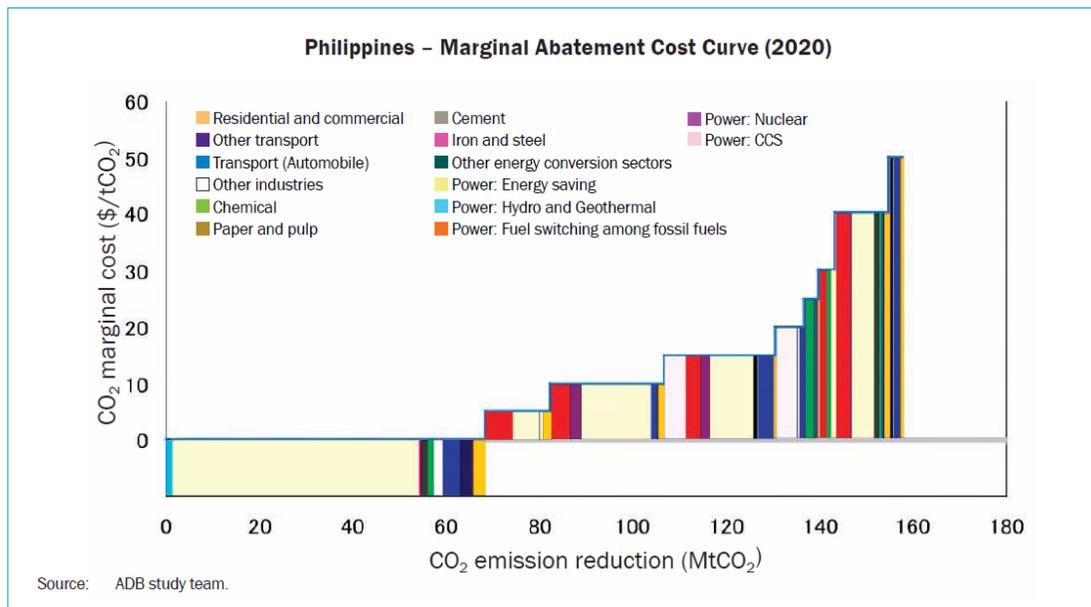
**Figure 2: Primary Energy and Power Generation Mix (2010)**



**Figure 3: McKinsey Marginal CO<sub>2</sub> Abatement Cost Curve**

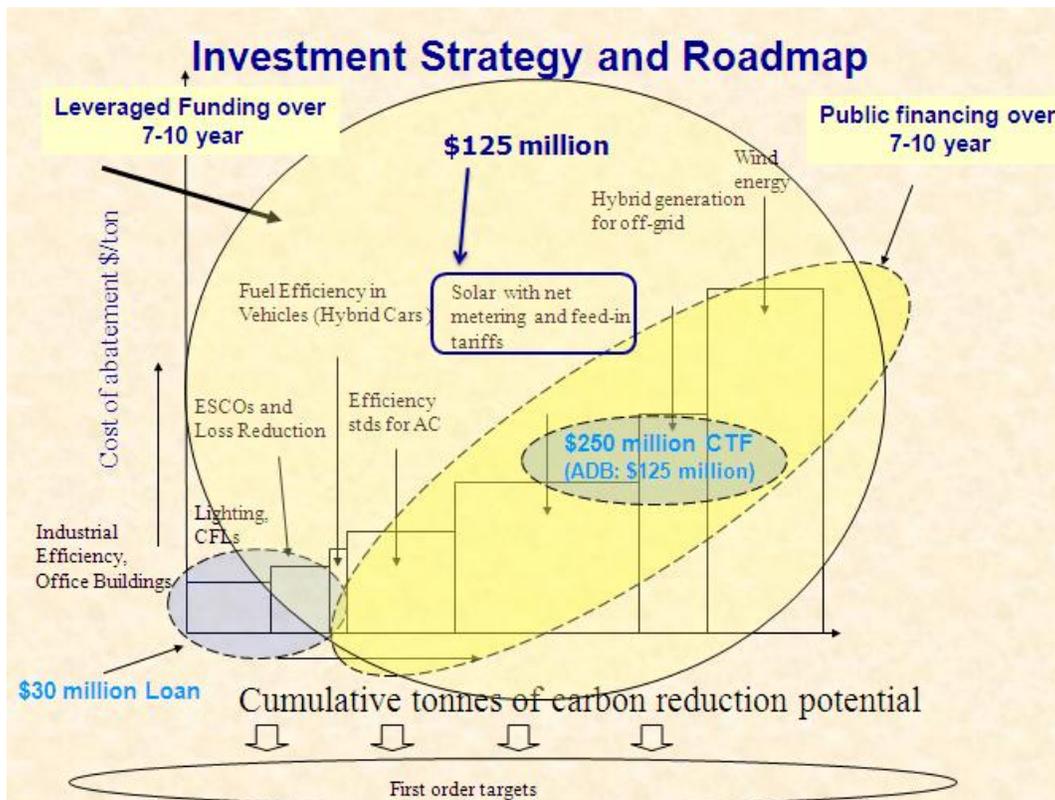


**Figure 4: Philippines Marginal CO<sub>2</sub> Abatement Cost Curve**

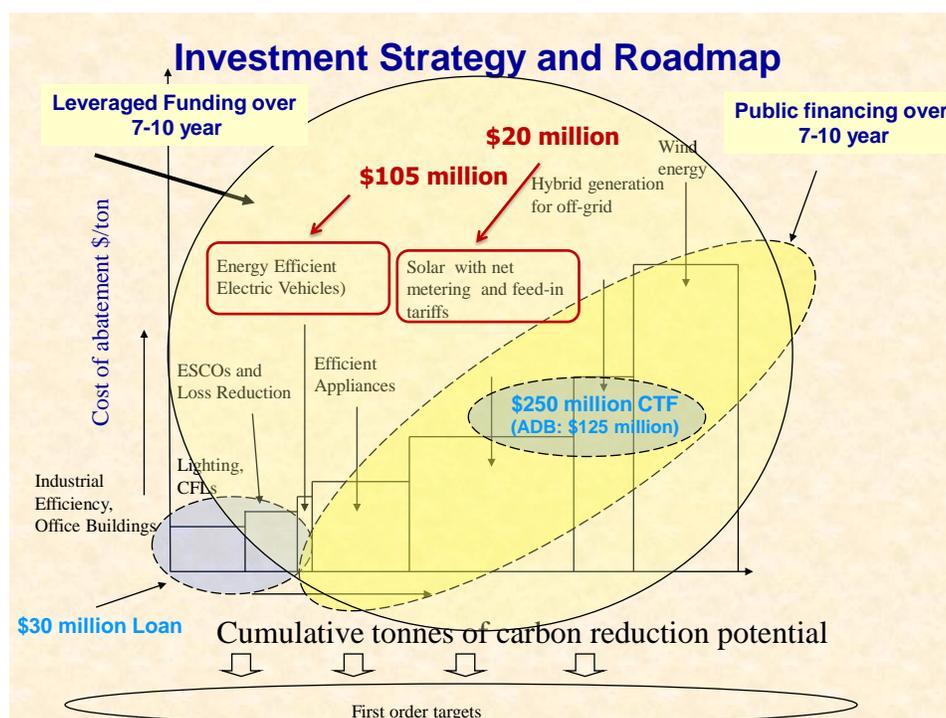


30. The government's high priority projects are illustrated in Figures 5 and 6, with the former representing the originally proposed use of CTF resources, and the latter representing the revised investment plan. The outer circle represents overall potential investment in various clean energy interventions, including private sector investments, superposed on the McKinsey curve for the Philippines. The small ellipse at the lower left represents investment potential in more efficient lighting, which has been partly addressed through public sector investment with ADB financial support. The larger ellipse represents the bulk of potential clean energy investment, toward which the original CIP directed \$250 million in CTF cofinancing. Of this \$250 million, \$125 million was proposed to cofinance the startup of the net metering program with solar photovoltaic (PV) systems.

**Figure 5: Investment Strategy and Priority CTF Projects (December 2009)**



**Figure 6: Investment Strategy and Priority CTF Projects (June 2012)**



**Status of Renewable Energy and Energy Efficiency Development**

31. The Philippines RE potential is high, but new investment has been limited during the last several years relative to the potential. Table 3 shows the installed capacity as of 2010, and projected additions as outlined in the National Renewable Energy Program (NREP), which was formulated under DOE’s leadership. Actual RE potential may prove to be higher, as prices for RE power generation technology fall and new systems are commercialized. Therefore, the NREP is a dynamic document, and the proposed capacity additions are not “cut in stone.” For example, Table 3 shows a solar power objective of 285 MW by 2030, but a long-term aspirational target of 1,528 MW of solar potential is noted in the NREP, and commercial potential may be even higher.<sup>10</sup>

**Table 3: Installed Renewable Energy Capacity and Projected Additions (MW)**

Resource	Installed Capacity in 2010	Targeted Capacity Additions				Total Capacity Addition 2011 – 2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	1,966	220	1,100	95	80	1,495	<b>3,461</b>
Hydropower	3,400	341.3	3,161	1,891	0	5,394	<b>8,724.1</b>
Biomass	39	276.7	0	0	0	276.7	<b>315.7</b>
Wind	33	1,048	855	442	0	2,345	<b>2,378</b>
Solar	1	269	5	5	5	284	<b>285</b>
Ocean	0	0	35.5	35	0	70.5	<b>70.5</b>
<b>TOTAL</b>	<b>5,438</b>	<b>2,155</b>	<b>5,156.5</b>	<b>2,468.8</b>	<b>85</b>	<b>9,865.3</b>	<b>15,304.3</b>

Source: Philippines Department of Energy

<sup>10</sup> The low-carbon scenario outlined in the original CIP (Figure 8 and Table 2) includes development of 2000 MW by year 2030.

32. To catalyze investment in RE, the Renewable Energy Law (R.A. 9513) became effective in 2009. The Renewable Energy Law mandates a universal charge on all customers to finance the proposed incentives for RE, especially the proposed FITs.<sup>11</sup> The Philippines already has the region's highest retail electricity tariffs. The potential increase in retail electricity price from this tariff could potentially further harm the broader economic development and investment climate. Although high electricity prices in the Philippines make clean energy projects financially attractive, without broad market transformation the desired objectives of the Renewable Energy Law will be difficult to achieve. The desired transformation requires adoption of new clean energy systems at scale, more responsive regulation, and consumer acceptance.

33. The already high retail electricity tariffs should make the Philippines one of the most attractive places for investments in EE. While high prices provide excellent incentives to undertake EE projects, very few EE projects have been implemented to date. The main barriers are considered to be lack of flagship projects to lead the way and generally weak awareness of EE opportunities by end users. The government has addressed the issue of lighting and building inefficiencies through the Philippine Energy Efficiency Project (PEEP), which is being implemented with ADB support. The PEEP is financing development of energy service companies (ESCOs) and implementation of a large-scale program to switch from use of incandescent to compact fluorescent lamps (CFLs). The PEEP is providing valuable learning experience to inform project design for EEEVs, solar lighting systems,<sup>12</sup> and energy efficient appliances.

### **Assessment of Investment Options**

34. ***The GoP remains fully committed to its development policy framework for energy security, climate change, environmental management, and public health.*** The general approach and overall objectives for low-carbon development presented in the original CIP remain valid, and the energy and transport sectors remain the highest priorities for GHG emissions reductions. The GoP is committed to reducing energy intensity and GHG emission reductions through a comprehensive policy framework as described in the NCCAP and the original CIP.

35. ***The strategic rationale for CTF intervention in the energy and transport sectors remains valid.*** Comparison of Figures 5 and 6 clearly shows consistency in the underlying clean energy and sustainable transport strategies. The transport sector, power generation, and other energy end-use are highly dependent on imported fuels, which render the country vulnerable to energy supply disruptions and global price fluctuations. The Philippines has a variety of RE resources – biomass/biogas, geothermal, small hydropower, solar and wind – with estimated total potential of more than 15,000 MW, of which about 35% has been developed. In the near term, biomass, geothermal, hydropower, and wind are expected to account for most of the new RE capacity additions. Additional potential from solar and waste-to-energy is high, but commercial development of these resources has high start-up costs; with solar and waste-to-energy not expected to contribute at the gigawatt (GW) scale in the immediate future. However, the landscape for solar power is changing rapidly as hardware costs continue to decrease, and near-term MW-scale development of solar PV systems is envisioned as an interim step to future

<sup>11</sup> The incentives include a renewable energy certification scheme, feed-in tariffs, renewable energy portfolio standards, net metering schemes, priority dispatch options, and support for renewable energy host communities.

<sup>12</sup> For example, ADB recently provided technical and financial assistance for installation of solar lighting systems in the Boni Tunnel in the Metro Manila area. This installation offers a technical and business model for utilization of solar resources for EEEV charging systems. A brief description of the Boni Tunnel installation is available online at: <http://www.adb.org/news/adb-support-brightens-dark-highway-tunnel-solar-powered-lights>

GW-scale capacity. Therefore, investments in more energy efficient transport systems and complementary development of solar rooftop systems with net metering are critical in the near to medium term. Figure 6 illustrates the proposed partial reallocation of CTF funding to support the introduction of EEEVs and demonstration of solar charging, discussed in more detail below.

36. The priority interventions for CTF support identified in the original CIP<sup>13</sup> remain the same, covering 3 broad areas follows:

- (i) Supply and demand side energy efficiency, including grid optimization and initial investments in smart grid technology, as well as urban energy efficiency;
- (ii) Renewable energy, including biomass and solid wastes, geothermal, hydropower, solar and wind, and
- (iii) Transport systems, including BRT, advanced vehicle technology, urban rail, motor vehicle inspection and emissions systems, and wider use of biofuels.

37. Energy efficiency, RE, and cleaner transport projects are being supported by IBRD and IFC. Given remaining uncertainties in the RE regulatory framework, the lengthy gestation period required for new project development, and the Government's emphasis on energy security, highest priority has been placed on new transport sector interventions, with RE development as the second priority. The transport sector options identified in the original CIP have been revisited, as summarized in Table 4.

**Table 4: Transport Sector Options**

<b>Transport Sector Options<sup>a</sup></b>	<b>Consistency with CTF Criteria and Other Considerations</b>
Traffic management	Lowest estimated cost, but no obvious need for concessional funding
Congestion pricing	Problematic with respect to defining pricing policy and structure. No clearly defined project opportunity for multilateral bank support
BRT systems	Already being supported by IBRD; no "additional" transformation potential would be realized with additional CTF cofinancing
Motor vehicle inspection	Good fit with CTF criteria, but limited co-benefits. No clearly defined project opportunity for multilateral development bank support
Biofuels	Good fit with CTF criteria. Being developed by private sector. No obvious need for concessional cofinancing. No project sponsors have requested multilateral development bank support.
Light vehicle technologies	Good fit with CTF criteria. Best option with respect to co-benefits from energy security and non-climate environmental considerations.
4-stroke tricycles	
Road maintenance and improvement	No obvious transformation potential and no clear need for concessional cofinancing.

Notes: <sup>a</sup> Options are taken from Table 1 of the original CIP and are listed in order of decreasing cost effectiveness (i.e., increasing estimated abatement cost).

38. Switching to cleaner petroleum-based fuels has not been a priority, and was not included in the original CIP, for several reasons. Compressed natural gas (CNG) is not considered a viable transport fuel option due to the lack of existing pipeline infrastructure and the long-term gas supply risk. The GHG emissions analyses (presented in Appendix 2) suggest that using natural gas for electricity generation to supply EEEVs would be a more GHG-friendly option than CNG. Liquefied petroleum gas (LPG) is already being used as a transport fuel, but expansion of LPG programs would have minimal impact on GHG emissions compared to EEEVs, and they also would be inconsistent with national energy security objectives. Biofuels

<sup>13</sup> See original CIP, paragraph 18 (iii), Tables 1 and 2, and Figure 10.

provide one of the only options for expanding use of domestically-produced renewable transport fuel, but production is limited and has yet to reach the mandated E10 and B5 blends (beyond which opens up issues of engine technologies and warranties – the so-called “blend wall”). Importing biofuels to meet mandated blends does not promote energy security. Conventional fuel switching projects are not viable candidates for major GHG emission reductions, and are therefore not viable for CTF co-financing. Furthermore, conventional fuel switching projects are already being undertaken by the DOE, rendering these options non-transformative for purposes of the CTF.

39. Based on the foregoing assessment, which was presented and discussed during the public consultations on the proposed CIP-R, encouraging lessons from the recent e-trikes pilot project, the potential for transformative impact given the large e-trikes fleet size (3.5 million vehicles across the country), and the large share of fuel use (54%) attributable to the transport sector, it was concluded that the large-scale replacement of conventional 3-wheel public transport vehicles with electric 3-wheelers is the best option within the EEEVs subsector. Once the charging infrastructure is established and technology credibility is improved, 4-wheel public transport vehicles, including electric jeepneys and buses, could also be attractive targets.

40. A recent ADB study concluded that to make 3-wheelers more energy-efficient and green, two technology options were available: (a) retrofit of existing units using conversion kits to LPG and CNG fuels; or (b) replacing the internal combustion engine (ICE) propulsion system with a more efficient ICE or that of either a hybrid or a purely battery-operated system. Only the battery operated option can significantly reduce the country’s reliance on fossil fuels. Battery operated electric vehicles can also be zero-emission vehicles, because the electricity they run on can be generated from 100% renewable sources, and the lack of tail-pipe emissions creates human health benefits from reduced urban air pollution. The electric option also represents a one-step solution, while retrofitting from gas to LPG entails a two-step solution (that may merely postpone an inevitable shift to electric propulsion). More importantly, EEEVs offer the highest net income potentials for tricycle operators and drivers. The annual operating cost is nearly 50% lower than a conventional gasoline-fueled public tricycle.

41. The proposed EEEV Project and Solar Energy Development Project comprise energy efficiency, renewable energy, and cleaner transport interventions consistent with the priorities identified in the NCCAP and the original CIP. The EEEVs project is an energy-saving intervention as well as a sustainable transport intervention. The introduction of solar charging stations will test and hopefully demonstrate the viability of powering EEEVs with renewable energy. The proposed Solar Energy Development Project retains elements of the similar project in the original CIP. The EEEVs Project is fully consistent with the low emissions transport sector objectives included in the NCCAP, including (i) Priority 5 – Climate Friendly Industries and Services, and (ii) Priority 6 - Sustainable Energy (see NCCAP page 6 and ensuing sections, including page 32 on sustainable transport). The EEEVs Project also should help to achieve the key target of a 10% reduction in energy consumption in all sectors. ***Further, the proposed EEEVs, solar charging stations, and solar energy development investments will establish linkages between clean energy and sustainable transport: promoting development of non-tradable domestic renewable energy resources as a transport fuel would be highly desirable with respect to improving energy security, end-use energy efficiency, urban air quality, and public health, while reducing GHG emissions.***

42. Figures 5 and 6 indicate that GHG reduction potential could be higher for EE appliances; however, the GOP strategy is to move systematically up the marginal abatement curve, therefore EEEVs have been given a qualitatively higher priority. The EE appliances project

(considered in the earlier submittal of the revised CIP in 2011) would not achieve the same co-benefits as the EEEVs Project, especially with respect to human health benefits from improved urban air quality, improved quality of life for EEEV drivers, and improved energy security, as the energy savings from energy efficient appliances would accrue only from avoided electricity generation. Further, during stakeholder interactions during May 2012 consultations, there was minimal support for retaining the energy efficient appliances concept, while there was strong support for retaining investment in the development of solar power. The Philippine Renewable Energy group at the stakeholder consultations argued that, with solar prices reduced, the original solar roof top project may be more viable now than envisioned in 2009, and that solar projects can now be implemented without reliance on a feed-in tariff. This view received support from civil society representatives. On this basis, the CIP-R no longer includes the energy efficient appliances intervention.

### **Proposed Projects**

#### **i. Priority Introduction of Energy Efficient Electric Vehicles**

43. Transport sector energy consumption is expected to grow at an average annual rate of 3.2%, with road transport accounting for 90% of energy demand for transport by 2030. The public transport sector, mainly tricycles, jeepneys, and buses, contributes a large portion of the country's CO<sub>2</sub> emissions: 3.5 million registered motorcycles and tricycles release 10 million tons of CO<sub>2</sub> into the atmosphere each year and consume close to \$3 billion worth of fuel. Introducing new technology is the best immediate option to mitigate transport emissions. Electric vehicles are 3–5 times more efficient than internal combustion engine (ICE) vehicles, whether fueled by gasoline, compressed natural gas (CNG), or liquefied petroleum gas (LPG).<sup>14</sup> The public transport sector can thus save a significant portion of imported energy and reduce CO<sub>2</sub> emissions by switching to energy-efficient electric vehicles (EEEVs).

44. EEEVs represent a new and rapidly advancing technology with the promise to transform the way energy is used compared to today's ICE vehicles. For net energy importing countries such as the Philippines, EEEVs can dramatically reduce the country's oil dependency and improve long-term energy security. EEEVs generate no harmful local air and noise pollution and can be powered by indigenous RE. The envisioned fleet conversion will contribute to making the transport sector's energy use sustainable, by introducing new technology that eventually will allow domestic hydropower, geothermal, solar, and wind power to be used as a fuel source for the transport sector, replacing the largely imported fossil fuels used today.<sup>15</sup>

45. GoP's preliminary modeling shows that a 7% electric vehicle penetration by 2015 and 15% by 2030 can reduce fuel imports by approximately 6% in 2015, 13% in 2020, and more than 40% by 2030 with concomitant reductions in GHG emissions and other air pollution. The proposed electric vehicle policy<sup>16</sup> directly supports electric vehicle related businesses and will exempt importation of all electric vehicles (plug in and hybrid) from taxes for nine years. The proposed EEEVs project will support the Department of Energy's Fueling Sustainable Transport Program and the Alternative Fuel Vehicles Incentives Act of 2011. ***This move to begin electrification of the vehicle fleet is fully consistent with the NCCAP, the Philippines***

<sup>14</sup> Greenhouse gas calculations are presented in the Appendices.

<sup>15</sup> Today, fossil fuels are trucked to the remotest consumption points from thousands of kilometers away. Domestic hydrocarbon production is dominated by natural gas, predominantly in offshore basins.

<sup>16</sup> Senate Committee Report No. 44 on Senate Bill No. 285–Electric, Hybrid and Other Alternative Fuel Vehicles Incentives Act of 2011.

**Energy Reform Agenda, the National Environmentally Sustainable Transport Strategy (NESTS), and the original CIP.**

46. The transport sector accounted for about one-third of national GHG emissions in 2009 (excluding emissions from land use change and forestry). Transport sector emissions have increased by about 6-10% per year since 1990, from about 10 million tons per year CO<sub>2</sub>e in 1990 to about 29 million tons CO<sub>2</sub>e per year in 2007.<sup>17</sup> Vehicles are one of the dominant sources of urban pollution that threatens both people's health and economic activity. In the Philippines, motorcycles and tricycles comprise more than 52% of the vehicle population, and these vehicles are the bottom of the transport sector "pyramid." Compared to other vehicles, motorcycles and tricycles are less expensive (and therefore more affordable), they are very visible in most cities of the country, and they play an important role in the transport market, particularly as a key short-distance transport mode for "last-mile" connectivity. However, the use of these vehicles contributes to the already declining state of the environment, particularly urban air quality. In an ADB study, transport sector emissions accounted for 30% of air pollution in the Philippines and about 80% of air pollution in Metro Manila.

47. In order to improve urban transportation systems, control pollution from fossil fuels, enhance energy security, and mitigate long-term GHG impacts, the GoP has embarked on an ambitious program to introduce electric and compressed natural gas (CNG) vehicles into the public transportation fleet.<sup>18</sup> ADB provided grant funding for a demonstration project<sup>19</sup> for introduction of e-trikes in Mandaluyong City (part of the Metro Manila core urban area). The initial results have been positive,<sup>20</sup> and GoP has requested ADB to provide financial support for the commercial deployment of 100,000 e-trikes by 2016.<sup>21</sup> The proposed EEEVs project will create an early-adopter opportunity to innovate in establishing sustainable local e-trike manufacturing capacity, battery and vehicle leasing schemes, and associated services for vehicle operation and maintenance, including prototype solar charging stations (SCS): the project is being designed to deliver an end-to-end infrastructure solution for cleaner transport which is consistent with GoP's overall energy security, economic development, and climate change objectives.

48. The private sector has indicated interest in EEEV development, including building and operating solar charging stations (SCS) for electric vehicles, but investors face a chicken-and-egg dilemma: until a commitment is made for large-scale deployment of EEEVs, private investors are unwilling to finance development of a charging network.<sup>22</sup> Therefore, the EEEVs project will include a prototype SCS component. The stations will utilize rooftop arrays at public transport stations, selling electricity at the same price as grid-supplied electricity so that EEEV operators can achieve the cost savings accruing from using electricity as transport fuel, while demonstrating the technological viability of the solar charging systems. The long-term objective

<sup>17</sup> CTF Investment Plan for the Philippines, endorsed in December 2009; paragraph 8 and Figure 3.

<sup>18</sup> CNG is used in some other countries (e.g., South Asia) for autorickshaws, and conceivably could be used for tricycles. However, GoP's emphasis on energy security and reduction of petroleum product imports points toward electrification as the preferred option.

<sup>19</sup> Financed by RETA 6441: *Efficiency Improvement and Connectivity Strengthening in Southeast Asia*. Manila.

<sup>20</sup> A summary of the initial results of the pilot and project concept can be found at:

<http://www.adb.org/projects/etrike/etrike-industry-presentation.pdf>

<sup>21</sup> ADB. 2010. *Technical Assistance to the Republic of the Philippines for Mitigation of Climate Change through Increased Energy Efficiency and the Use of Clean Energy*. Manila. (TA 7754-PHI).

<sup>22</sup> This situation is further compounded by a lack of proven business models in other countries which would apply to "bottom of the pyramid" transport networks. Charging networks under development in countries such as Israel and the US cater to high-end 4-wheel private vehicles, i.e., the top of the transport pyramid.

is to facilitate scale-up of solar charging systems and achieve grid-parity. **Additional details are presented in the concept paper in Appendix 2.**

## ii. Solar Energy Development

49. In keeping with the long-term objectives for energy security and economic development, GoP is committed to developing indigenous RE resources in a manner which protects consumer interests. RE development typically entails higher up-front capital costs, but lower operating and maintenance costs, and in most cases zero fuel costs.<sup>23</sup> The incremental upfront costs may be thought of as advance payments for renewable “fuel”, which are amortized and depreciated over the lifetime of RE systems – the fuel may be free, but the conversion to useful energy is not. Policy support via FITs is designed to eliminate the upfront cost barrier, but as noted above, the FIT will be limited in scope and there is a need for concessional financing to support RE development.

50. While the FIT and RPS were in regulatory suspense, ADB supported 2 noteworthy solar energy demonstration projects. In June 2012, ADB commissioned a 570 kW rooftop solar PV system at its Manila headquarters, which is the first of its kind in the Philippines and the largest rooftop PV project in Southeast Asia. The installed cost is well below that noted in the original CIP in 2009, suggesting that there is scope for rooftop solar PV development outside the envelope of the FIT (which is limited to ground-mounted installations). As noted above, earlier in 2012, ADB also supported the Boni Tunnel lighting project to demonstrate the feasibility of solar PV and lithium-ion battery technology for large-scale street lighting applications. This project comprises 59 square meters of solar panels which provide power to 94 light-emitting diodes (LEDs) with 22-watt capacity each. This project provides about 19% of the tunnel power demand, but achieves a 51% energy savings compared to the old lighting system.

51. As noted above, the rooftop solar concept presented in the original CIP is being retained in the CIP-R, albeit with a modified scope. GoP is requesting to reduce the original allocation to \$20 million of CTF cofinancing to support total investment of \$120 million to finance at least 40 MW of new solar PV capacity outside the envelope of the proposed solar FIT. **Additional details are presented in the concept paper in Appendix 3.**

## IV. PROPOSED CHANGES TO THE INVESTMENT PLAN

52. The original CIP identified several prospective interventions in EE, RE, and urban transport. The indicative financing plan endorsed in December 2009 is summarized in Table 5.

**Table 5: Indicative Financing Plan Endorsed in December 2009 (\$ million)**

Financing Source	Renewable Energy (WBG)	Urban Transport (WBG)	RE and EE (ADB)	Total
CTF	75	50	125	250
GoP / DBP	180	50	50	280
IBRD Loans	250	250	0	500
IFC Loans	250	0	0	250
ADB Loans	0	0	400	400
Private sector	750	0	350	1,100
<b>Total</b>	<b>1,505</b>	<b>350</b>	<b>925</b>	<b>2,780</b>

Source: CTF Investment Plan for Philippines 2009

<sup>23</sup> Exceptions are biomass power, where feedstock is normally not free, and geothermal, where steam production may be segregated and sold to generation units.

ADB=Asian Development Bank, CTF=Clean Technology Fund, DBP=Development Bank of the Philippines, EE=energy efficiency, GoP=Government of the Philippines, IBRD=International Bank for Reconstruction and Development, IFC=International Finance Corporation, RE=renewable energy, WBG=World Bank Group

53. **The major change proposed is to restructure CTF funding implemented in partnership with ADB to focus on an Energy Efficient Electric Vehicles project and a revised Solar Energy Development project.** In particular, EEEVs promise to transform the way energy is used by light-duty public vehicles. For net energy importing countries such as the Philippines, electric vehicles can dramatically reduce the country's dependence on imported energy resources, which in turn should reduce short term price volatility and increase long-term energy security. Electric vehicle technology presents the opportunity to transition from conventional fossil-fueled vehicles to vehicles which do not directly generate harmful local air and noise pollution and can be powered by indigenous RE resources such as solar, hydropower or geothermal. The complementary investments in solar energy development will provide part of the increased power demand from EEEVs.

54. These prospective investments are appropriate for CTF support given the transformational nature of the projects and the replication and scale-up potential.<sup>24</sup> It is proposed that \$105 million be allocated to the ADB EEEVs project and \$20 million to the solar energy development project, as shown in Table 6. Concept papers for the candidate investments are presented in Appendices 2 and 3.

**Table 6: Indicative Financing Plan after Reallocation (\$ million)**

Financing Source	Renewable Energy (WBG)	Urban Transport (WBG)	Energy Efficient Electric Vehicles (ADB)	Solar Energy Development (ADB)	Total
CTF	75	50	105 <sup>a</sup>	20 <sup>a</sup>	250
GoP / DBP	180	50	99	20	349
IBRD Loans	250	260	0	0	510
IFC Loans	250	0	0	0	250
ADB Loans	0	0	300	80	380
Private sector	750	0	(tbd) <sup>b</sup>	(tbd) <sup>b</sup>	750
Other cofinancing	0	245	0	0	245
<b>Total</b>	<b>1,505</b>	<b>605</b>	<b>504</b>	<b>120</b>	<b>2,734</b>

Source: MDB teams

ADB=Asian Development Bank, CTF=Clean Technology Fund, DBP=Development Bank of the Philippines, EE=energy efficiency, GoP=Government of the Philippines, IBRD=International Bank for Reconstruction and Development, IFC=International Finance Corporation, (tbd)=to be determined, WBG=World Bank Group

Notes to Table 5:

<sup>a</sup> For the EEEVs project, a CTF grant of \$1 million is requested for fine-tuning of technology options, technology transfer, local industry support and capacity building (implementation support, including monitoring and evaluation activities will be financed by the ADB loan). For the Solar Charging Stations component a CTF grant of \$4 million is requested; see discussion in main text and concept paper in Appendix 2 for further details.<sup>b</sup> Private sector entities will participate in project implementation via supply of goods and services. For the EEEVs project, private sector investment is expected during replication and scale-up, and as such no private sector cofinancing is shown in Table 5. Private sector cofinancing for the solar energy development project has yet to be determined.

<sup>24</sup> Pakistan, Indonesia, Malaysia, Bangladesh and Thailand have expressed interest in exploring options for implementing similar projects.

## V. POTENTIAL IMPLICATIONS OF PROPOSED CHANGES FOR ACHIEVEMENT OF INVESTMENT PLAN OBJECTIVES

55. The proposed changes will enhance renewable energy, energy efficiency and sustainable transport programs by using CTF resources to accelerate investment in advanced electric vehicle systems, and will contribute directly to the near-term strategic RE investment program. As noted, the proposed EEEVs, solar charging stations, and solar energy development investments will establish linkages between clean energy and sustainable transport by promoting development of non-tradable domestic renewable energy resources as a transport fuel. An assessment of potential implications of the proposed changes for the achievement of objectives and targets of the original CIP is summarized in Table 7 and discussed below. More details about the proposed projects are included in the concept papers in Appendices 2 and 3.

**Table 7: Summary Assessment of Proposed Adjustments to the Philippines CTF IP**

CTF Investment Criteria	Original Investment Plan: Net Metering with Solar PV	Updated Investment Plan: Energy Efficiency Electric Vehicles and Solar Energy Development Projects
<b>Potential for GHG Emissions Savings</b>	Direct reductions would be relatively modest but replication and scale-up potential is quite high as the investments would promote GHG reductions through RE and EE.	ADB program will target end-use efficiency improvements in the transport sector which represent permanent energy savings via avoided fuel imports. The solar charging stations will demonstrate the feasibility of fueling EEEVs with 100% renewable energy. The solar energy development project will complement the FIT and RPS objectives. Replication and scale-up potential is high for electric vehicles, solar charging stations, and solar energy development
<b>Cost-effectiveness</b>	Initial direct reductions of 100,000 tCO <sub>2</sub> e per year with 10:1 replication and scale-up potential  <u>Cost effectiveness:</u> CTF\$125 / tCO <sub>2</sub> e / year with replication and scale-up	<u>EEEVs project:</u> 100,000 vehicles will deliver net reduction of 270,000 tCO <sub>2</sub> e per year; with 10-year vehicle lifetime total GHG reductions are 2.7 MtCO <sub>2</sub> e. Replication and scale-up potential is at least 20 to 1.  <u>Cost effectiveness:</u> CTF\$105 million / 2.7 million tCO <sub>2</sub> e = CTF\$38 / tCO <sub>2</sub> e, declining to CTF\$3.89 / tCO <sub>2</sub> e with replication and scale-up of 10 to 1.  [See additional details in Appendix 2.]  <u>Solar energy development project:</u> At least 40 MW of rooftop solar PV operating at 15% load factor will deliver net reduction of about 0.03 million tCO <sub>2</sub> e per year assuming grid emissions factor of 0.52 tCO <sub>2</sub> e/MWh. With 15 year lifetime total GHG reductions are about 0.4 million tCO <sub>2</sub> e. Replication and scale-up potential is at least 10 to 1.  <u>Cost effectiveness:</u> CTF\$20 million / 0.4 tCO <sub>2</sub> e = CTF\$49 / tCO <sub>2</sub> e, declining to CTF\$4.87 / tCO <sub>2</sub> e with replication and scale-up of 10 to 1.
<b>Demonstration Potential at Scale</b>	Transformation potential <sup>a</sup> of at least 10	Transformation potential is estimated to be > 20 for EEEVs and >10 for solar energy development
<b>Development Impact</b>	The proposed investment would demonstrate viability of the net metering system (and business model) and accelerate development of the solar PV	The EEEVs and solar energy development projects will accelerate growth of the respective industries in the Philippines by demonstrating new technology / systems and business models.

CTF Investment Criteria	Original Investment Plan: Net Metering with Solar PV	Updated Investment Plan: Energy Efficiency Electric Vehicles and Solar Energy Development Projects
	industry in the Philippines	Impacts with respect to energy security and environmental benefits will be higher than the original CIP. Impacts on employment also may be higher than the original CIP given the potential benefits accruing to e-trike owner/operators and private sector firms involved in supply of hardware and after-market services for EEEVs, solar charging stations, and rooftop PV systems.
<b>Implementation Potential</b>	As the implementing rules and feed-in tariff for net metering had not been finalized as soon as expected, the originally proposed project never progressed beyond the concept stage.	The EEEVs project has been developed based on a successful pilot project in the Metro Manila region and is at an advanced stage of preparedness. The solar energy development project is in the identification stage, building on the Boni Tunnel Lighting project and ADB headquarters rooftop solar PV experience, and is tentatively scheduled for ADB Board consideration in 2013. See Table 9 for discussion of implementation risks and mitigation.
<b>Additional Costs and Risk Premium</b>	The additional costs of the solar PV systems and first-mover risk associated with net metering clearly justified the use of CTF resources.	The proposed projects will focus on using CTF for covering additional costs associated with introduction of electric vehicle systems and for covering additional costs and first-mover risks in solar energy systems investments (see Appendices 2 and 3).

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

CIP=CTF Country Investment Plan, CTF=Clean Technology Fund, EE=energy efficiency or energy efficient, EEEVs=energy efficient electric vehicles, GHG=greenhouse gas, PV=photovoltaic, RE=renewable energy, tCO<sub>2</sub>e=tons carbon dioxide equivalent

56. **Transformational impact will be enhanced.** The scope of RE and cleaner transport sector interventions will be expanded relative to the original CIP, bringing additional value by opening a new “window” for deploying EEEVs in sustainable transport systems, including RE-based charging for EEEVs. The proposed EEEVs, solar charging stations, and solar energy development investments will establish clear clean energy and sustainable transport linkages, and **the Philippines will be one of the first countries to begin development of non-tradable domestic renewable energy resources as a transport fuel.** More efficient battery technologies are providing a cleaner alternative to pollution-emitting ICE-powered vehicles. In some cases, conventional motorcycles emit more pollution per unit than large sport utility vehicles, because the former are not equipped with equivalent emissions-control technology.<sup>25</sup> Electric motorcycles and tricycles can immediately eliminate tailpipe emissions, significantly reducing urban air pollution. Commercial success of e-trikes can be replicated in other types of vehicles, including jeepneys and buses (although technical complexity increases with larger vehicles). The SCS component will demonstrate the technological viability of RE-based charging systems for e-vehicles and a business model which can be replicated and scaled up with private sector investment. The RE development project will support the GoP long-term objectives for energy security and economic development, taking into account rapid advances and cost reductions in photovoltaic solar power technology.

57. Large-scale market transformation often requires public sector intervention, and concessional financing and/or other financial instruments may be necessary. For example, the RPS and FIT represent advance market commitments whereby public policy supports development of new technologies, services, and markets, to ensure expansion of the RE sector.

<sup>25</sup> The Technology Review, published by MIT, 2007, available at: <http://www.technologyreview.com/energy/19069/>

These types of instruments, combined with other public sector intervention (e.g., government-led and funded prototype projects) are often necessary to initiate transformation. The proposed EEEVs Project is analogous to an advanced market commitment, as the government will guarantee a market that is large enough to attract investment by manufacturers and ancillary industries. Sustainable transformation of any industry requires innovative, which may require new entrants in the business. To attract a number of large international players — including the critical battery suppliers — a large market opportunity must be presented. The potential of CTF investment in this area has already created such an investment atmosphere. On the specific issue of battery systems, a fleet of 100,000 e-trikes would need aggregate battery capacity of 300 megawatt-hours (MWh), which exceeds the aggregate 240 MWh of batteries in the 10,000 Nissan Leafs currently operating in the US. ***This scale of EEEV deployment is required to create a “no turning back” development trajectory for this industry in the Philippines.***

58. ***Emissions reductions from the EEEVs and solar energy investments will be higher than anticipated through the interventions envisioned in the original Investment Plan.*** The estimated emissions reductions from the 2 proposed projects are 3 times higher than for the solar concept in the original CIP. The direct investments in the EEEVs and solar energy development projects will result in net avoided fossil fuel emissions estimated to be at least 0.3 million tCO<sub>2e</sub> per year: about 0.27 million tCO<sub>2e</sub> per year for the proposed EEEVs project and about 0.03 million tCO<sub>2e</sub> per year for the solar energy development project (emissions reductions estimates are discussed in Appendix 2). Cost-effectiveness will be better and replication and scale-up potential is equal to or higher than the original CIP as shown above in Table 7. In addition to the substantial energy security benefits, the EEEVs project will bring environmental and public health co-benefits equal to or greater than that which would have been realized under the original Investment Plan. The solar energy development project also will support expansion of the GoP clean energy infrastructure beyond that envisioned under the proposed FIT and RPS framework.

59. ***Replication and scale-up potential also will be higher than originally planned.*** The two proposed projects will invest in clean and sustainable transport opportunities. Commercial deployment of EEEVs will expand the urban transport program beyond the original CIP. The replication potential for e-trikes and motorbikes alone is at least 20 to 1 based on the current fleet of 3.5 million vehicles; however, replication and scale-up is conservatively assumed to be 10 to 1 for purposes of calculating total emissions reductions and indirect cost-effectiveness. Replication potential for investment in solar energy systems is well over 10 to 1: up to 100 MW of new solar capacity is envisioned, with long-term development potential of 1500 to 2000 MW (as shown in Table 3). Using CTF to cofinance investment on these types of pioneer projects will eliminate first-mover risk and help mobilize future commercial investment for replication and scale-up. Private sector firms will be actively engaged in project implementation via service, supply, and maintenance contracts; the private sector is expected to take a prominent role in replication and scale-up for both EEEVs and solar energy development.

60. ***Development impacts and co-benefits will be enhanced.*** New investment in EEEVs and solar energy systems will improve energy security, reduce GHG emissions, and reduce local pollutant emissions with substantial public health benefits. Using CTF to cofinance these types of pioneering projects will help mobilize future commercial investments (mainly by private sector entities) for replication and scale-up, which will stimulate economic growth and facilitate the long-term transition to low-carbon development. A comparison of proposed results indicators is presented in Table 8. Additional results indicators will be developed for project proposals in accordance with CTF guidance.

**Table 8: Results Indicators**

Results Indicator	Baseline	Expected Program Results in Original CIP: Net Metering with Solar PV	Expected Program Results For EEEVs and Solar Energy Projects
Cost of solar power units	\$18,000 with 9.8 year payback	\$10,000 with 2.5 year payback <sup>a</sup>	[To be determined during project identification and preparation.]
Number of commercial buildings with solar panels and net metering	Limited	30,000 buildings <sup>a</sup>	[To be determined during project identification and preparation.]
Number of e-trikes and support infrastructure in commercial operation	20 (with lithium ion batteries, post-pilot test) and about 200 using conventional lead acid batteries and less efficient motors.	n/a	100,000 e-trikes operating by 2016. Public charging infrastructure and battery leasing established in respective regions.
Number of Solar Charging Stations and Rated Capacity	n/a	n/a	Standardized design prototype solar powered charging stations. 5 x 200 kW solar-powered charging stations operating by 2015.
RE capacity and output	570 kW rooftop solar with 15% load factor	n/a	Standardized designs for rooftop solar PV 40 MW of rooftop solar PV by 2016, <sup>b</sup> Energy output of 52,560 MW-h per year at 15% load factor

Notes: <sup>a</sup> Indicators are from Table 1 of Executive Summary of the original CIP.

<sup>b</sup> Assumes \$3 per watt installed system cost.

Source: October 2011 Joint Mission

61. **Implementation potential for the EEEVs and solar energy projects is high.** The EEEVs project is scheduled for presentation to ADB's Board of Directors in 2012. This project has strong support at the highest levels of the GoP. The solar energy project is at the identification stage, and is expected to be prepared and presented for ADB Board consideration in 2013. The EEEVs project is based on a successful pilot project in Mandaluyong City. The solar energy development project will be designed in part based on the solar rooftop installation at ADB headquarters, which is the largest project of its type in Southeast Asia. Risks and mitigation measures are summarized in Table 9.

**Table 9: Risks and Mitigation Measures**

Risk	Mitigation Measure	Residual Risk
Policy and regulatory framework: Clarity of policies related to EE and cleaner transport and RE	<ul style="list-style-type: none"> <li>High energy prices and price volatility provide macro-economic support to end-use efficiency investments</li> <li>Application of innovative financing to cover part of front-end capital costs and to reduce first-mover risks</li> </ul>	L
Implementation Capacity: Readiness of owner-operators to procure and operate electric vehicles	<ul style="list-style-type: none"> <li>Technical assistance to transfer know-how on project planning, financing, risk management, especially for pioneering projects</li> </ul>	L/M
Technology: Limited know-how for after-market service of electric vehicles	<ul style="list-style-type: none"> <li>Technical assistance and know-how transfer for newly-introduced electric vehicles will be provided based on experience from pilot project.</li> </ul>	M/H

Risk	Mitigation Measure	Residual Risk
Finance: financial benefits of EEEVs need to be monetized	<ul style="list-style-type: none"> <li>E-trike operators are expected to improve net income by 50%; a rent-to-own approach will ensure affordability of vehicle ownership</li> <li>Carbon finance will be mobilized to the maximum extent possible, including prospective post-2012 carbon revenue.</li> </ul>	L/M
Environmental Management: Management and disposal of used appliances and batteries	<ul style="list-style-type: none"> <li>Battery leasing and recycling programs are integrated into the e-trikes projects.</li> <li>Rigorous application of GoP regulatory framework and ADB safeguards for environmental and social impact.</li> </ul>	L
Development Impact: Mobilization of investment for replication and scale-up; potential disruption of access to energy to “last mile” consumers	<ul style="list-style-type: none"> <li>Work closely with vehicle owners, business associations, and domestic financial institutions to raise awareness and promote future investment in electric vehicles and solar charging stations.</li> <li>Electricity demand from the EEEVs project will be offset by 1338 MW of new grid-connected capacity, more than compensating for incremental EEEV demand (see Appendix 2)</li> </ul>	L
Carbon finance delivery risk: Verification bottlenecks are currently delaying annual payments and affecting the financing structure of large scale transactions.	<ul style="list-style-type: none"> <li>Coordinate with ADB Future Carbon Fund to identify opportunities to maximize potential carbon revenues, and reduce or eliminate delays in methodology and verification processes</li> <li>Consider voluntary transaction in secondary carbon markets</li> </ul>	M/H
Procurement : Limited number of global suppliers for electric vehicle technologies may limit competition in some instances	<ul style="list-style-type: none"> <li>Competitive bidding will be utilized in accordance with MDB and GoP requirements. Project scale is sufficient to attract multiple suppliers.</li> </ul>	M/H
Overall risk after mitigation	<b>Moderate</b>	

62. The Philippines Department of Energy (DOE) will be the executing agency for these proposed projects, as DOE is the designated agency for RE development, energy efficiency, electric vehicles, and alternative fuels. The scope and implementation arrangements of the proposed projects have benefited from a substantial learning curve from the Philippines Energy Efficiency Project (PEEP, supported by ADB financial and technical assistance), the EEEVs pilot projects in Mandaluyong and Taguig Cities, the Boni Tunnel Lighting installation, and the rooftop solar installation at ADB headquarters. A key lesson learned from the EEEVs pilot projects is that for transformational impact to be realized, the investments must include the complete spectrum of stakeholders including vehicle owner/operators, equipment suppliers, and after-market service providers, i.e., **the project must facilitate “end-to-end” infrastructure development including the development of a credible battery industry with new technology** (i.e., the full supply chain must be developed).

63. **Additional costs and risk premiums justify use of CTF.** The EEEVs and solar energy development projects have up-front cost barriers and are both first-of-a-kind in the Philippines. The EEEVs project will be the largest effort in the Asia region to begin electrification of the public vehicle fleet. These pioneer projects face first-mover risk, and present higher-than-normal end-user costs with respect to purchase of new vehicles: the e-trikes cost at least \$1000 more per unit than conventional gasoline-powered tricycles. Lower operating costs will offset the initial purchase costs, but at present there is no mechanism to monetize the life-cycle savings to assist end-users in the initial purchase. Further, concessional finance will be used to maintain lower effective interest rates for the EEEVs rent-to-own mechanism.

64. The costs associated with prototype solar charging stations and new solar energy development also present barriers which have discouraged development. Concessional funds will buy down the cost of solar charging stations so that renewable electricity can be sold to EEEV operators at grid parity. The solar energy development project will focus on investments which are not supported by the FIT; detailed financing arrangements will be identified during project preparation. These cost barriers are not being addressed by carbon finance, funding offered by the Global Environment Facility, subsidized GOP investments, or other concessional funding sources.

65. Carbon finance is facing constraints due to post-2012 market uncertainties. Carbon finance opportunities will be pursued, but any revenue is expected to be “on delivery” and will not be sufficient to catalyze up-front investment. Also, any CDM funds are uncertain until registration with the UN, which typically occurs after the projects’ financial close. Moreover, projects from the Philippines not registered by December 2012 will not be eligible for carbon financing under the European Emissions Trading System.

66. Further discussion of CTF eligibility is included in the concept papers in Appendices 2 and 3.

## Appendix 1: Summary of Stakeholder Engagement during Investment Plan Revision

### A. Background

1. During development of the original CIP, the MDBs worked closely with the Department of Energy (DOE), Department of Finance (DOF), and the National Economic and Development Authority (NEDA). These agencies agreed that the \$125 million in CTF financing to be administered by ADB would be earmarked for the energy sector. Since the EEEV project is fundamentally seen as an energy project, and falls within the mandate of the DoE-led Fueling Sustainable Transport Program, project ownership rests with the DOE, with the DOF as the key counterpart for all MDB-financed projects, including those with CIF funding. DOE communicated this to the Department of Transport and Communication (DOTC) and the Department of Environment and Natural Resources (DENR), explaining DOE's interest in reallocating CTF resources from the previously planned renewable energy (rooftop solar development) and energy efficiency (energy efficient appliances) projects to the proposed the EEEVs project. NEDA also was kept informed of these developments, and it approved inclusion of the EEEVs project in the GoP's foreign assistance program (Attachment 1a). The President of the Philippines serves as Chair of the National Climate Change Commission (CCC), and has supported the e-trikes pilot project and development of the EEEVs project. Given this tacit endorsement, DOE did not solicit further official comment from the CCC.<sup>26</sup>

2. Subsequent to presentation and discussion of the CIP-R in November 2011, a group of local and international civil society organizations (CSOs) raised concerns about a perceived lack of consultation on the proposed reallocation of CTF funds from supporting the promotion of renewable energy to sustainable transport. ADB responded in writing, clarifying that the EEEVs project was still under development, and therefore, wide discussions and consultations would address the vehicle design, safety, disposal, post-sale issues, and other concerns raised by various stakeholders. A specific set of consultations was subsequently organized and held on 21-23 May 2012, covering both the allocation of CTF resources and design of the EEEVs project. These consultations are summarized below in Section C.

3. The EEEVs project team and the Government have been actively engaging on project design with a range of stakeholders – tricycle drivers, suppliers, manufacturers, government officials, lawmakers, and academic institutions – for more than one year. Since July 2011, ADB has hosted, on behalf of DOE, 7 informal industry meetings to foster improved communications and potential cooperation among international investors and members of the local tricycle manufacturing community. ADB has shared at these meetings, among others, findings from the pilot project in Mandaluyong, technical details of e-trike specifications, charging options, and bidding processes. These and more formal meetings and workshops have provided venues for professional networking within this nascent industry.

4. The DOE also undertook a nationwide e-trike design competition and selected 3 top designs from 180 entries. An internationally reputed car designer is working on a design that meets international safety and comfort standards taking into account ideas from the 3 winning designs and the feedback of the drivers on the pilot units.

5. The EEEVs project concept is thus the result of extensive and extended engagement with a range of stakeholders, and the proposed solar energy development project concept has also benefited from an active dialogue amongst stakeholders dating back to the original CTF

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<sup>26</sup> It should be noted that inter-governmental consultation is primarily the responsibility of the government.

Investment Plan's development. A solar energy development project is now being retained as part of the proposed CTF investment, based on stakeholder feedback, with the project concept to be further refined. The history of stakeholder engagement feeding into this Update is summarized below.

## **B. Informal Industry Meetings**

6. Beginning in July 2011, the EEEVs project team began hosting informal industry meetings to foster communication and cooperation amongst industry players and to ensure local buy-in throughout the project preparatory process. Seven informal meetings were held to encourage representatives of the local tricycle manufacturing community to ask questions about e-trike specifications, design and bidding processes, and to maintain open communication with the project team. These well attended meetings took place on the following dates (a list of organizations represented is given in Attachment 1b):

- July 12, 2011 at the Asian Development Bank;
- July 26, 2011 at the Serendipity Lounge, Discovery Suites;
- August 9, 2011 at the Serendipity Lounge, Discovery Suites;
- August 23, 2011 at the Serendipity Lounge, Discovery Suites;
- September 6, 2011 at the Savannah Function Room, Discovery Suites;
- September 20, 2011 at the Savannah Function Room, Discovery Suites; and
- October 25, 2011 at the Savannah Function Room, Discovery Suites.

7. Company representatives were encouraged to submit presentations regarding e-trike design and business practices. Working groups comprising project team members and industry representatives were established to explore different aspects of the scale-up of a local e-trike manufacturing, assembly, and battery supply business model. The topics examined include (i) the best possible set of criteria for companies to participate in the project and how to best structure a local industry, (ii) registration and franchising challenges and potential solutions; and (iii) developing a set of options and best practices for e-trike disposal and recycling.

8. Through the informal meeting process, the project design team gained valuable insight into the challenges and concerns facing local manufacturers regarding the scale-up planned as part of the e-trike project. Primary concerns include production capacity, government support (taxes, duties and fees), the ADB bidding process, and e-trike design specification.

## **C. More Formal Meetings and Workshops**

9. The project team has also organized more formal engagement with those interested in the EEEVs project design over the past year. Stakeholders have ranged from international electric vehicle experts, representatives of local governments, representatives from the Philippine Department of Energy (DOE) and other government agencies, representatives from Congress, and international battery manufacturers. Meetings such as these will continue throughout the project preparatory process and will transition to building community awareness and addressing industry, community and driver concerns as project implementation moves forward.

### **1. Energy Efficient Electric Vehicles Forum, April 28, 2011**

10. The Energy Efficient Electric Vehicles Forum at ADB served as an important venue for project concept introduction on behalf of government and industry representatives. The proposed project was introduced by the ADB and DOE, and international consultants discussed best practices for electric vehicles around the globe. The Forum emphasized the role of government support and incentives in creating a successful electric vehicles program, the role of the private sector in achieving successful economies of scale, and the importance of technology transfer to achieve the economic and environmental goals of the project.

### **2. Boracay Consultation Workshop, August 14-15, 2011**

11. Members of the project team traveled to Boracay Island to assess the existing conventional tricycle market and how to successfully work with local government officials and tricycle drivers to implement a full transfer to ADB sponsored e-trikes beginning in early 2012. Team members noted the concerns of local tricycle drivers, such as hilly conditions and passenger preferences geared towards promoting tourism (where to store luggage, seats facing out, etc.). Following the meetings and follow-up from project team members, the Municipal Council of Malay, which includes Boracay, passed a resolution on September 20, 2011 to shift to e-trikes in 2012. The resolution expresses the Council's support for the project not only on the Island of Boracay, but throughout the Philippines.

### **3. Meetings with Battery Manufacturers (Various Dates)**

12. The project team has met with various international battery manufacturers – Toshiba, Samsung, LG, Kokam, etc. These meetings have enforced the team's commitment to lithium ion battery technology, helped to evaluate various power capacity options and cost concerns, and have helped to determine how to structure the e-trike leasing program to maximize benefits to end users. The project team is working with battery manufacturers to achieve a cost-effective, lightweight, and environmentally sound battery solution that can sustain the industry on a long-term basis.

### **4. Workshop with Japanese Battery Manufacturers, November 23, 2011**

13. The DOE and ADB hosted a workshop for industry representatives and interested parties featuring presentations by Japanese manufacturers. Presenters included PriceWaterhouse Coopers Arata, PUES Corporation, Yamaha Motor Co., Ltd., Prostaff Co., Ltd., Tokyo R&D Co., Ltd., Toyota Industries Corporation, Nissan Motor Co., Ltd., and SIM Drive Corporation. A question and answer session followed.

### **5. Workshop in Tokyo, November 28, 2011**

14. A workshop was hosted at the Asian Development Bank Institute in Tokyo with representatives from the Philippine Embassy to Japan and ADB. Participants were invited to tour the Nissan factory and to see the electric vehicle model, the Leaf, in production. Participants included PwC, ITS Network, PUES Corporation, Tokyo R&D Co., Ltd., Assemblepoint Co., Ltd., Nissan Motor Co., Ltd., Toyota Industries Corporation, Toshiba Corporation, Prostaff Co., Ltd., E-Minimo Co., Ltd., MK & Associates, and Ibrida Cell Co., Ltd.

## **6. Electric Vehicle Summit in Shanghai, November 29-30, 2011**

15. Representatives from DOE, ADB, and the Philippine e-trike industry attended the Electric Vehicle Infrastructure Summit in Shanghai from November 29-30, 2011. Features of the summit included the following:

- Outlook of the People's Republic of China (PRC) EV industry and infrastructure development in next 5 years from a regulatory perspective;
- Develop effective business models to ensure the commercial success of EV infrastructure in the PRC;
- Standardization: EV roadmap in the PRC;
- Cutting-edge EV, battery and charging technologies showcase;
- How to work with governments and regulators to ensure future proof policy development in PRC;
- Future business models for auto manufacturers in PRC and how to maintain;
- Profitability with new industry landscape;
- Technical innovations for future EVs and how it could benefit auto OEMs;
- Collaborating to accelerate development of vehicle-grid connectivity standards; and
- World pioneering EV pilot project case studies and implications.

16. Participants included the Department of Energy, the Department of Environment and Natural Resources, the Department of Finance, the Department of Interior and Government, the Department of Science and Technology, the Department of Trade and Industry, the Department of Transportation and Communications, Land Transportation Franchising and Regulatory Board, Land Transportation Office, Mandaluyong Tricycle Regulations Office, Metropolitan Manila Development Authority, National Economic Development Authority, Office of Senator Ralph Recto, Fabella Sto. Rosario Tricycle Operators and Drivers Association, Golden eBike Philippines Inc., eSave Transport System, Green Vector Ventures, Inc., GerWeiss Motors Corporation, Partnership for Clean Air, FilOil, North 68 Corporation, MD Juan Enterprises, Mto Seiki Mtg. Corp., and PHUV Inc.

## **7. Workshop with Korean Battery Manufacturers, December 13, 2011**

17. On December 13, 2011 a workshop was held with representatives from the e-trike manufacturing industry, the project team, and Korean battery manufacturers. Presentations were given by Eco One and LG Chem Company, ETH Co., Ltd., and Power Logics. A question and answer session followed.

## **8. Presentation by Dr. Alastair Bacon, January 10, 2012**

18. The ADB hosted representatives from the industry and from the DOE to hear a presentation by Dr. Alastair Bacon, the Vice President for Driveline and Transmission Systems for Ricardo, a global multi-industry consultancy for engineering, technology, project innovation and strategy. A question and answer session followed.

## **9. Consultation with Civil Society Organizations, February 9, 2012**

19. ADB, DOE and 9 civil society representatives based in Washington, DC discussed the proposed reallocation of \$125 million of CTF funding from the renewable energy (solar power generation and net metering) concept included in the original CIP to an energy efficient (EE)

appliances project and EEEVs project. During the meeting, discussion initially covered process issues, including the need for consultation and inter-agency support for the CIP-R. Discussion then shifted to address several substantive issues, beginning with alternatives considered for inclusion in the CIP-R, potential for emissions reductions and cost effectiveness, and closing with clarifications about additional costs and risk premiums. As the CSOs had shared their concerns in advance of the meeting, ADB and DOE explained their positions on each issue, and agreed to follow up the issue of GHG reductions highlighted in a recent report by the UNDP Risoe Center report (which is noted in Appendix 2).

## **10. Industry Meeting, March 30, 2012**

20. On March 30, 2012, an industry meeting was held at ADB headquarters for DOE project updates and an open forum question and answer session. Over 60 people were in attendance from organizations and companies such as Meralco, Dow Chemical, Venture Japan K.K., Golden e-Bike Phils., Toyota Tsusho, Pricewaterhouse Coopers, Motolite, Itochu Corporation, Terra Motors Japan, Metchem, Gerweiss Motors, etc. Discussion largely surrounded the flow of funds, the bidding process, and the requirements and qualifications of the supplier.

## **C. May 2012 CTF Stakeholder Consultations**

21. A range of CSOs, NGOs, private sector, and other interested stakeholders were invited to participate in public consultations regarding the revised CTF Country Investment Plan, including the proposed EEEVs project on 21-23 May 2012. A steering committee with representatives from various interested CSOs/NGOs began meeting in February 2012 to develop agenda items and identify participants. The 3-day consultations began with discussions on the use of CTF resources for renewable energy versus sustainable transport investments. They then turned to issues surrounding design of the EEEVs project and CTF support for the renewable energy sector.

22. Day 1 of the consultations was entitled “Why Not Renewable Energy for the Clean Technology Fund?,” and its objectives included:

1. To present the CTF and the original Country Investment Plan (CIP) with its original components;
2. To understand the current state of RE in the Philippines and why a shift was being proposed to sustainable transport for the CTF;
3. To present the revised CIP and rationale for deviating from the original; and
4. To engage in a discussion on the use of the CTF for a transformational strategy in the energy sector to address growing demand.

23. Based on advice from the consultations steering committee, over 160 invitations were issued by email together with a web-based notice opening them to the public,<sup>27</sup> and nearly 100 participants attended to hear speakers and discuss related topics. Presentations included “Philippine Policy Framework for Renewable Energy”, “Harnessing RE Resources: Potential,

<sup>27</sup> There was good agreement among steering committee members on a range of issues, but full consensus could not be reached on all aspects of timing and approach prior to their conduct. DOE requested ADB to move ahead based on directions received from the steering committee, and a neutral facilitator was engaged to moderate discussions. Many of the relevant documents had been posted on the web some time in advance of the meetings, while others were distributed the week prior to the events. Every effort was made to send invitations more than a week in advance of the meetings (and many organizations were aware of the impending consultations), but some received invitations later. Adjustments were made to the announced agendas based on the availability of speakers and resource persons.

Benefits and Challenges”, “Is there Financing for RE Projects?”, “CTF Philippine Investment Plan Update”, and “Why the Shift?”. Participants discussed progress made in net metering, new climate funds becoming available for renewable energy, the DOE and the ADB’s collective commitment to renewable energy, and why the revised CIP reflected a higher priority for sustainable transport and energy efficiency initiatives – including e-trikes.

24. Day 2 of the consultations, entitled “Electrification of Public Transport: Why E-trikes?”, was organized by the Clean Air Initiative for Asian Cities (CAI-Asia), the Partnership for Clean Air (PCA) and DOTC in cooperation with DOE and ADB. The consultation was designed to clarify and discuss the rationale for electrification of tricycles using CTF resources. Presentations led by CAI-Asia and PCA included “The Role of Tricycles on Urban Transport in the Philippines”, “Plans and Programs of DOTC on Alternative Vehicles (including Electric)”, and discussion of the pilot e-trike programs in Mandaluyong and Boracay. Participants discussed the hierarchy of public transportation and the role tricycles play within that hierarchy, lessons from the pilot programs, and electrification and alternative fuel policies being pursued by the DOTC. The DOE also reconfirmed the Government’s commitment to the EEEVs project. A brainstorming at the end of the day centered on which project elements seemed most ready to proceed versus those needing further attention to design issues or implementation arrangements.

25. Day 3 of the consultations was hosted by the DOE and the ADB and addressed the subject of “Alternative Fuel Vehicles & Finance and Project Design” to address specific aspects of EEEVs project design and to understand and seek inputs on the proposed financing scheme. The discussion was also used to revisit the question of CTF resources being allocated to renewable energy development versus sustainable transport. Presentations and discussions on the concluding day of the consultations centered on the EEEVs project design, the proposed flow of funds, as well as the DOE implementation plan. A large part of the day was devoted to an open forum question and answer session.

26. Minutes were prepared for each of the 3 days of consultations, and these were distributed to participants for their review prior to finalization. To accommodate additional inputs on documentation discussed during the consultations, a commentary period of one month was provided (no further comments were received). Furthermore, at the request of civil society representatives, interested stakeholders who were not able to attend the consultations were able to submit comments to be included in the consultation minutes through the ADB website (again, none were received). The agendas, participant lists, presentations and minutes of these stakeholder consultations are available at the following links:

<https://www.dropbox.com/sh/5q2tobxqsovqp1l/xJkQYjJj90>

<http://www2.adb.org/Projects/eTrike/events.asp>

27. In follow-up to the consultations, it was agreed that there would be further discussions with renewable energy sector and other stakeholders. These were held in a spirit of compromise and problem solving on 28 May and 6 June, ending with a positive note of support for the EEEVs project and a revised proposal for CTF investment in the renewables sector. Dialogue continues with trike drivers and other stakeholder groups, based on the outcomes of these consultations. Five working groups were established, covering the topics of: payment options, driver selection, boundary collection, disposal of old tricycles, and sustainable charging options.

28. Based on more than a year of stakeholder engagement, and as a direct outcome of the consultations held on 21-23 May 2012 and subsequent discussions, a revised Investment Plan for the CTF allocation to be implemented in partnership with ADB, with the outcomes summarized in the table below.

### Summary Outcomes Following CTF Stakeholder Consultations

Pre-consultations	Post-consultations
<p>Proposed CTF allocation in partnership with ADB of \$125 million as follows:</p> <ul style="list-style-type: none"> <li>• \$101 million for EEEV's project, including \$99 million investment and \$1 million capacity building grant to support technology transfer</li> <li>• \$24 million for Energy Efficient Appliances Project</li> </ul>	<p>Proposed CTF allocation in partnership with ADB of \$125 million as follows:</p> <ul style="list-style-type: none"> <li>• \$105 million for EEEV's project, including \$99 million investment, \$1 million grant capacity building grant to support technology transfer, and \$4 million grant to support prototype e-vehicles solar charging stations</li> <li>• \$20 million for Solar Energy Development Project</li> </ul>
<p>Proposed EEEV Project parameters:</p> <ul style="list-style-type: none"> <li>• Project financing scheme: direct payment to suppliers, funds collected from drivers through LGUs</li> <li>• E-Trikes assumed to be charged from the electricity grid</li> <li>• Selection criteria for LGUs and drivers within LGUs to be decided during implementation</li> <li>• Vehicle design and safety: new e-trike designs were to be made public during bidding</li> <li>• Post-sale: discussions on warranty limited to battery and key parts</li> <li>• Procurement: pre-qualification documents to be obtained at the DOE</li> <li>• Tricycle disposal plan to be completed during implementation</li> </ul>	<p>Proposed EEEV project parameters:</p> <ul style="list-style-type: none"> <li>• Project financing scheme: clarified direct payment to suppliers, E-Trike implementation office to be established in each independent LGU, and collection from drivers may be outsourced, where possible</li> <li>• Solar charging of e-trikes to be piloted and actively promoted as public, private, or public-private-partnership venture (demonstration proposed with \$4m grant)</li> <li>• Criteria for both selection of LGUs and drivers within selected LGUs finalized, an application for e-Trike developed, to be finalized after detailed consultation with drivers in each LGU</li> <li>• Vehicle design and safety: competition-based designs confirmed for project support; new e-trike design was made public during the 3-day consultation</li> <li>• Post-sale: Minimum 3-year warranty covers all spare parts and overall performance of the vehicle, with small stand-by fleet to ensure drivers do not lose income in case of vehicle break-down</li> <li>• Procurement: Pre-qualification documents have been posted on both ADB and DOE websites</li> <li>• Material recovery plan complete, taking note of stakeholder concerns; vehicle disposal options broadened, with the ultimate goal of 100% scrapping</li> </ul>

<p>Project implementation support arrangements:</p> <ul style="list-style-type: none"> <li>• Industry working groups</li> <li>• ADB project team</li> <li>• DOE project team</li> </ul>	<p>Project implementation support arrangements:</p> <ul style="list-style-type: none"> <li>• Industry and other stakeholder working groups established, covering: <ul style="list-style-type: none"> <li>○ disposal of side cars and lead acid batteries from old tricycles,</li> <li>○ overall business model and options for revenue collection,</li> <li>○ driver selection criteria and driver selection,</li> <li>○ performance monitoring and disclosure of project information (including website),</li> <li>○ pilot solar charging stations development, and</li> <li>○ driver and consumer education.</li> </ul> </li> <li>• ADB and DOE project teams</li> <li>• ADB Advisory Group (representative experts from transport, energy, environment, and urban development communities of practice)</li> </ul>
<p>Proposed Solar Energy Development Project parameters:</p> <ul style="list-style-type: none"> <li>• Withdrawn from original CIP due to concerns over enabling conditions and markets trends: (i) delay in feed-in tariff, (ii) lack of net metering, (iii) cap of 50 MW for solar tied to FIT imposed by DOE; (iv) significant price impact to end consumers from adding higher cost solar power in the energy mix, and (iv) already strong private sector industry and interest in solar power.</li> <li>• Since 200-300 MW solar rooftop power could not be implemented in the next 3 years, no CTF support was proposed</li> </ul>	<p>Proposed Solar Energy Development Project parameters:</p> <ul style="list-style-type: none"> <li>• Proposed \$20 million CTF support for project (assuming an \$80 million ADB loan, and \$20 million GoP counterpart funding) based on: (i) DOE convinced solar panel prices have decreased sufficiently since 2009 to allow for a 60-70MW project to be designed and implemented without any subsidies through feed-in-tariff, (ii) means investment will be outside the DOE 50 MW policy cap</li> <li>• Solar charging for e-Trikes to be piloted at 5 sites (through proposed \$4 million grant), each of 200 kW capacity, or 1 MW total, which may be able to provide charging to about 1000 e-trikes.</li> </ul>

### ***Commitment to Continuous Consultation***

The proposed CTF funding for the EEEVs Project is an integral part of Government's transformation agenda. DOE and ADB are committed to continuous and thorough consultation for implementation of the EEEVs Project. DOE and ADB have developed principles and broad guidelines to address some of the risk factors identified — involvement of LGUs, collection from

drivers, and selection of recipients of e-Trikes — during CSO consultations. Within this umbrella framework, DOE and ADB will work with a range of stakeholders to develop detailed plans specific to each location for project implementation. Since public consultations conducted on 21-23 May 2012, DOE and ADB have continued to consult with tricycle drivers, associations of tricycle drivers and owners, and other stakeholders in (i) Puerto Princessa, (ii) Boracay, (iii) Quezon City, and (iv) Cabanatuan to continue dialogue and firm up understanding regarding the demand for e-Trikes in these locations. Further engagement with these and others will take place through the Working Groups enumerated above, once it is clear that the project will move forward.

DOE and ADB plan to invite all stakeholders including civil society to actively participate in these Working Groups, with plans to send invitations as soon as investment endorsement and approval have been granted by CTF and ADB's Board. Invitations will be posted on the e-trike website ([www.adb.org/etrike](http://www.adb.org/etrike)) and the ADB Facebook page. Detailed implementation arrangements will be developed as the project moves forward and will take account of local conditions and learning curves from initial stages of implementation. A flexible approach will be maintained within the umbrella framework and focus on Puerto Princessa and Boracay initially, which may be the only two cities to receive any e-trikes prior to the 13 May 2013 local government elections. Plan for other areas will develop slowly based on knowledge developed in these first two areas.

The broad timetable for a second round of public consultations, focused on the identified Working Groups, is as follows:

- On CTF Project Approval: Email invitation to all those invited to the previous 3-day consultations.
- Participants will also be asked to comment on the proposed schedule. Based on comment received, finalize and the overall plan for implementation by the second week.
- Within about 1 month: At least once meeting of each Working Group to finalize their agreed Terms of Reference and membership.

At present, based on discussions during and after the May 2012 consultations, the proposed Working Groups are expected to focus on the following topics:

- (i) Disposal of side cars and lead acid batteries from old tricycles;
- (ii) Overall business model and options for revenue collection;
- (iii) Driver selection criteria and driver selection;
- (iv) Performance monitoring and disclosure of project information (including website);
- (v) Pilot solar charging stations development; and
- (vi) Driver and consumer education.

To consolidate inputs from the Working Groups, an open workshop would be conducted within 3 months of project funding approval so that the detailed feedback from various groups can be reflected in the various agreements that the DOE will have with the LGUs and that the LGUs (E-Trike Office) will have with e-trike drivers.

**ADB Internal Advisory Committee:** In addition to the Working Groups, the ADB project team also will be expanded to form an internal advisory committee that will include staff experts on climate change, sustainable transport, social dimensions, and air quality.

**Attachment 1a: NEDA Board Approval of the EEVs Project****Official Gazette**

Edited at the Office of the President of the Philippines  
pursuant to Commonwealth Act No. 638 as amended by the Administrative Code of 1987

**NEDA Board approves e-Trike and hydroelectric power plant upr****A March 26, 2012 press release from the National Economic and Development Authority**

The NEDA Board approved on Thursday two energy projects amounting to P24.1 billion. These projects aim to promote sustainable transport, achieve energy efficiency and thus address market transformation in the sector.

The P21.5 billion Market Transformation through Introduction of Energy Efficient Electric Tricycle (e-Trike) Project will reduce fuel consumption of tricycles by 2.8 percent, equivalent to 560,926 oil barrels.

"The project will distribute 100,000 E-Trikes to tricycle operators on a lease-to-own arrangement, replacing their old gas-fed and two-stroke gasoline engine units. This way, we are also able to protect our environment," Socioeconomic Planning Secretary and NEDA Board Vice Chair Cayetano W. Paderanga Jr. said.

During Phase I of the project, 20,000 e-Trikes will be distributed to operators in Metro Manila, Boracay, Puerto Princesa City, Cabanatuan City, and Davao City while 80,000 units will be provided to operators in yet to be determined municipalities/cities during Phase II. The project also aims to promote the establishment and development of new associated electric vehicle support industries such as battery leasing/recycling/disposal, motor supply chain, and charging stations. This Department of Energy (DOE)-proposed project will be financed through a P12.9 billion loan from Asian Development Bank (ADB), P4.3 billion loan and P43 million grant from the Clean Technology Fund (CTF), P860 million Clean Development Mechanism (CDM) facility and P3.397-billion government counterpart funding.

**Attachment 1b: List of Organizations Represented During Informal Discussions on Design of the EEVVs Project**

- 1 3C Distributors International Inc
- 2 Aboitiz Power
- 3 AETI
- 4 Aksyon Klima
- 5 ALCapone Incorporated
- 6 Almozora Motors Corporation
- 7 Alternative Energy Trailblazers Inc
- 8 AMA Group of Companies
- 9 Amara Chivalry Contractors Inc
- 10 AMCA SMART Solutions Inc
- 11 AMEO Makati
- 12 APPEND
- 13 Archdiocese of Manila Ministry on Ecology
- 14 Asian Institute of Management
- 15 ASSCOM Multi Purpose Cooperative
- 16 Ateneo School of Government
- 17 Atin To Development Services
- 18 Batangas Laguna Autocenter Inc
- 19 Battery Doctors Phils.
- 20 Board of Investments
- 21 Cenro San Juan City
- 22 Center for Clean and Renewable Energy Development (C-CRED)
- 23 Center for Community Transformation
- 24 Chamber of Automotive Manufacturers of the Philippines, Inc.(CAMPI)
- 25 City Government of Makati
- 26 Clean Air Initiative-Asia Center
- 27 Clean Engines Phils. Inc.
- 28 Clean N Green Energy Solutions
- 29 Clean Rock Renewable Energy Resources Corp.
- 30 Climate Change Commission
- 31 Continental Sales, Inc (CSI)/LGK Grp of Co's
- 32 Corinthian Trucking
- 33 Cosmos Cars and Services, Inc. (on behalf of the North 68 group)
- 34 Cyber Cycling Inc
- 35 DBP Leasing Corporation
- 36 De La Salle University
- 37 Department of Energy
- 38 Department of Transportation and Communication
- 39 Design Upholstery
- 40 Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ)

41	Development Academy of the Philippines
42	Don Bosco College
43	Dow Chemical Pacific Limited
44	Earth Institute Asia Inc.
45	ECOS Foundation
46	Edward Marcs Philippines Inc
47	eJeepney Transport Corporation
48	Elaia Green Vehicles Corp.
49	Electric Vehicle Association Of the Phils.
50	Energy Logics Philippines
51	Energy Regulatory Commission (ERC)
52	Environmental Transportation Solutions (ETS)
53	Enzolutions Inc
54	E-Save Transport Systems, Inc
55	EV Motor Systems
56	Exponential Growth Realty
57	Fabricator Phils Inc
58	Fairways and Bluewater
59	Far Eastern University
60	FDC-PWG
61	FilOil Gas Inc
62	FRAU Electric Vehicles
63	Fundline Finance Corporation
64	GerWeiss Motors Corporation
65	Global Content & Research Ltd
66	Goldbell Philippines Inc
67	Golden eBike Phils Inc
68	Great Treasures Alliances International
69	Green Convergence
70	Green Frog Zero Emission Transport
71	Green Tech EcoCenter (GTE)
72	Green Vector Ventures Inc.
73	Greenpeace Southeast Asia
74	GSD C&T CO., LTD
75	Honda Philippines
76	INAFI
77	Institute for Climate and Sustainable Cities
78	Institutional Sales Engineer-Industrial Battery
79	International Cyber-Cycle Inc.
80	Itochu Corporation
81	JLBTC
82	June A. Yasol Alternative and Renewable Energy Consultancy
83	Korea Trade Center (KOTRA) Manila

84	Kymco Philippines
85	Land Bank of the Philippines
86	LAPOCOF
87	Lucky Garvonbill Trading/Yanhao Partnering China
88	Manila Electric Company
89	Mapua Institute of Technology
90	MCX Motor Phils.
91	MDPPA
92	MERALCO
93	Meralco Energy Corporation
94	METCHEM Business Solutions Inc
95	MH ADXPression Inc
96	Motolite
97	Motor Vehicle Parts Manufacturers Association of the Philippines Inc (MVPMAP)
98	Moving Ecology
99	National Anti-Poverty and Corruption
100	National Anti-Poverty Commission
101	National Renewable Energy Board
102	NCTS
103	NewJec Inc. International Operations
104	NGO Forum on ADB
105	Nito Seiki Manufacturing Corporation
106	North 68 Corporation
107	Oriental and Motolite Mktg. Corp
108	Partnership for Clean Air (PCA) Inc.
109	Philippine Chamber of Commerce and Industry (PCCI)
110	PEMC
111	Phil ETRO EV Inc
112	Philippine Electricity Market Corp.
113	Philippine Social Enterprise Network, Inc.
114	Philippine Solar Power Alliance (PSPA)
115	Philippines Vehicle Utility Inc (PHUV)
116	Pinno Technologies
117	PNOC Renewables Corp.
118	PricewaterhouseCoopers
119	Ramcar Technology
120	REAP
121	Renewable Energy Technology Center
122	Robert Bosch Inc
123	Skysea Energy
124	Solar Electric Company Inc
125	Southern Luzon State University
126	Sustainable Energy and Technology Solutions
127	Technostrat Corporation

- 128 Terra Motors Japan
- 129 Torrex Consulting
- 130 Toyota Tsusho Philippines Corporation
- 131 Unionbank
- 132 United Nations Development Programme
- 133 UP Electrical and Electronics Engineering Institute
- 134 UP SAVER
- 135 Venture Japan K.K.
- 136 Vita Verde
- 137 WINACE Holding Philippines
- 138 WWF Philippines
- 139 Yamaha Motors Phils.
- 140 Yiho Corporation

## Appendix 2: Market Transformation with Energy Efficient Electric Vehicles (ADB)

### Problem Statement

1. The Philippines transport sector accounted for about one-third of total GHG emissions in 2009 (excluding emissions from land use change and forestry). Transport sector emissions have increased by about 6-10% per year since 1990, from about 10 million tons per year carbon dioxide equivalent (MtCO<sub>2</sub>e/y) in 1990 to about 29 MtCO<sub>2</sub>e/y in 2007.<sup>28</sup> Vehicles are one of the dominant sources of urban pollution that threatens both people's health and economic activity. In the Philippines, motorcycles and tricycles comprise more than 52% of vehicle population. Compared to other vehicles, motorcycles and tricycles are less expensive. They are very visible in most cities of the country and play an important role in the transport market particularly used as alternative mode transport for short distances. However, the use of these vehicles contributes to the already declining state of the environment, particularly air quality in urban areas. In an ADB study, transport sector emissions accounted for 30% of air pollution in the Philippines and about 80% of air pollution in Metro Manila.

2. Accounting for the total energy consumed from well to wheel<sup>29</sup>, electric vehicles can reduce energy consumption by up to 50% and greenhouse gas emissions by up to 60% compared to internal combustion engine (ICE) vehicles. Electric vehicles will also reduce greenhouse gases and other harmful emissions because: (i) electric vehicles use no electricity while stranded in traffic jams (no air conditioning), (ii) electric motors have higher efficiencies than internal combustion engines, and (iii) transmission and distribution of electricity is more efficient and cost effective than transportation of liquid fuels to the end user.

3. In the Philippines, a typical tricycle driver uses about \$5 worth (5 liters) of gasoline to drive 100 km in a day and can save about \$4 a day by switching to an electric tricycle: for 100 km, an electric tricycle will consume about 5 kWh of power costing about \$1.<sup>30</sup> With large-scale adoption, these individual savings would accumulate to a significant national savings. Replacement of 100,000 gasoline tricycles with electric tricycles at a cost of about \$450 million, for example, can generate about \$150 million each year from avoided fuel costs (assuming 300 days per year operation). As noted in the main text (paragraph 52), e-trikes are expected to cost at least \$1000 more than conventional trikes, but this cost will be more than recovered through reduced operating costs over a nominal 10-year lifetime. Although the daily and life-cycle cost savings favor electric tricycles, there is no ready mechanism to monetize these savings for acquisition and deployment of electric vehicles at fleet scale.

4. The private sector has indicated interest in building and operating solar charging stations for electric vehicles, but investors face a chicken-and-egg dilemma; until a commitment is made for large-scale deployment of EEEVs, private investors will not finance development of a charging network. This first mover barrier can be overcome by including a component for prototype solar charging stations in the EEEVs project, for which CTF grant support is requested.

5. The additional cost of EEEVs is a barrier, and there is no ready mechanism to monetize the energy savings (and financial savings) for up-front co-financing. This cost barrier is not

<sup>28</sup> CTF Investment Plan for the Philippines, 2009; paragraph 8 and Figure 3.

<sup>29</sup> Energy consumed and green house gases (GHGs) emitted from the time a vehicle's energy source leaves the well to the time it is consumed by the vehicle, details available at: [http://web.mit.edu/evt/summary\\_wtw.pdf](http://web.mit.edu/evt/summary_wtw.pdf)

<sup>30</sup> Assuming cost of electricity of \$0.20 / kWh in the Philippines. As noted above, in the Mandaluyong City pilot project, e-trikes were driven about 55 km per day.

being addressed by carbon finance, GEF or subsidized GOP investments, and, as such, it is a logical entry point for CTF support.

6. Conventional supplier credit financing is not available, because there are not yet any suppliers to deliver EEEVs with financing. Financing may be available, but at usurious rates (e.g., 36% annual interest) that would negate the monetary energy savings benefits of the EEEVs. The project will introduce a rent-to-own arrangement whereby interest rates can be maintained at less than 10% per annum. The FIRR and EIRR calculations suggest that the project is viable without concessional financing; however, such “paper” analyses do not acknowledge the cost barrier noted above, and these analyses assume the project will be successfully implemented with or without concessional funds.

7. Concessional financing also allows the project to achieve a scale that will bring down the cost of the EEEVs, increase demand, and therefore make conventional credit rates more competitive for new entrants. Table A2.2 shows that CTF can add value by increasing the scale of the project, which will help establish a trajectory for market transformation. A recent study by McKinsey notes that manufacturing scale will be critical to expanding the market for electric vehicles.<sup>31</sup>

8. Also, the FIRR analysis does not capture other risks associated with the status quo, including the possibility of the market being flooded with cheap imported lead acid battery-based EVs, which occurred in Vietnam and in the People's Republic of China, among other countries. The introduction of large numbers of lead acid battery EVs creates an environmental hazard that can be avoided by using more efficient lithium ion batteries. It is estimated that 44-70% of the lead from lead acid batteries in China is released into the environment as waste. Groundwater and crop contamination from hazardous chemicals and metals has already caused some local health problems throughout the country. Indeed, these environmental issues and other concerns with lead acid batteries prompted the Government of Bangladesh to ban electric tricycles.

### **Proposed Transformation**

9. CTF cofinancing will be utilized to overcome the first-mover risks and cost barriers associated with introducing electric 3-wheelers (“e-trikes”) as a first step in electrification of the public vehicle fleet: the proposed project will facilitate deployment of 100,000 e-trikes. This will be the largest known project of this scope implemented in the Asia-Pacific region.<sup>32</sup> The physical investments (project outputs) include: (i) e-trike procurement, (ii) battery leasing, (iii) efficient electric motor supply chain, (iv) public charging stations, (iv) recycling and disposal, and (vi) communication, social mobilization, and technology transfer. CTF funds will be used alongside ADB’s loan to amortize up-front capital costs over a longer period than otherwise possible. GoP’s strategy is notable in that fleet electrification is to be initiated at the bottom of the transport pyramid, addressing the needs of poorer consumers including last-mile connectivity. Globally, most electric vehicle development is targeting the upper end of the private car market, with vehicles such as the Nissan Leaf which retails for around \$30,000.

<sup>31</sup> The article is available at this link:

[https://www.mckinseyquarterly.com/Energy\\_Resources\\_Materials/Electric\\_Power/Battery\\_technology\\_charges\\_ahead\\_2997](https://www.mckinseyquarterly.com/Energy_Resources_Materials/Electric_Power/Battery_technology_charges_ahead_2997)

<sup>32</sup> A detailed presentation on the proposed project is available online at:

<https://www.dropbox.com/s/g56m7lnjgdr1m6m/SH%20Presentation%20-%20Meralco%20EV%20submit.pdf>

10. Successful demonstration of the electric vehicles at this scale will facilitate replication and scale up of e-trikes and other public vehicles including jeepneys and buses. Further, development of local battery suppliers and maintenance/service industries will be fostered.

11. The SCS component will deploy rooftop PV arrays [with battery storage] at public transport stations. The electricity produced will be sold at the same price as grid-supplied electricity so that EEEV operators can achieve the cost savings accruing from using electricity as transport fuel, while demonstrating the technological viability of the solar charging systems. The long-term objective is to facilitate scale up of solar charging systems and achieve grid parity, but this requires demonstrate at commercial scale: the stations must support several hundred EEEVs to demonstrate the technology and the business model. In the Mandaluyong pilot test, actual driving of about 55 km per EEEV per day was documented, with consumption of about 3 kWh of energy. Assuming 3-4 hours of generation per day (15% load factor), 1 MW of solar capacity will generate about 3.5 MWh of electricity per day, which is sufficient to support 1000 EEEVs. The solar charging stations are proposed to be initially deployed in Boracay and Puerto Princesa, where the stations can support the majority of EEEVs deployed in the first phase of project implementation.

12. The cost of solar PV has rapidly declined in the last 3 years, and is now at parity with petroleum-fired electricity generation. However, the total cost of the solar charging stations will include the solar PV array, battery storage, controllers, etc., and the initial cost of electricity will be higher than current grid-supplied electricity. Concessional financing is needed in order to sell the electricity to EEEV operators at grid parity. In the longer term, as PV costs continue to decline, the electricity is expected to reach grid parity.

13. The project is designed to establish an end-to-end infrastructure (full supply chain) and create a market for EEEVs at the bottom of the public transport pyramid. The private sector, including financiers, awaits creation of the market for EEEVs, which is the broad objective of the proposed EEEVs project.

14. The project also aims to increase the financial viability of electric vehicles for the drivers and not some intermediaries. Currently, some private initiatives are charging eager drivers up to 3% per month (36% per year) for substandard electric tricycles with poor safety standards. The project will change the overall market dynamics by bringing in professional design and safety standards, better battery technology, and a cost of borrowing that is lower than 10% to benefit the drivers, who traditionally have no collateral.

15. As noted above, one of the key requirements for transformation in technical, market dynamics is scale, and the project success will be enhanced by the use of CTF co-financing in expanding the scale of the sector. Table A2.2 below shows the impact of scaling up with respect to vehicle cost reductions and cost-effectiveness of GHG reductions. Inclusion of the proposed solar charging network will have a synergistic impact on RE development in the country.

### **Implementation Readiness**

16. The E-trikes project is at the appraisal stage and is scheduled for presentation to ADB's Board of Directors in August 2012. The GoP is working on an electric vehicle policy<sup>33</sup>, which among others will exempt importation of all electric vehicles and components free of taxes for 9

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<sup>33</sup> Senate Committee Report No. 44 on Senate Bill No. 285–Electric, Hybrid and Other Alternative Fuel Vehicles Incentives Act of 2011.

years. In addition there will be other incentives to set up electric vehicle businesses in the Philippines.

### **Rationale for CTF Financing**

17. Electric vehicle deployment is both constrained and favored by several factors:
  - Commercial development and deployment of electric vehicles will increase Philippines's energy security, save foreign exchange, and protect against global price fluctuations by using non-tradable domestic energy sources, including renewable electricity.
  - Fleet-scale electric vehicle projects are at the pioneer stage and face additional costs and risks which are not being covered by conventional project financing. Creative financing approaches, including the use of concessional funds, are needed overcome first-mover risks and mainstream large-scale vehicle fleet financing.
  - Carbon finance can provide some financial support, but is not sufficient to overcome the cost and risk barriers noted above.
  - In order to realize the fuel cost savings expected for EEEVs, the SCS component will require grant support so that the electricity can be sold at grid parity at the outset.
  - CTF can provide a catalytic role in reducing or eliminating first mover risk for fleet-scale projects, and foster accelerated replication and scale-up in the near term.
  - The replication potential for e-trikes alone is more than 20 to 1. A substantial learning curve has already been overcome during the Mandaluyong pilot project.
  - GHG reductions and cost-effectiveness are comparable to or better than the original CIP (discussed further below).
  
18. CTF funding is requested and justified based on the following:
  - (i) \$1 million grant is requested to support technology transfer, build local knowledge and capacity about electric vehicles covering all stakeholders. This grant support will support critical aspects of project sustainability, especially after-sales service.
  
  - (ii) The solar charging stations are proposed for inclusion in the project with grant support to establish the viability for such charging stations with respect to technology (solar PV and advanced battery technologies) and business models (delivering electricity from solar PV at approximate grid parity). While the private sector has expressed some interest in EEEVs and in solar charging stations, private sector developers/sponsors have not come forward with proposals to develop the network, mainly because of off-take risks and lack of a demonstration project for solar charging of electric vehicle. Therefore, the proposed EEEVs project includes a request for a \$4 million grant to: (i) demonstrate technical viability of solar charging station with Lithium-ion batteries, (ii) develop a mechanism to aggregate individual drivers' daily electricity demands that support a guaranteed Power Purchase Agreement to reduce the off-take risk of private investors.
  
  - (iii) Private sector initiative is also an issue with respect to EEEV development and renewable fuel development: although there are efforts underway to develop an indigenous EEEVs sector, the scale and pace of development is slow. Likewise, indigenous production of renewable fuels has not progressed in accordance with mandated targets. Public sector intervention is required to accelerate and deepen the pace of EEEV market development in accordance with CTF principles.

### Cost Effectiveness of the Proposed EEEVs Project

19. Tables A2.1 and A2.2 illustrate the cost effectiveness and transformative impacts of the EEEVs project assuming a conservative replication and scale-up factor of 10 to 1. Table A2.1 indicates that cost effectiveness is well within expectations as presented in CTF investment guidance, even in a pessimistic scenario discounted by 30% for potential “rebound effects.”

**Table A2.1: CTF Cost-effectiveness Scenarios of EEEVs Project**

Net GHG Reductions (MtCO <sub>2</sub> e/year)	Cost Effectiveness (CTF\$/tCO <sub>2</sub> e/year)	Cost Effectiveness (CTF \$/tCO <sub>2</sub> e) <sup>a</sup>	Scenario / Assumptions
0.33	306.06	30.06	National electricity and heat emissions factor of 0.6 tCO <sub>2</sub> e/MWh <sup>b</sup>
0.27	374.07	37.41	ADB base case with grid emissions factor of 0.52 tCO <sub>2</sub> e/MWh <sup>c</sup>
0.231	437.23	43.72	0.33 MtCO <sub>2</sub> e/year discounted 30% for “rebound effect” <sup>d</sup>
2.31	43.72	4.37	Replication and scale-up of 10:1 on case assuming “rebound effect”

Source: ADB Estimates.

Notes:

<sup>a</sup> Clean Technology Fund, Investment Criteria for Public Sector Operations, 9 February 2009; paragraph 11 notes that “...CTF co-financing will ordinarily not be available for investments in which the marginal cost of reducing a ton of CO<sub>2</sub>-equivalent exceeds US\$200....”

<sup>b</sup> Emissions factor calculated for Philippines electricity and heat consumption by UK Defra.

<sup>c</sup> Additional discussion of emissions factors is presented in Appendix 2.

<sup>d</sup> Consideration of potential rebound effects is not required by CTF guidance.

<sup>e</sup> Adapted from Original CIP, Annex 2.

20. Table A2.2 illustrates how the cost of avoided CO<sub>2</sub> drops significantly with larger transformation brought about by the CTF investment, as well as the projected cost reductions for EEEVs as investment scale increases.<sup>34</sup> In the small, medium, and large project scenarios, CTF cost-effectiveness is well below the upper limit guidance of \$200 per ton. E-trikes also will generate significant fuel savings and other social co-benefits: about \$10,000 over the 10 year life, the overall cost of avoided CO<sub>2</sub> being about “**-\$200 per ton**” – not uncommon for end-use EE projects, which is also reflected in the McKinsey abatement cost curve for “Fuel efficiency in vehicles” (Figure 3 in main text) of about “-€50 per ton” or “-\$63 per ton” (based on 8 June 2012 exchange rate).

**Table A2.2: EEEVs Project Cost-Effectiveness vs. Investment Scale**

CTF Allocation and Scale Effects	Small isolated grids/ no CTF	Small Project	Medium Project	Large Project
Transformational Impact	Zero	Minimum	Partial transformation	Full transformation
Net Avoided CO <sub>2</sub> e (t/y/vehicle)	2.5	2.6	2.6	2.7
Number of EEEVs	5,000	20,000	50,000	100,000
EEEV Cost (\$/unit)	5,000	4,700	4,500	4,000
Total Cost (\$ Million)	25	94	225	400
CTF Amount (\$ Million)	0	30	70	101
CTF Cost-effectiveness (\$/t/y)	n/a	576.92	538.46	374.07
CTF Lifecycle Cost-effectiveness (\$/t)	n/a	57.69	53.85	37.41
Cost-effectiveness with 10x Replication and Scale-up (\$/t)	n/a	5.77	5.38	3.74

\$ = US dollars, CO<sub>2</sub>e = carbon dioxide equivalent, t = ton carbon dioxide equivalent, y = year

Source: ADB staff estimates

<sup>34</sup> Table 10 assumes a replication and scale-up factor of only 10 to 1 versus the 20 to 1 factor used in Table 5.

### Financing Plan

Source	Amount (US \$ million)
GoP	99
ADB	300
CTF (loan)	100
CTF (grant) <sup>a</sup>	5
<b>Total</b>	<b>504</b>
Carbon Finance <sup>b</sup>	0

<sup>a</sup> A CTF grant of \$1 million is requested for fine-tuning of technology options, technology transfer, local industry support and capacity building (implementation support, including monitoring and evaluation activities will be financed by the ADB loan).

<sup>b</sup> No provision has been made for the carbon finance risks associated with post-2012 uncertainties. Carbon finance is not expected to contribute to upfront project co-financing.

### Project Preparation Timetable

Milestone	Date
ADB Project Identification	May 2011
Appraisal / Negotiations	June 2012
ADB Board Consideration (Approval)	August 2012
Project Completion	August 2016

## Additional Notes on Battery Technology, Electricity Demand, GHG Calculations, and Electric Vehicle Eligibility for CTF

### Choice of Battery Technology and Disposal Implications

21. ADB's publication on electric bikes<sup>35</sup> identified lead (Pb) pollution as an inherent problem with electric vehicles and, as long as electric vehicles use lead acid batteries, the overall pollution loads will be several times higher than ICE. According to the United States Environmental Protection Agency, Li-ion batteries are not an environmental hazard<sup>36</sup>, and are safe for disposal in the normal municipal waste stream.<sup>37</sup> While other types of batteries include toxic metals such as cadmium, the metals in Lithium-ion batteries—cobalt, copper, nickel and iron—are considered safe for landfills or incinerators. Therefore, the e-Trikes will use Li-ion batteries at the outset; the battery leasing business model will allow for more advanced batteries to be supplied in the future.

### Net Impact on the Electricity Grid and GHG Reductions

22. Conversion from ICE to EEEVs will save energy, as the energy losses in ICE vehicles are typically 70–80% versus 5–15% in EEEVs. Additional electricity required for the EEEVs project will depend on the relative contribution of public charging stations used during peak time (6 MW of grid-connected charging stations, plus 1 MW of solar charging stations), and overnight home-based chargers (60 MW, off-peak). As both modes of charging will be implemented, and considering that overnight charging will provide night-time “valley filling” benefits, the incremental demand presented by the EEEVs project is expected to be less than 60 MW. A “maximum demand” case of 60 MW represents incremental power demand of about 0.37% of total installed generating capacity of 16,359 MW.<sup>38</sup> Total incremental energy demand due to the project is estimated at 150 GWh per year (assuming e-trike consumption of 5 kWh per day, 300 days per year operation, and fleet of 100,000 vehicles), which represents incremental

<sup>35</sup> ADB. 2009. *Electric bikes in the PRC: Impact on the Environment and Prospects for Growth*. Manila.

<sup>36</sup> <http://www.ehso.com/ehshome/batteries.php>

<sup>37</sup> <http://www.epa.gov/osw/hazard/wastetypes/universal/batteries.htm>

<sup>38</sup> Installed capacity is spread across 3 regional grids, as illustrated in the original CIP, Figure 11.

consumption of about 0.22% of reported generation output in 2010 and about 18.8 MW of equivalent baseload generation capacity. This additional demand on grid-supplied electricity is considered to be negligible.<sup>39</sup> Table A2.3 presents estimated changes in energy balance assuming the EEEVs and solar energy development projects are both implemented, along with other committed near-term RE development.

23. In the case of the Philippines, with a large share of RE in the generation mix, the GHG reductions and overall end-use EE gains will be quite significant. The GoP plans to establish solar charging stations wherever area and site access constraints do not exist, which will make the carbon footprint of these vehicles close to zero. Assuming consumption of 5 kWh per day and 300 days per year operation, an electric tricycle will use about 1.5 MWh of electricity per year, resulting in 780 kg CO<sub>2</sub>e per year using a grid emission factor of 0.52 tCO<sub>2</sub>e/MWh,<sup>40</sup> versus an equivalent ICE tricycle, which produces about 3.5 tons of CO<sub>2</sub> each for the same service delivery – more than a 70% GHG emissions reduction. This estimated GHG reduction is consistent with a recent study by MIT, which stated that accounting for the total energy consumed from well to wheel,<sup>41</sup> electric vehicles can reduce energy consumption by up to 50% and greenhouse gas emissions by up to 60% compared to ICE vehicles. The savings is in even more in congested urban areas, as the average speed is low (no electricity is used while stranded in traffic jams and these vehicles will not use any air conditioning). The energy losses in electric motors are less than ICE vehicles, and transmission and distribution of electricity is more efficient and cost effective than transportation of liquid fuels to the end user.

**Table A2.3: Capacity Balance for Vehicle Charging, Megawatts (MW)**

<b>Capacity Additions</b>	<b>MW</b>
Solar Charging Systems (5 x 200 kW stations )	1
New Rooftop PV and/or other solar energy installations	40
Near-term RE Power Additions (see Appendix 2, Table A2.2)	138.5
<b>Subtotal</b>	<b>179.5</b>
<b>Maximum Demand from EEEVs Project</b>	<b>60</b>
<b>Net Capacity Additions</b>	<b>119.5</b>

Source: ADB staff estimates

### **GHG Reduction Estimates**

24. ADB's carbon fund team has reviewed the proposed EEEVs project for potential CDM registration (independently of the ADB project team). As the pilot-tested EEEVs have reduced energy consumption as well as higher passenger capacity than conventional trikes, potential GHG reductions have been estimated on a per vehicle basis as well as a per passenger-kilometer basis. The range of estimates and assumptions are shown below in Table A2.4. As

<sup>39</sup> Considering that 1200 MW of coal-fired capacity is being developed in addition to the 138.5 MW of RE noted in Table 9, grid-supplied electricity would not be stressed even if replication and scale-up of 20:1 is achieved: deployment of 2 million e-trikes would result in electricity consumption of 3000 GWh per year, which would require about 375 MW of equivalent baseload capacity. Baseload capacity assumes 8000 hours per year generation output. See additional details in Appendix 2.

<sup>40</sup> The grid emissions factor of 0.52 tCO<sub>2</sub>e/MWh is consistent with 2010 generation output and various CDM projects, and is lower than equivalent emissions from gasoline-powered vehicles which would be 0.807 tCO<sub>2</sub>e/MWh for an ICE with 30% thermodynamic efficiency (see additional calculations and discussion in Appendix 2).

<sup>41</sup> Energy consumed and green house gases (GHGs) emitted from the time a vehicle's energy source leaves the well to the time it is consumed by the vehicle, details available at: [http://web.mit.edu/evt/summary\\_wtw.pdf](http://web.mit.edu/evt/summary_wtw.pdf)

noted in the main text, the base case with reductions on a per vehicle basis applied to 100,000 vehicles yields estimated GHG reductions of 0.27 million tCO<sub>2</sub>e per year. Table A2.4 also shows estimated reductions based on the 2010 generation output (“grid mix”), with an emissions factor of 0.52 tCO<sub>2</sub>e/MWh, and scenarios of 100% RE-based electricity and 100% coal-based electricity: net reductions are achieved in all scenarios. The grid emissions factor of 0.52 tCO<sub>2</sub>e/MWh is at the mid-range of emissions factors used for several recently registered Clean Development Mechanism (CDM) projects in the Philippines.<sup>42</sup>

**Table A2.4: Emissions Reduction Estimates (tCO<sub>2</sub>e/year)**

Case	Reduction on Per Vehicle basis	Total Reductions	Reduction on Per Passenger Basis	Total Reductions	Grid Mix
Optimistic	3.634	363,400	6.361	636,100	100% RE
Base	2.698	269,800	5.425	542,500	Current mix
Worst case	1.834	183,400	4.561	456,100	100% coal

Source: ADB carbon fund team

Assumptions:

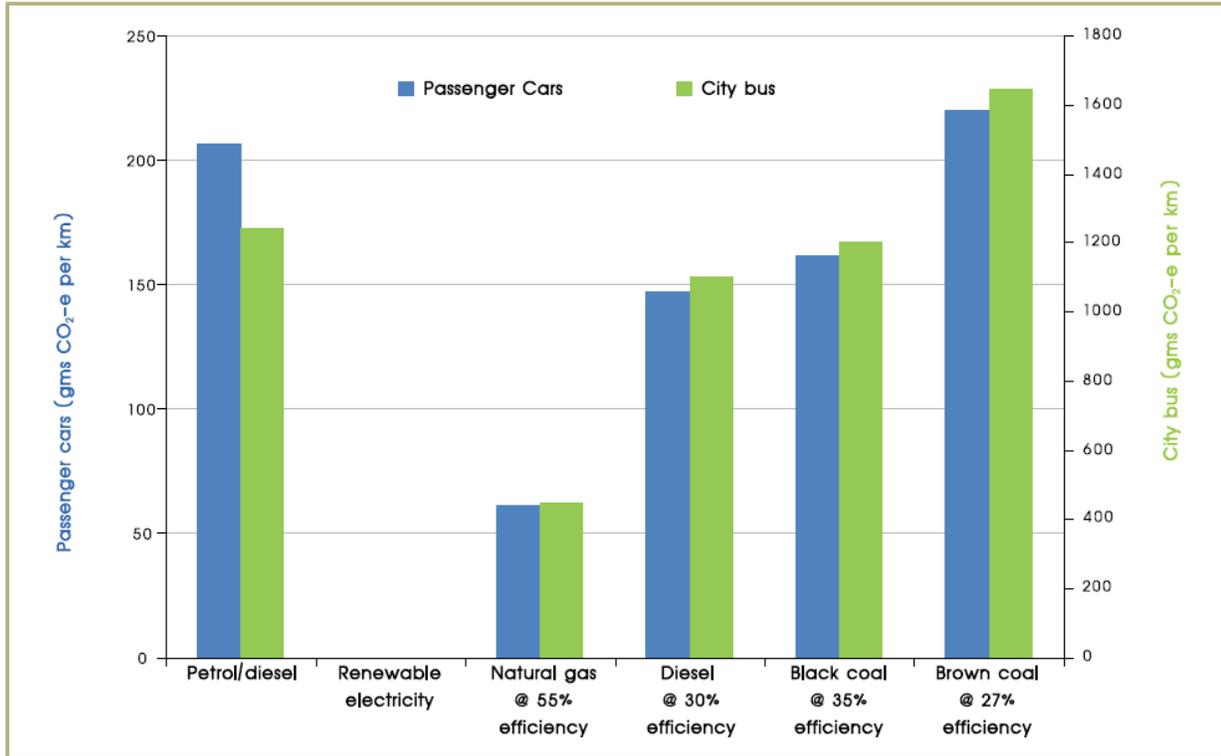
Vehicle operation / day	80	km / day
Passengers in the conventional vehicle	4	
Passengers in Etrike	7	
Vehicle mileage	15	km / lit
Vehicle operation	300	days / year
Etrike electricity consumption	6	kWh / day
Emission factor of grid	0.52	tCO <sub>2</sub> e / MWh
Emission factor of petrol	2.271793	kg CO <sub>2</sub> e / lit

25. The grid emissions scenarios shown in Table A2.4 are consistent with other analyses illustrated in Figure A2.1 below which shows the potential reductions of electric depending on the fuel used for grid-supplied electricity. [Note that Figure A2.1 is based on analysis of 4-wheel vehicles (cars and buses) and does not represent the local conditions in the Philippines.] Obviously, 100% RE-based vehicle charging provides the largest GHG reductions, and as noted above, the EEEVs project includes a component for prototype solar charging stations to demonstrate the technological viability and commercial potential of RE-based charging. In 2010, grid supplied electricity output was about 27% from geothermal, hydropower and other RE, and gas-fired power accounted for another 29% of output: the effective “all Philippines” grid emissions factor for 2010 is estimated to be 0.517 tCO<sub>2</sub>e/MWh, which is roughly equivalent to natural gas-fired electricity. According to the analysis shown in Figure A2.1, if “brown coal @ 27% efficiency” is used to provide the incremental power needed to charge the EEEVs, there would be no GHG reductions. However, Figure A2.1 is relevant for cars and buses in Europe, but does not provide an “apples to apples” comparison with local conditions in the Philippines. The existing 3-wheel vehicles in the Philippines have much higher emissions than that for cars and buses referenced in Figure A2.1. Also, emissions from EEEV charging are based on the Philippines grid mix because it is not possible to know precisely the source of incremental

<sup>42</sup> E.g., see Project Design Document for “ANAEROBIC DIGESTION SWINE WASTEWATER TREATMENT WITH ON-SITE POWER PROJECT (ADSW RP2024),” registered on 7 January 2011. The Project Design Document was accessed online on 14 November 2011 at: <http://cdm.unfccc.int/filestorage/S/2/Z/S2ZGB9RM5FO7D6W0E4PL3INVQCK8TH/2010.pdf?t=RFR8bHVvMXd5fDDh1GRICO3d4xwrYQ2HbisL>

electricity used for battery charging. Because charging times will vary and the marginal capacity on the grid changes with season and time of day, and also because the additional amount of electric generation required for the proposed EEEVs fleet is minimal (only 0.22% of 2010 generation output), using the average grid emission factor is the best approximation.

**Figure A2.1: Relative Greenhouse Gas Emissions for Petroleum vs. Electric Vehicles**



Source: United Nations Environment Programme, Risoë Centre, 2011. *Technologies for Climate Change Mitigation, Transport Sector*. TNA Guidebook Series. March 2011. Available online at: [http://tech-action.org/Guidebooks/TNA\\_Guidebook\\_MitigationTransport.pdf](http://tech-action.org/Guidebooks/TNA_Guidebook_MitigationTransport.pdf)  
Emissions are calculated using vehicle data cited for the Renault Fluence Z.E. and Tindo electric bus combined with fuel carbon intensities published in the Australian National Greenhouse Factors, July 2010, available at: <http://www.climatechange.gov.au/publications/greenhouse-acctg/national-greenhouse-factors.aspx>

### **Projected Changes in Grid Emissions Factors**

26. The Philippines Department of Energy *Power Development Plan 2009-2030* reports that near-term generation expansion comprises 1338 MW of committed capacity, of which 1200 MW is coal-fired, 70 MW is geothermal, 51 MW is hydropower, and 17.5 MW is biomass (see Table A2.5, below). Projecting beyond the current commitments is difficult, as the generation mix will be affected by the renewable portfolio standard and feed-in tariffs discussed in the main text. Table A2.6 presents grid emission factors for three expansion scenarios assuming (i) generation output for 2010 and (ii) current commitments shown in Table A2.5, (iii) a doubling of coal-fired capacity on top of 2010 generation output, and (iv) a 10-fold increase in coal-fired capacity on top of 2010 generation output. Of these 3 expansion scenarios, the first is considered to be firm, the second is considered to be plausible, and the third is considered to be unlikely. As noted in the main text, the incremental demand posed by 100,000 EEEVs is 0.22% of 2010 generation

output. Replication and scale up to 2 million EEEVs would represent 4.4% of 2010 generation output, but the actual share of future grid output would be lower given the programmed capacity additions.

27. The third scenario presented in Table A2.6 presents a grid emissions factor which is well below the calculated emissions factor for the current fleet of gasoline-powered tricycles (see further discussion below at paragraphs 27-31). Alternatively stated, with expansion of coal-fired power 10 times beyond current level, with no additional RE capacity additions, the grid supplied power would still be less carbon-intensive than the gasoline-fired ICE vehicles being replaced. This conclusion is consistent with independent estimates prepared by ADB's carbon fund team shown above in Table A2.4.

**Table A2.5: Near-term Generation Expansion**

Grid	Project Name	Capacity (MW)	Target Completion	Location	Proponent
Luzon	2x300MW Coal-Fired Power Plant	600	4th Qtr. Of 2012	Mariveles, Bataan	GN Power
	<b>Sub-total Luzon</b>	<b>600</b>			
Visayas	3x80MW CFB Power Plant Expansion Project	240	Unit I-March 2010 Unit II-June 2010 Unit III-Jan 2011	Brgy. Daanlungsod, Toledo City, Cebu	Cebu Energy Development Corporation (Global Business Power Corp.)
	2x100MW Cebu Coal-Fired Power Plant	200	Unit 1-Feb 2011 Unit 2-May 2011	Naga, Cebu	KEPCO SPC Power Corporation (KSPC)
	17.5MW Panay Biomass Power project	17.5	2011	Brgy. Cabalabaguan, Mina, Iloilo	Green Power Panay Phils., Inc.
	Nasulo Geothermal Plant	20	2011	Nasuji, Valencia, Negros oriental	Energy development Corporation
	2x80MW CFB Power Plant	160	Unit I-Sep 2010 Unit II-Dec 2010	Brgy. Ingore, La Paz, Iloilo	Panay Energy Development Corporation (Global Business Power Corp.)
<b>Sub-total Visayas</b>	<b>638</b>				
Mindanao	Sibulan Hydroelectric Power (Unit I-16.5MW) (Unit II-26MW)	43	Unit I-Feb 2010 Unit II-Apr 2010	Sta. Cruz, Davao del Sur	Hedcor Sibulan, Inc.
	Cabulig Mini-Hydro Power Plant	8	June 2011	Plaridel, Jasaan, Misamis oriental	Mindanao Energy Systems, Inc. (MINRGY)
	Mindanao 3 Geothermal	50	July 2014	Kidapawan, North Cotabato	Energy Development Corporation
	<b>Sub-total Mindanao</b>	<b>101</b>			
<b>Total Philippines</b>	<b>1,338</b>				

Note: Mindanao 3 Geothermal Plant was moved to 2014 from its original target year of 2010

Source: Philippines Department of Energy, *Power Development Plan 2009-2030*; Table 4.

**Table A2.6: Grid Emissions Factor Scenarios**

Source	Output in GWH	% of grid mix	Emissions Factor (t/MWh)	Total Emissions (t/y)
<b>Base Case: generation output in 2010</b>				
Oil-based	7101	10%	0.6	4260600
Hydro	7803	12%	0	0
Geothermal	9929	15%	0	0
Other RE	90	0%	0	0
Coal	23301	34%	0.9	20970900
Natural gas	19518	29%	0.5	9759000
<b>Total</b>	<b>67742</b>	<b>100%</b>	<b>0.517</b>	<b>34990500</b>

<b>Expansion Scenario 1: Current Generation Expansion shown in Table A1.2; no other renewable energy is added. Grid factor increases to 0.553 tCO<sub>2</sub>e/MWh.</b>				
Source	Output in GWH	% of grid mix	Emissions Factor (t/MWh)	Total Emissions (t/y)
Oil-based	7101	9%	0.6	4260600
Hydro	8026	10%	0	0
Geothermal	10420	14%	0	0
Other RE	213	0.3%	0	0
Coal	31711	41%	0.9	28539900
Natural gas	19518	25%	0.5	9759000
Total	76989	100%	0.553	42559500
<b>Expansion Scenario 2: Coal output expanded by 2x; all others fixed at 2010 output. Grid emissions factor would be slightly higher than gasoline emissions factor @ 40% thermodynamic efficiency of 0.605 tCO<sub>2</sub>e/MWh.</b>				
Source	Output in GWH	% of grid mix	Emissions Factor (t/MWh)	Total Emissions (t/y)
Oil-based	7101	8%	0.6	4260600
Hydro	7803	9%	0	0
Geothermal	9929	11%	0	0
Other RE	90	0%	0	0
Coal	46602	51%	0.9	41941800
Natural gas	19518	21%	0.5	9759000
Total	91043	100%	0.615	55961400
<b>Expansion Scenario 3: Coal output expanded by 10x; all others fixed at 2010 output. Grid emissions factor would approximately equal gasoline emissions factor @ 30% thermodynamic efficiency of 0.807 tCO<sub>2</sub>e/MWh.</b>				
Source	Output in GWH	% of grid mix	Emissions Factor (t/MWh)	Total Emissions (t/y)
Oil-based	7101	3%	0.6	4260600
Hydro	7803	3%	0	0
Geothermal	9929	4%	0	0
Other RE	90	0%	0	0
Coal	233010	84%	0.9	209709000
Natural gas	19518	7%	0.5	9759000
Total	277451	100%	0.806	223728600

Source: ADB staff estimates, based on Philippine Power Statistics, 2010.

Note: Estimates of generation output assume that the additional biomass, coal, and geothermal run at 80% output; and that additional hydropower runs at 50% output.

### **Comparison of ICE Emissions vs. Grid Emissions Factors**

28. As noted in the main text, conversion from ICE to EEEVs will save energy, as the energy losses in ICE vehicles are typically 70–80% versus 5–15% in EEEVs. A brief discussion follows to illustrate how current ICE efficiencies compare to the emissions scenarios presented in Table A2.3, and whether improvements in ICE efficiencies and sustainable renewable fuels could achieve the same GHG reductions envisioned in the proposed EEEVs project.

29. The energy and CO<sub>2</sub> content of gasoline expressed in terms of carbon intensity, analogous to a grid emissions factor, is calculated as follows:

Gross energy content of gasoline: 34.2 Megajoule (MJ) / liter (L)

Converted to kWh: 34.2 MJ / L x (1 kWh / 3.6 MJ) = 9.5 kWh / L

Theoretical Carbon intensity: (2.3 kg CO<sub>2</sub>e / L) / (9.5 kWh / L) = 0.2421 kg CO<sub>2</sub>e / kWh

30. This theoretical carbon intensity of gasoline, which assumes 100% thermodynamic efficiency, is much lower than the grid emissions factor estimated for 2010 generation output (the Base Case shown in Table A2.5 and Table A2.6). In practice, thermodynamic efficiencies of motorcycle/tricycle engines are probably on the order of 20%. Automobiles with internal combustion engines have typical efficiencies of about 25%. The Toyota Prius equipped with an Atkinson cycle engine has efficiency of 34% at peak power output of 52 kW.<sup>43</sup> Table A2.7 shows these efficiencies in terms of carbon intensity, compared with the emissions scenarios shown in Table A2.6.

**Table A2.7: ICE Efficiencies vs. Grid Emissions Scenarios**

Vehicle / ICE Efficiency	Carbon Intensity	Comparison to Emissions Scenarios in Table A2.6
3- and 2-wheelers / 20%	(0.2421 kg CO <sub>2</sub> e / kWh) / 0.2 = <b>1.21 kg CO<sub>2</sub>e / kWh</b>	More than 2.3 times as “dirty” as current grid mix and about 50% “dirtier” than Scenario 3.
Light duty vehicle / 25%	(0.2421 kg CO <sub>2</sub> e / kWh) / 0.25 = <b>0.97 kg CO<sub>2</sub>e / kWh</b>	“Dirtier” than Scenario 3. <i>Roughly equivalent to 100% coal-fired electricity.</i>
Toyota Prius / 34%	(0.2421 kg CO <sub>2</sub> e / kWh) / 0.34 = <b>0.712 kg CO<sub>2</sub>e / kWh</b>	The Prius engine is “dirtier” than the 2010 grid mix and Scenarios 1 and 2, but cleaner than Scenario 3.

Source: ADB staff estimates

31. An ICE would need to achieve 47% efficiency to have an emissions factor equivalent to the 2010 grid mix, calculated as follows:

$$(0.2421 \text{ kg CO}_2\text{e} / \text{kWh}) / (0.517 \text{ kg CO}_2 \text{ e} / \text{kWh}) = 47\%$$

32. This calculation shows that the current trikes would require upgrading to or replacement with ICEs with 47% efficiency to achieve the same emissions reductions expected from the proposed EEEVs project. **However, after more than 100 years of ICE technology development, there is no engine on the market with 47% efficiency that could be deployed at scale.** Further, the current push by the world’s major automobile manufacturers towards EEEVs suggests that there is no expectation of such an efficiency breakthrough in the near future. If such a breakthrough does occur, a converted fleet would need to be powered by sustainable renewable fuels in order to achieve the GHG reductions and the non-climate benefits associated with EEEVs.

### **Electric Vehicle Eligibility**

33. CTF guidance acknowledges the realities of building 100% RE-based charging infrastructure in advance of electric vehicle (EV) deployment: EVs are being marketed worldwide in advance of RE-based charging networks, and there is no country pursuing a 100% RE-based charging objective at present. Therefore, **CTF guidance does not require that EVs**

<sup>43</sup> Source: David J.C. MacKay. 2009. *Sustainable Energy Without the Hot Air*,” page 262. Available on line at: [www.withouthotair.com](http://www.withouthotair.com).

**be powered with RE.** The CTF Investment Criteria for Public Sector Operations, 9 February 2009; footnote 6 to paragraph 6 (b) (iv) states:

“Plug-in electric vehicles would be considered only when the energy systems from which they draw the power are less carbon intensive than the emissions from a stand-alone electric hybrid.”

34. In this case, the pilot-tested e-trikes are considered to be “plug-in electric vehicles.” However, to the best of ADB and GoP knowledge, “stand-alone electric hybrid” trikes or motorcycles have not been marketed and pilot-tested, so an “apples-to-apples” comparison is not possible. The calculations presented above are intended to demonstrate that the EEEVs project meets the CTF eligibility criteria. Until a stand-alone electric hybrid 3-wheeler appears on the market so that an apples-to-apples comparison can be made, the foregoing calculations and discussions indicate that the proposed EEEVs project meets the CTF eligibility requirement.

### Appendix 3: Solar Energy Development (ADB)

1. The rooftop solar project concept presented in the original CIP is being retained, but given the rapidly changing landscape for solar PV development, the detailed scope remains to be identified and developed. GoP is requesting to reallocate \$20 million of CTF cofinancing to support total investment of \$120 million, which would finance an estimated 40 MW of new solar PV and/or other RE capacity.

#### Problem Statement

2. In keeping with the long-term objectives for energy security and economic development, GoP is committed to developing indigenous RE resources in a manner which protects consumer interests. RE development typically entails higher up-front capital costs, but lower operating and maintenance costs, and in most cases zero fuel costs (which is the case for solar power).<sup>44</sup> The incremental upfront costs may be thought of as advance payments for renewable “fuel”, which are amortized and depreciated over the lifetime of RE systems [alternatively stated, the fuel may be free, but the conversion to useful energy is not]. Policy support via FITs is designed to eliminate the upfront cost barrier, but in the absence of an operational FIT and RPS, there is a need for concessional financing to support RE development.

3. New RE development has been because feed-in tariffs (FITs) were approved much later than expected (on 27 July 2012), and other regulations pursuant to the Renewable Energy Act of 2008 have not been finalized, and may not be in place for some time. Private sector developers are keen to take advantage of the FIT regime, but new investment is in suspense because the RE regulatory framework is not final. This uncertainty is compounded by consumer concerns that the cost of the FITs will ultimately result in higher retail electricity tariffs, which average around US\$0.20 / kWh -- the highest in Asia. This is of specific concern to public transport operators who are being encouraged to adopt EEEVs to replace conventional ICE vehicles. At the macro-economic level, the cost of the FIT program will be offset by avoided costs of imported fuels for power generation, but the economic benefits cannot be readily monetized and passed on directly to consumers.

4. The proposed FIT support will be limited to only 50 MW of ground-mounted solar installations, but the potential envisioned in the low-carbon development scenario is 2000 MW<sup>45</sup>. Solar PV systems have good load-following generation output, which reduces stress on the grid during afternoon demand peak. Space for ground-mounted solar power plants in Manila and other cities is limited or non-existent; the obvious prospect for urban area solar PV development is in rooftop installations.

5. Rapidly declining costs for solar PV systems suggest that policy support may not be necessary for commercial development. However, the market reality is that private investors are reluctant to move forward on new investments until the RE regulatory framework is finalized, especially the RPS and net metering provisions. In the absence of this policy support, purely voluntary solar PV investment will require concessional financing.

6. Against this policy and regulatory backdrop, ADB has supported 2 noteworthy solar energy projects. In June 2012, ADB commissioned a 570 kW rooftop solar PV system at its Manila headquarters which is the largest PV project in the Philippines to date. The installed

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<sup>44</sup> An exception is biomass power, where feedstock is normally not free.

<sup>45</sup> See original CIP, Figure 8 and Table 2.

cost is well below that noted in the CIP in 2009, suggesting that there is scope for rooftop solar PV development outside the envelope of the FIT (which is limited to ground-mounted installations). [This rooftop solar project has been implemented in parallel with an expansion of ADB headquarters, which has been designed to achieve state-of-the-art green building certification.] Earlier in 2012, ADB supported the Boni Tunnel lighting project to demonstrate the feasibility of solar PV and lithium-ion battery technology for large-scale street lighting applications. This project comprises 59 square meters of solar panels which provide power to 94 light-emitting diodes (LEDs) with 22-watt capacity each. This project provides about 19% of the tunnel power demand, but achieves 51% energy savings compared to the old lighting system. These projects are demonstrating the technological viability of solar PV and aiding in price discovery.

7. The technical benefits of rooftop solar PV are substantial: (i) the system generates power at the point of consumption, reducing the need for centralized generation and avoiding the transmission losses associated with centralized generating plants; (ii) solar PV has reasonably good load-following characteristics, generating maximum power output at times of peak demand in buildings (mainly for space cooling); and (iii) with eventual implementation of net metering, building owners will be motivated to implement EE measures to maximum net electricity sales to the grid. In theory, carbon finance and/or a FIT could monetize these technical benefits, but the proposed solar FIT will be limited to ground-mounted installations, and carbon finance is not readily delivered as upfront project cofinancing. In the current regulatory environment, the financial viability of rooftop solar will be dependent on savings associated with avoided costs of grid-supplied power, rather than revenue from sale of electricity. Therefore, some other form of concessional finance is needed to facilitate investment at the scale required for market transformation. [A key lesson learned from the ADB rooftop and Boni Tunnel projects is that for large buildings and facilities like the Boni Tunnel, the space available for solar arrays results in solar power output below the total demand of the building or facility. For these types of installations it is not clear that net metering will provide a meaningful contribution to financial viability (although the economic benefits via avoided fossil fuel consumption are obvious). Net metering should provide a more meaningful incentive for private residential buildings, where available rooftop area may be sufficient to cover most of the demand (from lighting, refrigeration, TVs, and space cooling).]

### Proposed Transformation

8. The legal framework and the economic incentives provided by high energy cost have not been sufficient for adoption of clean energy and energy efficiency by ordinary citizens and businesses. The proposed project will incorporate lessons learned the Philippine Energy Efficiency Project and other initiatives, in particular: (i) *economy of scale through* bulk procurement of at least 40 MW of new solar PV systems; and (ii) *improve technology credibility* through actual operations of rooftop systems at ADB headquarters and the Boni Tunnel lighting system.

9. The Philippines Renewable Energy Law with its RPS and Feed-in Tariffs with net metering<sup>46</sup> is a pioneering framework for the entire ASEAN region. This Law also provides for establishing a voluntary market for Renewable Energy Certificates. These provisions will not bring any fruit without appropriate investments in the sector. ADB will support this market

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<sup>46</sup> "Net Metering" refers to a system, appropriate for distributed generation, in which a distribution grid user has a two-way connection to the grid and is only charged for his net electricity consumption and is credited for any overall contribution to the electricity grid; (Source: Section 4 (gg), Philippine Renewable Energy Act of 2008 )

creation opportunity with a Government-led project that will quantify the benefits of solar technology to consumers, establish product quality benchmarks in the market and develop secondary supply and maintenance chains. Currently the specialized electronic meters (that can record electricity flow in both directions) and solar panel are not readily available in the retail market in the Philippines, and are controlled by a small number of technology vendors and service providers. A large scale project will bring in more players and choices to the market and improve sector efficiency.

10. CTF resources are proposed to enhance the investment project design as follows:
  - CTF investments will bring down the cost of these technically proven projects through bulk procurement and public awareness “packaging” (described above) to be financially and technically viable in the Philippines, reduce pay-back period for the customers, and increase credibility of the technology by maintaining (or improving) standards and providing direct incentives to try the new technology
  - CTF resources will cover part of the additional up-front costs of solar PV [details to be determined]. Financing instruments such as partial credit guarantees, contingent financing, and other output-based assistance will be evaluated during project design to determine an optimum use of CTF cofinancing. Different business models will also be considered, e.g., rent-to-own and other supplier credit approaches, and virtual rooftop projects where poorer communities build a common ground-mounted PV facility to avoid rooftop load structural limitations of residential buildings.
  - CTF resources will improve the “depth” of the ADB project by increasing the economies of scale and scope for high-cost investments, which will shorten the pay-back period and increase the financial rates of return.
  - The proposed market transformation initiative would cover at least 40 MW of new capacity installed at commercial, government offices, and/or large residences. It will encourage other building owners and electricity customers to switch, as the market transforms and the prices fall. The replication potential is at least 10 to 1, which is quite conservative considering the low-carbon development scenario of 2000 MW solar capacity by 2030.

### **Implementation Readiness**

11. The implementation of the project will be led by DOE in partnership with other stakeholders including private sector investors, and local government units as appropriate. DOE has sufficient expertise to manage the ADB investment project, and project management support will be included in the scope, including capacity building for participating financial institutions and service companies. The project is at the identification stage and is expected to be prepared and presented for ADB Board consideration in 2013.

### **Rationale for CTF Financing**

12. Solar energy development is constrained by several factors:
  - Accelerated introduction of solar energy systems will increase Philippines’s energy security, save foreign exchange, and protect against global price fluctuations by using non-tradable domestic energy sources, but these economic advantages cannot be readily monetized to support investment in solar energy projects.

- Although the installed cost of solar PV systems has rapidly declined in the past 2-3 years, and is projected to continue declining, the capital cost of rooftop PV remains a barrier in the absence of net metering or other policy support. Creative financing approaches, including the use of concessional funds, are needed to cover additional up-front capital costs to consumers.
- Management and technical expertise to identify and implement rooftop solar opportunities is limited in the Philippines.
- Perceived financial risk, i.e., payback periods on large capital investments may be in the range of 7-8 years or longer versus less than 3 years desired by building and plant owners.
- Commercial financing for candidate investments is not readily available, and as such private developers are unable to finance solar energy projects.
- The investment project to be supported by CTF is replicable and scale-able without long-term concessional financing. As the more building owners' enterprises gain comparative advantage, intra-sector competition will help drive replication. Commercial financing of solar energy will also increase as banks and other financial institutions gain experience on the CTF-supported project, and as government-sponsored RE funds are replenished through taxation mechanisms.

13. At least 40 MW of rooftop solar PV operating at 15% load factor will deliver net reduction of about 0.03 million tCO<sub>2</sub>e per year assuming grid emissions factor of 0.52 tCO<sub>2</sub>e/MWh. With 15 year lifetime total GHG reductions are about 0.4 million tCO<sub>2</sub>e. Replication and scale-up potential is at least 10 to 1. The cost-effectiveness is calculated as follows: CTF\$20 million / 0.4 tCO<sub>2</sub>e = CTF\$49 / tCO<sub>2</sub>e, declining to CTF\$4.87 / tCO<sub>2</sub>e with replication and scale-up of 10 to 1.

14. The indicative financing plan and preparation timeline are shown below.

### Financing Plan

Source	Amount (US \$ million)
GoP	20
ADB	80
CTF	20
<b>Total</b>	<b>120</b>
Carbon Finance <sup>a</sup>	n/a

<sup>a</sup> Carbon finance estimate is not expected to provide upfront project cofinancing.

### Project Preparation Timetable

Milestone	Date
ADB Project Identification	Q3 / 2012
Appraisal / Negotiations	Q2 / 2013
ADB Board Consideration (Approval)	Q3 / 2013
Project Completion	Q3 / 2016

Q2=second quarter, Q3=third quarter