Climate Investment Funds

CTF/TFC.IS.1/2
November 10, 2009

Inter-sessional Meeting of the CTF Trust Fund Committee
Washington, D.C.
December 1-2, 2009

CLEAN TECHNOLOGY FUND
INVESTMENT PLAN FOR VIETNAM

Proposed Trust Fund Committee Decision

The Trust Fund Committee reviewed document CTF/TFC.IS.1/2, *CTF Investment Plan for Vietnam*, endorses the plan and agrees to the further development of the activities foreseen in it. The Trust Fund Committee agrees to an envelope of up to USD 250 million in CTF funding to finance the plan.

Clean Technology Fund Investment Plan for Vietnam
Executive Summary

Introduction

1. This Clean Technology Fund Investment Plan for Vietnam proposes CTF co-financing of $250 million to support Vietnam's goals of reducing national energy consumption relative to business as usual projections by 5-8 percent by 2015, with renewable energy accounting for 5% of total power generating capacity by 2020, and expanding public transport to a 50 percent share of passenger-kilometers travelled by 2020. Specifically, the Investment Plan proposes CTF co-financing for industrial energy efficiency, ESCO-led energy efficiency programs, initial capitalization of Energy Conservation and Renewable Energy Funds, transmission system modernization, direct investment and risk-sharing facility for private sector renewable energy development, and enhancement to urban rail systems in Hanoi and Ho Ch Minh City. The CTF investments will mobilize financing of about $3.195 billion from the government, multilateral financiers, carbon finance and private sector.

Country and Sector Context

2. Vietnam has been one of the fastest growing economies in Asia for the last two decades, with real gross domestic product (GDP) growth averaging 8 percent annually in 2003-2007. For the past ten years, energy consumption has been increasing faster than GDP, averaging about 13 percent per year. This is attributable to the rapid expansion of heavy industry and motorized transport, as well as increased use of fossil fuels for power generation. Industry accounted for 48 percent of Vietnam's electricity consumption and the residential sector another 43 percent. Energy intensity of the Vietnamese economy has increased by nearly 50 percent since 1998.

3. Vietnam's CO_2 emissions have more than doubled over the past decade and are projected to reach 101.5 million tons of CO_2-equivalent from energy-related sources by 2010. Under a business as usual scenario, Vietnam's primary energy demand will more than double and total energy-related greenhouse gas emissions will triple between 2010 and 2030. Total emissions from primary energy consumption are projected to increase most rapidly in electric generation (248 percent), transport (214 percent), and industry (163 percent).

Priority Sectors for GHG Abatement

4. In December 2008, the Government of Vietnam approved a National Target Program to Respond to Climate Change, which sets out sector priorities and targets for 2010 and 2015. The strategies for the energy sector include:

- Effectively using and saving energy under climate change context.
- Properly and effectively using natural energy resources, developing and maximizing the exploitation of hydro power and natural gas.

- Developing and exploiting new forms of energy: geothermal energy, solar power, wind power and nuclear power.
- Evaluating costs and benefits of energy projects.

The Government is also considering new Energy Efficiency and Renewable Energy funds to accelerate investments in the near term as part of the proposed Energy Efficiency Savings Law and Renewable Energy Law. These funds would be capitalized by taxes on fossil fuel consumption.

5. Assessments by the Multilateral Development Banks conclude that it is technically feasible to mitigate 155 million tons of CO2-equivalent per year via supply-side power system efficiency improvements, energy efficiency gains in the industrial and residential sectors, and fuel switching in the power sector. A study in the context of developing Clean Development Mechanism projects identified opportunities for emissions reductions in the energy, transport and waste sectors ranging from 27 to 48 percent. Hydropower is currently the most promising renewable energy resource in Vietnam, with several thousand megawatts of potential in small hydro. To address the barriers to small scale renewable energy development, the Government has issued a standardized power purchase agreement and tariff formula for small renewable energy projects selling to the grid.

6. Vietnam has launched a series of efforts to promote energy efficiency, most notably the Vietnam National Energy Efficiency Program (VNEEP), which is the country's first-ever comprehensive plan to institute measures for improving energy efficiency and conservation in all sectors of the economy. The program's energy savings targets are three to five percent of total national energy consumption relative to business as usual projections during phase 1 (2006-2010) and five to eight percent during phase 2 (2011-2015). Achievements under phase 1 are significant: several energy efficiency and conservation directives, standards and labeling for appliances, and expansion of CFL production. The CTF co-financing would support implementation of phase 2, which will expand on the accomplishments of VNEEP phase 1.

7. The largest opportunities for greenhouse gas mitigation (about 2 million tons of CO_2-equivalent per year) in the transport sector are the expansion of urban rail and bus systems, complemented by the use of improved vehicle technology and modest contributions of renewable fuels. The Government is mobilizing substantial investments in public transport systems in large urban areas, with the objective of expanding public transport from about 10-15 percent to 50 percent of passenger-kilometers travelled by 2020. The highest priority is the development of urban rail lines in Hanoi and Ho Chi Minh City, complemented by high-efficiency buses and "connectivity" systems.

Rationale for Selected Sectors for CTF Co-Financing

8. The priority activities selected for CTF co-financing are:

(a) Industrial energy efficiency. CTF would co-finance investments in waste heat recovery and other conservation measures in ten cement enterprises, covering

about 25 percent of the country's cement sector output, with a view to achieving at least ten percent energy savings.

(b) ESCO-led energy efficiency programs and capitalization of an Energy Conservation Fund. CTF support would be utilized for the expansion of investment vehicles for accelerating scale-up of energy efficiency activities. The ESCO activities would cover small and medium enterprises and the commercial sector.

(c) Transmission system modernization. CTF would co-finance the upgrade of existing lines with advanced composite core conductors, thereby potentially reducing system losses by three percent. In addition, it is proposed that CTF support the introduction of newer grid operations technology, including substation automation and other "smart grid" systems, which could reduced losses by an additional three percent, while also achieving long-term emissions savings through demand-side management energy efficiency and enabling development of new renewable energy generation.

(d) Private sector support and risk-sharing facility for renewable energy development. CTF support will reduce the cost of financing of direct investments in about 500 MW of renewable energy development (mostly small hydro).

(e) Initial capitalization of a new Renewable Energy Fund. CTF co-financing would enable expansion of investments to an additional 1500 MW of renewable energy capacity.

(f) Comprehensive urban transport systems. The Government proposes to use CTF co-financing to provide enhancements to the urban rail projects in Hanoi and Ho Chi Minh City. The project would strengthen linkages between transport modes, introduce high efficiency buses, urban rail/bus interchanges and integrated ticketing, park and ride facilities, and modified parking charges in the urban core areas.

9. *Potential for GHG reduction:* The energy efficiency measures are expected to result in emissions reductions of about 1.8 millions tons of CO2 equivalent per year (MtCO2e/y). Emissions savings from transmission upgrade with AC3 are estimated at 0.156 million tons of CO2 equivalent, and about 0.5 MtCO2e/y) from the "smart grid investments (plus around 4.8 MtCO2e/y from small hydro enabled by the new grid technologies). The private sector risk-sharing facility and RE Fund will result in savings of about 4.8 MtCO2e/y. Finally the urban transport component is estimated to have emissions reduction potential of about 1.3 MtCO2e/y.

10. *Demonstration potential:* Replication of energy efficiency measures throughout the cement sector, covering up to 40 enterprises, could result in emissions savings of about 7.8 MtCO2e/y, representing about 25 percent of current total industrial sector emissions. Similar measures could be incorporated into the design of new installations and in other industrial sectors, so that the demonstration effect is even larger. The transmission upgrades introduce new technologies in Vietnam; once successfully demonstrated at scale, thereby overcoming initial cost and risk barriers, the utility is likely to adopt them as part of commercially financed investments. The Investment Plan also proposes a programmatic approach to scaling up renewable energy by developing

and implementing power grid enhancements and strengthening of the banking sector for renewable energy lending, thereby addressing transmission connection and off-take risks. The replication potential of the urban transport investments is significant, in view of the growing urbanization ratio in Vietnam (from 25 percent on 2002 to 43 percent in 2030).

11. *Development impact:* Meeting Vietnam's rising energy demand through a tripling of supply creates daunting development challenges. The costs will be higher than past capacity expansions, especially because much more of Vietnam's energy supply will need to be imported. Resource constraints along with energy security concerns make energy efficiency measures as well as development of domestic renewable energy resources central to maintaining Vietnam's economic growth. Furthermore, energy efficiency measures in the residential sector have a particularly positive effect on poorer consumers. Commercialization of small hydro power would benefit rural electric cooperatives. Environmental co-benefits will be realized from reduced pollutants from fossil-fuel power plants. The urban transport investments are an integral part of the Government's sector strategy to reduce traffic congestion, reduce travel times, lower pollution levels and improve access to transport services for poorer consumers.

12. *Implementation Potential:* VNEEP and the new Energy Efficiency and Savings Law are expected to provide a strong enabling environment for the CTF investments. Vietnam's power sector has a strong track record in project implementation and management of MDB loans. Most of the renewable energy projects are being led by private sector developers and/or local government-backed entities, which are being supported by the MDBs and have demonstrated technical capacity.

13. *Additional costs and risk premiums:* Working knowledge of energy efficiency opportunities at the industrial and commercial enterprise and retail consumer level is still limited and require positive incentives through demonstration. Furthermore, energy efficiency measures have upfront cost barriers, especially unaffordable for small and medium enterprises. For example, the capital costs for industrial cogeneration may range well above US$ 1 million, which may not be readily financeable from cash flow or working capital. Commercial banks are reluctant to lend to conservation projects, which do not involve physical assets and revenue streams. With the exception of a part of Vietnam's small hydropower, production costs of most renewable energy sources are above the Avoided Cost Tariff. The lack of transmission access is also a barrier to renewable energy development. Finally, the connectivity investments proposed for CTF co-financing are above and beyond the budgeted costs of the urban rail lines, which are currently being financed on a stand-alone basis.

Table 1: Results Indicators for CTF Co-Financed Energy Efficiency Investments

Indicators	Baseline	Investment Program Results
Carbon intensity	0.0004 $MtCO_2e$ per million US$ of GDP at PPP	Arresting anticipated increase
Electricity consumption	65,900 GWh (in 2008)	29,400 GWh saved, which represents 10% of national electricity consumption 2020
Power generation capacity from conventional sources	15,864 MW capacity (in 2009), expected to grow to 60,300 MW under BAU	5,880 MW of avoided capacity additions by (2020)
Annual GHG emissions	33.9 $MtCO_2e$ /y emissions from industrial sector	6 $MtCO_2e$ /y reduced (60 $MtCO_2e$ in the first 10 years)

Table2: Results Indicators for CTF Co-Financed RE Investments

Indicators	Baseline	Investment Program Results
Installed RE capacity	769 MW installed RE capacity at present (see Table 4), increasing to 5000+ MW under BAU expansion plans	8000 MW total installed capacity (additional 2000 MW of small hydro, + 500 MW of biomass and 500 MW wind power)
Power generation capacity from conventional sources	15,864 MW capacity (in 2009), expected to grow to 60,300 MW under BAU	2628 MW of avoided capacity additions by 2020
Annual GHG emissions from the electricity sector	27.7 MtCO2e/ y emissions from electricity sector (2010)	8.125 MtCO2e/y reduced (81.25 MtCO2e in the first 10 years)

Table 3: Results Indicators for CTF Co-Financed Urban Transport Investments

Indicators	Baseline	Investment Program Results
Carbon intensity	0.0004 $MtCO_2e$ per million US$ of GDP at PPP	Arresting anticipated increase
Number of cities with low-carbon public transport programs	0	2
Annual GHG emissions	3.7 MtCO2e/y emissions from transport in the target area	1.3 $MtCO_2e$/y reduced by the program (13 $MtCO_2e$ in the first 10 years)
Number of passenger-trips on public transport	10%	44% (by year 2030 in HCMC)

Table 4: Indicative Financing Plan
(in US$ millions)

Financing Source	Proposed Programs and Projects					
	Industrial Energy Efficiency (ADB, Annex 1)	**High Voltage Transmission Technology (ADB, Annex 2)**	**Urban Transport (ADB, Annex 3)**	**Smart Grid Technology (IBRD, Annex 4)**	**Clean Energy Financing Facility (IFC, Annex 5)**	**Total**
MDBs	40	260	500	180	200	1,180
GOV	25	40	100	100	0	265
CTF	**50**	**50**	**50**	**30**	**70**	**250**
GEF	0	0	0	0	0	0
Carbon Finance	10	0	0	0	0	10
Other Co-financing	40	200	500	0	0	740
Private Sector	100	500	0	0	900	1,000
TOTAL	**265**	**1,050**	**1,150**	**310**	**1,170**	**3,445**

VIETNAM

CLEAN TECHNOLOGY FUND INVESTMENT PLAN

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List of Abbreviations

ADB	Asian Development Bank
ACT	avoided cost tariff
AC3	advanced composite core conductor
ADB	Asian Development Bank
APEC	Asia-Pacific Economic Cooperation
APERC	Asia Pacific Energy Research Center
B10	10% biodiesel blended fuel
BAU	business as usual
BRT	Bus Rapid Transit
BST	bulk supply tariff
CCS	carbon capture and storage
CDM	Clean Development Mechanism
CFL	compact fluorescent lamp
CGM	Competitive Generation Market
CIP	Country Investment Plan
CNG	compressed natural gas
CO2e	carbon dioxide equivalent
CP	clean production
CTF	Clean Technology Fund
DSM	demand side management
E10 (20)	10% (20%) ethanol blended fuel
EE	energy efficiency
EE&C	EE and conservation
EES	EE and Savings
ERAV	Electricity Regulatory Authority of Vietnam
ESCO	energy service company
EVN	Vietnam Electricity (formerly Electricite de Vietnam)
GDP	gross domestic product
GEF	Global Environment Facility
GHG	greenhouse gas
GOV	Government of Vietnam
GWh	gigawatt-hour
HCMC	Ho Chi Minh City
HVDC	high-voltage direct current
IBRD	International Bank for Reconstruction and Development (World Bank)
IDA	International Development Association
IFC	International Finance Corporation
IPP	independent power producer
JICA	Japan International Cooperation Agency
kgoe	kilogram of oil equivalent
km	kilometer
kV	kilovolt
kWh	kilowatt-hour
LDUs	local distribution utilities
LNG	liquefied natural gas
LPG	liquefied petroleum gas
m^2	square meter
MDBs	multi-lateral development banks
MFF	multi-tranche financing facility
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transport
$MtCO_2e$	million tons carbon dioxide equivalent
mtoe	million tons of oil equivalent
MW	megawatt
MWh	megawatt-hour
NCCC	National Climate Change Communication
NPT	National Power Transmission Company
NTP-RCC	National Target Program to Respond to Climate Change
ODA	official development assistance
p.a.	per annum
PCs	Power Companies
PMDP	Power Master Development Plans
PoA	Program of Activities (CDM)
PPP	purchase power parity
PPTA	Project Preparation Technical Assistance
RCM	Retail Competitive Market
RE	renewable energy
REAP	RE Action Plan
REDP	RE Development Project
SMEs	small and medium size enterprises
SPPA	standardized power purchase agreement
T&D	transmission and distribution
TA	technical assistance
tCO_2e	tons of CO_2e
TMPs	transport master plans
TWh	terawatt-hour
UNFCCC	United Nations Framework Convention on Climate Change
VNEEP	Vietnam National EE Program
WB	World Bank (IBRD)
WCM	Wholesale Competitive Market
WTO	World Trade Organization
/y	per year

INTRODUCTION

1. This Clean Technology Fund (CTF) Investment Plan (CIP) proposes CTF financing of US$250 million to support the Socialist Republic of Vietnam in meeting its mid-term goals of reducing national energy consumption relative to business as usual projections by 5-8% by 2015, with renewable energy accounting for 5% of total power generating capacity by 2020, and expanding public transport to a 50% share by 2020. The plan is agreed between, and owned by, the Government of Vietnam (GOV), the Asian Development Bank (ADB), the International Finance Corporation (IFC) and the World Bank (IBRD). The plan is based on the Vietnam National Climate Change Communication (NCCC), the *National Energy Development Strate*gy for the period up to 2020, and other relevant sector development policies and programs, economic development plans and the government's investment programs and project proposals. The plan is considered a dynamic document, adaptable to changes in economic conditions, national regulatory policies, and the international context, in particular resulting from ongoing climate change negotiations under the UNFCCC.

2. The CIP is consistent with the country assistance and selector development strategies and programs of the ADB, the World Bank, and the IFC. The plan is considered a "business plan" for the participating Multilateral Development Banks (MDBs) and the projects and programs proposed for financing under this plan will be integrated with their country support and co-financed with the respective MDBs' operations. The project proposals, contained in the annexes to this plan, will be fully developed subsequent to the CTF Trust Fund Committee's endorsement of the Investment Plan.

3. The purpose of the CIP is to identify, assess, select and promote opportunities for investments in low carbon technology in Vietnam that support the government's development priorities, objectives and ambitions for the relevant sectors and that meet the criteria of the CTF, in particular: the potential of the proposed projects and programs to save Greenhouse Gas (GHG) emissions directly – and indirectly through demonstration, replication and scaling up of the application of energy-saving and renewable energy technologies and systems at acceptable costs while promoting the sustainable economic development in Vietnam. With this end in mind, the CIP provides a brief description of the country and sector context, identifies priority sectors for GHG reduction interventions, provides a rational for CTF support for selected sub-sectors, and assesses the relevant policy and regulatory support and implementation potential for the proposed projects.

I. COUNTRY AND SECTOR CONTEXT

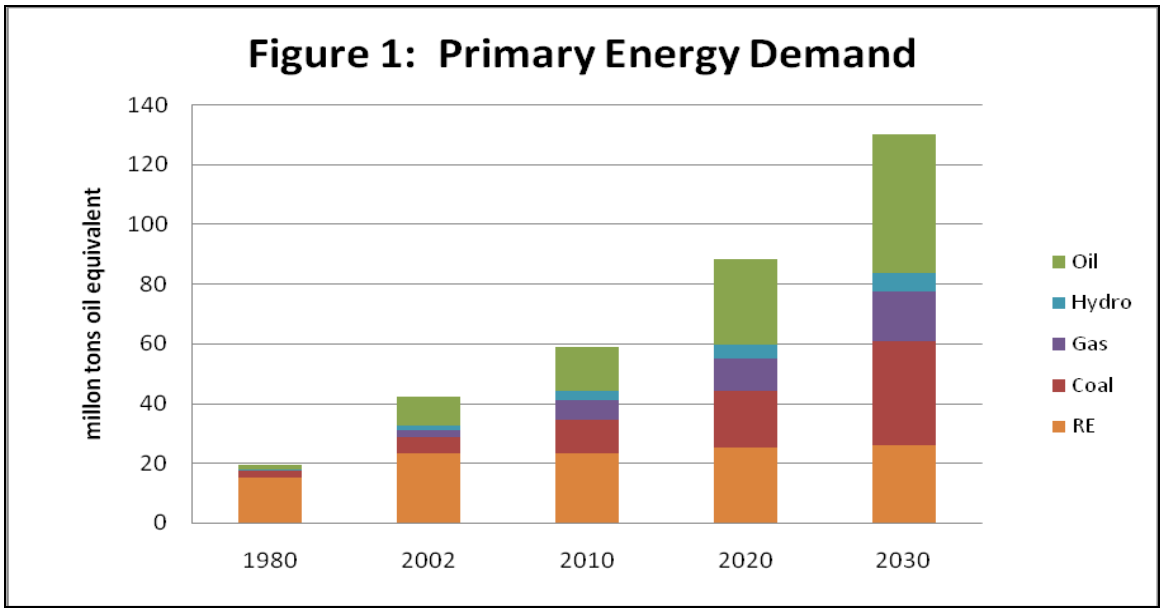
4. Vietnam is the largest country in the Greater Mekong Sub-region with a population of 84 million people in 2006. It is well-endowed with natural resources including crude oil, coal, hydropower, natural gas, and marine biodiversity. Vietnam has been a net energy exporter since 1990, and currently exports about 50% of coal production and about 75% of crude oil production. The country is expected to become a net energy importer after 2020.[1] Vietnam has been one of the fastest growing economies in Asia for the last two decades, with real gross domestic product (GDP) growth averaging 8.0% annually in 2003–2007. For the past 10 years, energy consumption has been increasing faster than GDP, averaging about 13% per year. The commercial energy use / GDP growth elasticity registered was a very high 1.7. This is attributable to a fast expansion of

[1] APERC Energy Overview 2008.

heavy industry and motorized transport, and increased use of fossil fuels for power generation (APERC 2006).

5. Vietnam's business-as-usual (BAU) scenario relating to the energy sector is characterized by continued rapid economic expansion at an average GDP growth rate of about 6% p.a. over the next two decades.[2] In 2030, Vietnam's population is expected to reach 108 million with a per capita income of about US$10,000 (up from US$2,500 in 2002, 2000 PPP) and an urbanization ratio of 43% (up from 25% in 2002). This rapid growth will not only lead to higher energy consumption and GHG emissions, but it will also force structural shifts in Vietnam's energy supply with a relatively faster growth in coal and oil consumption and a very rapid increase in electricity generation from 36TWh in 2002 to 266TWh in 2030, of which about 55% are projected to come from coal and oil in 2030. Vietnam's investment needs in electricity generation and transmission are projected at about US$50 billion (2000 US$) between 2020 and 2030. Under the current avoided cost tariff (ACT) system, renewable energy (RE) potential in the BAU scenario is limited to about 2000 MW of small hydropower and about 500 MW of wind power [referenced in Table 4]. Energy efficiency (EE) is considered to be a 3-5% reduction in national energy consumption, which GOV plans to achieve by 2010 relative to forecasts without EE measures. Under BAU from 2010-2030, primary energy demand will more than double and total energy related GHG emissions will triple (Figures 1 and 2). These BAU trends are described in greater detail below.

6. Economic growth has been facilitated by indigenous resources including biomass energy, coal, crude oil, hydropower, and natural gas. At present, renewable energy (RE) accounts for the largest share of primary energy demand, mainly due to the use of traditional biomass (mainly fuel wood) for residential use, particularly in rural areas. But, as shown in Figure 1, RE resources are limited and fossil fuels are projected to account for the largest share of primary energy demand after 2020 (APERC 2006).[3] Coal production is projected to remain sufficient to support net exports through 2030, but dependence on imported petroleum fuels for transport will increase with more than 50% net oil import dependency by 2030 (APEC 2006).



Source: APERC Energy Demand and Supply Outlook 2006

[2] Data from APERC Energy Demand and Supply Outlook of 2006.
[3] APERC Energy Demand and Supply Outlook of 2006.

7. The energy intensity of Vietnam's economy grew from 387 kilograms of oil equivalent (kgoe) per US$1000 of GDP in 1998 to 569 kgoe/US$1000GDP in 2006 (in constant 2000 prices). Aggregate energy intensity is projected to peak around 2010 and remain relatively flat during the next 2 decades, mainly due to increased use of commercial energy in lieu of traditional biomass, increased use of natural gas for power generation, and power system efficiency improvements. On a *per capita* basis, GHG emissions intensities are highest in the residential sector and are projected to continue increasing in all sectors with the fastest increases in the industry and transport sectors.

8. In 2005, Vietnam was ranked 41st in the world in GHG emissions. Estimated total emissions in 2000 were 114.6 million tons of carbon dioxide equivalent ($MtCO_2e$), including emissions from agriculture (Table 1).[4] Energy related emissions in 2000 were 48.4 $MtCO_2e$ (WRI-CAIT), and are projected to reach 101.5 $MtCO_2e$ in 2010 (APERC 2006), with per capita emissions increasing to over 1 ton per person. Principal energy-related emissions sources are the industry, electric power, and transport sectors (Figure 2). By 2010, the relative shares of emissions are projected to be: industry – 33%, electricity generation – 27%, transport – 24%, residential – 7%, commercial – 6%, and other [non-power] combustion – 2% (APERC 2006).

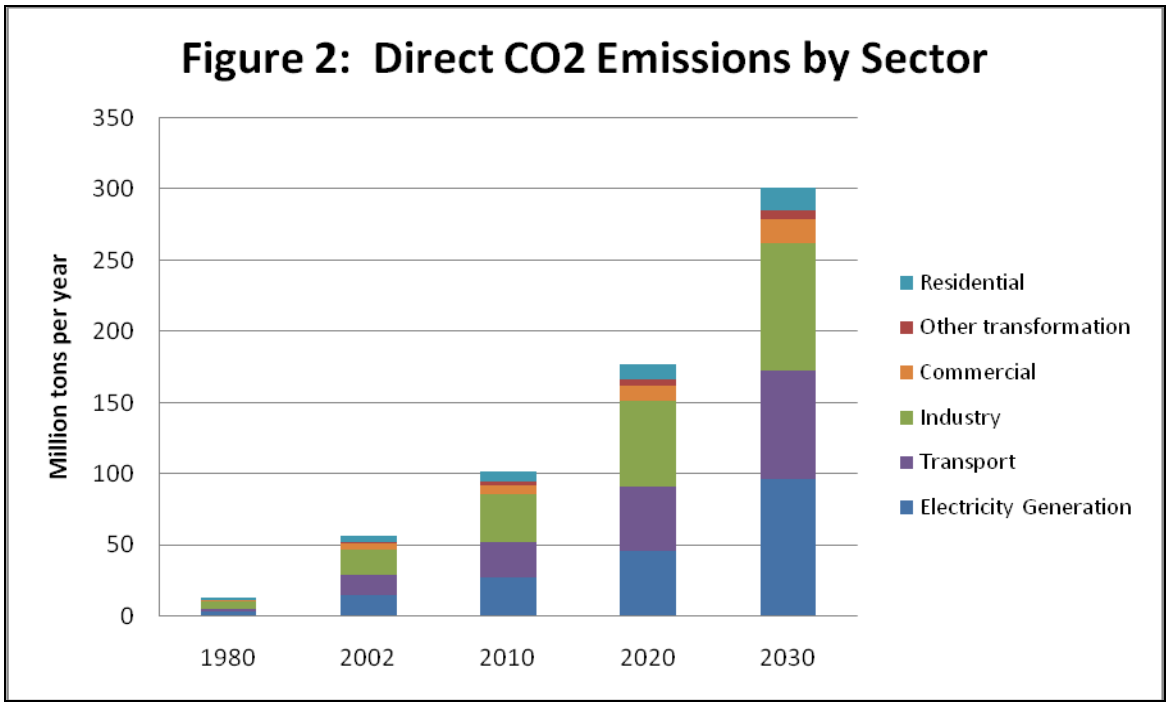
Table 1: Greenhouse Gas Emissions by Sector in 2000 ($MtCO_2e$)[a]

Sector	$MtCO_2e$	% of Total
Energy	48.4	42.2
Electricity & Heat	*11.2*	*9.7*
Manufacturing & Construction	*14.2*	*12.4*
Transportation	*10.9*	*9.5*
Other fuel combustion	*10.1*	*8.8*
Fugitive Emissions	*2.0*	*1.7*
Industrial Processes	6.6	5.8
Waste	9.5	8.3
Agriculture [b]	50.1	43.7
TOTAL	**114.6**	

Note: [a] Emissions exclude land use change, [b] Land Use and Land Use Change are not eligible for CTF support
Source: World Resources Institute Climate Analysis Indicators Tool (WRI-CAIT) version 6.0

9. Total emissions from primary energy consumption are projected to increase most rapidly in electric generation, industry, and transport (Figure 2), with electricity generation exhibiting more emissions-intensive growth in the 2020 – 2030 period, reflecting increased use of coal. In the period 2010 – 2030, emissions from power generation are projected to increase by 248% from 27.7 $MtCO_2e/y$ to 96.5 $MtCO_2e/y$, industry sector emissions will increase by 163% from 33.9 $MtCO_2e/y$ to 89.2 $MtCO_2e/y$, and transport sector emissions will increase by 214% from 24.3 $MtCO_2e/y$ to over 76.3 $MTCO_2e/y$ (APERC 2006).

[4] Data from World Resources Institute Climate Analysis Indicators Tool (WRI CAIT); ranking of 41st is based on total emissions in 2005.



Source: APERC Energy Demand and Supply Outlook 2006

10. A breakdown of total emissions by final energy consumption reflects the high energy and GHG intensity in the residential and industrial sectors. Energy efficiency in residential and industrial electricity use is low while consumption has been growing rapidly. Industrial and residential consumers are the two dominant electricity users in Vietnam: in 2006, the residential sector accounted for 43% of Vietnam's electricity consumption, and industry accounted for 48% (Table 2).[5] CO2 emissions from electricity generation can be ascribed largely and in roughly equal shares to the residential and industrial sectors, making industry the biggest (direct and indirect) GHG emitter in Vietnam, followed by the residential and transport sectors.

Table 2: Vietnam Final Commercial Energy Consumption, 2006 (mtoe)

Sector	Coal	Petroleum Products	Natural Gas	**Total Fuel**	Electricity	**Total**
Industry	5.2	2.4	0.1	**7.7**	4.6	**12.3**
Transport	0.0	6.9	0.0	**6.9**	0.1	**7.0**
Commercial & Public Services	0.4	1.0	0.0	**1.4**	0.8	**2.2**
Residential	0.9	0.9	0.0	**1.9**	4.2	**6.0**
Total	**6.5**	**11.2**	**0.1**	**17.9**	**9.7**	**27.5**

Note: Non-energy use and traditional biomass excluded
Source: Source: Taylor (forthcoming), based on: International Energy Agency, Government data.

[5] Robert P. Taylor, Jas Singh, Alberto U. Ang Co (forthcoming), Vietnam: Expanding Opportunities for Improving Energy Efficiency, World Bank / ESMAP report.

11. If past trends continue, energy demand in Vietnam will triple once again over the next ten years.[6] Unlike the past decade, however, meeting this demand through a tripling in supply in the coming decade will be a far more daunting challenge than before. The costs will most certainly be higher in real terms, especially because much more of the supply required will need to be imported, whereas Vietnam currently is a net exporter of coal and oil. Resource constraints along with energy security concerns as well as future costs and global and local environmental concerns make EE measures as well as the development of Vietnam's domestic RE resources an attractive course of action. EE alone can meet a sizable portion (typically 20-30%) of demand for increased energy services, at costs which are typically one-quarter as much as for additional energy supply.

12. In December 2008, GoV approved a National Target Program to Respond to Climate Change (NTP-RCC) [7], which sets out the principles, objectives, sectoral priorities, and targets for 2010 and 2015. The costs for implementation of the NTP-RCC for the period from 2009-2015 are estimated at US$120 million (not including the EE and RE activities noted above), and half of the investment is expected to come from the international development agency partners. The program includes specific action plans and financing mechanisms to integrate climate change concerns into the country's sectoral development plans and their implementation. The program sets out the target to develop a strategy of GHG reduction in the energy sector. The policy strategies for the energy sector as mentioned in the NTP-RCC document include (quote):

- Effectively use and save the energy under climate change context;
- Properly and effectively use natural energy resources, develop and maximize the exploitation of hydro power and natural gases;
- Develop and exploit new forms of energy: geothermal energy, solar power, wind power and nuclear power;
- Establish the standards of exhaust fumes; evaluate environmental cost and benefit of energy projects.

II. PRIORITY SECTORS FOR GHG EMISSION REDUCTION

13. Based on their large share of total emissions and the trend in emissions growth as well as policy conditions affecting primary energy supply and demand, emission savings interventions in the power sector (fuel switch, generation, transmission and distribution efficiency) and energy efficiency measures in industrial and residential/commercial sectors are most promising, followed by lower-emission alternatives in the transport sector (modal shift, bio-fuels), if such interventions can be developed at reasonable costs and replicated at large scale.

14. Recent analytical work by ADB[8] provides a preliminary GHG abatement cost profile for Vietnam. The ADB study utilized the "DNE21+" inter-temporal linear programming model which has high regional and technological resolutions.[9] Figure 3 illustrates the model summary results for technological interventions resulting in more than 5 $MtCO_2e/y$ reductions: it appears technically feasible to mitigate 155 $MtCO_2e/y$ via supply-side power system efficiency

[6] Assuming GDP grows at some 6.9% p.a. in 2009-2018 and constant energy use/GDP elasticity at 1.7, energy demand would grow by about 12.1% p.a, yielding a tripling in energy use in ten years and final energy consumption exceeding 100 million toe by 2018. (Taylor, forthcoming)

[7] Decision No. 158/2008/QD-TTg dated 2/12/2008

[8] ADB. 2009b. *The Economics of Climate Change in Southeast Asia: A Regional Review*. Manila (April 2009). This report is also referred to as the "mini-Stern report."

[9] This model can obtain a CO2 shadow price (which corresponds to the marginal cost of CO2 emission reduction) for achieving an assumed emission reduction target; alternatively, an expected emission reduction can be obtained under an assumed marginal cost of CO2 emission reduction.

improvements, energy efficiency gains in the industry and residential sectors, and fuel switching in the power sector (not including carbon capture and storage). The mitigation potential is approximately 140 $MtCO_2e/y$ at the benchmark of current carbon market prices (US$10/ton CO_2). It is critical to note that these estimates are technology-based, and do not reflect the actual cost of delivering GHG reductions via projects and programs which entail non-technical development risk and other transaction costs.

Figure 3: Technology-based Marginal Abatement Cost (US$) – Interventions > 5 $MtCO_2/y$

$30-$40/tCO_2											5	5
$25-$30/tCO_2										10		
$20-$25/tCO_2												
$15-$20/tCO_2								10	5			
$10-$15/tCO_2												
$5-$10/tCO_2						5	10					
$0-$5/tCO_2				5	7							
<$0/$tCO_2$	47	55	11									
Totals ($MtCO_2e/y$)	47	55	11	5	7	5	10	10	5	10	5	5
Cumulative ($MtCO_2e/y$)	47	102	113	117	125	129	140	149	155	165	170	175

Source: ADB 2009b. *Note:* Horizontal axis is not to scale

Key:	**Totals**	**Power / Energy Saving**	**67**
CCS	**20**	**Other Industries**	**67**
Power / Fuel Switching	**10**	**Residential & Commercial**	**11**

15. Other recent assessments by GOV, ADB, and World Bank, and others, also suggest that emissions reductions opportunities exist in energy efficiency, renewable energy, and transport systems. The World Bank Carbon Finance Assist program reviewed opportunities for mitigation in energy resources and electricity generation, industry, transport, waste, agriculture, and forestry from the perspective of developing Clean Development Mechanism (CDM) projects. Potential emissions reductions in the energy, industry, transport, and waste sectors range from 27% to 48%, of which 11% to 25% may be achievable with financial support from CDM or other sources of carbon or climate finance.

16. GOV recognizes that technology and modal shifts can be implemented to mitigate power and transport sector emissions growth, but the challenges are substantial given the current reliance on fossil fuels and the propensity for motorized personal transport. These mitigation wedges can be implemented in the near future if sufficient effort is made to address energy efficiency, renewable energy development, transmission and distribution system optimization, transport fuels, vehicle technology, infrastructure, and behavioral changes.

17. GOV is considering new EE and RE funds to facilitate accelerated investments in the near term. Special funds are expected to be incorporated into the proposed Energy Efficiency and Savings (EES) Law, as well as the new RE law. These funds would be capitalized by taxes on fossil fuel consumption, providing a conservation incentive, and could be structured to utilize donor resources to mobilize additional commercial investments in EE and RE.

Energy Efficiency

18. Table 3 shows the savings that are possible from EE interventions in Vietnam. The Table summarizes examples of EE interventions in the industrial and in the commercial/ residential/ public sectors, as well as in power transmission and distribution. The Table shows the potential energy savings compared with projected business-as-usual consumption in 2010 and the order-of-magnitude costs of these interventions if they were implemented. The Table also reports measures that have already been implemented in these sectors.

Table 3: Energy Efficiency Interventions and Savings in Vietnam

Sector/Sub-sector (examples of Interventions	Already Implemented	Potential Savings	Indicative Costs
Industrial EE (e.g., efficient drives, distributed generation, co-gen and tri-gen using natural gas)	Time-of-use meters have been installed at 5600 consumers; scale up by PCs and LDUs	15 – 20% annual savings on 2010 consumption = 2 – 2.7 mtoe/y = ~ 5 – 6.7 $MtCO_2e/y$	< US$1 million / MW
Commercial, residential, and public sector EE (e.g., including lighting, space cooling, refrigeration, water pumping)	Compact fluorescent lamps (CFL) and T8 tube lamps have been introduced and scale-up is planned	10 – 30 % annual savings on 2010 consumption = 1.3 – 3.9 $MtCO_2e/y$	< US$0.1 million / MW (total project cost) [Philippines Energy Efficiency Project, ADB 2009]
Transmission and distribution loss reductions (incl. high-voltage conductor technology and Smart Grid)	System losses have been reduced to about 10% for EVN-managed grid. Losses in LDU-operated systems may still be as high as 25%.	3% reduction in T&D system-wide losses [on 190 TWh increase from 2010-2030 @ 0.65 tCO_2e/MWh] = ~ 3.7 $MtCO_2e/y$	Incremental cost based on further reductions of 3%

Source: ADB technical assistance reports; WB CF Assist 2009
LDUs = local distribution utilities, PCs = Power Companies

19. The examples given in the Table for demand side EE measures in the industrial and commercial sectors stand for a large number of possible interventions that can be implemented in these sectors. On the supply-side, Vietnam Electricity (EVN) has already reduced its losses (technical and non-technical losses plus own electricity consumption) to 11% in 2008, down from over 20% ten years earlier. But much more can and needs to be done, in particular in locally-owned distribution grids, where losses can be as high as 25%. A 3% loss reduction (below BAU) in the power transmission and distribution system would bring Vietnam close to the international benchmark for transmission and distribution losses (which is 6-7%) and yield GHG reductions of about 3.7 $MtCO_2e/y$ in year 2030. In addition, Vietnam's electric power system will need to be ready to accept a further 5,000 MW of medium hydro plus another 2,000-3,000 MW of smaller hydro between now and 2020. If the system is not ready to accept this new hydropower capacity, then coal or gas power plants will be built instead, which are easier to integrate into the existing power system.

20. GOV has launched a series of efforts to expand its energy efficiency (EE) promotion work during the last five years. In 2003, GOV issued the Decree on Efficient Utilization of Energy and Energy Conservation. In 2006, the Prime Minister approved the Vietnam National Energy Efficiency Program (VNEEP) for the period 2005 - 2015, which was prepared by the Ministry of Industry and Trade (MOIT) (see Box below). A draft energy conservation law – Energy Efficiency and Savings (EES) Law – is being finalized after the first round of discussion with the National Assembly. MOIT expects that this EES Law will be passed by the National Assembly in summer 2010. During the initial phase, the ESS Law would make it mandatory for 1200 designated industrial establishments to periodically report on energy consumption as well as to implement energy audits and necessary investment measures to reduce their energy consumption levels.

Vietnam's National EE Program (VNEEP)

This program is Vietnam's first-ever comprehensive plan to institute measures for improving energy efficiency and conservation in all sectors of the economy in Vietnam. The program's energy savings targets are 3% to 5% of total national energy consumption relative to business as usual projections during phase 1 (2006–2010) and 5% to 8% of total national energy consumption during Phase 2 (2011–2015). Phase 1 aims to start up actively all components of the program; Phase 2 aims to expand each component, based on lessons learned from Phase 1. The six components in Phase 1 include: state management on EE&C, education and information dissemination, high EE equipment, EE&C in industrial enterprises, in buildings, and in transportation.

Achievements under Phase 1 are already significant, e.g. the draft "Law on Energy Conservation and Efficient Use", several EE&C directives, the establishment of an EE&C center in Hanoi, standards and labeling programs for appliances, CFL production, various surveys and pilot models, and research on public transport in cities. In 2007, about US$3 million of state budget funds were allocated for some 28 projects registered under the VNEEP – about one third of the funds to support two EE lighting manufacturers. In 2008, about US$2.25 million were allocated for some 48 projects – about one third of the funds to set up EE laboratories for air conditioners and refrigerators. Other projects include: standards and energy-use labels; EE&C management tools and technology in enterprises; building design and operations; fuel use and emissions from transportation; among others. (Taylor et al. (forthcoming).

Renewable Energy

21. Table 4 shows the RE opportunities in Vietnam. The Table summarizes the estimated potential for different sources of RE that could be added to the already installed capacity and the related order-of-magnitude costs.

Table 4: Options for Renewable Energy Development in Vietnam

Sector/Sub-sector	Installed Capacity	Potential Resources	Indicative Costs
Small hydropower	611 MW	2,000 MW[a]	US$1.5- 3.0 million / MW
Geothermal Power	n/a	1,400 MW	US$1.8- 2.6 million / MW
Wind	30 MW	1,500 MW[b]	US$2.5 million / MW
Solar	n/a	2.4 – 5.9 kWh/m^2/day	US$0.20 / kWh
Biomass (bagasse, paddy straw, rice husk)	158 MW	1000 MW	US$1.5-3 million / MW
Wood residue	(Non-commercial use)	100 MW	US$1.5 – 3 million / MW
Landfill gas & other waste conversion	n/a	230 MW[c] Potential GHG reductions of 16.3 $MtCO_2e/y$[d]	(Variable; may be financially viable with carbon finance)

Sources: RE potential from Nguyen et al, 2009 (IEW paper).
Notes: [a] About 2000 MW under development or proposed for development is considered to be BAU; an additional 2000 MW may be commercially viable. [b] Nguyen et al (2009) note theoretical wind power estimate of 120,500 MW with feed-in tariff ranging from US$0.05-0.08/kWh; however, this estimated is not supported by systematic wind monitoring, and MOIT suggests that maybe 2000 MW is commercial. About 500 MW of wind power is targeted for development by 2025 and is considered to be BAU. [c] Nguyen et al (2009) include 100 MW of waste-to-energy capacity as BAU. [d] Indicative number from World Bank CF Assist notes on waste subsector.

22. RE accounted for less than 1% of electric power generation in 2002 (not including large hydro which accounted for 26% of generation in the same year). The RE potential appears to be about 25% of currently installed power generation capacity. According to current plans, GOV expects RE to account for 3% of total power generation capacity in 2010, 5% in 2020, and 11% in 2050.[10] Nguyen et al. (2009) estimate that – under the current ACT pricing framework – the potential commercial RE capacity is about 4400 MW (about 22,000 GWh/year, assuming 5000 hours/year generation). By 2025, the RE capacity is expected to increase from less than 2000 MW of hydropower, biomass and other RE to a total of 5000 – 6000 MW i.e. about 25,000 to 30,000 GWh/y).

23. Hydropower is currently the most promising RE resource in Vietnam and, apart from some biomass technologies and some wind, probably the only commercially viable RE resource in Vietnam at this time. In 2007, the contribution of small hydropower generation (plants less than 30MW) was 575 GWh and is expected to reach 2000 GWh in a few years. A 2007 MOIT survey identified about 3,500 MW in small hydro projects, of which perhaps 1000 MW is economic at the projected ACT. About 2000 MW in additional capacity could be developed at a higher tariff , with corresponding GHG reductions of 7.9 Mt CO_2e/y. The increasing coverage of the country by the electricity grid brings these resources within range of connection.

24. Geothermal power is one of the most attractive RE technologies, as the energy source flows on a "24/7" basis, providing baseload power with high plant availability factors. The resource potential is estimated at 1400 MW, but commercial development will require site-specific evaluation including drilling of test wells. Until this has been conducted, it is impossible

[10] MOIT communication, October 2009.

to quantify the commercially viable potential; however, based on operating experience in other countries (e.g., the Philippines), up to 50% of the prospective resources (i.e. 700 MW) may eventually be commercially viable. Assuming that 300 – 700 MW could become viable, GHG reductions of 1.7 to 3.9 Mt CO_2e/y could be realized.

25. Wind power appears promising, based on preliminary satellite mapping, which suggests a technical potential exceeding 100,000 MW.[11] Site-specific monitoring has been conducted at only a few sites, and MOIT unofficially estimates the commercial wind power potential at about 2000 MW. About 500 MW of wind power may be commercially viable with current tariffs augmented with carbon finance, which would offset 0.975 Mt CO_2e/y. An additional 1500 MW at 35% load factor would offset about 2.925 Mt CO_2e/y. Currently, grid-connected wind power plays no role in Vietnam and is not considered economically viable, at least not until much of the country's hydropower potential is being used.

26. Solar photo-voltaic systems have been deployed in remote off-grid areas, but are not commercially viable under the current avoided cost tariff.

27. The total potential of biomass power is estimated at 1000 MW, which would yield GHG reductions of 5.5 Mt CO_2e/y.[12] About 100 very small biomass and biogas plants currently supply off-grid consumers.

28. The solid waste-to-energy potential is estimated at only 230 MW, which would provide only 1.3 Mt CO_2eq/y. One landfill gas recovery project has obtained CDM registration; registration of a second project is pending.[13] While these types of projects have a high development impact, their potential is limited by the technology requirements for gas recovery and treatment for on-site power generation. The total waste-to-energy potential is not sufficient to be considered transformational with respect to a low-carbon growth scenario.

29. GOV recognizes the potential of RE to contribute to the sustainable development of the electricity sector while also helping to close the crucial supply-demand gap, in particular in rural areas. It has made a solid start with the Renewable Energy Action Plan (REAP) in 2001, and through the World Bank's System Efficiency Improvement, Equalization and Renewables Project (2002), which has supported the development of the policy and regulatory framework. To address some of the barriers[14] to small scale RE development, MOIT has issued a "non-negotiation" standardized power purchase agreement (SPPA) and a tariff formula (the ACT) for small renewable energy projects selling to the grid.

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[11] Nguyen et al (2009) estimate 120,500 MW of potential capacity with feed-in tariffs ranging from US$0.05 – 0.08 / kWh. This estimate is based on satellite mapping and is not supported by site-specific wind monitoring. About 23,000 MW of wind power capacity could displace all projected coal-fired capacity additions through 2030, delivering 63.5 Mt CO2e/y reductions. However, feed-in-tariffs of US$0.05 – 0.08 / kWh for 10 years would cost US$9.7 – 12.3 billion, which does not appear to be competitive with near-term EE opportunities.

[12] Typical stand-alone biomass cogen plants need to achieve a cost of production of about US$0.08 / kWh to be financially viable, which is below the current avoided cost of power in Vietnam.

[13] Only 7 CDM projects have been registered for Vietnam as of July 2009: 3 small hydropower, 1 landfill gas, 1 wind power, 1 methane mitigation, and 1 reforestation. An additional 4 projects are in the registration queue with the CDM Executive Board.

[14] The barriers that hamper the large scale development of Vietnam's hydropower resources are: high transaction costs, no systematic site allocation to developers, weak developer capacity, lack of access to long-term financing, poor capacity to assess risks in potential project developers and commercial banks, who gravitate towards large scale projects of state-owned enterprises, where balance sheet lending and state backing is employed.

30. Developers (mostly private companies) have become more active in exploiting renewable energy resources (mainly small hydropower) to sell electricity to the national grid at the avoided cost tariff. GOV is also working with the World Bank on the promotion of RE. A recent World Bank project – The Renewable Energy Development Project (REDP) (2009) – addresses some of the barriers in RE development through a credit to commercial banks and technical assistance to support RE investments, support for regulatory development and project pipeline development. This project is also the basis for the first large scale CDM program in Vietnam. The REDP is currently the GOV's main instrument to establish the framework for small-scale, grid-connected renewables projects, demonstrate the viability of these projects to the banking sector, and build the requisite capacity and incentives among all stakeholders for large scale expansion of this sector.

31. MOIT is currently studying the government's options for a national strategy and a master plan for RE development, which may lead to the establishment of a RE development office and a RE development fund. GoV considers promoting RE development through a RE fund, which would make payments to RE projects to better reflect the avoided *economic* cost of alternative supply sources.

Transport

32. The transport sector currently contributes about one fourth of energy-related GHG emissions, slightly less than electric power generation. GHG emissions are projected to increase at approximately the same rate as for power generation and industry. A large percentage of the population now owns motorbikes, with a smaller percentage owning cars; car ownership is expected to increase dramatically as incomes continue to increase.

33. Table 5 shows GHG-reducing interventions in the transport sector in Vietnam. The Table lists the potential savings compared with current trends and government plans, and associated order-of-magnitude costs. The Table also shows that the planning and construction of urban rail systems in Vietnam's two major cities has begun and that GOV is working on biofuels and CNG busses.

Table 5: GHG Reductions in the Transport Sector in Vietnam

Sector/Sub-sector	Activities planned or underway	Potential Emissions Reductions	Indicative Costs
Urban Rail	Initial construction on 5 lines in Hanoi; initial design stage for 6 lines in HCMC	1.6 $MtCO_2e$/y reductions in major cities (from rail lines plus connectivity investments)	US$50-150 million / km
Bus Rapid Transit	n/a	0.33 $MtCO_2e$/y reductions in Hanoi and HCMC	US$2-10 million / km
Electric vehicles	n/a	4.2 $MtCO_2e$/y reductions by introduction of electric motorcycles replacing 50% of fleet	(US$3500 / motorcycle?)
Fuel switching (CNG, LPG, and biofuels)	Pilot testing of CNG in HCMC buses; initial biofuel production	E10 and B10 targeted by 2020; E20 potential is 1.6 $MtCO_2e$/y reductions	Development funding needed for feasibility studies and front-end engineering design

Sources: CTF Joint Mission notes; GHG reduction estimates from ADB (for urban rail) and World Bank Carbon Finance Assist (for other interventions).

34. Transport options appear limited to the expansion of urban rail and bus systems, complemented by the use of improved vehicle technology and modest contributions of renewable fuels. CNG expansion is technically possible but would depend on securing reasonably priced gas supplies under long-term contracts. GOV is mobilizing substantial investment in public transport systems in the large urban areas, with the objective of expanding public transport from about 10-15% to 50% of total passenger-kilometers travelled by 2020.

35. GoV is committed to addressing Vietnam's urban transport problems. Urban rail systems are under development with support from ADB as the core investments for private to public modal shift in Hanoi and HCMC. The rail projects will be complemented by high-efficiency bus systems and "connectivity" systems such as park-and-ride services – and an associated ADB project is included in this investment plan. Bus Rapid Transit (BRT) is under development in Hanoi to complement the urban rail system. BRT systems have been considered for HCMC but are not practical due to space limitations of the existing road network. Other options under consideration include: energy efficiency standards for new vehicles, optimization of urban transport routes, restriction and control of private transport in urban areas, introduction of hybrid technology buses, and possible fuel switching for buses.

36. Transport Master Plans exist for Hanoi and HCMC, which set targets of a 40-50% modal share for public transport by 2020, which is very high by international standards. The plans include the 6 urban rail lines for HCMC and 5 for Hanoi. ADB will finance some of these lines. However, these lines alone are insufficient to achieve the government's targets unless they will be fully integrated within a comprehensive transport system. This is what the proposed CTF project targets.

37. Petroleum fuels will continue to be used as the primary energy source for transport. Liquefied petroleum gas (LPG) will be introduced on a pilot basis in the near future. Compressed National Gas (CNG) is being pilot-tested in HCMC busses at present, but expansion will be depending on securing long-term supplies at reasonable prices. A nascent renewable fuels

program is being led by Petrovietnam, with the objective of 10% biodiesel (B10) and 10% ethanol blending (E10) by 2020. Vietnam's first commercial biofuel plant located in the Dung Quat industrial zone began initial production in mid-2009, and two other plants are beginning initial front-end engineering design.

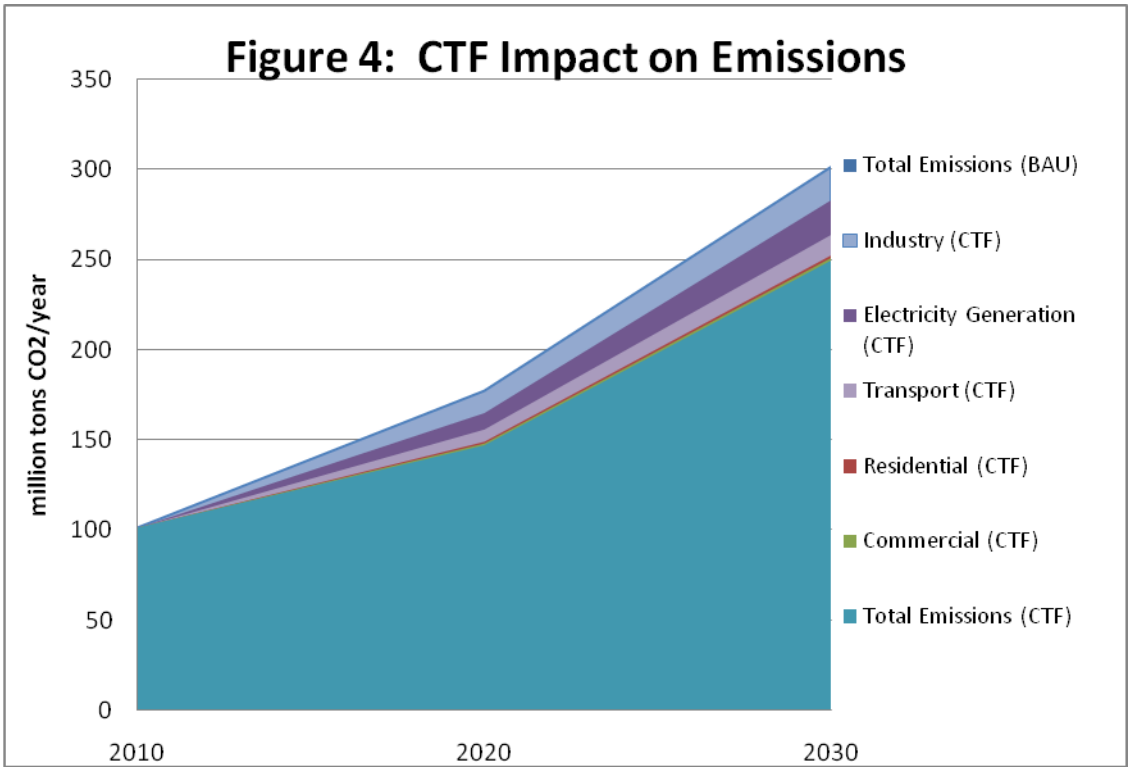
38. GOV has developed a "Strategy on Development of Vietnam's Transport Until 2020", which includes environmental considerations. A new environment department in the Ministry of Transport (MOT) is charged with environmental planning and is preparing a climate change action plan mandated by the National Target Program to Respond to Climate Change. Future plans that may reduce GHG emissions from the transport sector include vehicle inspections, fuel efficiency standards and buses using compressed natural gas (CNG).

Summary

39. Analyses conducted by ADB, World Bank, and IFC suggest that significant emissions reductions can be achieved: 20% reduction in industry, 20% reduction in power generation and supply, 15% reduction in transport, 10% reduction in residential, and 10% reduction in commercial sectors. As shown in Figure 4, the total GHG mitigation potential is more than 50 $MtCO_2e/y$, which comprises emission reductions resulting from CTF investments directly (about 8 $MtCO_2e/y$) and from scale up and replication (about 21.76 $MtCO_2e/y$) as well as reductions from EE and RE that go beyond the envisioned CTF financing plan.[15] Efficiency gains and emissions reductions in the industrial sector may be as much as 40%. Larger reductions may also be achieved in the commercial and residential sectors if building codes are updated to include "green building" standards.

40. The above description shows that one important area of mitigation action would be to curb the looming fast growth in power generation from fossil fuel. The high electricity intensity in the residential, commercial and industrial sectors in Vietnam and deficiencies in the country's power system suggest a focus on EE measures at the consumption level and in power transmission as well as acceleration of small hydropower development through more readily available and better-managed grid access. Another area of importance is the transport sector in the two big cities of Hanoi and HCMC, which is already poised for a transformative change due to the introduction of urban rail systems, which creates opportunities and the need to better connect and integrate the new rail systems with other transport options in order to exploit their full potential and lay the groundwork for future climate-friendly growth of the transport system in these cities.

[15] Additional mitigation reductions, not shown on Figure 4, could be made through development of large hydropower, biofuels, and new vehicle technologies. First-generation biofuels production capacity is being developed. Large hydropower potential may be several thousand megawatts (MW), but is not financially viable under the current tariff structure. New vehicles, e.g., electric motorbikes are commercially available, but they may not be affordable due to their much higher costs.



Source: ADB estimates based on APERC 2006 data.

III. RATIONALE FOR SELECTED SECTORS AND SUB-SECTORS FOR CTF CO-FINANCING

41. This section of the investment plan explains the considerations for selecting the emission reduction opportunities presented to the CTF. The selected measures are the result of discussions between GOV and ADB, IFC and the World Bank and reflect a combination of the government's priorities, the participating MDBs' capacity, experience and operational focus, and the priorities established by the CTF. The proposed interventions are part of the government's programs and of country programs of ADB, IFC and the World Bank.

42. The measures proposed for financing fall in three subsectors, namely energy efficiency, renewable energy and urban transport. Based on the foregoing discussion, energy use in the industry, electric power, and transport sectors present the highest priority for achieving large volumes of GHG reductions, and the following measures appear to be the most qualified for CTF financing due to their reduction potential, replicability, developmental impact and implementation potential:

(i) Supply- and demand-side EE&C in industry and power sectors, including advanced high-voltage transmission technology, smart grid technology, and distribution system loss reduction programs;
(ii) Scale up of clean and RE, primarily small hydropower, and advanced biomass energy, and wind; and
(iii) Public transport systems, complemented by fuel switching and advanced vehicle technology.

43. The emissions reductions expected to be associated with the proposed CTF-supported investments and with their replication and scaling-up are summarized in Table 6.

Table 6: Summary of CTF-Supported Emissions Reduction Scenario

CTF-Supported Intervention	Direct Reductions with CTF ($MtCO_2e/y$)	Reductions with Replication and Scale-up ($MtCO_2e/y$)
Industrial EE – (ADB) ESCO and EE Fund (ADB)	1.8	7.8 10.0
Transmission System Upgrade with AC3 (ADB)	0.156	1.56
Smart Grid (WB)	0.5	Enables 2000 MW of small hydro and other RE with up to 4.8 $MtCO_2e/y$ reductions
EE and RE Risk Sharing (IFC) RE Fund (IFC)	1.235 3.6	Enables additional 1000 MW of RE power with up to 2.4 $MtCO_2e/y$ reductions
Public transport enhancements (ADB)	1.3	1.6
Totals	**8.09**	**21.76**

Source: ADB estimates

44. The following interventions are being considered for possible CTF funding. The selection reflects the CTF criteria, the sector policies currently being implemented or under development by GOV, and the current preparatory work underway at the partner MDBs.

Energy Efficiency

45. Energy savings and GHG mitigation measures in the energy sector in Vietnam as well as the development of the country's RE resources face significant practical, financial and policy hurdles, which require not only an enhanced policy framework but also financial and technical assistance. With the passage of the Electricity Law in 2004, Vietnam has embarked on an ambitious long-term program to develop a competitive power market. The objective of the reform is to improve efficiency through competition, to minimize costs, and mobilize additional investment. GOV's current EE objective is to reduce national energy consumption by 5-8% relative to business as usual projections by 2015 (from 2006 baseline). GOV is in the process of updating its EE&C policy and energy pricing, which will strengthen the incentives for EE investments. Energy conservation and EE efforts will be explicitly supported by the Energy Efficiency and Savings (EES) Law, which will be considered by the National Assembly in May 2010 and then be implemented beginning in late 2010. However, while the EES Law will create an enabling environment for EE investments, large scale EE interventions by the government, in particular demand side interventions as proposed in this plan, will go beyond current plans.

46. *Priority interventions.* As noted above, the energy intensity in the Vietnamese industrial, residential and commercial sectors is high and the power sector still experiences transmission and distribution losses above international benchmarks. Possible interventions for demand and supply side EE, which could be co-financed by the CTF, include:

- Industrial EE (ADB): Investments in waste heat recovery and other measures at 10 enterprises with average production capacity of 1.5 million tons per year each would cover about 25% of the cement sector output. The investments directly supported by CTF are estimated to achieve at least 10% savings of electricity and coal consumption. Total energy savings of 26% at the 10 enterprises would deliver a total of 1.8 $MtCO_2e/y$ reductions. The CTF co-financed investments could be replicated throughout the sector, covering up to 40 enterprises by 2030, with total emissions reductions of 7.8 $MtCO_2e/y$, representing about 25% of current total industry sector emissions. Similar efficiency measures would be incorporated into the design of new installations in the cement sector and in other industrial sectors. [See Annex 1.]

- ESCO-led EE programs (ADB) and initial capitalization of an Energy Conservation Fund (ADB): In parallel with the industrial EE activities, ADB plans to support an expansion of the nascent energy service company (ESCO) business and the GOV-proposed Energy Conservation Fund as investment vehicles to promote replication and scale-up of EE activities. The ESCO activities would cover small and medium size enterprises (SMEs) and the commercial sector; in addition to performance contracting, other service modalities can be utilized to facilitate quick expansion of 3rd-party EE services. Providing start-up capital for the Energy Conservation Fund will also enable rapid start-up of operations to accelerate expansion of EE investments. Replication using these investment vehicles would result in an additional 10 $MtCO_2e/y$ reductions. [See Annex 1.]

- Transmission system modernization (ADB): The high-voltage network in Vietnam will require massive expansion during the next 20 years to allow effective load balancing between the north, south, and central regions of Vietnam. Upgrade of existing lines with advanced composite core conductors (AC3) has the potential to reduce system losses an additional 3% below BAU operations, and would postpone the construction of new high-voltage lines. Based on early experience in the US, transmission operations on a 100 km line would save about 240,000 MWh/y, with cost savings of US$9.6 million per year and emissions reductions of about 156,000 tons CO_2e/y. AC3 technology has yet to be adopted in Vietnam due to higher capital cost compared to conventional steel core conductors and perceived technology risk. AC3 is relatively new in the global market, operational experience is limited, and knowledge dissemination of operational success is practically non-existent. Thus, the technology is experiencing a "first mover" barrier. A successful deployment in a "test" section of the transmission network could be readily scaled up to at least 1000 km of high-voltage lines. On an avoided cost basis, the long-term net mitigation cost would be negative. [See Annex 2.]

- Transmission and distribution system upgrade (WB): Nationwide transmission and distribution (T&D) system losses are approximately 10%, but are estimated to be as high as 25% in some rural networks. System losses could be further reduced with newer grid operations technology, including substation automation and other "smart grid" systems, which enable the optimum use of intermittent renewable energy sources such as small hydropower and wind power. Energy storage (e.g., conventional pumped storage and advanced storage technologies) and "smart grid" technology are needed to fully optimize development and use of EE demand side and RE potential, especially intermittent resources such as wind and solar power. Smart grid upgrades could reduce losses by an additional 3% below BAU, representing about 0.5 $MtCO_2e/y$. Including 2000 MW of

new RE generation that could be enabled by the smart grid upgrades, long-term emission savings could be substantially higher. [See Annex 4.]

- New financing for private sector investment in EE (IFC): Proposed interventions include risk sharing facilities, lines of credit, mezzanine finance facilities, and capacity building programs to help address perceived risks and mobilize local financing to support EE and clean production in the industrial, commercial and residential sectors, as well as direct investments in RE project development. [See Annex 5.]

47. *Replication and scale-up potential.* Most of the technologies needed to implement the proposed measures are not new, and it can be expected that successful large scale interventions can, in principle, be replicated in the private and public sector. Possible new smart grid systems and advanced transmission conductors would introduce a new technology to Vietnam. CTF co-financing would support the demonstration and initial deployment of these new technologies, aimed at showing the costs and benefits as well as providing a learning opportunity. The deployment of these technologies would overcome the barriers of higher costs and perceived risks and risk averse investment policies and would led to their adoption as part of commercially financed replication projects. The CTF-supported projects would be implemented by the national utility and – once successfully demonstrated at scale – their replication would only be limited by available funding.

48. Government-led programs to promote energy conservation have so far had limited impact, and private sector investment has been minimal. EE is a relatively new business in Vietnam, ESCOs are not yet well established, and a learning curve must be surmounted, making start-up and scale-up support for these measures critical, before their replication potential can be realized. Most EE interventions will be relatively small investments, e.g., at the scale of individual plants, factories, and commercial and residential buildings. And they often compete with bigger and more urgent investment opportunities, such as increasing or diversifying production capacity. As part of the new EE policy, GOV currently considers the establishment of an Energy Conservation Fund, which could provide the specialized financing needed for rapid expansion of EE investments. Once the capacity in Vietnam to undertake EE efforts has been strengthened (with the help of the CTF), the scale up and replication risk would be low to moderate.

49. *Cumulative emissions savings*. Emissions reductions directly financed with CTF support are estimated at up to 10 $MtCO_2e/y$ (including reductions leveraged by the IFC-led investment program). Cumulative reductions are estimated at up to 17 $MtCO_2e/y$ for the industry sector (including EE investments led by IFC), with an additional 5-6 $MtCO_2e/y$ from power supply-side efficiency gains and the commercial and residential sectors.

50. *Co-benefits*. The development impact of EE investments is high given the inherent cost savings accruing to end users. This is particularly true in the residential sector, where the financial savings are pronounced for poorer consumers. Economic and environmental co-benefits will be realized via more efficient industrial production, reduced resource consumption, improved profitability, and reduced emissions of conventional pollutants from industry and power plants. These economic and environmental co-benefits are fully consistent with achieving the Millennium Development Goals. CTF-financed EE interventions will also contribute to the development of Vietnam's economy through the creation of new business (and potentially export) opportunities and greater employment at higher levels of qualification. A large scale EE program will also help Vietnam to reduce the energy and carbon intensity of its economy and lessen the resource constraints and higher cost of increased energy imports, which a rapid economic expansion could otherwise bring about – and suffer from.

51. *Implementation Potential*. Vietnam's National EE Program (VNEEP) is working to build the capacity for EE investments, and the new EES Law will further strengthen the capacity to implement the proposed measures. The World Bank, ADB and IFC have established working relationships with their counterparts in Vietnam, which support large investment programs in the energy sector, which often also promote EE. In particular, the power sector in Vietnam is one of the most effective in project implementation and disbursement compared with other countries in the region. ADB and World Bank are providing technical assistance to identify potential EE investments and will proceed only with projects that can be prepared and implemented with minimal lead time (i.e., < 12 months preparation) and where extensive capacity building at the enterprise level will not be necessary.

52. *Additional Costs/Risks*. Working knowledge of EE opportunities at the industrial and commercial enterprise and retail consumer level is still limited. Despite cost savings, relatively low capital costs, and quick payback, it is well known that EE projects do have upfront cost barriers, especially for small and medium size enterprises and poor residential consumers. E.g., capital costs for industrial co-generation may range well above US$1 million, which may not be readily financeable from cash flow or working capital. Commercial banks are reluctant to lend to EE projects, which typically do not involve physical assets and conventional revenue streams. The ESCO model is just now being introduced in Vietnam and is not considered "commercially" proven for purposes of conventional bank financing. Alternative business and investment modes, e.g., a national program of tradable EE certificates, might be technically viable but may encounter "first mover" risks.

53. *Program results indicators* for EE measures are reported in Table 7.

Table 7: Results Indicators for CTF Co-Financed Energy Efficiency Investments

Indicators	Baseline	Investment Program Results
Carbon intensity	0.0004 $MtCO_2e$ per million US$ of GDP at PPP	Arresting anticipated increase
Electricity consumption	65,900 GWh (in 2008)	29,400 GWh saved, which represents 10% of national electricity consumption 2020[a]
Power generation capacity from conventional sources	15,864 MW capacity (in 2009), expected to grow to 60,300 MW[b] under BAU	5,880 MW of avoided capacity additions by (2020)
Annual GHG emissions	33.9 $MtCO_2e$ /y emissions from industrial sector	6 $MtCO_2e$ /y reduced (60 $MtCO_2e$ in the first 10 years)[c]

Source: MDB estimates
Notes: [a] World Bank estimates total energy requirement of 294,000 GWh in year 2020, [b] World Bank estimate of total power capacity requirement in year 2020, [c] Emissions reductions from electricity and other fossil fuel use.

Renewable Energy

54. As noted above, Vietnam has significant undeveloped RE resources, in particular small hydropower. The development of some of these resources is commercially feasible, but is often hampered by financial and other barriers. GOV and the private sector realize this potential, and the World Bank already supports the construction of some 25 small hydropower installations through its "Renewable Energy Development Program" (REDP), and ADB is supporting small

hydropower development through its Renewable Energy Development and Network Expansion and Rehabilitation for Remote Communes Sector Project.

55. *Priority activities.* CTF co-financed programs could dramatically accellerate and scale up the exploitation of the existing biomass, hydropower, and wind power potential, thus reducing the need for construction of new fossil-fuel fired power stations to avoid shortages.

- Private sector support and risk-sharing facility for renewable energy development (IFC): CTF-support will reduce the cost of financing of selected direct investments in RE project development (mostly small hydropower). Based on anticipated private sector investments, up to 500 MW of new RE capacity could be supported with CTF funding, avoiding the need for about 380 MW of conventional fossil fuel power. The equivalent emissions reductions are estimated at 1.235 $MtCO_2e/y$. [See Annex 5.]

- Initial capitalization of a new RE Fund: Providing start-up capital for the Renewable Energy Fund, which is currently being considered by GOV, will enable a rapid commencement of operations, acceleration and expansion of RE investments. Assuming replication and scale up of an additional 1500 MW of RE capacity, using these investment vehicles would result in an additional 3.6 $MtCO_2e/y$ reductions.

56. *Replication and scale-up potential*. RE investments offer substantial GHG mitigation using commercially proven and locally available technologies, so that projects can be readily replicated. Private sector participation in the generation subsector is expected to grow, and implementation capacity is considered medium to high. The policy framework is expected to improve markedly with the new RE law. Near-term scale-up potential is 1500 MW and an additional 1000 MW could be expected based on current assessments of total RE resources (see Table 4).

57. Transmission connection and off-take risks could limit the rapid scaling-up of hydropower development, but these barriers could be removed or mitigated through new investments in the country's transmission and distribution grid, which is proposed for CTF co-financing above. In addition, CTF funds could be used to provide off-take guarantees to effectively "buy down" commercial lending costs. If both programs – power grid enhancements and strengthening of banking sector capacity for RE lending – are developed and implemented in synchrony, the resulting synergies could boost the replication potential quite dramatically.

58. *Cumulative emissions savings*. Emissions reductions directly financed with CTF support are estimated at 1.235 $MtCO_2e/y$. Cumulative reductions are estimated at up to 3.6 $MtCO_2e/y$, including small hydro, biomass, and wind power projects.

59. *Co-benefits*. The development impact of the proposed investments is expected to be medium to high. Commercialization of small hydropower (as well as biomass, wind, solar, and solid waste resources) would benefit rural electric cooperatives, offsetting emissions from traditional biomass (e.g., fuel wood and agricultural biomass). RE development will advance GOV's objective to increase the supply security, reduce future fuel imports and promote more stable electricity tariffs. Substantial environmental co-benefits can be realized via reduced emissions of conventional pollutants from coal and gas-fired power plants, and emissions reductions would be large compared to use of coal-fired power in the grid.

60. *Implementation Potential*. Most of the RE projects under development (mainly small hydropower and wind) are being led by private sector developers and/or local government-backed entities (which are being supported by the World Bank and ADB projects noted above). Management and technical capacity is sufficient to develop and implement additional projects, and reforms such as the standardized power purchase agreement and the ACT have made it easier and more predictable for these companies to become involved in the power market. But

commercial financing is still a limiting factor. CTF can assist in providing better financing terms for smaller RE projects that do not enjoy direct central government backing.

61. *Additional Costs/Risks*. With the exception of a part of Vietnam's small hydropower potential, production cost of most RE sources is above the current ACT, and all RE sources involve high upfront cost and risks (such as unproven geothermal resources and lack of site-specific wind data). Biomass and wind power typically cost US$1.5-3.0 million per MW of installed capacity vs. about US$1 million per MW for coal and natural gas. The non-availability and proximity of the transmission system is another cost and risk factor for RE development. Hydropower, the most promising RE in Vietnam, is to a large extend financially and/or economically viable, but still faces implementation hurdles such as high equity requirements and short tenures of commercial loans.

62. *Program results indicators* for RE measures are reported in Table 8.

Table 8: Results Indicators for CTF Co-Financed RE Investments

Indicators	Baseline	Investment Program Results
Installed RE capacity	769 MW installed RE capacity at present (see Table 4), increasing to 5000+ MW under BAU expansion plans	8000 MW total installed capacity (additional 2000 MW of small hydro, + 500 MW of biomass and 500 MW wind power)
Power generation capacity from conventional sources	15,864 MW capacity (in 2009), expected to grow to 60,300 MW[a] under BAU	2628 MW of avoided capacity additions by 2020
Annual GHG emissions from the electricity sector	27.7 MtCO2e/ y emissions from electricity sector (2010)	8.125 MtCO2e/y reduced (81.25 MtCO2e in the first 10 years) [b]

Source: MDB estimates
Notes: [a] World Bank estimate of total power capacity requirement in year 2020. [b] Emissions reductions are estimated with grid emissions factor of 0.65 tons CO2e / MWh as follows: Small hydropower: 2000 MW x 4000 hours/year = 8 million MWh/y x 0.65 tCO2e/MWh = 5.2 MtCO2/y. Biomass power: 500 MW x 6000 hours/y = 3 million MWh/y x 0.65 tCO2e/MWh = 1.95 MtCO2/y. Wind power: 500 MW x 3000 hours/y = 1.5 million MWh/y x 0.65 tCO2e/MWh = 0.975 MtCO2/y. Total = 8.125 MtCO2/y.

Urban Transport

63. In line with Vietnam's fast economic development, the demand for individual transport is growing rapidly in the cities of Vietnam, where people have begun the switch from motorcycles to owning passenger cars. GOV is targeting a public transport mode share of 45 to 50% by 2020 within HCMC and Hanoi (up from 10%), representing a significant shift away from cars and motorcycles. There are plans for six urban rail lines in HCMC and five in Hanoi. But these urban rail projects alone will not achieve the Government's targets by 2020.

64. *Priority activities.* GOV is proposing to use CTF financing to provide enhancements to the urban rail projects being planned in HCMC and Hanoi, and develop a comprehensive urban public transport system. The project responds directly to the government's priority on addressing pollution levels in dense urban areas (identified during the Joint Programming Mission to focus CTF resources). The ADB project will strengthen linkages between transport modes (buses, other public transport, private transport modes) increasing the catchment areas of the new urban rail lines. A variety of measures will be developed including introduction of high efficiency buses (hybrid technology and cleaner fuels), urban rail/bus interchanges and integrated ticketing, park

and ride facilities in urban outskirts, and modified parking charges in the core urban areas. The introduction of low carbon buses will set an example for fuel efficient public transport vehicles across Vietnam. In addition, policy reform measures will be developed that are aimed at discouraging private vehicle usage and encouraging public transport patronage. These measures will be initially designed for the HCMC Line 2, and then adapted to the Hanoi Line 3 periphery. But the same measures can be applied at all 6 lines in HCMC and all 5 lines in Hanoi.

65. *Replication and scale-up potential*. The proposed CTF enhancements will have the potential for replication to other urban rail lines and throughout the urban transport systems of the two target cities as they grow from their current populations (about 3.5 million people in Hanoi and about 6.7 million in HCMC). The urbanization ratio in Vietnam is expected to grow from 25% in 2002 to 43% in 2030. It is critical at this stage of major investments in urban transport in the two cities to demonstrate and introduce best emission-saving practice, which can then be replicated in the future. In addition, some aspects of the projects (such as low carbon buses and policy measures) can be applied in other large towns and cities in Vietnam, who may very well follow the example of the two dominant urban centers in Vietnam And the experience gained in HCMC and Hanoi can be transferred to other cities to achieve long-term transformational impact. The replication potential is thus considered to be high, as there is low technology risk and substantial private sector interest.

66. *Cumulative emissions savings*. Emissions reductions directly financed with CTF support are estimated at 1.3 $MtCO_2e/y$. This includes scale up in the HCMC urban area. An additional 0.3 MtCO2e/y reductions are expected from replication and scale-up in Hanoi and in other cities. Further reductions can be achieved with the introduction of advanced vehicles (e.g., electric motorbikes) and renewable fuels.

67. *Co-benefits*. The development impact is considered medium to high. The transportation situation in Hanoi and HCMC is quickly becoming unacceptable given the expected rapid increase in private car use and high pollution levels from motorcycles. The proposed project will expand the benefits of urban rail development to other areas of the cities, which is expected to contribute significantly to reduced traffic congestion and potential reductions in travel times and travel cost savings as well as lower pollution levels. The latter is particularly true for poorer consumers, who will not be able to buy their own cars.

68. *Implementation Potential*. There is a strong track record on urban rail and bus networks, and implementation capacity is high based on the current level of public sector investment in public transport systems. Nevertheless, the initial implementation risk is considered high, mainly due to the potentially disruptive nature of the projects. But the scale up and replication risk is considered low.

69. *Additional Costs/Risks*. The proposed connectivity investments are above and beyond the estimated and budgeted costs for the urban rail lines, which are presently being financed on a stand-alone basis.

70. *Program results indicators* for urban transport interventions are reported in Table 9.

Table 9: Results Indicators for CTF Co-Financed Urban Transport Investments

Indicators	Baseline	Investment Program Results
Carbon intensity	0.0004 $MtCO_2e$ per million US$ of GDP at PPP	Arresting anticipated increase
Number of cities with low-carbon public transport programs	0	2
Annual GHG emissions	3.7 MtCO2e/y emissions from transport in the target area	1.3 $MtCO_2e$/y reduced by the program (13 $MtCO_2e$ in the first 10 years)
Number of passenger-trips on public transport	10%	44% (by year 2030 in HCMC)

IV ENABLING POLICY AND REGULATORY ENVIRONMENT

71. The policy framework relevant to proposed CTF investments is the National Target Program to Respond to Climate Change (NTP-RCC) and applicable sector policies. Both are summarized below. The NTP-RCC contains principles, objectives, sectoral priorities, and targets for 2010 and 2015 as well as specific action plans and financing mechanisms to integrate climate change impacts in the country's sectoral development plans (Table 10).

Table 10: Vietnam Energy and Transport Policy Framework

Sub-sector	Key Policies, Programs, and Objectives	Expected Outcomes	Issues / Comments
Energy Efficiency	***National Energy Efficiency Program established by Prime Minister Decision 79/2006/QD-TTg*:** Strategy and components: • Develop management systems for energy savings • Strengthen education, disseminate information, and enhance public awareness for EE &C and environmental protection • Develop and popularize high efficiency equipment and gradually phase out low efficiency equipment • Promote EE&C in industry, buildings, and transport sector Other programs: • Consumption-based tariffs are in place, which discourage excessive electricity use and are pro-poor • Time of use tariffs introduced and being expanded • Efficient lighting program under implementation Energy sector reforms including introduction of Competitive Generation Market will reflect full-cost pricing of energy and provide market incentives for conservation and efficiency gains New Energy Conservation Decree under consideration with approval and implementation expected in 2010	*Current program:* • 3-5% reduction in national energy consumption relative to business as usual projections from 2006 – 2010, and 5-8% from 2011-2015 Draft Energy Efficiency and Savings Law: • Energy management training and certification • Energy audits and management systems implemented at designated enterprises and buildings • New Energy Conservation Fund capitalized with tax on fossil fuels • Updated standards and labeling for lighting and appliances • New guidelines and standards for construction materials and buildings	New Energy Efficiency and Savings Law will provide clear government authority to impose mandatory conservation measures, EE standards, and other conservation and/or utilization targets. EE still faces financing barriers partly due to the "invisibility" of EE measures and difficulty in demonstrating and quantifying results Limited private sector participation to date. Expansion of ESCO market being promoted by ADB.

Sub-sector	Key Policies, Programs, and Objectives	Expected Outcomes	Issues / Comments
Renewable Energy	*National Energy Strategy Development (Decision 1855/QD-TTg of 27 December 2007) and Viet Nam Power Sector Development Strategy (Decision 176/2004/QD-TTg)*: • RE development is priority for rural areas • Current strategy for 3% RE share by 2010, 5% by 2020, 11% by 2050 • Government investment will be limited to plants > 100 MW, with priority to multi-purpose hydro projects • Encourage new forms of investment for small hydropower • Avoided Cost Tariff applied to projects 30 MW or smaller; standard power purchase agreement utilized to facilitate quick negotiations Other Programs: • Competitive Generation Market being introduced • New law on RE is under development • Feed-in tariff and/or other incentives for ER being studied by MOIT	Ensure sufficient, stable, secure, accessible and reasonably-priced energy supply Pursue cleaner and efficient energy utilization and clean technologies adoption Diversify energy mix in favor of indigenous RE resources, and promote wide-scale use of RE as alternative fuels and technologies Competitive Generation Market will reflect true market price of fuels, and provide a more level playing field for renewable energy	RE potential remains underdeveloped and is projected to lose market share relative to coal-fired power over the next 2 decades Development barriers include higher capital cost for most RE technologies, cost of transmission access, and possibly off-take risk which constrains commercial bank financing ADB is supporting drafting of the new RE law GTZ is supporting analysis of feed-in tariffs
Transport	Public investment in urban rail networks and complementary urban transport facilities and services Biofuels development program led by Petrovietnam	Public transport: modal shift from ~ 10-15% of urban travel to 50% by 2020 (based on total passenger-km). 10% ethanol blend with gasoline (E10) and 10% biodiesel blends (B10) by 2020	Urban rail is currently cost-effective only in Hanoi and HCMC Development of new biofuel production plants is being hampered by lack of early project development funding to cover feasibility studies and front-end engineering design

Source: APERC 2008; ADB staff notes and consultants reports.

Energy Policy Framework

72. The *National Energy Development Strategy* for the period up to 2020 with outlook to 2050 approved by the Prime Minister on 27 December 2008 (Decision No. 1855/ QD-TTg) set various energy development targets. Relevant objectives include[16]:

- Developing power plants and power networks, ensuring a sufficient supply of electricity for socio-economic development, and ensuring the reliability of electricity supply is 99.7 percent in 2010.
- Achieving a share of renewable energy of 3 percent of total power generation capacity in 2010, 5 percent in 2020 and 11 percent in 2050, conforming to the objective set out in the national energy strategy.
- Completing the rural energy program for rural and mountainous areas. Increasing share of rural households using commercial energy to 50 percent in 2010 and 80 percent in 2020. By 2010, 95 percent of rural households will have access to electricity.
- Changing the electricity, coal, and oil and gas sectors to operate within competitive market mechanisms in compliance with State regulation. Establishing a competitive electricity retailing market in the period after 2022; establishing a coal and petroleum product business market by 2015.

73. With the passage of the Electricity Law (2004), Vietnam has embarked on an ambitious long-term program to restructure completely its power sector by discarding its current vertically-integrated electrical utility system in favor of a competitive power market. The objective of the reform is to improve efficiency through competition in the power industry, to minimize costs to consumers, and to expand the mobilization of investment and managerial resources from outside the current, state-operated system.

74. Key legislation on the electricity sector includes the Electricity Law (2004), followed by Decrees 105 and 106 (2005), which have to do with the implementation of the Electricity Law. The Prime Minister's Decision 258 of 2005 established the Electricity Authority of Vietnam (ERAV). The Prime Minister's Decision 26 of January 2006 set out the roadmap for reform of the power sector and Decision 1855 of December 2007 set out the national strategy for energy development to 2020. Other legislation includes Decree 55 (2003) and Decree 189 (2007), establishing the functions, tasks, powers and organizational structure of MOIT.

75. Central to the reform and restructuring is the Electricity Law, which was passed by the National Assembly in November 2004 and came into effect on July 1, 2005. The Electricity Law establishes a new framework for the power sector, comprising:

- A planning process to select new generation investment to supply projected demand consistent with security and reliability criteria and government energy policies. The PMDP[17] process will continue, as will the development of Provincial Power Development Plans covering distribution investments, but will be overseen by MOIT rather than EVN.
- The gradual development of a competitive power market, initiating with a competitive generation market that has a single wholesaler (the Single Buyer), its later development into a wholesale competitive market and finally the gradual development of retail competition.
- The establishment of a new regulatory agency, ERAV, under the Minister of the Ministry of Industry and Trade (MOIT).

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[16] Information and data are taken from APERC 2008.

[17] Power Master Development Plans

76. The Prime Minister's Decision 26 of 2006 approved the Roadmap for the development of the competitive power market and pre-conditions to be met for moving from one phase to the next. A three phase process is envisaged, each split into two stages: an initial pilot to test and improve the market design and then the stage for full implementation. The phases are:

- Phase 1 (2005 - 2014): Competitive Generation Market (CGM), to introduce competition to participate in the generation market. The pilot stage comprised an internal EVN power pool for generation owned by EVN, including equitized power plants. The complete CGM is planned to start in 2010. Power generators will sell to a single wholesale licensee (the Single Buyer), who will resell to Power Companies (PCs) at regulated Bulk Supply Tariffs (BSTs).
- Phase 2 (2015 - 2022): Wholesale Competitive Market (WCM), by allowing more than one wholesaler, and PCs and some large customers to buy directly from Generators or wholesalers. In the pilot stage, selected PCs and large customers will be allowed to buy from and contract directly with generators and from the spot market. In the final complete stage, all PCs and Large Customers will enter and participate in the wholesale market and multiple wholesale licensees will be allowed.
- Phase 3 (from 2023): Retail Competitive Market (RCM), gradually reducing PCs monopoly as retailers of small and medium sized customers. Small customers in some provinces and above a specified threshold (e.g. annual consumption or demand above a defined threshold) will be allowed to choose their supplier, with number of provinces gradually extended and thresholds gradually reduced.

77. Under the current and envisioned tariff structure, the business-as-usual (BAU) commercial RE potential could displace up to 4400 MW of fossil power capacity during the next 15 – 20 years.[18] The current objectives for RE development reflect the limited resources in the country. Under the Avoided Cost Tariff, commercial RE capacity is about 25% of currently installed power generation capacity, and would comprise only about 11% of generating capacity by 2030 (with the balance from large hydro, gas, and coal). Wind power resources may be much higher than currently estimated, but investment in site-specific monitoring will be required for accurate assessment of potential. MOIT is currently looking into a new pricing policy (feed-in tariff) and other incentive mechanisms in order to support commercial development of RE with higher costs or risks.

78. MOIT and EVN have implemented demand-side management and EE programs in recent years (with MDB assistance), including high-efficiency lighting programs (CFL and T8)[19]. The policy framework for EE and RE are expected to evolve rapidly during the next 2 – 3 years. The draft law on Energy Efficiency and Savings (EES) is under consideration by the National Assembly and is expected to be approved in May 2010 and begin implementation in 2010. A Renewable Energy Decree is under preparation and is slated for Prime Minister's approval in late 2009. A new Energy Conservation Fund and a new Renewable Energy Fund are to be proposed, which would provide entry points for CTF investment support.

Transport Policy Framework

79. The Government's transport sector strategy is spelled out in the Strategy on Development of Viet Nam's Transport Until 2020,[20] which drew from the 2000 Study on the National

[18] Nhan T. Nguyen and Minh Ha-Duong. May 2009. *Economic Potential of Renewable Energy in Vietnam's Power Sector*. Energy Policy, volume 37, Issue 5, pages 1601 – 1613. Elsevier, Ltd.

[19] T8 = fluorescent tube lights, standard model T8.

[20] Approved by the Prime Minister on 10 December 2004.

Transport Development Strategy, prepared with JICA. The strategy recognized the transport sector's importance to socioeconomic development, defense and security considerations, and national industrialization and modernization. It stresses the importance of maintenance, cost-efficiency, safety, and environmental impacts. All transport components from infrastructure, the transport industry and services need to interact seamlessly as well as satisfy interregional and international requirements. The Strategy realizes that private or public/private financing will be needed to cover future transport costs. The Strategy also contains a long list of proposals for funding, including developing a road fund, and developing policies for land clearance compensation.

80. The Ministry of Transport (MOT) increasingly recognizes that the environmental performance of the transport sector needs to improve. To this end, MOT has established a new environment department tasked with responsibility for improving environmental planning and management, commissioning environmental impacts assessments of new transport infrastructure; and preparing a climate action plan in response to requirements of the National Target Program to Respond to Climate Change.

81. The EES Law which is pending approval from the National Assembly will confirm MOT's responsibility for setting emissions standards for all forms of transport: road, rail, water, and air. MOT confirmed that Euro-II tailpipe emissions standards are in effect for new automobiles, but that there are no fleet fuel efficiency standards as yet. The major policy initiatives to be pursued during the next year are (i) drafting a road map for introduction of Euro-III, -IV, and –V standards, (ii) inspections and emissions testing for road vehicles in big cities and towns, (iii) piloting and scaling up the use of buses using compressed natural gas (CNG) and liquefied petroleum gas (LPG); and (iv) fuel efficiency standards.

V. IMPLEMENTATION POTENTIAL AND RISK ASSESSMENTS

82. This section addresses the capacity in place to implement the proposed investments and some of the constraints and key risks that could impede implementation. The implementation potential and risks are centered on a few key issues:

(i) the existing policy framework for EE and RE provides incentives for some investment, and is scheduled for a quantum advance with new legislation and decrees expected in late 2009 and mid-2010; however, there could be some risk of delay in upgrading the policy framework and in implementing it.
(ii) RE projects must deliver electricity at a cost very close to current retail tariffs; and
(iii) the viability of transport sector programs may vary considerably with global crude oil and petroleum product prices.

83. The overall implementation risk is considered to be medium to low. However, due to the limited project-related work undertaken in preparation of this investment plan, many of the financial and emission reduction estimates will have to be reviewed and may have to be revised as more information becomes available.

84. GOV recognizes the need for enhancing its energy and transport policies in order to maintain energy security and has developed appropriate near-term strategies for EE, RE, and cleaner transport. New EE business models are being introduced, and although prevailing energy prices are relatively low compared to other Southeast Asia countries, the progressive electricity tariff structure favors scale-up and replication of EE activities.

85. Vietnam's collective expertise is growing, especially for small hydropower development and biogas-biomass energy; but wind power development is immature. Sufficient commercial expertise exists to implement new RE projects and programs, and there is substantial public sector investment in transport systems (urban rail and complementary bus systems).

86. The implementation potential and risks of the measures proposed for CTF co-financing are summarized in Table 11. More details are contained in the Annexes.

Table 11: Implementation Potential and Risk Summary

RISK	MITIGATION	RESIDUAL RISK
Policy and Regulatory Framework: EE policy is immature (by developed country standards)	MOIT has regulatory authority to issue best practices guidelines and draft standards. Policy support can be provided through program lending and technical assistance to reduce project risk.	Medium
Institutional Capacity: Private sector experience in EE is limited	Sufficient human resources exist in the private sector to implement the proposed EE investments, but some skills development may be required at early project implementation stage.	Low – medium
Technology: Operational and maintenance problems can be expected with newly deployed systems. The AC3 conductor technology proposed for the transmission upgrade (ADB, Annex 2) and the smart grid technology is new to Vietnam.	Technologies being considered for CTF support have been commercially deployed in Vietnam or other countries. But international experience with the AC3 conductor technology is limited. Operations and maintenance training will be included in project design as necessary, and can be incorporated in contract specifications for goods and services.	Low
Finance: Commercial banks are unwilling to lend for EE and some RE projects	Guarantees and other financial products will be developed to reduce perceived risk. Technical assistance will be provided as necessary to upgrade commercial bank capacity to assess and mitigate project risk.	Low – medium
Scale-up and Replication: EE and RE market expansion may be restricted by technology and finance	Perceived financial risk will be reduced along with successful project implementation. Proven technologies will be utilized and projects will be sized and phased appropriately to prevent an "overload" of market and institutional capacity.	Low
Environmental and Social Safeguards: Projects must also be consistent with local and regional pollution control efforts.	Project design will follow GOV and multi-lateral bank safeguards. Appropriate environmental management measures will be incorporated into project design (e.g., CFL mercury waste management facilities). Social impacts are expected to be largely beneficial.	Low

Source: ADB, WB, and IFC mission notes, based on respective MDB risk assessment practices and CTF guidance.

VI. FINANCING PLAN AND INSTRUMENTS

87. This investment plan aims at developing an adequate financial package for the proposed investments in which the CTF contribution will leverage other sources of funding at a ratio of at least 1:5. Depending on the concrete nature of the proposed measures, additional funding sources will include concessional (IDA) and non-concessional loans from participating MDBs, grants and equity from multilateral, public and private financial institutions, risk-sharing facilities, and guarantees, as well as carbon finance. Other innovative financing mechanisms may be developed for private sector projects.

88. Grants from CTF and other sources may be utilized for project preparation covering feasibility studies, due diligence, and structuring of private sector projects e.g., power off-take guarantees. Project preparation is expected to require a US$ 1 million per proposed project for a total of US$5 million. These preparation funds will be complemented by funds from participating MDBs and from other donors, which are expected to amount to US$3 million.

89. Loans will comprise the bulk of project and program financing, and could include project loans, sector loans, and ADB's Multi-Tranche Financing Facility. Program loans may be employed in parallel to support policy development and implementation costs. Co-financing will be mobilized to the maximum extent possible from other IBRD, IFC, JICA/JBIC, private sector investors, and other donors. Guarantees will be used for private sector projects to mobilize commercial bank lending and project developers' equity. Guarantees may include partial credit guarantees, risk sharing, and other innovative forms depending on project structuring.

90. GEF and carbon finance will be sought for all measures where this is appropriate and can be secured given the regulatory complexities and time requirements of these funding sources. In particular, carbon finance could enhance the cash flow of small hydropower projects, for which the prevailing off-take tariff is insufficient. IBRD is already working with MOIT to develop and register a CDM Program of Activities (PoA) that would support the hydropower and other RE projects to be included in the World Bank's Renewable Energy Development Project (REDP). This CDM PoA could potentially also support hydropower projects to be developed as part of IFC's RE projects proposed for CTF support.

91. The use of carbon finance for EE and transport projects depends much on the projects' details, which determine the complexity of the CDM methodology and the success of project registration with the CDM Executive Board. The World Bank's Carbon Partnership Facility – as well as ADB's post-2012 carbon fund and IFC's carbon finance guarantee mechanisms – offer excellent opportunities to design and pilot enhanced long-term financing and risk coverage plans in sync with the development of the proposed CTF projects. Once such carbon finance program frameworks have been put in place and the associated capacity to manage them has been built in Vietnam, they offer additional incentives for the continuation, replication and scaling up of the CTF-supported intervention. The CDM verification regime and the cash flow from generating and transferring certified emission reductions will be an important incentive to maintain the CTF-supported projects and operate them in good working order.

92. The draft investment plan envisions US$250 million in CTF funding as shown in Table 12 below, which would leverage and additional US$3.2 billion in co-financing. In addition, some carbon finance contributions may be possible for some activities, but these opportunities have not yet been evaluated as they will depend on the specifics of the proposed project plans, in particular CDM eligibility and available methodologies.

Table 12: Project Financing Plan (indicative, US$ million)

Financing Source	Proposed Programs and Projects					
	Industrial Energy Efficiency (ADB – Annex 1)	**High Voltage Transmission Technology (ADB – Annex 2)**	**Urban Transport (ADB – Annex 3)**	**Smart Grid Technology (IBRD – Annex 4)**	**Clean Energy Financing Facility (IFC – Annex 5)**	**Total**
MDBs	40	260	500	180	200	1,180
GOV	25	40	100	100	0	265
CTF	50	50	50	30	70	250
GEF	0	0	0	0	0	0
Carbon Finance	10	0	0	0	0	10
Other Co-financing	40	200	500	0	0	740
Private Sector	100	500	0	0	900	1,000
TOTAL	265	1,050	1,150	310	1,170	3,445

Source: ADB and IBRD country programs; financing plans in Annexes 1-5; ADB, IBRD, and IFC staff estimates; IFC discussions with commercial banks and potential project sponsors.

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ANNEX 1: INDUSTRIAL ENERGY EFFICIENCY PROJECT (ADB)

Problem Statement

1. Under the business-as-usual scenario (2010 – 2030), industry sector emissions will increase by 163% from 33.9 $MtCO_2e/y$ to 89.2 $MtCO_2e/y$. Currently energy utilization in Vietnam can be characterized by (i) a lack of awareness of the benefits of energy conservation, (ii) a lack of skilled human resources to implement demand side management, and (iii) high losses and low efficiency due to use of obsolete technologies and equipment. Studies conducted by MOIT show potential for conservation in the industry sector is about 20% of current energy consumption. High energy demand coupled with limited energy conservation measures has contributed to electricity shortages, necessitating new investments in generation that could otherwise have been deferred.

2. ADB is providing technical assistance (TA) to MOIT for Supporting Implementation of the National Energy Efficiency Program (ADB TA 7024-VIE). The TA scope includes industrial enterprise surveys, energy audits, and analysis of potential EE opportunities in energy-intensive enterprises including cement, iron and steel, pulp and paper, and textiles. The TA is providing MOIT with the much-needed expertise and tools for (i) designing and developing training methods and materials for energy managers in industrial enterprises; (ii) designing and conducting a survey of energy consumption in selected industrial enterprises, thus creating a basis for analyzing energy consumption patterns in industry; (iii) establishing ESCOs that can provide auditing and advisory services to industrial enterprises on energy conservation measures; (iv) piloting energy audits in selected industrial enterprises; and (v) translating the ensuing recommendations into an appropriate investment plan to realize the energy-saving potential in a profitable manner. This TA is scheduled for completion by year-end 2009, and will provide specific recommendations for a follow-on investment project which would be supported by CTF.

Proposed Transformation

3. Energy conservation and efficiency (EE) measures offer win-win opportunities to reduce energy intensity and improve overall process and resource efficiency. However, the current EE policy and energy pricing framework provides limited incentives for investment, especially for capital-intensive upgrades in heavy industries. Energy service companies (ESCOs) are in early stages of corporate development, and commercial financing for EE investments is limited. Donor funding has provided limited investment in low-cost measures such as more efficient lighting (e.g., CFLs), and installation of time-of-use meters for some industrial and commercial consumers. Capital-intensive investments in heavy industries, such as waste heat recovery and cogeneration, has yet to occur.

4. The investment project will finance the deployment of cleaner industrial process technologies and EE measures in energy intensive sub-sectors such as cement, iron and steel, pulp and paper, textiles, and food and beverage. Candidate subprojects envisioned are: waste heat recovery and more efficient mills in cement plants; co-generation in iron and steel plants; energy recovery from organic wastes in food and beverage production; complementary equipment such as high-efficiency pumps and motors; and other systems as determined during the feasibility analysis stage. The project may also include ESCO-led investments in utility demand side management (DSM) programs and in residential and commercial sectors. Large scale EE investment is not occurring due to a combination of factors:

(i) lack of management knowledge and technical expertise to identify EE investment opportunities;

(ii) actual and perceived technological risk;
(iii) perceived financial risk, i.e., payback periods on large capital investments may be in the range of 7-8 years versus less than 3 years desired by plant owners
(iv) capital cost of waste heat recovery and cogeneration systems; and
(v) limited commercial financing for candidate investments.

5. The first 2 issues are being addressed in part by the ongoing ADB TA. The last 3 issues can be partially addressed by the proposed ADB investment project. CTF resources are proposed to enhance the project design, as follows:

- CTF resources can improve the "depth" of the ADB project by providing more attractive financing terms for the high-cost investments, which will shorten the pay-back period and enhance the financial rates of return. Financial instruments may include risk-sharing facilities with commercial banks and loan guarantees.
- CTF is also proposed to expand the scope of the investment project to include financial support for ESCO-led projects[21] in the form of low-interest working capital.
- CTF is proposed to contribute to the initial capitalization of the proposed GOV Energy Conservation Fund.

6. Preliminary analysis conducted under ADB TA 7024-VIE indicates that energy savings per ton of cement produced could be as high as 26%. EE investments of US$50 million at 10 enterprises with average production capacity of 1.5 million tons per year each would cover about 25% of the cement sector output. The investments directly supported by CTF are estimated to achieve at least 10% savings of electricity and coal consumption, delivering at least 85,500 MWh/y electricity savings, 30,000 tons/y coal savings, and avoided generation capacity of 12 MW. Total energy savings of 26% at the 10 enterprises would deliver a total of 1.8 $MtCO_2e/y$ reductions.

7. Nationwide cement production is projected to increase to about 60 million tons per year in the near future. Replication and scale up in the cement industry could result in total GHG reductions as high as 7.8 $MtCO_2e/y$.

8. The impact of these investments will be improved industrial productivity and profitability, which can be replicated and scaled-up in other sub-sectors as knowledge and operational experience increase. Replication of EE investment in other sectors could deliver an additional 10 $MtCO_2e/y$.

Implementation Readiness

9. MOIT has sufficient expertise to manage the overall ADB investment project, and project management support will be included in the project scope, including capacity building for financial institutions and ESCOs. ADB is providing Project Preparation Technical Assistance (PPTA), which will identify candidate sub-projects based on technical, financial, economic, social, and environmental aspects, as well as enterprise management capacity to implement the proposed EE investments.

Rationale for CTF Financing

[21] The term "ESCO" refers here to a broad spectrum of potential service providers and does not specifically refer to the common international definition of ESCOs, which work under performance and shared-savings contract mechanisms. In the Vietnam context, ESCOs may be expected to work in a variety of modes including stand-alone energy advisory services (audits and feasibility studies); engineering, procurement and construction management services; and performance contracting.

10. In addition to the issues noted above, large scale investment in EE opportunities is being constrained by other factors:

- GOV's current objective is to reduce national energy consumption by 5-8% relative to business as usual projection by 2015 (from 2006 baseline), which appears relatively modest compared to potential energy savings identified by various technical studies. With limited government leadership, under the current objectives, large scale EE interventions are clearly not business as usual.
- Despite long-term cost savings, the proposed capital-intensive investments, such as cogeneration, do present a cost barrier to some enterprises due to the high capital cost which cannot be readily covered with cash flow, working capital, or commercial bank financing. Small and medium-scale enterprises have limited capital reserves and limited access to commercial financing. Carbon finance may provide some financial support but revenue would be "on delivery" and not on an up-front basis.
- The ESCO model is just now being introduced in Vietnam, and is not considered "commercially" proven for purposes of conventional bank financing. Alternative business models and investment modes, e.g., a national program of tradable EE certificates, might be technically viable but may encounter "first mover" risks.
- The subprojects supported by CTF are replicable and scale-able without long-term concessional financing. As the more efficient enterprises gain comparative advantage, intra-sector competition will help drive replication. Commercial financing of EE will also increase as banks and other financial institutions gain experience as part of the CTF-supported project.

Financing Plan

11. The indicative financing plan for the project is shown in the table below.

Source	Total (US$ million)
GOV	25
ADB	40
Other co-financing	40
CTF	50
Carbon Finance	10
GEF	0
Private Sector	100
Total	265

Project Preparation Timetable

12. The indicative processing schedule for the project is shown in the table below.

Milestone[22]	Date
ADB PPTA approval	December 2009
PPTA implementation	March – July 2010
Appraisal / negotiations	August – September 2010
Approvals	October 2010
Project completion	December 2013

[22] The Program preparation timetable is for illustrative purpose only. It is based on the assumption that the Vietnam country investment plan will be approved by the CTF Trust Fund Committee in November 2009.

ANNEX 2: POWER TRANSMISSION SECTOR INVESTMENT PROGRAM (ADB)

Problem Statement

1. Vietnam's indigenous energy resources exhibit distinct geographic distribution. Coal reserves are primarily in the northern part of the country in Quang Ninh Province and the Red River Delta, in relative proximity to the Hanoi and Haiphong urban centers. Proven oil and natural gas reserves are mainly in the offshore basins in the southern region of the country, in relative proximity to Ho Chi Minh City (HCMC). Hydropower resources have been developed throughout the country and provide the largest share of electricity nationwide. Biomass resources are available throughout the country, with some concentration in mountainous regions and the Mekong and Red River deltas.

2. The energy resource distribution indicates the following logical considerations for the national electric power system over the medium to long term:

(i) Coal and gas are expected to provide baseload power in the northern and southern demand centers, respectively, for the foreseeable future.
(ii) Hydropower can meet most demand in the central region, although seasonal shortages have been experienced; when available, some seasonal surplus could be delivered to southern demand centers.
(iii) Gas can provide peak power supply in the southern region, and could possibly cover seasonal power deficits in the central region.
(iv) Renewable energy resources to complement fossil fuels and hydropower are relatively limited, with the possible exception of wind power [see further discussion below].
(v) The high-voltage transmission grid must be upgraded to achieve effective load balancing across the country.

3. The high-voltage north-south "backbone" is proposed to be upgraded from 500 kV to 800 kV to improve load balancing and system operations at an estimated cost of at least US$2 billion. Possible alternatives to the planned upgrade are (i) high-voltage direct current (HVDC) instead of the conventional alternating current system, and (ii) upgrade of existing lines with advanced composite core conductors (AC3). HVDC would allow for more efficient wheeling of power between regional load centers, but would require a new right-of-way and system upgrades at each end of the line. HVDC would provide a limited number of connection points. A new 800 kV line would also require new right-of-way and system upgrades. Upgrading the existing 500 kV corridors with AC3 conductors would increase transmission capacity without developing a new right-of-way and building new lines.

Proposed Transformation

4. AC3 conductors weigh much less than conventional metal conductors; an equivalent weight of new AC3 conductor can carry twice the power of conventional conductors with 25% lower line losses. AC3 technology presents the possibility of upgrading a transmission corridor on existing towers at much lower cost than a new 800 kV line or HVDC. The AC3 conductors would be complemented with software to provide enhanced system operations. Upgrade of the high-voltage network with an AC3 system could deliver an additional 2-3% reduction in line losses below business as usual. The AC3 systems can also be deployed on lower voltage corridors.

5. CTF funds of US$50 million are proposed to support the first commercial scale deployment of the AC3 technology covering 100 kilometers of existing transmission corridor. Based on early experience in the US, transmission operations on a 100 km line would save about 240,000 MWh/y, with cost savings of US$9.6 million per year and emissions reductions of about

156,000 tCO_2e/y (the actual power loss reductions may be higher than this estimate). A successful project could be readily scaled up to at least 1000 km of high-voltage lines.

6. Upgrading existing corridors with AC3 conductors versus HVDC will avoid costs estimated at US$900 million per 1000 km of transmission corridor (US cost basis). Assuming the projected increase of electricity generation of 190 TWh/y from 2010 – 2030, large scale deployment of AC3 conductors instead of conventional AC lines could result in avoided transmission losses of 5,700,000 MWh/y, representing cost savings of US$ 228 million per year. The equivalent avoided generation capacity of 814 MW represents an avoided cost of approximately US$1 billion. Total avoided GHG emissions are estimated at 3.7 $MtCO_2e/y$.

Implementation Readiness

7. CTF is proposed to expand the scope of the ADB transmission sector multi-tranche financing facility, included in the ADB country program for 2011, to include financial support for an AC3 component on a section of the high-voltage transmission system. A feasibility study will be required to identify a suitable project and prepare the investment program.

8. EVN has sufficient expertise to manage the proposed ADB investment program, and project management support will be included in the project scope.

Rationale for CTF Financing

9. AC3 technology has yet to be adopted in Vietnam due to higher capital cost compared to conventional steel core conductors and perceived technology risk. AC3 is relatively new in the global market, operational experience is limited, and knowledge dissemination of operational success is practically non-existent. Thus, the technology is experiencing a "first mover" barrier.

10. In addition to the issues noted above, large scale investment in EE opportunities is being constrained by other factors:

- Despite long-term cost savings, the proposed investment is capital-intensive and has perceived technology risk.
- Replication and scale-up of the successful demonstration would not require concessional financing. As EVN deploys the AC3 technology, accrued cost savings will be sufficient to support future expansion of the AC3 systems.

Financing Plan

11. The indicative financing plan for the project is shown in the table below.

Source	Total (US$ million)
GOV	40
ADB	260
Co-financing	200
CTF	50
Carbon Finance	0 **
GEF	0
EVN *	500
Total	1050

Note: * Future investment with self-financing or other private/commercial financial support.** The possibility of carbon finance has not yet been evaluated.

Project Preparation Timetable

12. The indicative processing schedule for the project is shown in the table below.

Milestone[23]	Date
ADB PPTA approval	January 2010
PPTA implementation	April – September 2010
Appraisal / negotiations	October – November 2010
Approvals	December 2010
Project completion	January 2013

[23] The Program preparation timetable is for illustrative purpose only. It is based on the assumption that the Vietnam country investment plan will be approved by the CTF Trust Fund Committee in November 2009.

ANNEX 3: URBAN TRANSPORT PROGRAM (ADB)

Problem Statement

1. The transport sector in Vietnam currently accounts for nearly 10% of the country's total GHG emissions, and a quarter of the energy-related emissions. The rate of public transport use in urban centers in Vietnam is very low compared to other parts of Asia, with around 90% of all trips being taken by private transport. The majority of these are by motorcycle, but the country's recent economic growth is resulting in rapidly increasing car ownership. This is placing enormous strain on infrastructure in the main urban areas of Hanoi and Ho Chi Minh City (HCMC), and other cities, in particular on the road networks. Traffic volumes well in excess of the networks' capacities result in congestion and high levels of mobile source pollutant emissions, including GHG, which will increase significantly unless the traffic issues are addressed urgently.

2. A recent study[24] of the existing traffic congestion in HCMC has shown that it is already having serious economic consequences. The average delay at peak times was 45 minutes and points to the lack of traffic discipline as well as overall traffic volume and the low share of public transport in the modal split as the source of the problem. The socio-economic cost was about VND14,000 billion a year (equivalent to some US$0.8 billion), 6.25% of the total GDP of HCMC. There is therefore a need to provide sustainable modes of urban transport that provide both effective, efficient and safe means of transport within the cities and links to external transport networks linking cities and regions of Vietnam, South Asia and the rest of the world. Without these, the economic potential of HCMC, Hanoi and other urban centers will be constrained; competitiveness, congestion, air pollution and safety will be compromised; and there will be consequential effects on wealth generation, household incomes, the urban environment and the quality of life.

3. GOV has recognized the need for improved public transport in urban areas. Transport Master Plans (TMPs) have been approved for both Hanoi and HCMC. These set targets of 40-50% modal share for public transport by 2020 (which is very high by international standards). The TMPs are based on networks of new urban rail lines, six in HCMC and five in Hanoi. These will contribute significantly to increasing the role of public transport and thereby the reduction of GHG emissions. However, the urban rail projects alone will not achieve GOV's targets by 2020. The urban rail lines will need to be fully integrated within a comprehensive transport system that includes buses, other public transport and linkages with private transport modes. These will all contribute to increasing the catchment areas of the urban rail lines. The feasibility study for the HCMC Line estimates that failure to organize the bus routes and other linking transport modes with the urban rail lines would result in reduced rail ridership projections of about 40%.

Proposed Transformation

4. The proposed CTF co-financed projects will be aimed at putting in place the catalysts to achieving a transformational modal shift to public transport. The program will focus on the two urban rail projects in Hanoi and HCMC. As described above, the proposed urban rail lines will need to be backed up by a range of other physical and policy initiatives in order to meet the government's modal split targets and thereby reduce GHG emissions. The range of potential interventions is illustrated in Box 1. For both cities it has been assumed that the 'business as usual' (BAU) scenario is the completed and operational rail lines (Line 2 in HCMC, Line 3 in Hanoi). The 'with CTF' scenario is the two lines with enhancements – and the CTF-induced

[24] National University, HCMC (2008). Study on Public Transport Structure by Bus in Ho Chi Min City.

transformation is these enhancements replicated across all urban rail lines (plus a potential for replication of some features in other cities).

The Situation in Ho Chi Minh City

5. As the largest city in Vietnam and the country's economic centre, HCMC has experienced rapid economic growth and development in the last decade. The city population has grown from 5.2 million in 2000 to 6.7 million in 2008.[25] Over the same period, the real annual rate of economic growth was 11%; the number of enterprises increased more than threefold; the number of registered employed grew by more than 50%; and GDP per capita grew by about 70%. Such rapid growth has transformed the city's economy and improved the living standard of the population but at the same time has placed enormous pressure on the transport network.

6. Only 15 years ago, the most popular mode of transport was by bicycle. Rapid growth in incomes has facilitated motorbike and car ownership; there are currently some 3.1 million motorbikes and 400,000 cars in HCMC. Of the estimated 19 million non-pedestrian trips a day, 93% are now by private vehicle with the most popular mode being motorbike accounting for some 78%, with cars only 1% and bicycles 14% and the remainder using public transport modes.

7. In HCMC, feasibility studies for all six urban rail lines have either been completed or are in progress and implementation is anticipated to be completed by 2020.

The Situation in Hanoi

8. Hanoi is the second largest city in Vietnam and is now experiencing rapid urbanization and development. The population of Hanoi at the start of 2008 was estimated at 3.5 million people residing in 14 districts with a total surface area of 921 km^2. As of August 1st 2008, Hanoi increased in size as a result of the inclusion of several provinces into the Hanoi Metropolitan area. 'New Hanoi' comprises an area of 3,324 km^2 with a population estimate of 6.2 million. Car ownership levels have been climbing in Hanoi recently, by as much as 11% a year and this is expected to continue.

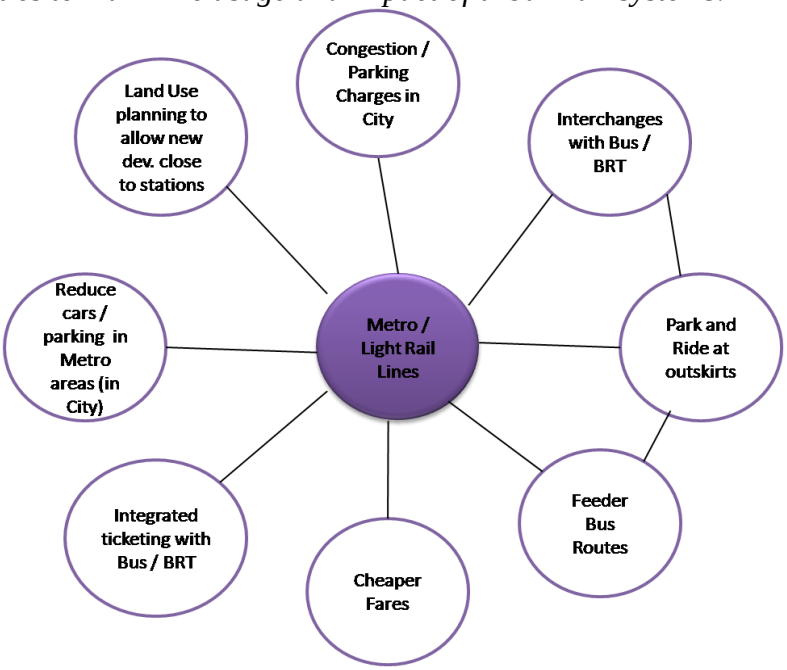
9. The Transportation Master Plan for Hanoi to 2020 includes a comprehensive improvement program for transport infrastructure. The proposed 5 urban rail lines as well as 2 Bus Rapid Transit (BRT) lines are proposed along with improvements to bus services. However, the feasibility of the proposed urban rail lines recognizes that certain enhancements such as park and ride and feeder bus services will create a more substantial modal shift towards public transport and ultimately increase the ridership and value of the urban rail system.

[25] All data: Vietnam Statistical Yearbook, 2008

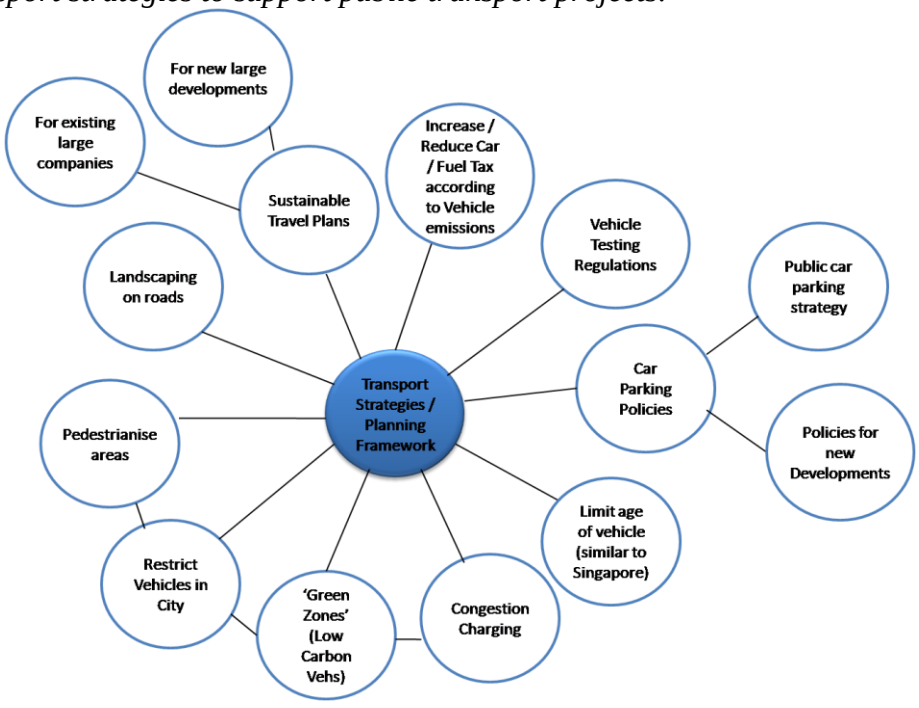
Box 1: Opportunities and Strategies for Public Transport Optimization

The two diagrams below illustrate the range of supporting mechanisms that could be introduced in order to maximize patronage and effectiveness of the proposed urban rail systems.

Opportunities to maximize usage and impact of urban rail systems:



Transport strategies to support public transport projects:



Proposed CTF Project Scope

10. The proposed CTF project comprises a number of components which will be enhancements to existing and planned public transport programs and strategies in HCM City and Hanoi. These components are all aimed at increasing the patronage of the urban rail systems and reaching the Government targets of 50% public transport mode share, along with significant environmental benefits including additional reduction in transport sector GHG emissions. The components are as follows:

- Planning of and investment in new feeder bus routes to increase the catchment areas (and hence patronage) of the urban rail lines (including potential bus priority routes). This will include a comprehensive review of current public transport plans. The transport forecasting models developed under ADB technical assistance TA4862 should be refined and used for this purpose. These models were developed and calibrated in 2007, and there should be no need for major refinement or recalibration of the models. Forecasting assumptions and parameters for the future year models for the "trend" and "policy" modal split scenarios should be reviewed. In particular, a review of policy changes to achieve these scenarios, and bus network assumptions including options for bus restructuring and feeder systems, would be needed.

- Development of strategically located park and ride sites to allow private vehicles to park and connect to the urban rail for travel into the cities. Appraisal of likely demand for other interchange services in HCMC at Line 2 stations such as taxi, private car, motorcycle drop-off, etc. Review opportunity for park-and-ride (for both motorcycle and car), and identify and finance key stations where such provision may be most appropriate.

- Introduction of new bus technology such as Hybrid and/or CNG buses. Hybrid bus technologies can deliver substantial reductions in GHG emissions (especially if powered by cleaner fuels such as CNG), while lowering emission of local criteria pollutants. The project will support part of the incremental cost in comparison to the standard technology buses, thus making it possible to initiate operation at a commercial scale and providing an experience of global value while reducing its cost. In HCMC this will include a review of the existing CNG initiatives and the potential for expansion. CTF would provide additional funding to cover procurement of a limited number of hybrid buses.

- Policy review and recommendations for incentives and enforcements to restrict private vehicle usage within the city centers. This will include extensive public consultation, as well as programs for public information and education aimed at encouraging public transport use.

- Plan integration and capacity building. This will include measures to ensure greater integration of planning and policy within the transport sector and with other sectors. It will also provide support for the development of a rational framework to address overarching urban transport issues in the metropolitan areas in order to maximize cost-effectiveness for the institutional and financial resources allocated to the sector. The project will also support capacity building and training to ensure a sustainable operation of hybrid bus technologies.

11. Estimated emissions reductions are 1.3 $MtCO_2e/y$ with scale up in the HCMC urban area. With replication and scale-up in Hanoi and other cities, an additional reduction of 0.3 $MtCO_2e/y$ is possible. Further reductions could be achieved through complementary investments such as the introduction of advanced vehicles (e.g., electric motorbikes) and renewable fuels.

Implementation Readiness

12. New feeder bus routes utilizing low carbon buses such as Hybrid or CNG buses can be implemented at the same time as the first urban rail lines in Hanoi and HCMC. The provision of

new buses and park and ride facilities is relatively simple to implement compared to large scale infrastructure projects.

13. A strategy for reducing cars within the cities, such as restrictions on car and motorcycle parking, can be implemented at the time of the opening of the urban rail lines, new bus routes and park-and-ride sites.

14. The HCMC urban rail project is included in ADB's program as a multi-tranche financing facility (MFF) to be approved in 2010. The proposed CTF supported components would be included in the 2nd tranche of financing to be approved by 2011.

Rationale for CTF Funding

15. CTF resources can help to overcome financial and institutional barriers to the realisation of a major modal shift in urban transportation. These include:

(i) The expansion and integration of bus services with urban rail lines will face institutional and political economy barriers, requiring fiscal measures that may not prove popular in the absence of financial and regulatory incentives.
(ii) Replacement of existing equipment is capital intensive, involving the purchase of many new vehicles, scrapping of old vehicles, and large transaction costs.
(iii) Adoption of low-carbon technologies (hybrid drives) is currently up to 50% more capital expensive than regular drives, even though their use would typically reduce maintenance expenditures by a similar margin. The additional upfront capital costs constitute a significant financial barrier.
(iv) Harmonization of sector plans and policies in urban development, air quality planning, transport planning and climate change, requires an additional effort that will not be undertaken unless there is a strong program that coalesces these different sectors toward common goals.

16. The availability of the CTF low-cost financing should encourage and accelerate the adoption of projects and policy measures that would otherwise be unattractive to city governments. For instance, authorities will be more likely to enforce stricter tail-pipe emission standards if they are able to demonstrate that public transport vehicles are meeting the standards. The proposed enhancements to the two urban rail lines will be directly and immediately replicable for other lines in the two cities, and certain aspects, such as the low-carbon technologies and policy measures, will have the potential for replication in other cities and towns.

Financing Plan

17. The indicative financing plan for the project is shown in the table below.

Source	(US$ million)
GOV	100
ADB	500
CTF	50
Carbon Finance	0*
GEF	0
Other co-financing	500
Private Sector	0
Total	1,150

Note: * The possibility of carbon finance has not yet been evaluated.

Project Preparation Timetable

18. The indicative processing schedule for the project is shown in the table below.

Milestone[26]	Date
ADB Project Preparation TA approval	January 2010
PPTA implementation	April – August 2010
Appraisal / negotiations	September - October 2010
Approvals	November 2010
Project completion	December 2013

[26] The Program preparation timetable is for illustrative purpose only. It is based on the assumption that the Vietnam country investment plan will be approved by the CTF Trust Fund Committee in November 2009.

ANNEX 4: SUPPORTING DEVELOPMENT OF A SMARTER TRANSMISSION GRID (IBRD)

Problem Statement

1. The growth of demand for electric power of about 15 percent per year over the past decade has mirrored the country's rapid economic development. Efforts in the power transmission subsector have been focused on connecting new generation capacity and in increasing supply to the centers of greatest demand in Hanoi and Ho Chi Minh City. The transmission and distribution system has also been built out to cover the rest of the country as electrification levels, and residential and industrial loads in secondary cities and rural areas have increased.

2. To increase Vietnam's capacity to finance the continued growth in demand beyond the more traditional sources of retained earnings, local banks and ODA, the government has embarked on an ambitious program of reform of the power sector. A key plank of this reform is to introduce competition in generation, which it is expected will improve supply side efficiency. The subsequent restructuring of the power sector has resulted in the creation of a separate National Power Transmission Company (NPT), the role of which is to develop and operate the 500 kilovolt (kV) and 220kV transmission system nationwide. In parallel, a new regulatory regime is being put in place, a key part of which is to 'unbundle' the tariff system; for NPT this now means that its revenues are directly linked to the amount of power it transmits between generators and distribution companies.

3. The transmission tariff creates incentives for NPT to operate at maximum levels of efficiency (in technical as well as commercial and financial terms) and availability, since energy lost in transmission through inefficiencies or outages represents lost revenues which the regulator does not permit to be recovered from consumers. Reduced availability of transmission lines to evacuate power from the most efficient plant – that is, those further up the merit order – may mean production from those plants is constrained from being dispatched and their place taken by less efficient plant, resulting in overall reductions in system efficiency.

4. The reforms and restructuring also create challenges for NPT. First, it must continue to meet the expanding demand for power transmission while also staying within agreed capital and operating budgets set by the regulator as well as meeting efficiency and availability targets. Second, the introduction of competition into generation is likely to bring greater diversity which must be connected, in an environment where demand growth is expected to continue at its historic levels. Third, NPT must continue to expand its system to meet the high demand growth and, at least for the foreseeable future, operate under severe capacity constraints.

5. These points are well illustrated by Vietnam's plans for hydropower. As much as half of today's installed capacity of 15,800MW is expected to be added from medium and small hydro between now and 2020. Under current plans some 22 medium sized hydropower plants (of around 100 – 500MW), totaling about 5,000MW and an estimated 2,000 – 3,000MW of small hydropower plants will be connected. As they are widely distributed around Vietnam – often in more remote areas – and are generally smaller than most conventional plants, they often require dedicated transmission capacity to be constructed. Project owners are likely to be highly sensitive to the timing of their transmission system connection and to outages or other dispatch constraints that may reduce the revenues from their investments.

Proposed Transformation

6. Internationally, there have been many recent advances in transmission system design, control, metering, and data acquisition and analysis technology, allowing major improvements in real-time, fine-tuned dispatch of small as well as medium and large scale generation, better routing of loads, system-wide use of storage capabilities, and enabling of quick and more widespread demand responses. All of these improvements add up to efficiency gains which may exceed 20%, and capacities to readily dispatch a wide range of smaller scale renewable or other low-carbon generation facilities. These "smart grid" technologies involve new, long-term design concepts, new hardware (especially for meters, controls and information technology), new software and data analysis techniques, and new operating practices.

7. The proposed transformation is to support NPT towards adopting smarter grid technologies in the transmission system at 500kV and 220kV levels. CTF co-financing would support the demonstration and initial deployment of the smart grid, aimed mainly at showing the costs and benefits as well as providing a learning opportunity for all parties involved. It would provide smarter grid technologies at substations and the necessary network management infrastructure that could be later used for further retrofit and for newly built substations that embed improved control, metering and management systems within their initial design. Particular areas for focus may include: (a) investments that directly improve the efficiency with which the transmission system can be operated; (b) investments that will improve the capacity of the transmission system to integrate renewable and aggregate several small renewable generation to connect directly to 220kV level, and enable aggregation to ready the system for more complex and demanding operations, (c) investments to allow real-time information on dispersed storage capacity (e.g. in hydroelectric facilities or planned new pumped storage plant) to flow to grid operators and to allow its timely dispatch, and (d) mutual real-time information flow between grid operators and large consumers on consumer demand, underpinning new programs to match consumer power use with supply costs.

8. The program is proposed for implementation in one section of the 500kV north south backbone by upgrading the existing Hoa Binh, Nho Quan, Ha Tinh, Da Nang and Pleiku 500kV substations. Retrofits of two 220kV substations would also be financed to demonstrate effectiveness at that voltage level.

Implementation Readiness

9. NPT has significant experience in implementing transmission projects, and has worked with the World Bank and ADB since its formation in mid-2008. For several years before NPT's formation, and since, actual project implementation has been undertaken by several highly experienced Power Project Management Boards. The power sector is one of the most effective in project implementation and consistently achieves project implementation and disbursement comparable with other countries in the region.

10. From a technical standpoint, the proposed equipment is readily available off the shelf from a variety of manufacturers. Because the investments involve retrofitting equipment in existing NPT facilities, environment and social issues are expected to be minimal.

Rationale for CTF Financing

11. CTF co-financing would overcome a viability/credibility gap by demonstrating at sufficient scale a cutting edge technology with potential to transform the operations and management of Vietnam's transmission system. The project would help bring down several

barriers to scale up, most particularly uncertainty about the costs and benefits of smarter grid investments, and perceptions about the risk to the availability of the transmission system:

- The cost of smarter grid technologies is considerably higher than that in current use. A 'smart meter', with data collection, storage and transfer capabilities may cost four or five times as much as a normal meter. Estimates of the cost to retrofit the necessary control and protection system are of the order of US$4 million for a 500kV substation and US$2 million for a 220kV substation; at the end of 2008, there were 15 x 500kV and 124 x 220kV substations in Vietnam. In addition, network level investments in information technology and management systems would also be required. Incremental costs for a new substation are substantially lower but not insignificant. Retrofitting the existing system as well as equipping new parts of the system represents a considerable financing and operational commitment;
- NPT, like most utilities, is quite conservative, especially when adopting 'mission critical' changes. It is reluctant to commit itself to a major investment program – a full retrofit program would cost in excess of US$300 million – without a much higher degree of assurance about its costs and benefits. Therefore positive incentives are required to buy down the perceived risk;
- The new focus on availability and efficiency resulting from the changes to the method of calculating the transmission fee makes it difficult to persuade the electricity regulator to agree that these technologies can be included in the capital expenditure program, especially in the absence of real, Vietnam-specific costs and benefits.

12. In bringing about this transformation, the proposed project brings about substantial co-benefits, specifically to enable the connection of a larger number of geographically diverse medium and small hydropower projects, and the improved dispatch of them, which will displace other forms of generation, primarily from fossil fuels. The investment could be expected to reduce emissions by about 1 $MtCO_2e$ over the lifetime of the project.[27] If scaled up to cover the entire system, approximately ten times that amount could be expected to be reduced. In addition, CO_2 emissions savings would also be generated by facilitating connection and dispatch of the larger amounts of hydropower and other renewables through improved system availability.

Financing Plan

13. The following is a first draft of the financing plan.

Source	Amount (US$ million)
NPT	100
IBRD	180
CTF	30
Total	310

[27] Estimates based on North-South power flows of 4.2 TWh/y and South-North power flows of 14.8 TWh/y and an estimated 20% efficiency improvement, to bring losses from the current 2.45% to 2%, hence a saving of about 86 GWh/y which at 0.6 tCO_2/MW is an annual saving of 51,000 tCO_2/y. Savings from the 220kV system are not computed.

Program Preparation Timetable

14. The project is expected to be prepared along the following timeframe.

Milestones[28]	Dates
Government concept approval / Bank concept review	November 2009
Project preparation	November 2009 – February 2010
Appraisal / negotiations	March 2010
Approval	April 2010
Project implementation start	April 2010

[28] The Program preparation timetable is for illustrative purpose only. It is based on the assumption that the Vietnam country investment plan will be approved by the CTF Trust Fund Committee in November 2009.

ANNEX 5: PRIVATE SECTOR FINANCING PROGRAM FOR ENERGY EFFICIENCY, CLEANER PRODUCTION AND RENEWABLE ENERGY (IFC)

Problem Statement

1. The private sector has a significant role to play in contributing to the reduction of GHG emissions. However, the private sector contribution has been limited thus far in Vietnam as discussed in this Country Investment Plan. GOV recognizes that private sector investments in EE improvement, cleaner production (CP) and RE is imperative in supporting Vietnam's economic growth in a sustainable manner. While the promise of a policy framework for EE and RE to create an enabling environment for more private investment in this area is encouraging, there are other impediments that constrain the wide spread implementation of clean energy projects.

2. Discussions between the MDB joint mission and the private sector project developers as well as local financial institutions indicate the existence of two major perceived risks in the sector – market and technical risks. These perceived risks are significant barriers for the private sector companies to access financing to fund EE/CP/RE projects. Financial institutions, especially local commercial banks, are reluctant to provide much-needed financing to the sector due to the perceived risks; and the majority of local financial institutions lack the capacity to properly assess risks related to EE/CP/RE projects. Unless the behavior of the local financial institutions is transformed, companies engaged in EE/CP/RE activities will continue to face serious barrier to accessing local financing.

3. With the recent strong growth of the industrial sector and increasing consumption by the household sector, Vietnam is facing difficulties in meeting its energy demand. Since 1995, electricity sales have grown by a consistent 15 percent per year, twice the GDP growth of the same period. Industrial electricity use tripled over the last decade, and has now overtaken residential consumption as the largest user, accounting for 50% of total electricity consumption. Rapid increases in industrial electricity use are linked to growth in the manufacturing industries. Industrial value added grew by about 11 percent per year during 1996–2004. Industry, which is relatively electricity-intensive, increased its share of GDP from 22.6 percent in 1995 to 42 percent in 2007. Apart from heavy industries, the types of light industry that have grown the fastest in Vietnam – food and beverage processing, textiles, light chemicals, and light consumer durable goods – often tend to increase power use per unit value added as development proceeds, due to increasing automation, packaging and (for food, beverages and textiles) increased use of cooling. Industrial electricity demand growth has increased especially fast during the last few years (17% p.a between 2000 and 2008), and is expected to continue to be a key demand driver.

4. While Vietnam's energy consumption per capita remains low compared to other countries, its energy intensity is one of the highest among APEC economies. Local companies use 1.5-1.7 times more energy than their peers in Thailand and Malaysia, for example, to produce a unit of product with the same quality. This inefficiency certainly affects industries' competitiveness, especially in the post-WTO environment. Vietnam's carbon emission per capita remains low, but its carbon emission per GDP unit is rather high (2.2 times higher than APEC average). Local industries have very old, low efficiency and outdated technologies, and manufacturing facilities are often located in densely populated areas. A scoping study undertaken in Vietnam by IFC in Aug/Sept 2007 reveals that manufacturing industries have increasing demand for business expansion, equipment replacement, and technology upgrading. This is not only to cope with integration pressure after WTO accession, but also to address cost structure challenges in the context of high-priced imported material inputs, increasing energy costs, and pollution control and other environmental improvement requirements. Although investment

decisions are largely driven by costs, many companies, especially exporting ones, are aware of the importance of environmental performance in global trade and supply chain competition. It is understood that the major challenges for these enterprises to upgrade their facilities towards cleaner and more efficient production are the lack of access to finance, and the lack of access to high-quality and affordable technical advisory services.

5. Financial institutions in both public and private sectors often do not have in-house technical capacity to evaluate EE and CP projects. With the lack of understanding of specific types of EE/CP investments and their risk profiles, banks often find it difficult to develop and structure appropriate financial products. Most of the commercial banks in Vietnam rely on short term deposits, which limit their ability to structure financial products that allow flexibility in loan repayment terms (3 to 7 years in CP/EE projects). There is no strategic partnership between banks and technical service providers, or between banks and equipment or technology suppliers. For technical service providers, there are also capacity constraints. Few appear technically competent, and will need support to consistently improve their quality of services and outreach to industries.

6. In addition to the need of scaling up EE/CP investments to address the demand side, Vietnam also needs to mobilize private sector investments to quickly develop the RE sector on the supply side. GOV sees the need to speed up the utilization of hydro resources and deploy new clean energy technologies such as biomass/biogas, wind and solar power. Government reforms are opening up the generation business to various IPPs to participate, and ongoing tariff reforms will also create further incentives for both international and local developers. However, it is also recognized that financing remains an obstacle for many developers due to limited participation of the financial sector. RE project finance is a new area, and it is considered high-risk for many local financial institutions. Unfamiliar with RE technologies, lack of long-term resources to lend and lack of financial instruments to address various needs of developers, financial institutions shy away from this new business opportunity.

7. The MDB joint team has identified various areas where the use of CTF-funded interventions in the private sector can address such barriers and have a transformational impact, promoting the transition to a low carbon economic growth in Vietnam. This annex outlines where IFC, together with the CTF, would leverage its skills, relationships and innovative financing instruments to design and implement such transformational interventions. Proposed interventions include risk sharing facilities, lines of credit, mezzanine finance facilities, and capacity building programs to help address perceived risks and mobilize local financing to support EE/CP in the industrial, commercial and residential sectors, as well as direct investments in RE project developments.

Proposed Transformation

8. These proposed interventions are designed to meet the needs in different sectors of the market. The proposals of private sector products in Vietnam will retain the flexibility to respond to dynamic market conditions and unidentified market opportunities. The proposed interventions will therefore be illustrative only, with more implementation details to be developed as each project is processed.

9. Energy Efficiency and Cleaner Production. The MDB mission believes that the CTF can have the most transformational impact in the EE/CP arena. According to the Ministry of Industry and Trade, the manufacturing sectors present an immediate opportunity to save 15% to 40% of energy through energy efficiency and cleaner production improvements if there is sufficient financing support. The CTF could catalyze transformation of the local financial institutions through a programmatic approach that addresses the barriers caused by the perceived market and technical risks.

10. IFC, together with CTF, and in coordination with the WB (which will mobilize IDA and/or GEF resources for EE/CP focusing on new industries), can provide a tailor made package of capacity building and financing instruments to address these barriers in the local capital market. This package will be designed to help transform the behavior of local financial institutions so that they will build up their in-house capacity to assess the technical and market risks of EE and CP projects and become ready financiers for the sector. Effective technical assistance (TA) includes the facilitating of marketing partnership between banks and equipment vendors, utility companies and project developers, creating a sustainable financing strategy, and developing tailor-made financing products for each segment of EE/CP. IFC's experience in implementing similar TA and investment programs in other developing countries clearly shows a successful domino effect – once a few initial financial institutions are successfully mobilized to finance EE/CP projects, other institutions usually follow.

11. Renewable Energy. Combined with CTF funding, IFC could provide appropriate incentives for qualified developers and financiers to fast-track the implementation of RE projects, such as hydro power plants, biomass energy and wind power projects among others. These initial projects, in addition to having an immediate GHG emission reduction impact, would provide valuable information on the types and amounts of incentives required to scale up RE development in the country. IFC would work with private sector RE developers, equipment manufacturers and financial institutions interested in entering the Vietnam power sector, but who need additional incentives or risk mitigation to make their investments feasible.

12. Each CTF project proposal would discuss the barriers to be addressed with CTF funds, the role of the carbon market in helping to move the sector and the direct GHG emissions reduction impact from the project. The program would address the question of additionality (supporting the lowest cost, most qualified, producer) by either supporting successful bidders or by supporting developers and financiers that meet specified, transparent, credit criteria established by IFC.

Implementation Readiness

13. Several local financial institutions have expressed strong interest in partnering with IFC under programs of risk sharing, facilities, line of credit, or mezzanine finance facilities to initiate financing to companies implementing EE improvement and CP, and developers of RE projects. The implementation potential of these programs is enhanced by IFC's established relationships with market players and its technical expertise on the topic (IFC has a core team focused on sustainable energy and more than ten years of history of financing such projects directly and through financial intermediaries). Accordingly, the likelihood of IFC being able to structure appropriate incentives and implement an initial program during the next six months is very high.

14. There are a number of private sector RE/EE/CP projects that could be implemented during 2009/2010 with the appropriate financial and risk incentives. Many of these companies have already approached IFC for assistance in obtaining financing on terms that would make the project feasible. IFC believes it could support three to five RE/EE/CP projects in the short term if the requested CTF resources were available.

Rationale for CTF Financing

15. With power constraints in Vietnam and the decreasing power use efficiency in this fast growing economy, RE/EE/CP is a top priority for IFC's investment and advisory interventions. CTF financing is necessary to provide appropriate financing and risk mitigations for local financial institutions to support the private sector's entry into Vietnam's RE/EE/CP sectors.

While there is interest in the market, local financial institutions and private developers are unable to do so without some enabling concessional support.

16. CTF funds are needed to incentivize financial institutions and local developers to undertake investments in lower carbon emitting technologies. Many companies involved in the development of RE, EE and CP have found it difficult to access local funding support in order to make investment in such projects. CTF financing could fill financing gaps on concessionary terms that overcome first-mover costs and provide sufficient returns to pioneer projects. CTF funding, and its flexible application, can provide incentives to local financial institutions and developers to implement projects. With effective financial structuring, CTF funds can address the specific barriers and catalyze the sector's transition to a lower carbon base. In addition to transforming Vietnam's energy sector, opportunities exist to share lessons learned and for replication in other Mekong countries for efficient use of resources regionally.

17. Technical Assistance: IFC has learned in other developing countries where it has successfully mobilized local financial institutions to finance projects of RE/EE/CP that the most effective way to achieve the mobilization goal is to combine investment with technical assistance that is tailor-made for the local financial institution partners. About 5% of the proposed CTF funding in each of the financing mobilization programs will be used to fund on-the-ground advisory service programs.

18. GHG Emissions Reduction. In the next few years, IFC will, through partnership with local financial institutions and private sector project developers, implement risk sharing facilities, mezzanine finance facilities and innovative structured finance to mobilize more than US$1 billion capital to support the sectors of RE/EE/CP. When all the sub-projects financed under this mobilization program are in commercial operations, total emissions of 2 $MtCO_2e/y$ can be avoided.

Financing Plan

19. The following is a conceptual financing plan for the proposed investments of risk sharing facilities, line of credit, mezzanine finance facilities, and direct financing to RE/EE/CP projects. This indicative financing plan has been formulated according to IFC's experience in designing and implementing similar financing mobilization programs in other developing countries. The targeted mobilization of up to US$1.17 billion to support RE/EE/CP shall be achieved in the next few years. Detailed financing plans for each transaction will be developed at the project proposal stage.

Source (US$ million)	RE	EE/CP	Total
Sponsors / Other lenders / Carbon Finance *	400	500	900
IFC	90	110	200
CTF	40	30	70
Total	530	640	1,170

Note: * The possibility of carbon finance has not yet been evaluated.

Program Preparation Timetable

20. The project is expected to be prepared along the following timeframe.

Milestones[29]	Dates
Government concept approval/Bank concept review	September- October 2009
Project preparation	November 2009 – March 2010
Appraisal/negotiations	March - June 2010
Approval	July 2010
Project implementation start	July - September 2010

[29] The Program preparation timetable is for illustrative purpose only. It is based on the assumption that the Vietnam country investment plan will be approved by the CTF Trust Fund Committee in November 2009.