CLEAN TECHNOLOGY FUND
UPDATE
OF
INVESTMENT PLAN FOR THE PHILIPPINES

December 2011

ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
BRT	Bus Rapid Transit
CIP	CTF Country Investment Plan
CTF	Clean Technology Fund
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
$MtCO_2e$	Million tons of carbon dioxide equivalent
RE	Renewable Energy
WBG	World Bank Group

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EXECUTIVE SUMMARY

The Government of Philippines (GoP) proposes to reallocate resources in the Clean Technology Fund (CTF) Country Investment Plan (CIP) which was endorsed by the Trust Fund Committee (TFC) in December 2009.

The Philippine Energy Reform Agenda has three pillars: (i) ensuring energy security, (ii) achieving optimal energy prices, and (iii) developing sustainable energy systems. Consistent with this reform agenda, the proposed changes to the CIP will attain timely use of CTF resources through reallocation of previously endorsed funds for renewable energy (net metering with rooftop solar) to energy efficiency via deployment of more efficient domestic appliances and energy efficient electric vehicles (EEEVs).

Philippine consumers pay one of the highest electricity tariffs in the world. As there are no subsidies for the generation sector, consumers and policy makers are rightfully concerned about further electricity price increases. At the same time, the feed-in tariff proposed by the electricity regulator has created large interest from the private sector for new investment, especially in solar and wind energy. In this context, the government has decided not to "crowd out" this significant private sector interest, which would be the case if the net metering project proposed in the original CIP were pursued. A project to finance roof-top solar power with net metering still remains a priority project but is not the highest priority at this stage. The Government plans to pursue this project at a later date once the price incentives are in place, with approved feed-in tariffs and established portfolio standards for each of the renewable energy technologies. At that time, if the sector requires public sector financing for market transformation, concessional resources may be sought to facilitate market penetration and transformation.

Since the original CIP was endorsed in December 2009, the GoP strategy has evolved to increase investment in end-use energy efficiency via public-led investment, as the highest priority project for market transformation. As a net importer of energy, the shift in priority for CTF funding will improve energy security caused by rising global concern over heightened competition for depleting energy resources and greater price volatility.

The overall context and objectives of the CIP remain unchanged. No changes have been proposed to the CTF allocation for the World Bank Group (WBG) projects and programs. The proposed change will reallocate funds for public sector investments led by Asian Development Bank (ADB) to include energy efficiency (EE) and cleaner transport investments, consistent with the long-term objectives of the original CIP. Table ES1 summarizes the indicative financing plan as endorsed in December 2009. Table ES2 presents the indicative financing plan after the proposed reallocations.

The overall context and objectives of the CIP are the same as the original CIP. The change in proposed ADB projects will achieve a better balance between supply and demand side investments without crowding out private sector investment in renewable energy and without compromising the Philippines energy reform objectives for 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.

This document has been revised considering CTF Trust Fund Committee discussion on 4 November 2011 and subsequent written comments. Additional project-specific considerations

will be addressed when specific projects reach the appraisal stage and are presented for funding approval by the Trust Fund Committee.

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
Total	**1,505**	**350**	**925**	**2,780**

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 Appliances (ADB)	Energy Efficient Electric Vehicles (ADB)	Total
CTF	75	50	24	101[a]	250
GoP / DBP	180	50	46	99	375
IBRD Loans	250	180	0	0	430
IFC Loans	250	0	0	0	250
ADB Loans	0	0	100	300	400
Private sector	750	0	(tbd) [b]	(tbd) [b]	750
Other cofinancing	0	20	0	0	20
Total	**1,505**	**300**	**170**	**500**	**2,475**

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, RE=renewable energy, (tbd)=to be determinedWBG=World Bank Group

Notes:

[a] 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).

[b] 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 EE appliances project has yet to be determined.

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 proposed change will reallocate funds for public sector investments led by Asian Development Bank (ADB) in net metering with solar power generation to include energy efficiency (EE) investments in public vehicles and domestic appliances. This change in investments is consistent with the long-term objectives of the original CIP. The overall context and objectives of the CIP are the same as the original CIP. The updated CIP 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 allocation for the International Bank for Reconstruction and Development (IBRD) and International Finance Corporation (IFC) and the IFC-led investment programs. Therefore, this document primarily covers the proposed changes and program to be implemented by the Asian Development Bank (ADB), and is organized as follows:

- Section II -- Review of the status of the 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 through the Ministry of Finance's letter dated 4 October 2011 to the CTF Trust Fund Committee; and
- Section V -- Assessment of the potential impact of the proposed changes on achieving the objectives and targets of the original investment plan.

II. STATUS OF ORIGINAL INVESTMENT PLAN IMPLEMENTATION

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

Table 1: Processing Status of IBRD and IFC Investment Programs

Project	TFC Approval Date	CTF Amount ($ million)	Leveraged Funding ($ million)
IFC RE Accelerator Program	September 2010	20	330
IFC Sustainable Energy Finance Program	February 2011	10	209
IBRD RE/EE Project	May 2012	45	200
IBRD Urban Transport (BRT)	June 2012	50	250

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. 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. Project appraisal is targeted for May 2012 and presentation to the IBRD Board is scheduled for October 2012.

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 bus rapid transit (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 demonstration project in Cebu City, from which lessons learned and institutional structures derived would be applied to the second phase, 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_2e 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_2e 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 1 is critical to expanding the scope to Phase ii. However, in addition to CO_2e emissions reductions, it is expected that Phase I demonstration project would have considerable impact on improving access to the poor, providing a 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	90	90
Clean Technology Fund	50	25	25
Agence Française de Développement	0	20	*tbd*
Total	**350**	**150**	**150**

Source: IBRD

13. Overall progress is shown above in Table 1. Project preparation work is proceeding well and three missions have been undertaken since April 2011. The Government has made a formal request for project preparation funds from the CTF. Appraisal of the project is targeted for June 2012 and presentation to the Bank's Board for November 2012.

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 (PSEFP)

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 UPDATE

17. The overall rationale for CTF intervention in the energy and transport sectors remains unchanged. GoP has requested that the ADB allocation be revised to accommodate 2 projects, instead of the single intervention proposed in the original CIP. Major changes in circumstances since 2009 are as follows:

(i) The specific rules for the Renewable Portfolio Standard (RPS), feed-in tariffs, and net metering have yet to be finalized and become fully effective. GoP is fully committed to the RPS, FIT, and net metering programs; finalization of the implementing rules is expected sometime in 2012.
(ii) The Philippines Department of Energy has proposed that the RPS for solar power will be 50 MW over a 3-year period, limited to ground-mounted installations.[1] The proposed feed-in tariff has attracted initial private sector interest for several times this capacity, obviating the need for concessional financing for solar power in the near term.
(iii) Increases in fossil fuel prices since 2009 point to the need for additional investments in energy end-use efficiency, including in the efficient energy use by the transport sector.
(iv) A successful pilot test of energy efficient electric vehicles (EEEVs)[2] conducted with ADB support is ready for scale up.

18. Based on circumstances (i) and (ii), the net metering project using distributed solar power proposed in the original CIP is not yet ready for implementation, and given private sector interest under the proposed FIT and RPS it is not obvious that concessional finance is needed in the near term for the net metering program (or for other utility-scale solar power projects). Based on circumstances (iii) and (iv), GoP believes that concessional financing could be better utilized in the near term to begin converting the public vehicle fleet to electric vehicles. Introduction of electric and hybrid vehicles is being complemented by other alternative and

[1] Philippines Department of Energy, Resolution dated 28 June 2011.
[2] The vehicles are motorcycles with side cars which provide taxi services, known locally as “tricycles”; this tricycle design is 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.

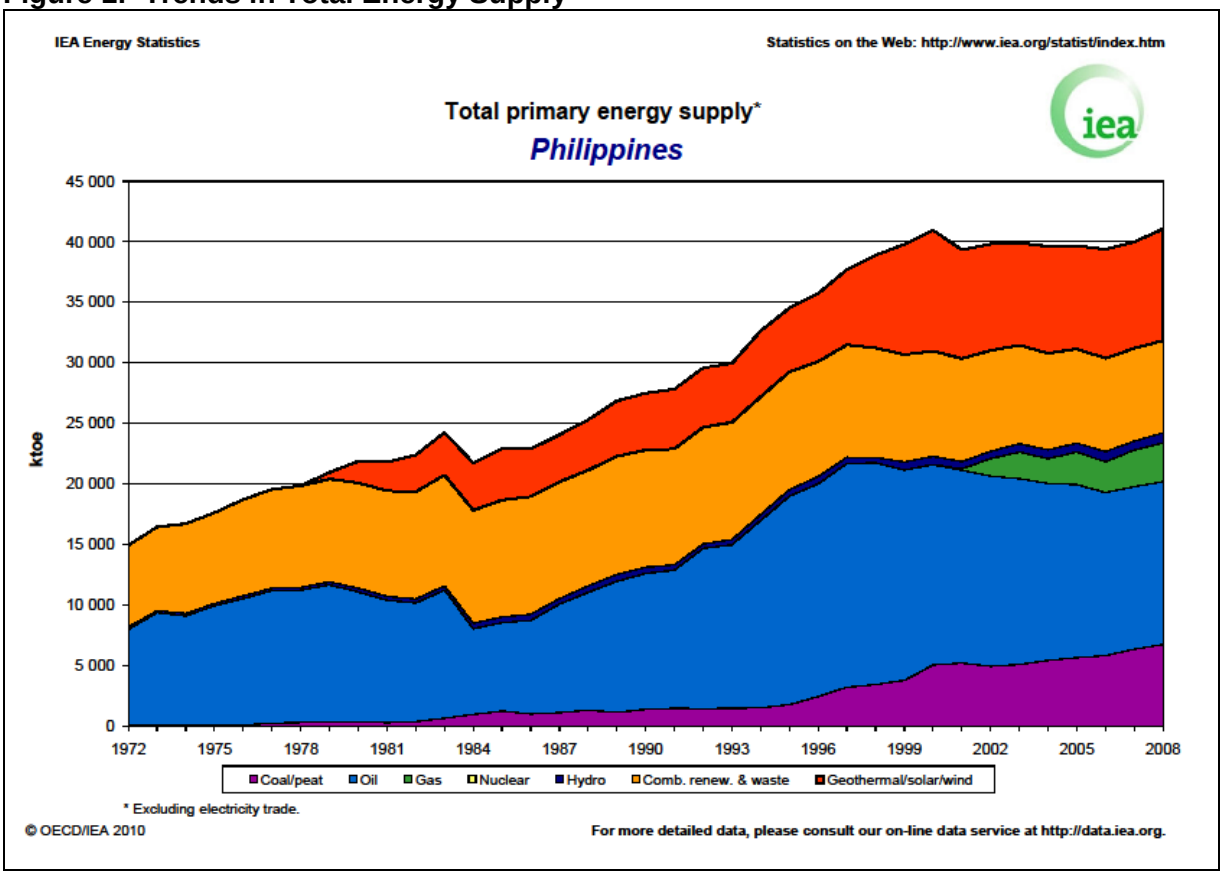
cleaner fuel development including domestic production of renewable diesel and ethanol to meet mandated blending requirements.

19. Given the need for convergence between climate change and energy security objectives, GoP has requested to shift the original $125 million of CTF resources slated for the net metering project, and re-direct $24 million to investments in energy efficient appliances and $101 million to the EEEVs project. The prospective investments are appropriate for CTF support given their transformational nature and the replication and scale-up potential. The shift toward demand-side investments from the original net metering project—which combines supply- and demand-side aspects—is fully consistent with GoP energy and transport policies. The proposed projects are discussed in more detail below and in Appendices 1 and 2.

Addressing Energy Security and the Philippines Energy Roadmap

20. GoP is committed to reducing energy intensity and greenhouse gas (GHG) reductions through a comprehensive policy framework as described in the original CIP. Figure 1 illustrates trends in total primary energy supply, indicating that coal and natural gas have displaced oil for power generation, while the share of renewables has not increased substantially during the past several years. The trend of increasing coal use is of particular concern with respect to energy security and GHG emissions. The IBRD and IFC programs (noted above in Section II) will continue to focus on RE and EE investments which are intended to reduce demand, add clean generation capacity, and offset future fossil power capacity additions.

Figure 1: Trends in Total Energy Supply

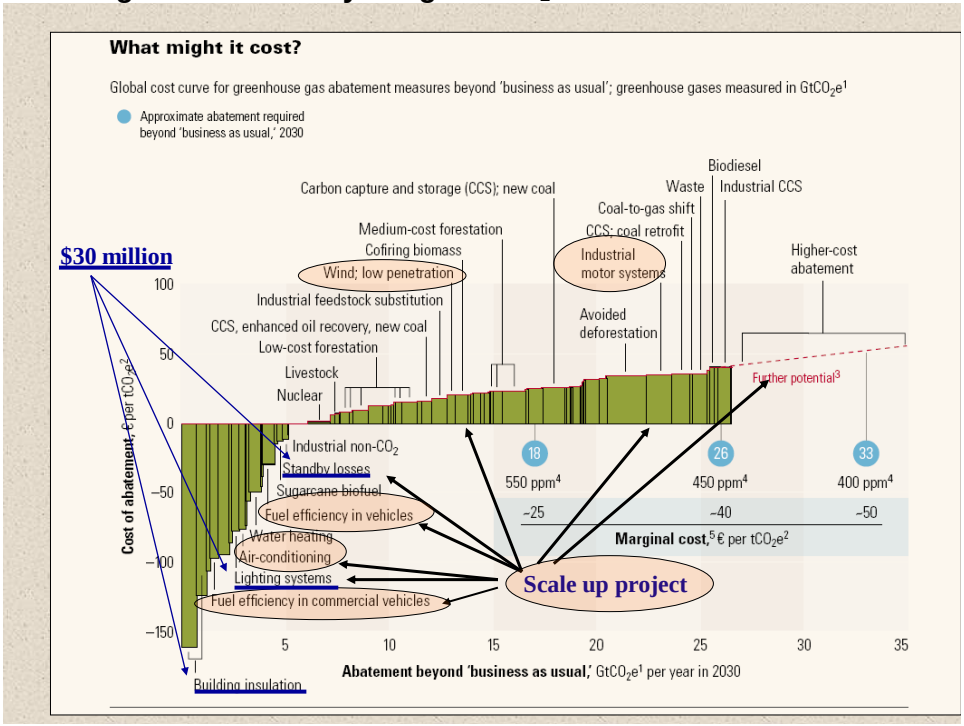


Source: IEA, accessed on 11 August 2011 from: http://www.iea.org/stats/pdf_graphs/PHTPES.pdf

21. In 2010, the Philippines spent approximately $8.78 billion[3] on imported oil–39% more than in 2009, about 66% of which was used by the transport sector. With growing population and urbanization, the cost of fuel imports is likely to grow by multiple times in the next 10-15 years. GoP plans to improve energy security—a national priority—with EEEVs, RE, and other EE investments.

22. Based on the McKinsey marginal abatement cost curve (Figure 2) and a study by ADB (Figure 3), GoP developed the investment strategy for the energy sector as shown in Figure 4, where $250 million was to be financed by the CTF. Energy efficient vehicles, although a GoP priority, were not part of the original CIP prepared in 2009 as no project or program had been formulated at that time. GoP proposes to change the prioritization considering the changed circumstances in relation to increased private investor interest in RE generation projects, consumers' concern on potential impacts of feed-in tariff, and prospect of higher electricity tariffs.

Figure 2: McKinsey Marginal CO_2 Abatement Cost Curve



23. The government's priority projects are illustrated in Figure 4, below. 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.

[3] Source: Department of Energy, available at: http://www.doe.gov.ph/DO/Report2010.htm

Figure 3: Philippines Marginal CO_2 Abatement Cost Curve

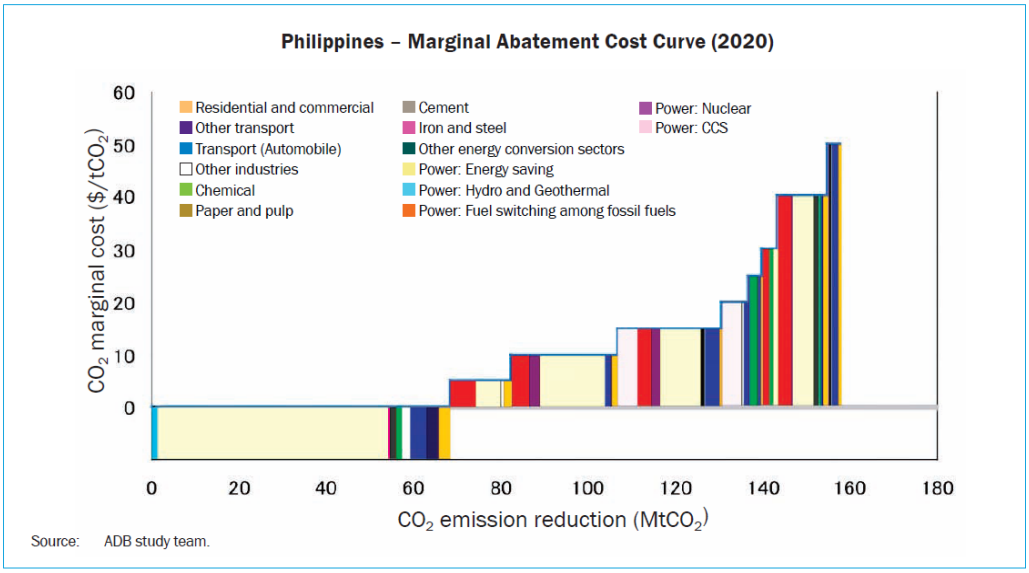
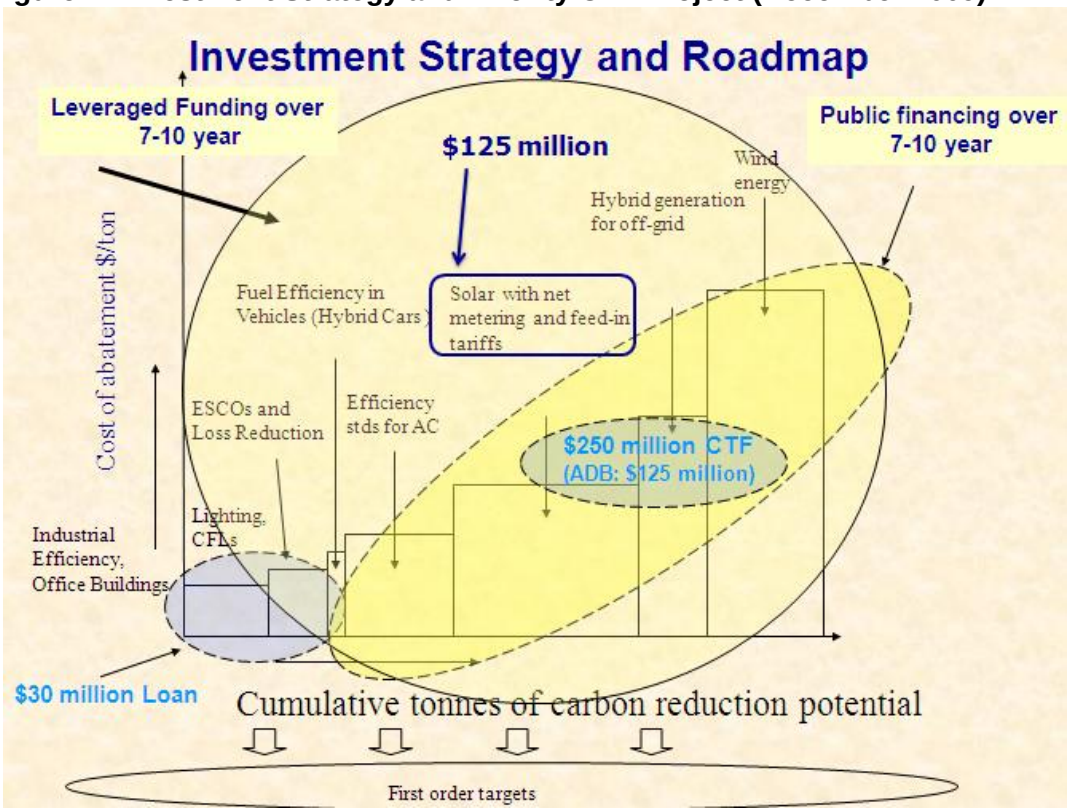


Figure 4: Investment Strategy and Priority CTF Project (December 2009)

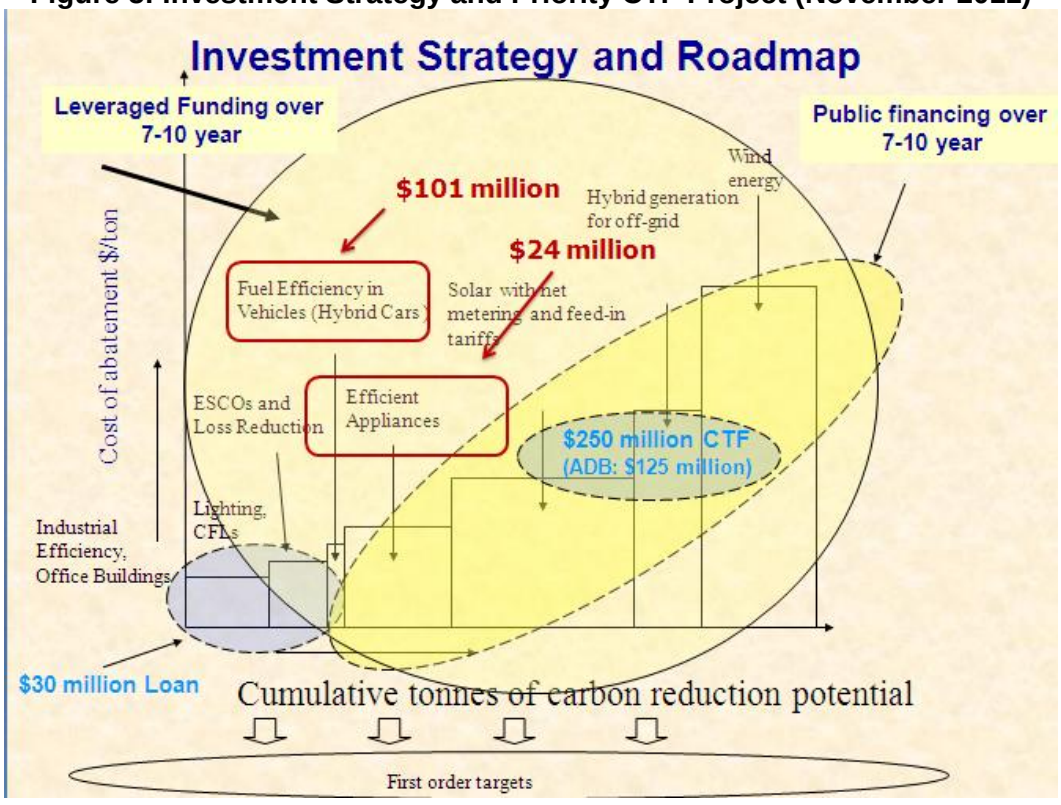


24. ***The GoP remains fully committed to its development policy framework for energy security, climate change, environmental management, and public health.*** The general

approach and overall objectives for low-carbon development presented in the original CIP remain the same. GoP is committed to reducing energy intensity and greenhouse gas (GHG) reductions through a comprehensive policy framework as described in the original CIP. The energy and transport policy frameworks discussed in the original CIP remain in effect. 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 the same.

25. ***The strategic rationale for CTF intervention in the energy and transport sectors remains unchanged.*** 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, and wind—with estimated total potential of about 7400 MW, of which about 60% 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 very high start-up costs; solar and waste-to-energy are not expected to contribute at the gigawatt scale in the foreseeable future. Therefore, investments in more efficient appliances and energy efficient transport systems are critical in the near to medium term. Figure 5 illustrates the proposed reallocation of CTF funding to EEEVs and energy efficient appliances which are discussed in more detail below. Comparison of Figures 4 and 5 clearly shows that the underlying clean energy and cleaner transport strategies have not changed.

Figure 5: Investment Strategy and Priority CTF Project (November 2011)



Status of Renewable Energy and Energy Efficiency Development

26. The Philippines RE potential is high, but new investment has been limited during the last several years relative to the potential (except in wind energy). The estimated RE potential is 2,000 megawatts (MW) for biomass; 3,400 MW for hydropower, of which 1,700 MW is small hydro; 1,070 MW for geothermal; and 500 MW for wind, as well as large potential for solar.[4] To catalyze investment in RE, the government approved the Renewable Energy Law in 2009. The Renewable Energy Law mandates a universal charge on all customers to finance the proposed incentives for renewable energy, especially the proposed feed-in tariff.[5] The potential increase in 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.

27. With the region's highest retail electricity tariffs, the Philippines should be the one of the most attractive places for investments in EE. The high electricity prices provide excellent incentives to undertake EE projects; unfortunately, very few EE projects have been implemented to date. The main barriers are lack of flagship projects and general 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 incandescent to compact fluorescent lamps (CFLs); the PEEP is providing valuable learning experience to inform project design for EEEVs and EE appliances.

Priority Introduction of Energy Efficient Electric Vehicles

28. Transport sector energy consumption will continue to grow at an average annual rate of 3.2%, with road transport accounting for 90% of energy demand for transport by 2030. The transport sector, mainly tricycles, jeepneys, and buses, contributes a large portion of CO_2 emissions: 3.5 million registered motorcycles and tricycles release 10 million tons of CO_2 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 vehicles (ICE), whether fueled by gasoline, compressed natural gas (CNG), or liquefied petroleum gas (LPG). The public transport sector can save a significant portion of imported energy by switching to energy-efficient electric vehicles (EEEVs).

29. EEEVs represent a new 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 air and noise pollution [at street level] and can be powered by indigenous RE sources such as solar, hydropower or geothermal resources. The envisioned fleet conversion will contribute to making the transport sector's energy use sustainable, by introducing new technology that eventually will allow domestic solar, wind and

[4] Commercial potential is noted as at least 800 MW, based on private sector commitments pursuant to the proposed feed-in tariff.

[5] 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.

hydropower power to be used as a fuel source for the transport sector, replacing the fossil fuels used today.[6]

30. 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[7] 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 National Environmentally Sustainable Transport Strategy (NESTS) described in the original CIP.***

31. The 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 ($MtCO_2e/y$) in 1990 to about 29 $MtCO_2e/y$ in 2007.[8] 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, 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 play an important role in the transport market, particularly as a key short-distance transport mode. 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.

32. 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.[9] ADB is supporting a demonstration project[10] for introduction of e-trikes in Mandaluyong City (part of the Metro Manila core urban area). The initial results have been positive[11], and GoP has requested ADB to provide financial support for the commercial deployment of 20,000 e-trikes, first phase of the 100,000 e-trikes to be eventually set out by 2016.[12] 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: the project is being designed to deliver an end-to-end infrastructure solution for cleaner transport which is

[6] Today, fossil fuels are trucked to the remotest consumption points from thousands of kilometers away. Domestic petroleum production (dominated by natural gas) is predominantly in basins located hundreds of kilometers offshore.
[7] Senate Committee Report No. 44 on Senate Bill No. 285–Electric, Hybrid and Other Alternative Fuel Vehicles Incentives Act of 2011.
[8] CTF Investment Plan for the Philippines; paragraph 8 and Figure 3.
[9] 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 a preferred option.
[10] Financed by RETA 6441: *Efficiency Improvement and Connectivity Strengthening in Southeast Asia*. Manila.
[11] 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
[12] 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).

consistent with GoP's overall energy security, economic development, and climate change objectives.

IV. PROPOSED CHANGES TO THE INVESTMENT PLAN

33. 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 3.

Table 3: Indicative Financing Plan Endorsed in December 2009 ($ million)

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Total	**1,505**	**350**	**925**	**2,780**

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

34. ***The major change proposed is to reallocate CTF funds for the Energy Efficient Electric Vehicles and Appliances projects to be cofinanced with ADB.*** In particular, EEEVs promise to transform the way energy is used by light-duty 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 will offset some short term price volatility and improve 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 air and noise pollution and can be powered by indigenous renewable energy resources such as solar, hydropower or geothermal.

35. These prospective investments are appropriate for CTF support given the transformational nature of the projects and the replication and scale-up potential.[13] The proposed changes will allocate $101 million to the ADB EEEVs project and $24 million to the EE Appliances project, as shown in Table 4. Concept papers for the candidate investments are presented in Appendices 1 and 2.

Table 4: Indicative Financing Plan After Reallocation ($ million)

Financing Source	Renewable Energy (WBG)	Urban Transport (WBG)	Energy Efficient Appliances (ADB)	Energy Efficient Electric Vehicles (ADB)	Total
CTF	75	50	24	101 [a]	250
GoP / DBP	180	50	46	99	375
IBRD Loans	250	180	0	0	430
IFC Loans	250	0	0	0	250
ADB Loans	0	0	100	300	400
Private sector	750	0	(tbd) [b]	(tbd) [b]	750
Other cofinancing	0	20	0	0	20
Total	**1,505**	**300**	**170**	**500**	**2,475**

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

[13] Pakistan, Indonesia, Malaysia, Bangladesh and Thailand have expressed interest in exploring options for implementing similar projects.

Development, IFC=International Finance Corporation, RE=renewable energy, (tbd)=to be determined, WBG=World Bank Group
Notes to Table 4:
[a] 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).
[b] 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 EE appliances project has yet to be determined.

V. POTENTIAL IMPACTS OF PROPOSED CHANGES ON INVESTMENT PLAN OBJECTIVES

36. The proposed changes will enhance both the EE and cleaner transport programs by using CTF resources to accelerate investment in advanced electric vehicle systems, and will contribute directly to the near-term strategic EE investment program. An assessment of potential impacts of the proposed changes on achieving the objectives and targets of the original CIP is summarized in Table 5 and discussed below.

37. ***Transformational impact will be enhanced.*** The scope of EE 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. More efficient battery technologies are providing a cleaner alternative to pollution-emitting ICE-powered vehicles. In some cases, conventional motorcycles emit more pollution than large sport utility vehicles because the former are not equipped with equivalent emissions-control technology.[14] 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).

Table 5: Summary Assessment of Proposed Changes

CTF Investment Criteria	Original Investment Plan: Net Metering with Solar PV	Updated Investment Plan: EE Appliances and Energy Efficiency Electric Vehicle Projects
Potential for GHG Emissions Savings	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 which represent permanent energy savings via avoided generating capacity and avoided fuel imports. Replication and scale-up potential is high for both EE and electric vehicles.
Cost-effectiveness	Initial direct reductions of 100,000 tCO_2e per year with 10 to 1 replication and scale-up potential Cost effectiveness: CTF$125 / $MtCO_2e$ / year with replication and scale-up (see additional calculations presented in Tables 9 and 10)	EE appliances project: 10 – 30% annual electricity savings are expected at a cost of 1/3 or less of new generating capacity. Energy savings of about 250 gigawatt-hour per year are expected to deliver GHG reductions of about 125,000 tCO_2e per year; with 10-year lifetime, total GHG reductions are 1.25 $MtCO_2e$. Replication and scale-up potential is at least 10 to 1. Cost effectiveness: CTF$24 million / 1.25 $MtCO_2e$ = CTF$19 / tCO_2e, declining to CTF$1.92 / tCO_2e with replication and scale-up. EEEVs project: 100,000 vehicles will deliver net reduction of 270,000 tCO_2e per year; with 10-year

[14] The Technology Review, published by MIT, 2007, available at: http://www.technologyreview.com/energy/19069/

CTF Investment Criteria	Original Investment Plan: Net Metering with Solar PV	Updated Investment Plan: EE Appliances and Energy Efficiency Electric Vehicle Projects
		vehicle lifetime total GHG reductions are 2.7 $MtCO_2e$. Replication and scale-up potential is at least 20 to 1. Cost effectiveness: CTF$101 million / 2.7 $MtCO_2e$ = CTF$37 / tCO_2e, declining to CTF$3.74 / tCO_2e with replication and scale-up of 10 to 1 [See additional calculations in Tables 9 and 10 and Appendix 1]
Demonstration Potential at Scale	Transformation potential [a] of at least 10	Transformation potential is estimated to be > 10 for EE appliances and > 20 for EEEVs
Development Impact	The proposed investment would demonstrate viability of the net metering system (and business model) and accelerate development of the solar PV industry in the Philippines	The EE appliances and EEEVs projects will accelerate growth of the respective industries in the Philippines by demonstrating new technology / systems and business models. 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.
Implementation Potential	As the implementing rules and feed-in tariff for net metering have not been finalized, the originally proposed project is not ready for implementation.	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 EE appliances project is in early development and is tentatively scheduled for ADB Board consideration in 2012. See Table 7 for discussion of implementation risks and mitigation.
Additional Costs and Risk Premium	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 EE investments (see Appendices 1 and 2).

[a] 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, RE=renewable energy, tCO_2e=tons carbon dioxide equivalent

38. ***Emissions reductions from the EE Appliances and EEEVs investments will be higher than the original investment plan, with higher replication and scale-up potential.*** The direct investments in the EE Appliances and EEEVs projects will result in net avoided fossil fuel emissions estimated to be at least 0.4 million $tCO2_e$/y, but with better cost-effectiveness and higher replication and scale-up potential than the original CIP as shown above in Table 5 (see additional discussion below at Tables 9 and 10, and in Appendix 1). The EEEVs project will bring environmental and public health co-benefits equal to or greater than that which would be realized under the original Investment Plan.

39. ***Replication and scale up potential will be higher than originally planned.*** 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 vehicle fleet size; however, replication and scale-up is conservatively assumed to be 10 to 1 for purposes of calculating total emissions reductions and cost-effectiveness. Replication potential for investment in EE appliances is well over 10 to 1. Using CTF to cofinance investment on these types of pioneer projects will eliminate first-mover risk and will 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 more prominent role in replication and scale-up.

40. ***Development impacts and co-benefits will be maintained or enhanced.*** Expanded investment in EE appliances and new investment in EEEVs will improve energy security, reduce GHG emissions, and reduce conventional 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 6.

Table 6: Results Indicators

Results Indicator	Baseline	Expected Program Results in Original CIP: Net Metering with Solar PV	Expected Program Results For EE Appliances and EEEVs Projects
Cost of solar power units	$18,000 with 9.8 year payback	$10,000 with 2.5 year payback [a]	n/a
Number of commercial buildings with solar panels and net metering	Limited	30,000 buildings	n/a
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	15,000 e-trikes operating by 2013 and about 100,000 by 2016. Public charging infrastructure and battery leasing established in respective regions.
Overall quality of appliances in the Philippines	Most commonly used 32 inch TV wattage is 100 Watt to 125 Watt	n/a	Benchmark Wattage established (40 Watt – 50 Watt). At least 50% of TV Wattage is below 60 Watt by 2015. Similar benchmark for (Computer monitors, refrigerators, room air-conditioners and fans)

Notes: [a] Indicators are from Table 1 of Executive Summary of the original CIP.
Source: October 2011 Joint Mission

41. ***Implementation potential for the EE Appliances and EEEVs projects is high.*** The EEEVs project is nearing the appraisal stage and is scheduled for presentation to ADB's Board of Directors in early 2012. The EE Appliances project is under preparation and is expected to be presented for ADB Board consideration in the first half of 2012. Risks and mitigation measures are summarized in Table 7.

42. The Philippines Department of Energy (DOE) will be the executing agency for these proposed projects, as DOE is the designated agency for EE activities as well as alternative fuels including electric vehicles. The scope and implementation arrangements of the proposed projects have considered substantial learning curve from the Philippines Energy Efficiency Project (PEEP, supported by ADB financial and technical assistance), and the EEEVs pilot projects in Mandaluyong and Taguig Cities. 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.

Table 7: Risks and Mitigation Measures

Risk	Mitigation Measure	Residual Risk
Policy and regulatory framework: Clarity of policies related to EE and cleaner transport	• High energy prices and price volatility provide macro-economic support to end-use efficiency investments • Application of innovative financing to cover part of front-end capital costs and to reduce first-mover risks	L
Implementation Capacity: Readiness of owner-operators to procure and operate electric vehicles	• Technical assistance to transfer know-how on project planning, financing, risk management, especially for pioneering projects	L/M
Technology: Limited know-how for after-market service of electric vehicles	• Technical assistance and know-how transfer for newly-introduced electric vehicles will be provided based on experience from pilot project	M/H
Finance:	• E-trike operators are expected to improve net income by 50% • Carbon finance will be mobilized to the maximum extent possible, including prospective post-2012 carbon revenue.	L/M
Environmental Management: Management and disposal of used appliances and batteries	• Battery leasing and recycling programs are integrated into the e-trikes projects. Recycling / de-manufacturing program will be included in the EE appliances project. • Rigorous application of GoP regulatory framework and ADB safeguards for environmental and social impact.	L
Development Impact: Mobilization of investment for replication and scale-up; potential disruption of access to energy to "last mile" consumers	• Work closely with vehicle owners, business associations, and domestic financial institutions to raise awareness and promote future investment in EE appliances and electric vehicles. • Electricity demand from the EEEVs project will be offset by efficiency gains from the EE appliances project and near-term solar power capacity additions funded by the private sector	L
Carbon finance delivery risk: Verification bottlenecks are currently delaying annual payments and affecting the financing structure of large scale transactions. Adders may preclude demonstration of CDM additionality.	• Coordinate with ADB Future Carbon Fund to identify opportunities to maximize potential carbon revenues, and reduce or eliminate delays in methodology and verification processes • Consider voluntary transaction in secondary carbon markets	M/H
Procurement : Limited number of global suppliers for electric vehicle technologies may limit competition in some instances	• Competitive bidding will be utilized in accordance with MDB and GoP requirements.	M/H
Overall risk after mitigation	**Moderate**	

43. ***Additional costs and risk premiums justify use of CTF.*** The EEEVs and EE appliances projects are both first-of-a-kind in the Philippines, and the e-trikes 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 and appliances (e.g., the e-trikes cost at least $1000 more per unit than conventional gasoline-powered trikes). 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.

44. Carbon finance is increasingly at risk 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.

VI. ADDITIONAL CONSIDERATIONS OF THE PROPOSED PROJECTS

Net Impact on the Electricity Grid and GHG Reductions

45. Overall, the additional energy required by the electric vehicles under the proposed ADB project will depend on the relative contribution of public charging stations used during peak time (6 MW, distributed and non-coincident) 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 demand of about 0.37% of total installed generating capacity of 16,359 MW.[15] 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 consumption of about 0.22% of reported generation output in 2010. This additional demand on grid-supplied electricity is considered to be negligible.[16] Table 8 presents estimated changes in energy balance assuming that the EEEVs and EE appliances project are both implemented, along with the near-term solar power development (noted above in Section III).

46. The efficient appliances component will include about 200,000 efficient air-conditioners, 150,000 refrigerators, 350,000 fans and 100,000 televisions. Collectively, the avoided energy consumption will be about 250 GWh and GHG reductions are estimated at 125,000 tCO_2e per year (additional information on estimated GHG reductions is presented in Appendix 2). The energy saved by the appliances (efficient and super-efficient) will more than offset the increase in demand by EEEVs, even if 100% of the electricity is taken from the existing grid, as shown in Table 8.

Table 8: Avoided New Energy Capacity, Megawatts (MW)

Avoided Capacity Additions from Energy Efficient Appliances	**MW**
Air-conditioners	60
Refrigerators	22
Fans	18
Televisions	10
Subtotal	110
Near-term RE Power Additions (see Appendix 1, Table A1.2)	138.5
Subtotal	248.5
Maximum Demand from EEEVs Project	60

[15] Installed capacity is spread across 3 regional grids, as illustrated in the original CIP, Figure 11.

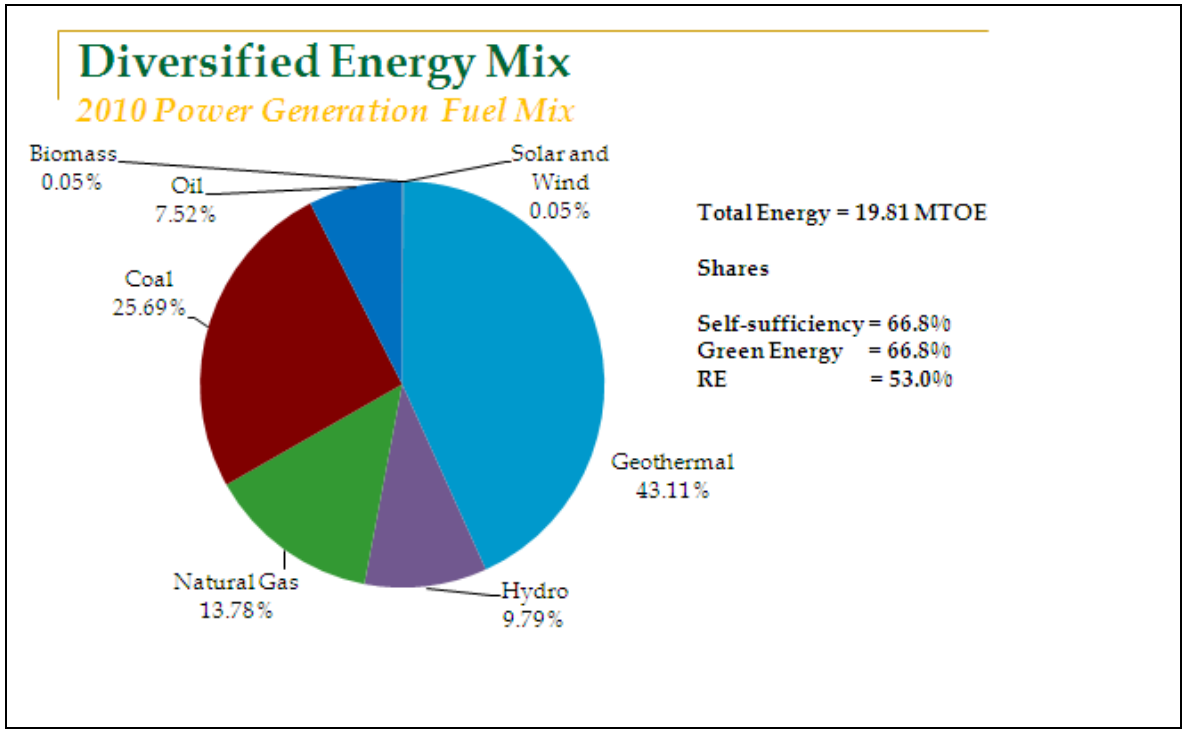
[16] Considering that 1200 MW of coal-fired capacity is being developed in addition to the 138.5 MW of RE noted in Table 8, grid-supplied electricity would not be stressed until replication and scale-up of 20:1 is achieved, i.e., deployment of 2 million e-trikes.

Net	-188.5

Source: ADB staff estimates

47. 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. As shown in Figure 6, clean energy accounts for about 66% of power generation and about 39% of total primary energy.[17] 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. With 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_2e per year using a grid emission factor of 0.52 tCO_2e/MWh,[18] versus an equivalent ICE tricycle which produces about 3.5 tons of CO_2 each for the same service delivery—more than 70% GHG 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[19], 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. [Additional calculations of GHG reductions are presented in the Appendices.]

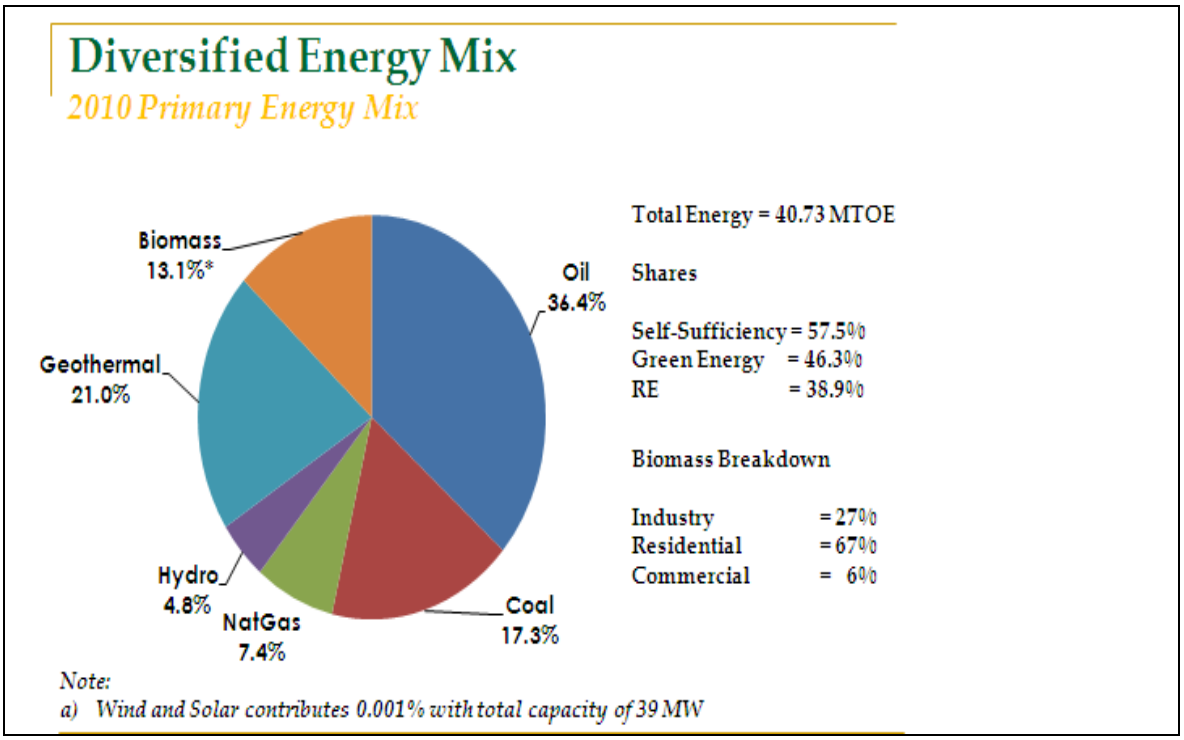
Figure 6: Primary Energy and Power Generation Mix (2010)



[17] Figure 6 reflects the current situation with oil dominating the transport sector, which presents a tremendous opportunity for end-use efficiency gains via electric vehicles.

[18] The grid emissions factor of 0.52 tCO_2e/MWh is consistent with 2010 generation output and various CDM projects, and is lower than equivalent emissions from gasoline-powered vehicles (see additional calculations and discussion in Appendix 1).

[19] 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



Choice of Lithium-ion Battery and Disposal Implications

48. ADB's publication on electric bikes[20] identified lead 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[21], and are safe for disposal in the normal municipal waste stream. [22] 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.

Cost Effectiveness of the Proposed EEEVs Project

49. Tables 9 and 10 show additional calculations of the cost effectiveness and transformative impacts of the EEEVs project, assuming a conservative replication and scale-up factor of 10 to 1. Table 9 indicates that cost effectiveness is well below the upper limit presented in CTF investment guidance, even in a pessimistic scenario discounted by 30% for potential "rebound effects." The pessimistic scenario shown in Table 9 shows that the proposed EEEVs project would be more cost-effective than the net metering project proposed in the original CIP.

50. Table 10 illustrates how the cost of avoided CO_2 drops significantly with larger transformation brought about by the CTF investment.[23] In the small, medium, and large project

[20] ADB. 2009. *Electric bikes in the PRC: Impact on the Environment and Prospects for Growth.* Manila.
[21] http://www.ehso.com/ehshome/batteries.php
[22] http://www.epa.gov/osw/hazard/wastetypes/universal/batteries.htm
[23] Table 10 assumes a replication and scale-up factor of only 10 to 1 versus the 20 to 1 factor used in Table 5.

scenarios, CTF cost-effectiveness is well below the upper limit guidance of $200 per ton. Assuming a full transformation and scale-up and replication of 10-to-1, the lifecycle CO_2 cost will be well below the $5 per ton estimated for the net metering project proposed in the original CIP. These e-trikes will generate significant fuel savings and other social co-benefits: about $10,000 over the 10 year life, the overall cost of avoided CO2 is 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 2, above) of about "-Euro 50 per ton" or "-$69 per ton" (based on 8 November 2011 exchange rate).

Table 9: CTF Cost-effectiveness of EEEVs Project vs. Original Net Metering Project

Net GHG Reductions ($MtCO_2e$/year)	Cost Effectiveness (CTF$/$tCO_2e$/year)	Cost Effectiveness (CTF $/$tCO_2e$) [a]	Scenario / Assumptions
0.33	306.06	30.06	National electricity and heat emissions factor of 0.6 tCO_2e/MWh [b]
0.27	374.07	37.41	ADB base case with grid emissions factor of 0.52 tCO_2e/MWh [c]
0.231	437.23	43.72	0.33 $MtCO_2e$/year discounted 30% for "rebound effect" [d]
2.31	43.72	4.37	Replication and scale-up of 10:1 on case assuming "rebound effect"
0.1	1250	50	Original CIP: net metering with solar PV; 25-year project lifetime [e]
1	125	5	Original CIP: net metering with solar PV; replication and scale-up of 10:1 [e]

Source: ADB Estimates.
Notes:
[a] 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_2-equivalent exceeds US$200...." Considering estimated total project costs of $500 Million, the cost effectiveness estimates may be multiplied by 5.
[b] Emissions factor calculated for Philippines electricity and heat consumption by UK Defra.
[c] Additional discussion of emissions factors is presented in Appendix 1.
[d] Consideration of potential rebound effects is not required by CTF guidance.
[e] Adapted from Original CIP, Annex 2.

Table 10: 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_2e (t/y)	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 ($/t/y)	n/a	576.92	538.46	374.07
Lifecycle Cost-effectiveness ($/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_2e = carbon dioxide equivalent, t = ton carbon dioxide equivalent, y = year
Source: ADB staff estimates

Technology Options

51. A recent ADB study concluded that to make tricycles 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) replace the propulsion system with either hybrid or purely battery-operated, or with more efficient internal combustion engine (ICE). Only the battery operated option can reduce the country's reliance on fossil fuels. Battery operated electric vehicles can also be "zero-emission vehicles", because the electricity can be generated from 100% renewable sources and these vehicles have no tail-pipe emissions. The electric option also represents a one-step solution, while retrofitting from gas to LPG entails a two-step solution that merely postpones the inevitable shift to electric. E-trikes offer the highest net income potentials for tricycle operators and drivers. The annual operating cost is nearly 50% lower than a conventional gasoline-fueled trike.

52. The EE appliances project will support accelerated introduction of more efficient appliances (liquid crystal display (LCD) and light-emitting diode (LED) televisions (TVs), computer monitors, fans, air conditioners and refrigerators, etc.). The proposed investment project will address the market failure for efficient appliances in the Philippines. For example, a conventional 27 inch cathode ray tube (CRT) television contains 2 kilograms of lead and consumes about 125 watts. Consumers are now switching to new generation LCD and LED TVs and literally dumping old TVs in landfills, each with 2 kilograms of lead. However, currently in the domestic market, the most energy efficient 32 inch LCD consumes about 100 Watt and the most efficient LED TV consumes about 72 Watt, while the "best in the world" 32 inch TV consumes 40 Watts. This is an obvious market failure, as substandard products are being brought in the market.

Further, a large number of very old CRT TVs (which can be considered electronic waste) are being brought into the country from developed countries including Japan, Taiwan and South Korea; these obsolete TVs are mostly purchased by the poorest consumers at "throw-away" prices. A key objective of the proposed EE appliances project is to (i) build awareness, (ii) improve local standards (e.g., mainstream 32 inch TVs consuming 40-50 Watts), (iii) reduce price through bulk procurement, and (iv) establish a "hire-purchase" scheme working with local power and cable companies. For example if 10,000 televisions are bought in bulk for $35 million, it will reduce the electricity demand by 1 MW; the energy savings to the consumer will recover the investment for the TVs within 3 years. The proposed project will be implemented in a manner similar to that being implemented for more efficient lighting and the proposed EEEVs project.[24] Additional details of the proposed project, which is still in the initial development stage, are presented in Appendix 2.

[24] The physical investments will be complemented with technical assistance and capacity building including public awareness and retail consumer credit facilitation to ensure that more efficient lighting, appliances, and electric vehicles can be deployed to end-users at scale. Additional notes on recent experience and proposed implementation approaches are included in Appendices 1 and 2.

Appendix 1: 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 ($MtCO_2e/y$) in 1990 to about 29 $MtCO_2e/y$ in 2007.[25] 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[26], 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[27]. 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 $175 million each year from avoided fuel costs. As noted in the main text (paragraph 43), 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.

Proposed Transformation

4. CTF cofinancing will be utilized to overcome the first-mover risks and cost barriers associated with introducing electric tricycles 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. The 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

[25] CTF Investment Plan for the Philippines, 2009; paragraph 8 and Figure 3.
[26] 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
[27] Assuming cost of electricity of $0.20 / kWh in the Philippines.

technology transfer. CTF funds will be used alongside ADB's loan to amortize up-front capital costs over a longer period than otherwise possible.

5. 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.

Implementation Readiness

6. The E-trikes project is nearing the appraisal stage and is scheduled for presentation to ADB's Board of Directors in early 2012. The GoP is working on an electric vehicle policy[28], which among others will exempt importation of all electric and vehicle free of taxes for 9 years. In addition there will be others incentives to set up electric vehicle businesses in the Philippines.

Rationale for CTF Financing

7. 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.
- 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.
- 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 pilot project.
- GHG reductions and cost-effectiveness are comparable to or better than the original CIP (as discussed in the main text).

Financing Plan

Source	Amount (US $ million)
GoP	99
ADB	300
CTF (loan)	100
CTF (grant) [a]	1
Total	**500**
Carbon Finance [b]	20

[a] 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).

[b] No provision has been made for the carbon finance risks associated with possible lack of agreement on a post-2012 successor to the Kyoto Protocol. The carbon finance estimate is preliminary and subject to further revision, and is not included as upfront project co-financing.

[28] Senate Committee Report No. 44 on Senate Bill No. 285–Electric, Hybrid and Other Alternative Fuel Vehicles Incentives Act of 2011.

Project Preparation Timetable

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

Additional Notes on GHG Calculations and Electric Vehicle Eligibility for CTF

Grid Emissions Factors

8. ADB has taken a reasonably conservative approach to estimating GHG reductions. The main text notes that GHG reductions are based on a grid emissions factor of 0.52 tCO_2e/MWh, which is at the mid-range of emissions factors used for several recently registered Clean Development Mechanism (CDM) projects in the Philippines. Typical emissions factors[29] reported the following margins[30] assuming that the Luzon and Visayas grids are taken as a common unit:

Operating Margin: 0.598 tCO_2e / MWh

Build Margin: 0.339 tCO_2e / MWh

Combined Margin: 0.469 tCO_2e / MWh

9. The combined margin for the combined Luzon-Visayas grid is 9.8% less than the grid factor of 0.52 tCO_2e / MWh noted in the main text. Considering that most of the EEEVs would be deployed in the Luzon-Visayas grid, the estimated GHG reductions are conservative (alternatively stated, about 10% "rebound effect" has already been considered for the Luzon-Visayas grid, even though CTF guidance does not require any consideration of rebound effects).

10. As the pilot-tested EEEVs have 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 is shown in Table A1.1, assuming 100,000 vehicles in full operation.

Table A1.1: Emissions Reduction Estimates (tCO_2e/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 staff estimates

[29] Taken from 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

[30] These margins are lower than the first CDM project registered in the Philippines, the Northwind Bangui Bay Project which was registered in 2006.

Electric Vehicle Eligibility

11. Clean Technology Fund, 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."

12. 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 below are intended to demonstrate that the EEEVs project meets the CTF eligibility criteria.

13. The grid-equivalent emissions factor for gasoline is calculated as follows:

Gross energy content: 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_2e / L) / (9.5 kWh / L) = <u>0.2421 kg CO_2e / kWh</u>

14. This theoretical carbon intensity of gasoline, which assumes 100% thermodynamic efficiency, appears to be much lower than the emissions factors noted above (at paragraph 8). More realistic carbon intensities of gasoline-powered tricycles, assuming 40%, 30%, and 20% thermodynamic efficiencies, are higher than the Operating Margin of 0.598 tCO2e / MWh noted above:

(0.2421 kg CO_2e / kWh) / 0.4 = 0.605 kg CO_2e / kWh

(0.2421 kg CO_2e / kWh) / 0.3 = 0.807 kg CO_2e / kWh

(0.2421 kg CO_2e / kWh) / 0.2 = 1.211 kg CO_2e / kWh

15. In practice, thermodynamic efficiencies of motorcycle/tricycle engines are probably on the order of 20%, suggesting that the emissions factor of no less than 0.807 kg CO_2e / kWh is an appropriate benchmark for the current fleet of gasoline-powered tricycles. Matching the Combined Margin factor for the Luzon-Visayas grid noted above would require a thermodynamic efficiency greater than 51% (which is unrealistic for gasoline-fired internal combustion engines[31]), calculated as follows:

0.2421 / 0.469 = 0.5162 = ~ 52%

16. 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 indicate that the proposed e-trikes project meets the CTF eligibility requirement. Changes in the grid emissions factor are discussed below.

[31] Automobiles with internal combustion engines have typical efficiencies of about 25%; the highest reported efficiency for ICEs is 52% for the Wartsila-Sulzer marine engine. The Toyota Prius equipped with an Atkinson cycle engine has efficiency of 34% at peak power output of 52 kW. Source: David J.C. MacKay. 2009. *Sustainable Energy Without the Hot Air*;" page 262. Available on line at: www.withouthotair.com.

Projected Changes in Grid Emissions Factors

17. 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 A1.2, 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 A1.3 presents generation output for 2010 and expansion scenarios assuming (i) current commitments shown in Table A1.1, (ii) increase in emissions factor equating to 40% gasoline thermodynamic efficiencies noted above, and (iii) increase in emissions factor equating to 30% gasoline thermodynamic efficiencies noted above. 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.

18. The third scenario presented in Table A1.3 would presents a grid emissions factor which is lower than the emissions factor of 0.807 kg CO_2e / kWh noted above as an appropriate benchmark for the current fleet of gasoline-powered tricycles. Alternatively stated, even 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 the estimates shown in Table A1.1.

Table A1.2: 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
	Sub-total Luzon	**600**			
Visayas	3x80MW CFB Power Plant Expansion Project	240	Unit I-March2010 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.)
	Sub-total Visayas	**638**			
Mindanao	Sibulan Hydroelectric Power (Unit I-16.5MW) (Unit II-26MW)	43	Unit I-Feb2010 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
	Sub-total Mindanao	**101**			
Total Philippines		**1,338**			

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 A1.3: Grid Emissions Scenarios

Source	Output in GWH	% of grid mix	Emissions Factor (t/MWh)	Total Emissions (t/y)
Base Case: generation output in 2010				
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
Total	67742	100%	0.517	34990500
Expansion Scenario 1: Current Generation Expansion shown in Table A1.2; no other renewable energy is added. Grid factor increases to 0.553 tCO_2e/MWh.				
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
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_2e/MWh.				
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
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_2e/MWh.				
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: Scenario 1 assumes that the additional biomass, coal, and geothermal, run at 80% output; and that additional hydropower runs at 50% output.

Appendix 2: Accelerated Introduction of Energy Efficient Appliances (ADB)

Problem Statement

1. Under the business-as-usual scenario (2010 – 2030), energy-related emissions from the commercial, industry, power, and residential sectors will increase by 123% from 77.4 MtCO2e/y to 172.5 MtCO2e/y.[32] Aggressive development of RE resources and investments in EE throughout the supply chain are necessary to promote energy security and reduce the economic and financial impacts of energy imports and price volatility.

2. The Philippines is leading energy efficiency and use of indigenous renewable energy in the ASEAN region: it was the first country to declare plans to phase out incandescent bulbs and was the first country to establish energy labeling for air-conditioners (1992). In March 2009 ADB approved a loan project and a grant (Philippine Energy Efficiency Project, PEEP),[33] to start up a comprehensive energy efficiency program to identify a range of pilot which could be scaled up later.

3. Retail electricity tariffs are the highest in the region after Japan, which should provide a ready market for the most efficient appliances; unfortunately the reality is quite different. The power consumption (wattage) of locally available "best" main consumer appliances (TVs, fans, computer monitor, air-conditioners, refrigerators etc.) consume more than 100% of the "world's best". For example, the local "best" of commonly used 32 inch TV (100 Watt) consumes 150% more energy than the world's best (40 Watt).

4. Based on a recent Lawrence Berkeley Lab report, the global TV market has undergone a quantum transition from cathode ray tube (CRT) TVs to Liquid Crystal Displays (LCDs). It is expected that LCD TVs will represent 90% of global TV market through 2012. At the same time, LCDs using cold cathode florescent lamp backlights are rapidly being replaced by LCDs using light emitting diode (LED) backlights[34]. Based on market research, without government intervention, the average power consumption of a typical 32 inch TV will not fall below 100 Watts, as the manufacturers are unwilling to bring the more efficient products to this price-sensitive market. Improving appliance efficiencies requires market intervention and transformation.

5. The Government of the Philippines (GoP) has requested ADB assistance in a longer-term investment program which will build on the success of the PEEP, including accelerated introduction of more efficient appliances - especially TVs, air conditioners, and refrigerators - which account for the bulk of residential electricity consumption. More efficient appliances can reduce household consumption by an estimated 10 - 30%, but the upfront cost presents a barrier to most consumers. <u>At present there is no mechanism to monetize the life-cycle savings of more efficient appliances to support consumer purchases.</u>

Proposed Transformation

6. The legal framework and the economic incentives provided by high energy cost have not been sufficient for adoption of clean energy and EE by ordinary citizens and businesses. The

[32] Emissions data are from APEC Energy Demand and Supply Outlook of 2006.
[33] ADB. 2009. *Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Republic of the Philippines for the Philippine Energy Efficiency Project.* Manila.
[34] Display Research (2011) Global TV Shipment Growth Improves to 15% Y/Y in Q4'10 as LCD Share Surges http://www.displaysearch.com/cps/rde/xchg/displaysearch/hs.xsl/110222_global_tv_shipment_growth_improves_to_15_y_y_in_q4_10_as_lcd_share_surges.asp

recent development in EE actually is growing the technology divide, most evident by average citizen's ignorance not just of how to utilize EE in everyday life but more importantly in even knowing what technology choices they have. The proposed project will bridge the growing technology-divide between the informed (often public sector and the rich among the population) and the ill-informed (non-urban and poor) by attacking it from two different angles: usability (through implementation) and education (through awareness). In addition, the project will incorporate the three proven elements from the CFL distribution component of the PEEP which set it apart from similar initiatives: (i) *scale economy*-bulk procurement of 13 million CFLs reduced unit cost by more than 60 percent of the retail price, (ii) *improve technology credibility*-the consumer markets were made aware of the benefits of the technology and pushed "10,000 hour" bulbs when the local market only carries CFLs with life between 1000 and 6,000 hours, and (iii) *CDM ready*-being a large project, it qualified and was able to finance the initials costs for CDM under the "Program of Activities" approach. The "CFL experience" has taught all a lesson: compelling economics, short-payback periods and friendly regulation is not sufficient for "big-bang" large impact changes, which is only possible with large investments that can "shake up" the existing paradigm and mindsets which are often the main barrier to new technology investments.

7. As part of GoP's plan to scale up the PEEP success, a new project is being prepared to support the long-term EE investment program. The proposed project will transform the appliance market which comprises (i) about 5 million air-conditioners which are more than 5 years old, (ii) 10-15 million refrigerators in the market, (iii) 7 million TV sets (with 1 million cable subscribers), (iv) more than 2 million computer monitors, and (v) close to 30 million in-efficient fans.

8. The project will purchase about 200,000 efficient air-conditioners, 150,000 refrigerators, 350,000 fans and 100,000 televisions under the program and a revolving energy efficiency trust fund will be established. The consumers will pay for the appliances over a 36 months hire-purchase scheme. Collectively, the avoided energy consumption will be about 250 GWh and GHG reductions are estimated at 125,000 tCO_2e per year.

9. CTF cofinancing will be utilized to support accelerated introduction of more efficient appliances by overcoming the cost barriers to consumers. CTF funds will be used alongside ADB's loan to amortize up-front capital costs over a longer period than otherwise possible. The proposed project is still at the definitional stage; lessons learned from PEEP implementation will be incorporated into project design.[35]

Implementation Readiness

10. The EE project is under preparation and is expected to be presented for ADB Board consideration in the first half of 2012. The GoP is working on additional incentive policies to promote EE investments, including possible import tax waivers for a limited period.

Rationale for CTF Financing

11. Introduction of more efficient appliances is both constrained and favored by several factors:

[35] The general approach for accelerated introduction of appliances is not unlike the "cash for clunkers" program for introduction of more fuel efficient vehicles in the United States.

- Accelerated introduction of more efficient appliances will increase Philippines's energy security, save foreign exchange, and protect against global price fluctuations by using non-tradable domestic energy sources.
- Consumers face additional costs for more efficient appliances which are not being covered by conventional supplier credit or other retail financing. Creative financing approaches, including the use of concessional funds, are needed to cover additional up-front capital costs to consumers.
- Carbon finance is not expected to overcome the cost barriers noted above.
- CTF can provide a catalytic role in removing the cost barriers for wide scale adoption of more efficient appliances, and foster accelerated replication and scale-up in the near term.
- The replication potential is at least 10 to 1.
- GHG reductions and cost-effectiveness are comparable to or better than the original CIP (as discussed in the main text).

Financing Plan

Source	Amount (US $ million)
GoP	46
ADB	100
CTF	24
Total	**170**
Carbon Finance[a]	5

[a] No provision has been made for the carbon finance risks associated with possible lack of agreement on a post-2012 successor to the Kyoto Protocol. Carbon finance estimate is preliminary and subject to further revision.

Project Preparation Timetable

Milestone	Date
ADB Project Identification	March 2012
Pilot Project ("TV Olympics")	June 2012
Appraisal / Negotiations	January 2013
ADB Board Consideration (Approval)	March 2012
Project Completion	June 2016

Additional Notes on GHG Calculations

12. Figures A2.1, A2.2, and A2.3 (below) present additional information about estimated energy savings, financial benefits, and GHG reductions. As noted above, the EE Appliances project is still in conceptual developmentthe detailed project scope has not been finalized, and projected market penetration rates and GHG reduction estimates are subject to evolution going forward.

Figure A2.1: Sample Cost Benefit Analysis for Energy Efficient TVs

Sample Cost Benefit Analysis

Indicators	21" CRT	22" LED	32" LED
Wattage	100W	25W	40W
Annual Electricity Cost ($)	41	9	15
Annual Savings ($)		32	26
Lifetime Savings ($)		320	260
CO_2 Equivalent Avoided (Metric Tons)		1.08	0.89

Assumptions:

Current electricity cost: 0.2$/kWh
Daily TV usage: 5 hours
Electricity Use Emission Factor = .00068951 MT/kWh
TV Life span = 10 years

Figure A2.2: Estimated Financial Benefits and GHG Reductions (Base Case)

Scenario Analysis Scale Up (100,000 Units)

Indicators	29 Inch CRT	22 Inch LED	32 Inch LED
Annual Savings (Million $)	-0.6	3.2	2.6
Lifetime Savings (10 years in Million $)	-6.4	32	26
CO2 Equivalent Avoided (Metric Tons)	-22,000	108,000	89,000

Figure A2.3: Estimated Financial Benefits and GHG Reductions with Replication and Scale-up to 90% of Philippine Households

Scenario Analysis Scale Up (12.6 million Households)

Indicators	29 Inch CRT	22 Inch LED	32 Inch LED
Annual Savings (Million $)	-0.6	403	328
Lifetime Savings (10 years in Billion $)	-10.2	4.03	3.28
Lifetime Savings (10 years in Billion PhP)	-434	171.3	139.4
CO2 Equivalent Avoided (in Million Metric Tons)	-3,700,000	13,608,000	11,214,000