ベトナム国天然資源環境省
ベトナム国ホーチミン市天然資源環境局

ベトナム国
国としての適切な緩和行動（NAMA）
計画及び策定支援プロジェクト
（自治体 NAMA・MRV 能力向上支援）

業務完了報告書

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独立行政法人国際協力機構（JICA）

パシフィックコンサルタンツ株式会社
株式会社オリエンタルコンサルタンツグローバル
株式会社数理計画

環境
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略 語 表

AFOLU	農業・林業・土地利用
BRT	バス高速輸送システム
C40	世界大都市気候先導グループ
CCAP	低炭素行動計画
CCB	気候変動室
CCSB	気候変動運営委員会
CDM	クリーン開発メカニズム
CITENCO	ホーチミン市都市環境公社
CNG	圧縮天然ガス
C/P	カウンターパート
DARD	ホーチミン市農業農村開発局
DCC	気候変動局
DOC	ホーチミン市建設局
DOF	ホーチミン市財務局
DOIT	ホーチミン市商工局
DONRE	ホーチミン市天然資源環境局
DOST	ホーチミン市科学技術局
DOT	ホーチミン市交通局
DPI	ホーチミン市計画投資局
ECC	省エネルギーセンター
EVN HCMC	ホーチミン市電力公社
GHG	温室効果ガス
GPC	コミュニティレベルの温室効果ガス排出量グローバルプロトコル
GWP	地球温暖化係数
HEPZA	ホーチミン市産業および輸出加工区当局
ICAP	国際炭素行動パートナーシップ
IGES	地球環境戦略研究機関
IE	他に含まれる（GHG インベントリの表記法）
IEA	国際エネルギー機関
INDC	自国が決定する貢献案
IPCC	気候変動に関する政府間パネル
IPPU	工業プロセス及び製品使用
JCM	二国間クレジット制度
LFG	ランドフィルガス
LIFSAP	畜産農家の競争力強化・安全性向上プロジェクト
MAUR	ホーチミン市人民委員会都市鉄道管理局
MBS	ホーチミン市固形廃棄物処理複合施設管理委員会
MHCC	気象水文気候変動課
MOCPT	ホーチミン市公共交通管理運営センター
MONRE	天然資源環境省
MRT	大量高速輸送システム
MRV	測定・報告・検証
NAMA	国としての適切な緩和行動
NDC	自国が決定する貢献
NE	算定してない（GHG インベントリの表記法）

NO	発生しない（GHG インベントリの表記法）
PDM	プロジェクト・デザイン・マトリクス
SAWACO	ホーチミン市水道総公社
SCFC	ホーチミン市洪水対策センター
UCCI	都市土木建設投資管理局
UDC	ホーチミン市都市排水公社
2006 IPCC ガイドライン	2006 年版温室効果ガスの排出・吸収に関する国家目録作成のためのガイドライン

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GHG インベントリ作成マニュアル
MRV マニュアル
Synthesis Report
気候変動緩和総合研修教材
GHG インベントリリーフレット

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1. 業務の概要

1.1 背景

ベトナムでは急速な経済成長に伴い、温室効果ガス（GHG）の排出量が増大している。これを受け、ベトナム政府は気候変動対策に関する包括的な取り組み方針として、2008 年に国家気候変動対策プログラムを首相決定し、関係機関は目標年である 2020 年までの気候変動対策を立案することになった。2011 年には国家気候変動戦略を首相決定し、天然資源環境省（MONRE）が各省と調整して国としての適切な緩和行動（NAMA）を計画することになった。

この流れを受け、自治体は低炭素行動計画（CCAP）を策定・実施することになっている。自治体は行政区域内の GHG 排出状況を把握し、NAMA の実施状況と効果を客観的に把握して対策を継続的に推進していくことが求められている。しかし、現状では一部の自治体で施策立案は行われているが、GHG 排出量、削減見込量、実削減量の定量化はできてない。気候変動対策に関する施策立案能力の強化と並んで、その効果を客観的に判断して施策の改善・追加などをしていく能力の向上が求められている。

こうしたなか、JICA は MONRE をカウンターパート（C/P）機関とし、ベトナム政府の NAMA 計画・実施能力を強化することを目的とした技術協力プロジェクトを開始した。本プロジェクトは、①MONRE の NAMA 開発・実施を進めるための調整能力を強化することと、②自治体を含む省庁などの NAMA 計画・実施能力を強化することを目指す。本業務は、上記②の成果達成を目的として、ホーチミン市をモデル都市として、ベトナムの都市が NAMA を計画・実施・管理するうえで必要な MRV（測定・報告・検証）様式を構築することを目的として実施した。

本業務対象のホーチミン市では、人民委員会委員長を長として関連部局が参画する気候変動運営委員会（CCSB）を設置し、2012 年に実務を担う部局として天然資源環境局（DONRE）に気候変動室（CCB）を設置した。人民委員会は 2013 年にホーチミン市における 2015 年までの気候変動適応策・緩和策に関する行動計画を策定・承認している。その後、2017 年 3 月に 2016～2020 年の CCAP が承認・公表されている。

1.2 目的

本業務の目的は、①ホーチミン市をモデル都市とし、GHG 排出・削減状況の継続的な定量化を可能にするための自治体の体制構築と職員の能力向上について支援する、②ベトナムにて普及展開が可能な都市・自治体レベルの MRV 様式を構築・提言する、③他都市を含めた能力向上のための教材等の開発と普及を行い、ベトナムでの NAMA の計画・実施・管理を推進するーことである。

業務開始当初、ホーチミン市は、本プロジェクトの計画策定に関わっていないこと、プロジェクト開始後にモデル都市に選定されたことなどから、本業務の内容や目的について十分知らされていなかった。専門家チームは、当初計画に従って活動を進める努力を行う一方、ホーチミン市と協議を重ね、同市の要望を踏まえて計画の一部を変更して業務を行うことについて関係者と合意した。その結果、当初計画されていたホーチミン市以外の都市での活動を中止する一方、ホー

チミン市の GHG インベントリ作成、GHG インベントリ作成マニュアルと MRV マニュアルの作成とそれらのホーチミン市の公式文書化、ホーチミン市職員の気候変動緩和に関する能力強化に注力することになった。

2. 活動実績と成果

2.1 活動概要

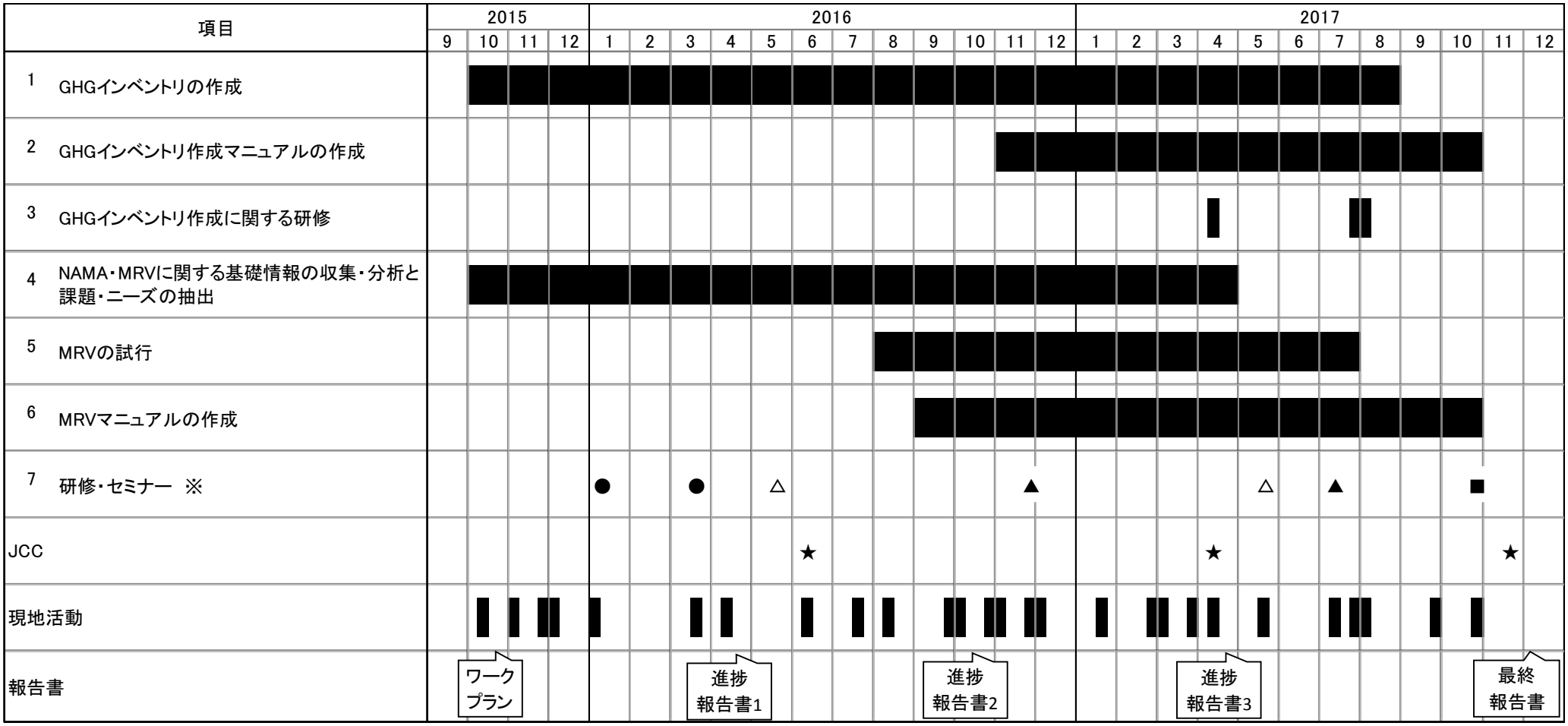
2015 年 9 月に活動を始めた。活動は大きく、GHG インベントリ、気候変動緩和策の MRV、研修・セミナーに分けられる。現地活動は 2015 年 10 月に始め、2017 年 10 月の第 21 回渡航で成果を発表する最終セミナーを行い、終了した。その後、本報告書を作成して業務を完了した。

GHG インベントリについては、2015 年 10 月からこれまでの実績を調べ、データの所在やインベントリの作成方針を調査・検討した。その後、インベントリの作成を始め、2017 年 8 月にはほぼ完成した。2016 年 11 月から GHG インベントリ作成マニュアルの作成を始め、関係者と協議を重ね、2017 年 3 月と 7 月の 2 回のコンサルテーション経て、2017 年 10 月に完成した。この間、ドラフト版マニュアルを使って、GHG インベントリを作成するための研修を 2017 年 4 月と 7-8 月の 2 回に分けて実施した。

MRV については、2015 年 10 月から緩和策に関する基礎情報などの収集・分析を行い、MRV を試行する案件の選定や MRV 実施体制の検討を進めた。2016 年 8 月から MRV の試行を始めた。2016 年 9 月から MRV マニュアルの作成を始め、MRV 試行の結果も受けて、GHG インベントリ作成マニュアルと同様なプロセスを経て、2017 年 10 月に完成した。

研修・セミナーについては、2016 年 5 月と 2017 年 5 月に本邦研修を行い、ホーチミン市にて 2016 年 11 月と 2017 年 7 月に気候変動緩和総合研修を開催したほか、最終セミナーと小規模なセミナー・勉強会を複数回開催した。

表 1　活動実績



※凡例　●：随時開催セミナー　△：本邦研修　▲：気候変動緩和総合研修　■：最終セミナー

2.2 GHG インベントリ

2.2.1 GHG インベントリの作成

(1) 基礎情報の収集

2015 年 10 月から 2016 年 1 月まで、現状調査を行った。GHG インベントリ作成に必要なデータについて、全面的に収集する必要があることが明らかになった。CCB との協議の結果、2013 年、2014 年、2015 年の 3 年分の GHG インベントリ作成に必要な情報とデータを収集することになった。作成した GHG インベントリが GHG 排出に関する対策立案に役立つよう産業分野別、技術別、燃料種別に詳細なデータを集める方針を立てた。

2016 年 1 月から 6 月には、GHG インベントリ作成のために必要な具体的データをリストアップした。これらのデータを有すると想定される機関を特定し、データの有無を確認する質問票を送付した。関係機関への聞き取りも実施した。その結果、収集可能なデータや情報が明らかになった。

2016 年 8 月から 10 月には、ベトナムの国家 GHG インベントリのデータ収集フォームを参考にしながら、ホーチミン市用データ収集フォームを作成した。関係機関にプロジェクトへの協力を要請するホーチミン市人民委員会の 2016 年 9 月 19 日付けレター発出後、CCB はデータ収集フォームを GHG インベントリ関係機関に送付した。その後、収集したデータの出典整理、追加で収集すべき情報の検討とデータ収集フォームへの反映なども行った。データを提供する機関と提供データ項目については、表 2 に示すとおりである。

表 2 データとデータ提供機関

区分	セクター	主な提供データ
DARD	農業・林業・土地利用	畜産情報、稲作情報、農業情報
DOC	工業プロセス及び製品使用	クリンカーや石灰の生産量
DONRE	廃棄物	都市固形廃棄物情報、医療廃棄物情報
	農業・林業・土地利用	土地利用及び土地利用変化情報
DOIT	固定エネルギー、交通	燃料消費量
DOT	交通	バス情報、船舶台数
EVN HCMC	固定エネルギー	電気消費量
	工業プロセス及び製品使用	電気設備の SF_6 の情報
HEPZA	廃棄物	産業排水量
SAWACO	固定エネルギー	電力消費量
SCFC	固定エネルギー、交通	電力消費量、燃料消費量
UDC	廃棄物、固定エネルギー、交通	下水処理情報、電力消費量、燃料消費量
統計局	廃棄物、工業プロセス及び製品使用、農業・林業・土地利用	人口、農業生産量、農地面積、工業製品生産量

注）DARD：ホーチミン市農業農村開発局、DOC：ホーチミン市建設局、DOIT：ホーチミン市商工局、DOT：ホーチミン市交通局、EVN HCMC：ホーチミン市電力公社、HEPZA：ホーチミン市産業および輸出加工区当局、SAWACO：ホーチミン市水道総公社、SCFC：ホーチミン市洪水対策センター、UDC：ホーチミン市都市排水公社

(2) GPC をベースとした GHG インベントリの作成

2016 年 10 月から 2017 年 8 月までの期間に、コミュニティレベルの温室効果ガス排出量グローバルプロトコル（GPC）をベースとした 2013 年のホーチミン市の GHG インベントリを作成した。この間、収集できたデータや不足データの検討、データ収集フォームと後述する GHG インベントリ計算ファイルの改善、作成した GHG インベントリドラフトの見直しと改善を繰り返した。

表計算ソフトを使った GHG インベントリ計算ファイルを作成した。データ収集フォームを使って入手したデータを入力するワークシートと、事前に設定するパラメータや排出係数のワークシートを別々に作成している。GHG インベントリ計算ファイルの構成や使い方は以下のとおりである。

1) 収集したデータは、Input Data ワークシートに入力する。
2) 入力したデータは、パラメータを用いて活動量に変換される。このパラメータは、事前に Parameter ワークシートに入力されている。活動量は、Activity Data ワークシートで計算される。
3) 排出係数は、事前に Emission Factor ワークシートに入力されている。
4) 排出量は、活動量と排出係数を使って、Emission ワークシートにて計算される。
5) 排出量は、GPC Inventory ワークシートにて、GPC に沿った報告様式に取りまとめられる。計算方法は、前もって組み込まれている。
6) 地球温暖化係数（GWP）は、事前に GWP ワークシートに入力されている。
7) すべての GHG は、GPC Inventory (GWP)ワークシートにて、CO_2 換算される。
8) GPC ベースの GHG インベントリは、10 Sector Inventory ワークシートにて、ホーチミン市の CCAP の 10 セクターに沿った区分で再整理される。

固定エネルギーセクターと交通セクターの計算は、多くのデータが共通であることから、同じ計算ファイルを用いた。電力消費、燃料燃焼、燃料漏出に分けて、排出量を算定した。燃料燃焼による排出量を GPC のサブセクター応じてまとめるために、国際エネルギー機関（IEA）のベトナムに関するエネルギー統計データを用いた。

廃棄物セクターは、固形廃棄物の処分、固形廃棄物の生物処理、廃棄物の焼却と野焼き、排水の処理と放出のサブセクターごとに計算ファイルを準備し、排出量を計算した。

工業プロセス及び製品使用セクターは、工業プロセスサブセクターと製品使用サブセクターの計算ファイルを準備し、排出量を計算した。

農業・林業・土地利用セクターは、畜産、稲作、N_2O の直接排出及び間接排出、バイオマス燃焼・石灰施用・尿素肥料、土地利用及び土地利用変化の発生源・吸収源ごとに計算ファイルを準備し、GHG 排出量と吸収量を計算した。

算定式は GPC をベースに構築した。排出係数やパラメータは、2006 年版温室効果ガスの排出・吸収に関する国家目録作成のためのガイドライン（2006 IPCC ガイドライン）やベトナムの国家インベントリの情報を用いた。

結果、完成した 2013 年の GPC をベースとした GHG インベントリの要約を表 3 に示す。報告様式は GPC に沿っている。スコープ 1（表 3 の Scope 1）は、市境界内に位置する排出源からの排出である。スコープ 2（表 3 の Scope 2）は、市境界内の送配電網からの電力消費や配管網で供給された熱の使用による排出である。スコープ 3（表 3 の Scope 3）は、市境界内の活動であって

市境界外で発生する排出である。IE は Included Elsewhere（他に含まれる）、NE は Not Estimated（算定してない）、NO は Not Occurring（発生しない）である。

ホーチミン市の 2013 年の GHG 排出量は約 3,850 万 tCO_2 換算と算定された。ベトナムの GHG 排出量は、2010 年の国家インベントリによると、約 2 億 4,680 万 tCO_2 換算である。ホーチミン市の人口は全国の 9%程度に過ぎないが、GHG 排出量は 16%を占めている[1]。

表 3　GPC ベースの 2013 年の GHG インベントリ

GPC ref No.	GHG Emissions and Removals GHG Emissions Sources (By Sector and Sub-sector)	Total GHG (metric ton CO2e/year) in 2013			
		Scope 1	Scope 2	Scope 3	Total
I	**STATIONARY ENERGY**				
I.1	Residential buildings	269,780	5,301,680	262,963	5,834,424
I.2	Commercial and institutional building and facilities	440,575	2,505,610	124,278	3,070,463
I.3	Manufacturing industries and construction	2,597,202	5,386,028	267,147	8,250,377
I.4.1/2/3	Energy industries	0	0	0	0
I.4.4	Energy generation supplied to the grid	10,316			
I.5	Agriculture, forestry and fishing activities	621,570	36,366	1,804	659,740
I.6	Non-specified sources	0	0	0	0
I.7	Fugitive emissions from mining, processing, storage, and transportation of coal	0			0
1.8	Fugitive emissions from oil and natural gas systems	23,378			23,378
	SUB-TOTAL	**3,952,505**	**13,229,684**	**656,192**	**17,838,381**
II	**TRANSPORTATION**				
II.1	On-road transportation	14,544,176	NO	NE	14,544,176
II.2	Railways	IE	IE	NE	0
II.3	Waterborne navigation	149,134	NO	NE	149,134
II.4	Aviation	IE	NO	2,701,073	2,701,073
II.5	Off-road transportation	IE	IE	NE	0
	SUB-TOTAL	**14,693,310**		**2,701,073**	**17,394,382**
III	**WASTE**				
III.1.1/2	Solid waste generated in the city	1,293,241			1,293,241
III.2.1/2	Biological waste generated in the city	24,900			24,900
III.3.1/2	Incinerated and burned waste generated in the city	5,606			5,606
III.4.1/2	Wastewater generated in the city	926,142			926,142
III.1.3	Solid waste generated outside the city	NE			0
III.2.3	Biological waste generated outside the city	NE			0
III.3.3	Incinerated and burned waste generated outside the city	NE			0
III.4.3	Wastewater generated outside the city	NE			0
	SUB-TOTAL	**2,249,889**			**2,249,889**
IV	**INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)**				
IV.1	Emissions from industrial processes occurring within the city boundary	565,704			565,704
IV.2	Emissions from product uses occurring within the city boundary	873			873
	SUB-TOTAL	**566,577**			**566,577**
V	**AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)**				
V.1	Emissions from livestock	372,891			372,891
V.2	Emissions from land	-161,037			-161,037
V.3	Emissions from aggregate sources and non-CO2 emission sources on land	211,508			211,508
	SUB-TOTAL	**423,362**			**423,362**
Total	**GHG Emissions and Removals**	**21,885,641**	**13,229,684**	**3,357,265**	**38,472,590**

図 1 に示すように、ホーチミン市の排出は、固定エネルギーセクターが 46%、交通セクターが 45%、廃棄物セクターが 6%、工業プロセス及び製品使用（IPPU）セクターが 2%を占めた。農業・林業・土地利用（AFOLU）セクターは、排出と吸収を合わせた正味で 1%を占めた。

図 2 に示すように、固定エネルギーセクターの内訳は、製造業及び建設業サブセクターが 46%、家庭サブセクターが 33%、商業業務サブセクターが 17%、農林水産サブセクターが 4%、燃料からの漏出サブセクターが 1%未満となっている。交通セクターについては、ガソリンの燃焼とデ

[1] 国家インベントリは、2013 年はないため 2010 年と比較している。ベトナムの排出量は増加傾向にあるため、ホーチミン市の排出量は、2013 年の国全体の排出量と比べた場合、16%より小さい可能性がある。

ィーゼルの燃焼からの排出が主な GHG 発生源である。

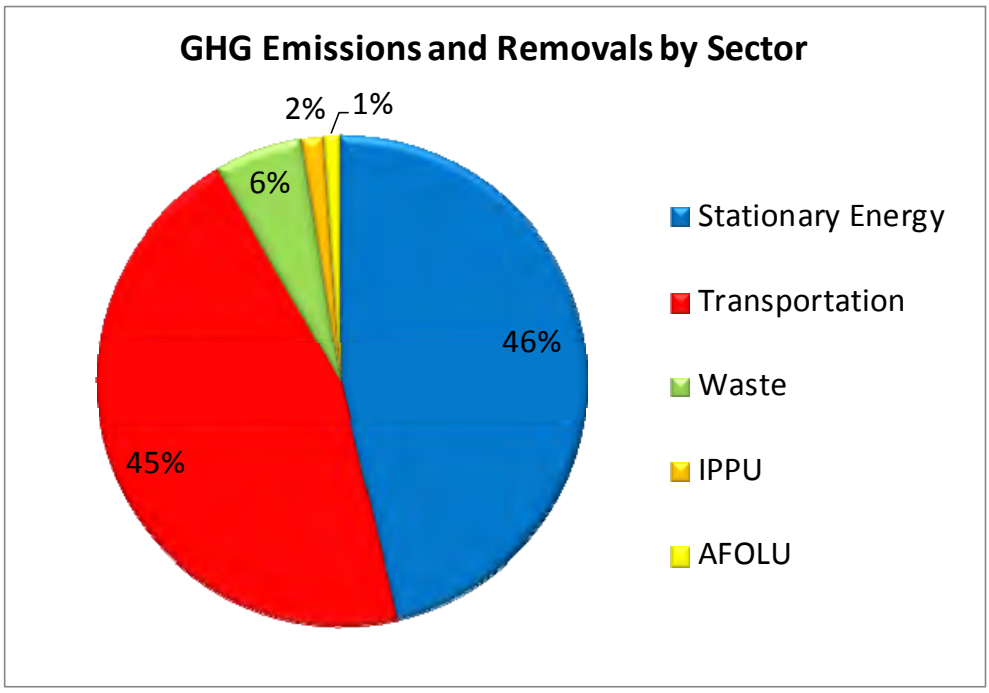


図 1　ホーチミン市のセクターごとの GHG 排出量と吸収量

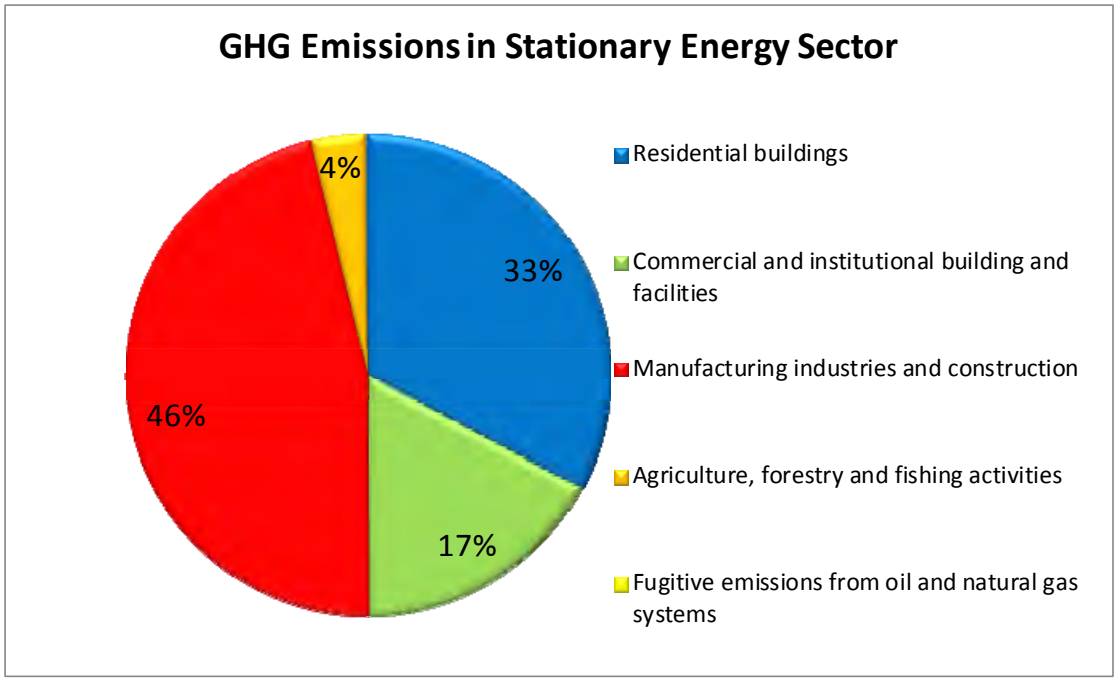


図 2　ホーチミン市の固定エネルギーセクターの GHG 排出量

作成したホーチミン市の GHG インベントリは、世界大都市気候先導グループ（C40）のレビューを受け、わずかに不足している点はあるが優良と評価された。C40 は GPC の共同開発者であり、GPC に基づく GHG インベントリの作成を支援している。

ホーチミン市の GHG インベントリは、2017 年 10 月 26 日に開催した最終セミナーで紹介したほか、リーフレットを作成して関係機関を通じて広く配布し、周知を図った。

(3) CCAP の 10 セクターに合わせた GHG インベントリの作成

CCB は、CCAP の 10 セクターに合わせて GHG インベントリを作成することも希望した。当初は、CCB は CCAP の 10 セクターに合わせた GHG インベントリの作成を重視していたため、GPC をベースとした GHG インベントリとは別に作ることを予定していた。ところが、データが集まりはじめ、GPC をベースとした 2013 年の GHG インベントリの形ができはじめたころに、CCB と改めて協議した結果、CCB は国際的に比較可能な GPC をベースとした GHG インベントリを重視する姿勢に転じた。

そこで、GPC をベースとした GHG インベントリを使って、CCAP の 10 セクターに合わせた GHG インベントリを作成することにした。表 4 に CCAP の 10 セクターと GPC のセクター・サブセクターとの関係を示す。CCAP の水管理、建設、保健、観光の各セクターについては、個別に排出量を算定することができず、他のセクターに含まれることになった。表 5 に CCAP の 10 セクターに合わせた 2013 年の GHG インベントリを示した。

表 4　CCAP10 セクターと GPC セクター・サブセクターの対応

CCAP の 10 セクター	GPC のセクター・サブセクター
都市計画	土地利用サブセクター
エネルギー	固定エネルギー（製造業及び建設業サブセクターと農林水産業サブセクターを除く）
交通	交通
工業	固定エネルギーの製造業及び建設業サブセクター 工業プロセス及び製品使用
水管理	他セクター（主に固定エネルギー）に含まれる※
廃棄物管理	廃棄物セクター
建設	他のセクター（主に固定エネルギーの製造業及び建設業サブセクター）に含まれる
保健	他のセクター（廃棄物）に含まれる※
農林水産	農業・林業・土地利用のうち、土地利用サブセクター以外のすべてのサブセクター 固定エネルギーセクターの農林水産業サブセクター
観光	他のセクター（主に固定エネルギーセクター）に含まれる※

※CCAP の 4 つのセクターについては、個別に排出量を算定することができない。

表 5　CCAP の 10 セクターに合わせた 2013 年の GHG インベントリ

CO_2

Các lĩnh vực ưu tiên/ (10 lĩnh vực)/ Priority Sectors (10 sectors)	Đơn vị/ Unit	Năm 2013 Year 2013
Quy hoạch đô thị/ Urban Planning Sector	$GgCO_2$/năm ($GgCO_2$/year)	*-161.04*
Năng lượng/ Energy Sector	$GgCO_2$/năm ($GgCO_2$/year)	8,522.40
Giao thông/ Transport Sector	$GgCO_2$/năm ($GgCO_2$/year)	14,612.35
Công nghiệp/ Industry Sector	$GgCO_2$/năm ($GgCO_2$/year)	8,531.14
Quản lý nước/ Water Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Quản lý chất thải/ Waste Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	5.48
Xây dựng/ Construction Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Y tế/ Health Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Nông nghiệp/ Agriculture, forestry, and fishing Sector	$GgCO_2$/năm ($GgCO_2$/year)	661.47
Du lịch/ Tourism Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Tổng/ Sub-total	$GgCO_2$/năm ($GgCO_2$/year)	32,171.81

CH_4

Các lĩnh vực ưu tiên/ (10 lĩnh vực)/ Priority Sectors (10 sectors)	Đơn vị/ Unit	Year 2013
Quy hoạch đô thị/ Urban Planning Sector	$GgCO_2$/năm ($GgCO_2$/year)	*0.00*
Năng lượng/ Energy Sector	$GgCO_2$/năm ($GgCO_2$/year)	4.22
Giao thông/ Transport Sector	$GgCO_2$/năm ($GgCO_2$/year)	42.93
Công nghiệp/ Industry Sector	$GgCO_2$/năm ($GgCO_2$/year)	11.39
Quản lý nước/ Water Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Quản lý chất thải/ Waste Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	2,084.35
Xây dựng/ Construction Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Y tế/ Health Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Nông nghiệp/ Agriculture, forestry, and fishing Sector	$GgCO_2$/năm ($GgCO_2$/year)	409.51
Du lịch/ Tourism Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Tổng/ Sub-total	$GgCO_2$/năm ($GgCO_2$/year)	2,552.40

N_2O

Các lĩnh vực ưu tiên/ (10 lĩnh vực)/ Priority Sectors (10 sectors)	Đơn vị/ Unit	Year 2013
Quy hoạch đô thị/ Urban Planning Sector	$GgCO_2$/năm ($GgCO_2$/year)	0.00
Năng lượng/ Energy Sector	$GgCO_2$/năm ($GgCO_2$/year)	14.40
Giao thông/ Transport Sector	$GgCO_2$/năm ($GgCO_2$/year)	38.02
Công nghiệp/ Industry Sector	$GgCO_2$/năm ($GgCO_2$/year)	6.41
Quản lý nước/ Water Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Quản lý chất thải/ Waste Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	159.93
Xây dựng/ Construction Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Y tế/ Health Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Nông nghiệp/ Agriculture, forestry, and fishing Sector	$GgCO_2$/năm ($GgCO_2$/year)	170.99
Du lịch/ Tourism Sector	$GgCO_2$/năm ($GgCO_2$/year)	IE
Tổng/ Sub-total	$GgCO_2$/năm ($GgCO_2$/year)	389.75

Khí khác/ Other Gas

Các lĩnh vực ưu tiên/ (10 lĩnh vực)/ Priority Sectors (10 sectors)	Đơn vị/ Unit	Year 2013
Quy hoạch đô thị/ Urban Planning Sector	$GgCO_2$/năm ($GgCO_2$/year)	NO
Năng lượng/ Energy Sector	$GgCO_2$/năm ($GgCO_2$/year)	0.87
Giao thông/ Transport Sector	$GgCO_2$/năm ($GgCO_2$/year)	NE
Công nghiệp/ Industry Sector	$GgCO_2$/năm ($GgCO_2$/year)	0.00
Quản lý nước/ Water Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	NE
Quản lý chất thải/ Waste Management Sector	$GgCO_2$/năm ($GgCO_2$/year)	NE
Xây dựng/ Construction Sector	$GgCO_2$/năm ($GgCO_2$/year)	NE
Y tế/ Health Sector	$GgCO_2$/năm ($GgCO_2$/year)	NE
Nông nghiệp/ Agriculture, forestry, and fishing Sector	$GgCO_2$/năm ($GgCO_2$/year)	0.00
Du lịch/ Tourism Sector	$GgCO_2$/năm ($GgCO_2$/year)	NE
Tổng/ Sub-total	$GgCO_2$/năm ($GgCO_2$/year)	0.87

2.2.2 GHG インベントリ作成マニュアルの作成

ホーチミン市が将来にわたり継続的に GHG インベントリを作成できるようにすることを目的に、GHG インベントリ作成マニュアルを作成した。マニュアルの目次を表 6 に示す。

表 6 GHG インベントリ作成マニュアルの目次

タイトル	概要
Chapter 1. Introduction	マニュアルの概要、用語の解説等
Chapter 2. GHG Inventory Preparation Procedures	関係機関の役割と作成手順
Chapter 3. Calculation Methods	排出・吸収量の計算方法
Chapter 4. Data Sources	データ源とデータ収集状況
Chapter 5. Calculation	排出・吸収量の具体的計算手順
Chapter 6. Reporting based on GPC	GHG インベントリの取りまとめ方法
Annex I. Data Collection Forms	データ収集フォーム一式
Annex II. The GHG inventory of HCMC in 2013	ホーチミン市の 2013 年の GHG インベントリ
Annex III. The GHG Inventory Based on the Priority Sectors in HCMC	ホーチミン市の優先セクター（CCAP の 10 セクター）に合わせた GHG インベントリ作成方法

マニュアルは、GHG インベントリを作成しながら作成した。第 1 章には、GPC や日本の GHG インベントリを参照し、概要や用語の解説などを記載した。第 2 章には、GHG インベントリに関する基礎情報の収集活動と CCB との協議の結果を踏まえて、関係機関の役割と作成手順を記載した。第 3 章には、GPC や 2006 IPCC ガイドラインを参照し、排出・吸収量の計算方法を記載した。第 4 章には、GHG インベントリに必要なデータを整理し、ホーチミン市で収集できているデータを明記した。第 5 章には、ホーチミン市の GHG 排出・吸収量を算出する具体的手順を記載した。第 6 章には、第 5 章で算出した GHG 排出・吸収量を GHG インベントリとして取りまとめる方法を記載した。

マニュアル完成までに、GHG インベントリの作成手順や関係機関の役割について意見を集約するために、2 回のコンサルテーションを実施した。第 1 回コンサルテーション会合は 2017 年 3 月 1 日に開催した。ホーチミン市職員 21 人、区や大学、燃料販売会社などの企業から 16 人が参加し、合計 9 の意見や質問が寄せられた。主に作成スケジュールや関係機関の役割分担を提案して意見を求めたが、大きな異論はなかった。

第 2 回コンサルテーション会合は 2017 年 7 月 12 日に開催した。ホーチミン市職員 20 人、企業や大学から 9 人が参加した。計 57 の意見や質問が寄せられた。電力消費による排出の重複計上、廃棄物の野焼き、Excel ではなく Access 等のソフトウェアの使用など、主として技術的な意見や質問が寄せられた。GHG インベントリの作成手順については、準備開始を早め、ドラフト作成の時間を長くとるスケジュールが良いとの意見が出た。DONRE には GHG インベントリ作成のためのリソースが十分にあるか、という問題提起もあった。

加えて、2017 年 8 月 29 日に行われた CCSB の事務レベル会合にて、マニュアルについて、ホ

ーチミン市関係部局と最後の意見交換を行った。統計データを優先して使用すること、データ提供部局の品質管理活動の範囲を限定することなどの意見があった。

こうしたプロセスと、CCB と繰り返し行った協議、長期専門家のアドバイスや MONRE の意見なども踏まえて、マニュアルを完成させた。マニュアルは 2017 年 10 月 26 日に開催した最終セミナーで紹介し、CCB を通じて関係機関に配布した。

なお、マニュアルはホーチミン市の GHG インベントリ作成方法を示しているが、内容の多くは一般的で共通する事項であり、他都市でも活用できる内容になっている。

2.2.3 GHG インベントリ作成に関する研修

2017 年 4 月と 7-8 月の 2 回に分けて、GHG インベントリ作成マニュアルのドラフトを使い、GHG インベントリを作成する研修を実施した。対象者は、GHG インベントリを継続的に作成していくことが期待される DONRE の CCB と気象水文気候変動課（MHCC）の担当者である。

研修では、2013 年の GHG インベントリを作成するために行ったデータ収集と同時に集めた 2014 年のデータと、先述の GHG インベントリ計算ファイルを用いて、GPC をベースとした 2014 年の GHG インベントリを作成した。表 7 に内容をまとめた。

表 7 GHG インベントリ作成研修の内容

日時	参加者	内容
2017 年 4 月 19 日 9:00～16:00	8 人	GHG インベントリ概要講義 電力の使用（固定エネルギーセクター）に係る GHG インベントリ作成
2017 年 4 月 20 日 9:00～16:00	8 人	燃料の燃焼（固定エネルギーセクターと交通セクター）に係る GHG インベントリ作成
2017 年 7 月 27 日 9:00～16:00	6 人	土地利用サブセクターに係る GHG インベントリ作成
2017 年 8 月 1 日 9:00～16:00	7 人	廃棄物セクターに係る GHG インベントリ作成
2017 年 8 月 2 日 9:00～16:00	5 人	農業サブセクター及び工業プロセス及び製品使用セクターに係る GHG インベントリ作成

教材はベトナム語で準備した。研修資料の要点はプレゼンにまとめ、プレゼン、GHG インベントリ計算ファイル、マニュアルを使って研修を進めた。参加者はパソコンを持ち込み、表計算ソフトを使って GHG の排出量と吸収量を計算した。参加者は内容をよく理解し、活発な議論も行われた。参加者の GHG インベントリに関する理解は深まり、作成能力が強化された。研修での主な議論や成果を表 8 に整理した。

表 8　研修の成果

セクター	主な議論内容	成果
固定発生源	電力排出係数	GHG インベントリで使うべき排出係数と JCM 等プロジェクトで使うべき排出係数についての理解
固定発生源及び交通	活動量の単位	燃料に関して、入手データの単位から GHG インベントリで必要な活動量の単位への換算手法についての理解
	セクター、サブセクターへの分類	入手した燃料データの GHG 排出のセクター、サブセクターへ分類方法についての理解
廃棄物	都市固形廃棄物情報	リサイクルに関する情報不足等による野焼き量推計の課題への理解
	産業廃棄物	産業廃棄物の情報不足の課題への理解
工業プロセス及び製品使用	発生源	幅広い活動が発生源であることと、現状ホーチミン市でのデータ収集の困難さへの理解
農業・林業・土地利用	土地利用情報	GHG インベントリ作成に必要な土地に関するデータの現状と、農業・林業・土地利用セクターの優先順位についての理解

さらに研修では、すべての計算プロセスを参加者と一緒にレビューした。結果、GHG インベントリ計算ファイルについて、細かなベトナム語の表現や計算シートの表記や配置について、改善が図られた。

2.3 MRV

2.3.1 NAMA・MRV に関する基礎情報の収集・分析と課題・ニーズの抽出

ホーチミン市の NAMA・気候変動緩和策と MRV に関する基礎情報を収集・分析し、MRV を実施するうえでの課題、関係機関の能力強化の課題とニーズを抽出した。対象分野は、エネルギー、交通、廃棄物の 3 分野とし、既存の資料やデータの分析、関連する組織に対するインタビューを通じて行った。ローカルコンサルタントを活用して情報収集や関係機関とのコミュニケーションの円滑化を図った。

(1) エネルギー分野

1) 関係機関の組織体制・関連施策・他ドナー支援等の整理

ホーチミン市の既存資料と DOIT、EVN HCMC へのインタビューにより、組織体制、実施する施策について、情報収集、整理を行った。

a) エネルギー利用状況

エネルギー分野の MRV 検討の背景となるホーチミン市のエネルギー利用状況を把握するために、産業分野別のエネルギー利用状況やエネルギー源別の供給量、エネルギー関連の諸施策等の情報を整理した。

b) エネルギー関連組織の役割

ホーチミン市のエネルギー分野の事業に関連する組織を整理し、そのなかでエネルギー分野の計画や施策を主に統括する組織は DOIT であることを確認した。

c) エネルギー分野の主な計画・施策

エネルギー分野の MRV 試行案件の選定等に必要な、実施中または計画されている関連施策やプロジェクトに関する情報を収集し、「2) NAMA 案件情報の収集」の基礎情報とした。CCAP で位置づけられている施策も情報収集の対象とした。

2) NAMA 案件情報の収集

MRV 試行の対象となりうる緩和策のロングリストを作成した。スコープは、ホーチミン市の再生可能エネルギー利用や省エネに関するすべての活動とし、プロジェクトベースと政策ベースの施策とした。実施中の施策だけでなく、近い将来に実施される予定の施策も含めた。

表 9　MRV 試行案件候補（ロングリスト）（エネルギー分野）

施策名	実施主体	概要
住宅の省エネ促進事業	DOIT	住宅の省エネを促進し CO_2 排出削減を目指すためのパイロット事業を実施する。40 億ベトナムドンをホーチミン市の予算として確保して 2020 年までに実施する。
省エネビジネスモデルの開発事業	DOIT	GHG 排出削減に資する省エネビジネスモデルの開発を目指す。再生可能エネルギーや省エネ設備を活用したビジネスモデルの調査を行う。40 億ベトナムドンをホーチミン市の予算として確保して 2020 年までに実施する。
歩道の照明の交換・更新プロジェクト	DOIT	歩道の照明を高効率なものに交換・更新するプロジェクト。172 億ベトナムドンをホーチミン市予算と海外支援により確保して 2020 年までに実施する。
エネルギーマネジメントに関するトレーニングセンターの設立事業	DOIT	エネルギーマネジメントと省エネ診断に関するトレーニングコースを提供するセンターを設立し、各種トレーニングを実施する。
発電と配電の効率化	DOIT	配電網の電力ロスの低減、発電設備の高効率化、電源構成の変更（再生可能エネルギーの割合増加）を 2030 年までに実施する。
省エネ設備・機器の導入促進事業	DOST, ECC	農業や産業分野へのコジェネレーション設備、排熱回収利用設備の導入促進、民生分野への高効率空調設備、高効率温水器、LED 照明、高効率冷蔵設備の導入促進を行う。
再生可能エネルギー促進事業	DOST	ホーチミン市の再生可能エネルギー導入に向けた取り組みを促進する。ホーチミン市の予算として 20 億ベトナムドンを確保して 2020 年までに実施する。

注）DOST：ホーチミン市科学技術局、ECC：省エネルギーセンター

(2) 交通分野

1) 関係機関の組織体制・関連施策・他ドナー支援等の整理

ホーチミン市の既存資料と DOT へのインタビューにより、MRV 制度や体制、手順等の検討に資する以下の情報を収集・整理した。

a) 交通状況

交通分野の MRV 体制検討の背景となるホーチミン市の交通分野の状況を把握するために、社会経済や交通に関する統計、公共交通の整備の現状や計画等の情報を整理した。

b) 交通関連組織の役割

ホーチミン市の交通分野の事業に関連する組織を整理し、そのなかで交通分野の計画や施策を主に統括する DOT の組織構成と各部署の役割を整理した。

c) 交通分野の主な計画・施策

交通分野の MRV 試行案件の選定等に必要な、実施中または計画されている交通関連施策に関する情報を収集し、「3) NAMA 案件情報の収集」の基礎情報とした。CCAP に位置づけられている施策も情報収集の対象とした。

2) NAMA 案件情報の収集

MRV 試行の対象となりうる緩和策のロングリストを作成した。実施中の施策だけでなく、近い将来に実施される予定の施策も含めた。

MRV 試行案件選定のスコープは、基本的にホーチミン市の運輸交通に関するすべての施策とした。プロジェクトベースと政策ベースの緩和策の MRV 試行可能性を検討した。プロジェクトベースの緩和策は、GHG 排出削減量の算定ロジックが比較的、立てやすく、モニタリングに必要なデータも得やすい。政策ベースの緩和策は、例えば、燃費基準の導入や低排出ガス車導入への補助金等が挙げられるが、これらはその政策以外の多くの要因によって排出削減量が増減するため、客観性のある算定ロジックの提示が難しい。これらの理由から、プロジェクトベースの緩和策を MRV 試行の主たる対象とした。

表 10 MRV 試行案件候補（ロングリスト）（交通分野）

施策名	実施主体	概要
CNG バス導入プロジェクト	サイゴンバス	ホーチミン市では CNG バスの導入が推進されている。Phase 1 では 21 台が路線 1 に導入された。Phase 2 では 29 台が路線 27 に導入され、2016 年 8 月から運用を開始している。
BRT 1 号線整備プロジェクト	MOCPT	Vo Van Kiet - Mai Chi Tho Boulevard 間の総延長 23km の BRT が計画されている。世界銀行の資金により建設され、車両には CNG バスが用いられる予定である。
MRT 1 号線整備プロジェクト	MAUR	JICA の支援により、Ben Thanh - Suoi Tien 間の総延長 19.7km、駅数 14 の都市鉄道が計画されている。このうち 2.6km、3 駅は地下。2020 年に 620,000 人/日の乗客数を見込んでいる。
MRT 2 号線整備プロジェクト	MAUR	ADB、KfW、EIB の支援により、Ben Thanh - Tham Luong 間の総延長 11.3km、駅数 10 の都市鉄道が計画されている。このうち 9.3km、9 駅が地下となる。
リバーバス導入プロジェクト	Thuong Nhat Co., LTD	市内の河川・運河にリバーバス（河川ボート）の導入が計画されている。路線 1 は、Bach Dang から Thanh Da 運河を通じて Sai Gon 川を通り、Linh Dong 区へ通じるルートである。路線 2 は Bach Dang から Ben Nghe 運河を通じて Tau Hu then を経由し、6 区の Gom port へ通じるルートである。
グエンフエ歩道整備プロジェクト	-	ホーチミン市人民委員会前に位置する幅 64m、延長 670m の歩道。2015 年 4 月に供用を開始した。

注）MOCPT：ホーチミン市公共交通管理運営センター、MAUR：ホーチミン市人民委員会都市鉄道管理局

(3) 廃棄物分野

1) 関係機関の組織体制・関連施策・他ドナー支援等の整理

ホーチミン市の廃棄物管理、排水処理を含む廃棄物分野に関する既存資料と関連機関へのインタビューにより、以下について整理した。インタビューは DONRE、ホーチミン市固形廃棄物処理複合施設管理委員会（MBS）、ホーチミン市都市環境公社（CITENCO）、UDC、DARD 等に対して行った。

a) 廃棄物管理状況

廃棄物分野の MRV 検討の背景となるホーチミン市の廃棄物分野の状況を把握するために、市内の廃棄物の発生状況や最終処分場を含めた処理状況、排水処理や排水処理施設の運転状況について、基本的な情報を整理した。

b) 廃棄物関連組織の役割

ホーチミン市の廃棄物分野の事業に関連する組織を整理した。廃棄物分野の計画や施策を統括する部局として、一般廃棄物については DONRE の固形廃棄物管理部、排水については SCFC、農業・畜産廃棄物については DARD であることを確認した。

c) 廃棄物分野の主な計画・施策

廃棄物分野の MRV 試行案件の選定等に必要な、実施中または計画されている廃棄物関連施策に関する情報を収集し、「2) NAMA 案件情報の収集」の基礎情報とした。CCAP に位置づけられている施策も情報収集の対象とした。

2) NAMA 案件情報の収集

MRV 試行の対象となりうる緩和策のロングリストを作成した。スコープは、ホーチミン市の廃棄物管理、排水処理に関するすべての活動とし、プロジェクトベースと政策ベースの施策とした。さらに、農業、畜産から発生する廃棄物、排水管理に関する活動もスコープに含めた。実施中の施策だけでなく、近い将来に実施される予定の施策も含めた。

表 11　MRV 試行案件候補（ロングリスト）（廃棄物分野）

施策名	実施主体	概要
市内 5 区を対象とした家庭廃棄物の分別回収プロジェクト	DONRE	1 区、3 区、6 区、12 区、Binh Thanh 区の一般家庭を対象に、家庭ゴミの分別を行うパイロットプロジェクト。
第 1 区の廃棄物運搬ルートの効率化	CITENCO	区内の一般廃棄物収集・運搬ルートを改善し、収集トラックによる燃料使用量の削減を目指す。
ゴーカット最終処分場の廃棄物発電プロジェクト	CITENCO	廃棄物最終処分場にて、有機性廃棄物から発生するバイオガスを回収して発電する（2.4MW）。発電した電力は処分場内で使用するが、余剰電力はグリッドに供給する。
廃棄物発電事業	CITENCO	家庭ゴミに含まれる有機物を燃焼して、エネルギー利用し、最終処分場への埋め立て量を削減する。
小規模農家の畜糞を利用したバイオガス生成プロジェクト	LIFSAP 事務局	世界銀行が支援しているプロジェクトの一環として、Cu Chi 区の畜産農家 844 戸にバイオダイジェスターを設置し、バイオガスを熱源として利用することで、畜産廃棄物からのメタン発生を抑制するとともに化石燃料の消費削減を図る。
バイオダイジェスター設置に関わる補助金制度	人民委員会	2008 年に制定された制令により、バイオダイジェスターを新たに設置する農家に対して機器購入費用の補助するもの。2012 年に終了。
醸造所からの廃水を利用したバイオガス生成	民間企業	工場廃水に含まれる有機物を処理する際に発生するバイオガスを活用し、エネルギー利用することで、化石燃料の消費を削減する。
Binh Dien 市場のバイオガス利用	DONRE	市場で発生する有機性廃棄物を活用し、エネルギー利用することで、最終処分場への埋め立て量削減を図るとともに、市場の化石燃料消費を削減する。
Long Hau 工業団地廃水処理場の処理水の再利用	民間企業	工業団地内に設置された廃水処理施設から発生する処理水を工業用水として再利用するもの。

注）LIFSAP：畜産農家の競争力強化・安全性向上プロジェクト

2.3.2　MRV の試行

以下のステップで MRV 試行案件を特定し、試行した。

- ステップ 1　選定基準の設定

  MRV の試行を行う案件の選定基準を設定した。選定基準は、ホーチミン市の対象分野に関連する上位計画との整合性、施策・技術の普及可能性、MRV の実効性、GHG 排出削減効果、コベネフィット、実施時期等の観点から設定した。選定基準を表 12 に示す。
- ステップ 2　案件候補の選定

  選定基準を用いてロングリストから複数の案件を最終候補として選定した。
- ステップ 3　対象案件の決定

関係機関に MRV 試行の可能性を打診し、CCB と協議のうえ対象案件を決定した。対象案件を表 13 に示す。

- ステップ 4　MRV 試行

MRV を試行した。

表 12　MRV 試行案件の選定基準

項目	基準
上位計画との整合性	対象分野の上位計画等に位置づけられている方針や政策に沿った施策である
施策・技術の普及可能性	今後、ホーチミン市にて広く普及していく可能性があると想定される施策である
MRV の実効性	測定・モニタリングや報告などを行う主体が明確で、実際に MRV が実施可能であると想定される施策である
GHG 排出削減効果	GHG 排出削減効果があると事前に推定される
コベネフィット	大気汚染防止や水質汚濁防止などのコベネフィット効果があると想定される
実施時期	既に実施されている、もしくは実施中の施策である

表 13　MRV 試行案件一覧

分野	施策名	実施主体	監督部局
エネルギー	道路灯の LED 照明への転換プロジェクト	第 3 区	DOIT
	太陽光発電設備の導入プロジェクト	ECC	DOST
交通	公共バスへの CNG 車導入プロジェクト	サイゴンバス	DOT、MOCPT
	BRT 1 号線プロジェクト	UCCI	-
	MRT 1 号線プロジェクト	MAUR	-
廃棄物	ゴーカット最終処分場の廃棄物発電プロジェクト	CITENCO	DONRE
	小規模農家の畜糞を利用したバイオガス生成プロジェクト	LIFSAP 事務局	DARD

注）UCCI：都市土木建設投資管理局

(1) エネルギー分野

ロングリストの各案件（表 9 参照）について、表 12 に示す選定基準により評価し、CCB を含

む関係者との協議のうえ、MRV 試行案件として「道路灯の LED 照明への転換プロジェクト」、「太陽光発電設備の導入プロジェクト」の 2 件を選定した。2 つのプロジェクトの概要を表 14、表 15 にそれぞれ示す。

これらの試行案件について、GHG 排出削減量算定に関する方法論を検討した。方法論は、極力既存のデータやモニタリング手法を利用でき、関係機関職員が容易に活用できる実務的なものとした。検討した方法論に沿って、ベースライン排出量とプロジェクト排出量の算定に必要な活動量データや排出係数等のデータを収集し、GHG 排出削減量の算定を試行した。

「道路灯の LED 照明への転換プロジェクト」については、電力消費量、点灯時間などのモニタリング活動が実施できなかったが、対象事業の事業報告書記載の導入 LED ランプ数、スペック情報を使って GHG 排出削減量を計算した。

「太陽光発電設備の導入プロジェクト」については、ECC がモニタリングした発電量データを用いて排出削減量を算定した。

MRV の体制、実施、具体的な手法について検討した。事業に関係する機関の役割、既存のモニタリング・報告制度の有無と MRV 試行活動への適用可能性、事業主体と監督部局の MRV 活動への関与等について調べた。これらを踏まえて、監督部局、CCB と協議を数回行い、適用可能な MRV 手法の構築に取り組んだ。

MRV 試行の過程で検討した各案件の MRV 体制、方法論、GHG 排出削減量の試算結果、モニタリング結果等を資料 1 に示す。

表 14　MRV 試行案件（道路灯の LED 照明への転換プロジェクト）の概要

プロジェクト名	道路灯の LED 照明への転換プロジェクト
実施主体	第 3 区
監督部局	DOIT
概要	道路照明灯（18W）を LED 照明（9W）に転換する。これまでに 2,100 個の照明を交換。ホーチミン市では、2020 年までにすべての道路照明を交換する予定（総数で 200,000 個を交換予定）。 MRV 試行は交換された照明のうち電力量計を接続している一部の照明を対象とする。

表 15　MRV 試行案件（太陽光発電設備の導入プロジェクト）の概要

プロジェクト名	太陽光発電設備の導入プロジェクト
実施主体	ECC
監督部局	DOST
概要	5 つのビル、10 戸の住宅の屋根に小規模な太陽光発電設備を設置し、発電した電力を自家消費する事業。ビルの場合、太陽光発電設備の導入費用はオーナーが負担するが、発電した電力量に電力単価（固定）を乗じた金額が実施機関からオーナーに対して一定期間支払われる。住宅への設備導入費用は実施機関が全て負担し、発電量に対するお金の支払いはない。

(2) 交通分野

ロングリストの各案件（表 10 参照）について、表 12 に示す選定基準により評価し、CCB を含む関係者との協議のうえ、MRV 試行案件として「公共バスへの CNG 車導入プロジェクト」、「BRT 1 号線プロジェクト」、「MRT 1 号線プロジェクト」の 3 件を選定した。BRT 1 号線と MRT 1 号線については、いずれも計画あるいは建設の段階のため、MRV を試行することはできなかったが、交通分野の重要プロジェクトで CCB や関係機関の期待が大きいため選定した。各プロジェクトの概要を表 16、表 17、表 18 にそれぞれ示す。

これらの試行案件について、GHG 排出削減量算定に関する方法論を検討した。方法論は、極力既存のデータやモニタリング手法を利用でき、関係機関職員が容易に活用できる実務的なものとした。検討した方法論に沿って、ベースライン排出量とプロジェクト排出量の算定に必要な活動量データや排出係数等のデータを収集し、GHG 排出削減量の算定を試行した。「公共バスへの CNG 車導入プロジェクト」では、サイゴンバスが実際にモニタリングにより走行距離と燃料消費量を継続的に収集し、その結果を用いて排出削減量の算定を行った。「BRT 1 号線プロジェクト」と「MRT 1 号線プロジェクト」については、モニタリングができないため、計画値を用いて排出削減量を算定した。その一連のプロセスについてそれぞれ UCCI、MAUR と勉強会を実施することで、関係者の技術的能力の向上を図った。

MRV の体制、実施、具体的な手法について、情報を収集して実現可能な方法を検討した。事業に関係する機関の役割、既存のモニタリング・報告制度の有無と MRV 試行活動への適用可能性、事業主体と監督部局の MRV 活動への関与等について調べた。これらを踏まえて、監督部局、CCB と協議を数回行い、適用可能な MRV 手法の構築に取り組んだ。

MRV 試行の過程で検討した各案件の MRV 体制、方法論、GHG 排出削減量の試算結果、モニタリング結果等を資料 1 示す。

表 16 MRV 試行案件（公共バスへの CNG 車導入プロジェクト）の概要

プロジェクト名	公共バスへの CNG 車導入プロジェクト
実施主体	MOCPT
監督部局	DOT
関連機関	バス・オペレーター：サイゴンバス
概要	2016 年 8 月に CNG バス 21 台が路線 27 に導入され、従来のディーゼルバスに代わって運用されている。CNG バスは、乗車定員 68 人、排気量 11,149cc、車両重量 10,780kg である。軽油と比較して炭素含有率が低い天然ガスを燃料として使用することで、GHG 排出が削減される。

表 17　MRV 試行案件（BRT1 号線プロジェクト）の概要

プロジェクト名	BRT 1 号線プロジェクト
実施主体	MOCPT
監督部局	DOT
関連機関	BRT オペレーター：未定 計画・設計：UCCI
概要	総延長 23km（An Lac Turnaround – Vo Van Kiet Boulevard – Mai Chi Tho Boulevard – Cat Lai T-junction (Rach Chiec Terminal)）。BRT 用バスには CNG 車を導入する見込み。自家用車等からより輸送効率の高い BRT への旅客モーダルシフトにより GHG 排出が削減される。

表 18　MRV 試行案件（MRT1 号線プロジェクト）の概要

プロジェクト名	MRT 1 号線プロジェクト
実施主体	MAUR
監督部局	（MAUR はホーチミン市人民委員会直属組織のため該当なし）
関連機関	MRT オペレーター：未定 計画・設計：MAUR
概要	総延長 19.7km（Ben Thanh and Suoi Tien）、14 駅。総延長のうち 17.1km は高架、2.6km は地下である。自家用車やバス等からより輸送効率の高い MRT への旅客モーダルシフトにより GHG 排出が削減される。

(3) 廃棄物分野

ロングリストの各案件（表 11 参照）について、表 12 に示す選定基準により評価し、CCB を含む関係者との協議のうえ、MRV 試行案件として「ゴーカット最終処分場の廃棄物発電プロジェクト」と「小規模農家の畜糞を利用したバイオガス生成プロジェクト」を選定した。各プロジェクトの概要を表 19 と表 20 にそれぞれ示す。

これらの試行案件について、GHG 排出削減量算定に関する方法論を検討した。方法論は、極力既存のデータやモニタリング手法を活用でき、実施主体が容易に活用できる実務的なものとした。検討した方法論に沿って、ベースライン排出量とプロジェクト排出量の算定に必要な活動量データや排出係数等のデータを収集し、GHG 排出削減量の算定を試行した。

「ゴーカット最終処分場の廃棄物発電プロジェクト」については、廃棄物発電事業による GHG 排出削減量を計算するために必要なデータである埋め立て処分場からのガス回収量、年間発電量、事業実施に伴う電力使用量等の活動量パラメータ、関連排出係数を収集し、排出削減量を計算した。MRV 実施体制と手順についても検討し、関係機関と協議した。「小規模農家の畜糞を利用したバイオガス生成プロジェクト」については、対象農家の家畜の頭数、バイオダイジェスターのサイズ、調理用燃料の消費量等を確認するための調査を行った。

事業実施機関や監督部局、CCB 職員を対象に GHG 排出削減量の計算に関する勉強会を開催し、

ホーチミン市関係者の技術的キャパシティの向上を図った。MRV の体制、実施、具体的な手法について、情報を収集して実現可能な方法を検討した。事業に関係する機関の役割、既存のモニタリング・報告制度の有無と MRV 試行活動への適用可能性、事業主体と監督部局の MRV 活動への関与等について調べた。これらを踏まえて、監督部局、CCB と協議を数回行い、適用可能な MRV 手法の構築に取り組んだ。

MRV 試行の過程で検討した各案件の MRV 体制、方法論、GHG 排出削減量の試算結果、モニタリング結果等を資料 1 に示す。

表 19　MRV 試行案件（ゴーカット最終処分場の廃棄物発電プロジェクト）の概要

プロジェクト名	ゴーカット最終処分場の廃棄物発電プロジェクト
実施主体	CITENCO
監督部局	DONRE
概要	ゴーカット最終埋立て処分場は 2001 年に固形廃棄物の受け入れを開始した。廃棄物発電（定格 2.4MW）事業は 2005 年より実施。処分場は廃棄物の受け入れを 2007 年に終了しているが、既に埋め立てられた廃棄物からランドフィルガス（LFG）を回収し、発電事業を継続している。事業開始当初は 400MWh/月を超える電力をグリッドに供給していたが、ガス発生量の低下や発電機（2016 年現在は 1 基のみ稼働中）の老朽化により、2016 年の平均発電量は 10MWh/月に低下している。

表 20　MRV 試行案件（小規模農家の畜糞を利用したバイオガス生成プロジェクト）の概要

プロジェクト名	小規模農家の畜糞を利用したバイオガス生成プロジェクト
実施主体	LIFSAP 事務局
監督部局	DARD
概要	ホーチミン市のクチ（Cu Chi）区の 844 戸の畜産農家にバイオダイジェスターを設置し、メタンの排出を抑制する事業。回収したメタンガスは農家での調理等に利用される。

2.3.3　MRV マニュアルの作成

CCB を含むホーチミン市関係者や他都市の職員が、継続的に気候変動緩和策の GHG 排出削減量を定量化して報告できるようにするために、MRV マニュアルを作成した。マニュアルは、MRV の試行と関連する制度や体制の調査、ホーチミン市関係機関を対象とした 2 回のコンサルテーション、MONRE と長期専門家との協議、CCB と繰り返し行った協議などの結果を踏まえて作成した。

MRV のフレームワークや手順についての意見を集約するために、市の関係部局や区、企業や大学などの関係者を対象とした第 1 回コンサルテーション会合を 2017 年 3 月 1 日に開催した。コンサルテーションでは、意見をできる限り多く集約するために、MRV フレームワークに関する全体説明の後、2 つのグループに分かれてディスカッションを行った。MRV マニュアル作成の背景や法的根拠、MRV を実施するための動機付け（義務化やインセンティブ付与）、MRV 実施に必要となる人的・経済的な支援について、明確化を求める意見が多く出された。

修正した最新版 MRV マニュアルに記載されている内容の妥当性､説明が十分にされているか、重複がないかなどについて確認する第 2 回コンサルテーション会合を 2017 年 7 月 11 日に開催した。市の関係部局、区や企業、大学などの関係者、MONRE が参加した。関係者には、コンサルテーション開催前にマニュアル全編を配布した。MRV マニュアルの目的や対象者、MRV する緩和策の選定基準や指針の明確化､排出削減量算定方法の記載の充実などを求める意見が出された。

2017 年 8 月 29 日に行われた CCSB 事務レベル会合にて、マニュアルについて、ホーチミン市関係部局と最後の意見交換を行った。既存の報告制度・手順と統合して追加的な作業をできる限り減らす仕組みにすること、今後の MRV 実施に向けた手順の明確化を求める意見が出された。

その後、MONRE、CCB の最終コメントも反映させて、MRV マニュアルを最終化した。マニュアルは 2017 年 10 月 26 日に開催した最終セミナーで紹介し､CCB を通じて関係機関に配布した。

このほか、2017 年 7 月 14 日に MONRE がハノイで開催した MRV に関する勉強会に参加し、MRV マニュアルの概要や MRV 試行から得られた教訓を紹介し、国の MRV 制度の設計に関わる関係省庁の職員 8 人と意見交換を行った。

表 21　MRV マニュアルの構成

タイトル	内容
Chapter 1. Introduction	マニュアルの目的、作成の背景、法的根拠、対象者、MRV の概要の説明
Chapter 2. Basic MRV Framework 2-1. Defining scope of mitigation actions to MRV in the city 2-2. Setting up MRV framework for the city	MRV フレームワーク、MRV フレームワーク設定手順の説明､MRV 対象スコープの設定方法
Chapter 3. MRV Process 3-1. Determining mitigation actions to MRV 3-2. Implement MRV 3-3. Approve MRV result	MRV の準備から、実施、承認までの一連の流れの説明
Annex I Case Studies on MRV	MRV のケーススタディの紹介
Annex II Typical Mitigation Actions and Emission Reduction Logic	主要な緩和策と排出削減ロジックの紹介
Annex III MRV Plan Form	MRV 計画書フォーム
Annex VI Mitigation Monitoring Report Form	モニタリング報告書フォーム

2.4　研修・セミナー

2.4.1　随時開催セミナー

GHG インベントリや MRV 試行に関係するホーチミン市職員を主な対象としたセミナーを表 22 のとおり 2 回実施した。講師は専門家チームが務めた。

表 22　随時開催セミナーの開催概要

	日時	会場	参加者	内容
第1回	2016年1月6日（水） 9:00～11:00	DONRE 会議室	CCBより6人、DOT、DOIT、MBS、MOCPT、EVN HCMCより各1人、CITENCOより2人	プロジェクトの概要、プロジェクトの進捗、GHGインベントリの概要、NAMAとMRVの概要
第2回	2016年3月18日(金) 9:00～10:30	貸会議室	CCB、DOT、DOIT、EVN HCMCより各1人、MBSより2人	NAMAとMRVの概要、ホーチミン市向けNAMA・MRVガイドラインの骨子、MRVを試行するNAMA案件の候補、MRVのためのGHG排出量算定方法の例

2.4.2　本邦研修

ホーチミン市職員を主な対象とした本邦研修を2回実施した。

第1回は2016年5月22日から28日までの日程で実施した。研修日程を表 23に示す。東京都環境局や大阪市環境局などから講義を受けたほか、廃棄物処理施設や省エネ性能に優れたビルなどを見学した。ワークショップでは、緩和策の立案演習を行った。参加者は「3.2 研修」のとおり。

表 23　第1回本邦研修の日程表

日付	時刻	研修内容
5/22 （日）		成田空港到着
5/23 （月）	9:00-9:30 9:30-10:00 10:00-12:00	• ブリーフィング • オリエンテーション • 研修員による発表（ホーチミン市の気候変動に関する取り組みの状況や課題、本研修に期待することなど）
	13:00-13:50 13:50-15:30 15:30-16:30	• 研修員による発表（つづき） • 短期専門家チームとのディスカッション • 東京都のマレーシア（イスカンダル地方とプトラジャヤ市）への協力事例紹介
5/24 （火）	10:00-12:00	• 東京都の気候変動対策（中小規模事業所報告書制度） • 東京都の資源循環施策（温室効果ガス削減の考え方・取り組み）
	14:30-16:30 17:15-17:45	• 東京スクエアガーデンの見学（ビル省エネに関するテナントビルの取り組み） • 新宿バスタの見学

日付	時刻	研修内容
5/25 （水）	8:00-12:00	大阪へ移動
	14:15-16:00 16:00-17:00	• 大阪市の地球温暖化対策実行計画について（概要、策定プロセス、進捗管理、改訂など）、大阪市における緩和策のモニタリング、排出削減量の算定について • アベノハルカスの省 CO_2 の取り組みについて（見学）
5/26 （木）	10:00-11:15	• ハグミュージアム見学（スマートエネルギーネットワークの取り組み、ビル・住居のエネルギーシステム）
	13:00-15:00 15:00-15:30 16:15-17:30	• 廃棄物処理施設の見学 • 舞洲工場周辺の施設見学（北港舞洲スラッジセンター、PCB 廃棄物処理施設、北港処分場） • 大阪市都市計画局と大阪地下街株式会社による講義、大阪駅周辺の地下街見学
5/27 （金）	9:00-12:00	• 研修報告会準備（グループディスカッション）
	13:00-15:30 15:30-16:00	• 研修報告会（グループごとに気候変動対策を立案し、実施に向けた方策を発表） • 閉講式
5/28 （土）		• 関西国際空港出発

第 2 回は 2017 年 5 月 21 日から 27 日までの日程で実施した。研修日程を表 24 に示す。東京都環境局から講義を受けたほか、廃棄物処理施設や下水処理施設を見学した。ワークショップでは、緩和策の MRV 計画を立案した。参加者は「3.2 研修」のとおり。

表 24　第 2 回本邦研修の日程表

日付	時刻	研修内容
5/21 （日）		成田空港到着
5/22 （月）	10:00-11:30 11:30-12:00	• ブリーフィング • オリエンテーション
	13:00-14:30 14:30-16:00 16:00-17:30	• 研修員による発表（各部局の取り組み、本研修に期待すること） • ホーチミン市の GHG インベントリ作成マニュアル • ホーチミン市の MRV マニュアル
5/23 （火）	9:30-12:00	• 東京都の気候変動対策
	13:30-17:00	• 東京都の GHG インベントリ • キャップ・アンド・トレード制度
5/24 （水）	9:30-12:00	• 中小規模事業者省エネ促進・クレジット創出プロジェクト
	14:00-16:00	• 大規模事業者のビル省エネの取り組み
5/25 （木）	9:30-11:30	• 大田清掃工場の見学
	14:00-16:00	• 東京都下水道局の温暖化対策

日付	時刻	研修内容
5/26 （金）	9:00-12:00	• ワークショップ（MRV 体制立案演習）
	13:00-13:20	• ワークショップの成果発表
	13:20-15:00	• 研修成果についてのグループ討議と発表
	15:00-16:00	• 評価会、終了証授与式
5/27 （土）		• 成田空港出発

2.4.3 気候変動緩和総合研修

ホーチミン市職員を対象にした気候変動緩和に関する総合研修を 2 回実施した。

第 1 回は 2016 年 11 月 25 日、28～30 日の 4 日間にわたり実施した。研修プログラムを表 25 に示す。専門家チームのほか、MONRE やベトナム気象・水文研究所の職員が講師を務めた。研修のパート A（11 月 25 日、28 日）では、気候変動問題の概要、GHG インベントリ、気候変動緩和策について講義を行った。パート B（11 月 29 日、30 日）では、緩和策の MRV についての講義と、ワークショップを行った。ワークショップでは、ホーチミン市で実行可能な緩和策の立案、緩和策による GHG の排出削減量の計算を行った。参加者は「3.2 研修」のとおり。

表 25　第 1 回気候変動緩和総合研修プログラム

モジュール	トピック	内容
パート　A 1. 気候変動問題の概要	1-1. 研修の概要説明、理解度テスト、自己評価の実施(事前アセスメント)	・研修の概要説明 ・研修の目的、期待される成果、研修プログラムの説明 ・理解度テスト、自己評価（事前アセスメント）
	1-2. 気候変動問題の概要及び国際社会の対応	・気候変動問題を理解するための基本的な概念(科学的知見、気候変動による影響、脆弱性、気候変動緩和策及び適応策、地球温暖化と GHG 排出、気候変動問題に対する国際社会及びベトナム国の対応)
	1-3. ベトナムの気候変動緩和政策	・気候変動問題に関する国際合意とベトナム政府の取り組み ・気候変動に対する国家目標プログラムと国家気候変動戦略、INDC、NAMA、国別報告書、GHG インベントリ
パート　A 2. 国及び都市レベルでの GHG 排出	2-1. 国家GHGインベントリ	・国家 GHG インベントリ作成の目的や意義、構成 ・日本とベトナムの国家インベントリ､国家インベントリ政策
	2-2. 都市/地域レベルの GHG インベントリ	・都市/地域レベルの GHG インベントリ作成の目的や意義、構成 ・日本とベトナムの都市/地域レベルのインベントリ、都市/地域レベルのインベントリ政策

モジュール	トピック	内容
	2-3. GHG インベントリ作成におけるデータ収集活動、排出量算定プロセス	・GHG インベントリの基本的な概念、ガイドライン ・GHG インベントリ作成におけるデータ収集活動、排出量算定プロセス
パート A 3. 気候変動緩和策	3-1. 気候変動緩和施策及び技術	・代表的な気候変動緩和施策及び緩和技術の事例
	3-2. 気候変動緩和政策	・気候変動緩和政策の事例 ・日本における都市レベルでの気候変動緩和政策の概要・事例（東京都の事例）
	3-3. 緩和策の選定と優先順位付け	・緩和策の選定手法
パート B 4. 気候変動緩和策の立案と MRV	4-1. 気候変動対策におけるファイナンス	・気候変動対策のための税制、インセンティブ、市場メカニズム
	4-2. 気候変動緩和策と MRV	・緩和策及び MRV の基本概念 ・従来の環境関連施策と緩和策の関係性 ・緩和策の MRV 事例
	4-3. 気候変動緩和策における GHG 排出量モニタリング手法及び GHG 排出削減量計算	・GHG 排出削減量のモニタリング手法及び計算手法
パート B 5. グループ演習：気候変動緩和策の立案と MRV	5-1. グループ演習	・ホーチミン市の気候変動緩和策の立案
		・緩和策と MRV 計画立案、GHG 排出削減量計算
	5-2. グループによる発表	・グループによる発表 ・専門家チームによる講評
	5-3. 総括、理解度テスト、自己評価の実施（事後アセスメント）	・総括 ・理解度テスト、自己評価（事後アセスメント）

注）INDC：自国が決定する貢献案

第 2 回は 2017 年 7 月 5～7 日の 3 日間にわたり実施した。研修プログラムを表 26 に示す。専門家チームのほか、MONRE 職員や C40 スタッフが講師を務めた。研修のパート A（7 月 5 日、6 日）では、気候変動問題の概要、GHG インベントリ、気候変動緩和策について講義を行った。パート B（7 月 7 日）では MRV 計画の立案ワークショップを行った。参加者は「3.2 研修」のとおり。

表 26　第 2 回気候変動緩和総合研修プログラム

モジュール	トピック	内容
パート A 1. 導入	1-1. 気候変動問題の概要と国際社会の対応	・気候変動の基礎と基本的概念（科学、影響、脆弱性、緩和と適応） ・地球温暖化と GHG の排出 ・気候変動に対する国際社会の対応
	1-2. 気候変動緩和に関するベトナムの政策	・国際的な合意とベトナムの対応 ・気候変動に対する国家目標プログラムと気候変動に関する国家戦略 ・NDC、NAMA、国別報告書、GHG インベントリ
パート A 2. 国・都市レベルの GHG 排出	2-1. GHG インベントリ	・国家及び都市レベルの GHG インベントリの目標と構成 ・プロトコル、ガイドライン類 ・GHG 排出量の算定と GHG インベントリの作成 ・日本とベトナムの国家インベントリ ・日本とベトナムの都市レベルの GHG インベントリ ・HCMC の GHG インベントリ作成マニュアル
	2-2. 世界の都市における GHG インベントリ	・GPC について ・インベントリ作成の様々なアプローチ ・共通の課題や成功事例 ・インベントリ作成の利点
パート A 3. 気候変動緩和策	3-1. 気候変動緩和の技術と取り組み	・代表的な気候変動緩和技術や緩和の取り組み事例
	3-2. 気候変動緩和政策	・気候変動緩和政策の事例 ・日本の都市レベルの気候変動緩和政策 ・東京都の気候変動緩和政策
パート A 4. 気候変動緩和策の計画と MRV	4-1. 気候変動緩和策のファイナンス	・税制上の施策と内部補助金 ・国際金融 ・市場メカニズム（炭素クレジット）
	4-2. MRV 可能な気候変動緩和策の計画	・MRV の考え方と NAMA・気候変動緩和策の要件
	4-3. 緩和活動による GHG 排出削減量のモニタリングと算定	・GHG 排出削減量の定量化手法
パート B 5. ホーチミンでの MRV の計画と実施	5-1.　講義	・MRV マニュアルについて ・MRV の体制と手順
	5-2. 演習、発表、議論	・MRV 計画の立案 ・GHG 排出削減のロジックの検討 ・グループごとの成果発表 ・JICA 専門家からのフィードバック

注）NDC：自国が決定する貢献

2.4.4 最終セミナー

プロジェクトの成果発表を目的とした最終セミナーを 2017 年 10 月 26 日に開催した。プログラムを表 27 に示す。参加者数は 89 人であった。内訳を表 28 に示す。

表 27 最終セミナープログラム

トピック	内容	発表者
1. プロジェクトの概要	・プロジェクトの背景と目的、活動概要、実施体制、成果の概要	専門家チーム
2. ホーチミン市の GHG インベントリ	・GHG インベントリの基本的事項 ・2013 年のホーチミン市の GHG インベントリ（排出源、排出量、国や他都市との比較）	専門家チーム
3. GHG インベントリ作成マニュアル	・マニュアルの目的と構成 ・ホーチミン市の GHG インベントリの作成手順とデータ源	専門家チーム CCB
4. MRV の試行	・MRV の基本的事項と MRV 試行の目的 ・MRV 試行の過程と成果（対象施策の概要、モニタリング活動、排出削減量の計算、課題と教訓）	専門家チーム MRV 試行の関係機関
5. MRV マニュアル	・マニュアルの目的と構成 ・ホーチミン市の MRV のフレームワークと手順	専門家チーム CCB
6. キャパシティビルディング	・プロジェクトで実施した研修やセミナーの概要 ・本邦研修の参加報告	DONRE
7. 東京都の事例から学ぶ都市の効果的な緩和施策	・建築物を対象とした東京都の GHG 排出削減施策 ・東京都の施策のホーチミン市への応用可能性	みずほ情報総研
8. ホーチミン市の今後の取り組み	・今後の取り組み方針 ・マニュアルなどプロジェクト成果の活用方針	CCB

表 28 最終セミナー参加者の内訳

組織	人数
MONRE	2
ホーチミン市の部局・区	47
ホーチミン市の企業	13
ホーチミン市の研究機関	9
国際機関	1
JICA ベトナム事務所	3
みずほ情報総研	1
ローカルコンサルタント・専門家チーム	13
合計	89

2.5 連携・対外発信

2.5.1 連携

多くの機関との連携・協力があった。ホーチミン市も参加する C40 は、プロジェクトで作成したホーチミン市の GHG インベントリについて、報告ツールの提供やレビューを行い、有用なアドバイスを提供した。プロジェクトで開催した気候変動緩和総合研修では、都市レベルの気候変動対策の重要性や GHG インベントリの有用性などについて、C40 の取り組みを紹介して説明した。専門家チームは、ホーチミン市での取り組みについて C40 に説明し、JICA と C40 が協力してホーチミン市の能力強化に取り組むよう協力した。

大阪市は、ホーチミン市との都市間連携事業の一環で開催したセミナーにて、本プロジェクト紹介の機会を設けた。その後、本邦研修を受け入れ、市内の気候変動緩和の取り組みを紹介した。

東京都は、本邦研修を 2 回受け入れ、都の気候変動緩和に関する施策や都の事業での低炭素化の取り組みを紹介した。専門家チームは、排出量取引など実効性ある気候変動対策を展開している事例を広く共有するために東京都が国際炭素行動パートナーシップ（ICAP）と共催したシンポジウムにて C/P が発表する支援を行った。

国立環境研究所、地球環境戦略研究機関（IGES）、みずほ情報総研らは、ホーチミン市の GHG 排出予測などに取り組んでいたが、その成果発表会にて本プロジェクト紹介の機会を設けた。その後、専門家チームは、同グループのベトナム人元メンバーをローカルコンサルタントとして契約し、GHG インベントリ作成マニュアルと MRV マニュアルの制度化に必要な調査の一環として、同グループの成果を活用した報告書を作成させた。

IGES、みずほ情報総研らは、環境省の事業を活用するなどして、プロジェクトで開催した気候変動緩和総合研修などで、東京都の気候変動緩和に関する施策などについて発表した。専門家チームは、同チームのホーチミン市での調査実施にあたって、関係機関を紹介するなどした。

2.5.2 対外発信・広報

JICA 技術協力プロジェクトサイトにて活動の状況を定期的に紹介した。はじめに第 1 回現地活動から 2016 年 3 月までの活動を紹介し、これ以降 3 カ月ごとに活動状況を発信した。記事は日本語、英語、ベトナム語の 3 言語で作成した。英語とベトナム語のニュースレターも 3 カ月ごとに作成し、同サイトに掲載した（資料 2)。ニュースレターは気候変動緩和総合研修やコンサルテーション会合などの行事で配布した。

2.6 プロジェクト目標の達成に対する貢献

プロジェクト目標は「ベトナム政府の NAMA の計画・実施に係る能力が強化される」である。本業務では、ホーチミン市をモデルとして都市レベルで気候変動緩和策をモニタリングする能力を強化した。特に、GHG インベントリ、個別緩和策の MRV に関して、ホーチミン市関係機関や MONRE と協議したうえで、実施手順や体制について提案してマニュアルを整備した。今後、2 つのマニュアルはホーチミン市の公式文書になる予定である。このことは、NAMA に関する政策

枠組みの制定、国家 MRV に関する規定の制定、地方政府の MRV 規定の国家 MRV 枠組みへの取り込みーの 3 つのプロジェクト目標の指標達成に貢献する。特に、緩和策の MRV については、ホーチミン市での取り組みは国家レベルでの検討に先行していて、国の枠組みや規定を制定するための良い具体的事例となっている。

3. 投入実績

3.1 専門家派遣

専門家チームの構成と各専門家の担当業務を表 29 に示す。専門家は計 7 人で、総括 1 人、GHG インベントリに関する業務の担当者 2 人、MRV に関する業務の担当者 3 人、ワークショップ企画運営／業務調整の担当者 1 人であった。本邦研修に関する業務は MRV に関する業務の担当者の 1 人が兼務した。

表 29　専門家チームの構成

氏名	所属	担当業務	業務内容
石坂　浩史	パシフィックコンサルタンツ株式会社	総括/MRV 体制・制度構築	1. 業務全体の総括、関係機関との折衝・協議、JICA への報告 2. 団員とローカルコンサルタントの監督・指導 3. GHG インベントリと MRV の制度化支援 4. ホーチミン市での研修・セミナーの教材作成・講義 5. 報告書の取りまとめ
桑原　文彦	株式会社数理計画	GHG インベントリ 1	1. ホーチミン市の GHG インベントリの作成 2. GHG インベントリ作成マニュアルの作成 3. GHG インベントリ作成に関する研修 4. GHG インベントリの広報・啓発資料の作成 5. ホーチミン市での研修・セミナーの教材作成・講義
森本　亘	株式会社オリエンタルコンサルタンツグローバル	GHG インベントリ 2	1. ホーチミン市の GHG インベントリの作成 2. ホーチミン市での研修・セミナーの教材作成・講義
水野　芳博	パシフィックコンサルタンツ株式会社	GHG 算定・排出削減量 1	1. 総括の補佐 2. NAMA・MRV に関する基礎情報の収集・分析と課題・ニーズの抽出 3. MRV の試行（エネルギー分野） 4. MRV マニュアルの作成 5. ホーチミン市での研修・セミナーの教材作成・講義
白川　泰樹	パシフィックコンサルタンツ株式会社（補強）	GHG 算定・排出削減量 2	1. NAMA・MRV に関する基礎情報の収集・分析と課題・ニーズの抽出 2. MRV の試行（交通分野） 3. MRV マニュアルの作成 4. ホーチミン市での研修・セミナーの教材作成・講義

氏名	所属	担当業務	業務内容
吉田　哲也	株式会社オリエンタルコンサルタンツグローバル	GHG 算定・排出削減量 3	1. NAMA・MRV に関する基礎情報の収集・分析と課題・ニーズの抽出 2. MRV の試行（廃棄物分野） 3. MRV マニュアルの作成 4. ホーチミン市での研修・セミナーの教材作成・講義
九石　太樹	パシフィックコンサルタンツ株式会社	ワークショップ企画運営/業務調整	1. ホーチミン市での研修・セミナーの企画運営 2. 本邦研修の企画運営 3. 活動状況・活動成果の対外発信・広報 4. 各種調整業務
水野　芳博	パシフィックコンサルタンツ株式会社	本邦研修	1. 本邦研修の企画運営

各専門家の業務従事実績を表 30 に示す。現地への総渡航回数は 21 回、総現地業務日数は 773 日であった。

表 30　専門家派遣実績

（11 月 9 日時点）

氏名 担当業務		渡航回数	2015年度							2016年度												2017年度									日数合計	人月合計
			9月	10月	11月	12月	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月	1月	2月	3月	4月	5月	6月	7月	8月	9月	10月	11月	12月		
石坂　浩史 （総括/MRV体制・制度構築）	現地業務	17		7-14 (8)	29-30 (2)	1-2 (2)	4-8 (5)			12-16 (5)		9-16 (8)		8-12 (5)	25-30 (6)	1,30,31 (3)	1-4,23-30 (12)	1-3 (3)	11-17 (7)	26-28 (3)	1-4 (4)	7-14 (8)	14-19 (6)		4-15 (12)	1-5,28-31 (9)	1-2 (2)	23-28 (6)			116	3.87
	国内業務	0	25 (1)	23 (1)	20 (1)	15 (1)	18 (1)		29 (1)	22 (1)	13,23 (2)	27 (1)	6 (1)	(0)	15 (1)	7,13 (2)	9,10,11, 18,21 (5)	6-8 (3)	10,18, 20,24 (4)	7,9 (2)	9 (1)	3 (1)	10,24,26 (3)	9,14,22 (3)	25 (1)	8 (1)	22 (1)	10,17 (2)			41	2.05
桑原　文彦 （GHGインベントリ1）	現地業務	17		7-14 (8)	29-30 (2)	1-4 (4)	4-9 (6)		13-19 (7)			13-18 (6)		7-13 (7)	28-30 (3)	1-6,25-31 (13)	1-5,24-30 (12)	1-3 (3)	9-21 (13)	21-28 (8)	1-4,21-31 (15)	1,10-22 (14)			3-14,23-31 (21)	1-5,28-31 (9)	1-2 (2)	23-28 (6)			159	5.30
	国内業務	0	(0)	1,2,15, 16 (4)	10 20 (2)	(0)	(0)	(0)	(0)	(0)	23 (1)	27 (1)	(0)	2 (1)	(0)	(0)	7,8,9,15, 16,17 (6)	13,28 (2)	24 (1)	17 (1)	16,17 (2)	4,24 (2)	(0)	27 (1)	(0)	(0)	(0)	(0)			24	1.20
森本　亘 （GHGインベントリ2）	現地業務	4		7-14 (8)	29-30 (2)	1-5 (5)	4-9 (6)										23-30 (8)	1-3 (3)												32	1.07
	国内業務	0	25,30 (2)	(0)	20 (1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	12, 15 (2)	1,3,5,6,7, 12 (6)	12-16, 26,27 (7)	10,12 (2)	(0)	(0)	5,6,10 (3)	(0)	(0)	(0)	(0)	(0)	(0)			23	1.15
水野　芳博 （GHG算定・排出削減量1）	現地業務	16		7-16 (10)	4-7,29-30 (6)	1-5 (5)	4-9 (6)		13-19 (7)			19-25 (7)	20-27 (8)		25-30 (6)	1,30,31 (3)	1-4,24-30 (11)	1-3 (3)		22-28 (7)	1-4 (4)	10-15 (6)	11-20 (10)		3-15 (13)	29-31 (3)	1-2 (2)	23-28 (6)			123	4.10
	国内業務	0	25 (1)	23 (1)	20 (1)	15,21 (2)	18 (1)		29 (1)	22 (1)		27 (1)	6 (1)		15 (1)	13 (1)	9,10,11, 14,21 (5)	6-8,12 (4)	10,30,31 (3)	3,10 (2)	30 (1)	7 (1)	10 (1)	9,12,13, 16 (4)	25 (1)	8 (1)	7,22 (2)	17,18 (2)			39	1.95
白川　泰樹 （GHG算定・排出削減量2）	現地業務	15		7-14 (8)	29-30 (2)	1-5 (5)	4-9 (6)		14-19 (6)			19-25 (7)	20-27 (8)		25-30 (6)	1,30,31 (3)	1-4,24-30 (11)	1-2 (2)		22-28 (7)	1-4 (4)	10-15 (6)	14-19 (6)		3-15 (13)	30-31 (2)	1 (1)	23-28 (6)			109	3.63
	国内業務	0	25 (1)	2 (1)	20 (1)	(0)	(0)	19 (1)	8 (1)	1,5 (2)	23 (1)	14 (1)	15 (1)	29 (1)	21 (1)	24 (1)	5,7,9,19 (4)	6 (1)	6 (1)	6,16,20 (3)	21,30, 31 (3)	3,4 (2)	10,12, 23,31 (4)	12,15,16 (3)	25,27 (2)	8 (1)	(0)			37	1.85
吉田　哲也 （GHG算定・排出削減量3）	現地業務	14		7-14 (8)	30 (1)	1-5 (5)	4-8 (5)		13-19 (7)			14-22 (9)	20-27 (8)		25-30 (6)	1,31 (2)	1-4,24-30 (11)	1-2 (2)		22-28 (7)	1-4 (4)	10-15 (6)	14-19 (6)		3-15 (13)			23-28 (6)			106	3.53
	国内業務	0	25 (1)	15 (1)	20 (1)	(0)	(0)	(0)	11 (1)	(0)	(0)	(0)	15 (1)	29 (1)	15,16, 20,21,2 (5)	7, 13, 24 (3)	14,15,16, 18,22 (5)	8,9,16, 20,26 (5)	10,13, 18,30 (4)	1,2,3, 10 (4)	13,17, 30 (3)	(0)	(0)	(0)	(0)	(0)	(0)			35	1.75
九石　太樹 （ワークショップ企画運営/業務調整）	現地業務	16		7-16 (10)	29-30 (2)	1-5 (5)	4-9 (6)		13-19 (7)			13-25 (13)		7-13 (7)	25-30 (6)	1,30,31 (3)	1-5,21-30 (15)	1-3 (3)		26-28 (3)	1-4 (4)	10-15 (6)	14-20 (7)		3-15 (13)	1-5,28-31 (9)	1-2 (2)	22-28 (7)			128	4.27
	国内業務	0	25 (1)	23 (1)	20 (1)	24 (1)	20 (1)	5 (1)	2,25 (2)	20,21 (2)	13,19, 23-27 (7)	28 (1)	7 (1)	16 (1)	15 (1)	13 (1)	9,10,11, 14,18 (5)	6-8,12 (4)	10,11,1 7,19,31 (5)	8,13 (2)	8,10 (2)	19,20,24 (3)	10,22-26 (6)	9,12,19 (3)	25 (1)	8 (1)	22 (1)	10,16 (2)			57	2.85
水野　芳博 （本邦研修）	国内業務	0							25,30 (2)	20,21 (2)	13,19, 23-27 (7)										8 (1)	21,24 (2)	2,8,9 23,25 (6)								20	1.00

現地実績	773	25.77
国内実績	276	13.80
合計		39.57

3.2 研修

3.2.1 本邦研修

表 31 のとおり本邦研修を 2 回実施した。表 32 と表 33 にそれぞれ第 1 回、第 2 回の参加者をまとめた。

表 31 本邦研修の実施概要

	日時	実施場所	参加者数	トピック
第 1 回	2016 年 5 月 22～28 日	東京都、大阪市	13 人	• 東京都の緩和施策 • 大阪市の地球温暖化対策実行計画 • オフィスビルの省エネ対策 • 廃棄物処分施設の見学 • ワークショップ
第 2 回	2017 年 5 月 21～27 日	東京都	10 人	• ホーチミン市の GHG インベントリ作成マニュアルと MRV マニュアル • 東京都の緩和施策 • 東京都の GHG インベントリ • オフィスビルの省エネ対策 • 廃棄物処分施設の見学 • 下水処理施設の見学 • ワークショップ

表 32 第 1 回本邦研修の参加者

氏名	所属
Nguyen Thi Lệ Thái	ホーチミン市人民委員会
Nguyễn Thị Diễm Hương	天然資源環境局
Trần Hồng Lan	天然資源環境局
Phùng Hoàng Vân	天然資源環境局
Lê Thị Thanh Thảo	固形廃棄物処理複合施設管理委員会
Phạm Quốc Huy	交通局
Phan Minh Tuan	商工局
Nguyễn Minh Hoàng	都市環境公社
Ha Le An	公共交通管理運営センター
Nguyễn Tuấn Dũng	電力公社
Nguyen Van Minh	天然資源環境省
Nguyen Thi Thao	商工省
Phung Tien Thanh	交通省

表 33　第 2 回本邦研修の参加者

氏名	所属
Nguyen Tuyet Phuong	天然資源環境局
Nguyen Huy Phuong	天然資源環境局
Chau Truc Phuong	天然資源環境局
Nguyen Viet Vu	天然資源環境局
Trinh Quoc Binh	商工局
Nguyen Thi Phuong Thao	農業農村開発局
Vo Thi Lam	畜産農家の競争力強化・安全性向上プロジェクト事務局
Phan Anh Tuan	洪水対策センター
Ha Quoc Linh	都市土木建設投資管理局
Huynh Van Hung	統計局

3.2.2　気候変動緩和総合研修

表 34 のとおり気候変動緩和総合研修を 2 回実施した。表 35 と表 36 にそれぞれ第 1 回、第 2 回の参加者をまとめた。

表 34　気候変動緩和総合研修の実施概要

	日時	実施場所	参加者数	トピック
第 1 回	2016 年 11 月 25 日、28～30 日	ホーチミン市	90 人	• 気候変動問題の概要 • 国及び都市レベルでの GHG 排出 • 気候変動緩和策 • 気候変動緩和策の立案と MRV
第 2 回	2017 年 7 月 5～7 日	ホーチミン市	68 人	• 気候変動問題の概要と国際社会の対応 • 国及び都市レベルでの GHG 排出 • 気候変動緩和策 • 気候変動緩和策の立案と MRV • ホーチミンでの MRV の計画と実施

表 35　第 1 回気候変動緩和総合研修の参加者

氏名	所属
Huỳnh Quốc Toàn	天然資源環境局
Nguyễn Thị Phương Thảo	天然資源環境局
Võ Thị Làm	天然資源環境局
Đỗ Thị Bưởi	建設局

氏名	所属
Phan Minh Tuấn	商工局
Vũ Thùy Linh	天然資源環境局
Phạm Thị Nguyệt Thanh	天然資源環境局
Hà Minh Châu	天然資源環境局
Lê Nguyễn Quế Hương	天然資源環境局
Nguyễn Huy Phương	天然資源環境局
Cao Hoàn Thanh Trúc	天然資源環境局
Nguyễn Thị Kim Liên	天然資源環境局
Trần Hồng Lan	天然資源環境局
Hồ Thị Kim Thi	天然資源環境局
Phạm Thị Kim Ngân	天然資源環境局
Đỗ Thi Hoàng Oanh	天然資源環境局
Nguyễn Ngọc Nguyễn	天然資源環境局
Huỳnh Lê Khoa	天然資源環境局
Hứa Huỳnh Khoa	天然資源環境局
Nguyễn Thị Lợi	計画建築局
Nguyễn Thị Thanh Vân	計画建築局
Trương Cẩm Tú	計画建築局
Lê Thị Thanh Thảo	科学技術局
Huỳnh Lưu Trùng Phùng	電力公社
Đoàn Phạm Tuấn Khanh	電力公社
Phung Hoang Van	電力公社
Nguyễn Thị Cẩm Vân	ホーチミン市開発科学研究所
Trần Nhật Nguyên	ホーチミン市開発科学研究所
Trịnh Thị Minh Châu	ホーチミン市開発科学研究所
Lê Đình Trung	ホーチミン市公安委員会
Nguyễn Thế Vinh	ホーチミン市公安委員会
Huỳnh Hoàng Linh	ホーチミン市公安委員会
Đặng Thị Hồng Phượng	都市環境公社
Nguyễn Ngọc Huy	都市環境公社
Hà Lê Ân	公共交通管理運営センター
Đồng Thị Hoài Phương	公共交通管理運営センター
Trương Thị Kim Phương	ホーチミン市都市排水公社
Võ Thanh Thủy	産業および輸出加工区当局
Nguyễn Thị Ngọc Mai	産業および輸出加工区当局
Nguyễn Quốc Bảo	産業および輸出加工区当局
Phạm Thị Ngọc Mai	産業および輸出加工区当局
Lê Nguyễn Hồng Ân	ビンタン区人民委員会
Phan Thanh Phong	ビンタン区人民委員会
Đào Thúy Vân	ビンタイン区人民委員会

氏名	所属
Phạm Thanh Tâm	第 1 区人民委員会
Nguyễn Lê Thiên Thanh	第 1 区人民委員会
Nguyễn Thị Kim Cúc	第 10 区人民委員会
Nguyễn Phan Bích Thủy	第 4 区人民委員会
Nguyễn Thị Kim Chi	第 4 区人民委員会
Thái Thủy Tú	第 6 区人民委員会
Hồ Nguyễn Anh Thư	第 6 区人民委員会
Lê Thu Cúc	第 7 区人民委員会
Tôn Nữ Phương Anh	第 7 区人民委員会
Nguyễn Hữu Phú	第 8 区人民委員会
Nguyễn Huỳnh Khải Huấn	第 8 区人民委員会
Võ Thị Như Quỳnh	第 9 区人民委員会
Phạm Thanh Phước	第 9 区人民委員会
Lã Minh Phượng	ゴーバップ区人民委員会
Lê Thanh Tú	ゴーバップ区人民委員会
Phạm Ngọc Hiệu	ホックモン区人民委員会
Lê Nguyễn Ngọc Tài	ニャベ区人民委員会
Tạ Công Tường Huy	ニャベ区人民委員会
Dương Thị Hồng Ngọc	フニュアン区人民委員会
Nguyễn Huỳnh Nhật Tân	フニュアン区人民委員会
Trần Hữu Thức	タンビン区人民委員会
Nguyễn Mai Thanh Tùng	タンビン区人民委員会
Nguyễn Khoa	タンフ区人民委員会
Huỳnh Vũ Thành Thi	ツゥドック区人民委員会
Nguyễn Thị Thanh Loan	ツゥドック区人民委員会
Nguyễn Thị Ngọc Thảo	サイゴン大学
Nguyễn Huy Hoàng Phi	サイゴン大学
Vũ Thụy Hà Anh	サイゴン大学
Phạm Bá Thủy	サイゴン水公社
Trần Đình Hòa	サイゴン水公社
Trần Nguyễn Minh Châu	サイゴン水公社
Võ Xuân Khanh	サイゴン水公社
Ngô Kim Hùng	サイゴン公共照明公社
Nguyễn Văn Hợp	サイゴン公共照明公社
Đặng Thị Thùy Trang	サイゴン交通技術公社
Nguyễn Hải Đảo	サイゴン交通技術公社
Hà Thanh Tuấn	洪水対策センター
Phạm Thị Minh Hiền	洪水対策センター
Hà Thanh Tuấn	洪水対策センター
Lê Hữu Quỳnh Anh	天然資源環境大学

氏名	所属
Nguyễn Kim Thiện	都市土木建設投資管理局
Trần Quân	都市土木建設投資管理局
Nguyễn Thanh Nghị	都市土木建設投資管理局
Huỳnh Tấn Lợi	バンラン大学
Lê Thị Kim Oanh	バンラン大学
Ngô Tiến Dũng	ビンディエンホールセールマネジメントアンドトレーディング

表 36　第 2 回気候変動緩和総合研修の参加者

氏名	所属
Vũ Thị Hoài Nhơn	都市環境公社
Lê Thị Thủy Tiên	都市環境公社
Nguyễn Minh Lý	農業農村開発局
Huỳnh Quốc Toàn	農業農村開発局
Phạm Tấn Thịnh	建設局
Nguyễn Hoàng Xuân Mai	建設局
Lương Xuân Nhung	商工局
Lý Thế Bảo	商工局
Trần Hồng Lan	天然資源環境局
Phạm Thị Kim Ngân	天然資源環境局
Hồ Thị Kim Thi	天然資源環境局
Huỳnh Lê Khoa	天然資源環境局
Châu Trúc Phương	天然資源環境局
Nguyễn Ngọc Nguyễn	天然資源環境局
Cao Lê Uyên Phương	天然資源環境局
Lưu Thị Giang	天然資源環境局
Vũ Thị Đăng Khoa	天然資源環境局
Bùi Hải Thiên Vũ	天然資源環境局
Hà Hương Liên	天然資源環境局
Nguyễn Khánh Tuyên	天然資源環境局
Nguyễn Thị Ý Nhi	天然資源環境局
Phạm Đại Nghĩa	天然資源環境局
Nguyễn Thị Liên	天然資源環境局
Hoàng Phương Lâm	天然資源環境局
Trần Thanh Sơn	天然資源環境局
Lê　Trung Nghĩa	天然資源環境局
Phạm Thị Nguyệt Thanh	天然資源環境局
Vũ Thùy Linh	天然資源環境局
Dương Thị Kiều Trang	計画建設局

氏名	所属
Hoàng Trung Hải	電力公社
Nguyễn Quốc Bảo	産業および輸出加工区当局
Nguyễn Hiếu Dân	産業および輸出加工区当局
Võ Thị Làm	畜産農家の競争力強化・安全性向上プロジェクト事務局
Hà Lê Ân	公共交通管理運営センター
Cao Trung Tín	公共交通管理運営センター
Nguyễn Tấn Đức	公共交通管理運営センター
Ngô Kim Hùng	サイゴン公共照明公社
Đặng Tấn Sơn	サイゴン公共照明公社
Võ Trần Phương	サイゴン公共照明公社
Nguyễn Đức Ban	洪水対策センター
Phan Phạm Thanh Trang	洪水対策センター
Nguyễn Việt Hưng	洪水対策センター
Nguyễn Thanh Nghị	都市土木建設投資管理局
Đoàn Ngọc Khánh Linh	科学大学
Hoàng Thị Thúy Phương	観光局
Phạm Dương Tùng	観光局
Lưu Nguyễn Bảo Uyên	技術大学
Nguyễn Ngọc Phước Đại	研究開発局
Nguyễn Dương Minh Hoàng	研究開発局
Nguyễn Thị Ngọc Thảo	サイゴン大学
Nguyễn Huy Hoàng Phi	サイゴン大学
Lâm Thị Hồng Thanh	サイゴン大学
Nguyễn Lê Nhi	サイゴン大学
Nguyễn Thị Tâm Lăng	サイゴンハイテクパーク
Nguyễn Thị Tú Quyên	サイゴンハイテクパーク
Lê Hoàng Bảo Trân	サイゴンハイテクパーク
Võ Mỹ Y	サイゴンハイテクパーク
Huỳnh Minh Hòa	サイゴンバス
Đinh Thị Nga	天然資源環境大学
Hoàng Thị Kiều Diễm	天然資源環境大学
Dương Phạm Hùng	バンラン大学
Hà Hoàng Hiếu	ビンドゥン大学
Vũ Mạnh Quyền	不明
Huỳnh Thị Thùy Dương	ホーチミン市警察
Lê ĐìnhTrung	ホーチミン市警察
Huỳnh Văn Hùng	ホーチミン市統計局
Lê Minh Hùng	ホーチミン市統計局
Đỗ Huy Lượng	保健局

3.3 一般業務費

合計 10,369,868 円を支出した。その内訳は表 37 のとおりである。

表 37 一般業務費支出内訳

費目	金額（円）
一般傭人費	0
特殊傭人費	1,715,131
車両関連費	469,225
賃料借料	7,598,888
施設・機材保守管理費	0
消耗品費	3,847
旅費・交通費	133,810
通信・運搬費	150,552
資料等作成費	298,415
水道光熱費	0
雑費	0
合計	10,369,868

3.4 再委託

3 件、合計金額 150,701.10 USD の再委託を行った。その内容は表 38 のとおりである。

表 38 再委託一覧

区分	業者名	履行期間	業務の概要
1	RCEE-NIRAS Joint Stock Company	2015 年 11 月 25 日 ～ 2016 年 12 月 30 日	ベトナム都市の NAMA/MRV の課題に関する調査、GHG インベントリ作成に必要なデータの収集、エネルギー・交通・廃棄物分野の NAMA に関係する各種文書の収集・分析、同分野の NAMA の GHG 排出削減量定量化に必要なデータの収集、同分野の NAMA の MRV 試行支援、セミナーの開催支援、通訳、翻訳、日程調整などのロジ業務など
2	RCEE-NIRAS Joint Stock Company	2016 年 11 月 25 日 ～ 2017 年 9 月 8 日	越語 GHG インベントリの作成、GHG インベントリに関する研修の開催支援、GHG インベントリ作成マニュアルの作成支援、エネルギー・交通・廃棄物分野の NAMA の MRV 試行支援、MRV マニュアルやセミナー資料の作成支援、通訳、翻訳など
3	Tran Thanh Tu と Phan Thu Nga（個人 2 人）	2017 年 4 月 3 日 ～ 2017 年 10 月 31 日	GHG インベントリと MRV に関する規則について人民委員会で審議するプロセスの提案、ホーチミン市関係機関に MRV 実施を促すための仕組みの提案、ホーチミン市の GHG 排出削減ポテンシャルの推計、GHG インベントリと MRV に関する規則の草案作成など

4. 提言と教訓

4.1 提言

4.1.1 GHG インベントリ

(1) ホーチミン市への提言

1) ホーチミン市の 2014 年と 2015 年の GHG インベントリを GHG インベントリ作成マニュアル、2013 年の GHG インベントリ、GHG インベントリ作成研修の成果を活用して完成させるべきである。そうすることにより、本プロジェクトで得られた知識や技術を復習し、GHG インベントリ作成能力の向上を図れる。データ提供機関から入手した 2014 年と 2015 年のデータは、既に GHG インベントリ計算ファイルに入力されている。
2) GHG インベントリ作成マニュアルの規定に従い、ホーチミン市の GHG インベントリは 2016 年以降、偶数年について作成していくべきである。
3) ホーチミン市の燃料消費量に関する情報は十分でないため、市内の LPG、天然ガス、石炭などの消費量について、情報収集を進めるべきである。
4) 廃棄物セクターのインベントリを改善するために、ホーチミン市の都市固形廃棄物の発生量、取扱量、リサイクル量、野焼き量を把握すべきである。
5) 廃棄物セクターのインベントリを改善するために、ホーチミン市の産業廃棄物の発生量、取扱量、処理量、リサイクル量を把握すべきである。
6) 廃棄物セクターのインベントリを改善するために、ホーチミン市の廃棄物処理場等で回収されている CH_4 の量を把握すべきである。
7) 継続的な GHG インベントリの作成を通じた経験やノウハウを元にして、GHG インベントリ作成マニュアルを継続的に改訂し改善していくべきである。
8) C40 の報告様式を満たすためには、ホーチミン市の人口、エリア情報、暖房日数、冷房日数などといった基礎的情報が必要である。
9) C40 の報告様式では、GHG インベントリ作成マニュアルを参考にして、すべてのサブセクターで、具体的なデータだけでなくデータ源や表記キーを記載する必要がある。
10) DOIT は、セクター別燃料種別の情報であるエネルギー強度調査の情報を毎年、提供すべきである。石炭の消費量について、報告しているのは一事業所のみで、記載ミスの可能性がある。2013 年の GHG インベントリにはそのデータを使うことができなかった。正しいデータが報告されているか、事業者への確認と経年的な報告データのチェックにより確認すべきである。
11) エネルギー強度調査には、一部定義が不明確な燃料種がある。例えば、エネルギー強度調査の燃料種には CNG があることから、Gas という区分をバイオガスと見なしている。エネルギー強度調査の燃料種ごとの定義を明確にする必要がある。

(2) MONRE への提言

1) 固定エネルギーと交通セクターの GHG インベントリを改善するために、MONRE は商工省（MOIT）に対してベトナムの国家エネルギー統計を作成するよう要請すべきである。
2) 固定エネルギーの GHG インベントリを改善するために、気候変動局（DCC）は、CO_2 のみならず、CH_4 と N_2O の電力排出係数も整備すべきである。

(3) JICA への提言

1) ホーチミン市は今後、GHG インベントリを 2 年に 1 回作成する。CCB をはじめとする DONRE 職員は、研修等でひととおり作成手順を学んだが、自力でインベントリを完成させた経験はない。CCB は引き続き、品質管理やレビューについて指導や支援が必要としている。C40 との協力も含めて支援策を検討し、実施することが望まれる。
2) GHG インベントリ作成の継続的実施と改善のための協力が必要である。例えば、新たな発生源を把握した場合に GHG インベントリにどのように反映させるべきか、石炭や薪の消費、工業プロセス及び製品使用、産業廃棄物の埋め立て処分などに関する情報が新たに得られた場合の GHG インベントリ計算ファイルの更新などについて、支援が必要と考えられる。ホーチミン市が GHG インベントリの改善計画をインベントリ作成の都度自ら立案し、実行できるようになる協力も必要である。

4.1.2 MRV

(1) ホーチミン市への提言

1) 持続可能な MRV 体制を確立するために、今後も MRV の試行を継続・拡大していくべきである。本プロジェクトでは十分な時間を確保できなかったため、MRV 体制の制度化には至っていない。MRV を制度化して全市で実施する前に、DONRE や関係機関は対象とする緩和策の選定、方法論の特定、マニュアルに則した MRV の実施などについて、さらに経験を積む必要がある。MRV 試行の継続・拡大を通じて、MRV マニュアル記載のフレームワークや手順の妥当性を検証し、実態に合っていない場合はマニュアルを改善していく必要もある。
2) MRV の実施は、関係者にとって新たな負担となる可能性が高く、簡単には受け入れられないかもしれない。関係者が MRV を実施するよう人民委員会の決定（Decision）等により MRV を制度化する必要がある。
3) MRV 実施が過度な負担とならないように、MRV にはモニタリングや報告に関する既存の体制や手順をできる限り活用すべきである。
4) MRV 実施に必要な予算確保と人材育成を行わなければならない。DONRE は計画投資局（DPI）や財務局（DOF）に対し、国内外の気候変動に関する動向、MRV 試行の結果、MRV マニュアルなどを用い、MRV 実施の重要性を説明すべきである。そして、MRV 実施に必要となる予算や人材の割当を要求するべきである。
5) MRV 実施の初期段階では、国内外の専門家（CDM や JCM、GHG 排出削減プロジェクトに関

する専門家）に排出削減量の計算やモニタリングを左右する方法論の特定をはじめとした専門性を必要とする部分に関して支援を求めるべきである。

6) DONRE は気候変動緩和策、MRV と MRV マニュアルに関するトレーニングコースを定期的に開催し、MRV に対する理解を促進して積極的な MRV 実施を促すべきである。
7) MRV 試行を通じて得られた経験や教訓を国家 MRV の検討を行っている MONRE や他の省庁とも共有し、現実的かつ実践的な国家 MRV 体制が構築されるよう協力すべきである。
8) ベトナム国内外の他都市とも都市レベルでの MRV に関する経験や仕組みを共有し、地域レベルで気候変動緩和に関するグッドプラクティスが促進されるよう貢献すべきである。

(2) MONRE への提言

1) 国家 MRV 体制に関する法的枠組みを確立し、ホーチミン市やベトナム国内の他都市が地域レベルの MRV の制度化に取り組めるようにすべきである。
2) ホーチミン市での MRV 試行を通じて得られた教訓や課題、作成された MRV マニュアルの内容を国家 MRV フレームワークの確立に活かすべきである。
3) 国が考える GHG 排出削減量の算定、モニタリングと報告活動に関する原則を示し、都市レベルでの MRV 実施についての疑問が生じないようすべきである。

(3) JICA への提言

上記ホーチミン市への提言のうち、1)、5)、6)など特に実行に専門性が必要なものについて、支援を検討するべきである。CCB は、MRV マニュアルに従って MRV を継続・拡大したいが、体制を確立して自律的に実施できるようになるには試行錯誤が必要で、それに対して引き続き JICA の支援が欲しいと考えている。

4.1.3 共通

2017 年 10 月 26 日に開催した最終セミナーにて、CCB はプロジェクト成果の活用方針と今後の計画について発表した。2017 年内に GHG インベントリと MRV に関するマニュアルをホーチミン市の公式文書として採択することや 2018 年以降の活動計画を示した。その内容は表 39 に要約できる。この内容は、これまでのプロジェクト活動を踏まえたもので、ホーチミン市の気候変動緩和の取り組みを促進するものであり、プロジェクト成果の持続性向上にもつながる。

発表では、今後も JICA、C40、東京都、大阪市などとの協力継続への期待も表明された。JICA は MONRE とともに、これらの機関や他ドナーとも調整・連携し、ホーチミン市の活動計画の展開を支援する方向で検討を進めるべきである。

表 39　ホーチミン市の今後の計画

区分	GHG インベントリ		MRV	
	活動	主体	活動	主体
2018	2016 年の GHG インベントリの作成	DONRE	MRV を試行する緩和策の選定	MRV 関係主要機関
	GHG インベントリに関する規定を草案するための計画の策定・承認	DONRE	MRV に関する規定を草案するための計画の策定・承認	DONRE
2019	GHG インベントリ作成プロセス・手法を改善するための 2016 年の GHG インベントリの評価	DONRE	選定した緩和策の MRV 試行	緩和策実施機関
	GHG インベントリに関する規定の草案	DONRE 司法局	MRV に関する規定の草案	DONRE 司法局
2020	2018 年の GHG インベントリの作成	DONRE	MRV 試行の継続	MRV 関係主要機関
	GHG インベントリに関する規定の決定・公布	人民委員会	MRV に関する規定の決定・公布	人民委員会
2020 - 2030	規定に基づく 2 年ごとの GHG インベントリの作成	DONRE	規定に基づく MRV の実施	MRV 関係主要機関

出典　最終セミナーの発表資料

4.2　教訓

(1) GHG インベントリ作成体制の構築

GHG インベントリを作成するためには多くの機関の協力が必要である。本プロジェクトでは、2 回のコンサルテーション会合と CCSB の事務レベル会合などを経て、データ提供機関、使用するデータ、関係機関の役割、インベントリ作成スケジュールなどが決まった。

データ提供機関は、元々DONRE への報告義務がない、GHG インベントリのためにデータを収集しているわけでない、提供したデータで作成した GHG インベントリの品質管理について貢献できる立場にないことなどから、CCB と専門家で提案したデータの品質管理を含む役割分担に関して、すぐには合意を形成することができなかった。こうしたなか、関係者が一堂に会するコンサルテーション会合などで、意見を共有して協議したことで相互理解が進んだ。新たに GHG インベントリ作成体制を整備するとき、GHG インベントリ改善の一環でデータ提供機関を追加するときなどは、こうした手法で協力体制を構築していくのがよい。

(2) GHG インベントリの品質管理

GHG インベントリは、品質管理や品質保証の観点から、誰が計算しても同じ結果になるように、

計算プロセスから特別な設定やブラックボックスを排除すべきである。そのため、本プロジェクトでは、ベトナムの国家インベントリと同じように、表計算ソフト Excel を使用してホーチミン市の GHG インベントリを作成した。毎年収集すべきデータ、事前に設定するパラメータや排出係数に分けて、データを入力するワークシートを作成した。データを入力すると、GHG 排出・吸収量算定の基本データである活動量が計算され、GHG 排出・吸収量が計算される構造にした。GHG インベントリ作成研修などで、この方法は分かりやすく効果的であることを確認した。GHG インベントリを作成する場合は、今後もこうしたアプローチを採用すべきである。

(3) 持続可能な MRV

交通関連プロジェクトの MRV には、車両の燃費や走行距離のデータが重要である。ホーチミン市の運行統計では、公共バスなどの燃費については市が定める規則に従い、走行距離に応じて一定量の燃料を供給するシステム（例えば 100km あたり 40 リットル）を採用しているため、実走行燃費を知ることが難しい。走行距離については、オドメーターを読んで実走行距離を記録することは行わず、走行ルートの距離にトリップ数を乗じて総走行距離を算定し、報告している。

MRV 試行では、これらの既存の報告システムを有効に活用し、事業者の負担を増やさないモニタリング方法をベースに排出削減量の算定等を行った。こうした方法は、事業者の手間を減らしコスト面からも有利なので MRV の持続性確保に効果的である。しかし、CDM や JCM などの方法論による実走行燃費あるいは実走行距離をベースとした手法と異なるため、これから決まるベトナムの国の MRV 規定にそぐわない可能性もある。MRV の持続性を担保するには既存システムの活用が有効であるが、MRV の規定内容によってはそうした方法を採用できない場面も出てくるので、注意が必要である。

(4) MRV 推進と部局間の連携

MRV 実施には、DONRE（CCB）の管轄の下、各施策の実施機関がモニタリングを行い、セクター監督機関等を通じて DONRE（CCB）に報告するなど、部門横断的な取り組みが不可欠である。

本プロジェクト開始当初は MRV の実施に関して DONRE（CCB）と関係部局間で十分連携できていなかった。実施機関や監督機関等と GHG 排出削減量の算定方法やモニタリング等の協議や勉強会を行う際に CCB 職員にも可能な限り同席を求めるなど、専門家チームは部局間で緊密な連携を図るよう働きかけた。この結果、MRV 試行がスムーズに実施でき、より実務的な MRV 体制や手順が構築された。部門横断的な取り組みを強化するためには、庁内ワーキンググループ等の公式な組織だけでなく、MRV に関連する日常的な打合せ等でも関係部局が連携することが重要である。

(5) MRV の動機付け

MRV 試行案件の実施機関などの MRV に関する理解を深めるために、監督部局も招いて勉強会を複数回開催した。勉強会で、MRV の基本的事項や手順、GHG 排出削減量の算定方法、作成し

た算定ツールを用いた計算等について、事例を用いて説明した結果、関係者の MRV への意識の向上がみられ、自律的に取り組んでいこうとする姿勢が見られた。MRV 実施を促すためには、排出削減量算定のロジックや削減量算出など、一般にはなじみの薄いことについて、おもしろいと関心を持ってもらうなど、MRV に関する理解を深めることが重要である。

(6) 本邦研修による関係構築

本邦研修が、関係機関のプロジェクトに対する認知度向上と C/P・CCB との関係構築に大きく寄与した。

研修には CCB のほかに、GHG インベントリ関係のデータ収集活動や MRV 試行に関係する機関など、プロジェクトに密接に関わる機関も参加するようにした。研修プログラムには見学や演習を取り入れ、参加者同士が議論する機会を意図的に設けた。これにより、CCB 職員は他機関の様々な職位の参加者と関係を構築できた。局長級、部長級の職員とも関係を構築できた。専門家にとっても CCB 以外の機関と関係を深めるよいきっかけとなった。

研修実施後、参加者は所属機関の窓口となって CCB や専門家とコミュニケーションするようになるなど、プロジェクトへの協力体制が強化された。研修参加者を介して関係機関の協力を要請することで、以前より活動がスムーズに行えるようになった。

気候変動対策のように組織横断的な協力が必要な課題に取り組む時や、今回のように多くの機関が関係するプロジェクトでは、本邦研修をうまく活用して関係構築を図るとよい。

(7) プロジェクトデザインの変更

本プロジェクトは MONRE を C/P 機関として 2015 年 1 月に開始した。ホーチミン市は後からパイロット都市に選定され、同市での活動は 2015 年 10 月に始まった。本業務はこれに合わせて開始され、ホーチミン市に専門家チームが派遣されるようになった。

ところが、活動開始当初は、ホーチミン市での活動はプロジェクト全体のなかで明確に位置づけられていなかったこと、同市に対して JICA の協力に関して十分な事前説明がなかったことなどから、関係者のプロジェクトへの理解は進まず、活動が遅れた。このため、CCB、MONRE、長期専門家と協議し、プロジェクト・デザイン・マトリクス（PDM）にホーチミン市をパイロット都市として明記することにした。合わせて、活動項目と指標をより妥当なものになるよう整理した。修正版 PDM は 2016 年 6 月の JCC にて承認された。

これに加えて、2016 年 9 月に実施された JICA 運営指導調査にて、プロジェクト全体の目的・目標とホーチミン市での活動の位置づけなどについて、関係者が一堂に会して協議した。協議への関係者の積極的な参加と、調査団の分析・指導により関係者の認識共有が進んだ。MONRE がホーチミン市での活動に期待することや具体的な課題がより明確になった。

本プロジェクトのように、詳細計画策定時から状況が変化し、実施機関が当初よりも増え、主たる活動場所が複数に分かれ、多くの関係者が関わるプロジェクトの場合は、このように PDM などの当初の計画を適切なタイミングで見直すこと、運営指導調査のような現地でのプロジェクト実施に関与しない第三者による分析・指導を行うことは、プロジェクトの円滑な実施に寄与する重要な取り組みである。

(8) 成果のオーナシップ

当初こそ活動に遅れが生じたが、後にプロジェクトは順調に成果を産出し、最終セミナーでの発表に見られるように、C/P によるプロジェクト成果に対する非常に強いオーナシップが発現した。

CCB を含むホーチミン市は、行政機関として自らが果たすべき役割や取り組むべき政策課題とプロジェクトに期待できることを精査し、プロジェクトの成果を一過性で終わらせることなく、継続する行政活動に如何に取り込むべきか検討した。例えば、GHG インベントリについて、後々に結果を公表することや施策立案に使うことを想定してデータ収集方法を検討し、データを事務連絡や職員の個人的つながりなどを利用してアドホックに収集するのではなく、人民委員会からの指示で関係機関に提出させることにした。GHG インベントリ作成マニュアルと MRV マニュアルについて、単なるプロジェクト成果品で終わらせるのではなく、ホーチミン市の公式文書として人民委員会に採用させる方針を定めるなどした。

C/P 機関は、プロジェクトの成果を十分に活用し、持続させられるよう必要な内部手続きを踏んでいる。こうしたプロセスに時間を要したことが当初、活動の遅れにつながったことは否めないが、その反面、C/P のプロジェクト成果に対するオーナシップ発現に大きく寄与している。時間が有限のプロジェクトでは大幅な遅れは問題となるが、成果の持続性を考えた場合、C/P 機関内部での検討・意思決定プロセスを尊重する重要性については言うまでもない。

専門家チームは、こまめに CCB らの希望や課題を聞き取り、活動計画や成果品などの案を具体的に示して密に協議した。十分な時間的猶予を持って案を示し、ホーチミン市内部での議論も促した。C/P 機関内部での検討・意思決定プロセスを尊重したのである。こうしたスタンスは、C/P のオーナシップ向上、C/P と専門家チームとの信頼関係構築に重要である。

付属資料

資料１
MRV 試行のまとめ

Annex The result of GHG emission reduction calculations, the result of monitoring activities

1. Replacement of Existing Street Lamp with LED
2. Introduction of Solar PV system
3. Introduction of CNG buses
4. BRT Line 1 project
5. MRT Line 1 project
6. Electricity Generation at Go Cat Landfill
7. Animal Manure Collection and Biogas Recovery at Small Farms

<Energy Sector>

Project name: Replacement of Existing Street Lamp with LED

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

Electricity consumption of LED is less than CFL. Replacing CFL with LED results in reduction of electricity consumption. That results in CO_2 emission reductions.

2) Methodology to calculate GHG emission reduction

A simple methodology was applied for this project as below, based on a basic emission calculation formula provided in the approved CDM methodology, "AMS-II.L, Demand-side activities for efficient outdoor and street lighting technologies."

$$\boldsymbol{ER_y = BE_y - PE_y}$$

$$\boldsymbol{BE_y = \sum_i (R_{BL,i} \times Q_{BL,i,y} \times O_{BL,i,y}) \times EF_{grid}}$$

BE_y	Baseline emissions in year *y* (tCO_2/year)
$R_{BL,i}$	Rated power of the CFL of the group of i lighting devices (kW)
$Q_{BL,I,y}$	Quantity of CFL used in the site (units)
$O_{BL,I,y}$	Annual operating hours for the CFL in year y
EF_{grid}	Emission Factor of the grid (tCO_2/kWh)

$$\boldsymbol{PE_y = \sum_i (R_{PJ,i} \times Q_{PJ,i,y} \times O_{PJ,i,y}) \times EF_{grid}}$$

PE_y	Baseline emissions in year *y* (tCO_2/year)
$R_{PJ,i}$	Rated power of the LED of the group of i lighting devices (kW)
$Q_{PJ,I,y}$	Quantity of LED distributed and installed under the project activity (units)
$O_{PJ,I,y}$	Annual operating hours for the LED in year y
EF_{grid}	Emission Factor of the grid (tCO_2/kWh)

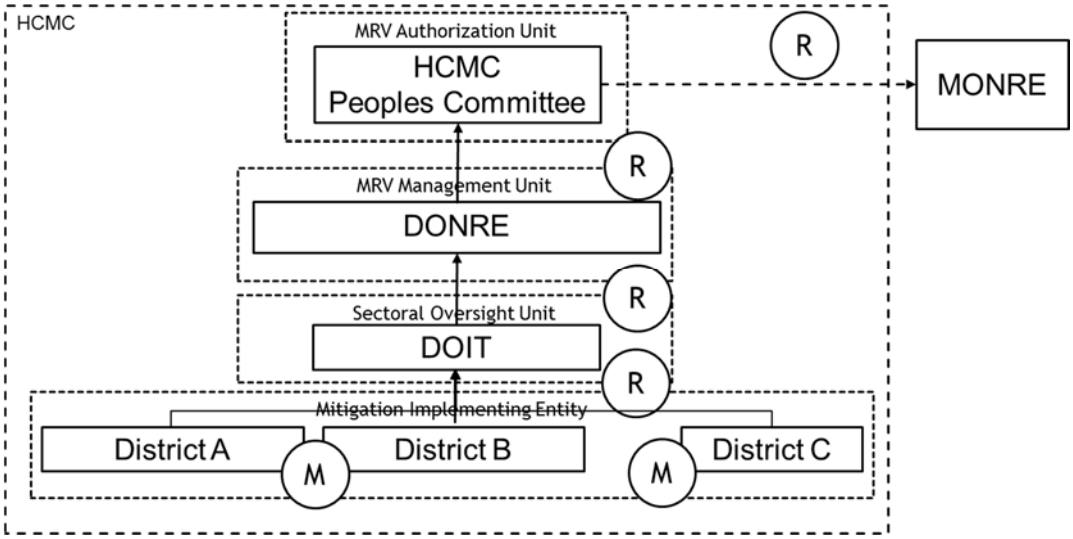
Monitoring Parameter:

EF_{grid}	Emission factor of the grid (tCO_2/kWh)
$Q_{PJ,I,y}$	Quantity of LED distributed and installed under the project activity (units)
$O_{PJ,I,y}$	Annual operating hours for the LED in year y

3) Estimated GHG emission reduction

50 tCO_2/year

4) Organizational structure for monitoring and reporting



5) Monitoring period

from January 1st 2016 until December 31st 2016

6) Monitoring methods

Monitoring parameters

Parameter	Monitoring method	Person/position in charge	Site
$Q_{BL,i}$ Quantity of CFL used in the site (units)	· The staff of the districts counts the quantity of CFL which are used at the site before the project starts.	Staff of the districts	The target small street
$O_{BL,l,y}$ Annual operating hours for CFL in year y (hours)	· A timer is used to count the hours. · The staff of the districts checks and records the setting value before the project starts.	Staff of the districts	Controller of the street lamps
$Q_{PJ,i}$ Quantity of LED distributed and installed under the project activity (units)	· The staff of the districts counts the quantity of installed LED lamps. · These data are recorded for 12 months.	Staff of the districts	The target small street
$O_{PJ,l,y}$ Annual operating hours for the LED in year y (hours)	· A timer is used to count the hours. The staff of the districts checks and records the setting value monthly.	Staff of the districts	Controller of the street lamps
EF_{grid} Emission factor of grid (tCO_2/kWh)	· Default value in official document by the MONRE is applied. · Check updated value every year and apply the latest value where appropriate.	Staff of the districts	N/A

Fixed parameters

Parameter	Source	Value
$R_{BL,i}$ Rated power of the CFL of the group of i lighting devices (W)	This value is provided by the supplier of CFL lamps.	18
$R_{PJ,i}$ Rated power of the LED of the group of i lighting devices (W)	This value is provided by the supplier of LED lamps.	9

(2) Result of monitoring activities

1) Monitoring period

From January 1st 2016 to December 31st 2016 (12 months)

2) Emission reductions of the monitoring period

12 tCO_2/year

3) Processes of the emission reduction calculation

The quantity of LED lamps distributed and installed under the project was counted and recorded monthly. And the setting value for operating hours was checked and recorded monthly.
Grid emission factor of the grid is 0.66 tCO_2/MWh, referred the latest official EF provided by the MONRE in May 2016.

Emission reductions for 12 months are calculated as follows:

$$\boldsymbol{BE_y} = \sum_{\boldsymbol{i}} (\boldsymbol{R_{BL,i,y}} \times \boldsymbol{Q_{BL,i,y}} \times \boldsymbol{O_{BL,i,y}}) \times \boldsymbol{EF_{grid}}$$

$$= \sum_i (18\ (kW) \times 250 \times 4{,}015\ (hous)) \times 0.66\ (\mathrm{tCO2/MWh})$$

$$= 152 \times 0.66\ (\mathrm{tCO2/MWh})$$

= 100 t-CO_2/year

$$\boldsymbol{PE_y} = \sum_{\boldsymbol{i}} (\boldsymbol{R_{PL,i,y}} \times \boldsymbol{Q_{PJ,i,y}} \times \boldsymbol{O_{PJ,i,y}}) \times \boldsymbol{EF_{grid}}$$

$$= \sum_i (9\ (kW) \times 250 \times 4{,}015\ (hous)) \times 0.66\ (\mathrm{tCO2/MWh})$$

$$= 76 \times 0.66\ (\mathrm{tCO2/MWh})$$

= 50 t-CO_2/year

$$\boldsymbol{ER_y} = \boldsymbol{BE_y} - \boldsymbol{PE_y}$$

$$= 100 - 50 = 50\ \mathrm{tCO_2/year}$$

(3) GHG emission reduction calculation sheet

Emission reduction calculation sheet for LED project

Emission Reduction

Description	Parameter	Unit	Emissions
Emission reduction	ER_y	tCO_2/year	**50**
Baseline emission	BE_y	tCO_2/year	100
Project emission	PE_y	tCO_2/year	50

Inputs

Description	Parameter	Unit	value	Data source
Annual operating hours of CFL in the year y	$O_{BL,i,y}$	hours/year	4015	Monitored
Quantity of CFL in year y	$Q_{BL,I,y}$	unit	250	Monitored
Wattage per lamp of CFL category i	$R_{BL,i}$	W	18	Catalog data
Annual operating hours of LED in the year y	$O_{PJ,i,y}$	hours/year	4015	Monitored
Quantity of CFL in year y	$Q_{PJ,I,y}$	unit	250	Monitored
Wattage per lamp of normal lamp category i	$R_{PJ,i}$	W	9	Catalog data
CO2 Emission factor of grid	EF_{grid}	tCO_2/MWh	0.66	

Project name: Introduction of Solar PV system

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

The electricity generated by the solar PV system is used as a substitute for the electricity from the grid. The electricity generated by the solar PV system does not emit any CO_2. On the other hand, thermal power plants connected to the power grid are using fossil fuels and emitting CO_2. Therefore, utilizing the electricity generated by solar PV system results in CO_2 emission reductions.

2) Methodology to calculate GHG emission reduction

A simple methodology was applied for this project as below, based on a basic emission calculation formula provided in the approved CDM methodology, "AMS-I.A: Electricity generation by the user."

$$\boldsymbol{ER_y = BE_y - PE_y}$$

$$\boldsymbol{BE_y = EG_{p,y} \times EF_{grid}}$$

BE_y	Baseline emissions in year *y* (tCO_2/year)
$EG_{p,y}$	Annual generated electricity by solar PV system (kWh)
EF_{grid}	Emission Factor of the grid (tCO_2/kWh)

$$\boldsymbol{PE_y = EG_{p,y} \times EF_{PV}} = 0$$

PE_y	Project emissions in year *y* (tCO_2/year)
$EG_{p,y}$	Annual generated electricity by solar PV system (kWh)
EF_{PV}	Emission Factor of the solar PV system (tCO_2/kWh) = 0

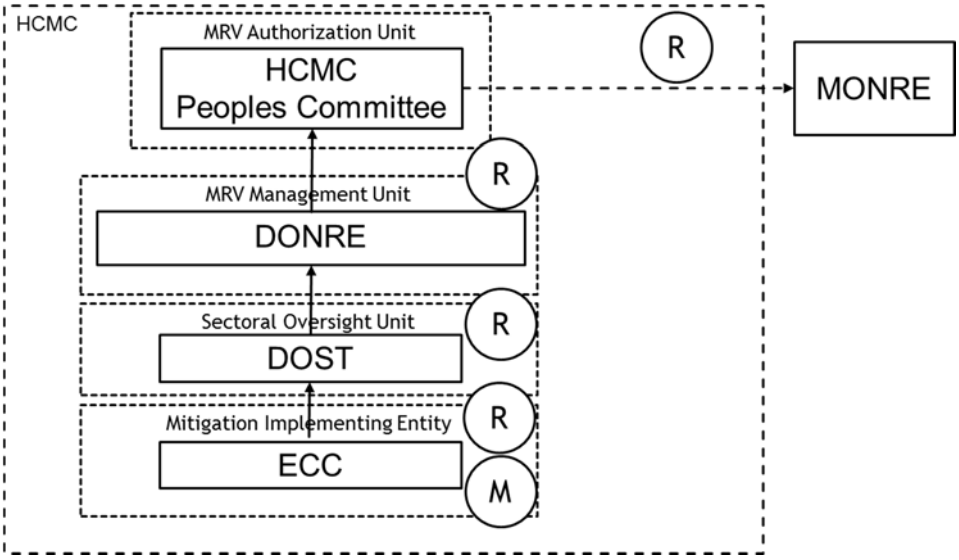
Monitoring parameters are as follows:

EF_{grid}	Emission Factor of the grid (tCO_2/kWh)
$EG_{p,y}$	Annual generated electricity by solar PV system (kWh)

3) Estimated GHG emission reduction

11 tCO_2/year

4) Organizational structure for monitoring and reporting



5) Monitoring period

From January 1st 2016 to December 31st 2016 (12 months)

6) Monitoring methods

Monitoring parameters

Parameter	Monitoring method	Person/position in charge	Site
$EG_{p,y}$ Annual generated electricity by solar PV system (kWh)	· The value of the electric meter is read and recorded monthly. · Recorded data is accumulated for 12 months and used for the GHG emission reduction calculation.	Staff of ECC	DOST's building
EF_{grid} Emission factor of grid (tCO_2/kWh)	· Default value in the official document by the MONRE is applied. · Updated value will be checked every year and the latest value will be applied where appropriate.	Staff of ECC	N/A

(2) Result of monitoring activities

1) Monitoring period

From January 1st 2016 to December 31st 2016 (12 months)

2) Emission reductions of the monitoring period

12 tCO_2/year

3) Processes of the emission reduction calculation

The amount of generated electricity by the solar PV systems was monitored as designated in the MRV Plan. The accumulated electricity generation amount was 20,764.40 (kWh).

Grid emission factor of the grid is 0.66 tCO_2/MWh, referred the latest official EF published by the MONRE in May 2016.

Emission reductions for 12 months are calculated as follows:

$$\boldsymbol{BE_y = EG_{p,y} \times EF_{grid}}$$
$$= 20{,}764.40\ (\text{kWh}) \times 0.66\ (\text{tCO2/MWh})$$
$$= 13.7\ \text{tCO}_2\text{/year}$$

$$\boldsymbol{PE_y = EG_{p,y} \times EF_{PV}}$$
$$= 0\ \text{tCO}_2\text{/year}$$

$$\boldsymbol{ER_y = BE_y - PE_y}$$
$$= 13.7 - 0 = 13.7\ \text{tCO}_2\text{/year}$$

Data for electricity generation provided by ECC

Monitoring period		Monitoring date	Electricity generation indicated by electric meter (kWh)	Accumulated electricity generation amount (kWh)
From	To			
1-Jan-16	31-Jan-16	31-Jan-16	1,810.48	1,810.48
1-Feb-16	29-Feb-16	29-Feb-16	1,812.49	3,622.97
1-Mar-16	31-Mar-16	31-Mar-16	2,016.81	5,639.78
1-Apr-16	30-Apr-16	30-Apr-16	1,821.87	7,461.65
1-May-16	31-May-16	31-May-16	1,757.80	9,219.45
1-Jun-16	30-Jun-16	30-Jun-16	1,512.80	10,732.24
1-Jul-16	31-Jul-16	31-Jul-16	1,786.83	12,519.07
1-Aug-16	31-Aug-16	31-Aug-16	1,701.74	14,220.81
1-Sep-16	30-Sep-16	30-Sep-16	1,570.40	15,791.21
1-Oct-16	31-Oct-16	31-Oct-16	1,621.46	17,412.67
1-Nov-16	30-Nov-16	30-Nov-16	1,887.52	19,300.20
1-Dec-16	31-Dec-16	31-Dec-16	1,464.20	20,764.40

(3) GHG emission reduction calculation sheet

GHG Emission reduction calculation sheet for PV project

Period of monitoring:

Emission Reduction

Description	Parameter	Unit	Emissions
Emission reduction	ER_y	tCO_2/year	**13**
Baseline emission	BE_y	tCO_2/year	13
Project emission	PE_y	tCO_2/year	0

Inputs

Description	Parameter	Unit	Amont of Electric generation	Data source
Amount of electricity generated in the year y	EG_{PJ}	kWh/year	20,764	Measured
CO2 Emission factor of grid	EF_{grid}	tCO_2/MWh	0.66	

<Transport Sector>

Project name: Introduction of CNG buses

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

Main component of CNG is natural gas and it has low carbon content per energy than diesel fuel. Therefore, even though efficiency of the diesel engines is slightly better than that of the CNG engines, CO_2 emission are reduced through replacing diesel buses by CNG buses.

2) Methodology to calculate GHG emission reduction

A simple methodology was developed for this project as below, based on a basic emission calculation formula provided in the IPCC 2006 guidelines.

$$\boldsymbol{BE_y = SFC_{diesel} \times NCV_{diesel} \times EF_{diesel} \times DD_y \times N_{PJ,y}}$$

$$\boldsymbol{PE_y = SFC_{CNG}/CF \times NCV_{CNG} \times EF_{CNG} \times DD_y \times N_{PJ,y}}$$

$$\boldsymbol{ER_y = BE_y - PE_y}$$

BE_y	Baseline emission in year *y* (tCO_2/year)
PE_y	Project emission in year *y* (tCO_2/year)
ER_y	Emission reduction in year *y* (tCO_2/year)

Monitoring Parameters:

DD_y	Annual average distance travelled in year *y* (km/year)
$N_{PJ,y}$	Number of CNG buses in year *y*

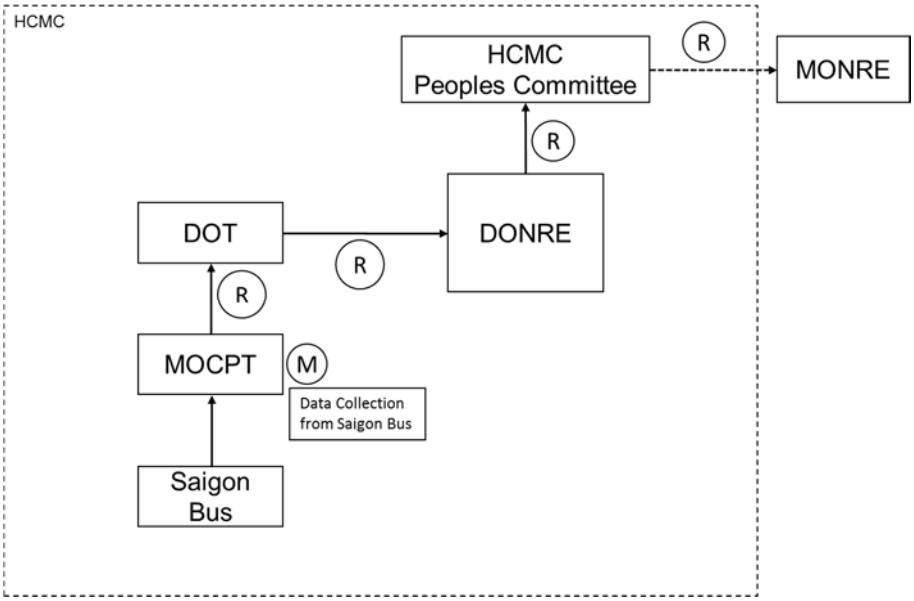
Fixed Parameters:

SFC_{diesel}	Specific fuel consumption of diesel bus (kg/km)
SFC_{CNG}	Specific fuel consumption of CNG bus (kg/km)
NCV_{diesel}	Net calorific value of diesel fuel (MJ/kg)
NCV_{CNG}	Net calorific value of CNG (MJ/kg)
EF_{diesel}	Emission factor of diesel fuel (tCO_2/MJ)
EF_{CNG}	Emission factor of CNG (tCO_2/MJ)
CF	Correction factor for CNG specific fuel consumption

3) Estimated GHG emission reduction

37 tCO_2/year

4) Organizational structure for monitoring and reporting



5) Monitoring period

From August 1st 2016 to December 31st 2016 (The period of the MRV trial)

6) Monitoring methods

Monitoring parameters

Parameter	Monitoring method	Person/position in charge	Site
DD_y Annual average distance travelled in year *y* (km/year)	· The data is provided by SaigonBus. · SaigonBus monitors distances travelled by each bus monthly (This is done as a part of their routine works). · These data are averaged to obtain the monthly average distance of all the buses. · Monthly average distance is calculated for 12 months and sum up these to obtain the annual average distance.	MOCPT receives the data from SaigonBus	N/A
$N_{PJ,y}$ Number of CNG buses in year *y*	· The data is provided by SaigonBus. · SaigonBus checks the number of CNG buses in the bus fleet registry.	MOCPT receives the data from SaigonBus	N/A

Fixed parameter

Parameter	Source	Value
SFC_{diesel} Specific fuel consumption of diesel bus (kg/km)	Determined by SaigonBus.	0.290

SFC_{CNG} Specific fuel consumption of CNG bus (kg/km)	Determined by SaigonBus using the actual driving distance and CNG consumption for all project buses.	0.365
NCV_{diesel} Net calorific value of diesel fuel (MJ/kg)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory"	43.0
NCV_{CNG} Net calorific value of CNG (MJ/kg)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory".	48.0
EF_{diesel} Emission factor of diesel fuel (tCO_2/MJ)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory"	0.0000741
EF_{CNG} Emission factor of CNG (tCO_2/MJ)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory"	0.0000561
CF Correction factor for CNG specific fuel consumption	Factor is set to correct/adjust fuel consumption between different specifications of baseline and project buses: Ratio of vehicle weight of CNG bus (10,780kg) to diesel bus (9,880kg)	1.09

(2) Result of monitoring activities

1) Monitoring period

From August 1st 2016 to December 31st 2016 (the period of the MRV trial)

2) Emission reductions of the monitoring period

10 tCO_2 (for 5 months)

3) Processes of the emission reduction calculation

Annual average distance travelled (DD_y) is 23,225 km for 5 months, determined based on the monitored data of 20 CNG buses from August 2016 to December 2016.

Specific fuel consumption of the diesel bus (SFC_{RF}) is 0.290, determined based on the fuel consumption of B80 diesel buses 34.5 liter/100km and the density of diesel 0.84 kg/liter.

Specific fuel consumption of the CNG bus (SFC_{PJ}) is 0.365, determined based on the monitored data of 20 CNG buses.

Emission reductions for 5 months are calculated as follows:

$$\boldsymbol{BE_y = SFC_{RF} \times NCV_{diesel} \times EF_{diesel} \times DD_y \times N_{PJ,y}}$$
$$= 0.290 \times 43.0 \times 0.0000741 \times 23225 \times 20$$
$$= 429\ \mathrm{tCO_2/year}$$
$$\boldsymbol{PE_y = SFC_{PJ}/CF \times NCV_{CNG} \times EF_{CNG} \times DD_y \times N_{PJ,y}}$$
$$= 0.365/1.09 \times 48.0 \times 0.0000561 \times 23225 \times 20$$
$$= 419\ \mathrm{tCO_2/year}$$
$$\boldsymbol{ER_y = BE_y - PE_y}$$

$= 429 - 419 = 10\ \mathrm{tCO_2/year}$

Data for CNG buses provided by Saigon Bus

August 2016

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)
1	5124.8	2,046.76	11	5103.7	1,924.39
2	5273.2	2,046.96	12	4872.5	2,031.96
3	4932.8	1,899.43	13	5020.9	1,882.21
4	4925.6	2,041.70	14	5314.3	2,126.86
5	4309.7	1,690.80	15	4882.8	1,786.52
6	4915.3	1,867.34	16	4760.8	1,761.72
7	4946.7	1,928.23	17	5079.5	2,152.46
8	5209.8	1,922.84	18	4696.9	1,817.53
9	4974.5	1,993.05	19	5153.7	1,906.62
10	4886.4	1,954.79	20	-	-
Total	49,498	19,391	Total	44,885	17,390

September 2016

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)
1	4851,4	1.792,71	11	5030,6	1.853,31
2	4910,6	1.819,54	12	5023,4	1.976,46
3	5020,3	1.858,79	13	4592,4	1.725,83
4	5454,9	2.123,20	14	4855	1.793,46
5	4679,4	1.684,89	15	4946,7	1.780,63
6	5058,4	1.857,79	16	4812,8	1.722,59
7	5058,4	1.920,28	17	4089,8	1.633,86
8	4964,2	1.771,54	18	4926,1	1.702,20
9	4549,1	1.647,25	19	5044,5	1.740,73
10	1390,4	500,37	20	1046,4	452,02
Total	45,937	16,976	Total	44,367	16,381

October 2016

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)
1	4557,4	1.684,35	11	4476	1.715,92
2	4607,4	1.879,61	12	4820	1.902,06
3	5167,6	1.986,36	13	4599,1	2.010,01
4	4739,7	1.850,54	14	5437,2	1.983,41
5	4838,6	1.775,92	15	4768	1.691,27
6	4795,8	1.844,40	16	4539,9	1.680,74
7	3785,5	1.476,55	17	4178,4	1.673,83
8	4349,3	1.625,09	18	4820	1.741,15
9	4700,5	1.731,80	19	4328,2	1.552,88
10	4543,5	1.762,15	20	5282,9	2.060,70
Total	46,085	17,617	Total	47,249	18,012

November 2016

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)
1	4689,7	1.717,78	11	4542,4	1.710,03
2	4349,3	1.732,40	12	4517,5	1.790,07
3	4556,3	1.725,97	13	4693,3	1.945,26
4	4483,8	1.741,21	14	4592,4	1.697,39
5	4559,9	1.650,96	15	4926,8	1.704,48
6	4448,2	1.669,89	16	3729,9	1.358,46
7	4332,9	1.679,62	17	4524,9	1.808,93
8	4552,7	1.662,96	18	4459,6	1.606,91
9	4489,7	1.633,29	19	4559,9	1.632,87
10	4893,6	1.884,48	20	4870,7	1.859,54
Total	45,356	17,099	Total	45,417	17,114

December 2016

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)
1	4778,3	1.655,87	11	2248,3	839,04
2	4174,8	1.614,95	12	4907,5	1.853,22
3	5044,5	1.853,92	13	4683	1.978,47
4	5237,6	2.008,72	14	4571,3	1.730,52
5	5242,3	1.879,66	15	5016,7	1.745,02
6	5242,5	1.900,76	16	4634,1	1.636,11
7	4718	1.710,06	17	4058,9	1.574,97
8	4809,7	1.658,23	18	5174,8	1.876,49
9	5077	1.819,79	19	5136,7	1.801,54
10	4711,9	1.715,20	20	4907,5	1.819,26
Total	49,036	17,817	Total	45,539	16,855

(3) GHG emission reduction calculation sheet

(Draft) Emission reduction estimation sheet for CNG bus project

Period of monitoring:

Emission Reduction

Description	Parameter	Unit	Value
Emission reduction	ER_y	tCO_2 /year	
Baseline emission	BE_y	tCO_2 /year	
Project emission	PE_y	tCO_2 /year	

Inputs

*Input only orange cell

Description	Parameter	Unit	Value	Data source
Annual average distance travelled in year y (km/year)	DD_y	km/year		Monitored
Number of CNG buses in year y	$N_{PJ,y}$	unit		Monitored
Specific fuel consumption of diesel bus	SFC_{diesel}	kg/km		Monitored
Net calorific value of diesel fuel	NCV_{diesel}	MJ/kg		IPCC2006
Emission factor of diesel fuel	EF_{diesel}	tCO_2 /MJ		IPCC2006
Specific fuel consumption of CNG bus	SFC_{CNG}	kg/km		Estimated
Correction factor for CNG specific fuel consumption	CF	-		
Net calorific value of CNG	NCV_{CNG}	MJ/kg		IPCC2006
Emission factor of CNG	EF_{CNG}	tCO_2 /MJ		IPCC2006

Project name: BRT Line 1 project

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

CO_2 emission is reduced through mode shift of passenger transportation from the existing means of transportation such as private cars and motorcycles to BRT. BRT systems are more efficient than private cars in terms of CO_2 emission per passenger-km.

2) Methodology to calculate GHG emission reduction

A simple methodology was developed for this project as below, by simplifying the CDM methodology "ACM0016 Mass rapid transit projects."

$$\boldsymbol{BE_y = \sum_i \left(PKM_y \times MS_{i,y} \times EF_{PKM,i} \times 10^{-6} \right)}$$

$$\boldsymbol{PKM_y = P_y \times TD_y}$$

$$\boldsymbol{EF_{PKM,i} = \frac{EF_{KM,i}}{OC_i}}$$

$$\boldsymbol{PE_y = FC_y \times NCV_{CNG} \times EF_{CNG}}$$

$$\boldsymbol{ER_y = BE_y - PE_y}$$

BE_y	Baseline emission in year *y* (tCO_2/year)
PE_y	Project emission in year *y* (tCO_2/year)
ER_y	Emission reduction in year *y* (tCO_2/year)

Monitoring Parameters:

PKM_y	Transported volume by BRT in year y (passenger km/year)
P_y	Number of passenger of BRT in year y (passenger/year)
TD_y	Average trip distance of the passenger of BRT in year y (km)
FC_y	CNG consumption by BRT buses in year y (ton/year)
i	1; Passenger car, 2; Bus, 3; Motorcycle, etc.

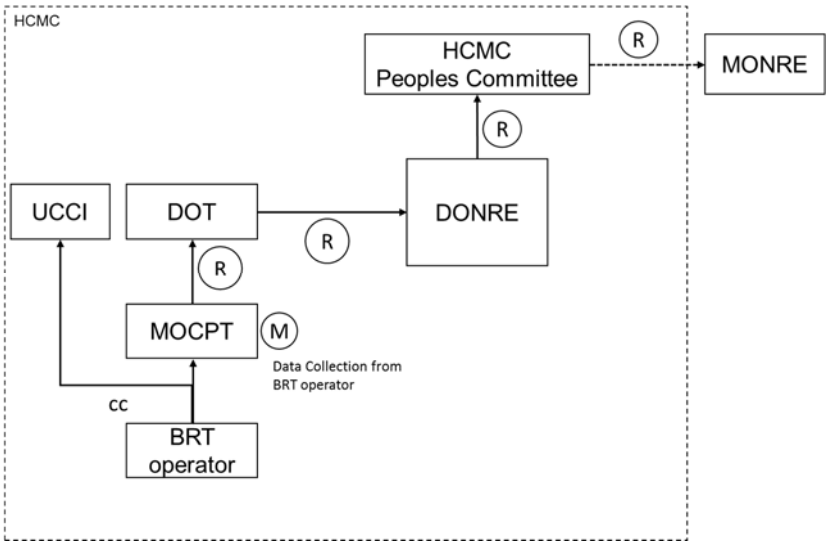
Fixed Parameters:

$MS_{i,y}$	Share of passengers using transport mode i in the baseline in year y
$EF_{PKM,i}$	CO_2 emission factor per passenger kilometer for transport mode i (gCO_2/passenger-km)
$EF_{KM,i}$	CO_2 emission factor of transport mode i (gCO_2/km)
OC_i	Average occupation rate of transport mode i (passenger/vehicle)
NCV_{CNG}	Net calorific value of CNG (MJ/kg)
EF_{CNG}	Emission factor of CNG (tCO_2/MJ)

3) Estimated GHG emission reduction

1,682 tCO_2/year

4) Organizational structure for monitoring and reporting



5) Monitoring period

Starts from January 1st 2021.

6) Monitoring methods

Monitoring parameters

Parameter	Monitoring method	Person/position in charge	Site
PKM_y Transported volume by BRT in year y (passenger km/year)	· The data is provided by the BRT operator. · The operator monitors/analyzes the data daily or monthly through ticketing system such as IC card system (This is done as their routine works). · The daily or monthly data are compiled to obtain the annual transported volume.	MOCPT receives the data from the BRT operator	N/A
P_y Number of passenger of BRT in year y (passenger/year)	· Use this parameter, if PKM_y is not obtained directly · The data is provided by the BRT operator. · The operator monitors/analyzes the data BRT daily or monthly through ticketing system such as IC card system (This is done as their routine works). · The daily or monthly data are summed up to obtain the annual number.	MOCPT receives the data from the BRT operator	N/A
TD_y Average trip distance of the passenger of BRT	· Use this parameter, if PKM_y is not obtained directly. · The data is provided by the BRT operator. · The operator monitors/analyzes the data	MOCPT receives the data from the BRT operator	N/A

in year y (km)	BRT daily or monthly through ticketing system such as IC card system (This is done as their routine works). · The daily or monthly data are averaged to obtain the annual average trip distance.		
FC_y CNG consumption by BRT buses in year y (ton/year)	· The data is provided by the BRT operator. · The operator monitors the consumption through direct measurement (by fuel meter) or invoice from the fuel company monthly. · The monthly data are summed up to obtain the annual consumption.	MOCPT receives the data from the BRT operator	N/A

Fixed parameter

Parameter	Source	Value
$MS_{i,y}$ Share of passengers using transport mode i in the baseline in year y	· Interview survey to passenger of BRT. Necessary number of samples should be taken. For the sample size and questionnaire, the CDM methodology "ACM0016 Mass rapid transit projects[1]" can be referred to. · Interview survey should be carried out once after the project starts. (Motorbike 41.6%, passenger car 7.9%, coach 8.3%, bus 38.7%, taxi 3.0% (Source: BRT FS report))	See "Source"
$EF_{PKM,i}$ CO_2 emission factor per passenger kilometer for transport mode i (gCO_2/passenger-km)	Motorbike 66, passenger car 142, coach 25, bus 25, taxi 82 (Source: New Mechanism Feasibility Study 2011 – Final Report, New Mechanism Feasibility Study for Development of Mass Rapid Transit (MRT) Systems in Jakarta, Indonesia, and Hanoi and Ho Chi Minh, Viet Nam., Mitsubishi Research Institute, Inc.)	See "Source"
$EF_{KM,i}$ CO_2 emission factor of transport mode i (gCO_2/km)	Use national or local values, in case $EF_{PKM,i}$ are not available.	-
OC_i Average occupation rate of transport mode i (passenger/vehicle)	Use national or local values or carry out a survey, in case $EF_{PKM,i}$ are not available.	-
NCV_{CNG} Net calorific value of CNG (MJ/kg)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory"	48.0

[1] https://cdm.unfccc.int/methodologies/DB/FXQBDV16UML49NJN03U1QQTEY9J90E

EF_{CNG} Emission factor of CNG (tCO_2/MJ)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory"	0.0000561

(2) Result of monitoring activities

Note: The following descriptions are based on the hypothetical data for this case study. Actual monitoring will start right after the operation of BRT starts.

1) Monitoring period

The 1st year after the operation starts.

2) Emission reductions of the monitoring period

1,700 tCO_2/year

3) Processes of the emission reduction calculation

Number of the passengers of BRT in the year is 11,026,650 and the average trip distance of the passenger of BRT in the year is 7.5km, thus transported volume by BRT in the year is 82,699,875 passenger-km/year. Share of the passengers using previous transport mode and CNG consumption by BRT buses are same as ex-ante estimation.

Emission reduction is calculated as follows:

$$\boldsymbol{PKM_y = P_y \times TD_y = 1,1026,650 \times 7.5 = 82,699,875}$$

$$\boldsymbol{BE_y = \sum_i \left(PKM_y \times MS_{i,y} \times EF_{PKM,i} \times 10^{-6}\right)}$$

$$= 82{,}699{,}875 \times (0.416 \times 0.000066 + 0.079 \times 0.000412 + 0.083 \times 0.000025 + 0.387 \times 0.000025 + 0.0030 \times 0.000082)$$

$$= \boldsymbol{4,374}$$

$$\boldsymbol{PE_y = FC_y \times NCV_{CNG} \times EF_{CNG}}$$

$$= 993 \times 48{,}000 \times 0.0000561$$

$$= 2{,}674$$

$$\boldsymbol{ER_y = BE_y - PE_y}$$

$$= 1{,}700\ tCO_2/\text{year}$$

(3) GHG emission reduction calculation sheet

(Draft) Emission reduction estimation sheet for BRT project

Emission Reduction

Description	Parameter		Value	Unit
Emission reduction	ER_y			tCO_2 /year
Baseline emission	BE_y			tCO_2 /year
Project emission	PE_y			tCO_2 /year

Inputs

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Description	Parameter		Value	Unit	Data source
Number of passenger of the project activity in year y	P_y			passenger/year	
Average trip distance of the passenger of BRT in year y	TD_y			km	
Use of default value of CO_2 emission factor per passenger-km	-		No		
Number of transportation mode in the baseline	-		5		
CO_2 emission factor per passenger kilometer for transport mode i	$EF_{PKM,i}$	Bike		tCO_2 /passenger-km	
		Passenger car		tCO_2 /passenger-km	
		Minibus		tCO_2 /passenger-km	
		Bus		tCO_2 /passenger-km	
		Other1		tCO_2 /passenger-km	
		Other2		tCO_2 /passenger-km	
Share of passengers by transport mode i in the baseline in year y	$MS_{i,y}$	Bike		%	
		Passenger car		%	
		Minibus		%	
		Bus		%	
		Other1		%	
		Other2		%	
CNG consumption by BRT buses in year y	FC_y			t/year	
CO_2 emission factor of CNG	EF_{CNG}			tCO_2 /MJ	
Net calorific value of CNG	NCV_{CNG}			MJ/t	

Project name: MRT Line 1 project

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

CO_2 emission is reduced through mode shift of passenger transportation from the existing means of transportation such as private cars, local conventional buses and motorcycles to MRT. MRT systems are more efficient than private cars in terms of CO_2 emission per passenger-km.

2) Methodology to calculate GHG emission reduction

A simple methodology was developed for this project as below, by simplifying the CDM methodology "ACM0016 Mass rapid transit projects."

$$\boldsymbol{BE_y = \sum_i \left(PKM_y \times MS_{i,y} \times EF_{PKM,i} \times 10^{-6} \right)}$$

$$\boldsymbol{PKM_y = P_y \times TD_y}$$

$$\boldsymbol{EF_{PKM,i} = \frac{EF_{KM,i}}{OC_i}}$$

$$\boldsymbol{PE_y = EC_y \times EF_{grid}}$$

$$\boldsymbol{ER_y = BE_y - PE_y}$$

BE_y	Baseline emission in year *y* (tCO_2/year)
PE_y	Project emission in year *y* (tCO_2/year)
ER_y	Emission reduction in year *y* (tCO_2/year)

Monitoring Parameter:

PKM_y	Transported volume by MRT in year y (passenger km/year)
$MS_{i,y}$	Share of passengers using transport mode i in the baseline in year y
P_y	Number of passenger of MRT in year y (passenger/year)
TD_y	Average trip distance of the passenger of MRT in year y (km)
EC_y	Grid electricity consumption by MRT in year y (MWh/year)
i	1; Passenger car, 2; Bus, 3; Motorcycle, etc.

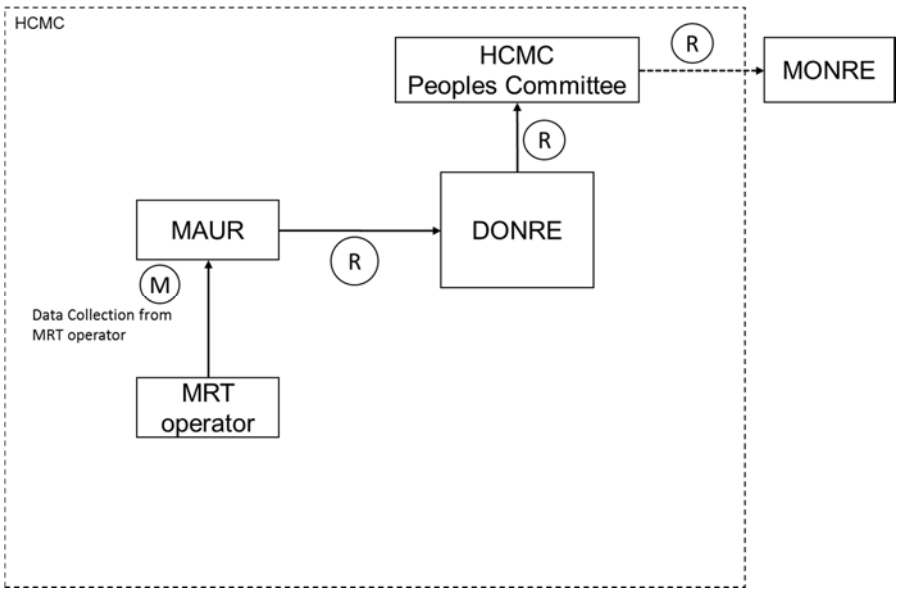
Fixed Parameter:

$EF_{PKM,i}$	CO_2 emission factor per passenger kilometer for transport mode i (gCO_2/passenger-km)
$EF_{KM,i}$	CO_2 emission factor of transport mode i (gCO_2/km)
OC_i	Average occupation rate of transport mode i (passenger/vehicle)
EF_{grid}	CO_2 emission factor of grid electricity (tCO_2/MWh)

3) Estimated GHG emission reduction

110,095 tCO_2/year

4) Organizational structure for monitoring and reporting



5) Monitoring period

Starts from January 1st 2021.

6) Monitoring methods

Monitoring parameters

Parameter	Monitoring method	Person/position in charge	Site
PKM_y Transported volume by MRT in year y (passenger km/year)	· The data is provided by the MRT operator. · The operator monitors/analyzes the data daily or monthly through ticketing system such as IC card system (This is done as their routine works). · The daily or monthly data are compiled to obtain the annual transported volume.	MAUR receives the data from the MRT operator	N/A
P_y Number of passenger of MRT in year y (passenger/year)	· Use this parameter, if PKM_y is not obtained directly · The data is provided by the MRT operator. · The operator monitors/analyzes the data MRT daily or monthly through ticketing system such as IC card system (This is done as their routine works). · The daily or monthly data are summed up to obtain the annual number.	MAUR receives the data from the MRT operator	N/A
TD_y Average trip distance of the passenger of MRT in year y (km)	· Use this parameter, if PKM_y is not obtained directly · The data is provided by the MRT operator. · The operator monitors/analyzes the data MRT daily or monthly through ticketing system such as IC card system (This is done as their routine works). · The daily or monthly data are averaged to obtain the annual average trip distance.	MAUR receives the data from the MRT operator	N/A

EC_y Grid electricity consumption by MRT in year y (MWh/year)	· The data is provided by the MRT operator. · The operator monitors the consumption through direct measurement (by electric power meter) or invoice from the power company monthly. · The monthly data are summed up to obtain the annual consumption.	MAUR receives the data from the MRT operator	N/A

Fixed parameter

Parameter	Source	Value
$MS_{i,y}$ Share of passengers using transport mode i in the baseline in year y	· Interview survey to passengers of MRT. Necessary number of samples should be taken. For the sample size and questionnaire, the CDM methodology "ACM0016 Mass rapid transit projects[2]" can be referred to. · Interview survey should be carried out once after the project starts. (Motorbike 89.9%, passenger car 2.8 %, bus 7.3 % (Source: New Mechanism Feasibility Study 2011 – Final Report, New Mechanism Feasibility Study for Development of Mass Rapid Transit (MRT) Systems in Jakarta, Indonesia, and Hanoi and Ho Chi Minh, Viet Nam., Mitsubishi Research Institute, Inc.)	See "Source"
$EF_{PKM,i}$ CO_2 emission factor per passenger kilometer for transport mode i (gCO_2/passenger-km)	Motorbike 66, passenger car 142, coach 25, bus 25, taxi 82 (Source: New Mechanism Feasibility Study 2011 – Final Report, New Mechanism Feasibility Study for Development of Mass Rapid Transit (MRT) Systems in Jakarta, Indonesia, and Hanoi and Ho Chi Minh, Viet Nam., Mitsubishi Research Institute, Inc.)	See "Source"
$EF_{KM,i}$ CO_2 emission factor of transport mode i (gCO_2/km)	Use national or local values, in case $EF_{PKM,i}$ are not available.	-
OC_i Average occupation rate of transport mode i (passenger/vehicle)	Use national or local values or carry out a survey, in case $EF_{PKM,i}$ are not available.	-
EF_{grid} CO_2 emission factor of grid electricity (tCO_2/MWh)	The latest official EF provided by MONRE in May 2016.	0.66

[2] https://cdm.unfccc.int/methodologies/DB/FXQBDV16UML49NJN03U1QQTEY9J90E

(2) Result of monitoring activities

1) Monitoring period

The 1st year after the operation starts.

2) Emission reductions of the monitoring period

121,744 tCO_2/year

3) Processes of the emission reduction calculation

The number of passengers of the MRT in the year is assumed as 116,800,000 and the average trip distance of the passengers of MRT in the year is 20 km, thus transported volume by MRT in the year is 2,336,000,000 passenger-km/year. Share of the passengers using previous transport mode and electricity consumption by MRT are same as the ex-ante estimation.

Emission reduction is calculated as follows:

$$\boldsymbol{PKM_y = P_y \times TD_y = 116,800,000 \times 20 = 2,336,000,000}$$

$$\boldsymbol{BE_y = \sum_i \left(PKM_y \times MS_{i,y} \times EF_{PKM,i} \times 10^{-6}\right)}$$

$$= 2{,}336{,}000{,}000 \times (0.899 \times 0.000066 + 0.028 \times 0.000142 + 0.073 \times 0.000025)$$

$$= 152{,}155$$

$$\boldsymbol{PE_y = EC_y \times EF_{grid}}$$

$$= 46{,}078 \times 0.66$$

$$= 30{,}411$$

$$\boldsymbol{ER_y = BE_y - PE_y}$$

$$= 121{,}744\ tCO_2/year$$

(3) GHG emission reduction calculation sheet

(Draft) Emission reduction estimation sheet for MRT project

Emission Reduction

Description	Parameter		Value	Unit
Emission reduction	ER_y			tCO_2/year
Baseline emission	BE_y			tCO_2/year
Project emission	PE_y			tCO_2/year

Inputs

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Description	Parameter		Value	Unit	Data source
Number of passenger of the project activity in year y	P_y			passenger/year	
Average trip distance of the passenger of BRT in year y	TD_y			km	
Use of default value of CO_2 emission factor per passenger-km	-		No		-
Number of transportation mode in the baseline	-		6		-
CO_2 emission factor per passenger kilometer for transport mode i	$EF_{PKM,i}$	Bike		tCO_2/passenger-km	
		Passenger car		tCO_2/passenger-km	
		Minibus		tCO_2/passenger-km	
		Bus		tCO_2/passenger-km	
		Other1		tCO_2/passenger-km	
		Other2		tCO_2/passenger-km	
Share of passengers by transport mode i in the baseline in year y	$MS_{i,y}$	Bike		%	
		Passenger car		%	
		Minibus		%	
		Bus		%	
		Other1		%	
		Other2		%	
Annual electricity consumption associated with the operation of the project activity in year y	$EC_{PJ,y}$			MWh/year	
CO_2 emission factor of the grid electricity	EF_{elec}			tCO_2/MWh	

<Waste sector>

Project name: Electricity Generation at Go Cat Landfill

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

- CH_4 emission is avoided, which would be generated by organic decay in landfill, through collecting such methane gas and utilizing it as energy source.
- CO_2 emission is also reduced through producing electricity by using the collected methane gas from landfill that displaces fossil fuel consumption at grid-connected thermal power plants.

2) Methodology to calculate GHG emission reduction

The following approved CDM methodologies were referred to:

- CDM methodology AMS-III.G "Landfill methane recovery" Version 09.0
- CDM methodology AMS-I.D "Grid connected renewable electricity generation" Version 18.0

The applied methodology estimates the amount of CH_4 emissions avoided by using the expected quantity of electricity generated by the plant, rather than using First Order Decay (FOD) model. Applied equations and description of each parameter is as below.

$$\boldsymbol{ER_y = BE_y - PE_y} \quad \text{(Equation 1)}$$

$$\boldsymbol{BE_y = BE_{1,y} + BE_{2,y}} \quad \text{(Equation 2)}$$

$$\boldsymbol{BE_{1,y} = (1 - OX) \times F_{CH4,PJ,y} \times GWP_{CH4}} \quad \text{(Equation 3)}$$

$$\boldsymbol{BE_{2,y} = EG_{PJ,y} \times EF_{grid,y}} \quad \text{(Equation 4)}$$

$F_{CH4, PJ, y}$	Volume of methane gas collected from landfill (m^3/year)
GWP_{CH4}	Global Warming Potential for methane
$EG_{PJ,y}$	Quantity of electricity generated by the project in year y (MWh/ year)
$EF_{grid,y}$	CO_2 emission factor of electricity grid in year y (t-CO_2/MWh)

$$\boldsymbol{F_{CH4,PJ} = \frac{EG_{PJ,y} \times 3600}{NCV_{CH4} \times EF} \times D_{CH4} \times GWP_{CH4}} \quad \text{(Equation 5)}$$

$EG_{PJ,y}$	Electricity generated by the project in year y (MWh)
D_{CH4}	Density of methane of the landfill gas in year y (ton of methane/m^3 of landfill gas)
GWP_{CH4}	Global Warming Potential (GWP) of methane
NCV_{CH4}	Net calorific value of methane (MJ/Nm^3)
EE_y	Energy Conversion Efficiency

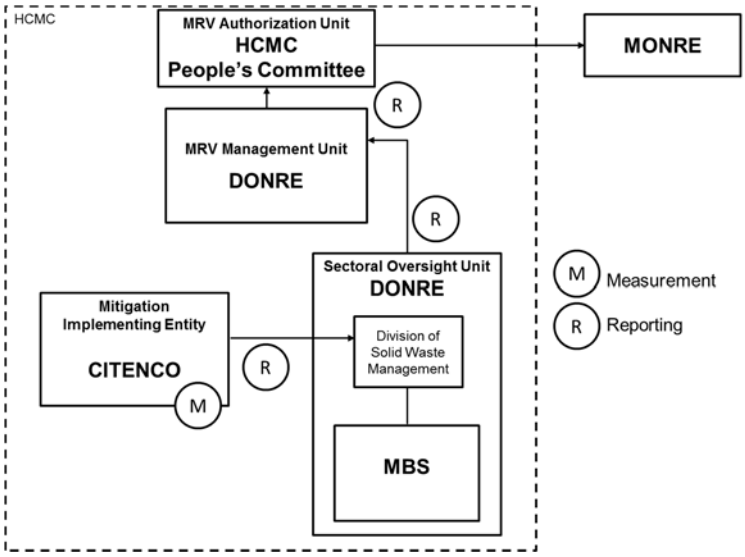
$$\boldsymbol{PE_y = EC_{PJ,y} \times EF_{grid,y}} \quad \text{(Equation 6)}$$

$EC_{PJ,y}$	Quantity of electricity consumed by the project in year y (MWh/year)

3) Estimated GHG emission reduction

462 ton-$CO_{2equivalent}$

4) Organizational structure for monitoring and reporting



5) Monitoring period

From 1 January 2016 to 31 December 2016

6) Monitoring methods

- Monitoring parameters

Parameters listed in the following table will be monitored during the monitoring period.

Monitoring method described below will be applied.

Parameter	Monitoring method	Person/position in charge	Site
$EG_{PJ,y}$ Electricity generated by the project in year y (MWh)	Monitored daily by reading an electricity meter that is equipped at the power plant and records the MWh data on the paper or electronically. Recorded data is shared with head office daily.	Technical staff of the power plant	Onsite (at the project site)
$EC_{PJ,y}$ Quantity of electricity consumed by the project in year y (MWh/yr)	Calculated monthly based on the rated output of all machineries and office equipment that are used for power plant operation. Hours of usage for each equipment are recorded and used for calculation.	Technical staff of the power plant	Onsite (at the project site)

- Fixed parameters

Parameters listed in the following table will not be monitored during the monitoring period. Fixed value will be applied throughout the project timeframe.

Parameter	Source	Value
$EF_{grid,y}$ CO_2 emission factor of electricity	Official data published by MONRE	0.6612 t-CO_2/MWh

grid in year y (t CO_2 /MWh)		
OX Oxidation factor	Default value (CDM methodology)	0.1
NCV_{CH4} Net calorific value of methane	Default value (IPCC Guidelines)	35.9 MJ/Nm^3
EE_y Energy Conversion Efficiency of the project equipment	Default value (CDM methodology)	40 %
D_{CH4} Density of methane in the landfill gas (ton/ m3)	Default value (CDM methodology)	0.716 kg/m^3
GWP_{CH4} Global Warming Potential of methane	Default value (IPCC Guidelines)	25

(2) Result of monitoring activities

1) Monitoring period

1 January 2016 to 30 July 2016

(The power plant did not operate from August 2016 until the end of 2016 due to the work associated with upgrading of EVN transmission line)

2) Emission reductions of the monitoring period

249 tons-$CO_{2\text{-equivalent}}$

3) Processes of the emission reduction calculation

Calculation of the GHG emission reductions was performed as below.

$$F_{CH4,PJ} = \frac{EG_{PJ,y} \times 3600}{NCV_{CH4} \times EE_y} \times D_{CH4} \quad \text{(Equation 5)}$$

= (54.737 × 3,600) / (35.9 × 0.4) × 0.716
= 9.83

$$BE_{1,y} = (1 - OX) \times F_{CH4,PJ,y} \times GWP_{CH4} \quad \text{(Equation 3)}$$

= 0.9 × 9.83 × 25
= 221

$$BE_{2,y} = EG_{PJ,y} \times EF_{grid,y} \quad \text{(Equation 4)}$$

= 54,737 × 0.6612
= 36

$$BE_y = BE_{1,y} + BE_{2,y} \quad \text{(Equation 2)}$$

= 221 + 36
= 257

$$PE_y = EC_{PJ,y} \times EF_{grid,y} \quad \text{(Equation 6)}$$

= 12 × 0.6612

= 8

$$ER_y = BE_y - PE_y$$ (Equation 1)=

= 257 - 8

= 249 ton$CO_{2\text{-equivalent}}$ /year

Data monitored by Mitigation Implementing Entity

	$EG_{PJ,y}$	$EC_{PJ,y}$
Jan	34,974	2.4
Feb	11,314	2.4
Mar	2,906	2.4
Apr	-	-
May	4,370	2.4
Jun	1,173	2.4
Total	54,737	12.0

(3) GHG emission reduction calculation sheet

Emission Reduction

Description	Parameter	Unit	Value
Emission reductions	ER_y	tCO_{2e}/year	**249**
Baseline emissions	BE_y	tCO_{2e}/year	257
Baseline emissions for CH_4	$BE_{1,y}$	tCO_{2e}/year	221
Baseline emissions for CO_2	$BE_{2,y}$	tCO_{2e}/year	36
Project emissions	PE_y	tCO_{2e}/year	8

Inputs

Description	Parameter	Unit	Value	Data source
Electricity generated by the project in year y	$EG_{PJ,y}$	MWh	54.737	Monitored
Quantity of electricity consumed by the project in year y	$EC_{PJ,y}$	MWh/ year	12	Monitored
CO2 emission factor of electricity grid in year y	$EF_{grid,y}$	t-CO2 /MWh	0.661	MONRE
Oxidation factor	OX	-	0.1	Methodology default
Net calorific value of methane	NCV_{CH4}	MJ/Nm3	35.9	IPCC Guidelines
Energy Conversion Efficiency of the project equipment	EE_y	%	40.0	Methodology default
Density of methane in the landfill gas	D_{CH4}	ton/ m3	0.716	Methodology default
Global Warming Potential of methane	GWP_{CH4}	-	25.0	IPCC Guidelines

Project name: Animal Manure Collection and Biogas Recovery at Small Farms

(1) Information on the MRV framework and involved organizations, the applied methodologies

1) Logic of GHG emission reduction

CH_4 emission is avoided through collecting and utilizing organic waste (animal manure) that would be abandoned in the field for organic decay.

CO_2 emission is reduced through avoiding the use of fossil fuels for cooking.

2) Methodology to calculate GHG emission reduction

Following approved CDM methodologies were referred to:

- AMS-III.R "Methane recovery in agricultural activities at household/small farm level"
- AMS-III.D "Methane recovery in animal manure management systems"

$$\boldsymbol{ER_y = BE_y - PE_y} \quad \text{(Equation 1)}$$

ER_y : GHG emissions reduction from the project in year y (ton-CO_{2e}/year)

BE_y : GHG emissions at baseline case without project activity (ton-CO_{2e}/year)

PE_y : GHG emissions from project activity (ton-CO_{2e}/year)

$$\boldsymbol{BE_y = BE_{1,y} + BE_{2,y}} \quad \text{(Equation 2)}$$

$BE_{1,y}$: GHG emissions (CH_4) at baseline case from disposed animal manure (ton-CO_{2e}/year)

$BE_{2,y}$: GHG emissions (CO_2) at baseline case from the consumption of fossil fuels currently used (ton-CO_{2e}/year)

$$\boldsymbol{BE_{1,y} = \sum \frac{(EF_{(T)} \times N_{(T)})}{10^3} \times GWP_{CH4}} \quad \text{(Equation 3)}$$

$EF_{(T)}$: Methane emission factor for livestock (kg CH_4/ head/ year)

$N_{(T)}$: Number of head of livestock (swine)

GWP_{CH4} : Global Warming Potential (GWP) of methane =25

$$\boldsymbol{BE_{2,y} = \sum BG_{PJ,y} \text{x } NCV \times EF_{PJ,y} \times 1/10^6} \quad \text{(Equation 4)}$$

$BG_{PJ,y}$: Quantity of fuel consumed by household without using biogas (kg/year)

NCV : Heating value of fuel (MJ/kg)

$EF_{PJ,y}$: CO_2 emission factor of fossil fuel (t-CO_2/MJ)

$$\boldsymbol{PE_y = 0.1 \times BE_{1,y}} \quad \text{(Equation 5)}$$

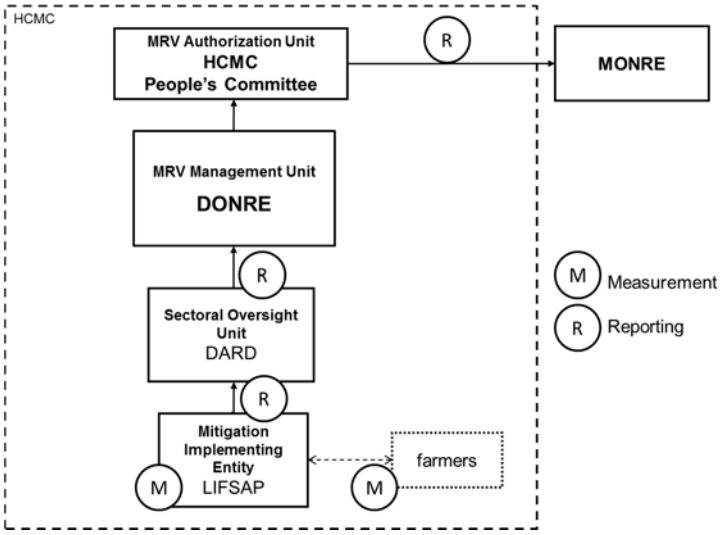
PE_y : GHG emissions from project activity (ton-CO_{2e}/year)

0.1 : Physical leakage of biogas from the animal manure management system to produce, collect and transport the biogas (fraction)

3) Estimated GHG emission reduction

6,862 ton-$CO_{2equivalent}$

4) Organizational structure for monitoring and reporting



5) Monitoring period

From 1 January 2017 to 31 March 2017

6) Monitoring methods

- Monitoring parameters

Parameters listed in the following table will be monitored during the monitoring period.

Parameter	Monitoring method	Person/position in charge	Site
$N_{(T)}$ Number of head of livestock (swine)	Number of head at households is counted by sample livestock farmers to yield average number. Number of samples will be large enough to represent the whole target households. Considering the large size of the target group and difficulty of frequent data collection, above information will be monitored every 3 month	Technical staff of LIFSAP project	Onsite (sample households)
$BG_{PJ,y}$ Quantity of fuel consumed by household instead of using biogas (kg/year)	Calculated based on the average capacity and quantity of cooking device used by target households, and average yearly cooking hours per household. Above information is collected by interview survey from the sufficient number of households that represent the entire target group. Considering the large size of the target group and difficulty of frequent data collection, above information is monitored every 3 month.	Technical staff of LIFSAP project	N/A

- Fixed parameters

Parameters listed in the following table will not be monitored during the monitoring period. Fixed value will be applied throughout the project timeframe.

Parameter	Source	Value
$EF_{(T)}$ Methane emission factor for livestock (kg CH_4/ head/ year)	Default value (IPCC Guidelines) Value for more than 28C average annual temperature is applied.	7 kg CH_4/ head/ year
GWP_{CH4} Global Warming Potential of methane	Default value (IPCC Guidelines)	25
NCV Net calorific value of fuel that would be used for cooking instead of biogas (MJ/ kg)	Default value (IPCC Guidelines) Value of LPG is applied.	47.3 MJ/ kg
$EF_{PJ,y}$ CO_2 emission factor of fuel that would be used for cooking instead of biogas (t-CO_2/MJ)	Default value (CDM methodology) Value of LPG is applied.	63.1 t-CO_2/MJ

(2) Result of monitoring activities

1) Monitoring period

From 1 January 2017 to 31 March 2017

2) Emission reductions of the monitoring period

1,716 tons-$CO_{2\text{-equivalent}}$

3) Processes of the emission reduction calculation

$$\boldsymbol{BE_{1,y}} = \sum_T \frac{(\boldsymbol{EF_{(T)}} \times \boldsymbol{N_{(T)}})}{\boldsymbol{10^3}} \times \boldsymbol{GWP_{CH4}} \quad \text{(Equation 3)}$$

= 844 x 7 x 45 / 10^3 x 25

= 6,647

$$\boldsymbol{BE_{2,y}} = \boldsymbol{BG_{PJ,y}} \text{x } \boldsymbol{NCV} \times \boldsymbol{EF_{PJ,y}} \times \boldsymbol{1/10^6} \quad \text{(Equation 4)}$$

= 844 x 349.7 x 47.3 x 63.1 / 10^6

= 881

$$\boldsymbol{PE_y} = \boldsymbol{0.1} \times \boldsymbol{BE_{1,y}} \quad \text{(Equation 5)}$$

= 0.1 x 6,646.5

= 665

$$BE_y = BE_{1,y} + BE_{2,y}$$ (Equation 2)

= 6,647 + 881.03

= 7,527

$$ER_y = BE_y - PE_y$$ (Equation 1)

= 7,527 – 665

= 6,863 (ton-$CO_{2\text{-equivalent}}$/ year)

= 1,716 (ton-CO_{2e}) (during the 3-month monitoring period)

(3) GHG emission reduction calculation sheet

Emission Reduction

Description	Parameter	Unit	Value
Emission reductions	ER_y	tCO_{2e}/year	**6,863**
Emission reductions (for 3-month monitoring period)	ER_y	tCO_{2e}	**1,716**
Baseline emissions	BE_y	tCO_{2e}/year	**7,527**
Baseline emissions (CH_4) from disposed animal manure	$BE_{1,y}$	tCO_{2e}/year	6,647
Baseline emissions (CO_2) from the consumption of fossil fuels	$BE_{2,y}$	tCO_{2e}/year	881
Project emissions	PE_y	tCO_{2e}/year	**665**

Inputs

Description	Parameter	Unit	Value	Data source
Number of head of livestock (swine)	$N_{(T)}$	head	37,980	Monitored
Quantity of fuel consumed by household instead of using biogas	$BG_{PJ,y}$	kg/year	295,147	Monitored
Methane emission factor for livestock	$EF_{(T)}$	kg CH_4/ head/ year	7	Methodology default
Global Warming Potential of methane	GWP_{CH4}	-	25	IPCC Guidelines
Net calorific value of fuel that would be used for cooking instead of biogas	NCV	MJ/ kg	47.3	IPCC Guidelines
CO_2 emission factor of fuel that would be used for cooking instead of biogas	$EF_{PJ,y}$	t-CO_2/MJ	63.1	IPCC Guidelines (value for LPG)

資料 2
ニュースレター

Project to Support the Planning and Implementation of NAMAs in a MRV Manner
Component 2 -Capacity Enhancement of Local Governments-

June 2017

Introduction

According to the National Strategy on Climate Change issued by the Prime Minister of Vietnam in December 2011, Nationally Appropriate Mitigation Actions (NAMAs) will be planned by the Ministry of Natural Resources and Environment (MONRE). In this context, a technical support project for capacity enhancement was requested to JICA. The "Project to Support the Planning and Implementation of NAMAs in a MRV Manner" (SPI-NAMA) started in January 2015. The purpose of SPI-NAMA is to enhance the capacity of the Government of Vietnam concerning the planning and implementing of NAMAs. To attain this goal, SPI-NAMA has two project components.

Project purpose

Achieve project purpose

Project component 1

Feedback to component 1

Project component 2

Project Component 1

The first project component aims to enhance the capacity of MONRE to facilitate the process of development and implementation of NAMAs. It is implemented by MONRE and the JICA Long-Term Experts.

Project Component 2

The second component aims to enhance the capacity of cities in Vietnam to quantify greenhouse gas (GHG) emissions and reductions, taking Ho Chi Minh City (HCMC) as a model city.

This component is implemented by the Climate Change Bureau (CCB), Department of Natural Resources and Environment (DONRE) of HCMC with the support of the JICA Short-Term Experts. The profile of Component 2 is shown below.

Main activities	Piloting MRV of NAMAs Preparing GHG inventory
Executive agency	DONRE-CCB of HCMC
Japanese side input	Seven Short-Term Experts
Project duration	24 months（2015-2017）
Project site	HCMC

Main activities

MRV of NAMAs

Ongoing or planned NAMAs to pilot MRV in HCMC are selected in three focused sectors. They are energy, transport and waste sectors. The baseline GHG emission at the project inception, and anticipated and actual emission reduction of selected NAMAs are quantified. Utilizing the outputs of the activities in HCMC, an MRV manual for HCMC and MRV guidelines for local governments are developed.

GHG Inventory

The activity data of 2013, 2014, and 2015 are collected. GHG inventory of 2013 and 2014 are developed following the Global Protocol for Community-Scale GHG Emission Inventories (GPC). The GHG inventory of 2013 is also prepared for ten sectors in the Climate Change Action Plan (CCAP) of HCMC.

Year	2013	2014	2015
Inventory format (Excel file)	Same format of excel file		
Data request	Yes	Yes	Yes
Compilation of Inventory (Based on GPC)	Yes	Yes	Optional
Compilation of Inventory (Based on 10 sectors)	Yes	Optional	Optional

Implementation structure

The seven-member JICA Short-Term Expert Team composed of three consulting firms assists the implementation of Component 2. The local consultant team represented by NIRAS-RCEE is also engaged to assist project implementation.

Short-Term Expert Team
JV of three consulting companies
- Pacific Consultants
- Oriental Consultants Global
- Suuri-Keikaku

HCMC DONRE-CCB

Local Consultants

CCB is the main counterpart to the JICA Short-Term Expert Team. CCB was established in DONRE in 2012 to execute practical work related to climate change policy following the decisions of the Climate Change Steering Board of HCMC.

Progress to date

During the April to June 2017 period, the Short-Term Experts made two visits to Vietnam.

- Monitoring reports of the MRV pilot projects were reviewed.
- Final draft of the 2013 GHG inventory based on the GPC was prepared.
- Development of the MRV Manual and GHG Inventory Preparation Manual was continued.

MRV of NAMAs

Monitoring of the MRV pilot projects in energy, transport, and waste sectors was continued. In the meetings with the concerned organizations, the monitoring status and GHG emission reductions were reviewed and contents and procedures on the reporting were discussed. The monitoring report of "Electricity Generation at Go Cat Landfill Site", which is one of the MRV pilot projects, was prepared by the HCMC Urban Environment Company Limited (CITENCO) and reviewed with the DONRE. The monitoring report of "Introduction of CNG Bus for Public Bus Fleet" was also prepared and reviewed with the relevant organizations such as the Department of Transport (DOT), Management and Operation Center for Public Transport (MOCPT), and Saigon Bus.

Preparing GHG Inventory

The 2013 GHG inventory based on GPC was completed in all sectors: Stationary Energy, Transportation, Waste, Industrial Processes and Product Use (IPPU), and Agriculture, Forestry and Other Land Use (AFOLU).

The trial calculation of the GHG inventory based on the ten sectors of CCAP was conducted. However, the GHG emissions could not be calculated for the Water Management, Construction, Health, and Tourism sectors.

The first half of the training on GHG inventory preparation targeting ten officials of DONRE was held on 19 and 20 April. The participants calculated the GHG emissions in the Stationary Energy and Transportation sectors in 2014 in accordance with the GHG Inventory Preparation Manual, which is under development. In the second half of the training, he GHG emissions in the Waste, IPPU, and AFOLU sectors will be calculated and the 2014 GHG inventory based on GPC will be completed.

Second training in Japan

The second training in Japan was held from 21 to 27 May 2017 targeting ten officials of HCMC.

In the first half of the training, lectures on the mitigation measures implemented by the Tokyo Metropolitan Government and policies to promote mitigation actions of private companies were given. A site visit to an energy efficient building was also conducted. Many questions were raised, especially during the lectures on the Reporting Program, and Cap and Trade Program. Keen interests in these programs were shown by the participants.

In the second half of the training, site visits to a solid waste treatment plant and a waste water treatment plant were held to learn the GHG emission reduction efforts in the public sector. In the final day of the training, as an exercise, the participants made a MRV plan of a waste-to-energy project in accordance with the MRV Manual which is been development under the project.

Date	Contents
21 May	• Arrival (Narita)
22 May	• Orientation • Presentation by participants (initiatives on mitigation in HCMC) • Lecture on MRV Manual and GHG Inventory Preparation Manual of HCMC
23 May	• Lecture on mitigation actions of Tokyo Metropolitan Government • Lecture on GHG inventory of Tokyo • Lecture on Reporting Program and Cap & Trade Program
24 May	• Lecture on program to promote energy saving of private sector • Visit to energy efficient building
25 May	• Visit to waste treatment plant • Visit to waste water treatment plant
26 May	• Workshop (MRV planning) • Presentation by participants • Closing
27 May	• Departure (Narita)

Project to Support the Planning and Implementation of NAMAs in a MRV Manner
Component 2 -Capacity Enhancement of Local Governments-

September 2017

Introduction

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Project purpose

Achieve project purpose

Project component 1

Feedback to component 1

Project component 2

Project Component 1

The first project component aims to enhance the capacity of MONRE to facilitate the process of development and implementation of NAMAs. It is implemented by MONRE and the JICA Long-Term Experts.

Project Component 2

The second component aims to enhance the capacity of cities in Vietnam to quantify greenhouse gas (GHG) emissions and reductions, taking Ho Chi Minh City (HCMC) as a model city.

This component is implemented by the Climate Change Bureau (CCB), Department of Natural Resources and Environment (DONRE) of HCMC with the support of the JICA Short-Term Experts. The profile of Component 2 is shown below.

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GHG Inventory

The activity data of 2013, 2014, and 2015 are collected. GHG inventory of 2013 and 2014 are developed following the Global Protocol for Community-Scale GHG Emission Inventories (GPC). The GHG inventory of 2013 is also prepared for ten sectors in the Climate Change Action Plan (CCAP) of HCMC.

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Data request	Yes	Yes	Yes
Compilation of Inventory (Based on GPC)	Yes	Yes	Optional
Compilation of Inventory (Based on 10 sectors)	Yes	Optional	Optional

Implementation structure

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JV of three consulting companies
- Pacific Consultants
- Oriental Consultants Global
- Suuri-Keikaku

HCMC DONRE-CCB

Local Consultants

CCB is the main counterpart to the JICA Short-Term Expert Team. CCB was established in DONRE in 2012 to execute practical work related to climate change policy following the decisions of the Climate Change Steering Board of HCMC.

Progress to date

During the July to September 2017 period, the Short-Term Experts made three visits to Vietnam.

- Training on climate change mitigation for HCMC officials was held.
- Second consultation meeting on the GHG Inventory Preparation Manual and MRV Manual were held.
- Final draft of the manuals has been agreed with CCB. The manuals will be completed after the final check.

MRV of NAMAs

The second consultation meeting on the MRV Manual was held on 11 July 2017 in HCMC. Forty people from departments of HCMC, districts, public companies, and universities participated in the meeting. More than 40 comments and questions were raised. Those included comments on the necessity of incentives or binding rules for MRV implementation, and the importance of consistency with the national MRV institutions.

The outline of the MRV Manual and lessons learned through the MRV trials were presented in a seminar organized by MONRE. Officials of MONRE as well as those of the Ministry of Construction and Ministry of Transport participated in the seminar.

(Consultation meeting)

Preparing GHG Inventory

The second consultation meeting on the GHG Inventory Preparation Manual was held on 12 July 2017. Around 30 people from HCMC departments, districts, public companies, and universities participated in the meeting. Around 60 comments and questions were raised including those on double counting of the GHG emissions, software to calculate the emissions, and preparation process of GHG inventory.

The second half of the training on GHG inventory preparation for officials of DONRE was held on 27 July and 1-2 August. The participants calculated the GHG emissions in the Waste, IPPU, and AFOLU sectors in 2014 in accordance with the GHG Inventory Preparation Manual, which is under finalization. As the emissions in other sectors were calculated in the first half of the training in this April, the calculation for all sectors in the 2014 GHG inventory based on GPC was completed in this training.

Second General Training on Climate Change Mitigation for HCMC Officials

The Second General Training on Climate Change Mitigation for HCMC Officials was held from 5 to 7 July 2017 in HCMC. Around 80 people participated in the training from departments of HCMC, districts, public companies, and universities.

Lectures on climate change mitigation, NAMA, MRV, and GHG inventory were given in the first and second days of the training (Part A). Lectures were given by MONRE and C40 as well.

In the third day (Part B), participants made MRV plans of energy saving project, urban railway project and waste-to-energy project as an group exercise. The participants did the MRV planning in accordance with the MRV Manual which is under finalization. JICA experts and local consultants joined in each group and provided advice. After the exercise, each group presented the MRV plans and discussion was held. Many questions and comments were raised during the lectures and workshop. The participants showed a very positive attitude towards the training.

Taskforce meeting of Climate Change Steering Board (CCSB)

Discussion was held with the concerned organizations on the GHG Inventory Preparation Manual and MRV Manual in the taskforce meeting of CCSB on 29 August 2017. Fourteen people participated in the meeting from ten organizations: DONRE, Department of Agriculture and Rural Development, Department of Planning and Investment, Department of Zoning and Architecture, Department of Science and Technology, Department of Transport, Department of Construction, Steering Committee for Flood Control Program, Department of Industry and Trade, and HCMC Institute for Development Studies.

Project to Support the Planning and Implementation of NAMAs in a MRV Manner
Component 2 -Capacity Enhancement of Local Governments-

November 2017

Introduction

According to the National Strategy on Climate Change issued by the Prime Minister of Vietnam in December 2011, Nationally Appropriate Mitigation Actions (NAMAs) will be planned by the Ministry of Natural Resources and Environment (MONRE). In this context, a technical support project for capacity enhancement was requested to JICA. The "Project to Support the Planning and Implementation of NAMAs in a MRV Manner" (SPI-NAMA) started in January 2015. The purpose of SPI-NAMA is to enhance the capacity of the Government of Vietnam concerning the planning and implementing of NAMAs. To attain this goal, SPI-NAMA has two project components.

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Achieve project purpose

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Project component 2

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HCMC DONRE-CCB

Local Consultants

CCB is the main counterpart to the JICA Short-Term Expert Team. CCB was established in DONRE in 2012 to execute practical work related to climate change policy following the decisions of the Climate Change Steering Board of HCMC.

Summary of Project Activities

The final seminar was held on 26 October 2017 in HCMC and all project activities in Vietnam were closed. The seven experts visited Vietnam 21 times and worked for 773 days in total since the project started in September 2015.

Piloting MRV

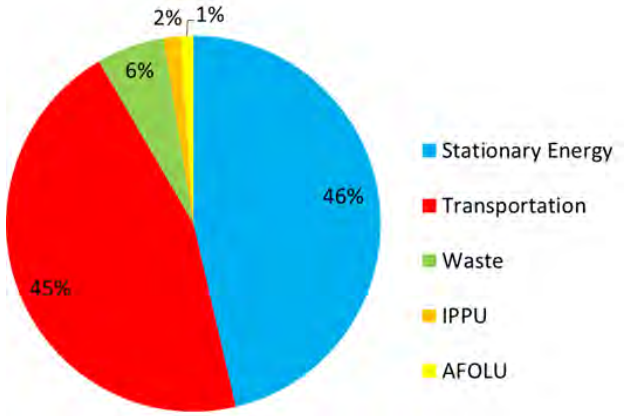
The MRV trials were implemented for three to 12 months targeting seven projects in the energy, transport, and waste sectors. The MRV trials were implemented in collaboration with the implementing body and relevant organizations of those projects

Development of MRV Manual

The MRV Manual was developed with the aim to assist HCMC to conduct MRV of mitigation measures continuously into the future. The manual was completed through successive discussions with CCB and two consultation meetings with the relevant organizations. The outcomes of the MRV trials are reflected in the manual.

Preparation of GHG inventory

The GHG inventory of HCMC for the year 2013 was prepared. The GHG emissions of HCMC in 2013 were calculated to be around 38.5 million tCO2e. The data to prepare GHG inventory was provided by 11 organizations of HCMC.



GHG Emissions and Removals by Sector in HCMC

Development of GHG Inventory Preparation Manual

The GHG Inventory Preparation Manual was developed with the aim to assist HCMC to prepare the GHG inventories continuously into the future. The manual primarily describes the steps to prepare the GHG inventory of HCMC, however, a greater portion of the manual can be also used in other cities and provinces.

Training and Seminars

General Training on Climate Change Mitigation

The General Training on Climate Change Mitigation for HCMC officials was held in 2016 and 2017. The lectures on climate change mitigation measures, MRV, and GHG inventory were given and a workshop was conducted. The first training was held for four days and the second for three days. Around 90 and 70 people participated respectively from departments of HCMC, districts, companies, and institutes.

Training in Japan

The training in Japan was held for one week in 2016 and 2017. Thirteen people participated in the first training and ten in the second. The participants were the officials of the organizations concerned with the project. They visited Tokyo Metropolitan Government and Osaka city to learn the mitigation actions of those cities. The training was good opportunity for CCB and experts to establish a strong relationship with participants who were at various positions of various organizations.

Final Seminar

The final seminar to report the achievements of the project was held on 26 October 2017 in HCMC. The presentations were made by the experts, CCB and relevant organizations, regarding the GHG inventory, two manuals, lessons learned through the MRV trials and experience of the training in Japan. The way forward for climate change mitigation actions in HCMC was also presented by CCB. With this final seminar, all project activities in Vietnam were closed.

資料 3
第 2 回コンサルテーション会合資料

Project to Support the Planning and Implementation of NAMAs in a MRV Manner

Consultation Meeting on MRV Manual

11 July 2017

SPI-NAMA: Background

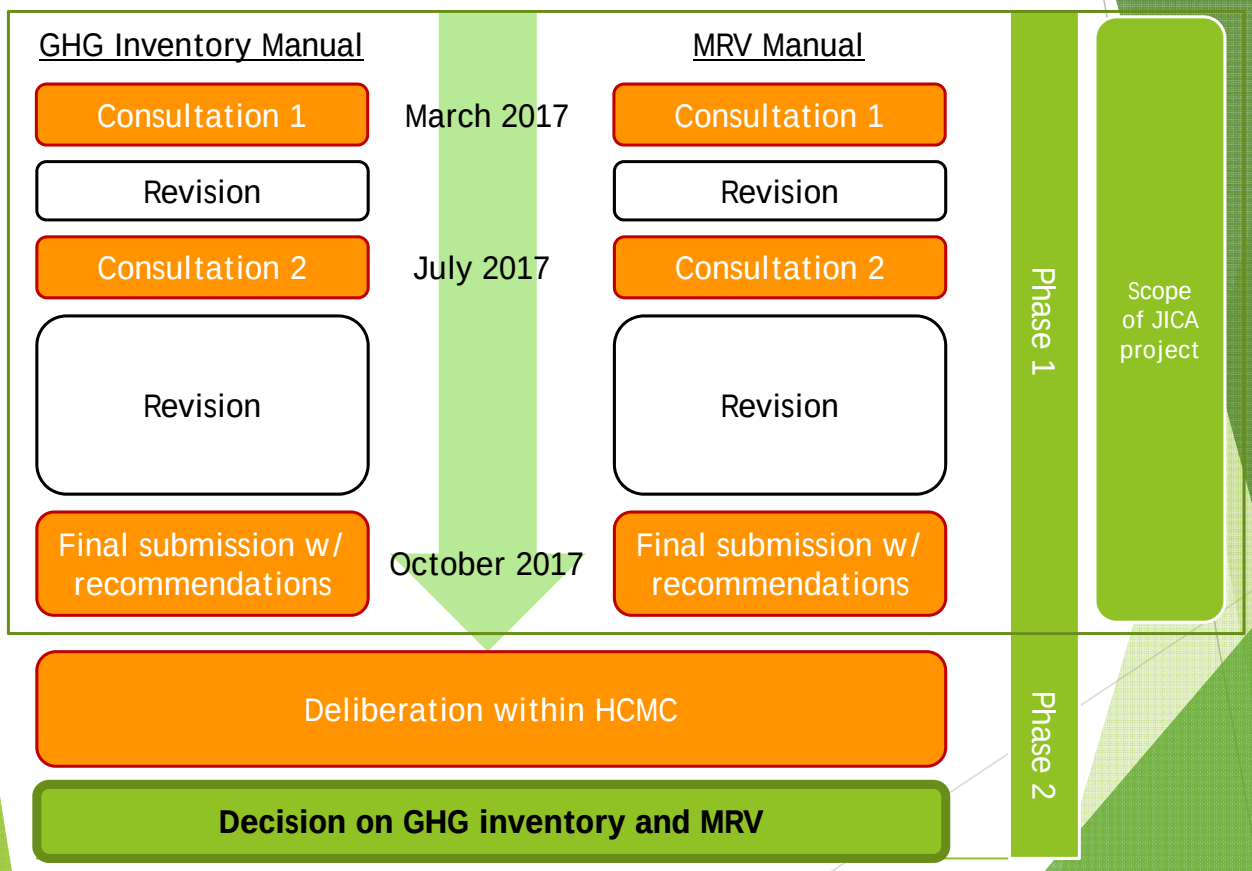
- Project started in January 2015 with MONRE and JICA Long-Term Experts
- HCMC selected as model city of Project and started activities with JICA Short-Term Expert Team from October 2015
  - ✓ Preparation of GHG inventory of HCMC
  - ✓ Piloting of MRV on selected mitigation measures
  - ✓ Drafting of manuals on GHG inventory and MRV
  - ✓ Training in HCMC and Japan

⇩

  - ✓ Institutionalization of GHG inventory and MRV

SPI NAMA: Current Focus in HCMC

Institutionalization of GHG inventory and MRV



Last Consultation (1 March 2017)

- MRV Manual

– morning session –

Discussions on framework and procedures on MRV for HCMC

- GHG Inventory Preparation Manual

– afternoon session –

Discussions on GHG inventory preparation procedures including institutional arrangements and roles of concerned organizations

Consultation Today

- MRV Manual

Second Consultation

- *Confirm appropriateness of information and explanation in MRV Manual, chapter by chapter.*
- *Check if explanation is sufficient and clear, and there are no redundant parts or unnecessary duplication.*

After consultation meeting, MRV Manual will be finalized taking into account feedback from participants and in consultation with CCB and MONRE.

Consultation meeting on Operational Manual for MRV on City-level Climate Change Mitigation Actions (Draft)

11.07.2017

JICA short term experts

Preface

- Purpose of the manual
- Recommended reader
- Structure of manual
- Remarks

Contents of Manual

1. Chapter 1- Introduction

2. Chapter 2 - Basic MRV framework

3. Chapter 3 - MRV process
   A. Determining mitigation actions to MRV
   B. MRV implementation
   C. Approve MRV results

Chapter 1 – Introduction

Pages: 1 – 14

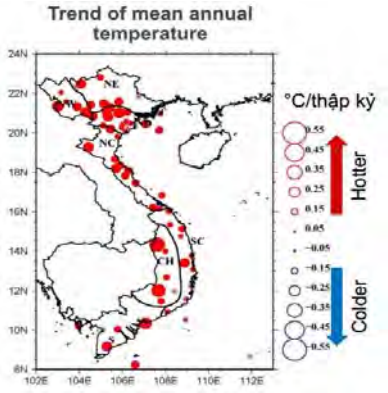
Brief summary of Chapter 1

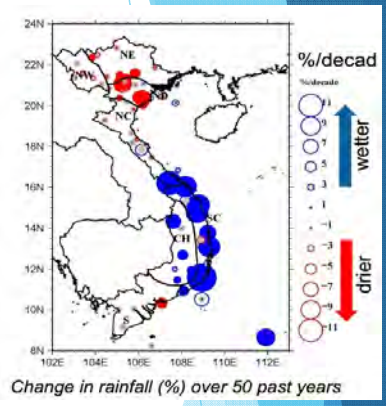
Chapter 1 provides general information such as introduction about climate change, efforts of international organizations and Vietnam in order to address climate changes. Following is the explanation about international and domestic mitigation policies and definitions of MRV.

Chapter 1 – Introduction

1.1. Context

- Global warming: Average temperature rise, ice melt, sea level rise
- Impacts of Climate change to Vietnam: Average temperature rising, rainfall increased, drought, salt intrusion, floods, etc.





Change in rainfall (%) over 50 past years

Trend and breakdown of GHGs emission in Vietnam by gas type

Unit: thousand tonnes of CO_2e

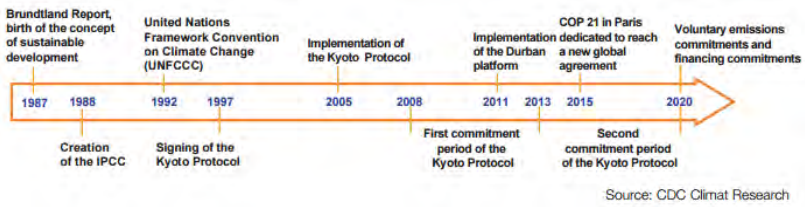
Sector	CO_2			CH_4			N_2O		
	1994	2000	2010	1994	2000	2010	1994	2000	2010
Energy	21,580	45,900	124,799	3,513	6,480	15,959	544	394	413
Industrial Process	3,807	10,006	21,172	0	0	0	0	0	0
Agriculture	0	0	0	43,951	50,059	57,909	8,494	15,032	30,446
LULUCF	15,217	11,860	-20,346	3,777	2,947	1,012	384	298	117
Waste	0	0	65	1,430	6,961	13,449	1,135	964	1,838
Total emissions (without LULUCF)	25,387	55,906	146,037	48,894	63,499	87,316	10,173	16,390	32,696
Total emissions (with LULUCF)	40,604	67,766	125,689	52,671	66,446	88,328	10,557	16,688	32,814

(Sources: National Communication 2003, 2010, National GHG Inventory Report 2010 of Viet Nam, The project "Capacity Building for National GHG Inventory in Viet Nam", 2014)

Chapter 1 – Introduction

1.2. Efforts to address climate changes

- International efforts



Source: CDC Climat Research

- Vietnam efforts

National level: National Strategy on Climate Change, Green Growth, NDC report

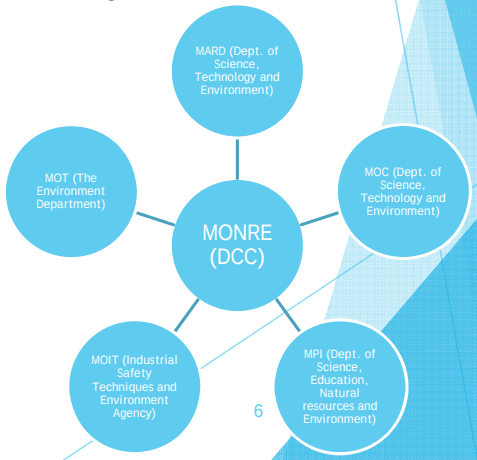
Local level: Climate Change Action Plan,

Green Growth Action Plan

Institutional:

National Committee on Climate Change

Department of Climate Change (DCC)



Chapter 1 – Introduction

1.3 Mitigation Actions to MRV

Definitions

- **Mitigation Actions?**

  Actions (such as policies, programs, measures) to reduce or avoid GHG emission.

  Ex: reduce electricity consumption in buildings, installation PV, use hybrid cars, etc.

Types of mitigation actions

- **Who will implement?**

  Those mitigation actions should be taken by individuals, enterprises and local governments.

  Local authorities:

  Formulate and implement policies, urban trading, cooperate with entities and citizenship

Level of mitigation action	Example
Individual action	Voluntary installation of LED lamps by citizens
Project	Installation of LED lamps in 100 households
Program	Installation of LED lamps in districts X, Y, and Z
Policy	Establishment of subsidy system for purchasing an LED lamp
Strategy/ plan	Development of a city master plan that sets LED lamp installation target of X% by 2020

Type of mitigation action	Examples
Hard measure	• Installation of LED lights • Replacing diesel buses with CNG buses • Construction and operation of a waste-to-energy plant
Soft measure	• Feed-in-tariff system for clean energy generation • Subsidy to purchase low-emission vehicle • Awareness raising to promote waste recycle

Chapter 1 – Introduction

Concept of MRV and its benefits to the city

- **What is MRV?**

  Is a tool to identify and manage GHG emission reduction and process of mitigation actions.

  MRV is Measurement, Reporting and Verification

- MRV is an indispensable component of mitigation actions that allows the check and report in a systematic way.

Measurement (M)	Measure directly using instruments and/or collect information and data that are necessary to calculate GHG emission reductions of the mitigation action.
Reporting (R)	Compile and report data and information that is collected or measured at the Measurement (M) stage.
Verification (V)	Check and confirm the contents that are reported at the Reporting (R) stage from the viewpoint of completeness, accuracy and consistency.

Type of benefit	Example
Enhanced clarity of project effectiveness and attainment of target	- By performing a well -planned MRV activity, the city can visualize effectiveness and impacts of the project , in terms of its GHG emissions and emission reductions. - Calculated GHG emission reductions are used to check if the mitigation target of Vietnam or a city is met.
Effective policy/ project formulation	- Even more effective policy development or project planning/ evaluation are possible in the future by applying experience of monitoring and evaluating the mitigation action under MRV.
Enhanced opportunity to access to finance	- By conducting MRV activities under specified rules , the mitigation project can have access to various types of climate finance sources , including international finances. MRV is particularly important for mitigation actions that apply to a carbon credit scheme (e.g. Clean Development Mechanism , Joint Crediting Mechanism).

Chapter 2 – Basic MRV framework

Pages: 15 – 22

Brief summary of Chapter 2

Chapter 2 presented the method to identify scope for mitigation actions to MRV and explained basic MRV framework for a city, showed responsibilities of each related agency in this MRV framework

Chapter 2 - Basic MRV framework

2.1 Defining scope of mitigation actions to MRV in a city

- **Approach 1**
  - ✓ If a city ALREADY HAS its own city-wide plan related to climate change, (e.g. climate change master plan, mitigation action plan, green growth strategy or socio-economic development plan), the city can set city-wide plan as the scope of mitigation actions to MRV, as all actions related to GHG emission reductions or prevention included in such a plan or strategy.
- **Approach 2**
  - ✓ If a city DOES NOT HAVE such a plan or strategy yet, the city can define the scope in accordance with its development priority or investment plan. For instance, some cities may want to include all publicly-financed activities in their jurisdictional area in the scope, or other cities may limit to specific sectors, for example scopes that are identified as major GHG emitting sectors in the city.

Box 2-1 Case study: Defining scope of mitigation actions to MRV for HCMC

HCMC chose Approach 1 to define its scope of mitigation actions to MRV.

HCMC has developed Climate Change Action Plan of Ho Chi Minh City (CCAP), which stipulates priority sectors for climate change mitigation. Based on these priority sectors of CCAP, HCMC has set its scope of mitigation actions to MRV as "all mitigation actions stipulated in the CCAP."

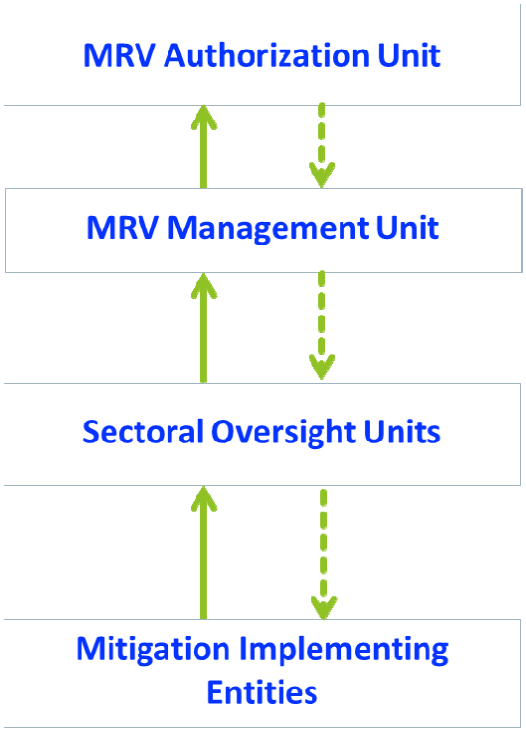
The defined scope of HCMC is characterized as follows:

- The scope contains various levels of mitigation actions from policy-level to project-level actions.
- The scope covers mitigation actions by private sector and individual mitigation actions.

Chapter 2 - Basic MRV framework

2.2. Setting up MRV Framework for the city

Roles of entities



- *Approve Mitigation action list, MRV Plans and MRV reports*

- *Check Mitigation action list, MRV Plans and Sectoral monitoring reports*
- *Submit Mitigation action list, MRV Plans , consolidate Sectoral monitoring reports into MRV Report*

- *Check Mitigation action list and MRV Plans*
- *Check Mitigation monitoring reports*
- *Submit Sectoral Monitoring reports*

- *Define mitigation actions and develop MRV Plans*
- *Submit Mitigation action list and MRV Plans*
- *Implement the mitigation actions' monitoring*
- *Consolidate monitoring results into Mitigation monitoring report*
- *Submit Mitigation monitoring report*

Chapter 2 - Basic MRV framework

Draft MRV framework for HCMC

HCMC People's Committee	**MRV Authorization Unit**
Department of Natural Resources and Environment	**MRV Management Unit**
Various oversight departments in HCMC	**Sectoral Oversight Units**
Various companies and organizations that implement mitigation actions in HCMC	**Mitigation Implementing Entities**

Chapter 2 - Basic MRV Framework

Sectoral Oversight Units

HCMC's Mitigation Sectors (CCAP-based)	Sectoral Oversight Units of HCMC
Urban planning	Department of Architecture and Planning
Energy	Department of Industry and Trade (DOIT)
Transport	Department of Transport (DOT)
Industry	Department of Industry and Trade (DOIT)
Water management	Department of Transport (DOT)
Waste management	Department of Natural Resources and Environment (DONRE)
Construction	Department of Construction (DOC)
Health	Department of Health
Agriculture	Department of Agriculture and Rural Development (DARD)
Tourism	Department of Tourism

Chapter 2 - Basic MRV framework

Mitigation implementation entities

Mitigation implementation entities of HCMC

- District's PCs
- HCMC Energy Conservation Centre (ECC)
- Public Lighting of HCMC (SAPULICO)
- Ho Chi Minh City urban drainage company limited (UDC)
- HCMC Urban Environment Company Limited (CITENCO)
- Vietnam Electricity (EVN)
- Saigon Trading Group (SATRA)
- Saigon Bus Company
- HCMC Saigon water corporation (SAWACO)
- Saigon transportation mechanical corporation limited (SAMCO)
- Others

(These entities was referred to Annex of Draft CCAP of HCMC and pilot activities of project "SPI-NAMA in a MRV manner)

Chapter 3 – MRV process

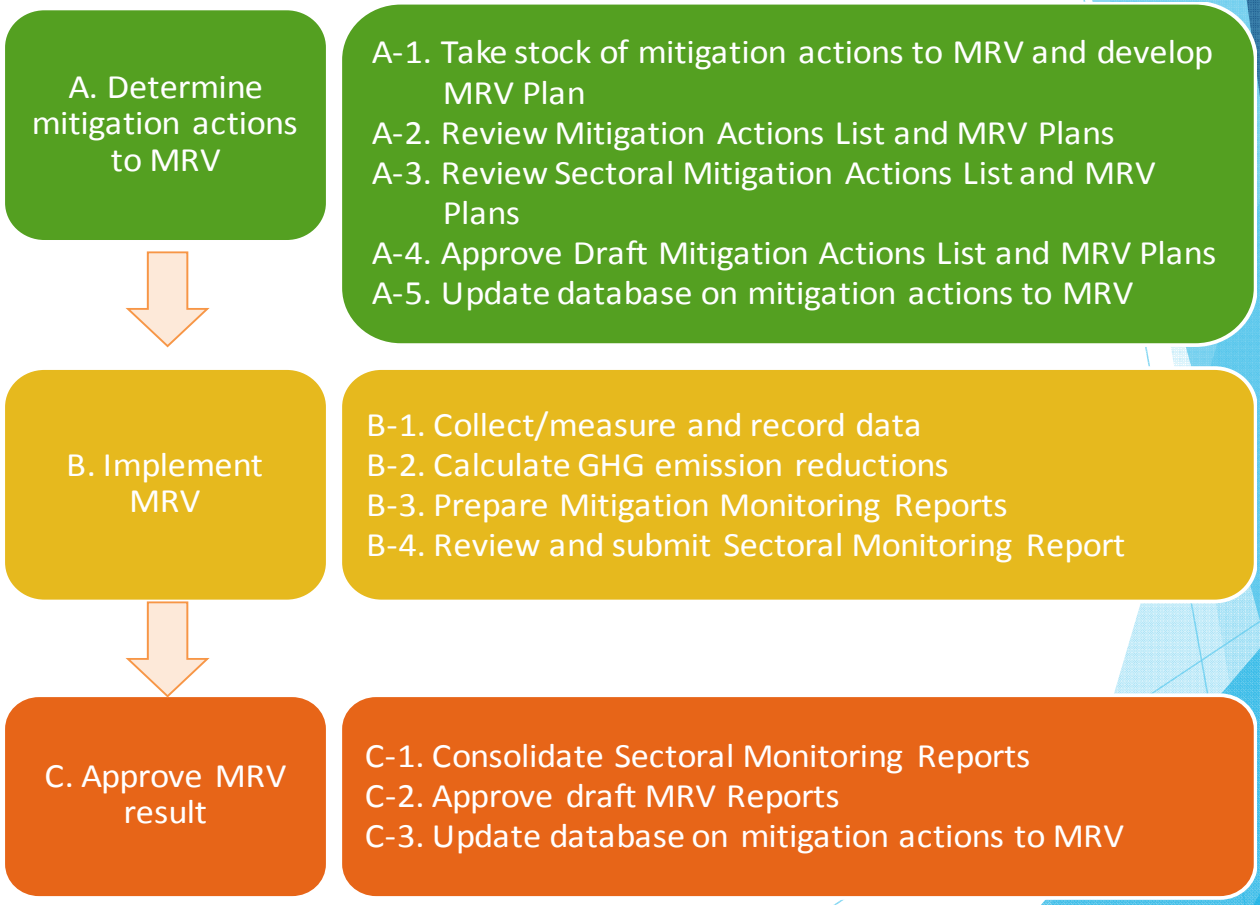
Pages: 23 – 50

Brief summary of Chapter 3

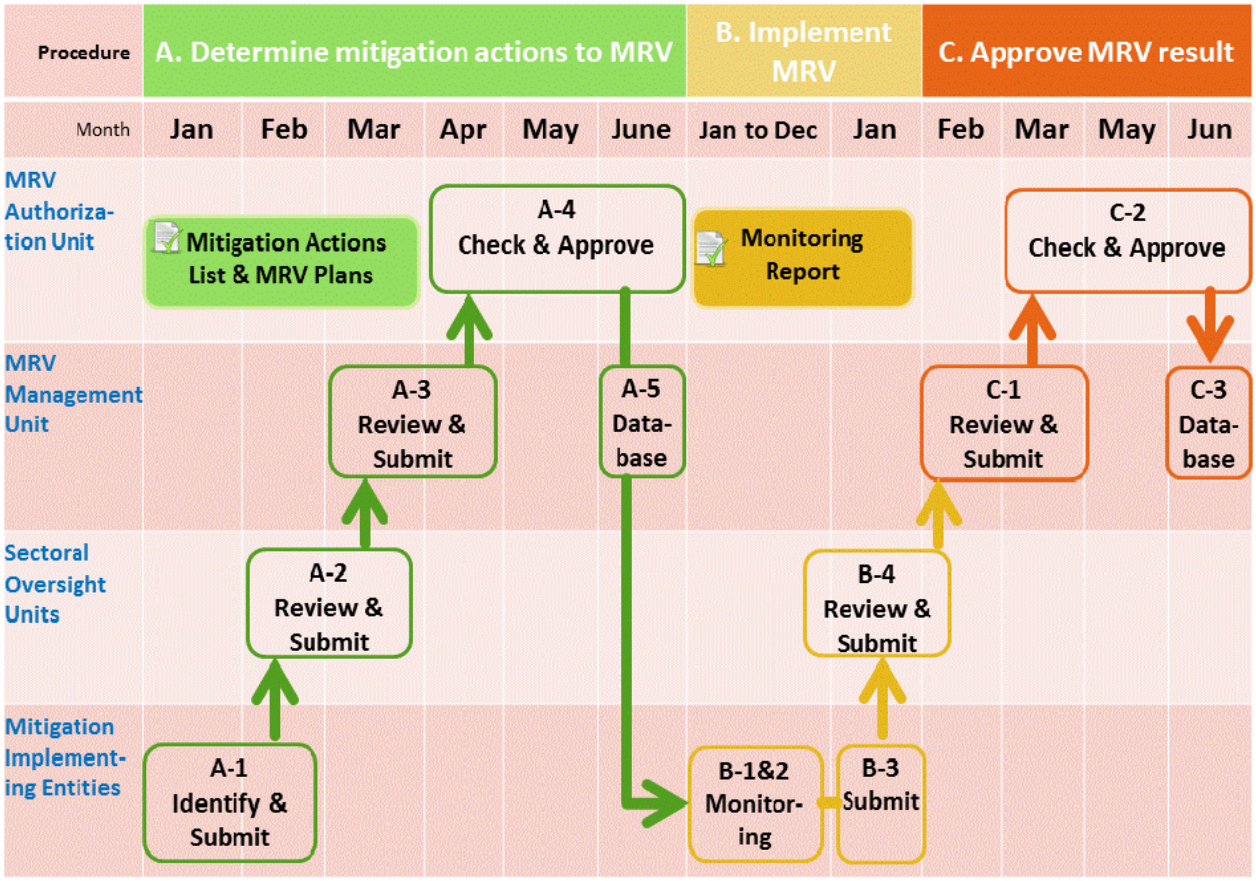
Chapter 3 provides steps by steps to implement MRV.

- Methodology and criteria to identify mitigation actions to MRV
- Implement MRV (Monitoring, Reporting, Verification)

Chapter 3. MRV process



Chapter 3. MRV Process



Chapter 3. MRV process

3-1. Define mitigation actions to MRV

3-1-1. Take stock of mitigation actions to MRV and develop MRV Plan

Pages: 25 – 37

This part instruct implementation entities to develop mitigation action list and MRV Plan

- Step 1 Preparing a long list of actions
- Step 2 Evaluating actions in accordance with the pre-defined criteria
- Step 3 Select actions to MRV and develop Mitigation Actions List

Chapter 3. MRV Process

3.1. Define mitigation actions to MRV

Responsible organization
Mitigation implementing entities

Take stock of mitigation actions to MRV and develop MRV Plan

- Step 1: Prepare a long list of potential mitigation actions
- Step 2: Evaluate/Select mitigation actions in accordance with the pre-defined criteria
  - Criterion 1: Mitigation Potential - Whether the action contributes to reduce GHGs?
  - Criterion 2: Practicability of MRV - Whether the action provides practical ways to MRV?
- Step 3: Select actions and develop Mitigation Actions List

No.	Name of mitigation action	Mitigation Implementing Entity	Location	MRV/Non-MRV
1		Entity A		MRV
2		Entity A		MRV
3		Entity A		Non-MRV
4		Entity A		MRV

Chapter 3. MRV process

3.1. Define mitigation actions to MRV

Responsible organization
Mitigation implementing entities

Prepare MRV plan

I. General information of the mitigation action
  a) Name of the mitigation action
  b) Involved organizations and their roles
  c) Objectives
  d) Technology introduced under the mitigation action
  e) Target GHG type
  f) Location
  g) Timeframe
  h) Cost of mitigation action
  i) Benefits of mitigation action and contribution to sustainable development
  j) Source of funding and supporting financial scheme
  k) Information on international market mechanisms
II. Emission reduction calculation, monitoring and reporting
  a) Logic of GHG emission reduction
  b) Methodology to calculate GHG emission reduction
  c) Estimated GHG emission reduction
  d) Organizational structure for monitoring and reporting
  e) Monitoring period
  f) Monitoring methods

Chapter 3. MRV process

3.1. Define mitigation actions to MRV

Responsible organization
Mitigation implementing entities

Prepare MRV Plan

Table 3-4 Major contents of methodology for GHG emission reduction calculation

Contents	Outline
Applicability	(A methodology contains) description/ explanation of what types of mitigation actions can use the methodology.
Logic of emission reduction	Describe how GHG emission is reduced through the mitigation action.
Formulae of emission reduction calculation	Show calculating formulae of baseline and project emission as well as emission reduction.
Monitoring method of necessary data for emission reduction calculation	Describe method for measurement/collection of each parameter in formulae for calculating baseline/project emission and emission reduction.

Table 3-5 Examples of existing methodologies

Title	Reference
Intergovernmental Panel on Climate Change (IPCC)	http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
Clean Development Mechanism (CDM)	http://cdm.unfccc.int/methodologies/index.html
Greenhouse Gas Protocol: GHG Protocol for Project Accounting	http://www.ghgprotocol.org/standards/project-protocol
International Finance Corporation (IFC) Greenhouse Gas Reduction Accounting Guidance for Climate Related Projects	http://www.ifc.org/
Gold Standard	http://www.goldstandard.org/
Joint Crediting Mechanism (JCM)	http://www.jcm.go.jp
Japan International Cooperation Agency (JICA)	http://www.jica.go.jp/english/our_work/climate_change/mitigation.html
Japan Bank for International Cooperation (JBIC)	http://www.jbic.go.jp/en/efforts/j-mrv

Chapter 3. MRV process

3-1. Define mitigation actions to MRV

3-1-2. Review Mitigation Actions List and MRV Plans

Page: 37

This part presented processes and criteria for Sectoral Oversight Units to review/check the mitigation actions list and MRV Plan

Chapter 3. MRV process

3.1. Define mitigation actions to MRV

Responsible organization:
Sectoral Oversight Units

Review Mitigation Actions List and MRV Plans

- Sectoral Oversight Unit examines Mitigation Actions List and MRV Plans submitted by Mitigation Implementing Entities.
- The example viewpoints of examination are as follows.
  - Whether there is lack in the submitted list/ detailed information
  - Whether the target, procedure and timing for MRV are clearly stated
  - Whether the target project can be expected to have GHG emission reductions
  - Whether the target project compliance with upstream, guiding plans/strategies
  - Whether the target project is MRV-able
- By the end of March, Sectoral Oversight Unit compiles all Mitigation Actions and MRV Plans of the sector as Sectoral Mitigation Actions List and MRV Plans and submits it to MRV Management Unit.

Table 3-6 Image of compiled Sectoral Mitigation Actions List

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	Location	MRV/Non-MRV
1	Energy		Unit AA	Entity A		MRV
2						MRV
3						Non-MRV
4				Entity B		MRV
5						MRV
6						MRV
7						MRV
8						Non-MRV
9				Entity C		MRV
10				Entity D		Non-MRV
...						

Chapter 3. MRV process

3-1. Define mitigation actions to MRV

3-1-3. Review Sectoral Mitigation Actions List and MRV Plans

Page: 38

This part presented process and criterion for MRV Management Unit to check mitigation actions list by sectors and MRV Plans submitted by Sectoral Oversight Units.

Chapter 3. MRV process

3.1. Define mitigation actions to MRV

Review Sectoral Mitigation Actions List and MRV Plans

Responsible Organization:
MRV Management Unit

- MRV Management Unit thoroughly examines the Sectoral Mitigation Actions List and MRV Plans submitted by Sectoral Oversight Units.
- The example viewpoints of examination are as follows.
  - Whether there is lack in the submitted list/ detailed information
  - Whether the target, procedure and timing for MRV are clearly stated
  - Whether the target project can be expected to have GHG emission reductions
  - Whether the target project is MRV-able
- By the end of April, MRV Management Unit compiles all Sectoral Mitigation Actions List and MRV Plans that will be MRV-ed in the next fiscal year, and submits it to MRV Authorization Unit with a recommendation for approval

Table 3-7 Image of Draft Mitigation Actions List

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	Location	Year of addition to the list	MRV/Non-MRV
1	Energy		Unit AA	Entity A		2016	MRV
2						2016	MRV
3						2017	Non-MRV
4				Entity B		2016	MRV
5						2016	MRV
6						2017	MRV
7						2017	MRV
8						2017	Non-MRV
9				Entity C		2016	MRV
10				Entity D		2017	Non-MRV
11	Transport		Unit BB	Entity E			MRV
12							Non-MRV
13				Entity F			MRV
14				Entity G			MRV
15	Waste		Unit CC	Entity H			MRV
...							

Chapter 3. MRV process

3-1. Define mitigation actions to MRV

3-1-4. Approve Draft Mitigation Actions List and MRV Plans

Page: 39

This part presented procedure for MRV Authorization Unit to approve mitigation actions list and MRV Plan submitted by MRV Management Unit.

Chapter 3. MRV process

3-1. Define mitigation actions to MRV

3-1-5. Update database on mitigation actions to MRV

Page: 39

This part presented procedure for MRV Management Unit to update database on mitigation actions to MRV

Responsible Organization :
MRV Authorization Unit

Approve Draft Mitigation Actions List and MRV Plans

- By the end of May, after receiving the Draft Mitigation Actions List and MRV Plans with a recommendation for approval, MRV Authorization Unit approves it as a Mitigation Actions List and MRV Plans.
- By the end of June, MRV Authorization Unit notifies the Mitigation Actions List and MRV Plans through MRV Management Unit to Sectoral Oversight Units

Responsible Organization:
MRV Management Unit

Update database on mitigation actions to MRV

- MRV Management Unit updates the database on mitigation actions to include the Mitigation Actions List and MRV Plans.

Table 3-8 An image of the database

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	Location	Year of addition to the list	MRV/Non-MRV	Emission reduction in year 1	Emission reduction in year 2
...	...	...	...	...	...	...	...	...	...
Total	-	-	-	-	-	-	-	XXXX	XXXX

Chapter 3. MRV process

3-2. Implement MRV

3-2-1. Collect/measure and record data (Monitoring)

Pages: 40-42

This part presented procedure for Mitigation Implementation Entities to conduct monitoring includes instruction to prepare monitoring sheet and calculation sheet and implement monitoring.

Responsible organization:
Mitigation Implementation Entities

Collect/measure and record data (Monitoring)

- Mitigation Implementing Entities conduct monitoring in accordance with respective MRV Plan, and prepare Monitoring Sheet every determined period such as monthly/ quarterly/bi-annually.
- Monitoring activity needs to be carried out at a designated method, procedure and period described in the respective approved MRV plan.
- Mitigation Implementing Entity monitors (through either direct measurement (monitoring) of parameters or data collection from operators such as bus companies) and collects all data (such as CO2 emission factors) that is necessary to calculate GHG emission reductions
- Mitigation Implementing Entity inputs all the collected and measured data and information into a Monitoring Sheet.
- Monitoring Sheet and GHG emission reduction calculation sheet need to be prepared for each mitigation action. Monitored data and its measurement method/ procedure are needed to be determined before implementing Monitoring activity.

Chapter 3. MRV process

3.2 Implement MRV

Prepare monitoring sheet

Table 3-9. Basic contents of Monitoring sheet

I. Information of the mitigation action
a) Name of the mitigation action
b) Sector
c) Mitigation Implementing Entity
d) Sectoral Oversight Unit
e) Name of the site
II. Results of monitoring
a) Monitoring year
b) Monitoring month
c) Creation date
d) Name of the person in charge
e) Monitoring results
f) Monitoring period

Monitoring sheet

Monitoring (Measurement) Sheet for Solr PV project

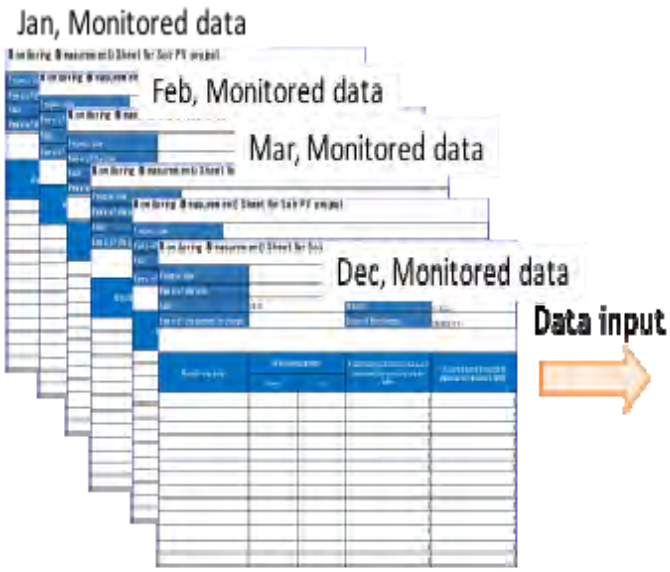
Project title	
Name of the site	
Name/ No. of the Monitoring Meter	
Starting date of Monitoring	
Name of the person in charge	

Monitoring period		Measured date	Electricty generation amount indicated by electric meter (kWh)	Accumulated electricty generation amount (kWh)
From	to			
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0
				0.0

Chapter 3. MRV process

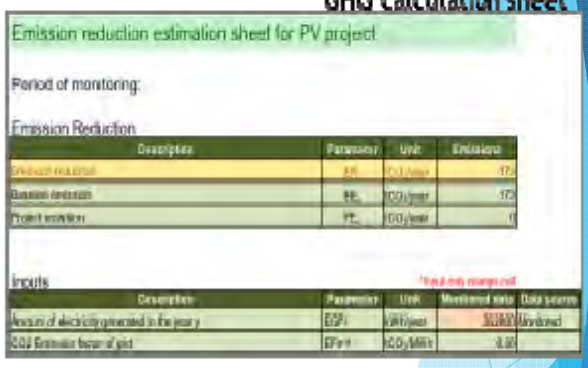
3.2 Implement MRV

Conduct monitoring



Data input

GHG calculation sheet



2017 Total

173 tons-CO_2

Chapter 3. MRV process

3-2. Implement MRV

3-2-2. Prepare and submit Mitigation Monitoring Reports

Pages: 42-43

This part presented the procedure and instruction for Mitigation implementation Entities to prepare and submit mitigation monitoring report

Responsible Organization:
Mitigation Implementation Entities

Prepare and submit Mitigation Monitoring Reports

- Mitigation Implementing Entities prepare Mitigation Monitoring Report using the data of the Monthly Monitoring Sheet and the results of GHG emission reduction calculations.
- The data of Monthly Monitoring Sheet, general information of the mitigation action needs to be included in the Mitigation Monitoring Report.
- Mitigation Implementing Entities conduct the GHG emission reduction calculation once a year by data in Monitoring sheet and GHG emission calculation sheet.
- Mitigation Implementing Entities submit the Mitigation Monitoring Report to Sectoral Oversight Unit by the end of January (once a year).

Table 3-10 Contents of Mitigation Monitoring Report

I. Monitoring period
II. Emission reductions of the monitoring period
III. Processes of the emission reduction calculation

Chapter 3. MRV process

3-2. Implement MRV

3-2-3. Review and submit Sectoral Monitoring Report

Page: 44

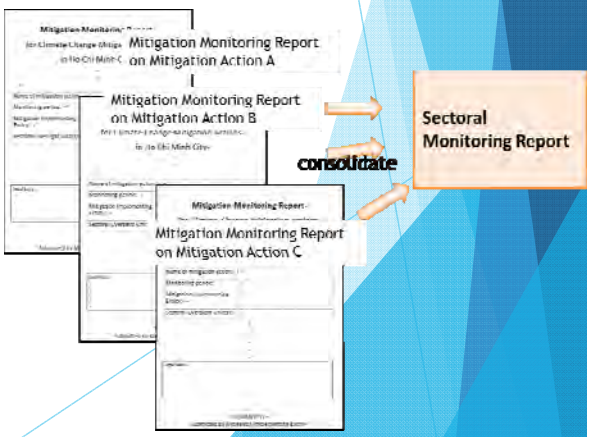
This part presented procedure and instruction for Sectoral Oversight Units to check mitigation monitoring report and consolidate into sectoral monitoring report.

Responsible organization:
Sectoral Oversight Units

Review and submit Sectoral Monitoring Report

- Sectoral Oversight Unit thoroughly reviews the submitted Mitigation Monitoring Reports. Following elements should be considered in examining the reports:
  - Whether there is lack of information in the submitted
  - Whether there is big gap between MRV plan and Mitigation Monitoring Report
- Sectoral Oversight Unit

consolidates the Mitigation Monitoring Reports as Sectoral Monitoring Report and then submits the Sectoral Monitoring Report to MRV Management Unit by the end of February (once a year).



Chapter 3. MRV process

3-3. Approve MRV result

3-3-1. Consolidate Sectoral Monitoring Reports

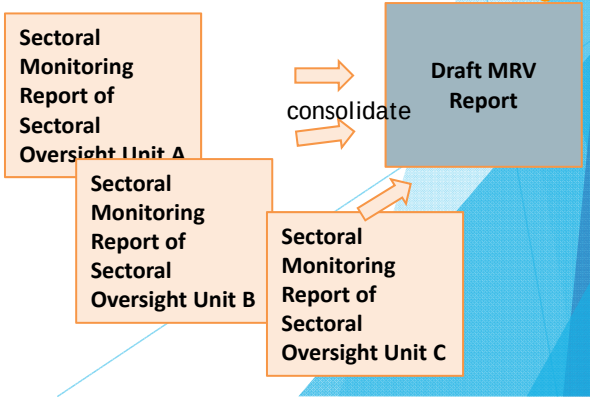
Pages: 45-46

This part presented procedure and instruction for MRV Management Unit to evaluate the Sectoral Monitoring reports and consolidate into Draft MRV Report and submit to MRV Authorization Unit.

Responsible organization:
MRV Management Unit

Consolidation of Sectoral Monitoring Reports

- MRV Management Unit examines Sectoral Monitoring Reports submitted by Sectoral Oversight Units. The example viewpoints of examination are as follows:
  - Whether there is lack of information/data in the submitted Sectoral Monitoring Report.
  - Whether MRV for the mitigation actions have been certainly implemented.
  - Whether GHG emission reduction is calculated accurately like in approved MRV Plan and data has been used is accuracy.
- MRV Management Unit consolidate Sectoral Monitoring Reports submitted by Sectoral Monitoring Reports into a Draft MRV Plan.
- By the end of March, MRV Management Unit submits consolidated Sectoral Monitoring Report to MRV Authorization Unit.



Chapter 3. MRV process

3.3. Approve MRV result

Responsible organization:
MRV Management Unit

Draft MRV Report

- Sector category
- Name of the mitigation action
- Sectoral Oversight Unit(s) and Mitigation Implementing Entity(ies)
- Brief description of the mitigation action
- Financial sources and cost size
- Emission reductions achieved by the mitigation action during the year
- Issues related to implementation of the mitigation action and MRV activity

Example of Draft MRV Report

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	MRV/ Non-MRV	GHG emission reductions (tCO_2e)
1	Energy		Unit AA	Entity A	MRV	
2					MRV	
3					Non-MRV	
4				Entity B	MRV	
5					MRV	
-		Sub-total				
6	Transport		Unit BB	Entity C	MRV	
7					Non-MRV	
8					MRV	
9				Entity D	MRV	
10					Non-MRV	
-		Sub-total				
11	Waste		Unit CC	Entity E	MRV	
12					MRV	
13				Entity F	MRV	
...					Non-MRV	
-		Sub-total				

Chapter 3. MRV process

3-3. Approve MRV result

3-3-2. Approve MRV reports

Page: 47

This part presented procedure for MRV Authorization Unit to approve MRV reports

Chapter 3. MRV process

3-3. Approve MRV result

3-3-3. Update database on mitigation actions to MRV

Page: 47

This part presented procedure for MRV Authorization Unit to update database on mitigation actions with data in approved MRV reports.

Responsible organization:
MRV Authorization Unit

Approve *Draft* MRV report

- By the end of May, MRV Authorization Unit checks the Draft MRV Report and then approve it as a MRV Report
- By the end of June, MRV Report are notified through MRV Management Unit to all concerned entities in HCMC as well as to MONRE.

Responsible organization:
MRV Management Unit

Update database on mitigation actions

- MRV Management Unit update the database of mitigation actions with data provided in approved MRV Report including calculated GHG emission reductions.

Annex

- **Annex 1: MRV Case studies**
  - **MRV Plan**
  - **Monitoring Report**
  - **GHG calculation sheet**

- Solar PV system installation on the roof top of the public building
- Introduction of air conditioning system with inverters to the office
- Replacement CFL to LED of the small street lamps
- Replacement to high energy efficient boilers at a dairy factory
- Introduction of CNG buses
- Eco-driving
- BRT (Bus Rapid Transit)
- Urban railway
- Collection and utilization of landfill gas at final disposal site
- Recycling of municipal solid waste
- Organic fertilizer production
- Animal manure management and biogas use

Annex

- Annex 2: Typical Mitigation Actions and Emission Reduction Logic
  - Generation of electricity
  - Factory
  - Commercial Buildings
  - Households
  - Cars/Motorbikes
  - Buses
  - Railway
  - Ships/vessels
  - Traffic Management
  - Freight transportation
  - Sea ports/Airports
  - Waste treatment/ Wastewater treatment

Annex 3

- Annex 3: Format of MRV Plan

MRV Plan

for Climate Change Mitigation Actions

in Ho Chi Minh City

Name of mitigation action:

Mitigation Implementing Entity:

Sectoral Oversight Unit(s):

Legal basis

DD/MM/YYYY

Submitted by Mitigation Implementing Entity

Table of Contents

1. General information of the mitigation action 1
1.1 Name of the mitigation action 1
1.2 Involved organizations and their roles 1
1.3 Objectives 1
1.4 Technology introduced under the mitigation action 1
1.5 Target GHG type 1
1.6 Location 1
1.7 Timeframe 1
1.8 Cost of mitigation action 2
1.9 Benefits of mitigation action and contribution to sustainable development 2
1.10 Source of funding and supporting financial scheme 2
1.11 Information on international market mechanisms 2
2. Emission reduction calculation, monitoring and reporting 3
2.1 Logic of GHG emission reduction 3
2.2 Methodology to calculate GHG emission reduction 3
2.3 Estimated GHG emission reduction 3
2.4 Organizational structure for monitoring and reporting 3
2.5 Monitoring period 3
2.6 Monitoring methods 3
Annex 4

Annex

- Annex 4: Format of Monitoring Report

Mitigation Monitoring Report

for Climate Change Mitigation Actions

in Ho Chi Minh City

Name of mitigation action:

Monitoring period:

Mitigation Implementing Entity:

Sectoral Oversight Unit(s):

Legal basis

DD/MM/YYYY

Submitted by Mitigation Implementing Entity

Table of Contents

1. Monitoring period 2
2. Emission reductions of the monitoring period 2
3. Processes of the emission reduction calculation 2
Annex 2

1

Project to Support the Planning and Implementation of NAMAs in a MRV Manner

Consultation Meeting on GHG Inventory Preparation Manual

12 July 2017

JICA Short-term Experts

Introduce

- GHG inventory experts of JICA short-term expert team
  - Mr. FUMIHIKO KUWAHARA
    - E-mail: kuwahara_fumihiko@sur.co.jp
- Local Consultants (Enerteam)
  - Ms. Tran Thi Yen Phuong
    - E-mail: phuong_tty@enerteam.org
  - Mr. Dang Van Dien
    - E-mail: dien_dv@enerteam.org

Table of Contents

- Chapter 1. Introduction
- Chapter 2. GHG Inventory Preparation Procedures
- Chapter 4. Data Sources
- Annex Data Collection Forms
- Chapter 3. Calculation Methods
- Chapter 5. Calculation
- Chapter 6. Reporting based on GPC
- GHG inventory calculation form (excel file)
- Questions and Answer Session

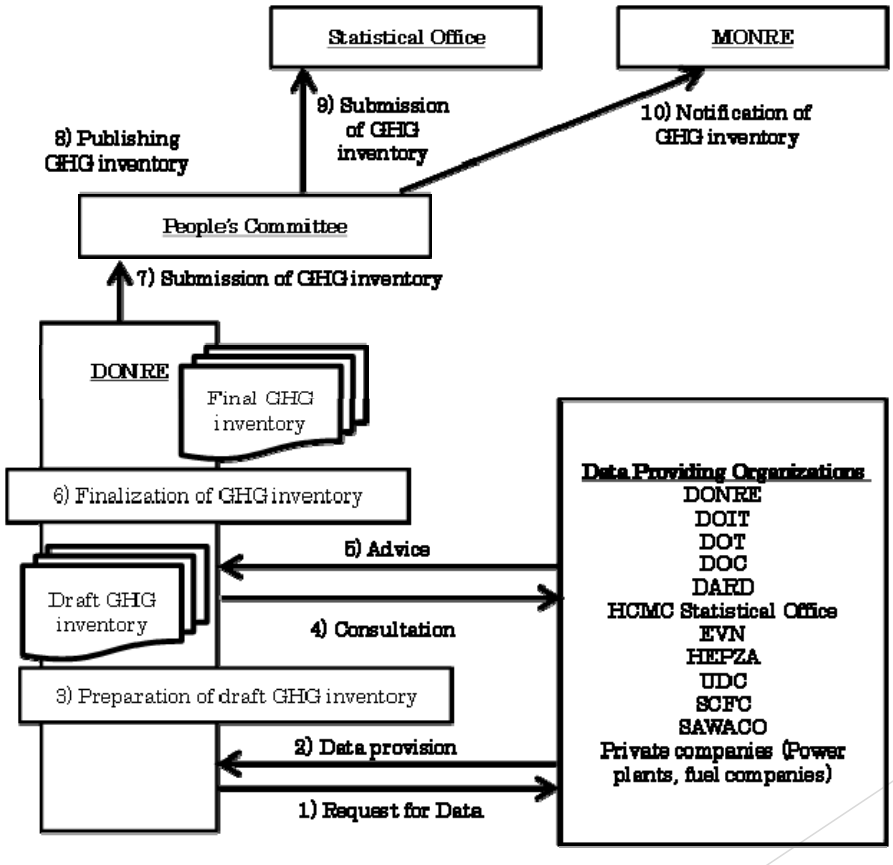
Chapter 1. Introduction

- 1.1 Terms and Definitions
  - GHG, Scope, Notation, Sector, etc.
- 1.2 Sector
  - Stationary Energy, Transportation, Waste
- 1.3 Basic Quantification Method
- 1.4 Calculation Flow
- 1.5 GWP
  - Confirmation of GWP values
- 1.6 QC and QA

Chapter 2. GHG Inventory Preparation Procedures

- 2.1 Overview
  - Institutional Arrangement for the GHG Inventory Preparation in HCMC
  - Preparation Flow of GHG Inventory
  - Roles and Responsibilities
  - Schedule of GHG Inventory Preparation

Chapter 2. GHG Inventory Preparation Procedures



Chapter 2. GHG Inventory Preparation Procedures

	Roles and Responsibilities
PC	Publish GHG inventory Submission of GHG inventory to MONRE
DONRE	Preparation of GHG inventory Preparation, confirmation, and approval of improvement plan on preparation of GHG inventory Performs actual work of GHG inventory compilation. Responsible for inventory calculations, compiling, and archiving and management of all data. Quality control
Data Providing Organizations	Data provision Quality control

Chapter 2. GHG Inventory Preparation Procedures

Preparation Year of GHG inventory: n (even number year) — For example — Preparation Year = 2018

Target Year of GHG inventory: n-2 (two year before) — Target Year = 2016

	Process	Relevant Organizations	Mar.	Apr	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
1	Preparation	DONRE	→	→							
2	Data request	DONRE			→						
3	Data preparation	Data Providing Organizations				→					
4	Data Collection	DONRE				→	→				
5	Preparation of draft GHG inventory	DONRE					→	→			
6	Checking draft GHG inventory	Data Providing Organizations						→	→		
7	Finalizing GHG inventory	DONRE							→		
8	Publishing GHG inventory	PC								→	→

Chapter 2. GHG Inventory Preparation Procedures

- 2.10 QC (add this session)
  - The common and fundamental QC activity on the preparation of GHG inventory is shown
- 2.11 QA
  - QA is review procedure conducted by personnel not directly involved in the inventory preparation process.

General QC (Quality Control), part1

Process of Data Collection and Entry Process of Activity Data Calculation	➢ Check for transcription errors in data entry and referencing ➢ Check the unit, since the persons in charge of data provider change, the new persons in charge might mistake the unit. For example, they might mistake the cubic meter for the liter. ➢ Check the completeness ➢ Check the accuracy of inventory data behavior from one processing step to the next ➢ Check time series consistency ➢ Check the trends on Activity Data
Process of EF and Parameter Setting	➢ Check EFs of past year ➢ Check time series consistency of EFs ➢ Check the local, regional or country-specific EFs ➢ Check the local, regional or country-specific parameters

General QC (Quality Control), part2

Process of Emission Calculation	➢ Check to see that emission units are accurately recorded ➢ Check to ensure that emissions are accurately calculated ➢ Check the connection between worksheets ➢ Check the conformity of files ➢ Check the accuracy of inventory data behavior from one processing step to the next ➢ Check the completeness ➢ Conduct comparisons with the past estimated values by checking the trends of emissions ➢ Check the link to other files
Others	➢ Consider the detailed data from other Data Providing Organizations, along the lines with sub-sector of GPC ➢ Confirm the definition of data collected from other Data Providing Organizations, because the data collected are sometimes not completely equal to the data required for GHG inventory. ➢ Consider the additional information on allocating emissions.

Chapter 4. Data Sources

- 4.1 Stationary Energy Sector
- 4.2 Transportation Sector
- 4.3 Waste Sector
- 4.4 IPPU Sector
- 4.5 AFOLU Sector

Summary of Data Sources

Provider	Sector	Main Provided Data
DOIT	Energy	Fuel Consumption
DOIT	Waste	Main Industrial outputs
EVN	Energy	Electricity Consumption
EVN	IPPU	SF6 of Electricity Equipment
DOC	IPPU	Cement (Kiln), Lime
DOC	Energy	Electricity Consumption
Statistical Office	Energy, Agriculture, Transportation	Agricultural Information
DONRE	Waste	Municipal Solid Waste, Sludge, Other Waste (Clinical Waste)
HEPZA	Waste	Wastewater
UDC	Waste	Sewage Treatment Plants
SCFC	Energy	Electricity Consumption
SAWACO	Energy	Electricity Consumption
DOT	Transportation	Number of Vehicle, Ships
DOT	Land Use	Number of Trees
DARD	Agriculture	Livestock, Rice cultivation, Agricultural Products
DONRE	LULUCF	Land Use and Land Use Change
DARD	LULUCF	Agricultural area

Example of Data Sources
(Residential Sub-sector)

Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Electricity	✓		EVN(Data Collection Form)	Information on consumption of sub-sector
Charcoal		✓		
Other Kerosene	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Fuel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Gasoline	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Gas		✓		
Coke coal		✓		
Coke gas		✓		
LPG	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Natural Gas	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Waste Oils		✓		
Peat		✓		
Wood/ Wood Waste		✓		
Other Liquid Biofuels		✓		
Other Biogas		✓		
Municipal Waste (biomass fraction)		✓		

Example of Data Sources
(Commercial Sub-sector part1)

Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Electricity consumption	✓		EVN(Data Collection Form)	Information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Information on consumption of sub-sector
	✓		SAWACO (Data Collection Form)	Information on consumption
	✓		UDC(Data Collection Form)	Information on consumption
	✓		SCFC(Data Collection Form)	Information on consumption
Charcoal	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
Other Kerosene	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Fuel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Gasoline		✓		
Gas		✓		

Example of Data Sources
(Commercial Sub-sector, part2)

Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Coke coal		✓		
Coke gas	✓		DOIT(Energy Intensity Monitoring Sheet)	Information on consumption of sub-sector
LPG	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Natural Gas	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Other Liquid Biofuels		✓		
Other Biogas		✓		
Municipal Waste (biomass fraction)		✓		

Example of Data Sources
(Manufacturing Sub-sector, part1)

Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Electricity consumption	✓		EVN(Data Collection Form)	Information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		HEPZA(Data Collection Form)	Information on consumption
Crude Oil		✓		
Orimulsion		✓		
Natural Gas Liquids		✓		
Other Kerosene	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Shale Oil		✓		
Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Fuel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
LPG	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Ethane		✓		
Ethane		✓		
Naphtha		✓		
Bitumen		✓		
Lubricants		✓		
Petroleum Coke		✓		
Refinery Feedstocks		✓		
Refinery Gas		✓		
Paraffin Waxes		✓		
White Spirit and SBP		✓		
Other Petroleum Products		✓		

Example of Data Sources
(Manufacturing Sub-sector, part2)

Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Anthracite		✓		
Coking Coal	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
Other Bituminous Coal		✓		
Sub-Bituminous Coal		✓		
Lignite		✓		
Oil Shale and Tar Sands		✓		
Brown Coal Briquettes		✓		
Patent Fuel		✓		
Coke Oven Coke and Lignite Coke		✓		
Gas Coke	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
Coal Tar		✓		
Gas Works Gas		✓		
Coke Oven Gas		✓		
Blast Furnace Gas		✓		
Oxygen Steel Furnace Gas		✓		
Natural Gas	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
	✓		World Energy Statistics (IEA)	Whole amounts in Vietname
Municipal Waste (non-biomass fraction)		✓		
Industrial Wastes		✓		
Waste Oils		✓		
Peat		✓		
Wood/ Wood Waste		✓		
Sulphite lyes (Black Liquor)		✓		
Other Primary Soiled Biomass		✓		
Charcoal	✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
Biogasoline		✓		
Biodiesels		✓		
Other Liquid Biofuels		✓		
Landfill Gas		✓		
Sludge Gas		✓		
Other Biogas		✓		
Municipal Waste (biomass fraction)		✓		

Example of Data Sources
(Agriculture Sub-sector)

Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Electricity consumption	✓		EVN(Data Collection Form)	Information on consumption of sub-sector
Charcoal		✓		
Other Kerosene	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Fuel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Gasoline	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Gas		✓		
Coke coal		✓		
Coke gas		✓		
LPG	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Natural Gas	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
	✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Other Liquid Biofuels		✓		
Other Biogas		✓		
Municipal Waste (biomass fraction)		✓		

Data Sources
(Transportation Sector, part1)

Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
On-road	Electricity		✓		
	Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
		✓		SCFC(Data Collection Form)	Information on consumption
		✓		DOT(Data Collection Form)	Information on consumption
		✓		UDC(Data Collection Form)	Information on consumption
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
	Gasoline	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
		✓		SCFC(Data Collection Form)	Information on consumption
		✓		DOT(Data Collection Form)	Information on consumption
		✓		UDC(Data Collection Form)	Information on consumption
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
	LPG	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
	Natural Gas	✓		Fuel Company(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
		✓		DOT(Data Collection Form)	Information on consumption
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname

Data Sources
(Transportation Sector, part2)

Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC	Note
Railways	Electricity		✓		
	Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Waterborn navigation	Electricity		✓		
	Diesel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
	Fuel Oil	✓		DOIT(Data Collection Form)	Whole amounts in HCMC and no information on consumption of sub-sector
		✓		DOIT(Energy Intensity Monitoring Sheet)	Sampling survey and Information on consumption of sub-sector
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
Aviation	Electricity		✓		
	Jet fuel	✓		DOIT(Data Collection Form)	Whole amounts in HCMC
		✓		World Energy Statictisc (IEA)	Whole amounts in Vietname
	Aviation Gasoline		✓		
Off-road	Electricity		✓		
	Diesel Oil		✓		
	Gasoline		✓		
	Fuel Oil		✓		

Data Sources
(Waste Sector)

Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC
Solid waste disposal	Site Opening and closing year and month	✓		DONRE(Data Collection Form)
	Site opening year, total capacity, and density conversion	✓		DONRE(Data Collection Form)
	Current waste in place and site closure date or capacity	✓		DONRE(Data Collection Form)
	Composition of waste going to solid waste disposal sites	✓		DONRE(Data Collection Form)
	Information on type of landfill site (managed, unmanaged, uncategorized, etc.)	✓		DONRE(Data Collection Form)
	Methane collected and removed in each landfill site		✓	
Biological treatment of waste	Mass of organic waste treated by biological treatment	✓		DONRE(Data Collection Form)
Incineratoin and open burning	Mass of waste incinerated	✓		DONRE(Data Collection Form)
	Information on type of incinerator	✓		DONRE(Data Collection Form)
	Population in HCMC	✓		Statistical Yearbook in HCMC
	Amounts of waste treated	✓		DONRE(Data Collection Form)
	Amounts of waste recycled		✓	
	Per capita waste generation	✓		National Environmental Report
Domestic wastewater treatment	City's population	✓		Statistical Yearbook in HCMC
	Fraction of population in income group i		✓	
	Degree of utilization (ratio) of treatment/ discharge pathway or system	✓		Environemt Survey Report
	Information on methane correction factor		✓	
	Organic componewnt removes as sludge		✓	
	Amount of methane recovered		✓	
Industrial Wastewater treatment	Amount of wastewater	✓		HEPZA(Data Collection Form)
	Information on methane correction factor		✓	
	Organic componewnt removes as sludge		✓	
	Amount of methane recovered		✓	

Data Sources
(IPPU Sector, Industrial Process)

Industrial Process				
Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC
Mineral Industry	Weight (mass) of clinker produced	✓		DOC(Data Collection Form)
	Weight (mass) of lime produced	✓		DOC(Data Collection Form)
	Mass of melted glass of type i (e.g. float, container, fiber glass, etc.)		✓	
Chemical Industry	Ammonia		✓	
	Nitric acid		✓	
	Adipic acid		✓	
	Caprolactam, glyoxal, and glyoxylic acid		✓	
	Carbide		✓	
	Titanium dioxide		✓	
	Soda ash		✓	
Metal Industry	All coke made onsite at iron and steel production facilities		✓	
	Iron and steel production	✓		Statistical Yearbook in HCMC
	Ferroalloy product type	✓		Statistical Yearbook in HCMC
	Aluminum production		✓	
	Magnesium production		✓	
	Total amount of magnesium casted or handled		✓	
	For HFC and other GHG gases, collect direct measurements or meaningful indirect data		✓	
	Lead products		✓	
	Zinc Production		✓	

Data Sources
(IPPU Sector, Product Use)

Product use				
Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC
Non-energy products from fuel and solvent use	Lubricants		✓	
	Paraffin waxes		✓	
	Bitumen; road oil and other petroleum diluents		✓	
	White spirit, kerosene, some aromatics		✓	
Emissions from the electrinic industry	Ethcing and CVD cleaning for semiconductors, liquid crystal displays and photovoltaic		✓	
	Heat transfer fluids		✓	
Fluorinated substitutes for ozone	Data on chemical sales by application		✓	
	Data on historic and current equipment sales		✓	
Other Product manufacture and use	Total SF6 consumption by equipment manufactures		✓	
	Total nameplate capacity of new equipment filled on site (not at the factory)		✓	
	Total nameplate capacity of installed equipment	✓		EVN(Data Collection Form)

Data Sources

(AFOLU Sector, Livestock Sub-sector)

Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC
Livestock	Dairy Cattle	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Other Cattle	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Buffalo	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Sheep	✓		DARD(Data Collection Form)
	Goats	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Camels		✓	
	Horses	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Mules and Asses		✓	
	Deer		✓	
	Alpacas		✓	
	Swine	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Poultry	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Other Cattle		✓	

Data Sources

(AFOLU Sector, Land Sub-sector)

Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC
Land	Forest Land Remaining Forest Land	✓		DONRE(Data Collection Form), DARD(Data Collection Form), Statistical Yearbook in HCMC
	Cropland Remaining Cropland: Paddy Land	✓		DONRE(Data Collection Form), DARD(Data Collection Form), Statistical Yearbook in HCMC
	Cropland Remaining Cropland: Perennial Crop Land	✓		DONRE(Data Collection Form), Statistical Yearbook in HCMC
	Cropland Remaining Cropland: Annual Crop Land	✓		DONRE(Data Collection Form), Statistical Yearbook in HCMC
	Before 2013: Grassland Remaining Grassland	✓		DONRE(Data Collection Form), Statistical Yearbook in HCMC
	After 2014: Grassland Remaining Grassland		✓	
	Wetlands Remaining Wetlands	✓		DONRE(Data Collection Form), Statistical Yearbook in HCMC
	Settlements Remaining Settlements	✓		DONRE(Data Collection Form), Statistical Yearbook in HCMC
	Other Land Remaining Other Land	✓		DONRE(Data Collection Form), Statistical Yearbook in HCMC
	Land Converted to Forest Land	✓		DONRE(Data Collection Form), DARD(Data Collection Form)
	Land Converted to Cropland: Paddy Land	✓ (2005, 2010, 2013)		DONRE(Data Collection Form)
	Land Converted to Cropland: Perennial Crop Land			
	Land Converted to Cropland: Annual Crop Land			
	Before 2013: Land Converted to Grassland			
	Land Converted to Wetlands			
	Land Converted to Settlements			
	Land Converted to Other Land			
	After 2014: Land Converted to Grassland		✓	

Data Sources
(AFOLU Sector, Others Sub-sector)

Sub-Sector	Required data	Data Collected in HCMC	Unavailable Data in HCMC	Data Source in HCMC
Aggregate sources and non-CO2 emission souces on land	Harvested Area of Rice	✓		DARD(Data Collection Form), Statistical Yearbook in HCMC
	Area of burnt land		✓	
	Amount of Calcic Limestone (CaCO3)		✓	
	Amount of Dolomite (CaMg(CO3)2)		✓	
	Amount of Urea Fertilization		✓	
	Amount of Organic N Fertilizer applied to Soil		✓	
	Amount of Managed Manure N applied to Soils		✓	
	Amount of urine and dung N deposited on pasure, range, paddock		✓	
	Amount of total sewage N applied to soils		✓	
	Amount of total compost N applied to soils		✓	
	Amount of other organic amendments usess as fertilizer		✓	
	Area of annual crop	✓		Statistical Yearbook in HCMC
	Annual crop production	✓		Statistical Yearbook in HCMC
	Amount of synthetic fertilizer N applied to soils		✓	
	Amount of animal manure, compost, sewage sludge, and other organic N additions applied to soils		✓	
	Annual amount of urine and dung N deposited by grazing animals on pasture, range and paddock		✓	

Annex Data Collection Forms

- Example of Data Collection Forms
  - Electricity Consumption
  - Fuel Consumption
  - Waste

Data Collection Form (Electricity Consumption part1)

DATA COLLECTION FORM
ENERGY SECTOR
(Attached in the document /DONRE-CCB date / /2016)

Sub-sector: Electricity consumption
Provider: EVN
Inventory Year: 20XX, 20XY

Table 1: Statistics of electricity consumption by the purpose

Sub-sector	Unit	20XX	20XY	Data Source
Residential	MWh /year			
Commercial and public service	MWh /year			
Industry (manufacturing and construction)				
Iron and steel	MWh /year			
Chemical	MWh /year			
Cement and building materials	MWh /year			
Foods and Tobacco	MWh /year			
Textile and Leather	MWh /year			
Paper, pulp and printing	MWh /year			
Construction	MWh /year			
Others	MWh /year			

Data Collection Form (Electricity Consumption part2)

Sub-sector	Unit	20XX	20XY	Data Source
Transport				
Road way	MWh /year			
River and seaway	MWh /year			
Water management				
Water supply station	MWh /year			
Drainage station	MWh /year			
Flood control station	MWh /year			
Waste management Solid waste collection and treatment	MWh /year			
Health				
Public hospital	MWh /year			
Private hospital	MWh /year			
Agriculture (Feedstock/ Farming/ Fishing)	MWh /year			
Tourism				
Restaurants	MWh /year			
Hotels	MWh /year			

Data Collection Form (Fuel Consumption part1)

DATA COLLECTION FORM

ENERGY SECTOR

(Attached in the document /DONRE-CCB date / /2016)

Sub-sector: Fuel consumption

Provider: DOIT

Inventory Year: 20XX, 20XY

Table 1: State of energy consumption by the purpose in year 20XX

	Data	Coal (…/yr)	Gasoline (…/yr)	Kerosene (…/yr)	DO (…/yr)	FO (…/yr)	LPG (…./yr)	Natural gas (…/yr)	Biomass (…/yr)	Biogas (…/yr)	Data Source
1	Residence										
2	Commerce + Public (building)										
3	Manufacture + construction										
3.1	Steel										
3.2	Chemicals										
3.3	Cement + construction materials										

Data Collection Form (Fuel Consumption part2)

	Data	Coal (…/yr)	Gasoline (…/yr)	Kerosene (…/yr)	DO (…/yr)	FO (…/yr)	LPG (…./yr)	Natural gas (…/yr)	Biomass (…/yr)	Biogas (…/yr)	Data Source
3.4	Food + Tobacco										
3.5	Textile + Leather										
3.6	Paper + Printing										
3.7	Construction										
3.8	Other										
4	Transportation										
4.1	Road										
4.2	River and sea way										
5	Water management										
5.1	Water supply station										
5.2	Drainage station										
5.3	Flood control station										
6	Waste management										

Data Collection Form (Fuel Consumption part3)

	Data	Coal (…/yr)	Gasoline (…/yr)	Kerosene (…/yr)	DO (…/yr)	FO (…/yr)	LPG (…./yr)	Natural gas (…/yr)	Biomass (…/yr)	Biogas (…/yr)	Data Source
6.1	Waste collection and treatment										
7	Health										
7.1	Public hospital										
7.2	Private hospital										
8	Agriculture										
8.1	Farming										
8.2	Feedstock										
8.3	Fishing										
9	Tourism										
9.1	Restaurant										
9.2	Hotel										

Data Collection Form (Solid Waste part1)

DATA COLLECTION FORM

WASTE SECTOR

(Attached in the document /DONRE-CCB date / /2016

Sub-sector: Solid waste being landfilled

Provider: Division of Solid Waste Management – DONRE

Inventory year: 20XX, 20XY

Table 1: Information on Solid Waste in HCMC

Type of waste	Unit	20XX	20XY	Data Source
The total amount of solid waste generated				
1) Municipal domestic solid waste	Ton/year			
2) Sludge waste	Ton/year			
- Industry	Ton/year			
- Domestic	Ton/year			
3) Solid waste from industry (non-hazardous waste)	Ton/year			
4) Hazardous waste	Ton/year			
5) Medical waste	Ton/year			
6) Others	Ton/year			

Data Collection Form (Solid Waste part2)

Type of waste	Unit	20XX	20XY	Data Source
The total amount of solid waste treated				
1) Municipal domestic solid waste	Ton/year			
2) Sludge waste	Ton/year			
- Industry	Ton/year			
- Domestic	Ton/year			
3) Solid waste from industry (non-hazardous)	Ton/year			
4) Hazardous waste	Ton/year			
5) Medical waste	Ton/year			
6) Others	Ton/year			

Data Collection Form (Solid Waste part3)

Type of waste	Unit	20XX	20XY	Data Source
The total amount of solid waste recycled and reused				
1) Municipal domestic solid waste	Ton/year			
2) Sludge waste	Ton/year			
- Industry	Ton/year			
- Domestic	Ton/year			
3) Solid waste from industry (non-hazardous)	Ton/year			
4) Hazardous waste	Ton/year			
5) Medical waste	Ton/year			
6) Others	Ton/year			

Chapter 3. Calculation Methods

- 3.1 Stationary Energy Sector
  - Electricity Consumption and Fuel Consumption
- 3.2 Transportation Sector
  - is same as the Stationary Energy Sector
- 3.3 Waste Sector
- 3.4 IPPU Sector
- 3.5 AFOLU Sector

Emissions from Electricity Consumptions

- $Emissions = Activity\ Data \times Emission\ Factor$

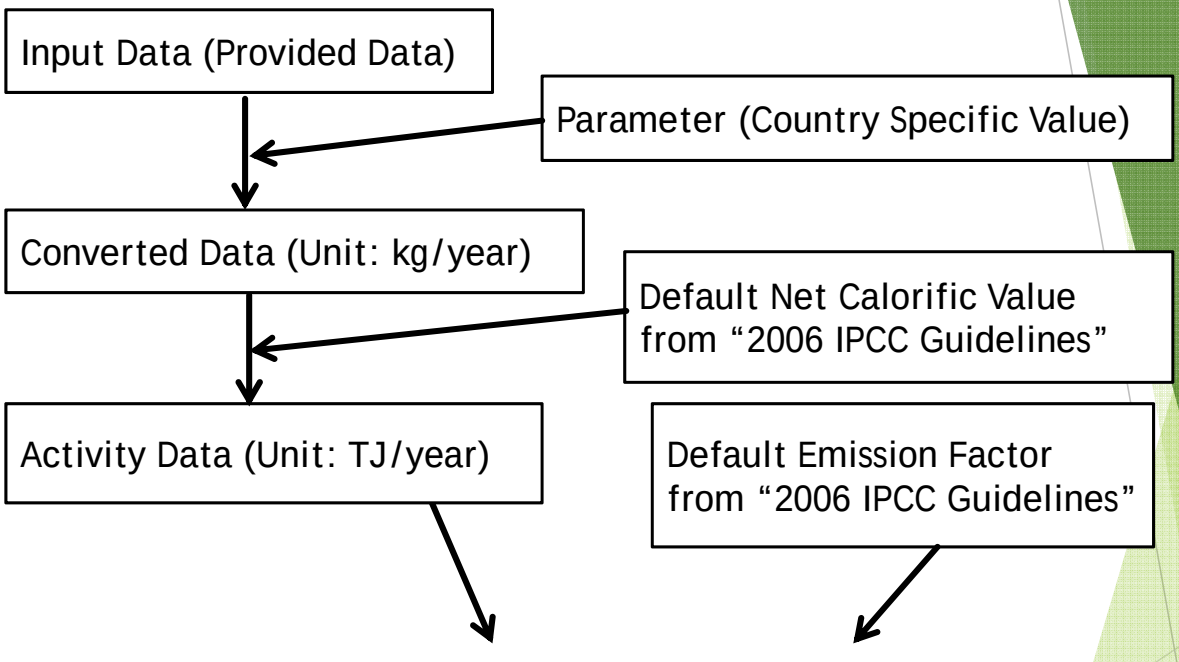
Electricity Consumption of each sub-sector as following
- Agriculture, Fishing and Forestry
- Manufacturing industries and Construction
- Commercial, Restaurant, Hotel
- Residential
- Others

Grid emission factor of electricity

Emission Factor is calculated by using information on the group of existing power plants supplying electricity to the grid in the target year.

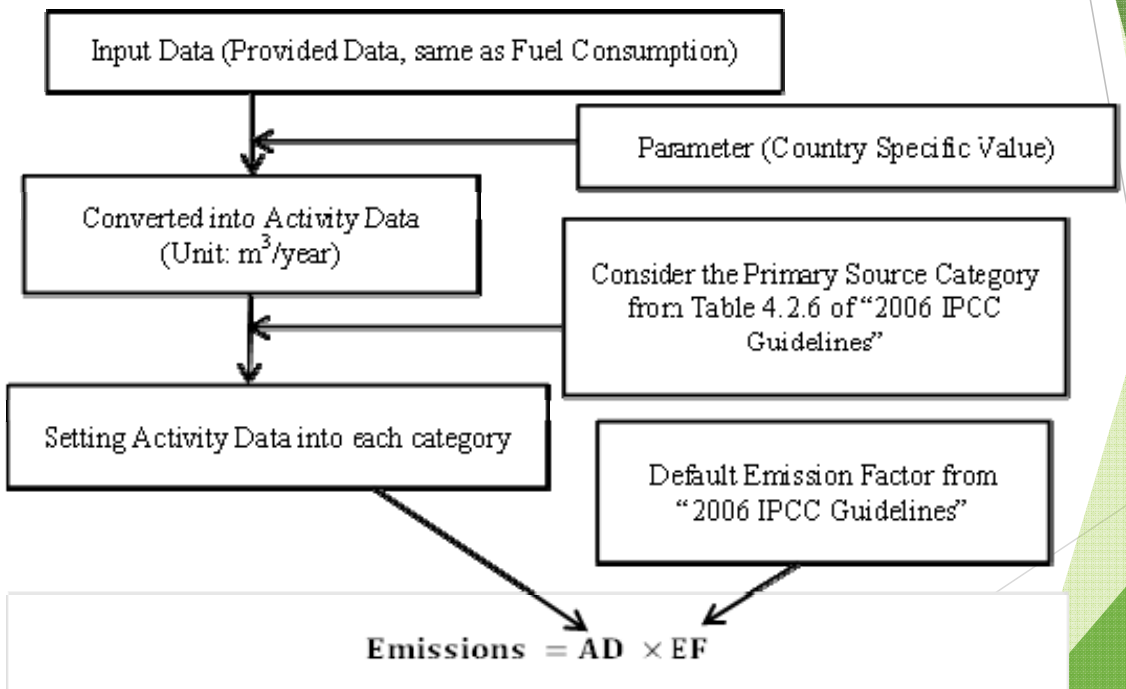
- Data Sources: Activity Data is EVN, Emission Factor is the official document in Vietnam.

Emissions from Fuel Consumptions



- $Emissions = Activity\ Data \times Emission\ Factor$
  - Activity Data is the fuel consumption in each subsector.
  - Country-specific Emission Factor should be used in the future.

Fugitive Emissions from Fuels



Waste Sector: FOD model (SWDS)

$$CH_4\ emissions = \left\{\sum_x \left[MSW_x \times L_0(x) \times \left(\left(1 - e^{-k}\right) \times e^{-k(t-x)}\right)\right] - R(t)\right\} \times (1 - OX)$$

CH_4	CH_4 emissions (tonne CH_4/year)
x	Landfill opening year or earliest year of historical data available
t	Inventory year
MSW_x	Total municipal solid waste disposed at SWDS in year x (tonnes/year)
R	Methane collected and removed in inventory year (tonnes CH_4/year)
L_0	Methane generation potential
k	Methane generation rate constant, which is related to the time taken for the DOC in waste to decay to half its initial mass (the "half-life") (refer "table 3.4" of 2006 IPCC Guidelines vol.3, chapter 3, p.3.17)
OX	Oxidation factor

Information is provided by DONRE and 2006 IPCC Guidelines.

Waste Sector: FOD model (SWDS)

Methane generation potential

$$L_0 = MCF \times DOC \times DOC_F \times F \times 16/12$$

L_0	Methane generation potential
MCF	Methane correction factor based on type of landfill site for the year of deposition (managed, unmanaged, etc.) (fraction), Managed = 1.0, Unmanaged (≥ 5 m deep) = 0.8, Unmanaged ($<$ 5m deep) = 0.5, Uncategorized = 0.6
DOC	Degradable organic carbon in year of deposition (tonnes C/tonnes waste)
DOC_F	Fraction of DOC that is ultimately degraded (reflects the fact that some organic carbon does not degrade)
F	Fraction of methane in landfill gas
16/12	Stoichiometric ratio between methane and carbon

Information is provided by DONRE and 2006 IPCC Guidelines.

Other Emission Sources on Waste Sector

- Biological Treatment of Solid Waste
  - $Emissions = Activity\ Data \times Emission\ Factor$
  - Activity Data is collected directly.
- Waste Incineration and Open Burning
  - $Emissions = Activity\ Data \times Emission\ Factor$
  - Activity Data is collected directly.
- Wastewater Treatment
  - $Emissions = Activity\ Data \times Emission\ Factor$
  - Activity Data is estimated by using population, information from HEPZA, and other information.

IPPU Sector

- Mineral Industry
- Chemical Industry
- Metal Industry
  - $Emissions = Activity\ Data \times Emission\ Factor$
  - Activity Data is collected directly.
- Product Use
  - SF6 emissions from electrical equipment
  - Equation adapted from 2006 IPCC Guidelines

AFOLU Sector

- Livestock
  - Enteric Fermentation, Manure management
- Aggregate Sources and non-CO2 emissions sources
  - Rice Cultivation, Biomass Burning and Liming Urea, Direct and Indirect N2O Emissions
- Land Use
  - Land Category: Forest land, Cropland, Grassland, Wetlands, Settlements, Other land
  - Carbon stock Changes on Carbon Pool: Biomass, Dead Organic Matter, and Soils
- Equation adapted from 2006 IPCC Guidelines

Chapter 5. Calculation

- 5.1 Stationary Energy Sector
  - 5.1.1 Electricity Consumption
  - 5.1.2 Fuel Consumption
  - 5.1.3 Fugitive Emissions from Fuel
- 5.2 Transportation Sector
  - is same as the Stationary Energy Sector
- 5.3 Waste Sector
  - 5.3.1 Solid Waste Disposal
  - 5.3.2 Biological Treatment of Solid Waste
  - 5.3.3 Incineration and Open Burning
  - 5.3.4 Wastewater Treatment and Discharge
- 5.4 IPPU Sector
- 5.5 AFOLU Sector

5.1.1 Calculation Process (Electricity Consumption)

- Activity Data

Electricity consumption	Unit	Year 2013	Year 2014	Year 2015
Agriculture, Fishing and Forestry sector	MWh/ year	48,520.254	61,811.746	67,128.218
Manufacturing industries and Construction	MWh/ year	7,186,161.416	7,557,369.663	8,094,021.380
Commercial, Restaurant, Hotel.	MWh/ year	2,254,535.866	2,378,573.402	2,622,860.896
Residential	MWh/ year	7,073,622.593	7,452,131.412	8,132,452.777
Others	MWh/ year	1,088,506.184	1,158,480.541	1,265,387.994
Total	MWh/ year	**17,651,346.313**	**18,608,366.764**	**20,181,851.265**

- Emission Factor

Grid Emission Factor	Unit	Year 2013	Year 2014	Year 2015
OM (Operating Margin EF)	ton-CO_2/MWh	0.7495	0.7802	0.7950

- Emissions

Emissions from Electricity consumption of each sector in HCMC	Unit	Year 2013	Year 2014	Year 2015
Agriculture, Fishing and Forestry sector	Gg CO_2/year	33	44	48
Manufacturing industries and Construction	Gg CO_2/year	4892	5425	5811
Commercial, Restaurant, Hotel	Gg CO_2/year	1535	1706	1883
Residential	Gg CO_2/year	4816	5350	5838
Others	Gg CO_2/year	741	832	908
Total	Gg CO_2/year	**12017**	**13357**	**14488**

Sector Specific QC (Electricity Consumption)

- Check the unit (kWh/year, MWh/year, or GWh/year, etc.).
- Confirm the definition of the classification of electricity consumption from the EVN, since the detailed sectors of EVN are not completely equal to the sub-sectors of GHG inventory.
- Generally, the electricity consumption is not so different from the past years, hence, the consistency and the trends of time series should be checked (e.g. mistakes in decimal point may be detected).
- The emission factor on electricity consumption varies every year.

5.1.2 Calculation Process (Fuel Consumption, part1)

- Data collected (Data Providing Organization: DOIT)

Bảng 6: Số lượng nhiên liệu bán ra tại TP.HCM:

STT	Loại nhiên liệu	Đơn vị (m3/năm)	2013	2014	2015	Nguồn số liệu
1	Xăng	m3/năm	3.582.529	3.687.417	4.160.437	
2	Dầu DO	m3/năm	3.328.293	3.909.982	5.002.386	
3	Dầu FO	m3/năm	404.333	418.625	489.335	
4	Dầu lửa	m3/năm	47.204	45.577	53.906	
5	Nhiên liệu bay	m3/năm	1.054.995	1.197.892	1.478.138	
6	Khí hóa lỏng (LPG)		B	B	B	
7	Khí thiên nhiên		B	B	B	
8	Khí nén (CNG)		B	B	B	
9	Than		B	B	B	

- Unit Conversion (m3year) → (ton/year) → (TJ/year)

Fuel type	Average (ton/m3)
Gasoline	0.73
Diesel	0.84
Fuel Oil	0.98
Kerosene	0.81
Jet fuel	0.81

Fuel Type	Unit	Net calorific value
Gasoline	TJ/Gg	44.3
Jet Kerosene	TJ/Gg	44.1
Other Kerosene	TJ/Gg	43.8
Diesel Oil	TJ/Gg	43.0
Fuel Oil	TJ/Gg	40.4
LPG	TJ/Gg	47.3
Natural Gas	TJ/Gg	48.0

5.1.2 Calculation Process (Fuel Consumption, part2)

- Activity Data

Fuel type	Unit	Year 2013	Year 2014	Year 2015
Gasoline	TJ/year	115855	119247	134544
Diesel	TJ/year	120218	141229	180686
Fuel Oil	TJ/year	15976	16540	19334
Kerosene	TJ/year	1664	1607	1901
Jet fuel	TJ/year	37569	42658	52638
LPG	TJ/year	2268	2246	2541
Natural Gas	TJ/year	1463	1441	1567

- Emission Factors

Fuel Type	CO_2 EF ($kg\ CO_2/TJ$)	CH_4 EF ($kg\ CH_4/TJ$)	N_2O EF ($kg\ N_2O/TJ$)
Gasoline	69300	10	0.6
Jet Kerosene	71500	10	0.6
Other Kerosene	71900	10	0.6
Diesel Oil	74100	10	0.6
Fuel Oil	77400	10	0.6
LPG	63100	5	0.1
Natural Gas	56100	5	0.1

5.1.2 Calculation Process (Fuel Consumption, part4)

- Emissions

Fuel type	Unit	Year 2013	Year 2014	Year 2015
Gasoline	Gg-CO2/year	8029	8264	9324
Diesel	Gg-CO2/year	8908	10465	13389
Fuel Oil	Gg-CO2/year	1237	1280	1496
Kerosene	Gg-CO2/year	120	116	137
Jet fuel	Gg-CO2/year	2686	3050	3764
LPG	Gg-CO2/year	143	142	160
Natural Gas	Gg-CO2/year	82	81	88
Total	Gg-CO2/year	20980	23175	28110

Sector Specific QC (Fuel Consumption)

- Check the unit (kg/year, ton/year, liter/year, or m^3/year, etc.).
- Check the conversion factors since these values are country specific values and sometimes change.
- Consider emission factors by collecting the information on the local, regional, or country-specific emission factors.
- Considering these country-specific values by using the information on the lower value and upper value of 2006 IPCC Guidelines.
- Considering the data sources of every type of fuel from departments or surveys such as the energy intensity monitoring, etc.).
- The fuel consumption in HCMC is generally not largely different from the previous year. The compiler should check the consistency and the trends of the time series.
- According to the economic growth, the fuel types consumed in HCMC might change.
- Fuel type collected by Data Providing Organization might change.
- Consider the additional information on allocating emissions.

5.1.3 Calculation Process on Fugitive Emissions from Fuels (part1)

- Considering Emission Sources
- Specific sources include, but are not limited to, equipment leaks, evaporation and flashing losses, venting, flaring, incineration, and accidental releases.
- The detailed activity is shown in 2006 IPCC Guidelines (table 4.2.6 and table 4.2.7, Chapter 4 Volume 2).
- Input Data (Collected Data)
  - Emission sources are gasoline, diesel, jet fuel, LPG, and natural gas. The source of the input data is the same as the fuel consumption

5.1.3 Calculation Process on Fugitive Emissions from Fuels (part2)

- First Step: the activity data on gasoline, diesel, and jet kerosene are set directly from input data by considering the number of digits.
- Second Step: the activity data of LPG (m^3/year) are obtained by dividing input data (ton/year) by conversion factor (kg/m^3).
- Third Step: the activity data of natural gas (m^3/year) are obtained by dividing the activity data of fuel consumption (TJ/year) by net calorific value (TJ/Gg) and conversion factor (kg/m^3).
- Conversion Factor

Natural Gas (CH4)	0.68	(kg/m^3)	:288.8K and 101.3kPa
LPG (C3H8)	2.54	(kg/m^3)	:288.8K and 101.3kPa

5.1.3 Calculation Process on Fugitive Emissions from Fuels (part3)

- Emission Factor

Category	Sub-category	Emission source	CO_2			CH_4			N_2O			Unit of measure
			Average	Lower	Upper	Average	Lower	Upper	Average	Lower	Upper	
Gas Distribution	All	All		5.10E-05	1.40E-04		1.10E-03	2.50E-03	ND	ND	ND	Gg per 10^4 m^3 of utility sales
Natural Gas Liquids Transport	Condensate	All	7.20E-06			1.10E-03			ND	ND	ND	Gg per 10^3 m^3 Condensate and Pentanes Plus
	Liquefied Petroleum Gas	All	4.30E-04			NA	NA		2.20E-09			Gg per 10^3 m^3 LPG
	Liquefied Natural Gas	All	ND	ND	ND	ND	ND	ND	ND	ND	ND	Gg per 10^4 m^3 of marketable gas
Refined Product Distribution	Gasoline	All	NA	NA	NA	NA	NA	NA	NA	NA	NA	Gg per 10^3 m^3 product transported
	Diesel	All	NA	NA	NA	NA	NA	NA	NA	NA	NA	Gg per 10^3 m^3 product transported
	Aviation Fuel	All	NA	NA	NA	NA	NA	NA	NA	NA	NA	Gg per 10^3 m^3 product transported
	Jet Kerosen	All	NA	NA	NA	NA	NA	NA	NA	NA	NA	Gg per 10^3 m^3 product transported

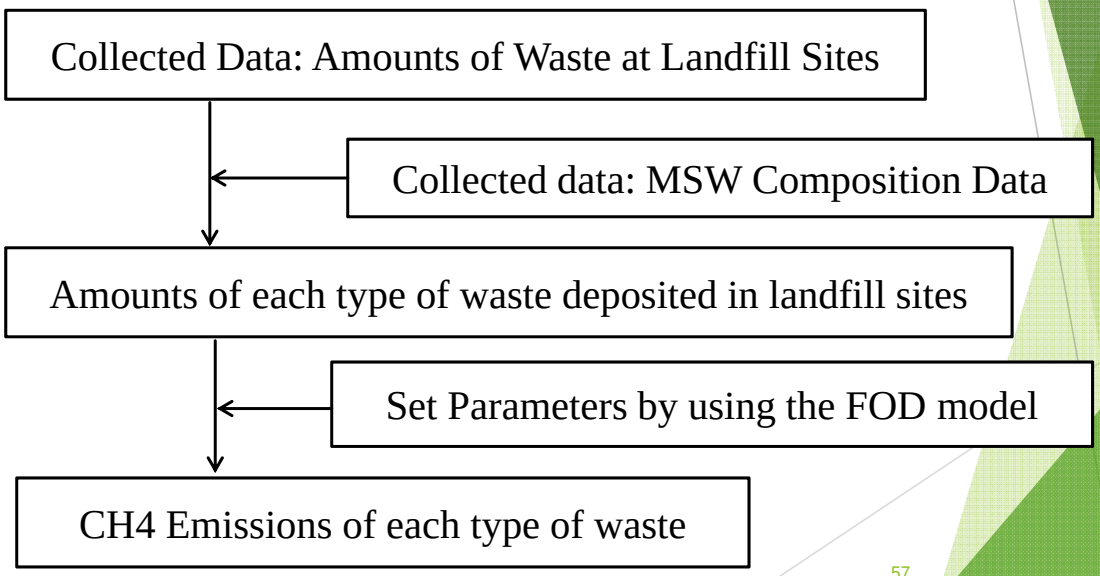
5.1.3 Calculation Process on Fugitive Emissions from Fuels (part3)

- Emissions

Category	Sub-category	Emission source	Unit	Year 2013	Year 2014	Year 2015
Gas Distribution	All	All	Gg CO_2/year	0.0063	0.0062	0.0067
Natural Gas Liquids Transport	Condensate	All	Gg CO_2/year	NO	NO	NO
	Liquefied Petroleum Gas	All	Gg CO_2/year	8.1253	8.0453	9.1031
	Liquefied Natural Gas	All	Gg CO_2/year	NO	NO	NO
Refined Product Distribution	Gasoline	All	Gg CO_2/year	NA	NA	NA
	Diesel	All	Gg CO_2/year	NA	NA	NA
	Aviation Fuel	All	Gg CO_2/year	NA	NA	NA
	Jet Kerosen	All	Gg CO_2/year	NA	NA	NA

5.3.1 Solid Waste Disposal

- The following figure is the outline of GHG emissions from solid waste disposal site.



5.3.1 Input Data on SWDSs

Landfill	Phước Hiệp 1	Phước Hiệp (1A)	Phước Hiệp (2)	Phước Hiệp (3)	Gò Cát	Đông Thạnh	Đa Phước	Data Source
Opening year	1/2003	02/2007	02/2008	10/2013	01/2001	1991	11/2007	DONRE
Closing year	5/2006	02/2008	10/2013		7/2007	2002		DONRE
Characteristic:								DONRE
1) Unmanaged – deep ≥ 5m								DONRE
2) Unmanaged – deep < 5m						x		DONRE
3) Managed – anaerobic	x	x	x	x	x		x	DONRE
4) Managed – semi -aerobic								DONRE
Total area of landfill (m^2)	160,000	97,500	195,000	195,000	250,000	250,000	1,280,000	DONRE
Density burial (mg/m^3)								DONRE
Total capacity (ton)	2,607,704	900,000	2,700,000		5,600,000	10,800,000	24,000,000	DONRE
Operating capacity according years (ton)								DONRE
+ Year 2013	Stop receiving waste	Stop receiving waste	920,432	308,038	Stop receiving waste	Stop receiving waste	1,098,675	DONRE
+ Year 2014			Stop receiving	1,018,319			1,145,913	DONRE
+ Year 2015			Stop receiving	248,189			1,815,490	DONRE

5.3.1 Parameter on MSW Composition Data

MSW Composition	Year 2013	Year 2014	Year 2015
Food waste	60.70%	60.70%	60.70%
Paper/ cardboard	6.87%	6.87%	6.87%
Wood	0.00%	0.00%	0.00%
Textiles	0.69%	0.69%	0.69%
Rubber/leather	0.25%	0.25%	0.25%
Plastic	25.21%	25.21%	25.21%
Metal	0.69%	0.69%	0.69%
Glass	0.00%	0.00%	0.00%
Others	5.59%	5.59%	5.59%
Total	100%	100%	100%

5.3.1 Parameters (part1)

	IPCC default value		Using Value	Country-specific value
	Range	Default value	Value	Reference and remarks
Starting year		1950	1991	
DOC (Degradable organic carbon)	(weight fraction, wet basis)			
Food waste	0.08-0.20	0.15	0.15	
Garden	0.18-0.22	0.2	0.2	=0.17; National Inventory
Paper	0.36-0.45	0.4	0.4	
Wood and straw	0.39-0.46	0.43	0.43	=0.3 ; National Inventory
Textiles	0.20-0.40	0.24	0.24	=0.4 ; National Inventory
Disposable nappies	0.18-0.32	0.24	0.24	
Sewage sludge	0.04-0.05	0.05	0.05	

5.3.1 Parameters (part2)

	IPCC default value		Using Value	Country-specific value
	Range	Default value	Value	Reference and remarks
Industrial waste	0-0.54	0.15	0.15	=0.17; National Inventory
DOCf (fraction of DOC dissimilated)		0.5	0.5	
Methane generation rate constant (k) (years-1)				
Food waste	0.17–0.7	0.4	0.4	=0.2 ; National Inventory
Garden	0.15–0.2	0.17	0.17	=0.03; National Inventory
Paper	0.06–0.085	0.07	0.07	=0.03; National Inventory
Wood and straw	0.03–0.05	0.035	0.035	=0.03; National Inventory
Textiles	0.06–0.085	0.07	0.07	=None; National Inventory
Disposable nappies	0.15–0.2	0.17	0.17	=None; National Inventory
Sewage sludge	0.17–0.7	0.4	0.4	=None; National Inventory

5.3.1 Parameters (part3)

	IPCC default value		Using Value	Country-specific value
	Range	Default value	Value	Reference and remarks
Industrial waste	0.15–0.2	0.17	0.17	=0.13; National Inventory
Delay time (months)		6	6	
Fraction of methane (F) in developed gas		0.5	0.5	
Conversion factor, C to CH4		1.3333	1.3333	
Oxidation factor (OX)		0	0	
Parameters for carbon storage				
% paper in industrial waste		0	0	
% wood in industrial waste		0	0	

5.3.1 CH4 Emissions from SWDSs on Food Waste

Năm/Year	Số lượng thải bỏ/ Amount deposited	MCF	DDOCm được thải bỏ/ Decomposable DOC (DDOCm) deposited	DDOC không phản ứng. Năm thải bỏ/ DDOC not reacted. Deposition year	DDOCm đã phân hủy. Năm thải bỏ/ DDOCm decomposed. Deposition year	DDOCm tích lũy trong bãi chôn lấp ở năm cuối/ DDOCm accumulated in SWDS end of year	DDOCm đã phân hủy/ DDOCm decomposed	CH4 sinh ra/ CH4 generated
	w	MCF	D = w * DOC * DOCf *MCF	B = D * exp2	C = D * (1-exp2)	H = B + ($H_{last\ year}$ * exp1)	E = C + ($H_{last\ year}$ * (1-exp1))	Q = E * 16/12 * F
	Gg	fraction	Gg	Gg	Gg	Gg	Gg	Gg
1991	573.03	0.4	17.19	17.19	0	17.19	0	0
1992	573.03	0.4	17.19	17.19	0	28.71	5.67	3.78
1993	573.03	0.4	17.19	17.19	0	36.43	9.47	6.31
1994	573.03	0.4	17.19	17.19	0	41.61	12.01	8.01
1995	573.03	0.4	17.19	17.19	0	45.08	13.72	9.15
1996	573.03	0.4	17.19	17.19	0	47.41	14.86	9.91
1997	573.03	0.4	17.19	17.19	0	48.97	15.63	10.42
1998	573.03	0.4	17.19	17.19	0	50.01	16.15	10.77
1999	573.03	0.4	17.19	17.19	0	50.71	16.49	10.99
2000	573.03	0.4	17.19	17.19	0	51.18	16.72	11.15
2001	1114.63	0.69154	57.81	57.81	0	92.12	16.87	11.25
2002	1114.63	0.69154	57.81	57.81	0	119.56	30.37	20.25
2003	1027.54	1	77.07	77.07	0	157.21	39.42	26.28
2004	1027.54	1	77.07	77.07	0	182.45	51.83	34.55
2005	1027.54	1	77.07	77.07	0	199.37	60.15	40.1
2006	744.08	1	55.81	55.81	0	189.45	65.73	43.82
2007	917.39	1	68.8	68.8	0	195.79	62.46	41.64
2008	998.93	1	74.92	74.92	0	206.16	64.55	43.03
2009	929.98	1	69.75	69.75	0	207.94	67.97	45.31
2010	929.98	1	69.75	69.75	0	209.13	68.56	45.71
2011	886.6	1	66.5	66.5	0	206.68	68.95	45.97
2012	886.6	1	66.5	66.5	0	205.04	68.14	45.43
2013	1412.58	1	105.94	105.94	0	243.38	67.6	45.07
2014	1313.69	1	98.53	98.53	0	261.67	80.24	53.49
2015	1252.65	1	93.95	93.95	0	269.35	86.27	57.51

5.3.1 Total CH4 Emissions from SWDSs

Năm/ Year	Mêtan phát thải/ Methane generated											Phát thải mêtan/ Methane emissions
	Thực phẩm/ Food	Chất thải vườn/ Garden	Giấy/ Paper	Gỗ/ Wood	Vải/Textile	Tã lót/ Nappies	Bùn thải/ Sludge	Chất thải rắn đô thị/ MSW	Chất thải công nghiệp/ Industrial	Tổng/ Total	Mê tan thu hồi / Methane Recovery	
	A	B	C	D	E	F	Gg	H	J	K	L	M = (K-L) * (1 - OX)
	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg	Gg
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
1992	3.78	0.00	0.24	0.08	0.06	0.00	0.00		0.00	4.16	0.00	4.16
1993	6.31	0.00	0.46	0.15	0.11	0.00	0.00		0.00	7.03	0.00	7.03
1994	8.01	0.00	0.67	0.23	0.16	0.00	0.00		0.00	9.07	0.00	9.07
1995	9.15	0.00	0.86	0.29	0.21	0.00	0.00		0.00	10.51	0.00	10.51
1996	9.91	0.00	1.04	0.37	0.25	0.00	0.00		0.00	11.57	0.00	11.57
1997	10.42	0.00	1.21	0.43	0.29	0.00	0.00		0.00	12.35	0.00	12.35
1998	10.77	0.00	1.36	0.49	0.33	0.00	0.00		0.00	12.95	0.00	12.95
1999	10.99	0.00	1.51	0.55	0.37	0.00	0.00		0.00	13.42	0.00	13.42
2000	11.15	0.00	1.65	0.61	0.40	0.00	0.00		0.00	13.81	0.00	13.81
2001	11.25	0.00	1.77	0.67	0.43	0.00	0.00		0.00	14.12	0.00	14.12
2002	20.25	0.00	2.45	0.91	0.60	0.00	0.00		0.00	24.21	0.00	24.21
2003	26.28	0.00	3.09	1.14	0.75	0.00	0.00		0.00	31.26	0.11	31.15
2004	34.55	0.00	3.95	1.45	0.97	0.00	0.00		0.00	40.92	0.23	40.69
2005	40.10	0.00	4.75	1.75	1.16	0.00	0.00		0.00	47.76	0.71	47.06
2006	43.82	0.00	5.49	2.04	1.34	0.00	0.00		0.00	52.69	1.10	51.59
2007	41.64	0.00	5.89	2.22	1.44	0.00	0.00		0.00	51.19	0.94	50.25
2008	43.03	0.00	6.45	2.45	1.57	0.00	0.00		0.00	53.50	0.78	52.72
2009	45.31	0.00	7.05	2.71	1.73	0.00	0.00		0.00	56.80	0.25	56.55
2010	45.71	0.00	7.54	2.93	1.84	0.00	0.00		0.00	58.02	0.19	57.83
2011	45.97	0.00	8.00	3.15	1.95	0.00	0.00		0.00	59.07	0.25	58.82
2012	45.43	0.00	8.36	3.04	1.88	1.73	0.00		0.00	60.44	0.15	60.29
2013	45.07	0.00	8.70	2.94	1.81	3.18	0.00		0.00	61.70	0.11	61.59
2014	53.49	0.00	9.55	2.83	1.77	5.43	0.00		0.00	73.07	0.20	72.87
2015	57.51	0.00	10.25	2.74	1.73	7.14	0.00		0.00	79.37	0.16	79.21

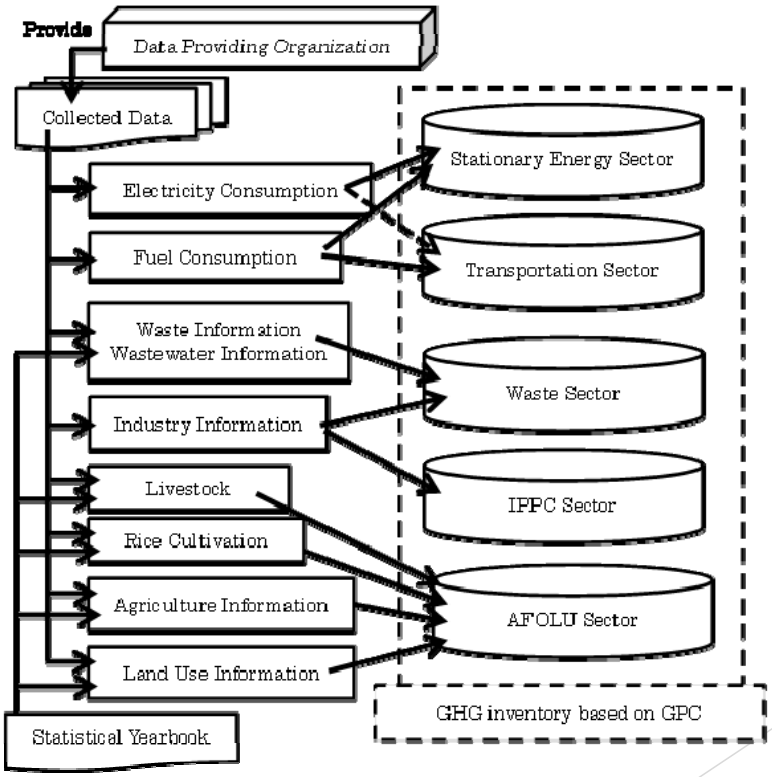
Sector Specific QC (SWDSs)

- Check the unit (kg/year, ton/year, liter/year, or m3/year, etc.)
- The opening and closing information on the disposal sites is important.
- Check and consider the information on the composition of waste going to solid waste disposal sites in each year, since the ratio of the component of solid waste may change over the time.
- Check to see that parameters and emission units are accurately recorded, and that proper conversion factors are used.
- Consider the local, regional or country-specific parameters.
- Check the management situation of each landfill site and value of MCF.
- Check the Oxidation factor and amounts of CH4 collected and removed.
- Consider the waste generated outside of the city boundary and treated within the boundary.
- Consider the waste generated and treated within the city's boundary.
- Consider the waste generated inside the boundary and treated outside of the boundary.

Chapter 6. Reporting based on GPC

- 6.1 Stationary Energy Sector
- 6.2 Transportation Sector
- 6.3 Waste Sector
- 6.4 IPPU Sector
- 6.5 AFOLU Sector

Chapter 6. Reporting based on GPC



6.1.1 Basic Concepts on Emissions Re-categorization Method on Electricity Consumption

Whole Data	Total emissions of each Sub-sector	Detailed information
EVN	Residential Emissions from Residential of EVN	<Unspecified emissions> All
	Commercial Emissions from Commercial, Restaurant, and Hotel of EVN Emissions from Others of EVN	<Specified emissions> Energy Intensity Monitoring Sewage Treatment Plants Infrastructure Equipment such as pump
		<Unspecified emissions> Remainder
	Manufacturing Emissions from Manufacturing industries and Construction of EVN	<Specified emissions> Energy Intensity Monitoring Industrial Zone
		<Unspecified emissions> Remainder
	Agriculture Emissions from Agriculture, Fishing and Forestry of EVN	<Unspecified emissions> All

6.1.1 GHG inventory (Electricity Consumption)

I. Lĩnh vực năng lượng cố định/ Stationary Energy Sector						
GPC ref No.	Phạm vi/ Scope					
I.1		Tòa nhà dân cư/ RESIDENTIAL BUILDINGS	Unit	Year 2013	Year 2014	Year 2015
I.1.1	1		GgCO2/năm (year)			
I.1.2	2	Phát thải từ tiêu thụ điện lưới trong thành phố/ Emissions from Grid-Supplied Energy Consumed (Electricity) within the city boundary	GgCO2/năm (year)	4816	5350	5838
I.1.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện/ Transmission and Distribution Loss Emissions from Grid-Supplied Energy Consumed (Electricity)	GgCO2/năm (year)	239	270	295
I.2		Tòa nhà thương mại, tòa nhà hành chính công và cơ sở hạ tầng/ COMMERCIAL and INSTITUTIONAL BUILDINGS and FACILITIES				
I.2.1	1		GgCO2/year			
I.2.2	2	Phát thải từ tiêu thụ điện lưới trong thành phố/ Emissions from Grid-Supplied Energy	GgCO2/năm (year)	1535	1706	1883
I.2.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện/ Transmission and	GgCO2/năm (year)	76	86	95
I.3		Sản xuất công nghiệp và xây dựng/ MANUFACTURING INDUSTRIES and CONSTRUCTION				
I.3.1	1		GgCO2/năm (year)			
I.3.2	2	Phát thải từ tiêu thụ điện lưới trong thành phố/ Emissions from Grid-Supplied Energy	GgCO2/năm (year)	4892	5425	5811
I.3.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện/ Transmission and	GgCO2/năm (year)	243	274	293
I.4		Công nghiệp năng lượng/ ENERGY INDUSTRIES				
I.4.1	1		GgCO2/năm (year)			
I.4.2	2	Phát thải từ tiêu thụ điện lưới trong thành phố/ Emissions from Grid-Supplied Energy	GgCO2/năm (year)	0	0	0
I.4.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện/ Transmission and	GgCO2/năm (year)	0	0	0
I.4.4	1		GgCO2/năm (year)			
I.5		Nông nghiệp, lâm nghiệp và thủy sản/ AGRICULTURE, FORESTRY and FISHING ACTIVITIES				
I.5.1	1		GgCO2/năm (year)			
I.5.2	2	Phát thải từ tiêu thụ điện lưới trong thành phố/ Emissions from Grid-Supplied Energy	GgCO2/năm (year)	33	44	48
I.5.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện/ Transmission and	GgCO2/năm (year)	2	2	2
I.6		Những nguồn không cụ thể/ NON-SPECIFIED SOURCES				
I.6.1	1		GgCO2/năm (year)			
I.6.2	2	Phát thải từ tiêu thụ điện lưới trong thành phố/ Emissions from Grid-Supplied Energy	GgCO2/năm (year)	741	832	908
I.6.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện/ Transmission and	GgCO2/năm (year)	37	42	46

6.1.2 IEA Data on Fuel Consumption

	Natural Gas	LPG	Gasoline	Kerosene	Diesel	Fuel Oil
ıtionary Energy Sector						
I.1 Residential Sub-sector	0%	55%	0%	74%	1%	1%
I.2 Commercial Sub-sector	0%	30%	0%	14%	4%	1%
I.3 Manufacturing Sub-sector	100%	15%	0%	12%	16%	86%
I.4 Energy Industries Sub-sector	---	---	---	---	---	---
I.5 Agriculture Sub-sector	0%	0%	2%	0%	5%	1%
I.6 Non-Specified Sources	0%	0%	0%	0%	0%	0%
ansportation Sector						
II.1 On-Road Transportation Sub-sector	0%	0%	98%	0%	74%	0%
II.2 Railways Sub-sector	0%	0%	0%	0%	0%	0%
II.3 Waterborne Navigation Sub-sector	0%	0%	0%	0%	0%	11%
II.4 Aviation Sub-sector	0%	0%	0%	0%	0%	0%
II.5 Off-Road Transportation Sub-sector	0%	0%	0%	0%	0%	0%

6.1.2 Basic Concepts on Emissions Re-categorization Method on Diesel Consumption

Whole Data	Total emissions of each Sub-sector	Detailed information
DOIT	Residential Emissions from DOIT data by using IEA data (refer to Table 6-6)	<Unspecified emissions> All
	Commercial Emissions from DOIT data by using IEA data (refer to Table 6-6)	<Specified emissions> Energy Intensity Monitoring
		<Unspecified emissions> Remainder
	Manufacturing Emissions from DOIT data by using IEA data (refer to Table 6-6)	<Specified emissions> Energy Intensity Monitoring
		<Unspecified emissions> Remainder
	Agriculture Emissions from DOIT data by using IEA data (refer to Table 6-6)	<Unspecified emissions> All
	On-Road Transport Emissions from DOIT data by using IEA data (refer to Table 6-6)	<Specified emissions> Energy Intensity Monitoring MOCPT
		<Unspecified emissions> Remainder
Thermal Power Plants	Energy Industry	<Specified emissions> All

6.1.3 GHG inventory (Fuel Consumption, CO2)

I. Lĩnh vực năng lượng cố định/ Stationary Energy Sector						
GPC ref No.	Phạm vi/ Scope					
I.1		**Tòa nhà dân cư/ RESIDENTIAL BUILDINGS**	Đơn vị/ Unit	Year 2013	Year 2014	Year 2015
I.1.1	1	Phát thải từ đốt cháy nhiên liệu trong thành phố/ Emission from fuel combustion within the city boundary	GgCO2/năm (year)	268.9	281.39	338.23
I.1.2	2	Phát thải từ đốt cháy nhiên liệu ngoài thành phố/ Emission from fuel combustion without the city boundary	GgCO2/năm (year)			
I.1.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện lưới/ Emission from transmission and distribution losses from grid-supplied energy consumption	GgCO2/năm (year)			
I.2		**Tòa nhà thương mại, tòa nhà hành chính công và cơ sở hạ tầng/ COMMERCIAL and INSTITUTIONAL BUILDINGS and FACILITIES**	Đơn vị/ Unit			
I.2.1	1	Phát thải từ đốt cháy nhiên liệu trong thành phố/ Emission from fuel combustion within the city boundary	GgCO2/năm (year)	428.36	500.91	617.67
I.2.2	2	Phát thải từ đốt cháy nhiên liệu ngoài thành phố/ Emission from fuel combustion without the city boundary	GgCO2/năm (year)			
I.2.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện lưới/ Emission from transmission and distribution losses from grid-supplied energy consumption	GgCO2/năm (year)			
I.3		**Sản xuất công nghiệp và xây dựng/ MANUFACTURING INDUSTRIES and CONSTRUCTION**	Đơn vị/ Unit			
I.3.1	1	Phát thải từ đốt cháy nhiên liệu trong thành phố/ Emission from fuel combustion within the city boundary	GgCO2/năm (year)	2490.89	41160.18	3440.21
I.3.2	2	Phát thải từ đốt cháy nhiên liệu ngoài thành phố/ Emission from fuel combustion without the city boundary	GgCO2/năm (year)			
I.3.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện lưới/ Emission from transmission and distribution losses from grid-supplied energy consumption	GgCO2/năm (year)			
I.4		**Công nghiệp năng lượng/ ENERGY INDUSTRIES**	Đơn vị/ Unit			
I.4.1	1	Phát thải từ đốt cháy nhiên liệu trong thành phố/ Emission from fuel combustion within the city boundary	GgCO2/năm (year)	0	0	0
I.4.2	2	Phát thải từ đốt cháy nhiên liệu ngoài thành phố/ Emission from fuel combustion without the city boundary	GgCO2/năm (year)			
I.4.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện lưới/ Emission from transmission and distribution losses from grid-supplied energy consumption	GgCO2/năm (year)			
I.4.4	1	Phát thải từ việc phát điện cấp lên lưới/ Emissions from enegry generation supplied to the grid	GgCO2/năm (year)	10263	12323	523
I.5		**Nông nghiệp, lâm nghiệp và thủy sản/ AGRICULTURE, FORESTRY and FISHING**	Đơn vị/ Unit			
I.5.1	1	Phát thải từ đốt cháy nhiên liệu trong thành phố/ Emission from fuel combustion within the city boundary	GgCO2/năm (year)	605.98	688.53	855.93
I.5.2	2	Phát thải từ đốt cháy nhiên liệu ngoài thành phố/ Emission from fuel combustion without the city boundary	GgCO2/năm (year)			
I.5.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện lưới/ Emission from transmission and distribution losses from grid-supplied energy consumption	GgCO2/năm (year)			
I.6		**Những nguồn không cụ thể/ NON-SPECIFIED SOURCES**	Đơn vị/ Unit			
I.6.1	1	Phát thải từ đốt cháy nhiên liệu trong thành phố/ Emission from fuel combustion within the city boundary	GgCO2/năm (year)	0	0	0
I.6.2	2	Phát thải từ đốt cháy nhiên liệu ngoài thành phố/ Emission from fuel combustion without the city boundary	GgCO2/năm (year)			
I.6.3	3	Phát thải do thất thoát trong quá trình truyền tải và phân phối điện lưới/ Emission from transmission and distribution losses from grid-supplied energy consumption	GgCO2/năm (year)			

6.1.2 GHG inventory (Fugitive Emissions from Fuels)

I. Lĩnh vực năng lượng cố định dựa trên GPC/ STATIONARY ENERGY Sector based on GPC

Nguồn phát thải CO2: Tiêu thụ nhiên liệu/ CO2 Emission Source: Fuel Consumption

I.7 Phát thải phát tán từ khai khoáng, quá trình, lưu trữ và vận chuyển than/ FUGITIVE EMISSIONS from MINING, PROCESSING, STORAGE and TRSANPORTATION of Coal

GPC ref No.	Phạm vi/	Nguồn phát thải KNK: phát thải CO2/ GHG Emission Sources: CO2 Emissions					
		Hoạt động/ Activity	Mô tả/ Description	Đơn vị/ Unit	Year 2013	Year 2014	Year 2015
I.7.1	**1**	**Sự phát thải từ việc đốt cháy nhiên liệu trong thành phố/ Emissions from Fuel Consumed within the city boundary**		GgCO2/năm (year)			

I.8 Phát thải phát tán từ hệ thống khí tự nhiên và dầu/ FUGITIVE EMISSIONS from OIL and NATURAL GAS SYSTEM

GPC ref No.	Phạm vi/	Nguồn phát thải KNK: phát thải CO2/ GHG Emission Sources: CO2 Emissions					
		Hoạt động/ Activity	Mô tả/ Description	Đơn vị/ Unit	Year 2013	Year 2014	Year 2015
I.8.1	**1**	**Sự phát thải từ việc đốt cháy nhiên liệu trong thành phố/ Emissions from Fuel Consumed within the city boundary**		GgCO2/năm (year)	8.1316	8.0515	9.1098

6.3 GHG inventory (Waste Sector (SWDSs))

Lĩnh vực chất thải theo GPC/ Waste Sector based on GPC

III.1 Thải bỏ chất thải rắn/ SOLID WASTE DISPOSAL

GPC ref No.	Phạm vi/ Scope	Ngồn phát thải KNK/ GHG emission Sources			Đơn vị/ Unit	Năm 2013 Year 2013
		Hoạt động/ Activity	Loại chất thải/ Waste type	Mô tả/ Description		
III.1.1	**1**	**Phát thải do chất thải rắn phát sinh trong thành phố và được thải bỏ vào bãi chôn lấp hoặc bãi rác hở trong thành phố/ Emissions from solid waste generated in the city and disposed in landfills or open dumps within the city**				
III.1.1	1	Bãi chôn lấp/ Landfills	Municipal Solid Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	1295.70
III.1.1	1	Bãi chôn lấp/ Landfills	Industrial Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.00
III.1.1	1	Bãi rác hở/ Open Dumps	Municipal Solid Waste	Đang xem xét/ Considering	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	
III.1.1	1	Bãi rác hở/ Open Dumps	Industrial Waste	Đang xem xét/ Considering	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	

6.3 GHG inventory (Waste Sector (Biological Treatment))

Lĩnh vực chất thải theo GPC/ Waste Sector based on GPC

III.2 Xử lý chất thải bằng phương pháp sinh học/ BIOLOGICAL TREATMENT of Waste

GPC ref No.	Phạm vi/ Scope	Nguồn phát thải GHG/ GHG emission Sources			Đơn vị/ Unit	Năm 2013 Year 2013
		Hoạt động/ Activity	Loại rác/ Waste type	Mô tả/ Description		
III.2.1	**1**	**Phát thải do chất thải rắn phát sinh trong thành phố và được xử lý bằng phương pháp sinh học trong thành phố/ Emissions from solid waste generated in the city that is treated biologically in the city**				
III.2.1	1	Composting	Chất thải rắn đô thị/ Municipal Solid Waste	Phát thải CH4/ CH4 Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	11.82
III.2.1	1	Xử lý bằng phương pháp phân hủy kị khí tại các thiết bị công trình khí sinh học/ Anarobic digestion at biogas facilities	Chất thải rắn đô thị/ Municipal Solid Waste	Phát thải CH4/ CH4 Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.00
III.2.1	1	Composting	Chất thải rắn đô thị/ Municipal Solid Waste	Phát thải N2O/ N2O Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	13.083
III.2.1	1	Xử lý bằng phương pháp phân hủy kị khí tại các thiết bị công trình khí sinh học/ Anarobic digestion at biogas facilities	Chất thải rắn đô thị/ Municipal Solid Waste	Phát thải N2O/ N2O Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	NA

6.3 GHG inventory (Waste Sector (Incineration, Open Burning))

Lĩnh vực chất thải theo GPC/ Waste Sector based on GPC

III.3 Lò đốt và đốt lộ thiên/ INCINERATION and OPEN BURNING

GPC ref No.	Phạm vi/ Scope	Nguồn phát thải khí nhà kính/ GHG emission Sources			Đơn vị/ Unit	Năm 2013 Year 2013
		Hoạt động/ Activity	Loại chất thải/ Waste type	Mô tả/ Description		
III.3.1	**1**	**Phát thải do chất thải phát sinh và được xử lý trong thành phố/ Emissions from waste generated and treated within the city**				
III.3.1	1	Lò đốt/ Incinerator	Chất thải rắn đô thị/ Municipal Solid Waste		Gg-CO_2/ năm (Gg-CO_2/year)	0.00
III.3.1	1	Lò đốt/ Incinerator	Chất thải rắn đô thị/ Municipal Solid Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.00
III.3.1	1	Lò đốt/ Incinerator	Chất thải rắn đô thị/ Municipal Solid Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.000
III.3.1	1	Lò đốt/ Incinerator	Chất thải y tế/ Clinical Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	NA
III.3.1	1	Lò đốt/ Incinerator	Chất thải y tế/ Clinical Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.01
III.3.1	1	Lò đốt/ Incinerator	Chất thải y tế/ Clinical Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.116
III.3.1	1	Đốt lộ thiên/ Open burning	Chất thải rắn đô thị/ Municipal Solid Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	0.91
III.3.1	1	Đốt lộ thiên/ Open burning	Chất thải rắn đô thị/ Municipal Solid Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	30.44
III.3.1	1	Đốt lộ thiên/ Open burning	Chất thải rắn đô thị/ Municipal Solid Waste		Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	10.370

6.3 GHG inventory (Waste Sector (Wastewater Treatment))

Lĩnh vực chất thải dựa trên GPC/ Waste Sector based on GPC

III.4 Xử lý nước thải và thải bỏ/ WASTEWATER TREATMENT and DISCHARGE

GPC ref No.	Phạm vi/ Scope	Nguồn phát thải KNK/ GHG emission Sources			Đơn vị/ Unit	Năm 2013 Year 2013
		Hoạt động/ Activity	Loại chất thải/ Waste type	Mô tả/ Description		
III.4.1	**1**	**Phát sinh do nước thải phát sinh và xử lý trong thành phố/ Emissions from wastewater generated and treated within the city**				
III.4.1	1	Nhà máy xử lý nước thải tập trung bằng công nghệ hiếu khí/ Centralized aerobic wastewater treatment plants	Nước thải sinh hoạt/ Domesitic wastewater	CH4	Gg-CO_2e/ năm (Gg-CO_2e/year)	0.00
III.4.1	1		Nước thải sinh hoạt/ Domesitic wastewater	N2O: Tất cả phát thải N2O từ dò ng nước thải xả vào môi trường/ All indirect N_2O emissions from wastewater effluent	Gg-CO_2e/ năm (Gg-CO_2e/year)	146.196
III.4.1	1	Hầm tự hoại/ Septic tanks	Nước thải sinh hoạt/ Domesitic wastewater	CH4	Gg-CO_2e/ năm (Gg-CO_2e/year)	583.18
III.4.1	1		Nước thải sinh hoạt/ Domesitic wastewater	N2O: "IE" (Được dự đoán ở những nhà máy xử lý tập trung bằng công nghệ hiếu khí)/ estimated in Centralized aerobic wastewater treatment plants)	Gg-CO_2e/ năm (Gg-CO_2e/year)	
III.4.1	1	Không được xử lý/ Untreatment	Nước thải sinh hoạt/ Domesitic wastewater	CH4	Gg-CO_2e/ năm (Gg-CO_2e/year)	1.87
III.4.1	1		Nước thải sinh hoạt/ Domesitic wastewater	N2O: "IE" (Được dự đoán ở những nhà máy xử lý tập trung bằng công nghệ hiếu khí)/ estimated in Centralized aerobic wastewater treatment plants)	Gg-CO_2e/ năm (Gg-CO_2e/year)	
III.4.1	1	Nước thải công nghiệp/ Industrial wastewater	Nước thải công nghiệp/ Industrial wastewater	CH4	Gg-CO_2e/ năm (Gg-CO_2e/year)	1.37

6.4 GHG Inventory (IPPU Sector (SF6 Emissions))

IV.2 Sử dụng sản phẩm/ PRODUCT USE

GPC ref No.	Phạm vi/ Scope	Hoạt động/ Activity	Mô tả/ Description	Đơn vị/ Unit	Năm 2013 Year 2013
IV.2	**1**	**Phát thải từ sử dụng sản phẩm trong thành phố/ Emissions from Product Use Occuring within the City Boundary**			
IV.2	1	Các sản phẩm phi năng lượng từ việc sử dụng dung mô	Phát thải CO_2/ CO_2 Emissions	$GgCO_2$/năm ($GgCO_2$/year)	
IV.2	1	Phát thải từ công nghiệp điện tử/ Emissions from the el	Phát thải HFCs / HFCs Emissions	$GgCO_2$/năm ($GgCO_2$/year)	
IV.2	1		Phát thải PFCs/ PFCs Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	
IV.2	1		Phát thải SF_6/ SF_6 Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	
IV.2	1		Phát thải NF_3/ NF_3 Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	
IV.2	1	Phát thải từ các chất flo thay thế cho các chất làm suy giảm tầng ozone/ Emissions from fluorinated substitues for ozone depleting substances	Phát thải HFCs/ HFCs Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	
IV.2	1		Phát thải PFCs/ PFCs Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	
IV.2	1	Phát thải từ quá trình sản xuất và sử dụng sản phẩm/ Emissions from other product manufacture and use	Phát thải PFCs/ PFCs Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	
IV.2	1		Phát thải SF_6 / SF_6 Emissions	Gg-CO_2e/ năm (Gg-CO_2e/year)	0.87

6.5 GHG Inventory (AFOLU Sector (Livestock))

V. NÔNG NGHIỆP, LÂM NGHIỆP, VÀ SỬ DỤNG ĐẤT KHÁC/ AFOLU

V.1 VẬT NUÔI/ LIVESTOCK

GPC ref No.	Phạm vi/ Scope	Nguồn phát thải khí nhà kính: phát thải CH_4 và N_2O/			
		Hoạt động/ Activity	Mô tả/ Description	Đơn vị/ Unit	Năm 2013 Year 2013
V.1	**1**	**Phát thải từ vật nuôi/ Emissions from Livestock**			
V.1	1	Quá trình tiêu hóa thức ăn/ Enteric fermentation	Phát thải CH_4/ CH_4 Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	236.67
V.1	1	Quản lý chất thải vật nuôi/ Manure Management	Phát thải CH_4/ CH_4 Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	102.69
V.1	1	Quản lý chất thải vật nuôi/ Manure Management	Phát thải N_2O/ N_2O Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	33.57

6.5 GHG Inventory (AFOLU Sector (Rice Cultivation))

V. NÔNG NGHIỆP, LÂM NGHIỆP, VÀ SỬ DỤNG ĐẤT KHÁC/ AFOLU

V.3 NGUỒN TỔNG HỢP/ AGGREGATE SOURCES

GPC ref No.	Phạm vi/ Scope	Nguồn phát thải khí nhà kính: phát thải CH_4 GHG Emission Sources: CH_4 Emissions			
		Hoạt động/ Activity	Mô tả/ Description	Đơn vị/ Unit	Năm 2013 Year 2013
V.3	**1**	**Phát thải từ nguồn tổng hợp và các nguồn phát thải không phải CO_2 trên đất Emissions from aggregate sources and non-CO2 emission sources on land**			
V.3	1	Canh tác lúa Rice cultivations	Phát thải CH_4/ CH_4 Emissions	Gg-CO_2 tương đương/năm (Gg-CO_2e/year)	65.10

資料 4
最終セミナー資料

Project to Support the Planning and Implementation of NAMAs in a MRV Manner

Overview of Activities in HCMC

Final Seminar

26 October 2017

Background and Objectives

Project to Support the Planning and Implementation of NAMAs in a MRV Manner (SPI-NAMA)

- SPI-NAMA started in January 2015 with MONRE and JICA Long-Term Experts
- HCMC selected as model city of Project and started activities with JICA Short-Term Expert Team from October 2015

Project Framework

Project Purpose: Capacity of the Government of Vietnam concerning the planning and implementation of NAMAs is enhanced.
Output 1: Capacity of MONRE to facilitate the process of development and implementation of NAMAs is enhanced.
Output 2: Capacity of the line ministries and *other stakeholders* to plan and implement NAMAs is enhanced.

Feedback

Activities

1. GHG Inventory
   - ✓ Preparation of GHG inventory of HCMC
   - ✓ Training on GHG inventory preparation
   - ✓ Drafting of manual
2. MRV of Mitigation Measures
   - ✓ Piloting of MRV on selected mitigation measures
     Focus: energy, transport and waste sectors
   - ✓ Drafting of manual
3. Capacity Building on Climate Change Mitigation
   - ✓ Training in HCMC and Japan

Institutionalization of GHG inventory and MRV

Implementation Structure

JICA Short-Term Expert Team
JV of three consulting companies
- Pacific Consultants
- Oriental Consultants Global
- Suuri-Keikaku

HCMC
DONRE-CCB

Local Consultants
- RCEE-NIRAS JSC with ENERTEAM
- Private Consultants

Departments and Organizations of HCMC
Statistical Office
Public Companies

Achievements

1. GHG Inventory

(1) Prepared 2013 GHG inventory of HCMC based on:

a.) GPC (Global Protocol for Community-Scale GHG Emission Inventories)

b.) Ten sectors of Climate Change Action Plan

- ✓ *Completed data collection for 2014 and 2015*

(2) Produced publicity material on GHG inventory of HCMC

(3) Completed training on GHG inventory preparation

(4) Completed GHG Inventory Preparation Manual

- ✓ *Two consultation meeting conducted*

Achievements

2. MRV of Mitigation Measures

(1) Completed MRV Piloting

(2) Completed MRV Manual

- ✓ *Two consultation meeting conducted*
- ✓ *Discussions with central level held*

3. Capacity Building on Climate Change Mitigation

(1) Two training trips to Japan

(2) Two training courses in HCMC

(3) Several short seminars

4. Institutionalization of GHG inventory and MRV

Prepared background documents

GHG Inventory of HCMC

Final Seminar

Fumihiko KUWAHARA

Table of Contents

- 1. Basics on GHG inventory
  - 1.1 What is Greenhouse Gases (GHGs)?
  - 1.2 What is GHG Inventory?
  - 1.3 How to Use GHG Inventory?
  - 1.4 How to Calculate on GHG Emissions
- 2. Commentary on 2013 GHG inventory of HCMC
  - 2.1 Summary of GHG Inventory in HCMC
  - 2.2 Comparison with Countries and Cities
  - 2.3 Recommendations
  - 2.4 Future Improvement Idea

1.1 What is Greenhouse Gases

- Greenhouse gases (GHGs) trap heat in the atmosphere and global warming.
- GHGs consists of CO_2, CH_4, N_2O, HFCs, PFCs, SF6, and NF_3.

Source: http://www.gov-online.go.jp, city.muroran.lg.jp

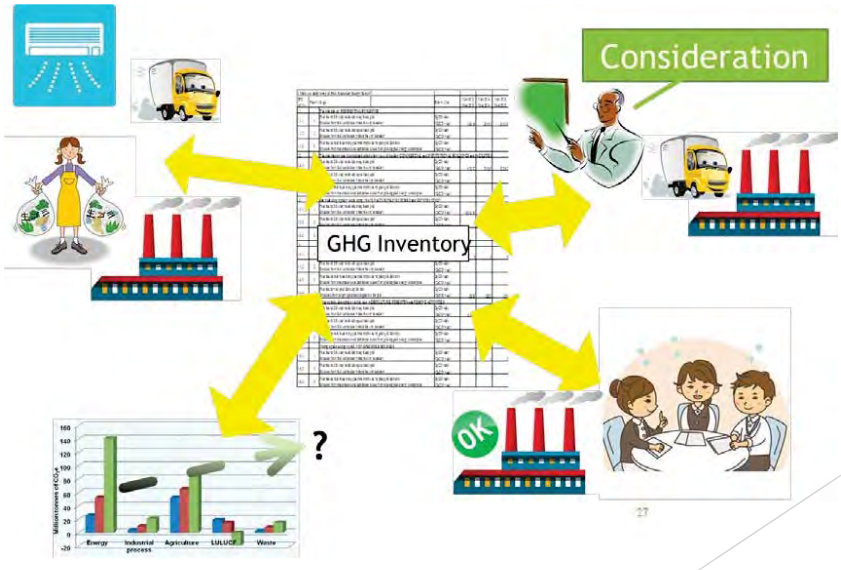
1.2 What is GHG Inventory?

- **Comprehensive List** of GHG emissions and removals
  - Result of Human Activities
  - Within national Territory or city boundary
  - Annual data and time series
- Quantity of GHGs by each Source.
- Policy-makers can use GHG inventory for planning climate change mitigation actions.

1.3 How to Use GHG Inventory?

- GHG inventory enables cities to:
  - understand the amount of GHG emitted in the city;
  - understand the emissions contribution of various activities in the city;
  - compare GHG emissions over time;
  - compare GHG emissions across cities;
  - project future GHG emissions;
  - set GHG emission reduction targets;

- identify the sectors and sub-sectors to focus emission reduction efforts;
- track the impact of mitigation measures; and
- provide solid proof of GHG development for carbon financing.



1.4 How to Calculate GHG Emissions

- Basically, GHG emissions are calculated in each emission sources category using following basic equitation.

- Activity Data are amounts of human activities resulting in emissions, such as gasoline consumption, electricity consumption, amounts of waste disposed, and etc.
- Emission Factor are the average rate of emissions of GHG per unit of activity data, for example: 0.75 tCO_2/MWh in 2013 for electricity.

2. Commentary on 2013 GHG inventory of HCMC

- 2.1 Summary of GHG Inventory in HCMC
- 2.2 Comparison with Countries and Cities
- 2.3 Recommendations
- 2.4 Future Improvement Idea

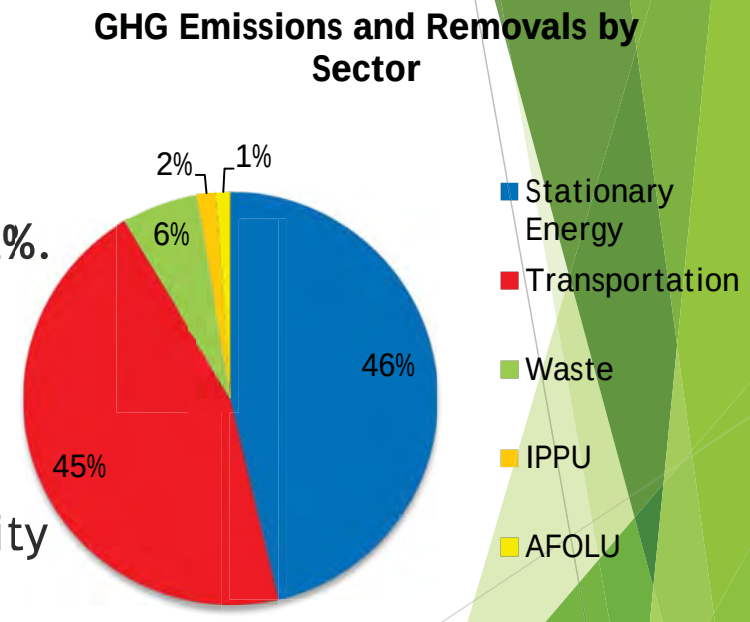
2.1 Summary of GHG Inventory in HCMC

GPC ref No.	GHG Emissions and Removals GHG Emissions Sources (By Sector and Sub-sector)	Total GHG (metric ton CO2e/year) in 2013			
		Scope 1	Scope 2	Scope 3	Total
I	**STATIONARY ENERGY**				
I.1	Residential buildings	269,780	5,301,680	262,963	5,834,424
I.2	Commercial and institutional building and facilities	440,575	2,505,610	124,278	3,070,463
I.3	Manufacturing industries and construction	2,597,202	5,386,028	267,147	8,250,377
I.4.1/2/3	Energy industries	0	0	0	0
I.4.4	Energy generation supplied to the grid	10,316			
I.5	Agriculture, forestry and fishing activities	621,570	36,366	1,804	659,740
I.6	Non-specified sources	0	0	0	0
I.7	Fugitive emissions from mining, processing, storage, and transportation of coal	0			0
1.8	Fugitive emissions from oil and natural gas systems	23,378			23,378
	SUB-TOTAL	**3,952,505**	**13,229,684**	**656,192**	**17,838,381**
II	**TRANSPORTATION**				
II.1	On-road transportation	14,544,176	NO	NE	14,544,176
II.2	Railways	IE	IE	NE	0
II.3	Waterborne navigation	149,134	NO	NE	149,134
II.4	Aviation	IE	NO	2,701,073	2,701,073
II.5	Off-road transportation	IE	IE	NE	0
	SUB-TOTAL	**14,693,310**		**2,701,073**	**17,394,382**
III	**WASTE**				
III.1.1/2	Solid waste generated in the city	1,293,241			1,293,241
III.2.1/2	Biological waste generated in the city	24,900			24,900
III.3.1/2	Incinerated and burned waste generated in the city	5,606			5,606
III.4.1/2	Wastewater generated in the city	926,142			926,142
III.1.3	Solid waste generated outside the city	NE			0
III.2.3	Biological waste generated outside the city	NE			0
III.3.3	Incinerated and burned waste generated outside the city	NE			0
III.4.3	Wastewater generated outside the city	NE			0
	SUB-TOTAL	**2,249,889**			**2,249,889**
IV	**INDUSTRIAL PROCESSES and PRODUCT USES (IPPU)**				
IV.1	Emissions from industrial processes occurring within the city boundary	565,704			565,704
IV.2	Emissions from product uses occurring within the city boundary	873			873
	SUB-TOTAL	**566,577**			**566,577**
V	**AGRICULTURE, FORESTRY and OTHER LAND USE (AFOLU)**				
V.1	Emissions from livestock	372,891			372,891
V.2	Emissions from land	-161,037			-161,037
V.3	Emissions from aggregate sources and non-CO2 emission sources on land	211,508			211,508
	SUB-TOTAL	**423,362**			**423,362**
Total	**GHG Emissions and Removals**	**21,885,641**	**13,229,684**	**3,357,265**	**38,472,590**

Scope 1 emissions are the emissions from sources located within the city boundary.
Scope 2 emissions are mainly the emissions from electricity consumption.
Scope 3 emissions are mainly the emissions of transmission and distribution losses from the use of electricity consumption.
NE is Not Estimated, IE is Included Elsewhere, NO is Not Occurring.

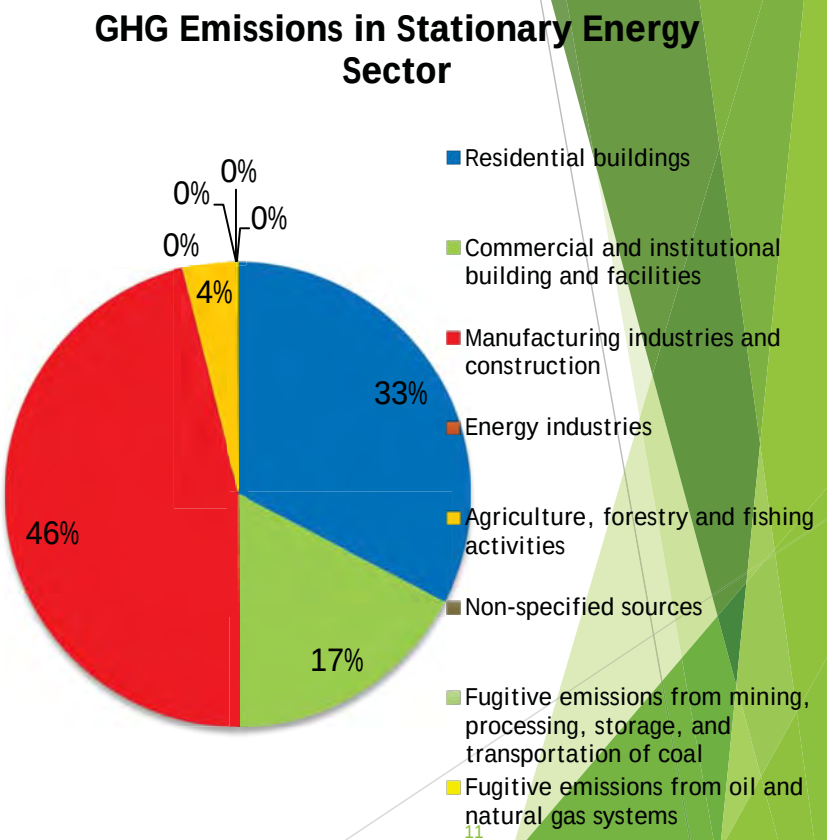
GHG Emissions and Removals by Sector in HCMC

- Stationary Energy: 46%
- Transportation: 45%
- Stationary Energy + Transportation Sectors = 91%.
- Waste: 6%
- IPPU: 2%
- AFOLU: 1%
- Stationary Energy: Electricity Consumption.
- Transportation: Gasoline Combustion and Diesel Combustion.



GHG Emissions in Stationary Energy Sector

- Residential Buildings: 33%
- Commercial and Institutional Building and Facilities: 17%
- Manufacturing Industries and Construction: 46%
- Agriculture, Forestry and Fishing Activities: 4%
- Fugitive Emissions from Oil and Natural Gas Systems: very small
- Others: Not Occurring



2.2 Comparing with Countries and Cities

- Comparison with GHG Inventory of Vietnam and HCMC
- Emission Composition of Cities (Stationary Energy, Transportation, and Waste)
- GHG Emissions per Capita
- GHG Inventory from Stationary Energy and Transportation

Comparison with GHG Inventory of Vietnam and HCMC

- 246.8 million ton CO_2e (Vietnam, Year 2010)
- 38.5 million ton CO_2e (HCMC, Year 2013)
- Although the calculation year differs, the **population** of HCMC is around **9%** of Vietnam, but the **GHG emissions** occupy around **15%** or more.

HCMC is suggested to be the large emission sources in Vietnam.

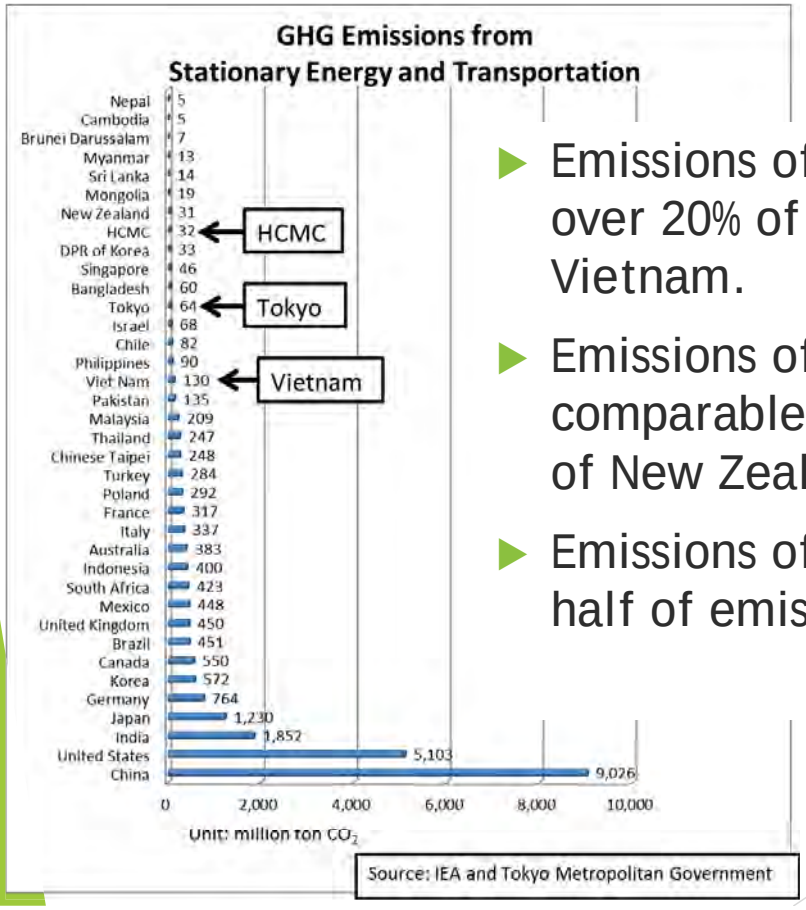
GHG Emissions per Capita

- The **per capita emissions** of HCMC is at the same level of Seoul, London, and Buenos Aires despite HCMC being much less economically developed than its counterparts.

City	GHG emissions per capita ($tonCO_2e$/year/capita)	GHG inventory per GDP ($kgCO_2e$/year/GDP)	GDP/capita (USD/capita)
Seoul	4.638		
London	4.732	82.786	57,157
Los Angeles	7.458	33.422	223,138
Durban	6.588		
Yokohama	5.662	165.596	34,195
Toronto	7.064	123.341	57,273
Buenos Aires	4.395	170.454	25,782
Austin	11.599	121.534	95,437
Madrid	2.869	89.118	32,196
Auckland	5.890	139.831	42,125
Washington DC	12.730	72.891	174,642
Portland	10.064	47.102	213,659
Boston	9.346	54.861	170,355
Salvador de Bahia	1.332	154.384	8,628
Oslo	2.148	24.590	87,361
HCMC	**4.157**	**915.311**	**4,542**

The importance of making policy on GHG emission reduction is suggested.

GHG Inventory from Stationary Energy and Transportation



- Emissions of HCMC occupy over 20% of total emissions in Vietnam.
- Emissions of HCMC are comparable to the emissions of New Zealand.
- Emissions of HCMC are around half of emissions of Tokyo.

2.3 Recommendations

- GHG Inventory of HCMC in 2014 and 2015
- A Complete Fuel Consumption on LGP, Natural Gas, Coal, etc.
- Amount of Municipal Solid Waste Generated, Recycled, and Open-burned
- Amount of industrial waste Generated, Treated, Disposed, and Recycled
- Amount of CH_4 Recovered at Landfill Sites
- Continuously Update and Improve GHG Inventory Preparation Manual

- CH_4 and N_2O Emission Factor of the Grid
- Fulfilling the reporting requirement of C40:
  - Geographic boundary, heating and cooling degree days, population, GDP, and etc.
- Requirement on reporting form of C40:
  - Data, data sources, notation keys in each sub-category
- DOIT under HCMC provides information from the Energy Intensity Monitoring Sheet
- Definition of the fuel type stated in the Energy Intensity Monitoring Sheet

2.4 Future Improvement Idea

- Availability of Emission Factor on Iron and steel industry and Ferroalloy industry in IPPU sector by considering the industrial process of each factory in HCMC
- Vietnamese Energy Statistical Yearbook should be developed by MOIT every year.

Example of Tokyo Case (more detailed information)

- How should the GHG inventory be improved into the future?
- The GHG inventory needs to be improved continuously year by year.
- All fuel types should be collected.
- More detailed information on electricity consumption such as commercial building application, and etc.
- If more detailed information are collected, the GHG inventory using this information can be used for planning of policy and measures and their follow-up.

Example of GHG Emission in Tokyo Metropolitan Government

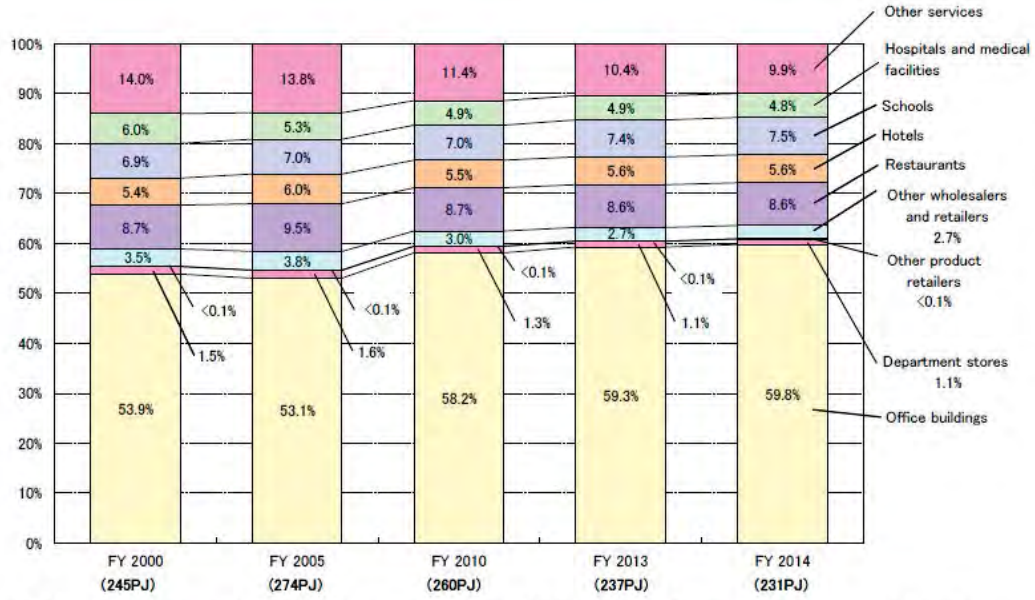


Figure 2-14 Composition ratios in final energy consumption by building application in the commercial sector

Source: Final Energy Consumption and Greenhouse Gas Emissions in Tokyo (FY 2014)
March 2017 Bureau of Environment Tokyo Metropolitan Government

Thank you very much

- Climate Change Bureau in Department of Natural Resources and Environment (DoNRE)
  - Mr. Hà Minh Châu
  - Mr. Nguyễn Huy Phương
  - Ms. Phạm Thị Kim Ngân
  - Ms. Trần Hồng Lan
- GHG inventory experts of JICA short-term expert team
  - Mr. FUMIHIKO KUWAHARA
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GHG Inventory Preparation Manual

Final Seminar

Ms. Phạm Thị Kim Ngân

Mr. FUMIHIKO KUWAHARA

Table of Contents

- 1. Objective and Composition of Manual
  - 1.1 Objective
  - 1.2 Composition
  - 1.3 Sector
  - 1.4 Scope
- 2. Procedures and data sources in HCMC
  - 2.1 Procedure
  - 2.2 Data Sources

1.1 Objective

- Method of preparation of the GHG inventory of HCMC
- Reference document for the person related with the preparation of GHG inventory

- Based on Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) and 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines).

1.2 Composition

Chapter	Notes
Chapter 1: Introduction	Basic Information, such as outlines, terms, etc.
Chapter 2: GHG Inventory Preparation Procedure	Preparation Procedure, such as schedule, roles and responsibility, Institutional Arrangement, etc.
Chapter 3: Calculation Methods	Basic Calculation Formula, including data collection methods
Chapter 4: Data Sources	All data sources necessary for preparing GHG inventory
Chapter 5: Calculation	The concrete calculation steps in HCMC.
Chapter 6: Reporting Based on GPC	The reporting form referring to the GPC.
Annex I: Data Collection Forms	Data collection forms
Annex II: GHG inventory of HCMC in 2013	GHG inventory based on GPC
Annex III: GHG inventory based on the Priority Sectors in HCMC	GHG inventory based on sectors of CCAP

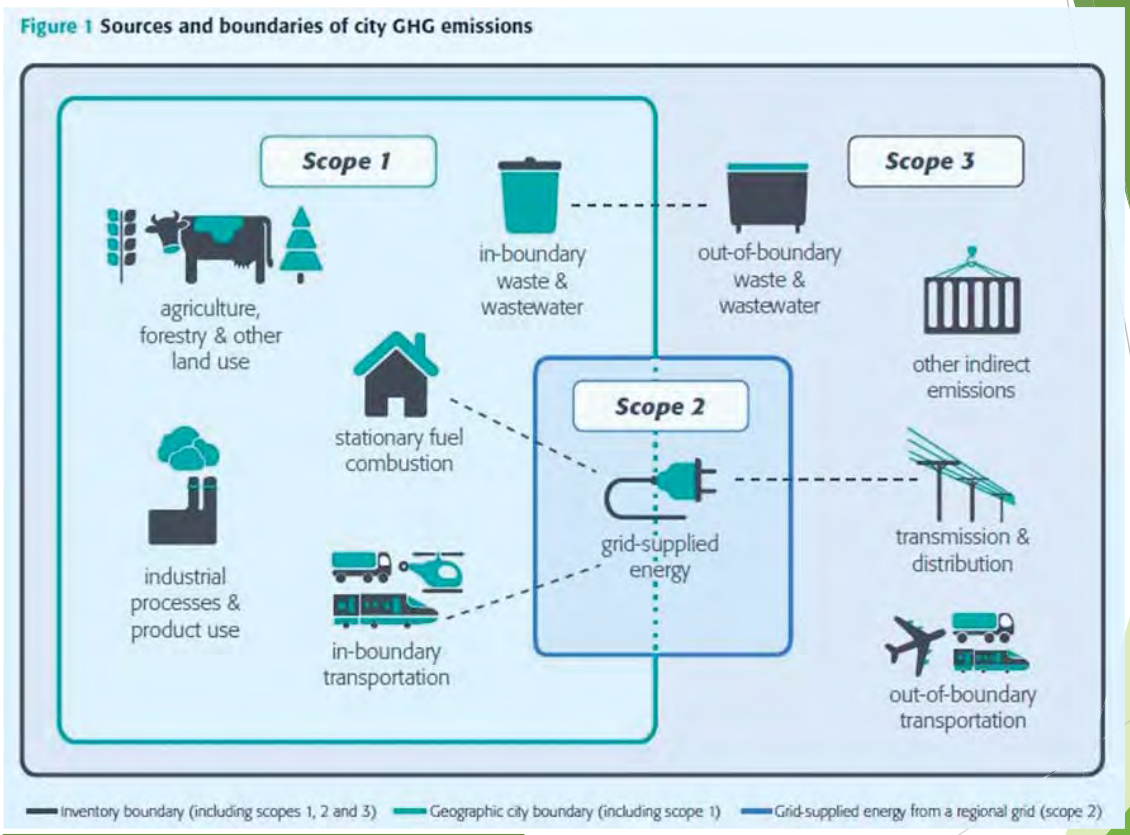
1.3 Sector

Sector	Based on GPC. 1) Stationary energy Sector 2) Transportation Sector 3) Waste Sector 4) Industrial process and product use (IPPU) Sector 5) Agriculture, forestry, and other land use (AFOLU) Sector
Sub-Sector	Divisions that make up a sector
Sub-categories	An additional level of categorization, such as vehicle type, building type, and etc. Sub-categories provide opportunities to use disaggregated data, improve inventory detail, and help identify mitigation actions and policies.

1.4 Scope

- GHG inventory of city level shall consider the Geographic Boundary. This tool is “Scope”
- Emissions are categorized by Scope as following.
- Scopes definitions for city inventories (only city level)

Scope 1	GHG emissions from sources located within the city boundary
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary
Scope 3	All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary

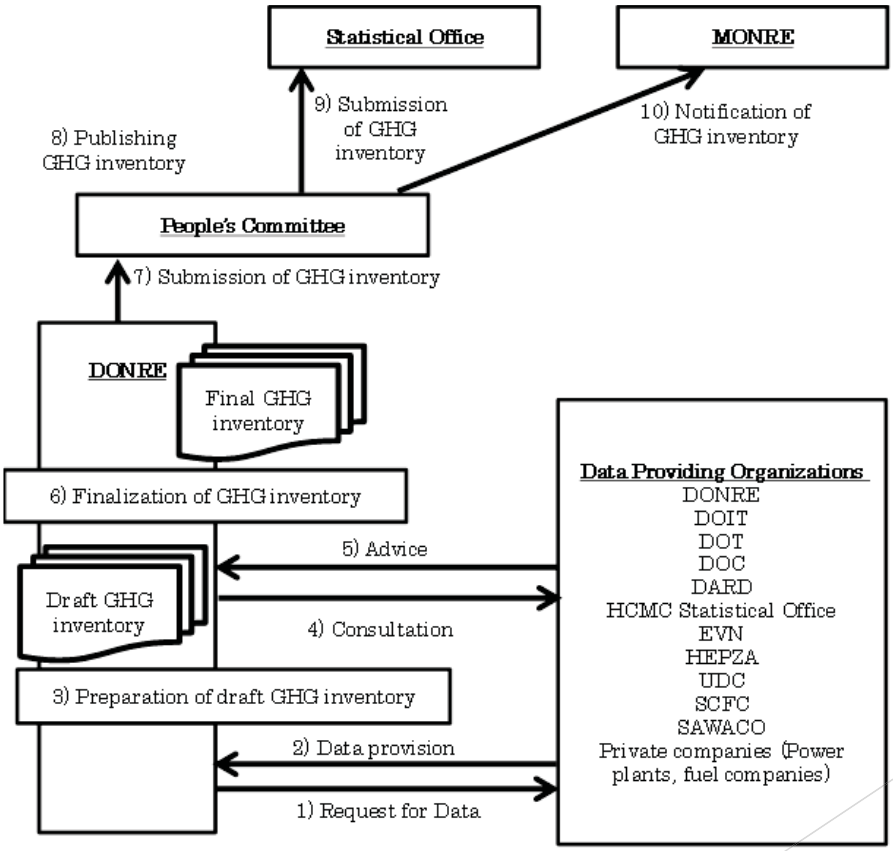


Source: GPC

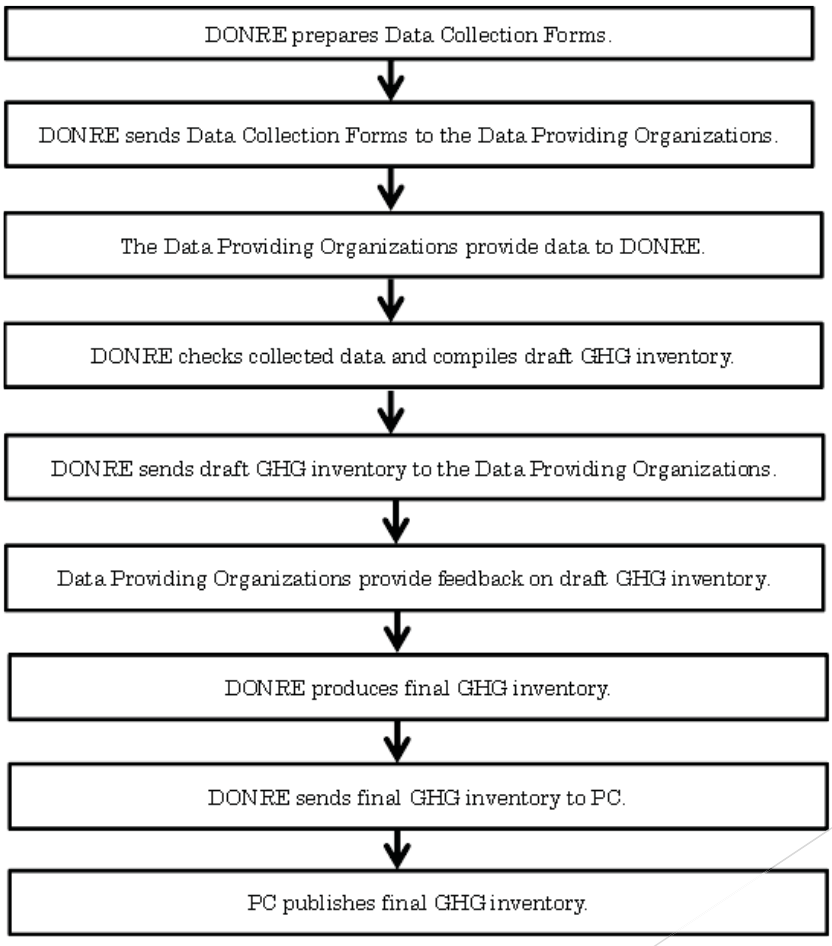
2.1 Procedures (Chapter 2 of Manual)

- 2.1 Overview
- 2.2 Preparation
- 2.3 Data Request
- 2.4 Data Preparation
- 2.5 Data Collection
- 2.6 Preparation of GHG Inventory
- 2.7 Feedback on Draft GHG Inventory
- 2.8 Finalizing GHG Inventory
- 2.9 Publishing GHG Inventory
- 2.10 QC
- 2.11 QA

Institutional Arrangement for the GHG Inventory Preparation in HCMC



Preparation Flow of GHG Inventory



Roles and Responsibilities

	Roles and Responsibilities
PC	Publish GHG inventory Submission of GHG inventory to MONRE
DONRE	Preparation of GHG inventory Preparation, confirmation, and approval of improvement plan on preparation of GHG inventory Performs actual work of GHG inventory compilation. Responsible for inventory calculations, compiling, and archiving and management of all data. Quality control
Data Providing Organizations	Data provision The following quality control ➢ Confirmation of data provided for the preparation of the inventory. ➢ Responding to inquiries regarding data it has provided.

Schedule of GHG Inventory Preparation

Preparation Year of GHG Inventory: n (even number year) For example Preparation Year = 2018

Target Year of GHG Inventory: n-2 (two year before) Target Year = 2016

	Process	Relevant Organizations	Jan.	Feb.	Mar.	Apr	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.
1	Preparation	DONRE	→	→									
2	Data request	DONRE			→								
3	Data preparation	Data Providing Organizations				→							
4	Data Collection	DONRE				→	→						
5	Preparation of draft GHG inventory	DONRE					→	→	→	→			
6	Feedback on draft GHG inventory	Data Providing Organizations								→	→		
7	Finalizing GHG inventory	DONRE									→	→	
8	Publishing GHG inventory	PC										→	→

QC (Quality Control)

- Manual includes QC method.
- QC is a system of routine technical activities to assess and maintain the quality of the GHG inventory as it is being compiled.
- QC is performed by personnel compiling the GHG inventory.
- The common and fundamental QC activity on the preparation of GHG inventory is shown in following tables.

QA (Quality Assurance)

- Manual includes QA method.
- QA is review procedure conducted by personnel not directly involved in the inventory preparation process.
- Good Candidates to perform QA:
  - An academic organization
  - C40 Cities Climate Leadership Group
  - ICLEI-Local Governments for Sustainability
  - MONRE, etc.

2.2 Data Sources (Chapter 4 of Manual)

- In Manual, all required data based on GPC are shown.
  - 4.1 Stationary Energy Sector
  - 4.2 Transportation Sector
  - 4.3 Waste Sector
  - 4.4 IPPU Sector
  - 4.5 AFOLU Sector
- The data related in HCMC are shown in following pages.

Summary of Data Sources

Provider	Sector	Main Provided Data
DOIT	Stationary Energy and Transportation	Fuel consumption
EVN	EnergyStationary Energy	Electricity consumption
EVN	IPPU	SF_6 of electricity equipment
DOC	IPPU	Cement (Kiln), Lime
Statistical Office	Waste, AFOLU, IPPU	Population (Domestic wastewater) Agricultural information Products of manufacturing industry
DONRE	Waste	Municipal solid waste, Sludge, Other waste (Clinical waste)
HEPZA	Waste	Wastewater
UDC	Waste, Stationary Energy, and Transportation	Sewage treatment plants Electricity consumption
SCFC	Stationary Energy and Transportation	Electricity and fuel consumption
SAWACO	Stationary Energy	Electricity consumption
DOT	Transportation	Number of vehicle, Ships
DARD	AFOLU	Livestock, Rice cultivation, Agricultural information
DONRE	AFOLU	Land use and land use change

Example of Data Sources
Stationary Energy

Required Data	Data Providing Organization	Notes
Electricity consumption for 5 sub - sector	EVN	Data Collection Form
Kerosene	DOIT	Data Collection Form
Fuel oil	DOIT	Data Collection Form Energy Intensity Monitoring Sheet
Diesel oil	DOIT	Data Collection Form Energy Intensity Monitoring Sheet
LPG	Fuel Companies DOIT	Data Collection Form Energy Intensity Monitoring Sheet
Natural Gas	Fuel Companies DOIT	Data Collection Form Energy Intensity Monitoring Sheet

Example of Data Sources
Transportation

Required Data	Data Providing Organization	Notes
Diesel oil	DOIT DOIT SCFC DOT UDC	Data Collection Form Energy Intensity Monitoring Sheet Data Collection Form Data Collection Form Data Collection Form
Gasoline	DOIT DOIT SCFC DOT UDC	Data Collection Form Energy Intensity Monitoring Sheet Data Collection Form Data Collection Form Data Collection Form

Example of Data Sources
Waste

Required Data	Data Providing Organization	Notes
Amount of solid waste generated, treated, recycled, and reused	DONRE	Data Collection Form
Composition of waste going to solid waste disposal sites	DONRE	Data Collection Form
Mass of organic waste treated by biological treatment	DONRE	Data Collection Form
Mass of waste incinerated	DONRE	Data Collection Form
Degree of utilization ratio of treatment and discharge pathway or system on domestic wastewater	National Environment Report	
Amount of industrial waste water	HEPZA	Data Collection Form

Example of Data Sources
IPPU

Required Data	Data Providing Organization	Notes
Iron and steel production	Statistical Yearbook	
Ferroalloy production	Statistical Yearbook	
Total nameplate capacity of installed equipment (circuit breaker with SF6)	EVN	Data Collection Form

Example of Data Sources
AFOLU

Required Data	Data Providing Organization	Notes
Dairy Cattle	Statistical Yearbook	
Other Cattle	Statistical Yearbook	
Buffalo	Statistical Yearbook	
Fraction of total annual nitrogen excretion managed in manure management system for livestock	Result of the Viet Nam Household Living Standard Survey 2014	
Information on land	DONRE	Data Collection Form
Harvested Area of Rice	Statistical Yearbook	
Area of annual crop	Statistical Yearbook	
Annual crop production	Statistical Yearbook	

Thank you very much

Basics on MRV and objectives of MRV trial

26 October, 2017

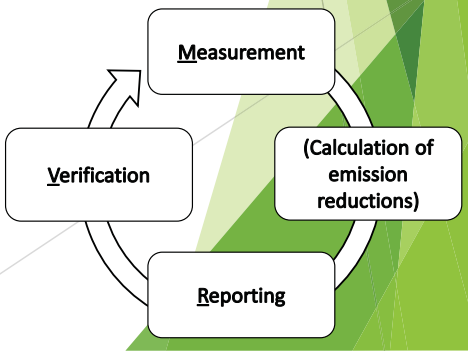
Mr. Yoshihiro Mizuno, JICA Expert Team

1. Basis on MRV

- **Measurement, Reporting and Verification (MRV):**
  - An indispensable component of mitigation actions that allows check and report in a systematic way.
- **Measurement ("M"):**
  - Direct measurement using instruments and/or collection of information and data that are necessary to calculate GHG emission reductions of the mitigation action.
- **Reporting ("R"):**
  - Compilation and reporting of data and information that is collected or measured at the Measurement (M) stage.
- **Verification ("V"):**
  - Checking and confirming the contents that are reported at the Reporting (R) stage from the viewpoint of completeness, accuracy and consistency.

2. Benefits of MRV to the city

- **Enhanced clarity of project effectiveness**
  - The city can visualize the effectiveness and impacts of the project, in terms of its GHG emissions and emission reductions
- **Enhanced opportunity to access finance**
  - The mitigation project may have access to various types of climate finance sources, including international finance
- **Improved policy/ project formulation**
  - policy development or project planning/ evaluation can be improved in the future

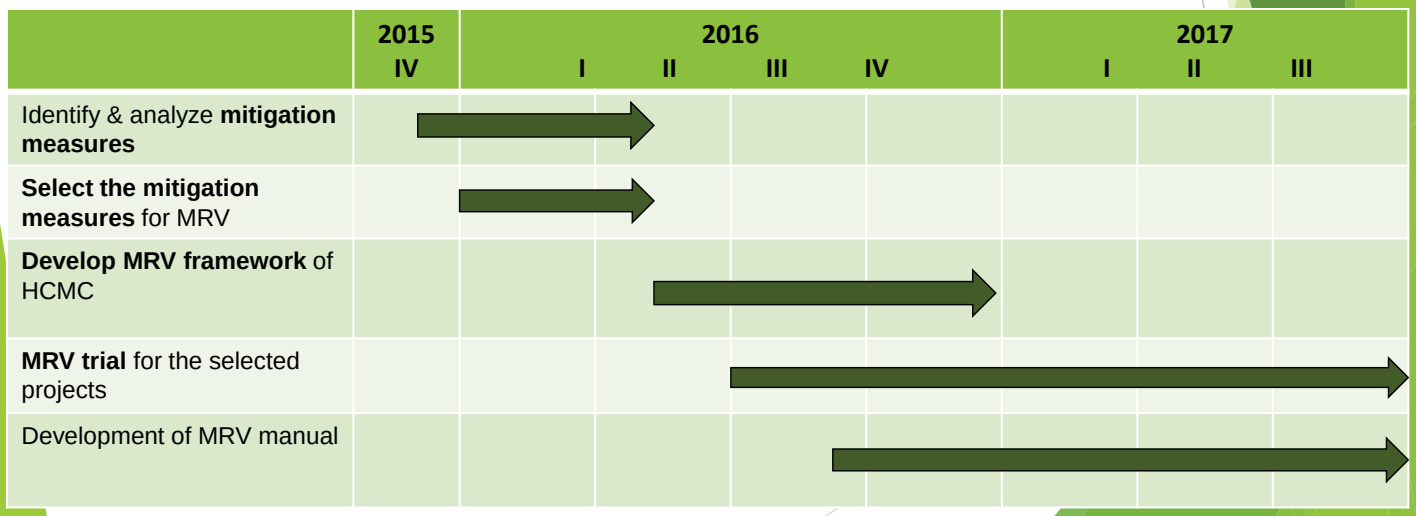


3. Objectives of MRV trial

- To develop and recommend an MRV framework applicable at the city level in Vietnam
- To assist the capacity enhancement of the officials in HCMC on the monitoring, calculation and reporting of GHG emission reductions of mitigation actions
- To develop MRV manual for cities in Vietnam

4. Outline of MRV trial

- Energy, transport and waste sectors were the target sectors
  - Solar PV system (20kW) installation on the roof top of the public building (Energy sector)
  - Introduction of CNG Bus for Public Bus Fleet by SaigonBus (Transport sector)
  - Animal manure collection and biogas recovery at small farms (Waste sector)



Outcomes and Experiences from MRV Trial Activity (Energy sector)

October 26, 2017

Name of presenter (Mr. Cuong)
Energy Conservation Center

Contents of the presentation

1. Outline of the mitigation project for MRV trial
2. Organization structure for MRV trial
3. MRV process of the MRV trial
4. Experiences and lessons learnt through MRV trial activity

1. Outline of the mitigation project for MRV trial

Outline of the mitigation project, including its objective, brief description of low-carbon technology, location, schedule (when the mitigation project started) will be explained. 1 page.

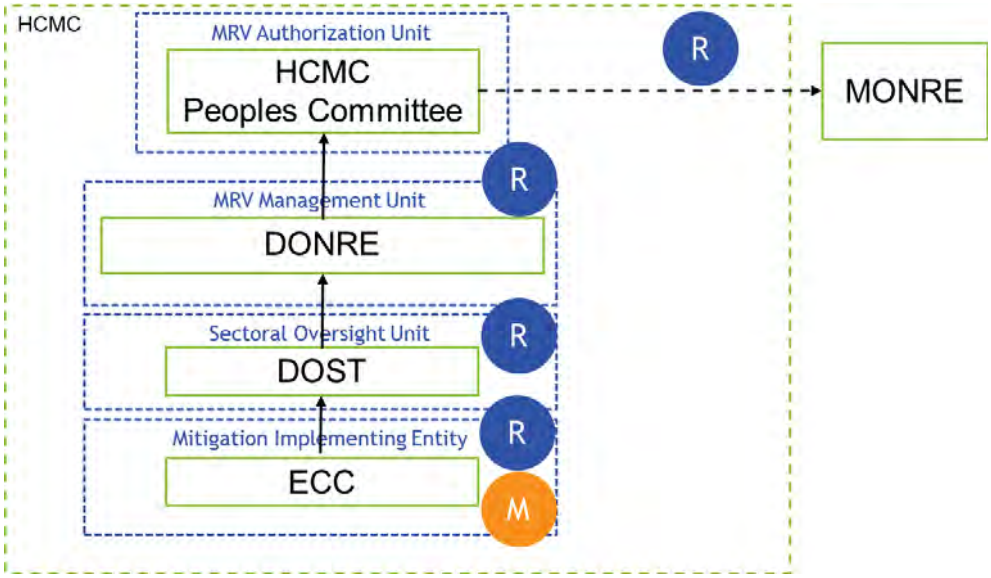
- **Name of the mitigation action**
  Solar PV system (20kW) installation on the roof top of the public building

- **Objective**
  HCMC has a plan to achieve the target of having 1.74% of energy use coming from renewable energy. In order to promote renewable energy generation, HCMC set the program named “Pilot program for Supporting mechanisms of solar PV investment in Ho Chi Minh city” to provide incentives to households and buildings that are willing to install the solar PV system on their rooftop. Solar PV system (20kW) are installed on the roof top of the DOST’s building.

- **Technology introduced under the mitigation action**
  Solar PV system is an electricity generation system which converts sunlight into electricity by the use of photovoltaic (PV) modules. In general, the system also includes ancillary equipment such as inverters in order to change the electrical current from direct current (DC) to alternating current (AC).

2. Organization structure for MRV trial

Organization structure of MRV trial, and roles of each organizations involved in MRV trial will be presented. 1 page.



DOST	Examine monitoring reports submitted by ECC and submit it to DONRE. (Sectoral Oversight Unit)
ECC	Operate solar PV systems and monitor/provide necessary data for GHG emission reduction calculations to DOST.

3. MRV process of the MRV trial (1)

Define mitigation actions to MRV;
How the selected project meets the selection criteria

Criterion 1: Mitigation Potential - Whether the action contributes to reduce GHGs

The electricity generated by the solar PV system is used as a substitute for the electricity from the grid. The electricity generated by the solar PV system does not emit any CO2 because CO2 emission factor of the electricity is zero.

Criterion 2: Practicability of MRV - Whether the action has practical ways to MRV

The MRV of Solar PV project requires only two parameters to be monitored, generated electricity by solar PV system and emission factor of the grid. The monitoring for generated electricity by solar PV system is using a electricity meter. That is daily or monthly routine operation for the owner to know the amount of generated electricity.

Besides the above criteria, in the MRV trial, for the purpose of the SPI-NAMA project, the important point of selecting mitigation actions was that the action is on-going (under operation).

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

Following contents of MRV plan will be explained. Less than 5 pages.

I. General information of the mitigation action

** Information on a) to d), f), g): Described in "1. Outline of the mitigation project for MRV trial"*

e) Target GHG type

CO_2

i) Benefits of mitigation action and contribution to sustainable development

Social benefits: Stimulate the utilization of renewable energy,

Economic benefits: Reduce electricity cost;

Environmental benefits: Reduce air pollutants from the electric generation plant using fossil fuel:

j) Source of funding and supporting financial scheme

HCMC support the investment cost including equipment costs and installation cost. The name of the program is "Pilot program for Supporting mechanisms of solar PV investment in Ho Chi Minh city"

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

II. Emission reduction calculation, monitoring and reporting

a) Logic of GHG emission reduction

The electricity generated by the solar PV system is used as a substitute for the electricity from the grid.

The electricity generated by the solar PV system does not emit any CO2 because CO2 emission factor of the electricity is zero.

The emission factor of the grid electricity is 0.66 t-CO2/MWh.

Utilizing the electricity generated by solar PV system results in CO2 emission reductions.

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

b) Methodology to calculate GHG emission reduction

$$\boldsymbol{ER_y = BE_y - PE_y}$$

$$\boldsymbol{BE_y = EG_{p,y} \times EF_{grid}}$$

BE_y Baseline emissions in year y (tCO_2/year)

$EG_{p,y}$ Annual generated electricity by solar PV system (kWh)

EF_{grid} Emission Factor of the grid (tCO_2/kWh)

$$\boldsymbol{PE_y = EG_{p,y} \times EF_{PV}} = 0$$

PE_y Project emissions in year y (tCO_2/year)

$EG_{p,y}$ Annual generated electricity by solar PV system (kWh)

EF_{PV} Emission Factor of the solar PV system (tCO_2/kWh) = 0

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

c) Estimated GHG emission reduction

11 tCO_2/year

e) Monitoring period

From January 1st 2016 to December 31st 2016

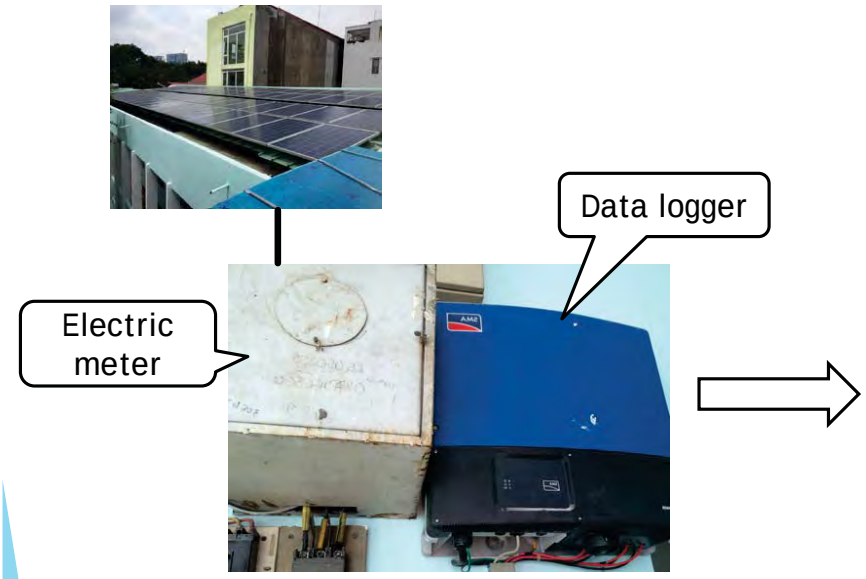
f) Monitoring methods

Monitoring parameter: parameters which should be collected every year after the project starts

Parameter	Method	Person/position in charge
$EG_{p,y}$ Annual generated electricity by solar PV system (kWh)	· The value of the electric meter is read and recorded monthly. · Recorded data is accumulated for 12 month and used for the GHG emission reduction calculation.	Staff of Energy Conservation Center
EF_{grid} Emission factor of grid (tCO_2/kWh)	· Default value in official document by MONRE is applied. · Check updated value every year and apply the latest value where appropriate.	Staff of Energy Conservation Center

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions



The generated electricity measured by the electricity meter in daily and recorded in the data logger.

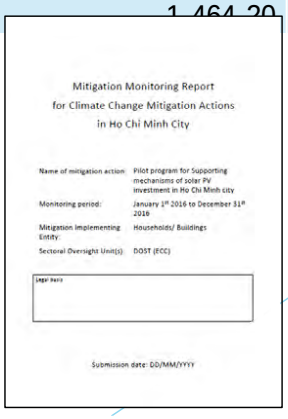
The recorded data was taken by the staff of ECC monthly from the data logger.

	SN: 1900718424 STP 20000TL-30 1900718424	SN: 1900718424 STP 20000TL-30 1900718424
	Total yield	Day yield
	Counter	Analog
dd/MM/yyyy	kWh	kWh
01/01/2016	7017.576	61.232
02/01/2016	7068.068	50.492
03/01/2016	7104.198	36.13
04/01/2016	7158.687	54.489
05/01/2016	7205.871	47.184
06/01/2016	7254.135	48.264
07/01/2016	7313.291	59.156
08/01/2016	7361.273	47.982
09/01/2016	7428.632	67.359
10/01/2016	7497.371	68.739
11/01/2016	7554.396	57.025
12/01/2016	7613.699	59.303
13/01/2016	7673.509	59.81
14/01/2016	7739.291	65.782
15/01/2016	7798.547	59.256
16/01/2016	7851.31	52.763
17/01/2016	7911.386	60.076
18/01/2016	7971.64	60.254
19/01/2016	8026.837	55.197
20/01/2016	8097.736	70.899
21/01/2016	8156.276	58.54
22/01/2016	8224.137	67.861
23/01/2016	8291.175	67.038
24/01/2016	8344.411	53.236
25/01/2016	8419.009	74.598
26/01/2016	8478.836	59.827
27/01/2016	8523.856	45.02
28/01/2016	8573.971	50.115
29/01/2016	8640.601	66.63
30/01/2016	8696.473	55.872
31/01/2016	8766.822	70.349

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Monitoring report

Monitoring period		Monitoring date	Electricity generation indicated by electric meter (kWh)	Accumulated electricity generation amount (kWh)
From	To			
1-Jan-16	31-Jan-16	31-Jan-16	1,810.48	1,810.48
1-Feb-16	29-Feb-16	29-Feb-16	1,812.49	3,622.97
1-Mar-16	31-Mar-16	31-Mar-16	2,016.81	5,639.78
1-Apr-16	30-Apr-16	30-Apr-16	1,821.87	7,461.65
1-May-16	31-May-16	31-May-16	1,757.80	9,219.45
1-Jun-16	30-Jun-16	30-Jun-16	1,512.80	10,732.24
1-Jul-16	31-Jul-16	31-Jul-16	1,786.83	12,519.07
1-Aug-16	31-Aug-16	31-Aug-16	1,701.74	14,220.81
1-Sep-16	30-Sep-16	30-Sep-16	1,570.40	15,791.21
1-Oct-16	31-Oct-16	31-Oct-16	1,621.46	17,412.67
1-Nov-16	30-Nov-16	30-Nov-16	1,887.52	19,300.20
1-Dec-16	31-Dec-16	31-Dec-16	1,464.20	20,764.40


Mitigation Monitoring Report
for Climate Change Mitigation Actions
in Ho Chi Minh City

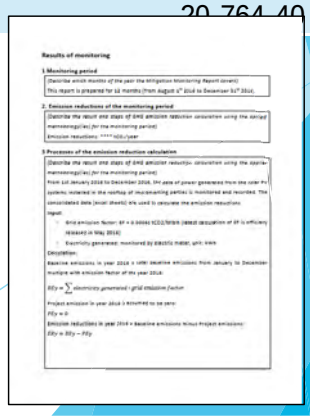
Name of mitigation action: Pilot program for Supporting mechanisms of solar PV investment in Ho Chi Minh city

Monitoring period: January 1st 2016 to December 31st 2016

Mitigation Implementing Entity: Households/ Buildings

Sectoral Oversight Unit(s): DOST (ECC)

Submission date: DD/MM/YYYY



3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Monitoring report

a) Monitoring period

12 months (from January 1st 2016 to December 31st 2016)

b) Emission reductions achieved during the monitoring period

12 tCO_2/5months

c) Process of emission reduction calculation

From 1st January 2016 to December 2016, the amount of generated electricity by the solar PV systems has been monitored. The accumulated electricity generation amount is 20,764.40 (kWh).

Grid emission factor of the grid is 0.66 tCO2/MWh, referred the latest official EF provided by MONRE in May 2016.

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Monitoring report

$$BE_y = EG_{p,y} \times EF_{grid}$$

$$= 20{,}764.40\ (\text{kWh}) \times 0.66\ (\text{tCO2/MWh})$$

$$= 13.7\ \text{tCO}_2/\text{year}$$

$$PE_y = EG_{p,y} \times EF_{PV}$$

$$= 0\ \text{tCO}_2/\text{year}$$

$$ER_y = BE_y - PE_y$$

$$= 13.7 - 0 = 13.7\ \text{tCO}_2/\text{year}$$

GHG Emission reduction calculation sheet for PV project

Period of monitoring:

Emission Reduction

Description	Parameter	Unit	Emissions
Emission reduction	ER_y	tCO_2/year	0
Baseline emission	BE_y	tCO_2/year	0
Project emission	PE_y	tCO_2/year	0

Inputs

*Input only orange cell

Description	Parameter	Unit	Amont of Electric generation	Data source
Amount of electricity generated in the year y	EG_{PJ}	kWh/year	0	Measured
CO2 Emission factor of grid	EF_{grid}	tCO_2/MWh	0.66	

3. MRV process of the MRV trial (5)

Implement MRV and Approve MRV result

How the Monitoring Report should be reviewed and which department should be responsible for the review. How the Monitoring Report should be submitted to MRV Management Unit. 1-2 pages.

In the actual MRV, ECC should submit the monitoring report to DOST. DOST should check the following elements.

- whether there is lack of information in the submitted Mitigation Monitoring Report;
- whether there is big gap between the MRV plan and Mitigation Monitoring Report.

After checking the monitoring report, DOST consolidates the monitoring reports of the solar PV installation project and other mitigation actions into Sectoral Monitoring Report and submits it to DONRE.

DONRE should examine the report in following elements;

- whether there is a lack of information/ data in the submitted Sectoral Monitoring Report;
- whether MRV for the approved mitigation actions has been adequately implemented in accordance with the approved MRV plan;
- whether GHG emission reduction is accurately calculated in accordance with the approved MRV plan and whether appropriate data is applied for calculation.

DONRE submits the report to PC with a recommendation for approval.

4. Experiences and lessons learnt through MRV trial activity

Experiences and lessons learnt through MRV trial activity

- If the project itself has already put in place their monitoring system for the project purpose (beside climate objective), the MRV process will be very much facilitated. Otherwise, investing a whole system for data collection and monitoring (just for MRV purpose) will be a burden for the project developer without any incentives.
- The definition of baseline and how to determine the baseline should be very clear from the beginning (For example: which default values, which grid emission factor should be used, what is the boundary of the project emissions, etc.)
- Official request from PC under the form of a policy document is a must so that relevant stakeholders take responsibility to allocate resources to implement MRV for selected mitigation actions.
-

Outcomes and Experiences from MRV Trial Activity (Transport sector)

October 26, 2017

Mr. Cao Trung Tin
Management and Operation Center for Public Transport

Contents of the presentation

1. Outline of the mitigation project for MRV trial
2. Organization structure for MRV trial
3. MRV process of the MRV trial
4. Experiences and lessons learnt through MRV trial activity

1. Outline of the mitigation project for MRV trial

Outline of the mitigation project, including its objective, brief description of low-carbon technology, location, schedule (when the mitigation project started) will be explained. 1 page.

- **Name of the mitigation action**
  Introduction of CNG Bus for Public Bus Fleet by SaigonBus.

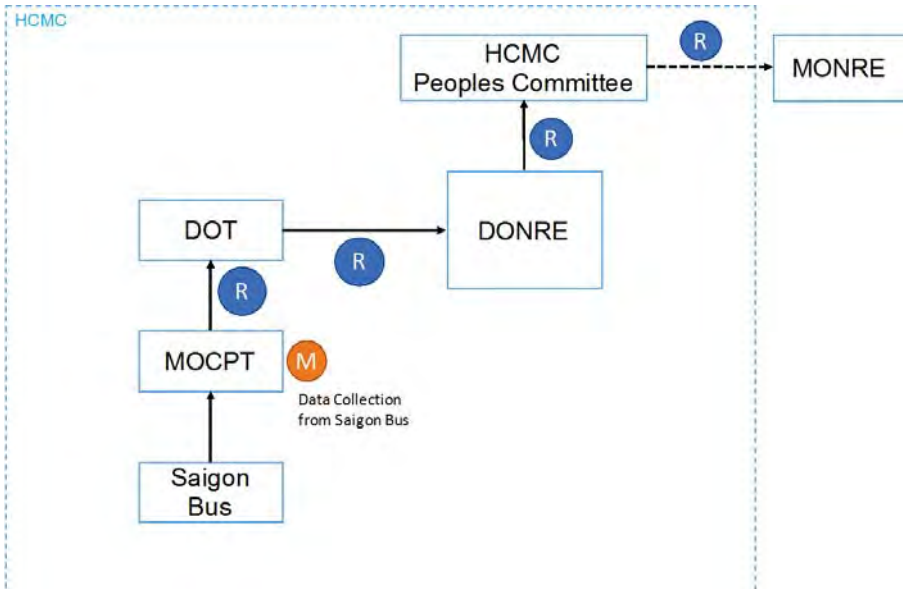
- **Objective**
  HCMC invested new 21 CNG buses to operate for bus route number 27 on August 2016. Those CNG buses promote to reduce GHG emissions and local air pollutants such as PM (Particulate Matters).

- **Technology introduced under the mitigation action**
  The diesel buses used for bus route number 27 were Mercedes buses, with 48 seats and 36 standing, engine is 5,958cc, vehicle weight is 9,880 tons. The CNG buses used now are Hyundai buses, with 40 seats and 28 standing, engine is 11,149cc, vehicle weight is 10,780 tons.

Source: Isuzu Web site

2. Organization structure for MRV trial

Organization structure of MRV trial, and roles of each organizations involved in MRV trial will be presented. 1 page.



DOT	Examine monitoring reports submitted by MOCPT and submit it to DONRE. (Sectoral Oversight Unit)
MOCPT	Receive the monitoring data from SaigonBus, calculate GHG emission reductions, and prepare monitoring reports. The monitoring reports are sent to DOT. (Mitigation Implementing Entity)
SaigonBus	Operate CNG buses and monitor/provide necessary data for GHG emission reduction calculations to MOCPT.

3. MRV process of the MRV trial (1)

Define mitigation actions to MRV

How the selected project meets the selection criteria will be explained.

Criterion 1: Mitigation Potential - Whether the action contributes to reduce GHGs

Main component of CNG is natural gas and it has low carbon content per energy than diesel fuel. Therefore, even though efficiency of diesel engines is slightly better than that of CNG engines, CO_2 emission are reduced through replacing diesel buses by CNG buses.

Criterion 2: Practicability of MRV - Whether the action has practical ways to MRV

The MRV of CNG bus project requires only two parameters to be monitored. The calculation formula is also simple and easy to calculate with less parameters which are collected routinely in daily operation of bus services.

Besides the above criteria, in the MRV trial, for the purpose of the SPI-NAMA project, the important point of selecting mitigation actions was that the action is on-going (under operation).

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

Following contents of MRV plan will be explained. Less than 5 pages.

I. General information of the mitigation action

** Information on a) to d), f), g): Described in "1. Outline of the mitigation project for MRV trial"*

e) Target GHG type

CO_2

i) Benefits of mitigation action and contribution to sustainable development

Social benefits: Local people might see cleaner and safety buses then use those buses more and more;

Economic benefits: Reduce fossil fuel (diesel), increase clean fuel (CNG), reduce fuel cost, improve energy condition and technology transfer;

Environmental benefits: Reduce noise, air pollutants: PM, CO.

j) Source of funding and supporting financial scheme

Transport operators invest in CNG fleet with tax incentives from HCMC.

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

II. Emission reduction calculation, monitoring and reporting

a) Logic of GHG emission reduction

Main component of CNG is natural gas and it has low carbon content per energy than diesel fuel. Therefore, even though efficiency of diesel engines is slightly better than that of CNG engines, CO_2 emission are reduced through replacing diesel buses by CNG buses.

b) Methodology to calculate GHG emission reduction

A simple methodology was developed for this project as below, based on a basic emission calculation formula provided in the IPCC2006 guideline.

$$ER_y = BE_y - PE_y$$
$$BE_y = SFC_{diesel} \times NCV_{diesel} \times EF_{diesel} \times DD_y \times N_{PJ,y}$$
$$PE_y = SFC_{CNG}/CF \times NCV_{CNG} \times EF_{CNG} \times DD_y \times N_{PJ,y}$$

BE_y Baseline emission in year *y* (tCO_2/year)
PE_y Project emission in year *y* (tCO_2/year)
ER_y Emission reduction in year *y* (tCO_2/year)

Monitoring Parameter:
DD_y *:* Annual average distance travelled in year *y* (km/year)
$N_{PJ,y}$ *:* Number of CNG buses in year *y*
Fixed Parameter:
SFC_{diesel}, SFC_{CNG}: Specific fuel consumption of diesel bus and CNG bus, respectively (kg/km)
NCV_{diesel}, NCV_{CNG}: Net calorific value of diesel fuel and CNG, respectively (MJ/kg)
EF_{diesel}, EF_{CNG}: Emission factor of diesel fuel and CNG (tCO_2/MJ)
CF : Correction factor for CNG specific fuel consumption

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

c) Estimated GHG emission reduction

37 tCO_2/year

e) Monitoring period

From August 1st 2016 to December 31st 2016 (The period of the MRV trial.)

f) Monitoring methods

Monitoring parameter: parameters which should be collected every year after the project starts

Parameter	Method	Notes
DD_y Annual average distance travelled in year y (km/year)	· The data is provided by SaigonBus. · SaigonBus monitors distances travelled by each bus monthly (This is done as their routine works). · These data are averaged to obtain the monthly average distance of all the buses. · Monthly average distance is calculated for 12 month and sum up these to obtain the annual average distance.	MOCPT receives the data from SaigonBus
$N_{PJ,y}$ Number of CNG buses in year y	· The data is provided by SaigonBus. · SaigonBus check the number of CNG buses in the bus fleet registry.	

3. MRV process of the MRV trial (2)

Develop MRV plan for a mitigation actions

Fixed parameter: parameters which should be fixed before the 1st emission reduction calculation (one year after the project starts)

Parameter	Source	Value
SFC_{diesel} Specific fuel consumption of diesel bus (kg/km)	Determined by SaigonBus.	0.290
SFC_{CNG} Specific fuel consumption of CNG bus (kg/km)	Determined by SaigonBus using actual driving distance and CNG consumption for all project buses.	0.365
NCV_{diesel} Net calorific value of diesel fuel (MJ/kg)	Default value of "2006 IPCC Guidelines for National Greenhouse Gas Inventory".	43.0
NCV_{CNG} Net calorific value of CNG (MJ/kg)		48.0
EF_{diesel} Emission factor of diesel fuel (tCO_2/MJ)		0.0000741
EF_{CNG} Emission factor of CNG (tCO_2/MJ)		0.0000561
CF Correction factor for CNG specific fuel consumption	Set factor to correct/adjust fuel consumption between different specifications of baseline and project buses.: Ratio of vehicle weight of CNG bus (10,780kg) to diesel bus (9,880kg)	1.09

3. MRV process of the MRV trial (3)

Collect/measure and record data (Monitoring)

Contents of monitoring activity will be explained in detail (how the monitoring data was obtained). Photo of monitoring activity should be shown if possible. 1 or 2 pages.

Number of parameters to be monitored are only two as described in slide 8.

1. Annual average distance travelled in year y (km/year)
2. Number of CNG buses in year y

These data are secondary data and not newly monitored for this project. These are routinely monitored and recorded in the bus fleet datasets for the purpose of daily operation of buses.

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Monitoring report

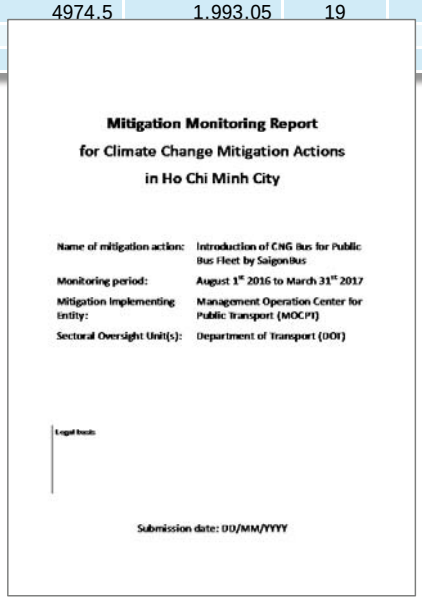
Completed monitoring sheet that shows the actually monitored data will be shown in 1 page.
Also, the following contents of Monitoring Report will be explained within 2 pages.
a) Monitoring period
b) Emission reductions achieved during the monitoring period
c) Process of emission reduction calculation

Images of the monitoring sheet

August 2016

No.	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Travel distance (km/month)	Fuel consumption (kg /month)
1	5124.8	2,046.76	11	5103.7	1,924.39
2	5273.2	2,046.96	12	4872.5	2,031.96
3	4932.8	1,899.43	13	5020.9	1,882.21
4	4925.6	2,041.70	14	5314.3	2,126.86
5	4309.7	1,690.80	15	4882.8	1,786.52
6	4915.3	1,867.34	16	4760.8	1,761.72
7	4946.7	1,928.23	17	5079.5	2,152.46
8	5209.8	1,922.84	18	4696.9	1,817.53
9	4974.5	1,993.05	19	5153.7	1,906.62
10					
Total					

Images of the monitoring report



Mitigation Monitoring Report

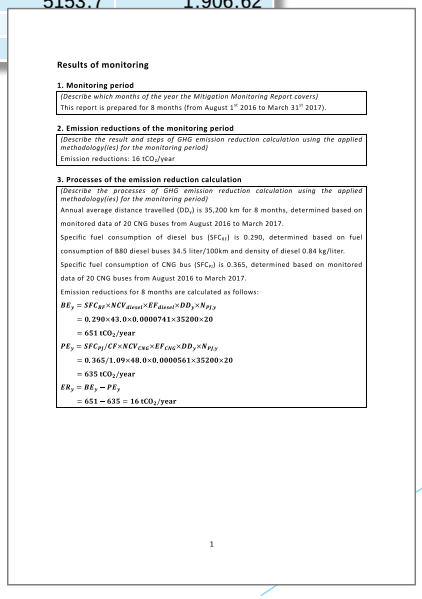
for Climate Change Mitigation Actions

in Ho Chi Minh City

Name of mitigation action:	Introduction of CNG Bus for Public Bus Fleet by SaigonBus
Monitoring period:	August 1st 2016 to March 31st 2017
Mitigation Implementing Entity:	Management Operation Center for Public Transport (MOCPT)
Sectoral Oversight Unit(s):	Department of Transport (DOT)

Legal basis

Submission date: DD/MM/YYYY



Results of monitoring

1. Monitoring period

(Describe which months of the year the Mitigation Monitoring Report covers)
This report is prepared for 8 months (from August 1st 2016 to March 31st 2017).

2. Emission reductions of the monitoring period

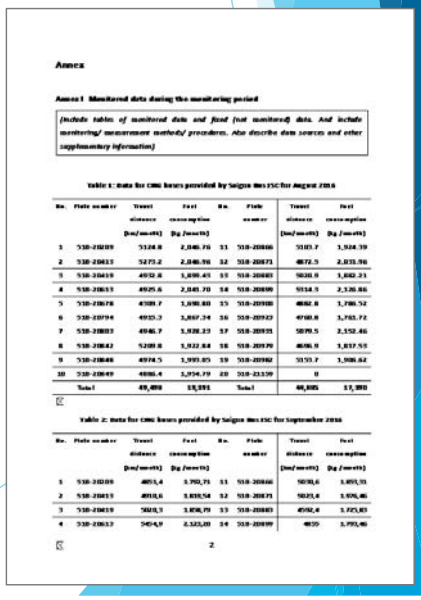
(Describe the result and steps of GHG emission reduction calculation using the applied methodology(ies) for the monitoring period)
Emission reductions: 16 tCO_2/year

3. Processes of the emission reduction calculation

(Describe the processes of GHG emission reduction calculation using the applied methodology(ies) for the monitoring period)
Annual average distance travelled (DD_y) is 35,200 km for 8 months, determined based on monitored data of 20 CNG buses from August 2016 to March 2017.
Specific fuel consumption of diesel bus (SFC_{RF}) is 0.290, determined based on fuel consumption of B80 diesel buses 34.5 liter/100km and density of diesel 0.84 kg/liter.
Specific fuel consumption of CNG bus (SFC_{PJ}) is 0.365, determined based on monitored data of 20 CNG buses from August 2016 to March 2017.
Emission reductions for 8 months are calculated as follows:

$$BE_y = SFC_{RF} \times NCV_{diesel} \times EF_{diesel} \times DD_y \times N_{PJ,y}$$
$$= 0.290 \times 43.0 \times 0.0000741 \times 35200 \times 20$$
$$= 651\ tCO_2/year$$
$$PE_y = SFC_{PJ}/CF \times NCV_{CNG} \times EF_{CNG} \times DD_y \times N_{PJ,y}$$
$$= 0.365/1.09 \times 48.0 \times 0.0000561 \times 35200 \times 20$$
$$= 635\ tCO_2/year$$
$$ER_y = BE_y - PE_y$$
$$= 651 - 635 = 16\ tCO_2/year$$

1



Annex

Annex I Monitored data during the monitoring period

(Include tables of monitored data and fixed (not monitored) data. And include monitoring/ measurement methods/ procedures. Also describe data sources and other supplementary information)

Table 1: data for CNG buses provided by Saigon Bus JSC for August 2016

No.	Plate number	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Plate number	Travel distance (km/month)	Fuel consumption (kg /month)
1	51B-20899	5124.8	2,046.76	11	51B-20866	5103.7	1,924.39
2	51B-20813	5273.2	2,046.96	12	51B-20871	4872.5	2,031.96
3	51B-20819	4932.8	1,899.43	13	51B-20885	5020.9	1,882.21
4	51B-20853	4925.6	2,041.70	14	51B-20890	5314.3	2,126.86
5	51B-20878	4309.7	1,690.80	15	51B-20908	4882.8	1,786.52
6	51B-20894	4915.3	1,867.34	16	51B-20923	4760.8	1,761.72
7	51B-20883	4946.7	1,928.23	17	51B-20935	5079.5	2,152.46
8	51B-20842	5209.8	1,922.84	18	51B-20970	4696.9	1,817.53
9	51B-20848	4974.5	1,993.05	19	51B-20982	5153.7	1,906.62
10	51B-20949	4986.4	1,954.79	20	51B-23339	0	0
	Total	49,898	19,391		Total	48,885	17,903

Table 2: data for CNG buses provided by Saigon Bus JSC for September 2016

No.	Plate number	Travel distance (km/month)	Fuel consumption (kg /month)	No.	Plate number	Travel distance (km/month)	Fuel consumption (kg /month)
1	51B-20899	4853.4	1,792.71	11	51B-20866	5030.6	1,855.55
2	51B-20813	4918.6	1,819.54	12	51B-20871	5023.4	1,976.46
3	51B-20819	5028.3	1,858.79	13	51B-20885	4592.4	1,725.83
4	51B-20853	5454.9	2,323.00	14	51B-20899	4859	1,793.46

2

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Monitoring report

a) Monitoring period

From August 1st 2016 to December 31st 2016. (The period of the MRV trial)

b) Emission reductions achieved during the monitoring period

10 tCO_2/5months

c) Process of emission reduction calculation

Annual average distance travelled (DD_y) is 23,225 km for 5 months, determined based on monitored data of 20 CNG buses from August 2016 to December 2016.

Specific fuel consumption of diesel bus (SFC_{RF}) is 0.290, determined based on fuel consumption of B80 diesel buses 34.5 liter/100km and density of diesel 0.84 kg/liter.

Specific fuel consumption of CNG bus (SFC_{PJ}) is 0.365, determined based on monitored data of 20 CNG buses.

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Monitoring report

Emission reductions for 5 months are calculated as follows:

$$BE_y = SFC_{RF} \times NCV_{diesel} \times EF_{diesel} \times DD_y \times N_{PJ,y}$$
$$= 0.290 \times 43.0 \times 0.0000741 \times 23225 \times 20$$
$$= 429\ tCO_2/year$$

$$PE_y = SFC_{PJ}/CF \times NCV_{CNG} \times EF_{CNG} \times DD_y \times N_{PJ,y}$$
$$= 0.365/1.09 \times 48.0 \times 0.0000561 \times 23225 \times 20$$
$$= 419\ tCO_2/year$$

$$ER_y = BE_y - PE_y$$
$$= 429 - 419 = 10\ tCO_2/year$$

(Draft) Emission reduction estimation sheet for CNG bus project

Period of monitoring:

Emission Reduction

Description	Parameter	Unit	Value
Emission reduction	ER_y	tCO_2/year	
Baseline emission	BE_y	tCO_2/year	
Project emission	PE_y	tCO_2/year	

Inputs

*Input only orange cell

Description	Parameter	Unit	Value	Datasource
Annual average distance travelled in year y (km/year)	DD_y	km/year		Monitored
Number of CNG buses in year y	$N_{PJ,y}$	unit		Monitored
Specific fuel consumption of diesel bus	SFC_{diesel}	kg/km		Monitored
Net calorific value of diesel fuel	NCV_{diesel}	MJ/kg		IPCC2006
Emission factor of diesel fuel	EF_{diesel}	tCO_2/MJ		IPCC2006
Specific fuel consumption of CNG bus	SFC_{CNG}	kg/km		Estimated
Correction factor for CNG specific fuel consumption	CF	-		
Net calorific value of CNG	NCV_{CNG}	MJ/kg		IPCC2006
Emission factor of CNG	EF_{CNG}	tCO_2/MJ		IPCC2006

3. MRV process of the MRV trial (5)

Implement MRV and Approve MRV result

How the Monitoring Report should be reviewed and which department should be responsible for the review. How the Monitoring Report should be submitted to MRV Management Unit. 1-2 pages.

In the actual MRV, MOCPT should submit the monitoring report to DOT. DOT should check the following elements.

- whether there is lack of information in the submitted Mitigation Monitoring Report;
- whether there is big gap between the MRV plan and Mitigation Monitoring Report.

After checking the monitoring report, DOT consolidates the monitoring reports of the CNG project and other mitigation actions into Sectoral Monitoring Report and submits it to DONRE.

DONRE should examine the report in following elements;

- whether there is a lack of information/ data in the submitted Sectoral Monitoring Report;
- whether MRV for the approved mitigation actions has been adequately implemented in accordance with the approved MRV plan;
- whether GHG emission reduction is accurately calculated in accordance with the approved MRV plan and whether appropriate data is applied for calculation.

DONRE submits the report to PC with a recommendation for approval.

4. Experiences and lessons learnt through MRV trial activity

Advantages and disadvantages through MRV trial activity

- Advantages:

- Saigon Bus is implementing entity, necessary data is daily monitoring data, support management activity of the company.

- Technical staff of Saigon Bus was trained all skills in collecting, assessing data and calculating the emission.

- Disadvantages:

- MRV trial for 20 CNG buses if want to multiple should have sufficient resources.

- In order to multiply MRV activities in transport sector, technical staffs should have training to know how to develop methodology and model to calculate GHG emission reduction.

4. Experiences and lessons learnt through MRV trial activity

Experiences and lessons learnt through MRV trial activity

- Operator:

Needs to monitor and collect specific data for each vehicle in order to prepare for next steps.

- MRV implementing entity:

- Check data submitted by Operator.

- Consolidat, assess data → Calucate the GHG emission, Propose and submit Mitigation Monitoring Report.

- Sub-sectoral Oversight Unit and MRV Management Unit:

Needs to have knowledge about transport sector in order to check and approve reports submitted by implementing entity.

Outcomes and Experiences from MRV Trial Activity (waste sector)

October 26, 2017

Mr. Huynh Quoc Toan
Department of Agriculture and Rural Development

Contents of the presentation

1. Outline of the mitigation project for MRV trial
2. Organization structure for MRV trial
3. MRV process of the MRV trial
4. Experiences and lessons learnt through MRV trial activity

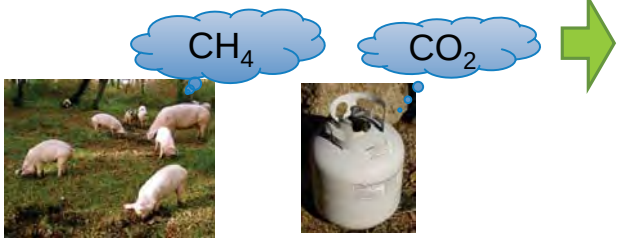
1. Outline of the mitigation project for MRV trial

- **Name of the mitigation project**
  Animal manure collection and biogas recovery at small farms

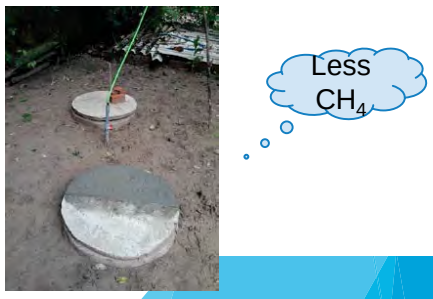
- **Objective**
  To increase the production efficiency of household-based livestock producers and to reduce the environmental impact of livestock production such as on local water and air pollution by installing bio-digesters at small farms.

- **Technology introduced under the mitigation action**
  Bio-digesters installed at livestock farms have the capacity of 7 m^3 or 9 m^3 and they collect animal manure to generate biogas. Collected biogas is used by farmers for cooking purpose (3 hours usage per day on average). Total number of biodigesters installed is 844. Average number of livestock (swine) per household is 45.

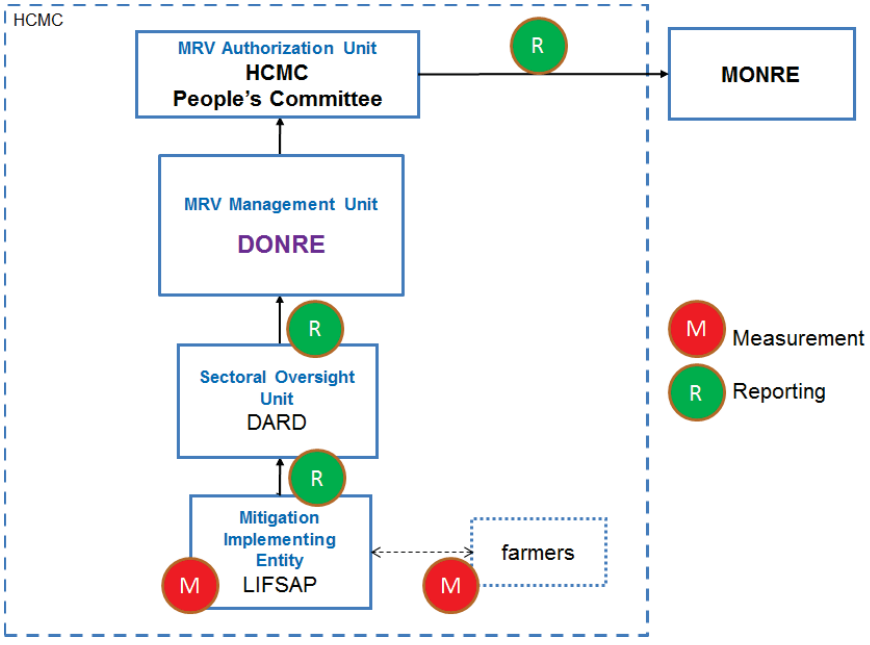
Baseline GHG emissions:
- CH_4 from animal manure
- CO_2 from combustion of LPG



Project GHG emissions:
- CH_4 leakage from bio-digester



2. Organization structure for MRV trial



DARD *Sectoral Oversight Unit* of MRV
Examine monitoring report submitted by LIFSAP and submit it to DONRE.

LIFSAP* *Mitigation Implementing Entity* of MRV
Perform monitoring activity, GHG emission reduction calculation, coordination with data holders (farmers), preparation and submission of Mitigation Monitoring Report.

* LIFSAP: Livestock Competitiveness and Food Safety Project

3. MRV process of the MRV trial (1)

Define mitigation actions to MRV

The mitigation project meets the project selection criterion as follows.

Criterion 1: Mitigation Potential (Whether the action reduces GHGs)

- The project reduces GHGs by recovering and utilizing biogas for heat generation at small farms.
- CH_4 is reduced by stopping disposal of animal manure on the field.
- CO_2 is reduced by displacing LPG consumption by bio-digesters.

Criterion 2: Practicability of MRV
(Whether the action has practical ways to MRV)

- Similar projects (animal manure collection and biogas use) are taking place in many countries and MRV-ed.
- Methodologies that specify necessary parameters to be monitored and formulas to calculate GHG emission reductions are widely used.
- Project implementer is able to obtain necessary data through the existing monitoring system set up by LIFSAP.

3. MRV process of the MRV trial (2)

Develop MRV plan for mitigation actions

MRV Plan of the mitigation project was established as follows.

I. General information of the mitigation action

Target GHG type

- CO_2 and CH_4

Benefits of mitigation action and contribution to sustainable development

- Social benefits: improve environmental awareness by local farmers
- Economic benefits: improved production of livestock, fuel cost saving by farmers
- Environmental benefits: improved local air and water condition

Source of funding and supporting financial scheme

- Part of the cost for purchasing and installing biodigesters was supported by World Bank.

3. MRV process of the MRV trial (2)

Develop MRV plan for mitigation actions (cont'd)

II. Emission reduction calculation, monitoring and reporting

a) Logic of GHG emission reduction

- CH_4 emission is avoided through collecting and utilizing animal manure that would be disposed of at the field and decomposed.
- CO_2 emission is reduced through displacing the use of fossil fuels (LPG) for household cooking with biogas.

b) Methodology to calculate GHG emission reduction

- Internationally acknowledged and widely used methodologies were referred to (CDM methodologies).

$$ER_y = BE_y - PE_y$$

$$BE_{1,y} = \sum \frac{(EF_{(T)} \times N_{(T)})}{10^3} \times GWP_{CH4}$$

$$BE_{2,y} = \sum BG_{PJ,y} \times NCV \times EF_{PJ,y} \times 1/10^6$$

$$PE_y = 0.1 \times BE_{1,y}$$

ER_y	Emission reduction in year *y* (ton-$CO_{2equivalent}$/year)
BE_y	Baseline emission in year *y* (tCO_{2e}/year)
$BE_{1,y}$	CH_4 emission at baseline case from disposed animal manure (tCO_{2e}/year)
$BE_{2,y}$	CO_2 emission at baseline case from the consumption of LPG (tCO_{2e}/year)
PE_y	Project emission in year *y* (tCO_{2e}/year)

3. MRV process of the MRV trial (2)

Develop MRV plan for mitigation actions (cont'd)

c) Estimated GHG emission reduction

6,862 tCO_{2e}/year

d) Monitoring period

1 January 2017 to 31 March 2017 (period of the MRV trial)

e) Monitoring methods

Monitoring parameters: parameters which will be collected every quarter

Parameter	Monitoring method
$N_{(T)}$ Number of head of livestock (swine)	• Data will be provided by sample livestock farmers that yields average number of livestock head per household. • Collected data will be compiled by technical staff of LIFSAP. • Number of samples should be large enough to represent the whole target households. Considering the large size of the target group and difficulty of frequent data collection, this data will be monitored every 3 month.
$BG_{PJ,y}$ Quantity of fuel consumed by household instead of using biogas (kg/year)	• Data will be calculated based on the average capacity and quantity of cooking device used by target households, and average daily cooking hours per household. • Above information should be collected by interview survey from the sample households. Sample size should be large enough to represent the entire target group.

3. MRV process of the MRV trial (2)

Develop MRV plan for mitigation actions (cont'd)

Fixed parameters: parameters which will not be monitored or collected

Parameter	Data source	Applied value
$EF_{(T)}$ Methane emission factor for livestock	Default value (IPCC Guidelines): value for more than 28ºC average annual temperature is applied.	7 kg CH_4/ head/ year
GWP_{CH4} Global Warming Potential of methane	Default value (IPCC Guidelines)	25
NCV Net calorific value of fuel that would be used for cooking instead of biogas	Default value (IPCC Guidelines): value for LPG is applied.	47.3 MJ/ kg
$EF_{PJ,y}$ CO_2 emission factor of fuel that would be used for cooking instead of biogas	Default value (CDM methodology): value for LPG is applied.	63.1 t-CO_2/MJ

3. MRV process of the MRV trial (3)

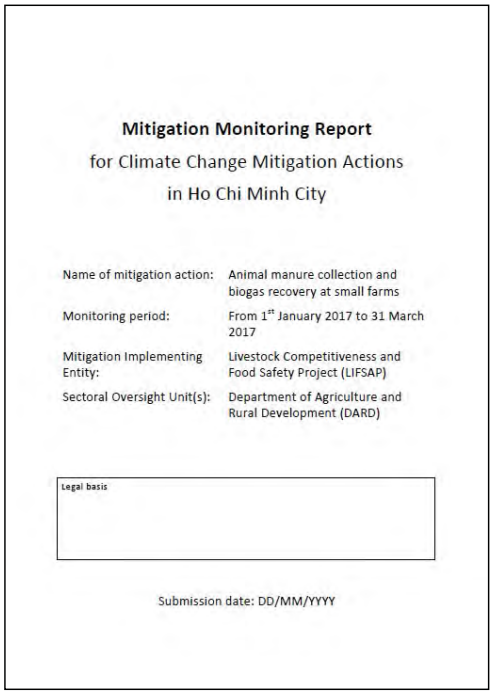
Collect/measure and record data (Monitoring)

- In accordance with the methodology, trial monitoring was conducted where necessary data for GHG calculation was collected.
- Parameters that need be monitored are the followings as specified in the methodology:
  - *Number of head of livestock (swine) (head)*
  - *Quantity of fuel consumed by household instead of using biogas (kg/year)*
- Above data was collected from sample livestock farmers (GAP households) by technical staff of LIFSAP.
- Data collection was conducted using the existing monitoring work under LIFSAP project to minimize the work and cost for monitoring.

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Mitigation Monitoring Report

Result of monitoring including GHG emission reduction information was compiled into a designated format of Mitigation Monitoring Report.



Mitigation Monitoring Report

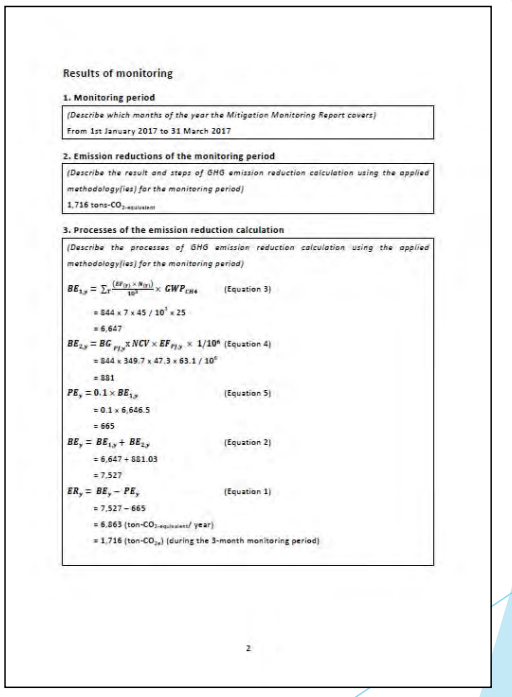
for Climate Change Mitigation Actions

in Ho Chi Minh City

Name of mitigation action:	Animal manure collection and biogas recovery at small farms
Monitoring period:	From 1st January 2017 to 31 March 2017
Mitigation Implementing Entity:	Livestock Competitiveness and Food Safety Project (LIFSAP)
Sectoral Oversight Unit(s):	Department of Agriculture and Rural Development (DARD)

Legal basis

Submission date: DD/MM/YYYY



Results of monitoring

1. Monitoring period

(Describe which months of the year the Mitigation Monitoring Report covers)

From 1st January 2017 to 31 March 2017

2. Emission reductions of the monitoring period

(Describe the result and steps of GHG emission reduction calculation using the applied methodology(ies) for the monitoring period)

1,716 tons-$CO_{2\text{-equivalent}}$

3. Processes of the emission reduction calculation

(Describe the processes of GHG emission reduction calculation using the applied methodology(ies) for the monitoring period)

$BE_{CH_4,y} = \sum_t \frac{(AP_{ty} \times N_{ty})}{10^3} \times GWP_{CH4}$ (Equation 3)

= 844 x 7 x 45 / 10^3 x 25

= 6,647

$BE_{EC,y} = BG_{PJ,y} \times NCV \times EF_{PJ,y} \times 1/10^6$ (Equation 4)

= 844 x 349.7 x 47.3 x 63.1 / 10^6

= 881

$PE_y = 0.1 \times BE_{CH_4,y}$ (Equation 5)

= 0.1 x 6,646.5

= 665

$BE_y = BE_{CH_4,y} + BE_{EC,y}$ (Equation 2)

= 6,647 + 881.03

= 7,527

$ER_y = BE_y - PE_y$ (Equation 1)

= 7,527 – 665

= 6,863 (ton-$CO_{2\text{-equivalent}}$/ year)

= 1,716 (ton-CO_{2e}) (during the 3-month monitoring period)

2

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Mitigation Monitoring Report (cont'd)

a) Monitoring period

From 1st January 2017 to 31 March 2017

b) Emission reductions achieved during the monitoring period

1,716 tons-$CO_{2\text{-equivalent}}$ (for the above 3-month monitoring period)

c) Process of emission reduction calculation

- Total number of livestock (swine) was estimated by determining the average number of livestock per household (45 heads for the 3-month monitoring period). Average number was determined based on monitored data of sample households from January to March 2017.
- Quantity of LPG that was displaced by household by using biogas was estimated based on the survey of sample households on the daily hours of cooking using biogas.

3. MRV process of the MRV trial (4)

Prepare monitoring sheet and Mitigation Monitoring Report (cont'd)

Emission reductions for 3 months are calculated as follows:

$$BE_{1,y} = \sum_T \frac{(EF_{(T)} \times N_{(T)})}{10^3} \times GWP_{CH4} = 844 \times 7 \times 45 / 10^3 \times 25 = 6{,}647$$

$$BE_{2,y} = BG_{PJ,y} \times NCV \times EF_{PJ,y} \times 1/10^6 = 844 \times 349.7 \times 47.3 \times 63.1 / 10^6 = 881$$

$$PE_y = 0.1 \times BE_{1,y} = 0.1 \times 6{,}646.5 = 665$$

$$BE_y = BE_{1,y} + BE_{2,y} = 6{,}647 + 881.03 = 7{,}527$$

$$ER_y = BE_y - PE_y$$

$$= 7{,}527 - 665$$

$$= 6{,}863 \ (tCO_{2\text{-}e}/\text{ year})$$

$$= 1{,}716 \ (tCO_{2e}/\text{ 3-months})$$

Emission Reduction

Description	Parameter	Unit	Value
Emission reductions	ER_y	tCO_{2e}/year	**6,863**
Emission reductions (for 3-month monitoring period)	ER_y	tCO_{2e}	**1,716**
Baseline emissions	BE_y	tCO_{2e}/year	**7,527**
Baseline emissions (CH_4) from disposed animal manure	$BE_{1,y}$	tCO_{2e}/year	6,647
Baseline emissions (CO_2) from the consumption of fossil fuels	$BE_{2,y}$	tCO_{2e}/year	881
Project emissions	PE_y	tCO_{2e}/year	**665**

Inputs

*Input only orange cell

Description	Parameter	Unit	Value	Data source
Number of head of livestock (swine)	$N_{(T)}$	head	37,980	Monitored
Quantity of fuel consumed by household instead of using biogas	$BG_{PJ,y}$	kg/year	295,147	Monitored
Methane emission factor for livestock	$EF_{(T)}$	kg CH_4/ head/ year	7	Methodology default
Global Warming Potential of methane	GWP_{CH4}	-	25	IPCC Guidelines
Net calorific value of fuel that would be used for cooking instead of biogas	NCV	MJ/ kg	47.3	IPCC Guidelines
CO_2 emission factor of fuel that would be used for cooking instead of biogas	$EF_{PJ,y}$	t-CO_2/MJ	63.1	IPCC Guidelines (value for LPG)

3. MRV process of the MRV trial (5)

Approve MRV result

- In the actual MRV, LIFSAP will submit the completed Mitigation Monitoring Report to DARD for review and check.
- DARD will then check the following elements.
  - whether there is a lack of information in the submitted Mitigation Monitoring Report;
  - whether there is a significant gap between the approved MRV Plan and the submitted Mitigation Monitoring Report.
- After checking the Mitigation Monitoring Report, DARD will consolidate the monitoring reports of the LIFSAP project and other mitigation actions in the concerned sector into the Sectoral Monitoring Report and submits it to DONRE.
- DONRE will then examine the Sectoral Monitoring Report from the following perspectives;
  - whether there is a lack of information/ data in the submitted Sectoral Monitoring Report;
  - whether MRV for the approved mitigation action has been adequately implemented in accordance with the approved MRV Plan;
  - whether GHG emission reduction is accurately calculated in accordance with the approved MRV Plan and whether appropriate data is applied for calculation.
- DONRE then submits the report to PC with a recommendation for approval.

4. Experiences and lessons learnt through MRV trial activity

Advantages and disadvantages of MRV trial activity

Advantages

Enthusiastic support of GAP -group leaders

Full support of JICA short-term experts and Vietnamese experts during the implementation of MRV trial

In the calculation process, the parameters were selected by the experts so the data collection and calculation were more easier.

Disadvantages

There should be expense for GAP-group leaders during the survey.

Parameters and equations for calculation were still complicated. If not simplify some parameters, the investigation and calculation process will be very difficult and MRV can not be implemented successfully in state agencies/organizations.

4. Experiences and lessons learnt through MRV trial activity

Experiences and lessons learnt through MRV trial activity

MRV implementing entity:

- Identify clearly baseline emissions and project emissions

- Apply methodologies that have been widely applied around the world to indicate the parameters to be monitored and the formulas for calculating GHG emission reduction.

- Do calculation

Sectoral oversight unit and MRV management unit:

It is necessary to have knowledge of the relevant fields in order to verify the reports issued by the implementing entities.

Operational Manual for MRV on City-level Climate Change Mitigation Actions

26.10.2017

Mr. Yoshihiro Mizuno, JICA short term experts

Mr. Phuong Nguyen, Climate Change Bureau

Purpose of this manual and Recommended readers

(1) Purpose of this manual

- guide local governments (provinces and municipalities) in Vietnam to initiate Measurement, Reporting and Verification (MRV) of climate change mitigation actions. It describes the methods and procedures to implement MRV.
- provides formats that can be used for effective MRV and case studies on MRV for several mitigation actions.
- This manual was developed based on the experiences from the MRV trials in Ho Chi Minh City (HCMC) conducted under the Project to Support the Planning and Implementation of NAMAs in a MRV Manner (SPI-NAMA) in which six mitigation actions from energy, transport and waste sectors were MRV-ed.

(2) Recommended readers

- The officials of HCMC who are involved in planning, implementation and evaluation of climate change mitigation actions.
- The officials of other local governments intending to initiate MRV

Basis of this manual

- Law on Environmental Protection No: 55/2014/QH13;
- Resolution 24/NQ-TW: Active response to climate change, improvement of natural resource management and environmental protection;
- Decision No. 2139/QD-TTg of December 5, 2011: Approving the national strategy for climate change;
- Decision No. 1393/QD-TTg of September 25, 2012: Approving the national strategy on green growth;
- Decision No. 1474/QD-TTg of October 5, 2012: Issuance of the national action plan on climate change period 2012 – 2020;
- Decision No. 2053/QD-TTg of October 28, 2016: Promulgating the plan to implement the Paris Agreement on Climate Change; and
- Decision No. 1775/QD-TTg of November 21, 2012: Approval of the project of greenhouse gas emission management

Contents of this manual

1. Chapter 1- Introduction
2. Chapter 2 - Basic MRV framework
3. Chapter 3 - MRV process
   A. Determining mitigation actions to MRV
   B. MRV implementation
   C. Approve MRV results

Chapter 2 – Basic MRV framework

Pages: 4 – 10

Brief summary of Chapter 2

Chapter 2 presented the method to identify scope for mitigation actions to MRV and explained basic MRV framework for a city, showed responsibilities of each related agency in this MRV framework

Chapter 2. Basic MRV Framework

2.1 Defining scope of mitigation actions to MRV in the city

- **Approach 1**
  - ✓ If a city ALREADY HAS its own city-wide plan related to climate change, (e.g. climate change master plan, mitigation action plan), the city can employ that plan. Because such a plan usually contains major actions related to GHG emission reduction or prevention in the city.

- **Approach 2**
  - ✓ If a city DOES NOT HAVE such a plan or strategy yet, a plan yet, the city can set the sectors that are identified as major GHG emission sources in the city as the scope of mitigation actions to MRV.

Box 2-1 Case study: Defining scope of mitigation actions to MRV for HCMC

HCMC chose Approach 1 to define its scope of mitigation actions to MRV.

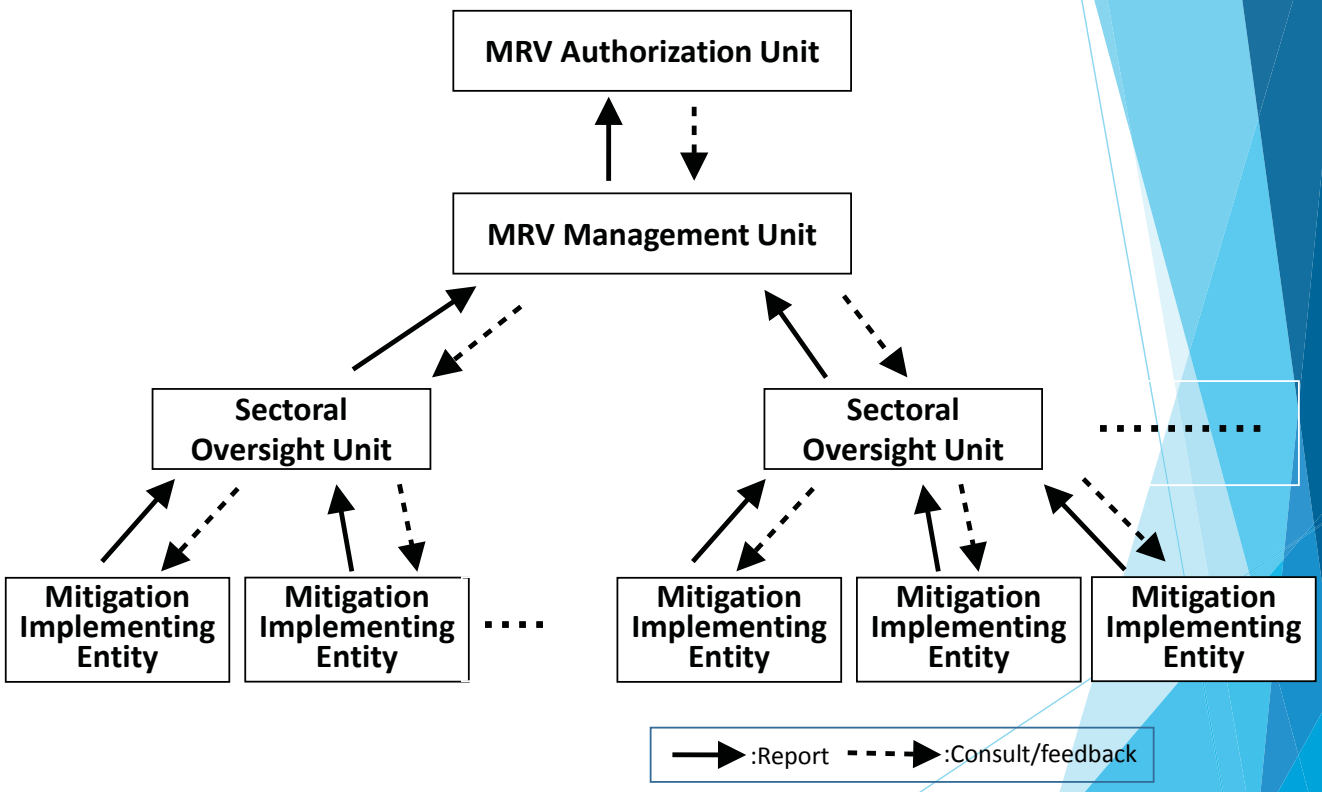
HCMC has developed Climate Change Action Plan of Ho Chi Minh City (CCAP), which stipulates priority sectors for climate change mitigation. Based on these priority sectors of CCAP, HCMC has set its scope of mitigation actions to MRV as "all mitigation actions stipulated in the CCAP."

The defined scope of HCMC is characterized as follows:

- The scope contains various levels of mitigation actions from policy-level to project -level actions.
- The scope covers mitigation actions by private sector and individual mitigation actions.

Chapter 2 - Basic MRV framework

2.2. Setting up MRV Framework for the city



Chapter 2 - Basic MRV framework

Draft MRV framework for HCMC

HCMC People's Committee	MRV Authorization Unit
Department of Natural Resources and Environment	MRV Management Unit
Various oversight departments in HCMC	Sectoral Oversight Units
Various companies and organizations that implement mitigation actions in HCMC	Mitigation Implementing Entities

Chapter 2 - Basic MRV Framework

Sectoral Oversight Units

HCMC's Mitigation Sectors (CCAP-based)	Sectoral Oversight Units of HCMC
Urban planning	Department of Architecture and Planning
Energy	Department of Industry and Trade (DOIT)
Transport	Department of Transport (DOT)
Industry	Department of Industry and Trade (DOIT)
Water management	Department of Transport (DOT)
Waste management	Department of Natural Resources and Environment (DONRE)
Construction	Department of Construction (DOC)
Health	Department of Health
Agriculture	Department of Agriculture and Rural Development (DARD)
Tourism	Department of Tourism

Chapter 3 – MRV process

Pages: 11 – 35

Brief summary of Chapter 3

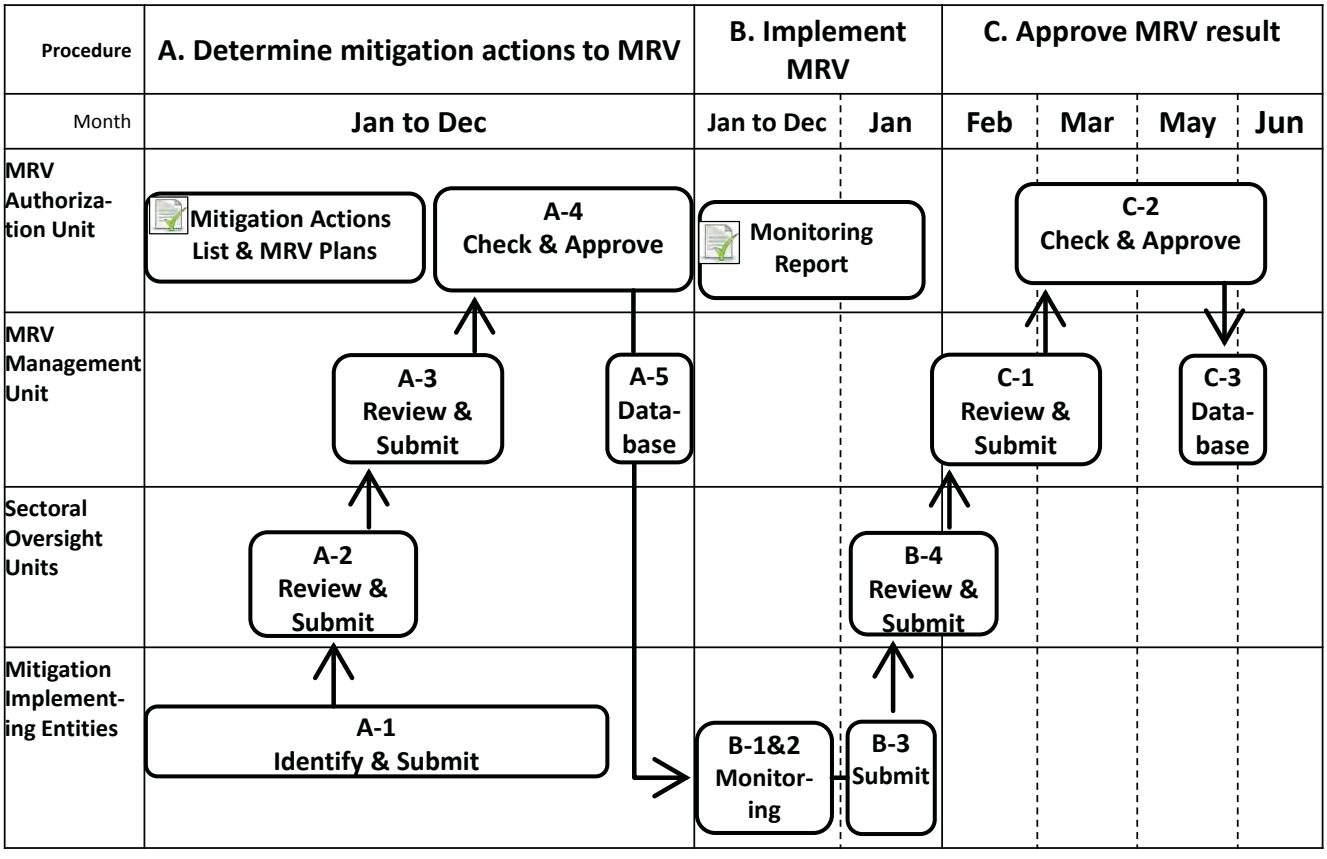
Chapter 3 provides steps by steps to implement MRV.

- Methodology and criteria to identify mitigation actions to MRV
- Implement MRV (Monitoring, Reporting, Verification)

Chapter 3. MRV process

A. Determine mitigation actions to MRV (Section 3-1)	A-1. Take stock of mitigation actions to MRV and develop MRV Plan (3-1-1) A-2. Review Mitigation Actions List and MRV Plans (3-1-2) A-3. Review Sectoral Mitigation Actions List and MRV Plans (3-1-3) A-4. Approve Draft Mitigation Actions List and MRV Plans (3-1-4) A-5. Update database on mitigation actions to MRV (3-1-5)
B. Implement MRV (Section 3-2)	B-1. Collect/measure and record data (3-2-1) B-2. Calculate GHG emission reductions (3-2-2) B-3. Prepare Mitigation Monitoring Reports (3-2-2) B-4. Review and submit Sectoral Monitoring Report (3-2-3)
C. Approve MRV result (Section 3-3)	C-1. Consolidate Sectoral Monitoring Reports (3-3-1) C-2. Approve MRV Reports (3-3-2) C-3. Update database on mitigation actions to MRV (3-3-3)

Chapter 3. MRV Process



Chapter 3. MRV process

3-1. Determining mitigation actions to MRV

3-1-1. Take stock of mitigation actions to MRV and develop MRV Plan

Pages: 13 – 26

This part instruct implementation entities to develop mitigation action list and MRV Plan

- Step 1 Preparing a long list of mitigation actions
- Step 2 Asses actions in accordance with the pre-defined criteria
- Step 3 Select the actions to MRV and develop the Mitigation Actions List

Responsible organization
Mitigation Implementing Entities

Take stock of mitigation actions to MRV and develop MRV Plan

- Step 1: Prepare a long list of potential mitigation actions
- Step 2: Assess mitigation actions in accordance with the pre-defined criteria
  - Criterion 1: Mitigation Potential - Whether the action contributes to reduce GHGs
  - Criterion 2: Practicability of MRV - Whether the action provides practical ways to MRV
- Step 3: Select the actions and develop the Mitigation Actions List

No.	Name of mitigation action	Mitigation Implementing Entity	Location	MRV/Non-MRV
1		Entity A		MRV
2		Entity A		MRV
3		Entity A		Non-MRV
4		Entity A		MRV

Chapter 3. MRV process

3.1. Determining mitigation actions to MRV

Responsible organization
Mitigation Implementing Entities

Prepare MRV plan

I. General information on the mitigation action
- a) Name of the mitigation action
- b) Involved organizations and their roles
- c) Objectives
- d) Technology introduced under the mitigation action
- e) Target GHG type
- f) Location
- g) Timeframe
- h) Cost of mitigation action
- i) Benefits of mitigation action and contribution to sustainable development
- j) Source of funding and supporting financial scheme
- k) Information on international market mechanisms

II. Emission reduction calculation, monitoring and reporting
- a) Logic of GHG emission reduction
- b) Methodology to calculate GHG emission reduction
- c) Estimated GHG emission reduction
- d) Organizational structure for monitoring and reporting
- e) Monitoring period
- f) Monitoring methods

Chapter 3. MRV process

3.1. Define mitigation actions to MRV

Responsible organization
Mitigation Implementing Entities

Prepare MRV Plan

Table 3-3 Major contents of methodology for GHG emission reduction calculation

Contents	Outline
Applicability	A methodology contains description/ explanation on what types of mitigation actions can use the methodology.
Logic of emission reduction	Description on how GHG emission is reduced through the mitigation action.
Formulae of emission reduction calculation	Description on calculation formulae for the baseline and project emissions as well as emission reductions.
Monitoring method of necessary data for emission reduction calculation	Description on the method for measurement/collection of each parameter in the formulae for calculating the baseline/project emissions and emission reductions.

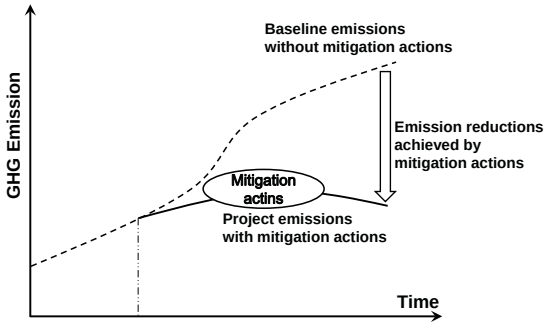


Table 3-4 Sources of existing methodologies

Title	Reference
Intergovernmental Panel on Climate Change (IPCC)	http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html
Clean Development Mechanism (CDM)	http://cdm.unfccc.int/methodologies/index.html
Greenhouse Gas Protocol: GHG Protocol for Project Accounting	http://www.ghgprotocol.org/standards/project-protocol
International Finance Corporation (IFC) Greenhouse Gas Reduction Accounting Guidance for Climate Related Projects	http://www.ifc.org/
Gold Standard	http://www.goldstandard.org/
Joint Crediting Mechanism (JCM)	http://www.jcm.go.jp
Japan International Cooperation Agency (JICA)	http://www.jica.go.jp/english/our_work/climate_change/mitigation.html
Japan Bank for International Cooperation (JBIC)	http://www.jbic.go.jp/en/efforts/j-mrv

Chapter 3. MRV process

3-1. Determining mitigation actions to MRV

3-1-2. Review Mitigation Actions List and MRV Plans

Page: 24

This part presented processes and criteria for Sectoral Oversight Units to review/check the mitigation actions list and MRV Plan

Responsible organization:
Sectoral Oversight Unit

Review Mitigation Actions List and MRV Plans

- Sectoral Oversight Unit examines Mitigation Actions List and MRV Plans submitted by Mitigation Implementing Entities.
- The example viewpoints of examination are as follows.
  - Whether there is lack in the submitted list/ detailed information
  - Whether the target, procedure and timing for MRV are clearly stated
  - Whether the target project can be expected to have GHG emission reductions
  - Whether the target project compliance with upstream, guiding plans/strategies
  - Whether the target project is MRV-able
- Sectoral Oversight Unit compiles all Mitigation Actions and MRV Plans of the sector as Sectoral Mitigation Actions List and MRV Plans and submits it to MRV Management Unit anytime throughout year.

Table 3-5 Image of compiled Sectoral Mitigation Actions List

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	Location	MRV/ Non-MRV
1	Energy		Unit AA	Entity A		MRV
2						MRV
3						Non-MRV
4				Entity B		MRV
5						MRV
6						MRV
7						MRV
8						Non-MRV
9				Entity C		MRV
10				Entity D		Non-MRV
...						

Chapter 3. MRV process

3-1. Determining mitigation actions to MRV

3-1-3. Review Sectoral Mitigation Actions List and MRV Plans

Page: 25

This part presented process and criterion for MRV Management Unit to check mitigation actions list by sectors and MRV Plans submitted by Sectoral Oversight Units.

Chapter 3. MRV process

Responsible Organization:
MRV Management Unit

3.1. Determining mitigation actions to MRV

Review Sectoral Mitigation Actions List and MRV Plans

- MRV Management Unit thoroughly examines the Sectoral Mitigation Actions List and MRV Plans submitted by Sectoral Oversight Units.
- The example viewpoints of examination are as follows.
  - Whether there is lack in the submitted list/ detailed information
  - Whether the target, procedure and timing for MRV are clearly stated
  - Whether the target project can be expected to have GHG emission reductions
  - Whether the target project is MRV-able
- By the end of April, MRV Management Unit compiles all Sectoral Mitigation Actions List and MRV Plans that will be MRV-ed in the next fiscal year, and submits it to MRV Authorization Unit with a recommendation for approval

Table 3-6 Image of Mitigation Actions List

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	Location	Year of addition to the list	MRV/ Non-MRV
1	Energy		Unit AA	Entity A		2016	MRV
2						2016	MRV
3						2017	Non-MRV
4				Entity B		2016	MRV
5						2016	MRV
6						2017	MRV
7						2017	Non-MRV
8				Entity C		2016	MRV
9				Entity D		2017	Non-MRV
10	Transport		Unit BB	Entity E			MRV
11							Non-MRV
12				Entity F			MRV
13				Entity G			MRV
14	Waste		Unit CC	Entity H			MRV
...							

Chapter 3. MRV process

3-1. Determining mitigation actions to MRV

3-1-4. Approve Mitigation Actions List and MRV Plans

Page: 26

This part presented procedure for the MRV Authorization Unit to approve the mitigation actions list and MRV Plan submitted by the MRV Management Unit.

Chapter 3. MRV process

3-1. Determining mitigation actions to MRV

3-1-5. Update database on mitigation actions to MRV

Page: 26

This part presented procedure for the MRV Management Unit to update database on mitigation actions to MRV

Chapter 3. MRV process
3.1. Determining mitigation actions to MRV

Responsible Organization :
MRV Authorization Unit

Approve Mitigation Actions List and MRV Plans

- By the end of May, after receiving the Draft Mitigation Actions List and MRV Plans with a recommendation for approval, MRV Authorization Unit approves it as a Mitigation Actions List and MRV Plans.
- By the end of June, MRV Authorization Unit notifies the Mitigation Actions List and MRV Plans through MRV Management Unit to Sectoral Oversight Units

Responsible Organization:
MRV Management Unit

Update database on mitigation actions to MRV

- MRV Management Unit updates the database on mitigation actions to include the Mitigation Actions List and MRV Plans.

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	Location	Year of addition to the list	MRV/ Non-MRV	Emission reduction in year 1	Emission reduction in year 2
...	...	...	...	...	...	...	...	...	...
Total	-	-	-	-	-	-	-	XXXX	XXXX

Chapter 3. MRV process
3-2. Implement MRV
3-2-1. Collect/measure and record data (Monitoring)
Pages: 27-32

This part presented procedure for the Mitigation Implementation Entities to conduct monitoring includes instruction to prepare monitoring sheet and calculation sheet and implement monitoring.

Chapter 3. MRV process

3.2 Implement MRV

Responsible organization:
Mitigation Implementation Entities

Collect/measure and record data (Monitoring)

- The Mitigation Implementing Entities conduct monitoring in accordance with respective MRV Plan, and prepare Monitoring Sheet every determined period such as monthly/ quarterly/bi-annually.
- Monitoring activity needs to be carried out using the designated method, procedure and period described in the respective approved MRV plan.
- The Mitigation Implementing Entity monitors (through either direct measurement (monitoring) of parameters or data collection from operators such as bus companies) and collects all data (such as CO2 emission factors) that is necessary to calculate GHG emission reductions
- The Mitigation Implementing Entity inputs all the collected and measured data and information into the Monitoring Sheet.
- The Monitoring Sheet and GHG emission reduction calculation sheet need to be prepared for each mitigation action. The monitored data and its measurement method/ procedure are needed to be determined before implementing the monitoring activity.

Chapter 3. MRV process

3.2 Implement MRV

Prepare monitoring sheet

Table 3-8 Basic contents of Monitoring sheet

I. Information on the mitigation action
a) Name of the mitigation action
b) Sector
c) Mitigation Implementing Entity
d) Sectoral Oversight Unit
e) Name of the site
II. Results of monitoring
a) Monitoring year
b) Monitoring month
c) Creation date
d) Name of the person in charge
e) Monitoring results
f) Monitoring period

Monitoring sheet

Monitoring (Measurement) Sheet for Solar PV project

Project title	
Name of the site	
Name/ No. of the Monitoring Meter	
Starting date of Monitoring	
Name of the person in charge	

Monitoring period		Measured date	Electricity generation amount indicated by electric meter (kWh)	Accumulated electricity generation amount (kWh)
From	to			
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0

Conduct monitoring

Jan, Monitoring data

Feb, Monitoring data

Dec, Monitoring data

Monitoring (Measurement) Sheet for Solar PV project

Project title	
Name of the site	
Name/ No. of the Monitoring Meter	
Starting date of Monitoring	
Name of the person in charge	

Monitoring period		Measured date	Electricity generation amount indicated by electric meter (kWh)	Accumulated electricity generation amount (kWh)
From	to			
				0
				0
				0
				0
				0
				0
				0
				0
				0
				0

Data input

GHG calculation sheet

GHG Emission reduction calculation sheet for PV project

Period of monitoring:

Emission Reduction

Description	Parameter	Unit	Emissions
Emission reduction	ER_y	tCO_2/year	12
Baseline emission	BE_y	tCO_2/year	12
Project emission	PE_y	tCO_2/year	0

Inputs

*Input only orange cell

Description	Parameter	Unit	Amont of Electric generation	Data source
Amount of electricity generated in the year y	EG_{PJ}	kWh/year	18,000	Measured
CO2 Emission factor of grid	EF_{grid}	tCO_2/MWh	0.66	

Chapter 3. MRV process

3-2. Implement MRV

3-2-2. Prepare and submit Mitigation Monitoring Reports

Pages: 30-32

This part presented the procedure and instruction for the Mitigation implementation Entities to prepare and submit Mitigation Monitoring Report

Responsible Organization:
Mitigation Implementation Entities

Prepare and submit Mitigation Monitoring Reports

- The Mitigation Implementing Entities prepare the Mitigation Monitoring Report using the data of the Monitoring Sheet and the results of GHG emission reduction calculations.
- General information of the mitigation action are also described in the Mitigation Monitoring Report.
- The Mitigation Implementing Entities calculates the GHG emission reduction for the mitigation action to MRV once a year using the data contained in the Monitoring sheets and GHG emission calculation sheet.
- The Mitigation Implementing Entities submit the Mitigation Monitoring Report to the Sectoral Oversight Unit by the end of January (once a year).

Table 3-9 Contents of Mitigation Monitoring Report

I. Monitoring period
II. Emission reductions of the monitoring period
III. Processes of the emission reduction calculation

Chapter 3. MRV process

3-2. Implement MRV

3-2-3. Review and submit Sectoral Monitoring Report

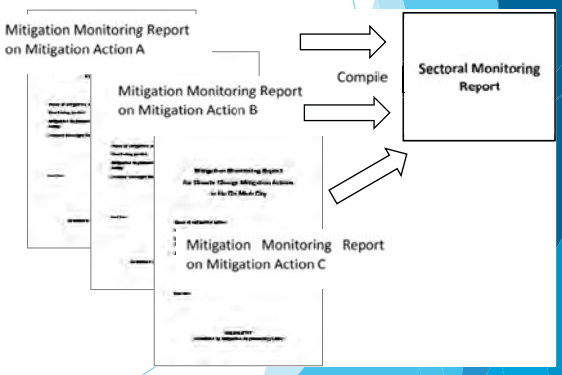
Page: 31

This part presented procedure and instruction for the Sectoral Oversight Unit to check mitigation monitoring report and consolidate into sectoral monitoring report.

Responsible organization:
Sectoral Oversight Unit

Review and submit Sectoral Monitoring Report

- The Sectoral Oversight Unit thoroughly reviews the submitted Mitigation Monitoring Reports. Following elements should be considered in examining the reports:
  - Whether there is lack of information in the submitted
  - Whether there is big gap between MRV plan and Mitigation Monitoring Report
- The Sectoral Oversight Unit compiles the Mitigation Monitoring Reports to develop the Sectoral Monitoring Report and the submits it to the MRV Management Unit by the end of February (once a year).



Chapter 3. MRV process

3-3. Approve MRV result

3-3-1. Compile Sectoral Monitoring Reports

Pages: 33-35

This part presented procedure and instruction for the MRV Management Unit to evaluate the Sectoral Monitoring reports and compile into MRV Report and submit to MRV Authorization Unit.

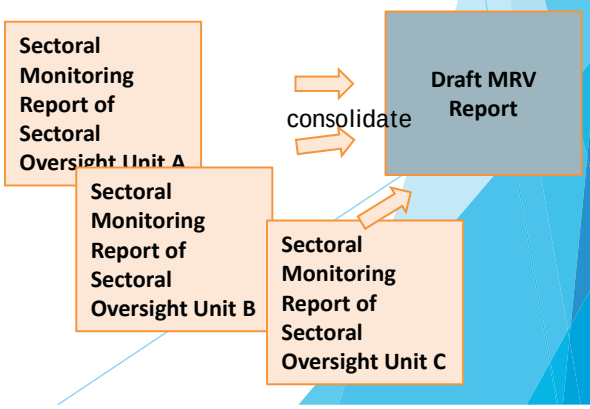
Chapter 3. MRV process

3.3. Approve MRV result

Responsible organization:
MRV Management Unit

Compile Sectoral Monitoring Reports

- The MRV Management Unit examines Sectoral Monitoring Reports submitted by Sectoral Oversight Units. The example viewpoints of examination are as follows:
  - Whether there is lack of information/data in the submitted Sectoral Monitoring Report.
  - Whether the MRV for the approved mitigation actions has been adequately implemented in accordance with the approved MRV Plan.
  - Whether GHG emission reduction is accurately calculated in accordance with the approved MRV Plan and whether appropriate data is applied for the calculation.
- The MRV Management Unit compile the Sectoral Monitoring Reports of the year submitted by all Sectoral Monitoring Reports into the MRV Plan.
- By the end of March, the MRV Management Unit submits the MRV Report to the MRV Authorization Unit.



Chapter 3. MRV process

3.3. Approve MRV result

Responsible organization:
MRV Management Unit

MRV Report

- Sector category
- Name of the mitigation action
- Sectoral Oversight Unit(s) and Mitigation Implementing Entity(ies)
- Classification of MRV or Non-MRV
- Emission reductions achieved by the mitigation action during the year

Table 3-10 Example of MRV Report

No.	Sector	Name of mitigation action	Sectoral Oversight Unit	Mitigation Implementing Entity	MRV/ Non-MRV	GHG emission reductions (tCO_2e)
1	Energy		Unit AA	Entity A	MRV	
2					MRV	
3					Non-MRV	
4				Entity B	MRV	
5					MRV	
-		Sub-total				
6	Transport		Unit BB	Entity C	MRV	
7					Non-MRV	
8				Entity D	MRV	
9					Non-MRV	
-		Sub-total				
10	Waste		Unit CC	Entity E	MRV	
11					MRV	
12				Entity F	MRV	
...					Non-MRV	
-		Sub-total				

Chapter 3. MRV process

3-3. Approve MRV result

3-3-2. Approve MRV reports

Page: 35

This part presented procedure for the MRV Authorization Unit to approve the MRV reports.

Chapter 3. MRV process

3-3. Approve MRV result

3-3-3. Update database on mitigation actions to MRV

Page: 35

This part presented procedure for the MRV Authorization Unit to update database on mitigation actions with data in the approved MRV reports.

Chapter 3. MRV process

3.3. Approve MRV result

Responsible organization:
MRV Authorization Unit

Approve MRV report

- By the end of May, the MRV Authorization Unit checks the MRV Report and then approve the MRV Report
- By the end of June, MRV Report are notified through the MRV Management Unit to relevant entities in the city as well as to the MONRE.

Responsible organization:
MRV Management Unit

Update database on mitigation actions

- The MRV Management Unit update the database on mitigation actions with information contained in the approved MRV Report including attached GHG emission reductions.

Annex

- **Annex 1: MRV Case studies on MRV**

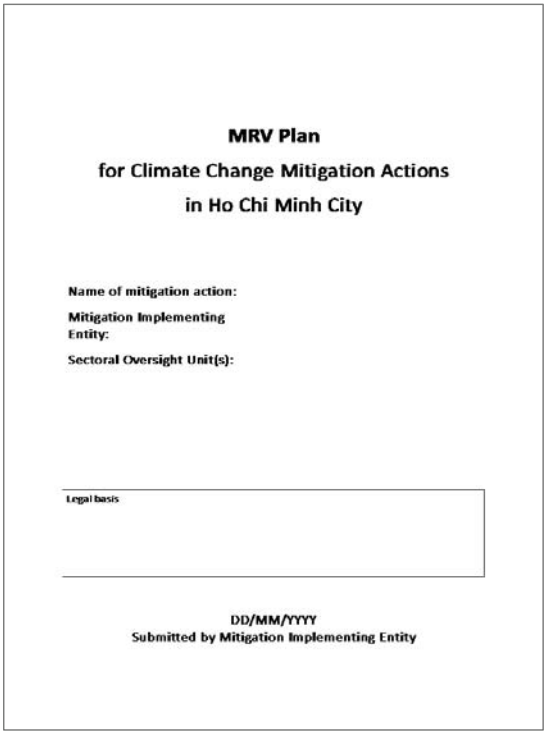
1. Installation of solar PV system on the roof top of the public buildings
2. Introduction of air conditioning system with inverters to the offices
3. Replacement CFL with LED for the small street lamps
4. Replacement to high energy efficient boilers at a dairy factory
5. Introduction of CNG buses
6. Promotion of eco-driving
7. Introduction of Bus Rapid Transit (BRT)
8. Introduction of urban railway
9. Collection and utilization of landfill gas at final disposal site
10. Recycling of municipal solid waste
11. Production of organic fertilizer
12. Collection of animal manure for biogas generation

Annex

- Annex 2: Typical Mitigation Actions and Emission Reduction Logic
  - Generation of electricity
  - Factory
  - Commercial building (hotel, shopping mall, market, etc.)
  - Household
  - Car/motorcycle
  - Bus
  - Railway
  - Ship/vessel
  - Traffic management
  - Freight transportation
  - Port/airport
  - Waste treatment
  - Wastewater treatment

Annex 3

- Annex 3: Format of MRV Plan



MRV Plan

for Climate Change Mitigation Actions

in Ho Chi Minh City

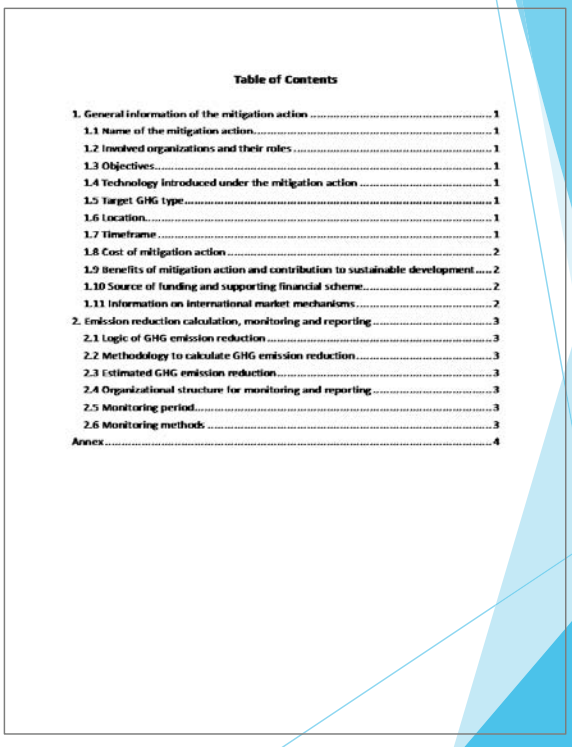
Name of mitigation action:

Mitigation Implementing Entity:

Sectoral Oversight Unit(s):

Legal basis

DD/MM/YYYY
Submitted by Mitigation Implementing Entity



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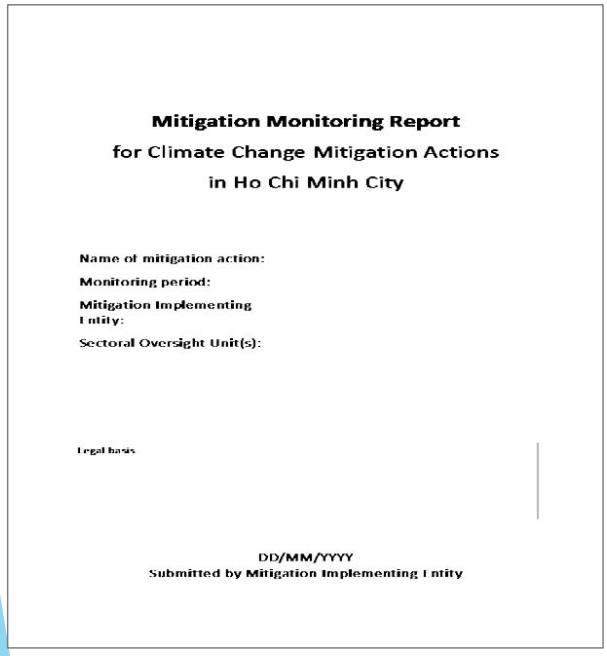
1. General information of the mitigation action 1
1.1 Name of the mitigation action 1
1.2 Involved organizations and their roles 1
1.3 Objectives 1
1.4 Technology introduced under the mitigation action 1
1.5 Target GHG type 1
1.6 Location 1
1.7 Timeframe 1
1.8 Cost of mitigation action 2
1.9 Benefits of mitigation action and contribution to sustainable development 2
1.10 Source of funding and supporting financial scheme 2
1.11 Information on international market mechanisms 2
2. Emission reduction calculation, monitoring and reporting 3
2.1 Logic of GHG emission reduction 3
2.2 Methodology to calculate GHG emission reduction 3
2.3 Estimated GHG emission reduction 3
2.4 Organizational structure for monitoring and reporting 3
2.5 Monitoring period 3
2.6 Monitoring methods 3
Annex 4

Annex

- Annex 4: Format of Monitoring Report



Mitigation Monitoring Report
for Climate Change Mitigation Actions
in Ho Chi Minh City

Name of mitigation action:

Monitoring period:

Mitigation Implementing Entity:

Sectoral Oversight Unit(s):

Legal basis

DD/MM/YYYY
Submitted by Mitigation Implementing Entity

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1. Monitoring period 2
2. Emission reductions of the monitoring period 2
3. Processes of the emission reduction calculation 2
Annex 2

1

Project to Support the Planning and Implementation of NAMAs

in a MRV Manner

Capacity building of HCMC officials

Sở Tài nguyên và Môi trường TP.HCM

26 tháng 10 năm 2017

Introduction

- **Legal basis:**
- Decision No. 1911/QĐ-BTNMT of July, 29,2015 : Approving Project document "Project to Support the Planning and Implementation of NAMAs (SPI-NAMA)"
- The policy of the People's Committee in Official Letter No. 5128 / UBND-DT of September,19,2016: Implementation of the SPI-NAMA project in Ho Chi Minh City, (Assigned DONRE in collaboration with the Japan International Cooperation Agency (JICA) to organize training courses, to enhance the capacity of HCMC officials on climate change response and management of GHG reduction activities within the framework of the project in 2016 and 2017.
- **Training sessions within the framework of the project :** 04 sessions in HCMC and 3 sessions in Japan.

Table of Contents

Part 1: Summary of capacity buildings

Part 2: Experience of training in Japan

Part 1: Summary of capacity buildings

Part 2: Experience of training in Japan

Summary of capacity buildings

Jan 2016	Seminar on Climate Change Mitigation for HCMC Officials (1st)
Mar 2016	Seminar on Climate Change Mitigation for HCMC Officials (2nd)
May 2016	Training in Japan (1st)
Sept 2016	Training in Japan (organized by Hanoi-side)
Nov 2016	General Training on Climate Change Mitigation for HCMC Officials (1st)
May 2017	Training in Japan (2nd)
July 2017	General Training on Climate Change Mitigation for HCMC Officials (2nd)

1. Seminar on Climate Change Mitigation for HCMC Officials

Objective: Understand outline of SPI-NAMA and basics of GHG inventory and NAMA/MRV

	Date	Participants	Contents
First	6 Jan 2016	13 people (DONRE, DOT, DOIT, MBS, MOCPT, EVN, CITENCO)	➢ Introduction to SPI-NAMA ➢ Basics on GHG inventory ➢ Basics on NAMA/MRV
Second	18 Mar 2016	6 people (DONRE, DOT, DOIT, EVN, MBS)	➢ Outline of NAMA/MRV guidelines for HCMC ➢ Candidate NAMAs to pilot MRV ➢ Calculation of GHG emissions for MRV

2. General Training on Climate Change Mitigation for HCMC Officials

Objective: Enhance capacity of HCMC officials to plan and monitor climate change mitigation measures

	Date	Participants	Contents
First	25 and 28 to 30 Nov 2016 (4 days)	80 in Part A and 49 in Part B	➢ Part A: Lecture on climate change mitigation, GHG inventory, and MRV ➢ Part B: Exercise on planning mitigation measures / planning MRV procedure
Second	5 to 7 July 2017 (3 days)	56 in Part A and 39 in Part B	

3. Training in Japan

Objective: Understand climate change mitigation measures of Japan at local government level

	Date	Participants	Contents
First	22 to 28 May 2016	10 from HCMC (PC, DONRE, MBS, DOT, DOIT, CITENCO, MOCPT, EVN) 3 from Ministries	➢ Mitigation actions of Tokyo Metropolitan Government and Osaka City ➢ Site visit to solid waste treatment plant
Second	21 to 27 May 2017	10 from HCMC (DONRE, DOT, DARD, SCFC, UCCI, Statistical Office)	➢ Mitigation actions of Tokyo Metropolitan Government ➢ Site visits to solid waste treatment plant, waste water treatment plant, and energy-efficient building

4. Training in Japan (Organized by Hanoi-side)

Objective: Learn national and local actions on climate change mitigation in Japan

Date: 6 to 12 September 2016

Participants: Director of DONRE, Vice-Director of CCB, MONRE, MPI, MOIT, MOC, MOT, Da Nang Hai Phong

Visited: Ministries, Business (Keidanren), Tokyo Metropolitan Government, Public thinktanks, Private energy efficient building

Part 1: Summary of capacity buildings

Part 2: Experience of training in Japan

Schedule of the training

Date		Contents
Sun 21 May		*Arrival (Narita)*
Mon 22 May	AM	• Orientation
	PM	• Presentation by trainees (mitigation actions in HCMC) • Lecture by JICA experts
Tue 23 May	AM	• Lecture by Bureau of Environment Tokyo Metropolitan Government (TMG)
	PM	• Lecture by Bureau of Environment TMG
Wed 24 May	AM	• Lecture by Bureau of Environment TMG
	PM	• Site visit to energy efficient building
Thu 25 May	AM	• Site visit to solid waste treatment plant
	PM	• Site visit to waste water treatment plant
Fri 26 May	AM	• Workshop (planning of MRV structure of mitigation measures)
	PM	• Presentation by trainees • Closing ceremony
Sat 27 May		*Departure (Narita)*

1. Detail of the training sessions

Presentation by trainees :

- Overview of mitigation action plans and policies in HCMC, Contents of the works that their organization is planning or implementing.
- Objectives and issues
- Expectations from the training session

Lecture by experts

- Introduction of GHG inventory
- Introduction of Mesuerement- Reporting- Verification (MRV) process

Lecture by Bureau of Environment Tokyo Metropolitan Government (TMG)

* **Tokyo Metropolitan Government's strategy to respond to climate change**
- Overview of CO_2 emission in Tokyo
- Target: (By 2020: Cut 25% of GHG emission in Tokyo compared to 2000, by 2030: 38%)

Lecture by Bureau of Environment Tokyo Metropolitan Government (TMG)

* **Tokyo Metropolitan Government's strategy to respond to climate change**

- **Basic environmental plan of Tokyo**
  - Build a energy smart city:

✓Energy efficiency and energy management activities

✓Extension of using renewable energy

✓ Build a low carbon society , bear and prevent from disaster, use Hydrogen energy

Lecture by Bureau of Environment Tokyo Metropolitan Government (TMG)

* Diagnosis of energy efficiency in Tokyo Metropolitan project

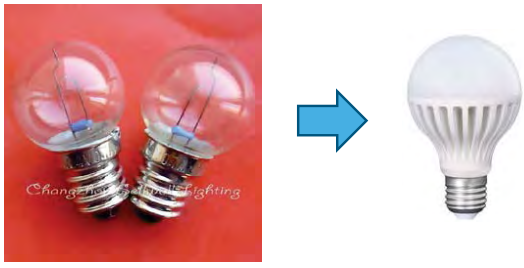
✓Definition

✓ Energy efficiency diagnostic process

✓ Diagnostic achievements

✓Diagnostic efficiency

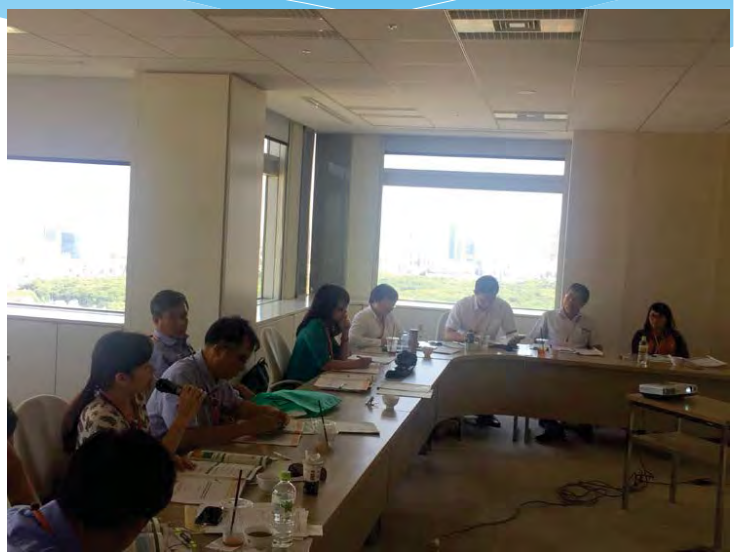
✓Example on energy efficiency and introduction of the project



Lecture by Bureau of Environment Tokyo Metropolitan Government (TMG)

* Cap-and-Trade

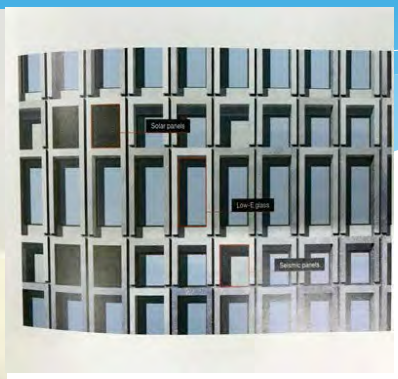
* Energy efficiency promotion program of small and medium private companies and Credit creation project



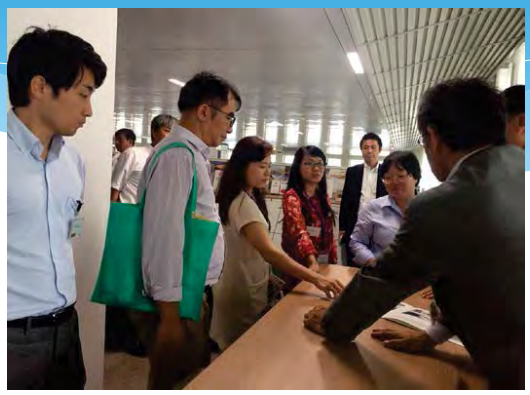
Site visit to energy efficient building - Office of Tokyo public environment company

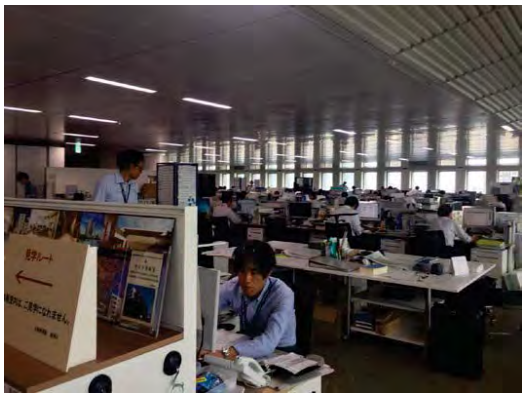
*Visit headquater of Shimizu Group:

Typical building for energy efficiency – Breakthrough solutions in design, lighting and air conditioning.

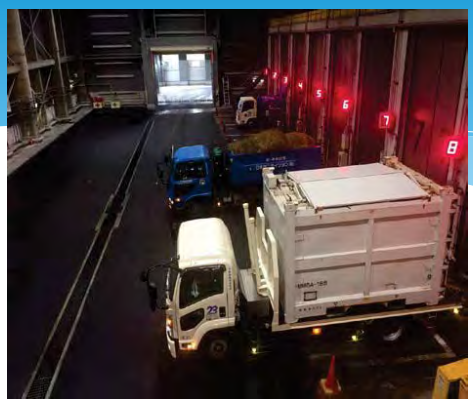


Site visit to energy efficient building
- Office of Tokyo public environment company





Site visit to solid waste treatment plant Ota



Garbage truck to transport the center

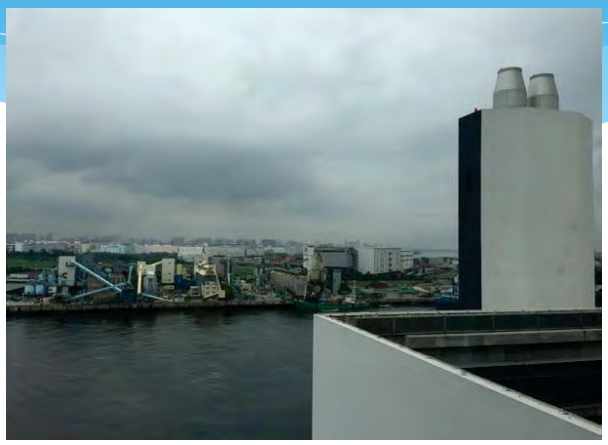
Garbage

Control room

Garbage burning model

Site visit to solid waste treatment plant Ota

Model of turbine generator



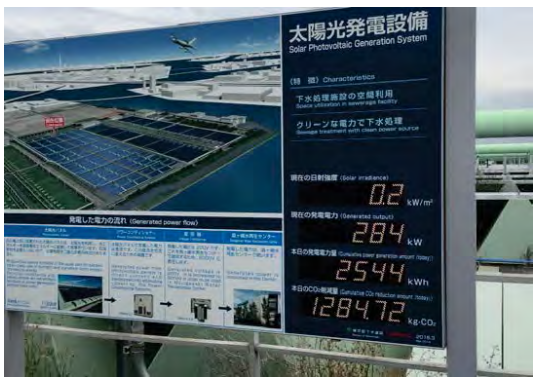
Chimney after the burning process

Site visit to waste water treatment plant Morigasaki

Diagram of using the sludge decomposition process to generate electricity

Solar panels cover reaction tanks

Sedimentation tanks



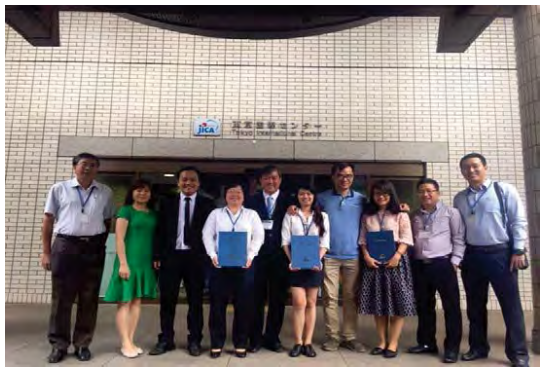
Parameters of the solar panels

Site visit to waste water treatment plant Morigasaki

Utilization of wastewater after treatment for hydropower

Group working on planning of MRV

Presentation – Evaluation– Conclusion



2. Gained Knowledge

Climate change mitigation policies of Tokyo Metropolitan Government

For large scale industrial and commercial manufacturing enterprises (anual energy consumption > 1.500 kL crude oil equivalent)	For medium small scale industrial and commercial manufacturing enterprises	For households
Cap-and-trade: - Purchase the GHG emission reduction credit - Purchase renewable energy credits - Purchase GHG emission reduction outside	Diagnosis of energy efficiency for enterprises that registered technical assistance on improved operation, on introduction of energy efficiency equipment	Partial support (free 2 incandescent bulbs with 1 LED bulb) Scoring system for energy efficiency buildings

2. Gained Knowledge

Manual for Mesuerement- Reporting- Verification (MRV) process

Through an exercise to implement an basic MRV framework for specific project, the knowledge gained:

- MRV is an indispensable component of each mitigation actions that allows check and report in a systematic way.
- MRV is an effective tool to quantify mitigation of each activities
- The works for each stage M, R, V
- Logic of Emission reduction
- Responsibilities of relevant organizations in MRV process
- Benefits and meanings of MRV implementation

Introduce the basic MRV framework(scale, , compulsory or encouraging, financial support, calculation methodologies)

3. How to apply the gained knowledges through training sessions in HCMC

- GHG inventory : Enhance the coordination between organizations and departments
- Submit Manual for MRV to People Committee HCMC to issue : MRV trials for state enterprises, large scale enterprises, large scale wastewater treatment plant, landfill
- Study and develop policies to encourage organizations and individuals in HCMC to participate in energy efficiency, policies on energy use
- Study and introduce the model of garbage collection - incineration - energy generation
- Study and propose efficient using of water resources – energy generation from waste water treatment process
- Propaganda to community .

4. Comments for future training sessions

- *Seminar : target groups*
- *Competitions (test, examination)*
- *Discussion session*
- *Site visit / Introduce the practical model*

Conclusion

* The training sessions had remarkable results
* To apply it needs more research on real situation in HCMC
* When implementing, it is necessary to consult and coordinate with relevant parties
* Cooperate and exchange experience in implementing process
* Community consultation
* Propaganda to community
* Financial resources : sponsorship, JCM mechanism ...

Developing Effective Mitigation Policies for Cities:

Learning from Tokyo

26 OCTOBER 2017 @ Caravelle Saigon

Kazuya FUJIWARA
Mizuho Information & Research Institute Inc.,

Outline

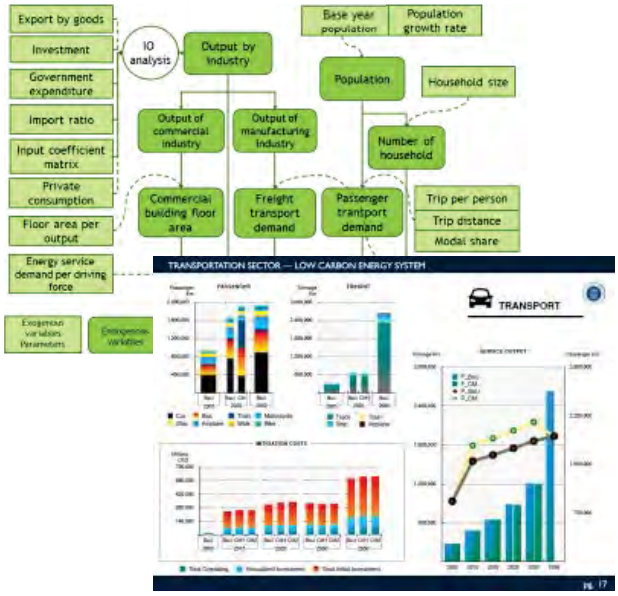
- Introduction of AIM
- Mitigation Policies in Tokyo
- Activities for Knowledge Sharing
- Possible activity in Ho Chi Minh City

Introduction of AIM

What is AIM?

- Asia-Pacific Integrated Model (AIM) is a family of analytical models which are developed by research institutes in Japan. AIM contributes IPCC reports, discussion on climate change mitigation actions in Japan and Asian countries.
- AIM can be regarded as **"researchers network"**, because AIM is developed and applied through collaboration with researchers in various countries.

Model



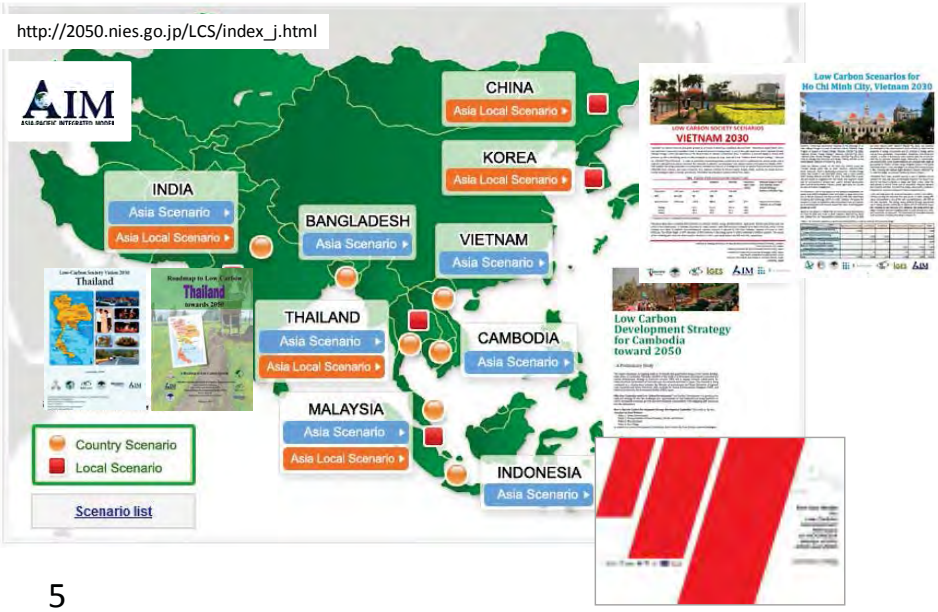
Example of AIM's structure and output

Researchers Network

21th AIM International Workshop

AIM activities in Asia

- AIM has contributed processes to formulate climate policy in Japan, and the activities are expanded to Asia. AIM has been involved in formulation processes of low carbon policies through collaboration with Asian researchers.
- Since FY2014, "Asia Low Carbon Society Research (LCSR) Project" which is funded by MoEJ is launched. The project includes not only making low carbon scenarios but also designing practical programs to realize LCS in target regions.

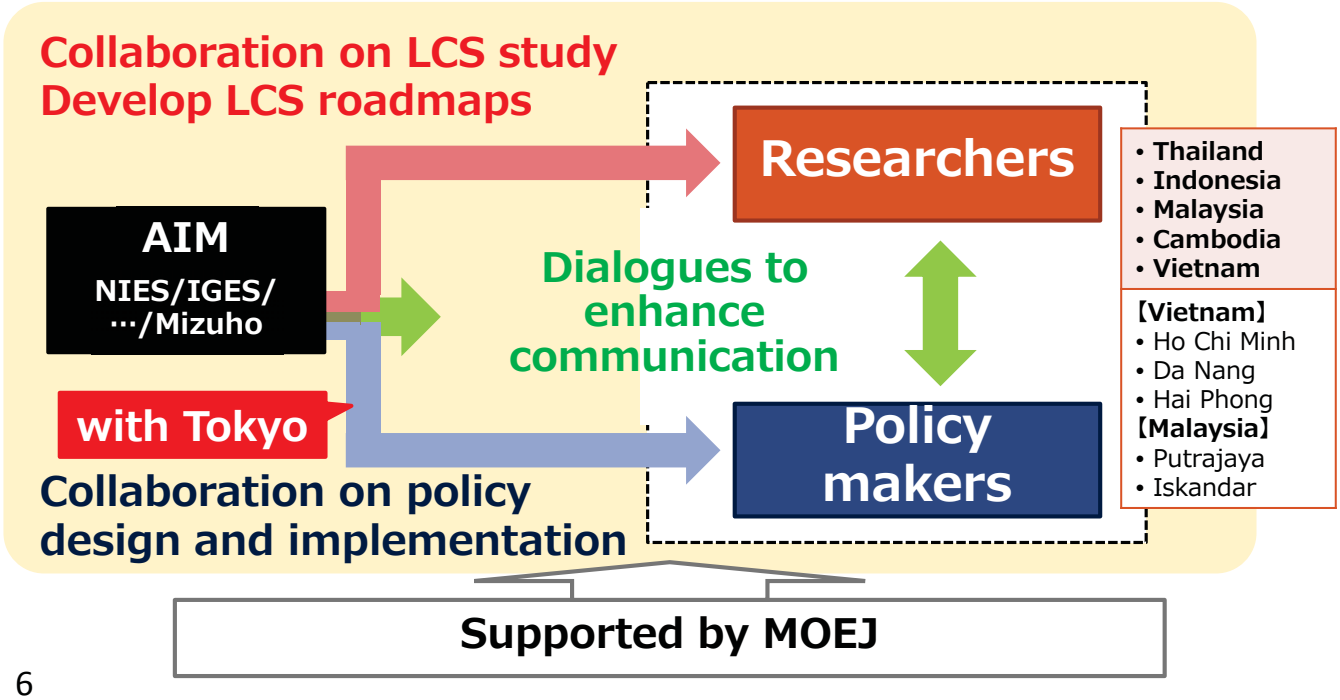


Target Regions
FY2014 -

National	**• Thailand** **• Indonesia** **• Malaysia** **• Cambodia** **• Vietnam**
City	**【Vietnam】** • Ho Chi Minh • Da Nang • Hai Phong **【Malaysia】** • Putrajaya • Iskandar

Asia Low Carbon Society Research Project (MOEJ)

- AIM team has conducted Asia Low Carbon Research Project which is supported by MOEJ.
- The project aims to support developing LCS plans and designing policy instruments to enhance mitigation actions in target regions through collaborative works with Asian researchers and policy makers.



Steps to develop LCS scenarios

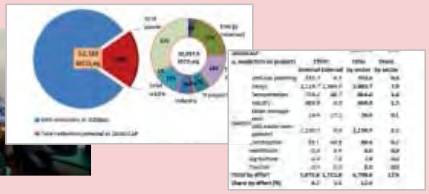
- Components of activities of LCSR project are shown below. Scope and target area of the activities vary year by year.

1 Relation building

a. Find counterparts
b. Relation building
⇐ **Dialogues, WS**

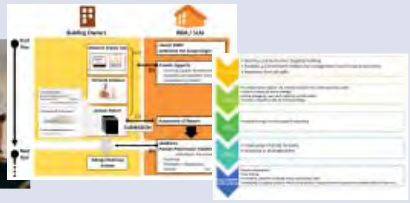

2 Develop LCS plan

a. CB of researchers
b. Quantitative analysis
⇐ **Training, collaboration**

2+ Design program

a. CB of policy makers
b. Design practical program
⇐ **Training, collaboration**

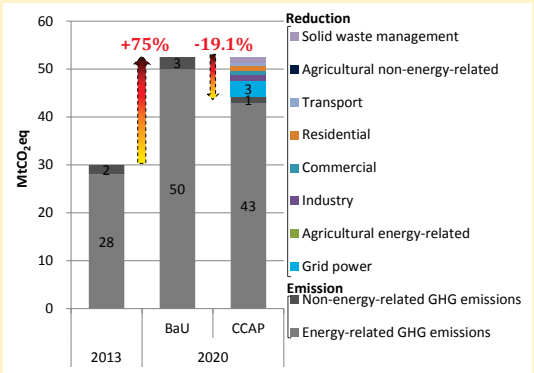
3 Policy dialogue

a. Input to local authorities
b. Appeal to various parties
⇐ **International events**

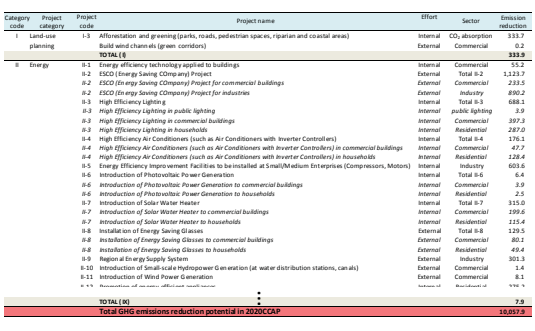

LCS Studies in Vietnamese Cities

- AIM has supported to develop LCS plans in Ho Chi Minh, Da Nang and Hai Phong cities. GHG reduction potential and possible countermeasures towards 2030 are identified based on quantitative analysis by AIM/ExSS.
- LCS plans were developed through collaborative works and discussions with counterparts.

GHG Emission & Reduction



GHG Reduction by Projects

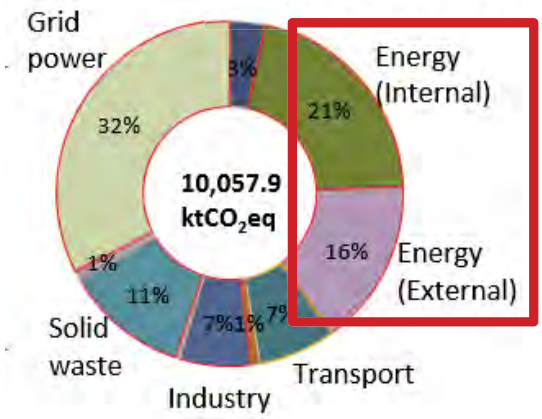


Category code	Project category	Project code	Project name	Effort	Sector	Emission reduction
I	Land-use planning	I-3	Afforestation and greening (parks, roads, pedestrian spaces, riparian and coastal areas)	Internal	CO_2 absorption	333.7
			Build wind channels (green corridors)	External	Commercial	0.2
			TOTAL (I)			333.9
II	Energy	II-1	Energy efficiency technology applied to buildings	Internal	Commercial	55.2
		II-2	ESCO (Energy Saving COmpany) Project	External	Total II-2	1,123.7
		II-2	*ESCO (En ergy Saving COmpany) Project for commercial buildings*	External	Commercial	233.5
		II-2	*ESCO (En ergy Saving COmpany) Project for industries*	External	Industry	890.2
		II-3	High Efficiency Lighting	Internal	Total II-3	688.1
		II-3	*High Efficiency Lighting in public lighting*	Internal	public lighting	3.9
		II-3	*High Efficiency Lighting in commercial buildings*	Internal	Commercial	397.3
		II-3	*High efficiency Lighting in households*	Internal	Residential	287.0
		II-4	High Efficiency Air Conditioners (such as Air Conditioners with Inverter Controllers)	Internal	Total II-4	176.1
		II-4	*High Efficiency Air Conditioners (such as Air Conditioners with Inverter Controllers) in commercial buildings*	Internal	Commercial	47.7
		II-4	*High Efficiency Air Conditioners (such as Air Conditioners with Inverter Controllers) in households*	Internal	Residential	128.4
		II-5	Energy Efficiency Improvement Facilities to be installed at Small/Medium Enterprises (Compressors, Motors)	Internal	Industry	603.6
		II-6	Introduction of Photovoltaic Power Generation	Internal	Total II-6	6.4
		II-6	*Introduction of Photovoltaic Power Generation to commercial buildings*	Internal	Commercial	3.9
		II-6	*Introduction of Photovoltaic Power Generation to households*	Internal	Residential	2.5
		II-7	Introduction of Solar Water Heater	Internal	Total II-7	315.0
		II-7	*Introduction of Solar Water Heater to commercial buildings*	Internal	Commercial	199.6
		II-7	*Introduction of Solar Water Heater to households*	Internal	Residential	115.4
		II-8	Installation of Energy Saving Glasses	External	Total II-8	129.5
		II-8	*Installation of Energy Saving Glasses to commercial buildings*	External	Commercial	80.1
		II-8	*Installation of Energy Saving Glasses to households*	External	Residential	49.4
		II-9	Region al Energy Supply System	External	Industry	301.3
		II-10	Introduction of Small-scale Hydropower Generation (at water distribution stations, canals)	External	Commercial	1.4
		II-11	Introduction of Wind Power Generation	External	Commercial	8.1
			TOTAL (II)			7.9
			Total GHG emissions reduction potential in 2020CCAP			10,057.3

Reduction Potential in HCMC

- HCMC already developed CCAP2016-2020 in which projects for mitigation are grouped into 10 fields.
- AIM team analyzed the reduction potential in project level through collaborative work with HCCB. According to the analysis, projects belonging to “Energy” filed have the largest reduction potential.

Reduction in “Energy”



The largest reduction potential exists in “Energy” field.

Reduction Potential in HCMC

- According to the analysis, ESCO and diffusion of energy efficient devices have large reductions.
- In order to realize actual reductions, a strategic approach is required to expand individual mitigation projects to whole city.

Project List in Field of "Energy"

Project code	Project Group	Sector	Reduction (ktCO2eq)
II-01	**Energy efficiency technology applied to buildings**	Commercial	**55.2**
II-02	**ESCO (Energy Saving COmpany) Project**		
	- for commercial buildings	Commercial	**233.5**
	- for industries	Industry	**890.2**
II-03	**High Efficiency Lighting**		
	- in public lighting	Commercial	**3.9**
	- in commercial buildings	Commercial	**397.3**
	- in households	Residential	**287.0**
II-04	**High Efficiency Air Conditioners (such as Air Conditioners with Inverter Controllers)**		
	- in commercial buildings	Commercial	**47.7**
	- in households	Residential	**128.4**
II-05	**Energy Efficiency Improvement Facilities to be installed at Small/Medium Enterprises**	Industry	**603.6**
II-06	Introduction of Photovoltaic Power Generation		
	- to commercial buildings	Commercial	3.9
	- to households	Residential	2.5
II-07	Introduction of Solar Water Heater		
	- to commercial buildings	Commercial	199.6
	- to households	Residential	115.4
II-08	Installation of Energy Saving Glasses		
	- to commercial buildings	Commercial	80.1
	- to households	Residential	49.4
II-09	Regional Energy Supply System	Industry	301.3
II-10	Introduction of Small-scale Hydropower Generation (at water distribution stations, canals)	Commercial	1.4
II-11	Introduction of Wind Power Generation	Commercial	8.1
II-12	Promotion of energy-efficient appliances	Residential	275.2
Grid	Improvement of generation efficiency, Reduction of transmission loss	Grid	3,259.3
		Total	6,943.0

Reduction by ESCO & Diffusion of Energy Efficient Devices

= 2,650 ktCO2

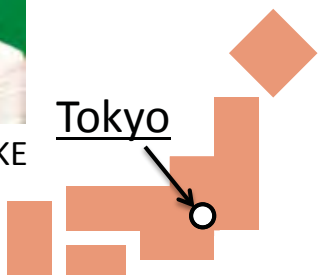
Strategic approach is required.

Mitigation Policies in Tokyo

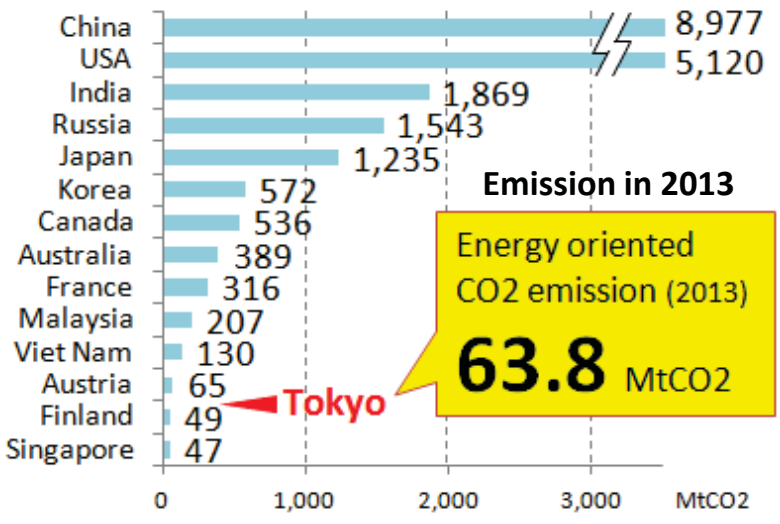
Overview of Tokyo

- Energy-oriented CO2 emission from Tokyo is around 64 MtCO2 in 2013, which corresponds to "a nation level" emission.
- Tokyo Metropolitan Government (TMG) has implemented various policy instruments to develop sustainable city in which both of energy saving and economic growth are realized.

Governor KOIKE



Population	14 million (6,200persons/km2)
Economy	GRDP: 0.8 trillion USD (20% of JP's GDP)



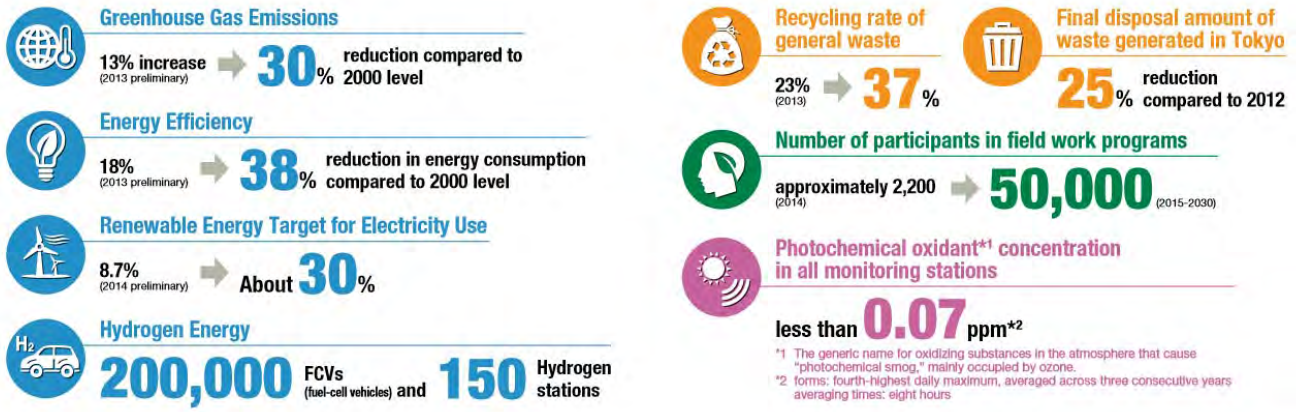
Source: IEA CO2 Emissions from Fuel Combustion [2015 Edition]

Climate Change Policy in Tokyo

- TMG determined the Environmental Master Plan that showcases the environmental policies to be implemented by 2030.
- Climate change policy is included in the Master Plan with quantitative target towards 2030.

Tokyo's Challenges declared in the Master Plan

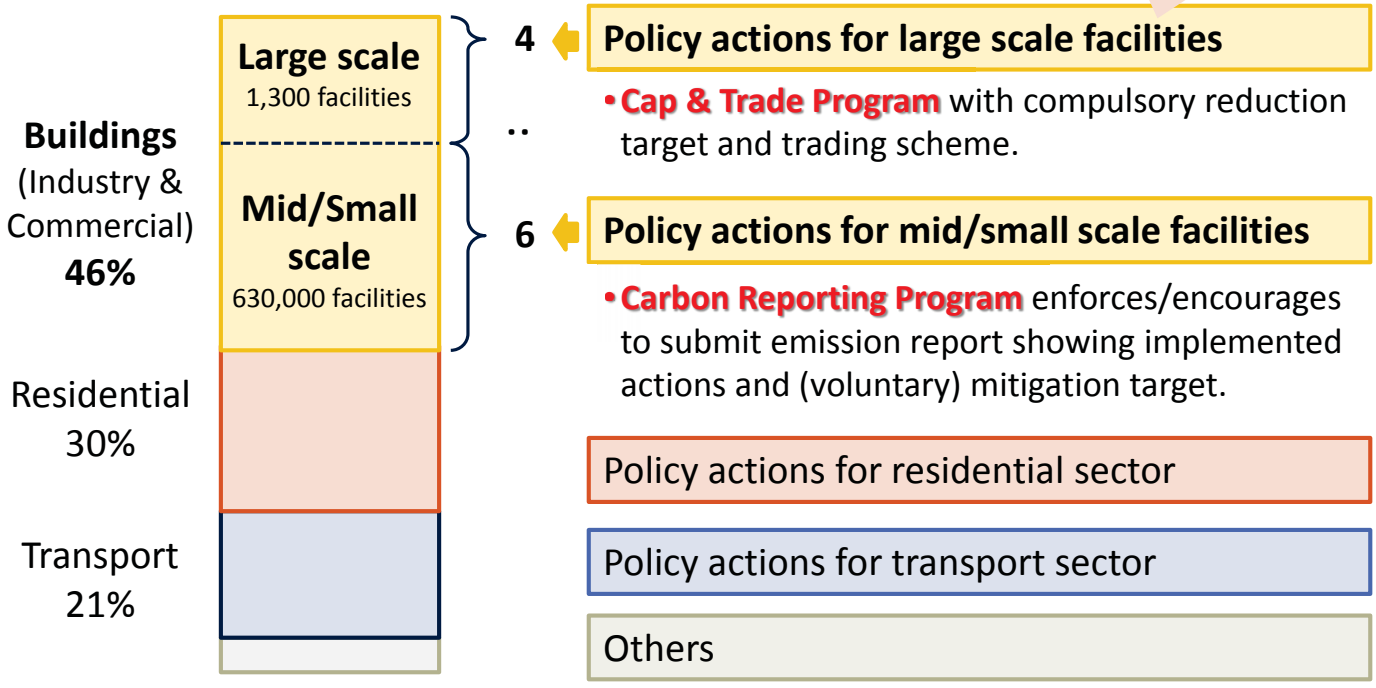
1. **Climate Change** and Urban Energy
2. Sustainable Materials and Waste Management
3. Clean and comfortable air, water, and soil
4. Urban Biodiversity and Greenery



Policies for Energy Saving in Building Sector

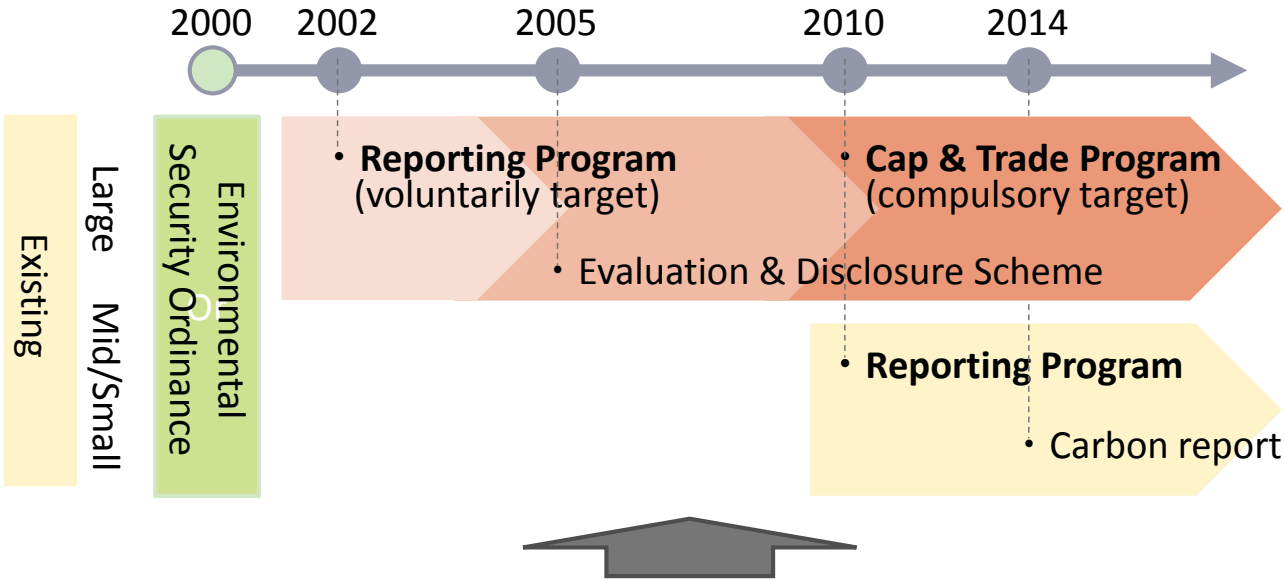
- Emission from building in industrial facilities and commercial sector covers half of Tokyo's emission.
- TMG implemented several policy actions to enhance mitigation activities in building sector.

CO2 Emission in Tokyo



Regulations for Saving Energy in Buildings

- TMG has gradually strengthened policy actions for building sector rafter enactment of the Environmental Security Ordinance in 2000.
- Introducing and implementing the actions have contributed to enhance capacity of TMG staffs and accumulation of data to enhance mitigation actions in Tokyo.



Implementation of those programs has enhanced capacity of TMG staffs and to accumulate data for taking mitigation actions

Impact of Reporting Program

Actual Reduction ← Identification of **countermeasures** enables to take mitigation actions and reduce emission.

Countermeasures ← Identification of **current status** and considera-tion of **reduction target** enables to identify countermeasures to realize mitigation potential.

Current Status & Reduction Target ← **Monitoring** enables to indentify current status of CO2 emission and mitigation potential, which contributes to consider emission reduction.

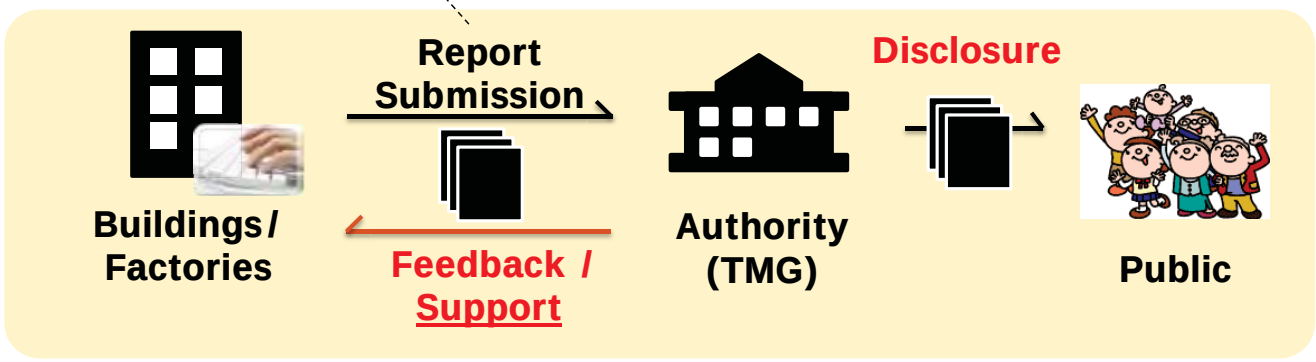
Monitoring ← **Reporting Program** enforces or encourages buildings owners and users to monitor CO2 emission.

Reporting Pg

Carbon Reporting Program in Tokyo

- TMG has operated the reporting program which encourages facilities (enforces large consumers) to monitor and report energy use, CO2 emission and mitigation actions which they take.
- Facilities which submit the report can receive feedbacks and supports to promote mitigation actions.

1. Energy Consumption and CO2 Emission in Previous FY
2. Mitigation Actions which are Taken in Previous FY



For example, free access to **energy saving assessment** services, providing **recommended actions**, tax break, preferential treatments, etc.

Free Access to Energy Saving Assessment

- Energy saving assessment enables to identify status of energy use and equipment and suggest measures to improve energy efficiency.
- TMG provides free access to energy saving assessment to enhance taking actions by mid/small scale facilities.

Experts visit facility.

Conduct an interview and on site inspection on energy consuming features.

Simple advices are provided on-site and detailed report including possible measures to save energy, its impact on utility cost reduction, information of subsidies, etc.

The report will be utilized by facilities to take actions.

Recommended Actions

- TMG identified 255 (recommended) actions from which buildings select actions they did and report TMG.
- Actions can be categorized into prioritized actions and others.

	Prioritized (Lv 1~3)	Others
Institutional Arrangement	Measures relating to institutional arrangement to tackle mitigation actions.	
Monitoring Energy Use	Monitoring consumption of electricity, gas, fuels, water and sewage to grasp CO2 emission.	
Operational Measures	Measures relating to improving operation of equipment without investment.	
Maintenance	Measures relating to maintaining performance of equipment and devices.	
Retrofit / Replacement	Retrofit/replacement requires large investment cost, however they have large impact on emission reduction.	

Example

Actions to improve operation of equipment
[Measure No. 51] Display lighting map

Benefits of Carbon Reporting Program

- The program provides building owners and/or users (tenants) an opportunity to understand the status of energy use and reduction potential, which contributes actual energy cost savings.
- Disclosure of energy performance contributes to obtain good reputation, which may invite (green) investment.

Buildings

1. Energy saving
- enables reduction of energy cost.

2. Good reputation
- contributes to invite green investment

3. Incentives
- tax break
- subsidy
- free access to consultation by experts

Local Authority

1. Green growth/Low carbon city
- contributes to achieve policy goal

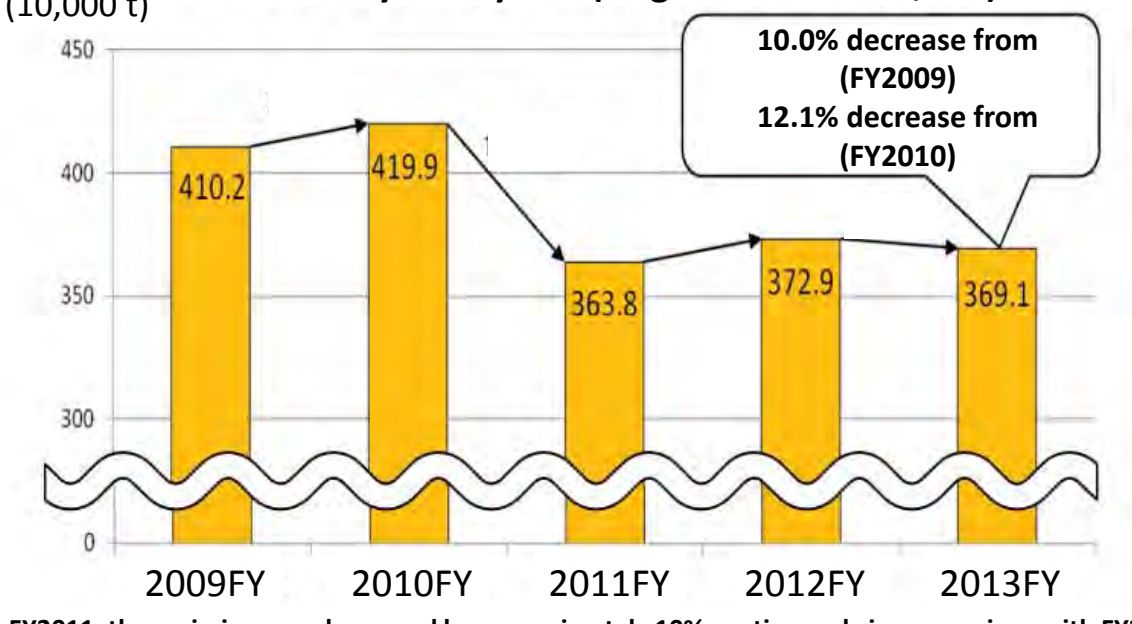
2. Good reputation
- contributes to invite green investment

3. Data accumulation
- energy use/GHG emission
- actions taken in jurisdiction
- other relating information

Impact of Carbon Reporting Program

- The reporting program contributed to reduce CO2 emission in 2013FY by 12% compared to 2010.

Total CO_2 emissions of facilities which have submitted the report continuously for 5 years (target facilities: 23,069)



After FY2011, the emission was decreased by approximately 10% continuously in comparison with FY2009.

* Calculated by fixing the electricity emission coefficient at 0.382t-CO_2/thousand kWh.

Analysis of Tokyo Carbon Reduction Reports
http://www8.kankyo.metro.tokyo.jp/ondanka/news/20150312/index.html

Activities for Knowledge Sharing

Case in Malaysia

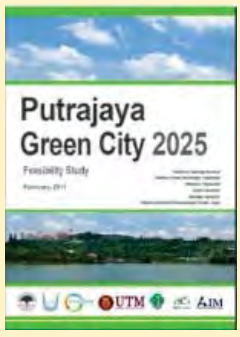
- AIM team has collaborated with local authorities in Malaysia (Putrajaya and Iskandar) to create LCS plans, and completed.
- Both of the cities are now moving on to implementation of the LCS plans to realize low carbon society.

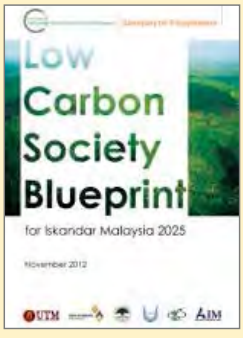
LCS Planning

through quantitative approach

GHG Emission & Reduction

LCS Policies & Actions





City level LCS Plans

COMPLETED!!

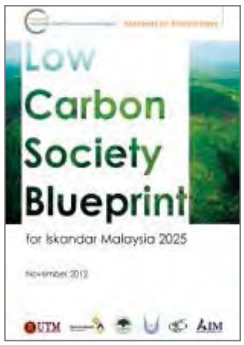
Next Stage

Implementation

Case in Malaysia

- For example, Iskandara Malaysia developed LCS plan which is approved by national government too.
- The plan includes description of development monitoring system.

LCS Blueprint IM 2025



12 actions
281 programs

	Action Names	Themes
1	Integrated Green Transportation	GREEN ECONOMY
2	Green Industry	
3	**Low Carbon Urban Governance**	
4	**Green Buildings & Construction**	
5	Green Energy System & Renewable Energy	
6	Low Carbon Lifestyle	GREEN COMMUNITY
7	Community Engagement & Consensus Building	
8	Walkable, Safe, Livable City Design	GREEN ENVIRONMENT
9	Smart Growth	
10	Green and Blue Infrastructure & Rural Resources	
11	Sustainable Waste Management	
12	Clean Air Environment	

The blueprint said that
*" An effective **monitoring, assessment and publication system** on the progress and achievement of carbon reduction targets and low carbon society is **indispensable** ".*

BEMRS

Case in Malaysia

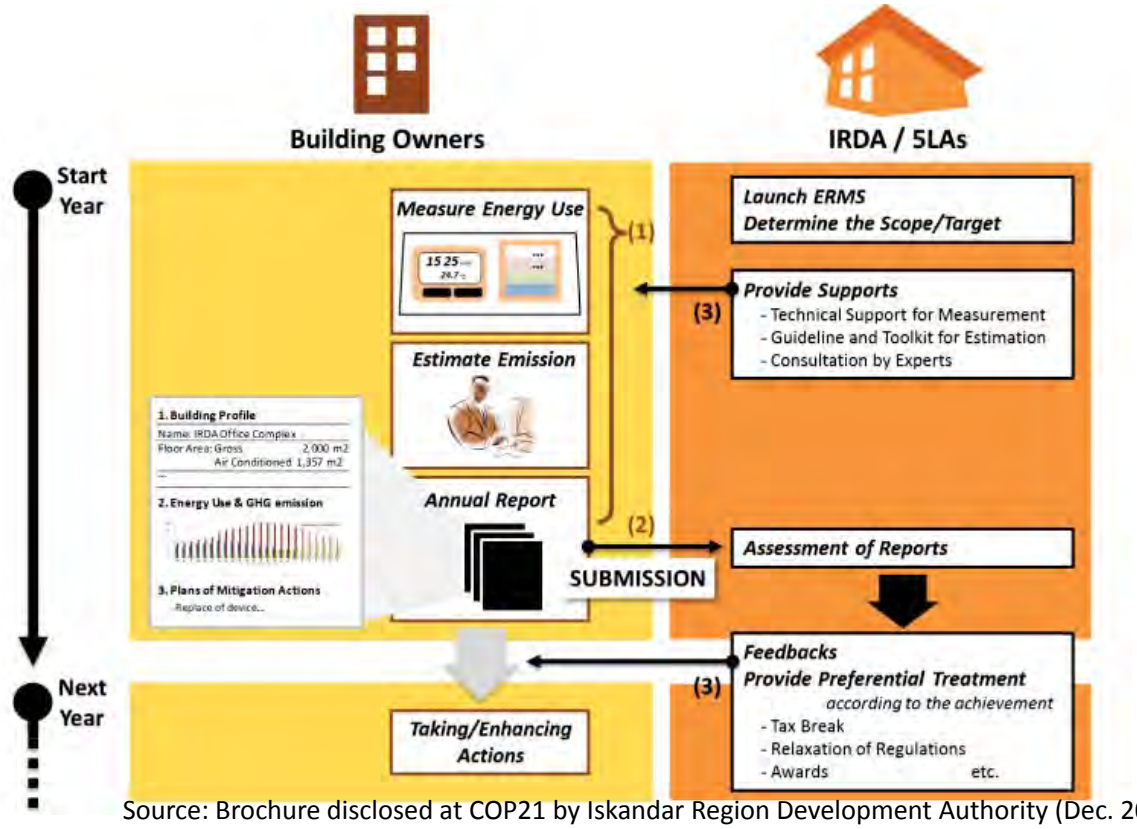
- AIM team has collaborated with both cities (Putrajaya and Iskandar) to design monitoring and reporting program since 2014.
- Trainings, workshops and intensive discussions among city staffs, TMG staffs and AIM experts have been conducted for many times.

2014	2015	2016	2017
Dialogues & training workshops for knowledge sharing	Draft new scheme & disclose it at COP21	Workshop for program design in details	Policy dialogue & collaborative works for program design in details

The scheme will be implemented from 2018FY

Case in Malaysia

- For example, Iskandar authority has drafted the Building Energy Monitoring and Reporting System: BEMRS by referring policy action implemented in Tokyo.



Source: Brochure disclosed at COP21 by Iskandar Region Development Authority (Dec. 2015)

Case in Malaysia

- Iskandar authority is now conducting energy audit program as pilot phase of BEMRS implementation.
- The program will be started in next year targeting governmental buildings.

Source: Presentation by Mr Boyd who is Head of Environment Office of IRDA at MoEJ (Jan. 2017)

Trial in HCMC in 2016

- Simplified training on TMG's reporting program was delivered in Ho Chi Minh City. City officers show interest in TMG's program.
- Some surveys on existing regulations in HCMC. It is revealed that regulations on energy saving exist in Vietnam, but strategy for utilizing existing framework may be required to be re-considered.

Possible Activities in Ho Chi Minh City

Possible Activities in HCMC

■ **Knowledge sharing on policy actions relating to mitigation**

- In this fiscal year (FY2017), AIM team would like to organize a 1-2 day(s) training course on TMG's policy actions, especially reporting program on energy use in buildings.
- The experiences in Tokyo will be shared with city staffs through lectures, exercise and discussions.
- Expected participants are city officers in charge of CCAP implementation in building sector.

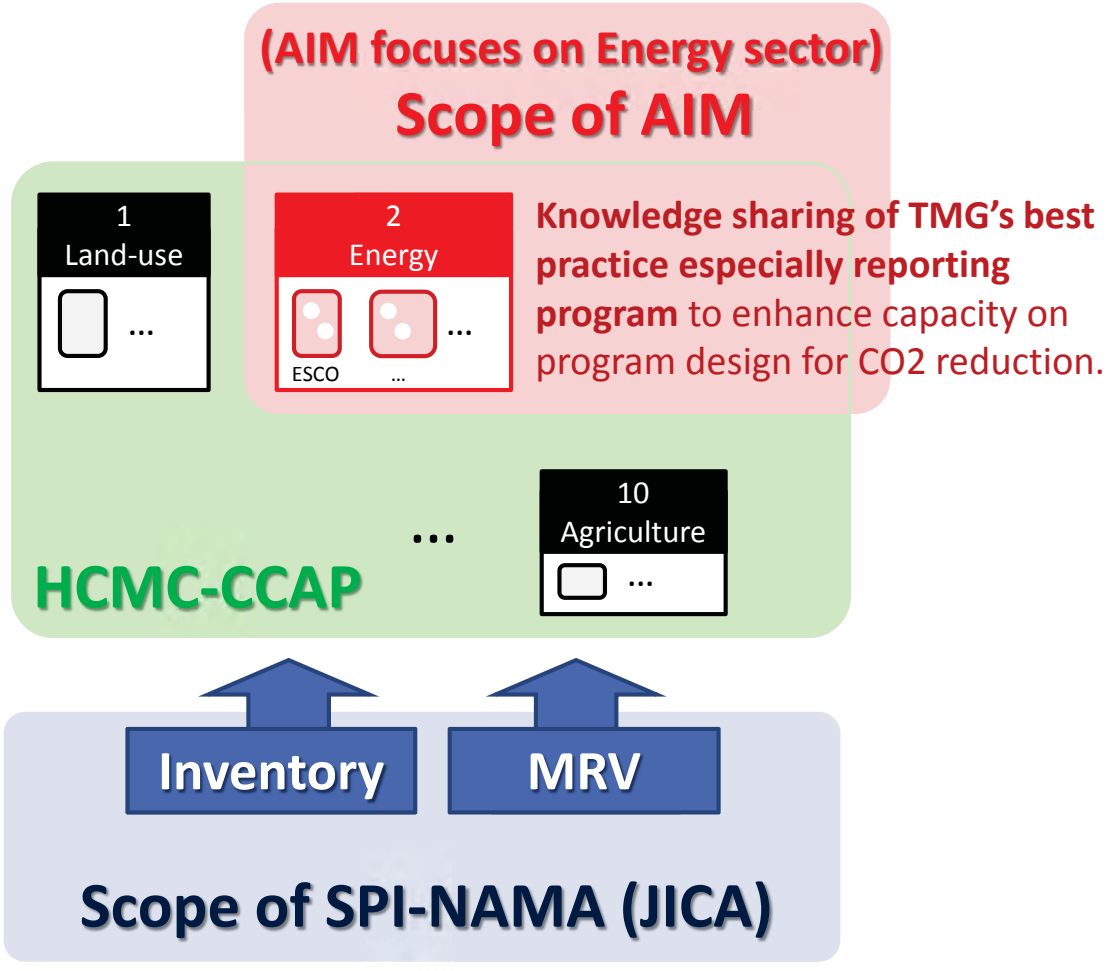
FY2017 (this activity is supported by MOEJ by MAR 2018)

- **Training course** for sharing information and experiences in Tokyo.
- Trial on **drafting possible practical programs** by referring case in Tokyo.

FY2018 ~ (if MOEJ continues the project after FY2017)

- **Complete program design** according to requirements in HCMC.
- **Preparatory activities to implement the program** actually in HCMC.

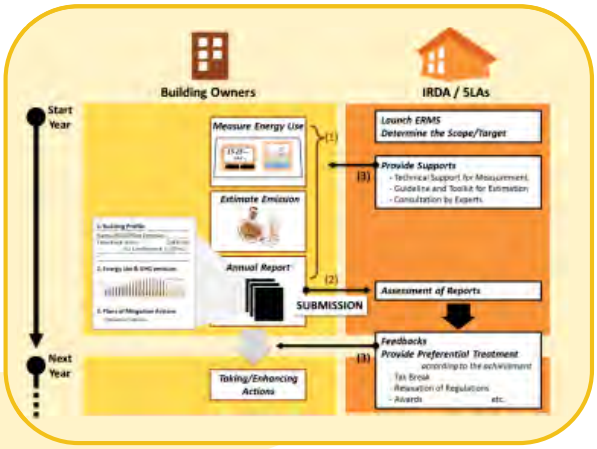
Scope of AIM activities



Expected Outcomes

Enhanced Capacity

Actual Practical Program

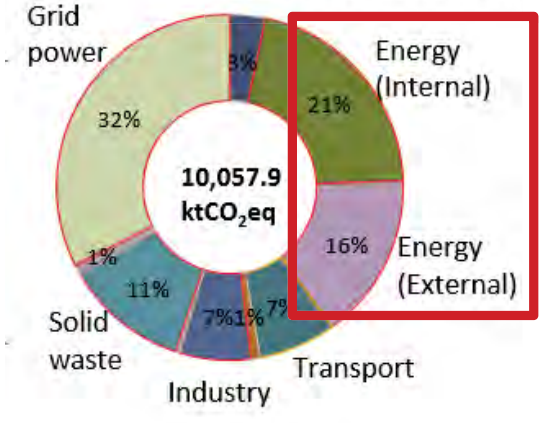


Practical program designed and implemented by trained city staffs enables to reduce CO2 emission in HCMC, which contributes Vietnam's NDC.

LCS Study in HCMC (again)

- HCMC already developed CCAP2016-2020 in which projects for mitigation are grouped into 10 fields.
- AIM team analyzed the reduction potential in project level through collaborative work with HCCB. According to the analysis, projects belonging to "Energy" filed have the largest reduction potential.

Reduction in "Energy"



The largest reduction potential exists in "Energy" field.

LCS Study in HCMC (again)

- According to the analysis, ESCO and diffusion of energy efficient devices have large reductions.
- In order to realize actual reductions, a strategic approach is required to expand individual mitigation projects to whole city.

Project List in Field of "Energy"

Project code	Project Group	Sector	Reduction (ktCO2eq)
II-01	**Energy efficiency technology applied to buildings**	Commercial	**55.2**
II-02	**ESCO (Energy Saving COmpany) Project**		
	- for commercial buildings	Commercial	**233.5**
	- for industries	Industry	**890.2**
II-03	**High Efficiency Lighting**		
	- in public lighting	Commercial	**3.9**
	- in commercial buildings	Commercial	**397.3**
	- in households	Residential	**287.0**
II-04	**High Efficiency Air Conditioners (such as Air Conditioners with Inverter Controllers)**		
	- in commercial buildings	Commercial	**47.7**
	- in households	Residential	**128.4**
II-05	**Energy Efficiency Improvement Facilities to be installed at Small/Medium Enterprises**	Industry	**603.6**
II-06	Introduction of Photovoltaic Power Generation		
	- to commercial buildings	Commercial	3.9
	- to households	Residential	2.5
II-07	Introduction of Solar Water Heater		
	- to commercial buildings	Commercial	199.6
	- to households	Residential	115.4
II-08	Installation of Energy Saving Glasses		
	- to commercial buildings	Commercial	80.1
	- to households	Residential	49.4
II-09	Regional Energy Supply System	Industry	301.3
II-10	Introduction of Small-scale Hydropower Generation (at water distribution stations, canals)	Commercial	1.4
II-11	Introduction of Wind Power Generation	Commercial	8.1
II-12	Promotion of energy-efficient appliances	Residential	275.2
Grid	Improvement of generation efficiency, Reduction of transmission loss	Grid	3,259.3
		Total	6,943.0

Reduction by ESCO & Diffusion of Energy Efficient Devices

= 2,650 ktCO2

How to expand individual projects to whole city?

Impact of Reporting Program (again)

Actual Reduction ← Identification of **countermeasures** enables to take mitigation actions and reduce emission.

Countermeasures ← Identification of **current status** and considera-tion of **reduction target** enables to identify countermeasures to realize mitigation potential.

Current Status & Reduction Target ← **Monitoring** enables to indentify current status of CO2 emission and mitigation potential, which contributes to consider emission reduction.

Monitoring ← **Reporting Program** enforces or encourages buildings owners and users to monitor CO2 emission.

Reporting Pg

Xin cảm ơn!

Thank you for your attention!

PROJECT TO SUPPORT THE PLANNING AND IMPLEMMENTATION OF NAMA IN A MRV MANNER

(SPI-NAMA)

COMPOSITION IN HO CHI MINH CITY

ORIENTATION OF FOLLOW-UP ACTIVITIES AFTER THE PROJECT SPI-NAMA

HCMC , October 2017

CONTENTS

1. **The main achievements of the project**
2. **The tasks of 2018**
3. **The tasks up to 2020**
4. **Orientation after 2020**

1. The main achievements of the project

- Results of GHG Inventory
- GHG Inventory Manual
- Manual for MRV
- Proposed policy framework for NAMA implementation.
- Capacity Building of CBCC, VC staff

2. The tasks of 2018

- Issuing GHG Inventory Manual and Manual for MRV
- GHG Inventory for 2016 and after every two years in even year (Guidelines are available from the People's Committee).
- Planning to implement Paris Agreement on Climate Change to 2030 (Applying for the City People's Committee).

3. The tasks up to 2020

- Develop regulation on GHG inventory and MRV *(depend on Decree of Government):* Expected to complete in 2019.
- Implement MRV pilot projects
  - 7 projects of 3 sectors have been implemented in SPI-NAMA *(Energy 2 projects , Transportation 3 projects, Waste 2 projects).*
  - Collaborative projects with Osaka *(if possible)*: Frequency converter project and Solar power project
  - Other projects in CCAP 2017-2020, in Implementation plan of Green Growth Program, Implementation plan of Paris Agreement to 2030

MRV for cooperation projects with Japanese partners in the period of 2018-2020

3. The tasks up to 2020

- Proposed policies to support NAMA and development of carbon market: Proposed cooperation with Tokyo
- Continue marketing communication activities in the country
  - Documentation
  - Media
  - Training course, seminar
- Capacity Building: Proposed cooperation with JICA, C40, Tokyo, Osaka.
- Proposed data collection process *(process, time , form, additional data survey, provision, publish data on each sector)*

Study of Tokyo Model

Proposed contents:

- Identifying target group (key enterprises using energy, commercial buildings, etc.…)
- Encouraging each group to report the current state of energy use
- Looking for support to carry out appropriate mitigation activities for enterprises
- Reviewing, evaluating

3. Proposed plan to 2020

	GHG Inventory		MRV	
Time	Contents	Responsible organization	Contents	Responsible organization
2018	GHG inventory of HCMC 2016	DONRE	Choose projects and mitigation activities for MRV pilots	Main Units in MRV process
	Plan and approve the regulation of GHG inventory in HCMC	DONRE	Plan and approve the regulation of MRV process for mitigation activities	DONRE
2019	Evaluation of GHG inventory 2016 to improve the process and methodology	DONRE	Implement selected mitigation MRV pilot projects	Mitigation Implementing Entity
	Regulation on GHG inventory in HCMC	DONRE DOJ	Regulation on MRV process for mitigation activities in HCMC	DONRE DOJ
2020	GHG inventory in HCMC 2018	DONRE	Continue to implement MRV Pilot projects	Main Units in MRV process
	Issue regulation on GHG inventory in HCMC	HCMC People's Committee	Issue regulation on MRV process for mitigation activities in HCMC	HCMC People's Committee
2020-2030	GHG inventory every 2 years according to issued regulation	DONRE	Implement mitigation projects to MRV according to issued regulation	Main Units in MRV process

4. Orientation after 2020

- Standardizing the data collection process.
- Continuing to standardize GHG inventory process (update, addition).
- Continuing to standardize MRV process (update, addition).
- Developing, monitoring, reporting process procedures of Paris Agreement on climate change implementation
- Proposing the polices (if any)
- Sharing experience with other local

** Note : The above issues depend on the Decree of the Government.*

Thank you very much