2018 Myanmar MRV Energy Sector Status Assessment & Recommendations for Enhanced Transparency Framework Implementation

LIST OF ACRONYMS

ADB	Asian Development Bank		MoAI	Ministry of Agriculture and Irrigation
AEC	ASEAN Economic Community		MoALI	Ministry of Agriculture, Livestock and Irrigation
AFOLU	Agriculture, Forestry and Other Lar		MoE	Ministry of Energy[1]
BUR	Biennial Update Report		MoECAF	Ministry of Environment, Conservation and Forestry[2]
CDC	City Development Committee		MoEE	Ministry of Electricity and Energy
CO_2 eq	Carbon dioxide equivalent		MoEP	Ministry of Electric Power[3]
DCA	Department of Civil Aviation		MoGE	Myanmar Oil and Gas Enterprise
DMA	Department of Marine		MoI	Ministry of Industry
DRD	Department of Rural Development		MoLFRD	Ministry of Livestock, Fisheries and Rural Development[4]
ECD	Environmental Conservation		MoM	Ministry of Mines[5]
EDC	Energy Development Committee		MoNREC	The Ministry of Natural Resources and Environmental Conservation
EE	Energy Efficiency		MoST	Ministry of Science and Technology
EECD	Energy Efficiency and Conservation Division		MoTC	Ministry of Transport and Communication
EE&C	Energy Efficiency and Conservation		MPA	Myanmar Port Authority
EIA	Environmental Impact		MPE	Myanmar Petrochemical Enterprise
EPGE	Electric Power Generation Enterprise		MPPE	Myanmar Petroleum Products Enterprise
EST	Environmentally Sound Technology		MR	Myanmar Railways
ETPA	Education, Training and Public Awareness		MSDP	Myanmar Sustainable Development Plan
FDI	Foreign Development Index		NC	National Communication
GGGI	The Global Green Growth Institute		NDC	Nationally Determined Contributions
GHG	Greenhouse gases		NEMC	National Energy Management
GMS	Greater Mekong Sub-region		NGHGI	National Greenhouse Gas Inventory
GPG	Good Practice Guidance		NGOs	Non-government Organizations
IEP	Integrated energy planning		NMVOC	Non-methane Volatile Organic Compound

[1] Ministry of Energy was merged into Ministry of Electricity and Energy in 2016

2 Ministry of Environment, Conservation and Forestry was merged into Ministry of Natural Resources and Environmental Conservation in 2016

[3] Ministry of Electric Power was merged into Ministry of Electricity and Energy in 2016

4 Ministry of Livestock, Fisheries and Rural Development was merged into Ministry of Agriculture, Livestock and Irrigation in 2016

5 Ministry of Mines was merged into Ministry of Natural Resources and Environmental Conservation in 2016

INC	Initially National Communication		NSDS	The National Strategy for Development of Statistics
INDC	Intended Nationally Determined Contribution		OGPD	Oil and Gas Planning Department
INGOs	International Non-Government		PIP	Project Implementation Plan
IPCC	Intergovernmental Panel on Climate Change		PMT	Project Management Team
IWT	Inland Water Transport		PRC	The People's Republic of China
ktoe	Kilo tonnes of oil equivalent		QA/QC	Quality Assurance and Quality Control
kton	Kilo tonnes		REAM	Renewable Energy Association Myanmar
LPG	Liquefied petroleum gas		RTAD	Road Transport Administration Department
LULUCF	Land use, land-use change, and forestry		RSO	Research and Systematic Observation
MCCSAP	Myanmar Climate Change Strategy and Action Plan		SDG	Sustainable Development Goal
MEP	Ministry of Electric Power		SME	Small and Medium Enterprise
MES	Myanmar Engineering Society		SNC	Second National Communication
MGS	Myanmar Geoscience Society		TFEC	Total Final Energy Consumption
MNA	Myanmar National Airline		TWG	Technical Working Group
Mtoe	Million tonnes of oil equivalent		UNFCCC	United Nations Framework Convention on Climate Change
MRV	Monitoring, Reporting and Verification		V&A	Vulnerability and Adaptation

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EXECUTIVE SUMMARY

This paper presents the existing MRV system of Myanmar, what the scope of energy sector in national GHG inventory is and GGGI conducted stakeholder analysis to study institutional arrangement, legal infrastructure and developing of GHG inventory. In Myanmar, some MRV-related initiatives are already in place. In energy sector, following four sectors as per IPCC 2006 Guidelines are covered to track emission from energy consumption.

1. Primary energy source exploration and exploitation
2. Primary energy sources are transformed into useful energy forms in refineries and power plants
3. Transmission and distribution of fuel
4. Fuels consumption in stationary and mobile applications

Within these sectors, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) in national GHG inventory of energy sector are monitored.

In June 2018, five technical working group have formed with the permission of notification number (90/2018) by Union Government to formulate SNC and GHG Inventory and Mitigation Action TWG is included among these TWG. The draft institutional arrangement of energy sector including transport sector is set up within GHG inventory team. There are 18 representatives from various ministries and departments who are relating with energy and transportation.

In term of legal infrastructure, some strategies have been set up in INDC to address rising GHG emission in energy sector. Moreover, the country already developed some policies and guidelines to support the strengthen of Myanmar Energy Sector such as National Energy Policy, Energy Efficiency Policy, Electricity Policy, Myanmar Sustainable Development Plan. Particularly, national CO_2 emission, consumption of biomass and electricity demand are highlighted to reduce in year 2020 compared to the baseline of 2012 based on the calculated energy saving potential in the National Energy Efficiency Policy.

Currently, national GHG inventory team is using UNFCCC NAIIS GHG Inventory software version 1.3.2 and IPCC Inventory software to formulate the national GHG inventory for year 2010. Mostly, Tier 1 approach is used in each categories of energy sector based on the country particular conditions and data accessibility. The MoEE (especially OGPD, MPE, MOGE, MPPE, EPGE) is the main source of data for the energy sector including the transportation sector to estimate the emission for GHG inventory. On the other hand, Mining Department, Custom and Ministry of Commerce, CDC and Forest Department are providing any other necessary data which is under their coverage. However, the capacity building programs and human resources in national GHG inventory team are needed to strengthen the existing MRV system.

အစီရင်ခံစာ အနှစ်ချုပ်

ဤ အစီရင်ခံစာသည် အမျိုးသား ဖန်လုံအိမ် ဓာတ်ငွေ့စာရင်း အတွက် စွမ်းအင်ကဏ္ဍ ၏ နယ်ပယ်နှင့် ဖန်လုံအိမ် ဓာတ်ငွေ့စာရင်း ၏ အဖွဲ့အစည်း ဆိုင်ရာအစီအစဉ်များ၊ ဥပဒေရေးရာအခြေခံများ နှင့် ဖန်လုံအိမ်ဓာတ်ငွေ့စာရင်း တွက်ချက်နည်း များ ကို လက်ရှိ တည်ဆဲ မြန်မာနိုင်ငံ ဇ။ MRV စနစ် အပေါ်တွင် GGGI မှ ပါဝင်ပတ်သတ်သူများ ထံမှ ဆန်းစစ်ချက်များ ကို တင်ပြထားခြင်းဖြစ်ပါသည်။ မြန်မာပြည် တွင် MRV နှင့် သက်ဆိုင်သော အချို့သော လုပ်ငန်းစဉ်များအား အစပျိုးထား နှင့် ပြီးသား ဖြစ်ကြသည်။ စွမ်းအင်ကဏ္ဍ အတွက် အောက်ဖော်ပြ နယ်ပယ် ၄ ခု မှ စွမ်းအင်သုံးစွဲမှု မှ တစ်ဆင့် မှန်လုံအိမ်ဓာတ်ငွေ့ ထွက်ရှိခြင်း ကို ခြေရာခံလျက်ရှိသည်။

၁။ မူလ စွမ်းအင် ထုတ်လုပ်ခြင်း နှင့် အသုံးချခြင်း

၂။ မူလ စွမ်းအင် အရင်းမြစ်များ ကို ချက်စက်ရုံများ နှင့် လျှပ်စစ် ဓာတ်အားပေးစက်ရုံများ အတွက် အသုံးဝင်သော စွမ်းအင်ပုံစံများ သို့ အသွင်ပြောင်းခြင်း

၃။ လောင်စာဆီများ သယ်ယူပို့ဆောင်ခြင်း နှင့် ဖြန့် ဖြူးခြင်း

၄။ အထိုင်စက်ရုံများ နှင့် ရွှေ့လျားသွားလာနေသော စက်ကိရိယာ များ အတွက် လောင်စာ သုံးစွဲခြင်း

ထိုနယ်ပယ်များ မှ ထွက်ရှိသော ကာဗွန်ဒိုင်အောက်ဆိုဒ်၊ မီသိန်း နှင့် နိုက်ထရပ်အောင်ဆိုဒ် များ ကို စွမ်းအင်ကဏ္ဍ၏ အမျိုးသား ဖန်လုံအိမ် ဓာတ်ငွေ့စာရင်း တွင် လေ့လာ စောင့်ကြည့်လျက်ရှိသည်။

၂၀၁၈ ဖွန်လတွင် နည်းပညာလုပ်ငန်းအဖွဲ့ ၅ ဖွဲ့ ကို ပြည်ထောင်စုအစိုးရ အမိန့်ကြော်ငြာစာ အမှတ် (၉၀/၂၀၁၈) ဖြင့် ရာသီဥတု ပြောင်းလဲမှုဆိုင်ရာ ဒုတိယအကြိမ် မြန်မာနိုင်ငံ အမျိုးသားအဆင့် အစီရင်ခံစာ ရေးဆွဲပြုစုရေးအတွက် ဖွဲ့စည်းခဲ့ ပြီး မှန်လုံအိမ်ဓာတ်ငွေ့ စစ်တမ်းကောက်ယူခြင်း နှင့် မှန်လုံအိမ် ဓာတ်ငွေ့ထုတ်လွှတ်မှု လျော့ချရေး အခွင့်လမ်းများ ဆောင်ရွက်ခြင်း အတွက် နည်းပညာ လုပ်ငန်းအဖွဲ့ လဲ အပါအဝင်ဖြစ်သည်။ စွမ်းအင် ကဏ္ဍအတွက် စွမ်းအင် နှင့် သယ်ယူပို့ဆောင်ရေး ဖြင့် သက်ဆိုင် သော အဖွဲ့ဝင် ၁၈ ဦးပါဝင် ပြီး မူကြမ်းအဖွဲ့အစည်းဆိုင်ရာ အစီအစဉ်များ သည် လဲ ချမှတ်ပြီးသား ဖြစ်သည်။

အခြေခံ ဥပဒေရေးရာ များ အရ အချို့သော နည်းဗျူဟာများ ကို INDC တွင် စွမ်းအင် ကဏ္ဍအတွက် မှန်လုံအိမ် ဓာတ်ငွေ့ မြင့်တက်လာမှု လျော့ချရေး အစီအမံများ ချမှတ်ပြီးဖြစ်သည်။ ဒါအပြင် မြန်မာစွမ်းအင် ကဏ္ဍ တိုးတက်ရေးအတွက် အမျိုးသားစွမ်းအင်မူဝါဒ၊ စွမ်းအင် အကျိုးရှိ ထိရောက်စွာ သုံးစွဲရေး မူဝါဒ၊ လျှပ်စစ်မူဝဒါ၊ မြန်မာနိုင်ငံဇ။ ရေရှည် တည်တံ့ ခိုင်မြဲပြီး ဟန်ချက်ညီသော ဖွံ့ဖြိုး တိုးတက်မှု စီမံကိန်း အစရှိသော မူဝါဒ နှင့် လမ်းညွှန်ချက် များ ကို မြန်မာ စွမ်းအင် ကဏ္ဍ ဖွံ့ ဖြိုးတိုးတက်ရေး အတွက် အထောက်အကူပြုရန် ရေးဆွဲခဲ့ပြီးသားဖြစ်သည်။ အထူးသဖြင့် စွမ်းအင် အကျိုးရှိ ထိရောက်စွာ သုံးစွဲရေးမူဝါဒ တွင် ၂၀၁၂ ခုနှစ် ဇ။ အလားအလာရှိသော စွမ်းအင်ခြိုးခြံချွေတာရေး တွက်ချက်မှုများ ကို အခြေခံကာ အမျိုးသား အဆင့် ကာဗွန်ဒိုင်အောက်ဆိုဒ် ထုတ်လွှတ်ခြင်း၊ သဘာဝလောင်စာ နှင့် လျှပ်စစ် လိုအပ်ချက် များ ကို ၂၀၂၀ ခုနှစ်တွင် အထိုက်အလျောက် လျော့ချရေး ကို မီးမောင်းထိုးပြထားသည်။

လက်ရှိအနေဖြင့် အမျိုးသားအဆင့် မှန်လုံအိမ်ဓာတ်ငွေ့ စစ်တမ်းကောက်ယူရေး အဖွဲ့ သည် UNFCCC NAIIS GHG Inventory software version 1.3.2 and IPCC Inventory software များ ကို အသုံးပြုကာ ၂၀၁၀ ခုနှစ်အတွက် မှန်လုံအိမ်ဓာတ်ငွေ့ စာရင်းကို တွက်ချက်လျက်ရှိသည်။ အများအားဖြင့် နိုင်ငံဖ်။ သတင်း အချက်အလက် များ ရရှိနိုင်မှု ပေါ်မူတည်ပြီး Tier 1 ချဉ်းကပ်နည်းကို အသုံးပြုကာ စွမ်းအင်ကဏ္ဍဖ်။ အမျိုးအစား အားလုံးကို တွက်ထုတ်လျက်ရှိသည်။ ထိုသို့ တွက်ချက်ခြင်း အတွက် လျှပ်စစ် နှင့် စွမ်းအင် ဝန်ကြီးဌာန သည် သတင်း အချက်အလက်များ ဖ်။ အရင်းအမြစ် အဖြစ်တည်ရှိနေပြီး သတ္တုတွင်းဌာန၊ ကုန်သွယ်ရေးဦးစီးဌာန၊ အကောက်ခွန်ဦးစီးဌာန၊ မြို့တော်စည်ပင် နှင့် သစ်တောဦးစီးဌာန တို့ မှလဲ အခြားလိုအပ်သော သတင်းအချက်လက်များ ကို ထောက်ပံ့ပေးလျက်ရှိသည်။ သို့သော်လည်း ရှိဆဲ MRV စနစ် တိုးတက်ကောင်းမွန်ရန် အလို့ ငှာ အမျိုးသား အဆင့် မှန်လုံအိမ်ဓာတ်ငွေ့ စစ်တမ်းကောက်ယူရေး အဖွဲ့ အတွက် လူသားအရင်းမြစ် နှင့် စွမ်းဆောင် ရေးတိုးတက်ရေး မွန်းမံ အစီအစဉ်များ လိုအပ်လျက်ရှိပါသ

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CHAPTER 1: INTRODUCTION

Based in Seoul, The Global Green Growth Institute (GGGI) is an intergovernmental organization founded to support and promote a model of economic growth known as "green growth", which targets key aspects of economic performance such a poverty reduction, job creation, social inclusion, and environmental sustainability. GGGI works with countries around the world, building their capacity and working collaboratively on green growth policies that can impact the lives of millions. The organization partners with countries, multilateral institutions, government bodies, and the private sector to help build economies that grow strongly and are more efficient and sustainable in the use of natural resources, less carbon intensive, and more resilient to climate change.

GGGI is working with the Republic of the Union of Myanmar, hereafter referred to as Myanmar, to design its 2017-18 program. The planned outcome of this program is strengthening the government's institutional framework for the implementation of its Intended Nationally Determined Contribution (INDC) and assessing Myanmar's green growth potential and future green growth priorities.

Based on Myanmar's request for GGGI to support NDC implementation and financing, the Institute will support government in establishing a monitoring, reporting and verification (MRV) system to facilitate data collection and report generation requisite for national and international review. To introduce MRV in Myanmar, GGGI conducted a detailed stakeholder and situation analysis to assess the current institutional capacity and data availability for such a system, to eventually build on the existing mechanisms and institutional roles and responsibilities, strengthen capacity to collect and manage data, and support the aggregation of this information into reports and inventories. The MRV system will incorporate poverty reduction, gender and social inclusion metrics in its design in order to strengthen buy- in for mitigation action among policy makers and their constituencies, showcasing the social impact of mitigation.[6]

The first national communication was officially submitted to UNFCCC in 2012. The key information in INC are summarized as follow-

1. Myanmar is a sink country with the net removal of ~67,000 Gg CO2 eq;
2. Agriculture and Other Land Use Sectors are key categories for GHG emissions and removals.
3. IPCC 2006 guideline was used at Tier 1 level;[7]

Based upon the INC submission, Project Implementation Plan - PIP for second national communication report preparation was formulated to implement the following activities (preparation of NC report chapters);

- Introduction and Institutional Setup
- National Circumstance
- National Greenhouse Gas Inventory on
- Energy Sector
- Industrial Sector
- Agriculture Sector
- Land Use Change and Forestry Sector
- Waste Sector (Myanmar Energy Sector Assessment, Strategy and Roadmap, 2016) (Myanmar's Intended Nationally Determined Communication - INDC, 2015) (Myanmar's Intended Nationally Determined Communication - INDC, 2015) (Myanmar's Intended Nationally Determined Communication - INDC, 2015)

[6] Seres, Stephen. 2017. The Status of Monitoring, Reporting and Verification of Nationally Determined Contributions to Climate Actions in Myanmar. GGGI/MONREC MRV Project Report No.1

[7] Myanmar's Initial National Communication Under The United Nation Framework Convention on Climate Change (UNFCCC), 2012

- Measures to facilitate vulnerability assessment and adaptation options
- Measures to facilitate Climate Change Mitigation;
- Other information on (Environmentally Sound Technology; Climatic Research and Systematic Observation; Education, Training and Public Awareness);
- Constraints and Gaps in terms of Finance, Technology and Capacity Building.

This report is an explorative study that maps out the existing initiatives, actors and regulations in Myanmar. Although the context of MRV in the international climate change negotiations is important in terms of the implications for future national reporting requirements, this report was undertaken with a focus on MRV of domestic actions. In Myanmar, some MRV-related initiatives are already in place and therefore it makes sense to build on the existing structures. However, these structures are often disparate. Therefore, the report started with a scoping exercise through online searches and informal conversations within our own networks and identifying relevant stakeholders. Then, stakeholder engagement, institutional arrangement, legal infrastructure, data collection and methodologies of current inventory team are presented.

CHAPTER 2: SCOPE OF MRV SYSTEMS FOR THE ENERGY SECTOR IN MYANMAR

Introduction to MRV

There are three distinct types of MRV systems (see figure 1):

1. MRV of GHG emissions refers to estimating, reporting, and verifying actual emissions over a defined period of time. This type of MRV can be performed at national level, or by organizations and facilities. For example, national GHG inventories, which are mandatory national MRV systems established by the Conference of the Parties, include an account of emissions from a country for a particular period, are reported to UNFCCC through NC and BUR.
2. MRV of mitigation actions involves assessing (ex-ante and/or ex-post) GHG emissions reductions and/or sustainable development (non-GHG) effects of policies, projects, and actions, as well as monitoring their implementation progress. For example, the policies and mitigation actions identified in a country's NDC fall into this category. It also involves assessing progress toward mitigation goals. While MRV of GHG emissions measures actual emissions, MRV of mitigation actions estimates the change in emissions and other non-GHG variables that results from those actions, and evaluates their impacts as well.
3. MRV of support focuses on monitoring the provision and receipt of financial flows, technical knowledge, and capacity building, and evaluating the results and impact of support, and linking the quantified support to the country's needs. An example of this kind of MRV would be developing countries tracking climate-specific finance received through bilateral or multi-lateral channels.[8]

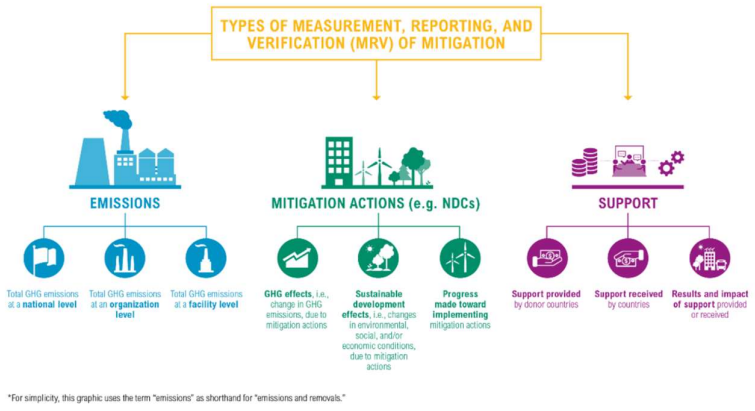


Figure 1: MRV Types

Source: WRI 2016

[8] The concepts for this section is largely based on WRI 2016

MRV of Emissions from Energy sector in Myanmar

The first national communication of Myanmar, prepared as per the IPCC 2006 guidelines, with the base year of 2000 covered the following sources:

1A Fossil fuel combustion

1A1 Energy Industries

1A2 Manufacturing Industries and Construction

1A3 Transport

1A4 Other sectors

1B1a Fugitive emissions from coal mining activities

1B2 Fugitive emissions from oil and natural gas systems

However, there are several activities that occur in Myanmar and form the scope of MRV of Emissions from Energy sector for future reporting under the enhanced transparency framework for the Paris Agreement[9]:

1A Fuel Combustion Activities

1A1 Energy Industries

- 1A1a Main Activity Electricity and Heat Production
- 1A1b Petroleum Refining
- 1A1c Manufacture of Solid Fuels and Other Energy Industries

1A2 Manufacturing Industries and Construction

- 1A2a Iron and Steel
- 1A2b Non-Ferrous Metals
- 1A2c Chemicals
- 1A2d Pulp, Paper and Print
- 1A2e Food Processing, Beverages and Tobacco
- 1A2f Non-Metallic Minerals
- 1A2g Transport Equipment
- 1A2h Machinery
- 1A2i Mining and Quarrying
- 1A2j Wood and wood products
- 1A2k Construction
- 1A2l Textile and Leather
- 1A2m Non-specified Industry

1A3 Transport

- 1A3a Civil Aviation
- 1A3b Road Transportation
- 1A3c Railway
- 1A3d Water-borne Navigation
- 1A3e Other Transportation

1A4 Other Sectors

- 1A4a Commercial/Institutional
- 1A4b Residential
- 1A4c Agriculture/Forestry/Fishing/Fish Farms

1A5 Non-specified

- 1A5a Stationary
- 1A5b Mobile
- 1A5c Multilateral Operations

1B Fugitive Emissions from Fuels

1B1 Solid Fuels

- 1B1a Coal mining and handling

1B2 Oil and Natural Gas

- 1B2a Oil
- 1B2b Natural Gas

1B3 Other emissions from Energy Production

1C Carbon dioxide transport and storage.[10]

A detailed list of activity and source structure in the Energy Sector according to 2006 IPCC Guidelines is provided in Appendix I. The following types of GHGs will be covered, as per the IPCC 2006 guidelines: CO_2, N_2O, CH_4.

The current inventory of GHG emissions from energy consumption took into account all emissions from fossil fuel combustion. Fuel combustion, one of the largest contributors to GHG emissions in Myanmar, can be broadly categorized into four groups for emission assessment, i.e. energy industries, manufacturing industries and construction, transport and other sectors having emissions from energy consumption. Myanmar's commercial energy resources depended

[9] 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 2: Energy

[10] Currently Myanmar doesn't have any facility that is storing CO2, hence this is excluded from the scope of energy emissions for the country.

almost fully on hydropower and fossil fuels. The emission sources in the sector of electric power and heat supply were defined to be the power generation and heat supply of Myanmar's thermal power utilities while the emissions from auxiliary power plants and other sources of heat supply were reported in the relevant sectors. Machineries and equipment for fossil fuel combustion composed of gas turbines and combined cycle power plants, power generating boilers, industrial boilers, industrial kilns, household cooking ovens, farm implements, power-generation internal-combustion engines, different kinds of aviation vehicles, road transport vehicles, railway transport vehicles, shipping transport vehicles, etc.

The national GHG inventory for the energy sector covered three major GHGs: CO_2, CH_4, N_2O. The main sources of GHG emissions examined are fossil fuel combustion, traditional biomass fuel combustion, fugitive emissions from coal mining activities, and oil & natural gas system. The total GHG emissions from energy sector of Myanmar were estimated to be 7,863.47 Gg CO_2e most of which come from fossil fuel combustion according to Myanmar INC 2012. CO_2 emissions accounted for 97 % of total emissions while CH4 and N2O emissions shared only 2% and 1% respectively.

Currently, Myanmar has been using different types of primary energy sources such as solid and liquid fuels. The main sources of GHG emissions in the energy sector are fossil fuel combustion, traditional biomass fuel combustion, fugitive emissions from coal mining activities, and oil and natural gas system. Three different gases are tracked which are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) in national GHG inventory of energy sector[11].

[11] Myanmar's Initial National Communication Under The United Nation Framework Convention on Climate Change (UNFCCC), 2012

Components of INDC and NDC

Myanmar has submitted its INDC in 2015 and its NDC released in 2017. Mitigation actions from INDC, and probable data to be measured include:

- Renewable energy – Hydroelectric power. Increase the share of hydroelectric generation within limits of technical hydroelectric potential and instead of the development of fossil fuel-based power generation. Indicative data and information to be collected and measured: installed capacity, planned capacity, emission factors for the grid, grid-connected or off-grid, water sources other non-carbon benefits; and at later stages, potential sources of methane emissions.
- Renewable energy – Rural electrification. To increase access to clean sources of electricity amongst communities and households currently without access to an electric power grid system. The Project will support the scale-up of low carbon energy through grid connections and renewable or hybrid energy for village-scale mini-grids and off-grid solar home systems to replace current fossil fuel sources of electricity and lighting including diesel and kerosene. Indicative data and information to be collected and measured: types of renewable energy available; potential of exploitable renewable energy available and utilized; emission factors for the renewable energy sources; grid-connectivity / off-grid access points; non-carbon benefits.
- Energy efficiency – industrial processes. To mitigate GHG emissions in the rapidly developing industrial production sector by reducing energy consumption by 20% by 2030 against the base year of 2012. Indicative data and information to be collected and measured: Existing baseline

of select industrial processes for energy consumption, projections for demand in the next short to long-term, supply-side and demand-side energy-efficiency audits, baseline fuels, emission factors, grid-connectivity / off-grid access points; non-carbon benefits.

- Energy efficiency – cook stoves. To increase the number of energy efficient cook stoves distributed in order to reduce the amount of fuel wood used for cooking.[12] Indicative data and information to be collected and measured: Baseline fuel consumption, categorization, renewable and non-renewable biomass categorization, cookstove usage, suppressed-demand estimation and calculation, any other methodology-related parameters.

Myanmar's Climate Change Strategy and Action plan's ultimate goal is to plot out climate resilient, low carbon and sustainable development pathway for the country. For the energy sector, this means choosing a development strategy that minimizes social and environmental impacts while expanding access to energy to the public and for economic development.

- Expand energy access to the public using renewable and low-impact technologies. The INDC targets 6 million people living in rural areas to gain access to electricity from micro-hydro, biomass, wind and solar mini-grid technologies.
- Increase the role of renewable energy throughout the energy sector.
- Promote technology transfer, capacity building, and funding to minimize the environmental impacts of energy sector development[13]

Current status of mitigation actions of Energy Sector on INDC

Hydropower

At present, total 27 numbers hydropower stations with the total installed capacity of 3221 MW have been connected to national grid. The total electricity installed capacity in Myanmar from 2001 to 2015, with hydropower currently representing around 60% of total capacity. The installed capacity of hydro has increased by more than four times from 2006 to 2015, while natural gas, thermal, and diesel power plants have remained relatively unchanged in the same period. The total electricity generation has doubled over the last decade, particularly as a result of increasing hydropower generation, which now represents more than 66% of total electricity generation. Moreover, MOEP is operating 32 mini hydro projects with a total installed capacity of 33.1 MW which is not connected to the grid. Generally, hydropower can be defined into four categories under MOEE, identified hydropower potential, completed and generated hydro-power stations, ongoing hydropower projects and future plan projects. These categories are briefly mentioned in general as follow[14]:

- 92 sites Potential capacity = 46099 MW
- 27 sites completed installed capacity = 3221 MW
- 8 on-going sites install capacity = 1691.6 MW
- 57 Future Plan sites = 41186.4 MW

[12] Myanmar's Intended Nationally Determined Communication- INDC, 2015

[13] Myanmar's Climate Change Commitments and Indigenous People's Right

[14] The Role of Hydropower in Myanmar. Khin Thi Aye. Planning and Statistic Branch. Minister's Office. MoEE

Rural Electrification

The Ministry of Livestock, Fisheries and Rural Development has received co-funding from a number of international development partners to develop mitigation actions in this sub-sector (such as the drafting of the Comprehensive Village Development Plan). As a final result of the overall action, 6 million people in rural areas will have access to electricity generated by a variety of sources, at least 30 % of which will be sourced from renewables such as of mini-hydro, biomass, solar, wind and solar mini-grid technologies.

Currently, there are 142,968 number of households which have been accessed electricity from 2,718 villages under rural electrification program in 2016-2017 FY. During 2017-2018 FY, 93,725 households from 1,397 villages are on-going process to access electricity. Overall, 647,008 households from 9,869 villages are expected to access electricity at the end of 2021 FY. Table-1 shows the current status of rural electrification rate.

Sr.	Fiscal Year	SHS		Mini-Grid		Total		Remark
		Village	Household	Village	Household	Village	Household	
1	2016-2017	2708	141465	10	1503	2718	142968	Complete
2	2017-2018	1366	88019	31	5706	1397	93725	On Going
3	2018-2019	2454	132340	100	10000	2554	142340	Plan
4	2019-2020	1500	122950	100	9095	1600	132045	Plan
5	2020-2021	1500	128550	100	7380	1600	135930	Plan
Total		9528	613324	341	33684	9869	647008	

Table 1: Current Status of Rural Electrification Rate; Source: DRD

Energy efficiency – industrial process

2012 is the base year for saving energy consumption especially electricity consumption. Industry sector used 3,650 GWh of electricity which was the significant energy user in 2012 compared to residential sector, commercial sector, etc. Figure 2 represents overall energy consumption in 2012. In industrial sector, energy management training, steam system optimization training, compressed air optimization training and demonstration projects are currently being implemented under Improvement of Industrial Energy Efficiency (IEE) Project (2015-19) with the technical cooperation of United Nation Industrial Development Organization (UNIDO) by utilization of Global Environment Facilities-GEF fund. Moreover, with UNIDO, Resource Efficient and Cleaner Production (RECP) Project (2016-17) is being implemented for food processing and hotel sector. The same time, EECD is trying to raise the public energy efficiency awareness by establishing workshop, seminar, pamphlets distribution and awareness training.[15]

[15] Energy Efficiency and Conservation. Myanmar Industry Portal

Sector	2012 Energy Consumption (GWh)	End-Use Consumption (%)
Industry	3,650	44%
Commercial / Public	1,643	20%
Residential	2,681	32%
Other	281	3%
Total	**8,254**	

Figure 2: Overall Energy Consumption in 2012; Source: National Energy Efficiency and Conservation Policy, Strategy and Roadmap for Myanmar 2015

Energy efficiency – cook stoves

MOECAF, as part of the Comprehensive Plan for Dry Zone Greening (2001-31), has distributed approximately 286,000 cook-stoves during 2001-15, and plans to distribute an additional 260,000 cook stoves between 2016 and 2031.[16]

Some 22,000 households in Mandalay Region are using fuel-efficient stoves as part of a government effort to reduce the use of firewood and the resulting destruction of forests and mangroves, according to the Mandalay Forestry Department[17].

Country Specific Energy Generation and Consumption[18,19]

Myanmar has rich energy resources, especially for hydropower and natural gas. More than 100,000 megawatts hydropower potential is expected in Myanmar. Offshore gas is currently playing the most essential source of country's export revenues, recently supplying Thailand and the plan of a new gas pipeline to the People's Republic of China (PRC) is currently pending due to a proper social impact assessment. About 30% of the country total households have access to electricity, and Myanmar is the lowest per capita energy consumption of electricity among in Asia.

Figure 2 sets out the historical Total Final Energy Consumption (TFEC) for Myanmar. This show the country consumed a total amount of 14 Mtoe of fuels in 2013. Figure 3 illustrates sectors' contribution in the total consumption for each year. The largest energy end user is the residential sector with 75% of total consumption followed by the industrial sector (9%), transport sector (8%) and others (6%). The remaining 2% is from energy consumption of commercial and agricultural sectors.

[16] Myanmar's Intended Nationally Determined Communication- INDC, 2015

[17] Fuel-efficient cooking stoves in 22,000 households in Mandalay. Khin Su Wai. Myanmar Times

[18] National Energy Efficiency and Conservation Policy, Strategy and Roadmap for Myanmar 2015

[19] Myanmar Energy Master Plan, 2015

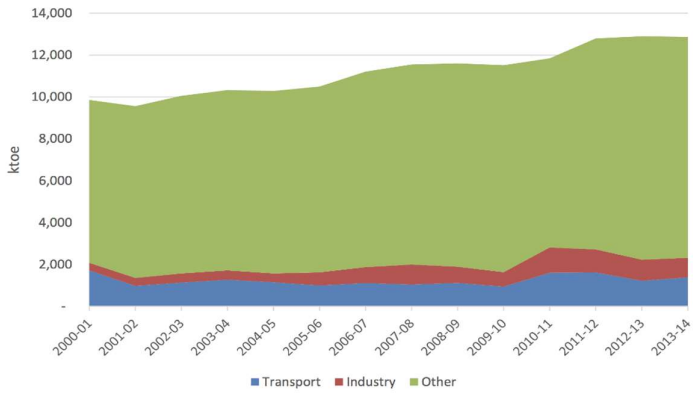


Figure 3: Myanmar Total Final Energy Consumption (TFEC) by Sector; Source: Myanmar Energy Master Plan 2015

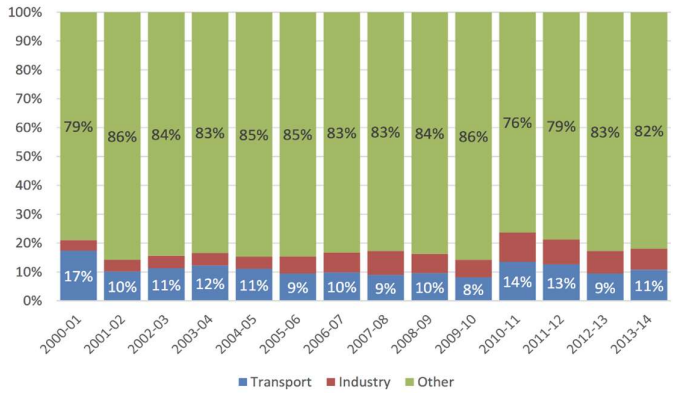


Figure 4: Myanmar Total Final Energy Consumption for 2013; Source: Myanmar Energy Master Plan 2015

Between 2000 and 2013, overall Myanmar's total final energy consumption (TFEC) increased annually by an average of 2.3%, from 11 Mtoe to 14.3 Mtoe. The industrial sector energy consumption was double over this period, and three times of commercial sector energy consumption was grown up, whereas there was no generally increased from transportation sector energy use. Annually, 1,3% of energy consumption is increased by residential sector; nonetheless, it remains by far the largest consumer of energy due to exclusive use of biomass (fuel wood and charcoal). Below Figure 4 is the overall Myanmar Energy Flow Diagram for 2013/2014.

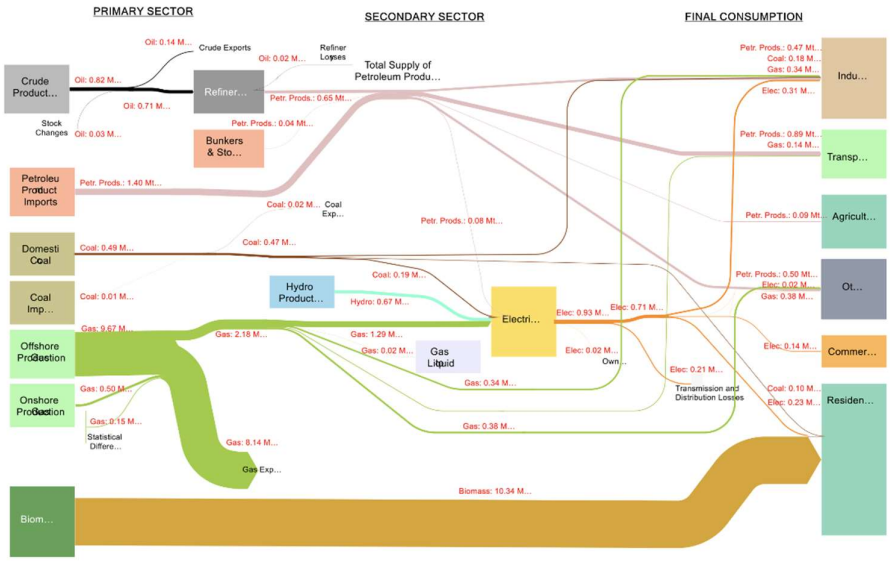


Figure 5: Overall Myanmar Energy Flow Diagram for 2013/2014; Source: Myanmar Energy Master Plan 2015

Coal

Coal is used in domestic industries and a small amount is exported. Domestic coal consumption in Myanmar has seen a general increase over the last 10 years, which has been driven by increased use in the construction and cement industry and also increased use of coal in the residential sector for cooking. Coal for electricity generation was 131 kton in 2013/14, down on the 303 kton in the year prior. Coal for electricity in 2013/14 corresponded to 26% of Myanmar's total demand for coal, compared to 40% in the year prior. Industry was the next largest coal end user to the electricity sector, accounting for about 56% of total domestic coal consumption in 2013/14. Cement production is responsible for the majority (69% in 2013/14) within the industrial category.

Petroleum

Major petroleum products consumed in Myanmar are gas/diesel oil, motor gasoline and jet kerosene. Gas and diesel oil constitutes some 59% of petroleum demand in Myanmar, followed by 24% motor gasoline and 5% jet kerosene. The imported segment of gas and diesel oil is dominant accounting for 87% over the last three years (2011/12 to 2013/14). Similarly, around 58% of the motor gasoline in Myanmar is imported. The transport sector is the largest end user of petroleum products. In 2013/14, it consumed 1,038 ktoe out of a total of 2,348 ktoe, or 44% of the country's final petroleum consumption.

Natural Gas

Industry is the largest single sector in terms of gas uses. Its share in total final consumption was more than 50% until 2011 but has then decreased, to about 40% by 2013. Within the industrial sector, fertilizer plants are the largest natural gas users, responsible for roughly a fourth of all sector consumption. Domestically, Myanmar's electricity sector accounts for around 55% to 60% of natural gas consumption. Other major gas users are the government-owned factories (20%), fertilizer plants (7.9%), a compressed natural gas facility (7.2%), and LPG production (0.9%).

Electricity

Electricity consumption has increased significantly in the last five years at an annual average growth rate of 13.6%. Industrial, residential and commercial sectors are the

major end users of electricity in descending order. The industrial sector has been observed to have annual average growth rate of 15.1% over the last 5 years, followed by 13.8% in the commercial sector and 11.9% in the residential sector.

Biomass

All end-use consumption of biomass is in the residential sector. In terms of equivalent caloric values the use of fuel wood dominates final energy consumption in Myanmar. For example, in 2012/13, there was about 9,000 ktoe of fuel wood, compared to just 231 ktoe of electricity consumed by the residential sector.

A simplified energy balance table for Myanmar for the year 2013/14 in energy units (ktoe) is provided in Table 1. This provides a snapshot of energy flows in the country based on the information and data according to Myanmar Energy Master Plan 2015.

Supply & Consumption	Coal	Crude Oil	Petroleum Products	Natural Gas	Hydro	Biomass	Electricity	Total
Production	355	838		8,014	761	8,564		**18,532**
Imports			1,922					**1,922**
Exports	-21	-236		-6,059				**-6,316**
Stock Changes	-	3						**3**
TPES	**334**	**606**	**1,922**	**1,955**	**761**	**8,564**		**14,142**
Statistical Error	-34	-42	-8	-69				**-153**
Electricity Generation	-83		-63	-1,080	-761		1,056	-931
Other Transformation				-9				-9
Oil Refineries		-552	526					-25
Losses		-12					-223	-234
TFEC	**217**		**2,348**	**912**		**8,564**	**827**	**12,867**
Transport	-		1,038	345				1,384
Industry	181		390	129			232	932
Other (Commercial, Residential, Others)	36		919	437		8,564	594	10,551

Table 2: Energy Balance Table for 2013/2014; Source: Myanmar Energy Master Plan 2015

CHAPTER 3: IDENTIFICATION AND ENGAGEMENT OF STAKEHOLDERS

The Environment Conservation Department (ECD) of the Ministry of Natural Resources and Environmental Conservation (MoNREC) is the focal point for climate change issues in general, and is responsible for coordinating the Myanmar government's NDC MRV implementation. The existing capacity of ECD requires reinforcement, while capacities in other ministries and agencies also require dedicated support to be able to integrate climate change and MRV needs into respective Programs.[20]

In June 2018, five technical working group were formed with the permission of meeting number (5/2014) by Union Government. These 5 TWGs are:

(1) GHG Inventory and Mitigation Action TWG,

(2) Vulnerability Assessment and Adaption TWG,

(3) Environmental Sound Technology TWG,

(4) Research and Systematic Observation TWG and

(5) Education, Training and Public Awareness TWG.

Among the five TWGs, there are 13 different stakeholders from different ministries for the energy sector and 5 stakeholders for the transportation sub-sector who are directly linked with Energy Sector MRV system. This institutional arrangement is an ad-hoc basis for SNC development, which may change for future iterations. Following is the list of stakeholders for Energy Sector.[21]

1. Daw Swe Lin Myint – Assist. Director- Department of Planning - Myanmar Petrochemical Enterprise (Leader)
2. U Aung Zaw Myint – Depart. Chief - Myanmar Petroleum Product Enterprise (Co-leader)
3. U Myat Tun Kyaw – Director – Department of Trade
4. Daw Phyu Phyu Khin – Dep. Director – Department of Electric Power and Planning
5. Daw Sein Nwet – Assist. Director – Irrigation and Water Utilization Management Department
6. Daw Mi Mi Tun – Assist. Director – Bridge Management Department
7. U Aung Kyaw Phyo – Assistant Engineer – Department of Mines
8. U Aung Phyo – Assist. Director - Myanmar Customs
9. U Paw Lar Aung – Manager – Myanmar Oil and Gas Enterprise
10. U Kyaw Nyunt – Officer – Road Management Department
11. U Ye Htet Lwin – Officer – Oil and Gas Planning Department
12. Daw Aeint Kyawt Hmuee – Junior Engineer – Department of Rural Development
13. U Myint Soe – External Expert – Advisor

Below are the Transportation Sector stakeholders who relate to the energy sector.

1. U Thaung Htike – Assist. Engineer – Road Transport Administration Department (Leader)
2. U Kyaw Moe – Assist. Director – Department of Marine Administration (Co-leader)

[20] Seres, Stephen. 2017. The Status of Monitoring, Reporting and Verification of Nationally Determined Contributions to Climate Actions in Myanmar. GGGI/MONREC MRV Project Report No.1

[21] Notification (90/2018), 7 June 2018, , 2018) (Energy sector assessment, strategy, and roadmap, 2016) (Myanmar Energy Master Plan, 2015)

3. U Kyi Soe – Assist. General Manager – Myanmar Railways
4. Daw Saw Sandar Hlaing – Assist. Director – Department of Civil Aviation
5. Daw Chan Myae Thidar Kyaw – Assist. Engineer – Department of Civil Aviation

Mapping of key institutions for energy sector

To strengthen the coordination and cooperation between line ministries for the energy sector, the government established the National Energy Management Committee in January 2013 by the President Office Notification No. 12/2013 and the National Electrification Executive Committee in September 2014. NEMC has its Patron being the Vice President of Myanmar and its Chairman being the Union Minister for Energy. NEMC primary function is to provide administrative functions for all energy policy and planning matters. In addition, the government also constituted Energy Development Committee (EDC) to support the activities of NEMC. This illustrates the relationship between NEMC, EDC and other entities that influence Myanmar's energy industry.[22]

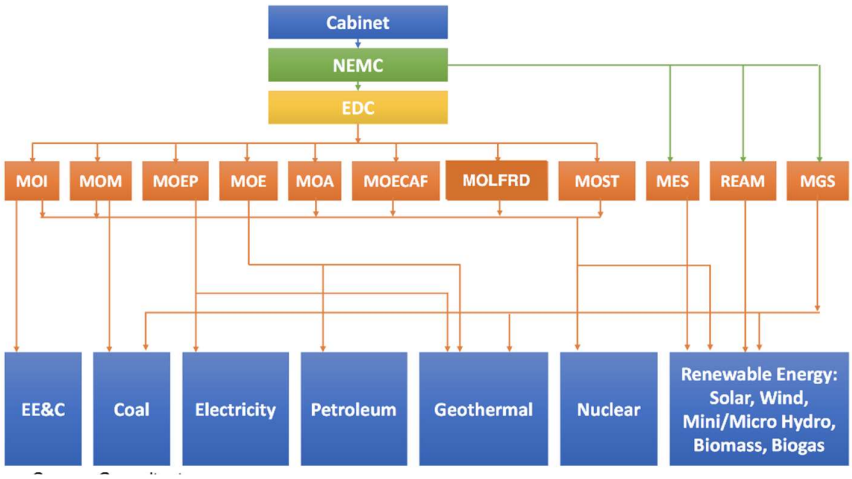


Figure 6: Governance of Myanmar Energy Sector

Source: Energy Master Plan

In April 2016, the government restructured its organization and reduced the number of ministries from 36 to 21. In light of the ministerial reorganization in April 2016, the government abolished more than 100 committees including the National Energy Management Committee and National Electrification Executive Committee. The government is reviewing the need to establish new coordinating committees in the energy sector. This included the merging of the Ministry of Energy and Ministry of Electric Power into the new MOEE, which is responsible for oil and gas and electricity operations. Other ministries related to the energy sector include (i) Ministry of Agriculture, Livestock, and Irrigation with responsibility for off-grid rural electrification, (ii) Ministry of Natural Resources and Environmental Conservation with responsibility for coal mining, and (iii) Ministry of Industry with responsibility for energy efficiency. The organization chart of MOEE, based on then structures of the Ministry of Energy and Ministry of Electric Power, is shown in Figure

[22] Myanmar Energy Master Plan 2015

7.[23] Ministry of Transportation and Communication has responsibility for fuel used in all kind of vehicle.

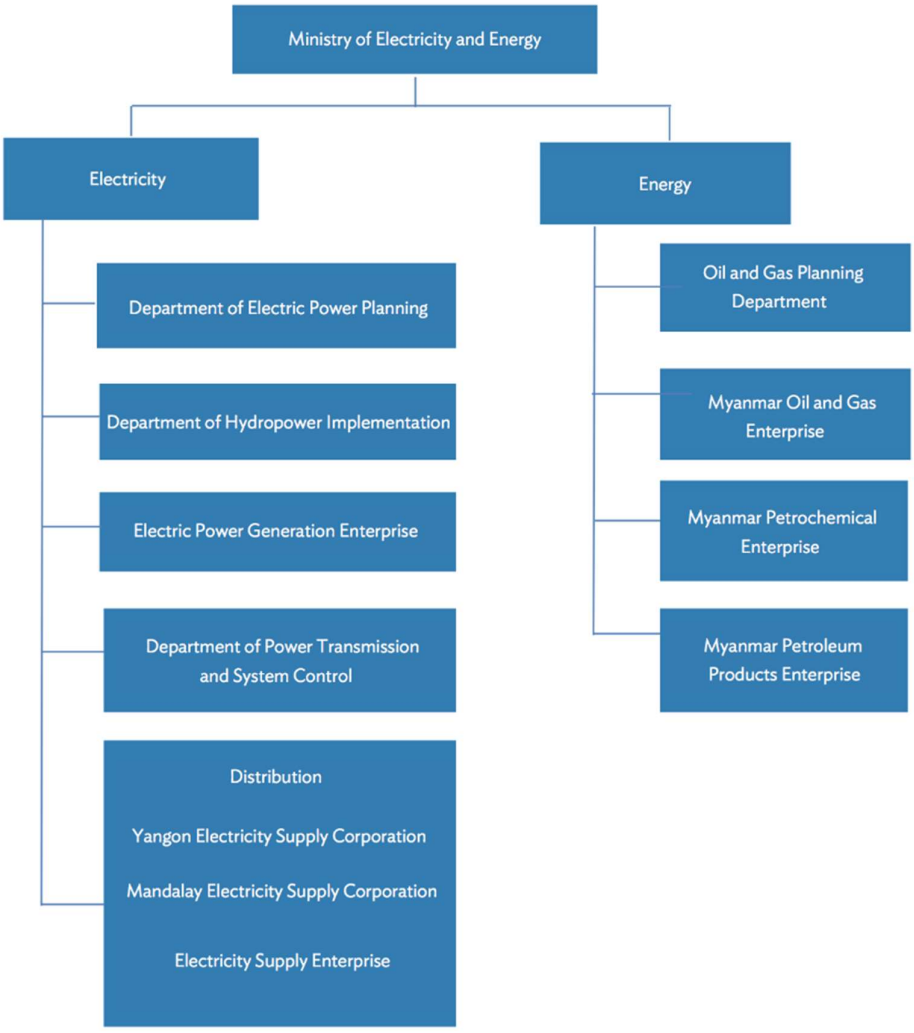


Figure 7: Organization of Ministry of Electricity and Energy

[23] Energy sector assessment, strategy, and roadmap, ADB, 2016

CHAPTER 4: INSTITUTIONAL ARRANGEMENTS

MoNREC's ECD is the focal point for climate change and deals with climate change issues at international level, including UNFCCC negotiations and reporting. It is also responsible for translating global-level decisions for national implementation. The ECD is also responsible for engaging other ministries and departments to address climate change. The management arrangements for the preparation of the SNC will follow the standard project management arrangements for the UNEP umbrella projects.

Project management team, based at ECD, is led by the Project Director. The project management team reports regularly and directly to the Deputy Director General of ECD. The project management team is under the guidance of the project steering committee. It will also receive technical supports/advices from the national and international experts and UNEP Umbrella Program. The project management team is responsible for the administrative and technical coordination of the activities of the various working groups. Major decisions and reporting responsibilities lies with the project steering committee. Five Thematic Working Groups (WGs) are constituted based on the key elements of the national communication as discussed above. Memberships of the WGs are drawn from relevant private, public institutions and national consultants. The WGs are responsible for the planning, implementing and reporting of their respective sectors to the project steering committee through the project manager.

Since Second National Communication project has been launched by September 2016, the team has endeavored to set up robust and sustainable National GHG Inventory Management System with the active participation of government agencies, non-government organization and academia. According to Project Implementation Plan and national capacities, National GHG Inventory and Mitigation Thematic Working Group was being set up into one instead of two separate TWGs. The broader NGHGI&M TWG is sub-divided into 1. Energy, 2. Industry, 3. Agriculture, 4. Forestry, 5. Waste, 6. QA/QC and Verification and 7. Data Archiving. Each group has their own roles and responsibility.

Figure 8 represents the draft institutional arrangements for SNC. The National GHG Inventory Group will be formed to carry out the GHG inventory (sources and sinks) in the country. The group will consist of experts from relevant ministries, institutions and agencies of government and non-government organizations. It will ensure that specific tasks relating to the national GHG inventory is carried out in a timely manner and will ensure efficient coordination of outputs of consultants and national institutions. The activities undertaken by the national institutions will contribute to strengthening institutional arrangements for compiling, archiving, updating and managing GHG inventory data.

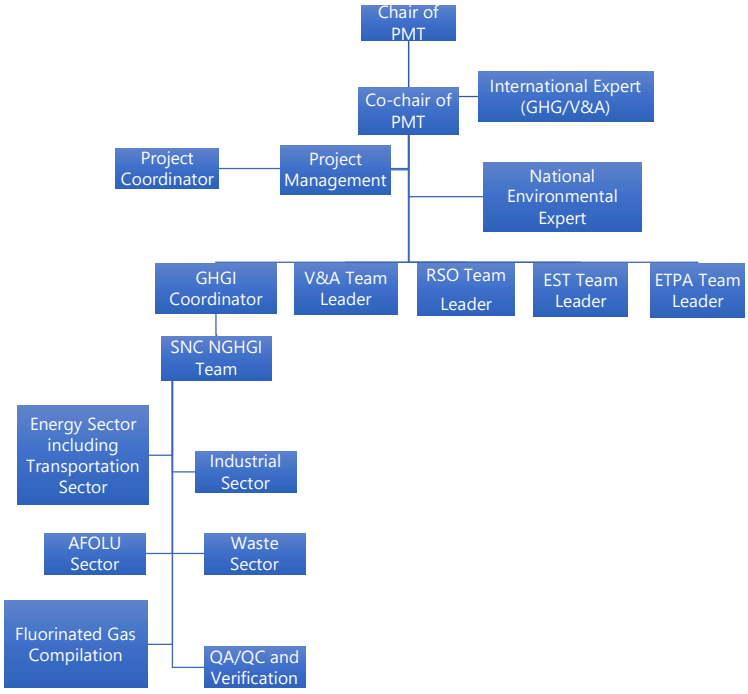


Figure 8: Draft Institutional Arrangements of SNC

Draft Institutional Arrangement of Energy Sector[24]

The institutional arrangement assists inventory teams in assessing and documenting the strengths and weaknesses of existing institutional arrangements for inventory development to ensure continuity and integrity of the inventory, promote institutionalization of the inventory process, and facilitate prioritization of future improvements. The inventory management team coordinates the development of the national GHG inventory.

Tables 3 through 5 provide the draft institutional arrangements for inventory management team for energy sector by using the template "Institutional arrangements for national inventory systems (IA)", based on the template created by UNFCCC. Once completed, the template summarizes existing institutional arrangements for GHG inventory management in a Party. In preparing this document, the inventory team will need to document what arrangements exist, document the status of existing arrangements for inventory development, and identify and list future improvements which will subsequently be prioritized in the national inventory improvement plan (NIIP) template. This completed document creates an archive for describing institutional arrangements in future national communications and related documents. This template to enter country-specific data and for preparing final plans following the steps below[25]:

[24] Source: Swe Lin Myint. Assistant Director. Department of Planning – Myanmar Petrochemical Enterprise

[25] https://archive.epa.gov/epa/climatechange/national-ghg-inventory-capacity-building.html

Step 1: Identify current inventory management team

Step 2: Provide sectoral roles and arrangements

Step 3: Provide improvements to institutional arrangements

Step 4: Review and complete inventory cycle timeline.

Since NGHGI&M TWG has formed recently, the draft institutional arrangements are set in place. However, this exercise needs to be completed for each iteration of GHG inventory preparation. Therefore, all the tables inside the template are not able to present below. Consequently, the full sample template is provided in Appendix III. In Table 3, the lead agency is listed and identify inventory management team members is in Table 4.

Table 3: Designated Inventory Agency

Designated National GHG Inventory Preparation Agency/Organization	UNFCCC Focal Point (Name) and UNFCCC Focal Point Agency	Describe the arrangements or relationship between Inventory Agency/Organization and UNFCCC Focal Point Agency, if different.
National Greenhouse Inventory and Mitigation Action Thematic Working Group – Environmental Conservation Department	Environmental Conservation Department, MoNREC	

Table 4: National Inventory Management Team for the SNC

Role	Name	Organization	Contact Information	Comments
Inventory Director/Coordinator	U Kyaw Moe Aung	Second National Communication Project	Building (53) Naypyitaw	
Energy Sector Lead	Daw Swe Lin Myint	Myanma Petrochemical Enterprise	Building (44) Naypyitaw	Notification (90\2018) of Ministry of Natural Resource and Environmental Conservation, dated on 7 June 2018
QA/QC coordinator	Daw Khin Swe Latt	Central Statistical Organization	khinswelatt@gmail.com	Notification (90\2018) of Ministry of Natural Resource and Environmental Conservation, dated on 7 June 2018

Table 5 is provided for energy sector to document existing arrangements for obtaining, compiling and reviewing inventory data. In this table, identify the role, organization, and contact information for those providing relevant data for estimating emissions are needed to provide.

Table 5: Energy Sector Institutional Arrangements

Role	Organization	Contact(s) [Name]	Contact Information [E-mail, Phone, etc.]	Participated in meetings on GHG inventory development? [Yes/No]	Comments [See instructions above]
Technical coordinat / Sector Leader	MPE - MOEE	Daw Swe Lin Myint	shwelinmyint@gmail.com,	Yes	According to the Notification (90\2018), Team Leader of Energy Sector in NGHGI was assigned in NGHGI and Mitigation Action Thematic Working Group for Second National Communication Project.
Consultant compiling estimates	External	U Myint Soe	myintsoe9999@gmail.com	Yes	According to the Notification (90\2018), one of the members of Energy Sector.
Expert reviewer	Second National Communication Project (SNC)	U Kyaw Moe Aung	kyawmoeaung.kyawmoe@gmail.com	Yes	
Data provider	MoEE and MoTC	See in Appendix II		Yes	According to the Notification (90\2018), Greenhouse Inventory and Mitigation Action Thematic Working Group was comprised 13 members from respective departments and enterprises from MoEE for Energy Sector and 5 members from MoTC for Transportation Sector.

CHAPTER 5: REVIEW OF LEGAL FRAMEWORK

Although the sectors are regulated by an extensive and rapidly evolving regulatory framework, it is not explicit on the relatively new challenges posed by climate change. However, their respective policy directions incorporate, to different degrees and extent, some level of awareness on the need to develop in a sustainable manner, which has relevant co-benefits to making Myanmar resilient to climate change. The overall challenge across sectoral policy remains to keep a balance between the needs to pursue energy production and distribution; increase transport access; traffic capacity and industrial productivity; and to ensure sustainability in undertaking these actions. In other words, there is a need to do it right the first time.

Energy policy directions for Myanmar focus on the need for energy security, affordability, access, poverty benefits, wellbeing and foreign revenue generation. Although climate change is not prominent in the policy so far, there are considerations related to carbon emissions — for example, in Energy Master Plan. There is a growing concern — confirmed by the sub-national consultations undertaken when developing the National Climate Change Strategy and Action Plans that Myanmar needs to priorities the production of energy from renewable sources. A number of national policies focus on energy efficiency and conservation, with the evident co-benefits of reducing prices and so increasing inclusiveness of access; reducing carbon emissions from fugitive and wasted energy use; and reducing the overall impact on natural resources.

Myanmar's Ministry of Industry developed the National Energy Efficiency and Conservation Policy, Strategy and Roadmap and it has been approved by the Cabinet in February 2016. The policy's objective is to reduce the use of energy 12 per cent by 2020, 16 per cent by 2025 and 20 per cent by 2030 against the baseline year 2012 by reducing energy use and resulting GHG emissions.

As energy is the world's largest single GHG source, mainstreaming climate change considerations in this policy environment will be key to reaching the overall strategy ambition. The regulatory framework for transport is also evolving, with a focus on improved and extended public transport systems and infrastructure, particularly for roads. Myanmar is directing its efforts at improved national and international transport systems, environmental improvement and reduced emissions. There is evidence of attempts to contain emissions through e.g. incentives for electric cars. However, the regulatory environment for transport could further consider climate resilience to long-term changes in the climate in addition to reducing GHG emissions, to ensure viability of the sector over time.

The policy framework for industry is largely regulated, although most of the legal instruments such as the 1914 Companies Act are out-dated. This limits any considerations about climate change. The notable exception is the 2012 Environmental Conservation Law, to which all investors must abide. The overall focus of policy direction is on: SME development; support for manufacturing and processing; skills development; and seeking increased FDI for economic development. In Myanmar's drive towards creating an enabling environment for increased FDI it plans to shift to an industry-based economy by 2030. However, it is important that small, medium and large-scale industry should not give way to unsustainable practices; the country should operate in the context of adhesion to climate change global commitments and national adaptation requirements. Myanmar launched its new Environmental Impact Assessment procedures in January 2016. This is considered as an important step forward.

Policy measures to addressing rising GHG emissions in Energy Sector[26]

Use of energy will increase with the growing population and economy which will be accompanied by increasing GHG emissions. In order to mitigate the GHG emissions and adapt to the increased warming, the following policy measures have been identified for integration into the national and sectoral development plans and programs.

1. Enhance energy conservation, efficiency and production and ensure energy security.
2. Promote efficiency of national transportation system and regulate imports of second-hand motor vehicles.

To address rising GHG emission in energy sector, following strategies have been set up in INDC.

1. Perform energy audit
2. Tap all potential sources including renewable energy for increased power generation and utilization.
3. Improve traffic demand management
4. Establish national ambient air quality standards

National Energy Policy[27]

Recognizing the critical importance of energy for sustainable economic development and the wellbeing of the people, the Government in 9th January 2013 established the National Energy Management Committee (NEMC), with Vice President of the Government of the Union of Republic of Myanmar as the Patron and the Union Minister for Energy as the Chairman. The implementation and the execution of the Myanmar Energy Policy will be under the guidance and coordination of the National Energy Management Committee and with the support of all concerned organizations/agencies as well as the civil society.

To ensure development of the energy and electricity sectors, the NEMC prepared the National Energy Policy paper which was approved by the President in January 2014. The paper summarized the national energy sector policies as follows:

1. To implement short-term and long-term comprehensive energy development plans based on systematically investigated data on the potential energy resources that are feasible and can be practically exploited, considering minimum impact on natural environment and social environment.
2. To institute laws and rules and regulations to promote private sector participation and privatize state energy organizations in line with State Economic Reform Policy.
3. To compile systematic statistics on domestic demand and supply of various different kinds of energy resources of Myanmar.
4. To implement programs through which local population could proportionally enjoy the benefit of energy reserve discovered in the areas.
5. To implement programs on a wider scale, utilizing renewable energy resources such as wind, solar, hydropower, geothermal, and bioenergy for the sustainable energy development in Myanmar.
6. To promote energy efficiency and energy conservation.
7. To establish a research, development, design, and dissemination institution to keep abreast with international practices in energy resources exploration and development works, and to produce international quality products and conduct

[26] Myanmar's Initial National Communication Under The United Nation Framework Convention on Climate Change (UNFCCC), 2012

[27] National Energy Policy, 2015

energy resources exploration works in accordance with international standards.

8. To promote international collaboration in energy matters.
9. To formulate appropriate policy for energy product pricing, meeting economic security of energy producers and energy consumers.

There are the several objectives for Policy number 1based on the different energy resources such as coal, oil and natural gas, electricity, renewable energy and nuclear energy within the policy. Among several objectives, conduct EIA and SIA is the provision to collect data according to the work program within the policy by studying in the energy exploration work and in the electric power development program in order to minimize impact on natural environment and social environment.

Based on the Policy number 3, MRV mechanism is already in place to collect statistics on domestic demand and supply, which can be used for NDC revision. Moreover, energy efficiency policy, strategy and roadmap which is presented below has been developing to achieve policy no-6.

The National Energy Management Committee, with its uniquely positioned administrative status and leadership, shall coordinate among the stakeholders for the successful implementation of the Energy policy. The formation of the National Energy Committee (NEMC) also represents a commitment to the concept of integrated energy planning. The IEP is recommended to be carried out on a 5-year cycle. Typical components of any IEP implementation should include data collection; data compilation, analysis and statistical reporting; energy demand forecasting; energy supply forecasting; developing an overall strategy; and monitoring and evaluation.

An energy master plan must be based on sound research on the national energy consumption trends, existing and potential energy supplies, energy prices, supply and demand-side technologies, population growth, environmental and social impacts, and political situation of a country. It is critical to understand the importance that IEP enables informed decisions to be made in terms of energy policy; robust research into the present context and assessing numerous scenarios allows for more informed and robust decision-making.[28] The main aspects of any IEP implementation is discussed below which is one of the supporting for MRV.

Energy Efficiency Policy, strategy and roadmap[29]

The Asian Development Bank (ADB) is providing assistance to the Government of Myanmar for capacity development for Institutional Strengthening of the National Energy Management Committee (NEMC) in Energy Policy and Planning. By the assistance of ADB, the report of EE Policy, Strategy, the proposed activities in the key sectors and the road map for implementation is developed. The report provides information on the rationale for the policy, identifies linkages to the National Energy Policy and other related policies. There is an approach to estimate the energy saving potential in two areas. Therese are:

1. Electricity consumption in all sectors and
2. Biomass consumption in the residential sector.

Based on the analysis conducted in all sectors, a realistic EE target would be 12% of total energy (electricity) consumption by 2020 with 2012 as the baseline (similar to the baseline used in the Energy Master Plan); and targets of 16% and 20% by 2025 and 2030 respectively.

It should be noted that obtaining baseline energy consumption was a difficult task and the estimation of energy saving potential in some sectors were based on international best practices (particularly in the region); and to enable proper energy planning and Energy

[28] Myanmar Energy Master Plan 2015

[29] National Energy Efficiency and Conservation Policy, Strategy and Roadmap for Myanmar 2015

Use Database has been included as one of the short-term activities in the roadmap.

Based on the calculated energy saving potential the National Energy Efficiency Policy objective using 2012 as the baseline is as follows:

- Reduce that national electricity demand by 12% in 2020 compared to the baseline demand in 2012
- Reduce the biomass consumption by 2.3% in 2020 compared to the baseline biomass demand in 2012.
- Reduce national CO2 emissions by 78,690 tons in 2020.

To reach the overall energy efficiency objective, the Alternative Case outlined in the Myanmar Energy Outlook (2013) was adjusted by the results of the assumed energy efficiency in the following sectors identified as priority areas for the national EE policy, strategy and action plan:

- Energy Efficiency in Industry
- Energy Efficiency in Commercial Sector
- Energy Efficiency in Residential Sector (Urban and Rural)
- Energy Efficiency in Public Sector

Common activities for energy efficiency implementation

The EECD will be responsible for the implementation of several common activities across the identified priority sectors that would ensure a sustainable approach to EE implementation in Myanmar. These activities include the following:

1. Energy data collection and analysis
2. Energy Efficiency awareness and education
3. Monitoring & Evaluation
4. Develop Energy Efficiency standards for Buildings and Appliances
5. Accreditation scheme for Energy Auditors and Energy Managers
6. Regional cooperation and networking
7. Develop Legal and Financial Framework for Energy Efficiency

According to activity 1, mitigation actions of NDC can be revised since MRV mechanism is already in place to collect data and information on energy consumption from industry sector, commercial sector, residential sector and public sector. Below are action items of activity 1 to implement.

Action Items	Activity 1: Energy data collection and analysis			
	Industry	Commercial	Residential	Public Sector
Identifications of agencies for data collection	MOI, MOE. MOEP, Industry associations	MOEP, sub-sector associations, building managers	MOEP, MOE, MOECAF, Housing association	MOE, MOEP
Establish procedures for data collection and templates	Annual consumption reports by individual industries	Building managers submit reports and verified by MEP	Electricity consumption data from MEP and biomass data from MOECAF	Annual reports from individual ministries and verified by MEP

Action Items	Activity 1: Energy data collection and analysis			
	Industry	Commercial	Residential	Public Sector
Design of energy use database, data entry and analysis	Database managed by EECD	Database managed by EECD	Database managed by EECD	Database managed by EECD
Annual publication of energy consumption	National energy balance published by MOE; Also, included in Myanmar Statistical Yearbook	National energy balance published by MOE; Also, included in Myanmar Statistical Yearbook	National energy balance published by MOE; Also, included in Myanmar Statistical Yearbook	National energy balance published by MOE; Also, included in Myanmar Statistical Yearbook

Table 6: Action items of Energy Data Collection and Analysis Activity

IEP Process[30]

The basic features of integrated energy planning are similar to those of the current energy planning and environmental planning practices, including integrated assessment, life-cycle assessment and integrated resource planning. However, IEP is unique because it mainly focuses on issues relating to energy extraction, transportation, transmission, distribution and use.

Integrated Energy Planning (IEP) takes into account plans relating to transport, agriculture, electricity, industry, petroleum, water supply, trade, macroeconomic infrastructure development, housing, air quality management, greenhouse gas mitigation within the energy sector and integrated development plans of local and provincial authorities. The IEP needs to inform and be informed by plans across all sectors (primary, secondary and tertiary) whose plans impact on or are impacted by the energy master plan. The IEP process is intended to provide an integrated implementation of the individual subsectors. A key issue is the relationship between EMP and other ministry-level plans.

The main aspects of any IEP implementation includes the following:

1. Data collection - A strategy needs to be put into place to support the routine collection and reporting of. While data uncertainty can never be completely eliminated, the need for verification and validation is important as it ultimately informs the IEP process of trends in energy supply and energy demand. Furthermore, a process to recognize and set in motion a process for obtaining any missing data is required – for example, designing targeted surveys or legislating mandatory declarations of stocks and inventory for commercial enterprise. Tools such as spreadsheets and databases are required to support this.
2. Compilation, analysis and statistical reporting on data - Data will necessarily be fragmented across different agencies who are concerned with different subsets of the energy conversion chain (gas, oil, electricity, commerce, industry, etc.). The data needs to be transformed to develop a holistic picture of the energy situation. This may require analytics and/or reconciliation processes to eliminate gaps.

[30] Myanmar Energy Master Plan 2015

Analysis of this kind enables one to identify any emerging trends in energy supply and demand, which in turn is necessary for use in the development or calibration of forecasting models.

3. Energy demand forecasting - The IEP requires as a key input projections of energy demand for all key sectors: industry, commerce, residential, agriculture, transport and others. These needs to be consistent with an underlying set of economic scenarios. The IEP may involve developing a set of independent forecasts or leveraging externally developed forecasts3. Other dimensions to this include the issue of energy efficiency and energy access. Models to support the development of energy demand forecasts are essential.
4. Energy supply forecasting - Issues to be addressed include estimates of primary energy resources, existing and planned infrastructure, options for development, cost of developing primary energy resources, fuel costs, operational expenditure, capital costs, assessments of conventional and emerging technologies, and costs of developing them etc. Again, a database and basic supply option cost models support this process.
5. Developing an overall strategy - A process to translate the projections and modelling results into a meaningful set of recommendations. The demand and supply analysis will require consideration of a range of scenarios that need to eventually be used to guide key decisions on policy and a concrete set of implementation plans or roadmaps for each of the main subsectors.
6. Monitoring and evaluation - Finally, the progress, and effectiveness of any IEP needs to be checked. This process is one of comparing actual outcomes to those that had been planned, identifying areas of discrepancy and making refinements to the IEP process to better address these issues on a go-forward basis.

Electricity Policy[31]

The National Energy Policy, which is to be prepared by NEMC, is a policy including all related sectors. Each sector will not make an individual policy but will implement each sector policy in accordance with the Energy Policy. MOEP makes the following items of the draft policy in power sector:

- For sufficient electricity supply throughout the country, to expand the national power grid for effective utilization of generated power from the available energy resources such as hydro, wind, solar, thermal and other alternative ones;
- To conduct the electricity generation and distribution in accordance with advanced technologies and to uplift and enhance private participation in regional distribution activates;
- To conduct EIA (Environmental Impact Assessment) and SIA (Social Impact Assessment) for power generation and transmission projects in order to minimize these impacts;
- To restructure the power sector with cooperation, boards, private companies and regional organizations for more participation of local and foreign investments and formation of competitive power utilities;
- To formulate the electricity acts and regulations with the assistances of the local and international experts to be line with the open economic era.

[31] The Project for Formulation of The National Electricity Master Plan in The Republic of The Union of Myanmar, Final Report, 2014

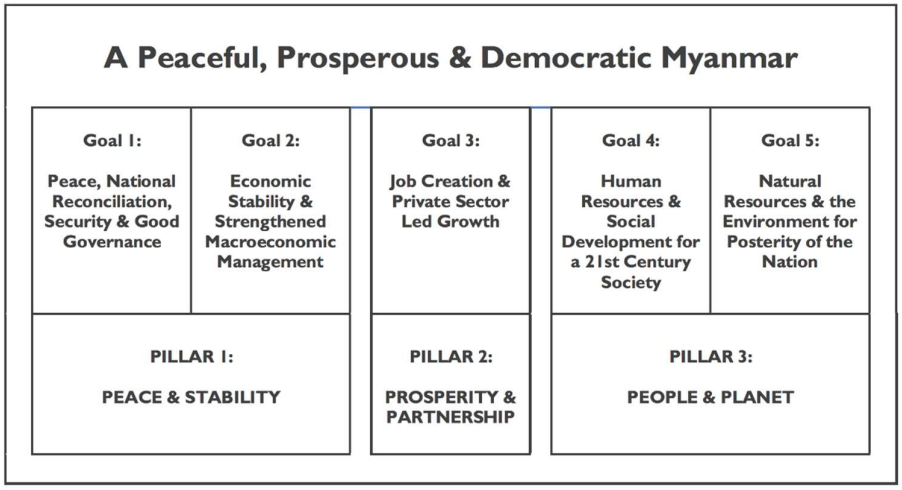
Myanmar National Climate Change Policy, Strategy and Action Plan (2017 – 2030)[32]

Myanmar Climate Change Strategy & Action Plan (MCCSAP) 2017-2030, six Sectoral Action Plans, as mandated by the National Climate Change Policy is developed and it is expected to lunch in following year. Energy Transport and industry are the backbone of development and economic growth, and the projected source of income and jobs in future years. It is important that they grow in a way that is resilient to the changes in climate, while contributing to the global effort of reducing carbon emissions. For this reason, Myanmar must plan for "climate-resilient and low-carbon energy, transport and industrial systems that support inclusive and sustainable development and economic growth" as a sectoral outcome. The three expected results to achieve the sectoral outcome are:

1. Energy security for the country is based on generating a large share of its energy from renewable sources and high energy efficiency in domestic, industrial and other use.
2. Transport systems are adapted to heightened risks of disasters from new climatic conditions and sustainable through to efficiency and low-carbon technologies.
3. Industrial systems are highly productive and competitive due to their climate resilient, sustainable, low-carbon and green characteristics.

Myanmar Sustainable Development Plan[33]

The MSDP is structured around 3 Pillars, 5 Goals, 28 Strategies and 251 Action Plans. All are firmly aligned with the SDGs, the 12 Point Economic Policy of the Union of Myanmar, and various regional commitments which Myanmar has made as part of the Greater Mekong Sub-region (GMS) Strategic Framework, the ASEAN Economic Community (AEC) and many others.



[32] Resilient and low-carbon energy, transport and industrial systems for sustainable growth, Policy Guidance Brief 3, 2017

[33] Myanmar Sustainable Development Plan (2018 – 2030)

Figure 9: The Myanmar Sustainable Development Plan Summary Framework

Goal 5 focuses on the legal, institutional and policy frameworks required to better protect and manage natural environment and ecosystems, through strengthened conservation efforts, improved development and infrastructure planning, and increased enforcement against illegal natural resource related practices, pollution and other harmful activities. Strategies and Action Plans involve encouraging good water use practices, increasing renewable energy generation, climate change mitigation, increasing green investments, protecting biodiversity, improving waste management, promoting sustainable urban development and the mainstreaming of environmental consideration into policies, plans and national accounting systems.

Myanmar will prioritize the long-term benefits gained by managing the safe and sustainable development of energy sector, including ensuring careful consideration of available energy resources, together with analysis of consumption patterns and future projections. The country will also priorities the creation of an investment friendly environment which encourages the use of innovative, sustainable and renewable energy generation technologies. Therefore, Myanmar plans for "Provide affordable and reliable energy to populations and industries via an appropriate energy generation mix" as strategy 5.4 under Goal 5. The following Action Plans have been identified to achieve this strategy.

1. Achieve an optimal level of renewable sources in the primary energy fuel supply
2. Scale-up use of renewable energy resources such as wind, solar, hydro, geothermal and bio-energy in partnership and with agreement of local populations
3. Develop and implement comprehensive national and sub-national energy development plans, prioritizing least-cost generation expansion potential financing from sector revenues, while ensuring minimal adverse impact on our natural environment and local communities
4. Facilitate policy, legal, regulatory and broader good governance actions which will enable greater investment and private sector participation in energy generation and provision
5. Promote energy generation and distribution efficiency and conservation in industry, commercial, household and public-sector use
6. Facilitate greater cross-border, regional and international collaboration in energy matters in partnership with State and Region governments
7. Formulate policies to inform appropriate electricity product pricing (including appropriate use of subsidies) which strike an appropriate balance between needs of producers and consumers
8. Ensure access to affordable, sustainable energy for rural populations and vulnerable groups
9. Create an enabling environment which promotes greater private sector participation in energy generation and supply including privatization of State-owned energy providers

CHAPTER 6: DATA SOURCE AND METHODOLOGIES

Myanmar is preparing its second GHG inventory. The inventory for 2000 was prepared in accordance with to the 2006 IPCC Guidelines, and submitted as part of Myanmar's Initial National Communication. That national GHG inventory of the country was competed and published in 2012, reporting emissions for the year 2000. The draft GHG inventory for the year 2010 under the SNC is expected to be published in 2019.

Collecting and Sharing data

ECD has the data requesting authority from each ministry. However, the response is often delayed due to capacity challenges in understanding the requirements. Furthermore, there is room to improve on data collection, recording and management. To calculate GHG emissions from the energy sector, activity data collection process is beyond the regular data collection activities carried out by responsible entities, which in themselves face delays due to human, technical and financial challenges and requires constant follow-up. The process of data request and collection is also procedural as to initiate the data process, ECD sends official letters to each ministry, which in turn send their own letters to their respective companies and other entities requesting data.

From the first national communication, data was eventually acquired to produce a basic GHG inventory but it was very laborious and costly to collect. Often, several personal visits to the source of the data (ministry, association or private company) over several months had to be carried out in order to acquire the data. In a few instances, proxy data had to be pieced together to reconstruct missing data.[34]

During discussions with the current NGHGI Project coordinator, it was indicated that there is ad-hoc data collection for certain data with a regular frequency and each ministry has responsibility for its own data collection. However, data collection frequency and methods are variable. The necessary activity data is currently being collected at regular intervals to estimate GHG emissions which previously required formal procedures to acquire. For example, one of the important activity data points is fuel use by fuel type for energy which is commonly needed to calculate GHGs. Such kind of data is recently being collected with regular frequency based at the ministry of electricity and energy. Relevant activity data necessary for MRV is being collected by other ministries as well. Recently, NGHGI team collected data from 2005 to 2015 through 3 different ways which are via email, within official meeting and through official request letters as mentioned above.

Data Source[35,36,37]

The MoEE is the main source of data for the energy sector including the transportation sector to estimate the emission for GHG inventory while Ministry of Transport and Communication, Mining Department, Custom and Ministry of Commerce, CDC and Forest Department are providing any other necessary data which is under their coverage. Table 7 represents data sources for various fuel types.

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[34] Seres, Stephen. 2017. The Status of Monitoring, Reporting and Verification of Nationally Determined Contributions to Climate Actions in Myanmar. GGGI/MoNREC MRV Project Report No.1

[35] Source: Kyaw Moe Aung. Project Coordinator. SNC. ECD

[36] Source: Swe Lin Myint. Assistant Director. Department of Planning – Myanmar Petrochemical Enterprise

[37] Myanmar Statistical Yearbook 2016. Central Statistical Organization

Table 7: Data sources for various fuel types

Fuel Types			Name of the responsible ministries, departments and organizations
Liquid Fossil	Primary Fuels	Crude Oil	MPE/OGPD
		Orimulsion	N/A
		Natural Gas Liquids	MOGE/ OGPD
	Secondary Fuels	Gasoline	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		Jet Kerosene	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		Other Kerosene	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		Shale Oil	N/A
		Gas / Diesel Oil	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		Residual Fuel Oil	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		LPG	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		Ethane	N/A
		Naphtha	MPE for Production/ MPPE for distribution/ Custom/ Commerce-import and export
		Bitumen	N/A
		Lubricants	MOI, MoALI, MoTC, MPE, MPPE, Custom, Trade and Commence
		Petroleum Coke	MPE
		Refinery Feedstocks	MPE
		Other Oil	MPE (Blue Oil which is used for soap production)
Solid Fossil	Primary Fuels	Anthracite(a)	N/A
		Coking Coal	N/A

Fuel Types			Name of the responsible ministries, departments and organizations
		Other Bit. Coal	Department of Mines/ MoNREC/Custom/ Commerce - import and export
		Sub-bit. Coal	Mining Department/ MoNREC/Custom/ Commerce - import and export
		Lignite	Mining Department/ MoNREC/Custom/ Commerce - import and export
		Oil Shale	N/A
	Secondary Fuels	BKB & Patent Fuel	N/A
		Coke Oven/Gas Coke	N/A
		Coal Tar	N/A
Gaseous Fossil		Natural Gas (Dry)	MOGE/MPPE/Private Sector
Other	Municipal Wastes (non-bio. fraction)		CDC (Nay Pyi Taw, Mandalay, Yangon)
	Industrial Wastes		MOI and CDC (Nay Pyi Taw, Mandalay, Yangon)
	Waste Oils		CDC (Nay Pyi Taw, Mandalay, Yangon)
Peat			Forest Department/ MoNREC

An annexure to this report contains information on the sources of data for all the sub-categories of IPCC 2006 guidelines for the energy sector.

All of the energy activities data which are being used in calculating the emissions for national GHG inventory are provided particularly from Oil and Gas Planning Department (OGPD) which is playing the vital role for collecting, sharing and compiling the energy data from various ministries and departments. Moreover, Myanmar Petrochemical Enterprise (MPE), Myanmar Oil and Gas Enterprise (MOGE), Myanmar Petroleum Products Enterprise (MPPE) and Electric Power Generation Enterprise (EPGE) under Ministry of Electricity and Energy (MoEE) reinforce the data collecting and sharing for national GHG inventory team. Furthermore, MoTC is the major source of activity data of Transport. Under MoTC, road transport activities data are coming from Road Transport Administration Department (RTAD), railway data is from Myanma Railway (MR), civil aviation data is from Department of Civil Aviation (DCA) and Myanmar National Airline (MNA), and water-borne navigation data is from Department of Marine Administration (DMA), Myanmar Port Authority (MPA) and Inland Water Transport (IWT). For solid fuels, Mining Department under MoNREC provides activity data of coal mining and handling. Table 7 shows type of activities which are covered by national GHG inventory and the respective institutions who is currently

providing the data to calculate GHG emission, and the data are sent to OGPD to compile the data for sharing with other institutions.

Table 8: Source of data and information for each activities type

Type of Activity	Source of Data and information
1.A.1 - Energy Industries	OGPD, MPE, MOGE, MPPE and EPGE
1.A.2 - Manufacturing Industries and Construction	OGPD, MPE, MOGE, MPPE and EPGE
1.A.3 - Transport	OGPD, MoTC, DCA, MNA, RTAD, MR, DMA, MPA and IWT
1.A.4 - Other Sectors	OGPD, MPE, MOGE, MPPE and EPGE
1.B.1 – Solid Fuels	OGPD, MoNREC and Mining Department
1.B.2 - Oil and Natural Gas	OGPD, MPE, MOGE and MPPE

Methodologies

Since there are no specific emission factors in Myanmar for emission calculation, default values proposed by IPCC 2006 guidelines were utilized, whether in net calorific value estimation or in CO_2 emanation studies or in fractions of carbon oxidization. Emissions from the utilization of fossil fuels from international bunkers are avoided in the present national GHG calculations. In this manner, CO_2 emission from international aviation fuel consuming are not represented in the national inventory.

For assessing GHG emissions, the IPCC 2006 Guidelines, Tier 1 and Tier 2 were applied relying upon the quality and accessibility of activity data and emissions coefficients as required by each methodology. The inventory at the same time embraced the reference approach and sectoral approach dependent on detailed information on technologies as suggested by the IPCC Guidelines. The sectoral approach was applied as the fundamental for the present inventory. The grouping of sectors and fuel types are fundamentally equivalent to the arrangement in the IPCC Guidelines in which the transport sector is characterized as the transport of the entire society.

Tier 1 approach is used in natural gas consumption in energy industries sector. The transport sector was segregated into road, rail, aviation and navigation. CO_2 emission for all these sectors was estimated by using Tier 1 method and as for CH_4 and N_2O emission for road and air sub sector, Tier 2 method was employed. The IPCC Tier 1 is applied to calculate methane emissions from coal mining such as surface and underground mining activities and also the fugitive methane emissions from oil and gas systems in Myanmar based on the country particular conditions and data accessibility. UNFCCC NAIIS GHG Inventory software version 1.3.2 and IPCC Inventory software are used to formulate the national GHG inventory for year 2010.

The detailed methodologies and data and information collection tools and templates should be developed as the next step.

CHAPTER 7: CONCLUSION AND RECOMMENDATIONS

Conclusion

The Republic of the Union of Myanmar has till date carried out several activities to develop its national MRV system. The country has submitted its first national communication and is currently working on its second national communication. Myanmar has submitted its INDC in 2015 and its NDC released in 2017.

The greenhouse gas inventory for the SNC is expected to be conducted for the year 2010[38]. The national GHG inventory in energy sector covers three major GHGs: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). ***The scope of the national MRV system, GHG inventory, energy sector, will include the emissions and removals from the three GHGs, carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).***

ECD is the focal point of UNFCCC to arrange NDC submission. and some institutions are already assigned for National GHG Inventory Team to formulate GHG inventory for SNC. To formulate the SNC, 5 technical working groups are formed according to notification of Union Minster Officer of MoNREC. Mitigation actions currently being implemented in the country will also form part of the TWG's responsibilities. ***Going forward, Myanmar intends to continue to use the technical working groups configuration for developing its national GHG inventory, energy sector.***

Recommendation

To improve the existing MRV system for the energy sector, and to prepare for the enhanced transparency framework of the Paris Agreement, the following activities should be carried out:

1. Develop detailed tools, guidelines and data and information collection templates for the sub-sectors of energy as per IPCC 2006 guidelines;
2. Develop capacity-building and awareness creation plans and activities;
3. Capacity building of Individual researchers in energy sector for MRV system should be promoted;
4. Develop guidelines and standards for data and information management and build capacity accordingly. This facilitates transfer and data sharing between institutions.
5. Engage one or more persons to set up and manage the data management system as it pertains to MRV under the Paris Agreement with a clear mandate and timelines to follow through.
6. Engage one or more persons responsible for the capacity building program with a clear mandate and timelines to follow through with training.

Stakeholders Consultation Workshop

A stakeholders' consultation workshop was organized at ECD (list of attendees is in Appendix IV). Stakeholders discussed the challenges which they faced during the data/information sharing and reporting process and identified possible solutions to overcome these challenges.

[38] Source: Swe Lin Myint. Assistant Director. Department of Planning – Myanmar Petrochemical Enterprise

The attendees confirmed the scope of the national MRV system for Energy sector, including the GHGes to be reported.

Currently, most of the data sharing system and requests within ministries are on an ad-hoc basic, and they share the information annually with the ministries. There is no designated responsible person or position assigned with associating roles and responsibilities for data provision, administration and verification. Some ministries and departments are further not aware of the purpose of sharing the data with focal ministries. Data gaps are challenging the completion of inventory projects, such as the SNC. For instance, water borne navigation fuel consumption is an identified gap in the current ongoing SNC project, since there is currently no representative who is responsible for providing activity data. Further, lack of systematic format/template of data sharing and reporting between ministries is another challenge.

As per the discussions at the workshop, most participants identified capacity building for database management, communication and information flow system for energy sector as a high priority need. One of the solutions identified is placing formal legal contracts between ministries for data sharing and reporting and for better data management and data sharing, a common database management system should be set up.

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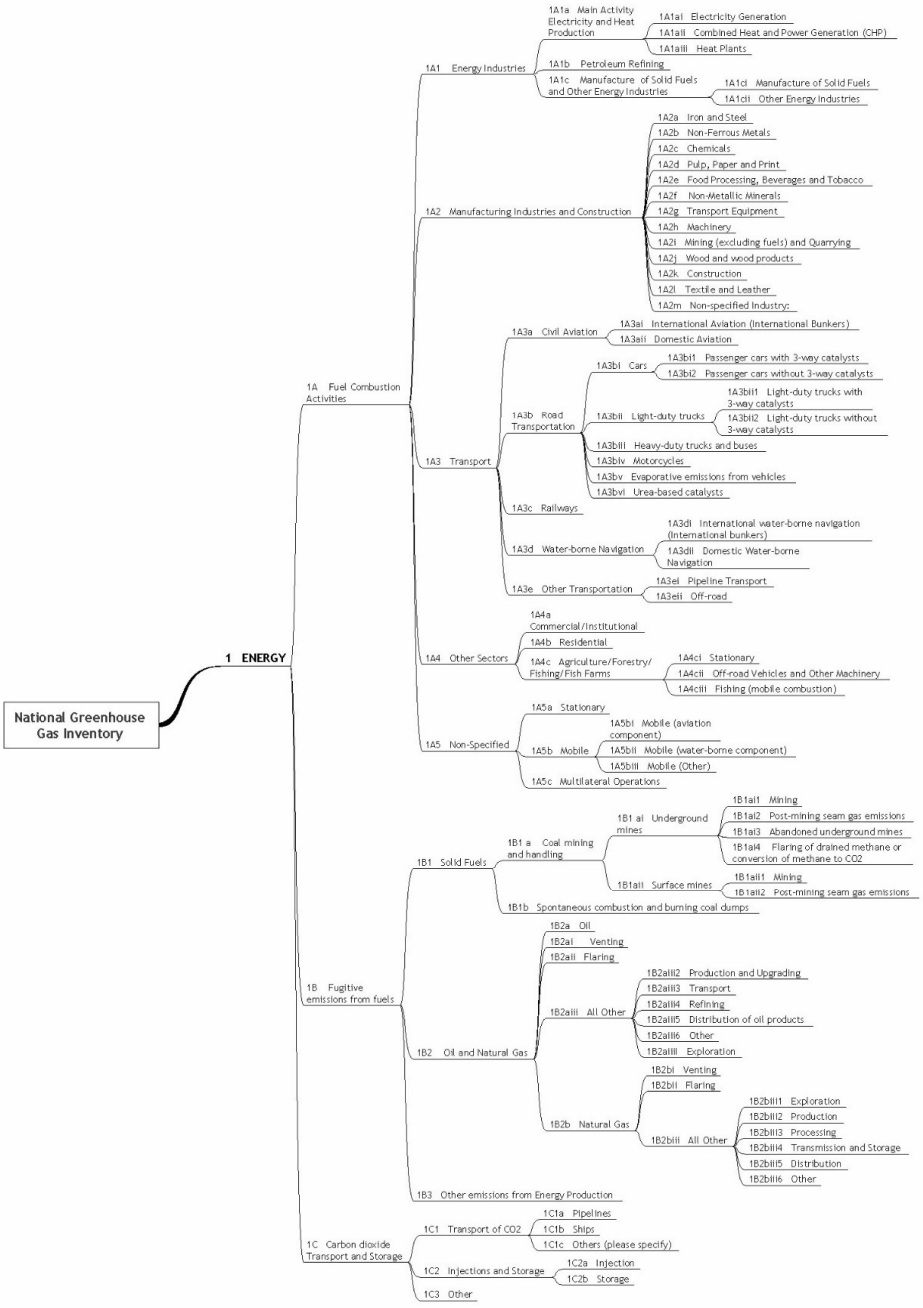
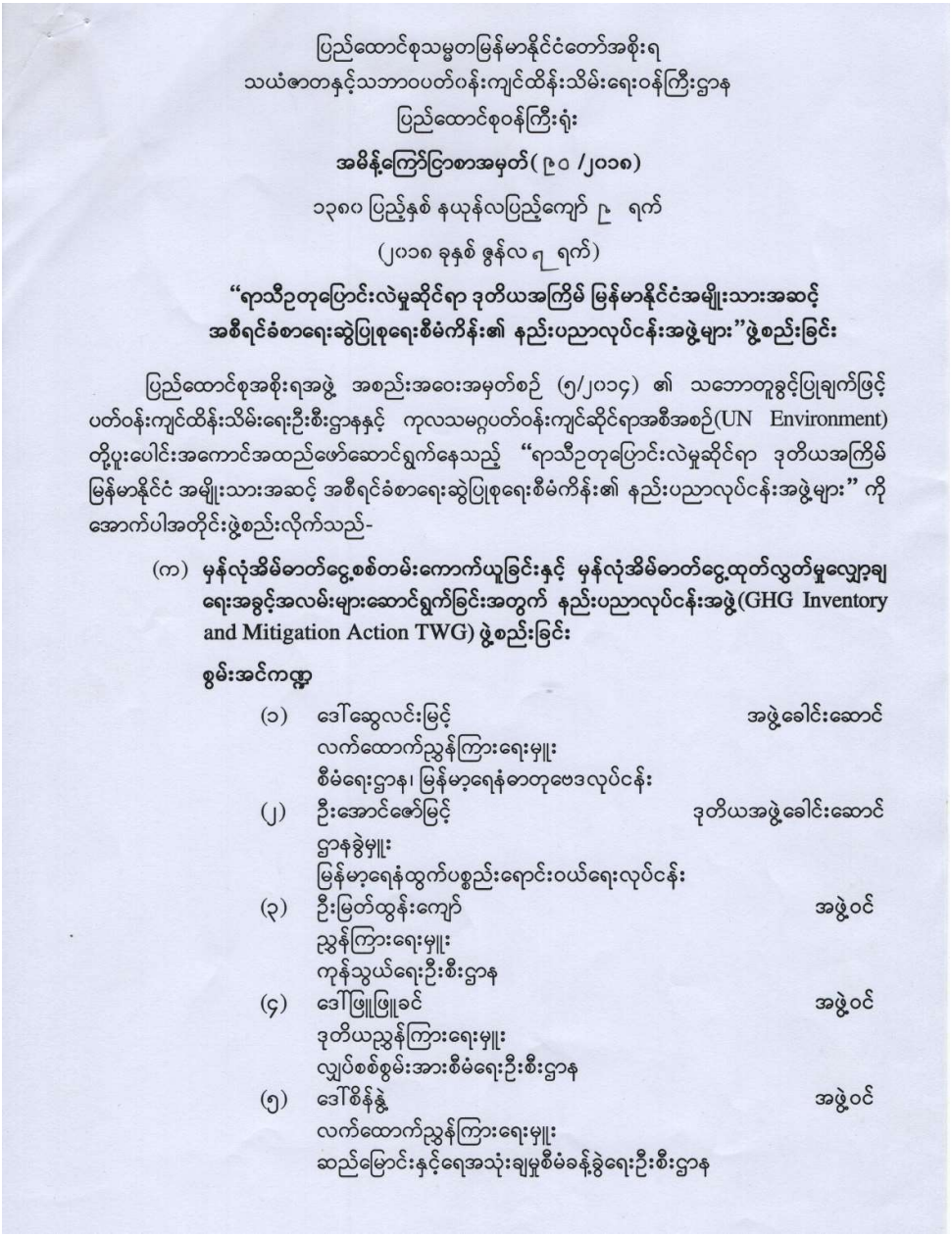
APPENDIX I. ACTIVITY AND GHG SOURCE IN THE ENERGY SECTOR AS PER IPCC 2006 GUIDELINES



APPENDIX II: INSTITUTIONAL ARRANGEMENTS FOR THE SNC

This appendix presents the official information of institutional arrangements for preparing SNC by Notificaiton (90/2018) of MoNREC. Here, only Energy Sector Team including Transport Sector and QA/QC and Verification Team is presented.



ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံတော်အစိုးရ
သယံဇာတနှင့်သဘာဝပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာန
ပြည်ထောင်စုဝန်ကြီးရုံး

အမိန့်ကြော်ငြာစာအမှတ်(၉၀ /၂၀၁၈)

၁၃၈၀ ပြည့်နှစ် နယုန်လပြည့်ကျော် ၉ ရက်

(၂၀၁၈ ခုနှစ် ဇွန်လ ၅ ရက်)

"ရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ ဒုတိယအကြိမ် မြန်မာနိုင်ငံအမျိုးသားအဆင့် အစီရင်ခံစာရေးဆွဲပြုစုရေးစီမံကိန်း၏ နည်းပညာလုပ်ငန်းအဖွဲ့များ"ဖွဲ့စည်းခြင်း

ပြည်ထောင်စုအစိုးရအဖွဲ့ အစည်းအဝေးအမှတ်စဉ် (၅/၂၀၁၄) ၏ သဘောတူခွင့်ပြုချက်ဖြင့် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာနနှင့် ကုလသမဂ္ဂပတ်ဝန်းကျင်ဆိုင်ရာအစီအစဉ်(UN Environment) တို့ပူးပေါင်းအကောင်အထည်ဖော်ဆောင်ရွက်နေသည့် "ရာသီဥတုပြောင်းလဲမှုဆိုင်ရာ ဒုတိယအကြိမ် မြန်မာနိုင်ငံ အမျိုးသားအဆင့် အစီရင်ခံစာရေးဆွဲပြုစုရေးစီမံကိန်း၏ နည်းပညာလုပ်ငန်းအဖွဲ့များ" ကို အောက်ပါအတိုင်းဖွဲ့စည်းလိုက်သည်-

(က) **မှန်လုံအိမ်ဓာတ်ငွေ့စစ်တမ်းကောက်ယူခြင်းနှင့် မှန်လုံအိမ်ဓာတ်ငွေ့ထုတ်လွှတ်မှုလျှော့ချရေးအခွင့်အလမ်းများဆောင်ရွက်ခြင်းအတွက် နည်းပညာလုပ်ငန်းအဖွဲ့(GHG Inventory and Mitigation Action TWG) ဖွဲ့စည်းခြင်း**

စွမ်းအင်ကဏ္ဍ

(၁)	ဒေါ်ဆွေလင်းမြင့်	အဖွဲ့ခေါင်းဆောင်
	လက်ထောက်ညွှန်ကြားရေးမှူး	
	စီမံရေးဌာန၊ မြန်မာ့ရေနံဓာတုဗေဒလုပ်ငန်း	
(၂)	ဦးအောင်ဇော်မြင့်	ဒုတိယအဖွဲ့ခေါင်းဆောင်
	ဌာနခွဲမှူး	
	မြန်မာ့ရေနံထွက်ပစ္စည်းရောင်းဝယ်ရေးလုပ်ငန်း	
(၃)	ဦးမြတ်ထွန်းကျော်	အဖွဲ့ဝင်
	ညွှန်ကြားရေးမှူး	
	ကုန်သွယ်ရေးဦးစီးဌာန	
(၄)	ဒေါ်ဖြူဖြူခင်	အဖွဲ့ဝင်
	ဒုတိယညွှန်ကြားရေးမှူး	
	လျှပ်စစ်စွမ်းအားစီမံရေးဦးစီးဌာန	
(၅)	ဒေါ်စိန်ဇွဲ	အဖွဲ့ဝင်
	လက်ထောက်ညွှန်ကြားရေးမှူး	
	ဆည်မြောင်းနှင့်ရေအသုံးချမှုစီမံခန့်ခွဲရေးဦးစီးဌာန	

(၆) ဒေါ်မိမိထွန်း — အဖွဲ့ဝင်
လက်ထောက်ညွှန်ကြားရေးမှူး
တံတားဦးစီးဌာန

(၇) ဦးအောင်ကျော်ဖြိုး — အဖွဲ့ဝင်
လက်ထောက်အင်ဂျင်နီယာ
သတ္တုတွင်းဦးစီးဌာန

(၈) ဦးအောင်ဖြိုး — အဖွဲ့ဝင်
လက်ထောက်ညွှန်ကြားရေးမှူး
အကောက်ခွန်ဦးစီးဌာန

(၉) ဦးပေါ်လာအောင် — အဖွဲ့ဝင်
မန်နေဂျာ
မြန်မာ့ရေနံနှင့်သဘာဝဓာတ်ငွေ့လုပ်ငန်း

(၁၀) ဦးကျော်ညွှန့် — အဖွဲ့ဝင်
ဦးစီးအရာရှိ
လမ်းဦးစီးဌာန

(၁၁) ဦးရဲထက်လွင် — အဖွဲ့ဝင်
ဦးစီးအရာရှိ
မြန်မာ့ရေနံနှင့်သဘာဝဓာတ်ငွေ့စီမံရေးဦးစီးဌာန

(၁၂) ဒေါ်အိမ့်ကျော့မူး — အဖွဲ့ဝင်
အငယ်တန်းအင်ဂျင်နီယာ
ကျေးလက်ဒေသဖွံ့ဖြိုးတိုးတက်ရေးဦးစီးဌာန

(၁၃) ဦးမြင့်စိုး — အကြံပေး
ပြင်ပကျွမ်းကျင်ပညာရှင်

သယ်ယူပို့ဆောင်ရေးကဏ္ဍ

(၁၄) ဦးသောင်းထိုက် — အဖွဲ့ခေါင်းဆောင်
လက်ထောက်အင်ဂျင်နီယာ
ကုန်းလမ်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာန

(၁၅) ဦးကျော်မိုး — ဒုတိယအဖွဲ့ခေါင်းဆောင်
လက်ထောက်ညွှန်ကြားရေးမှူး
ရေကြောင်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာန

(၁၆) ဦးကြည်စိုး — အဖွဲ့ဝင်
လက်ထောက်အထွေထွေမန်နေဂျာ
မြန်မာ့မီးရထား

(၁၇) ဒေါ်စောစန္ဒာလှိုင် — အဖွဲ့ဝင်
လက်ထောက်ညွှန်ကြားရေးမှူး
လေကြောင်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာန

(၁၈) ဒေါ်ချမ်းမြသီတာကျော် — အဖွဲ့ဝင်
လက်ထောက်အင်ဂျင်နီယာ
လေကြောင်းပို့ဆောင်ရေးညွှန်ကြားမှုဦးစီးဌာန

တွက်ချက်မှု မှန်ကန်ရေး (QA/QC and Verification)

(၁၈) ဒေါ်ခင်ဆွေလတ် — အဖွဲ့ခေါင်းဆောင်
ညွှန်ကြားရေးမှူး
ဗဟိုစာရင်းအင်းအဖွဲ့

(၁၉) ဦးမင်းမြတ်အောင် — ဒုတိယအဖွဲ့ခေါင်းဆောင်
လက်ထောက်ညွှန်ကြားရေးမှူး
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

(၆၀) ဒေါ်တင်တင်အေး — အဖွဲ့ဝင်
ဦးစီးအရာရှိ
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

(၆၁) ဒေါ်မို့မို့ဟန် — အဖွဲ့ဝင်
ဦးစီးအရာရှိ
ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဦးစီးဌာန

(၆၂) Dr. Aaron Russell အဖွဲ့ဝင်
Country Representative
Global Green Growth Institute (GGGI)

မှန်လုံအိမ်ခတ်ငွေ့စစ်တမ်းကောက်ယူခြင်းနှင့် မှန်လုံအိမ်ခတ်ငွေ့ထုတ်လွှတ်မှုလျှော့ချရေး အခွင့်အလမ်းများ ဆောင်ရွက်ခြင်းအတွက် နည်းပညာလုပ်ငန်းအဖွဲ့ (GHG inventory and Mitigation Action TWG) ၏လုပ်ငန်းတာဝန်ဝတ္တရားများ

(၁) E-learning စနစ်ဖြင့် နည်းပညာကျွမ်းကျင်မှု အတိုင်ပင်ခံအဖွဲ့ သင်တန်းပေးခြင်းနှင့် မှန်လုံအိမ်ခတ်ငွေ့ အချက်အလက် ကောက်ယူခြင်းဆိုင်ရာ လေ့လာခြင်း၊ သင်တန်းပေးခြင်း၊

(၂) မှန်လုံအိမ်ခတ်ငွေ့ အချက်အလက်ကောက်ယူခြင်းကို 2006 IPCC Guideline, 2000 GPG နှင့် 2003 Land Use, Land Use Change and Forestry၊ 2013 Wetland GPG ပါ နည်းလမ်းများအတိုင်း လိုက်နာဆောင်ရွက်ရန်၊

(၃) IPCC Software ကို အသုံးပြု၍ ကောက်ယူရရှိသော မှန်လုံအိမ် ခတ်ငွေ့ အချက်အလက်များကို တွက်ချက်ရန်၊

(၄) မှန်လုံအိမ်ခတ်ငွေ့ထုတ်လွှတ်မှု အစီရင်ခံစာ မူကြမ်းကို ပြုစုရန်၊

(၅) အကြံပြုချက်များအတွက် ပါဝင်ပတ်သက်သူ အားလုံးပါဝင်သည့် အလုပ်ရုံဆွေးနွေးပွဲ (၁) ခု ကျင်းပရန်၊

(၆) ကဏ္ဍအလိုက် မှန်လုံအိမ်ခတ်ငွေ့ (စုပ်ယူထိန်းသိမ်းမှုနှင့် ထုတ်လွှတ် မှု) စစ်တမ်း ကောက်ယူခြင်းနှင့် ရာသီဥတုပြောင်းလဲခြင်းမှ လျော့နည်းသက်သာစေရေးအခွင့်အလမ်းများဆောင်ရွက်ခြင်း အစီရင်ခံစာကိုအချောသတ် ပြုစုရန်။

APPENDIX III. INSTITUTIONAL ARRANGEMENTS (IA) FOR NATIONAL INVENTORY SYSTEM

For the future reporting, Myanmar can use the below template to update their institutional arrangements for national inventory system.

Table 1: Designated Inventory Agency

Designated National GHG Inventory Preparation Agency/Organization	UNFCCC Focal Point (Name) and UNFCCC Focal Point Agency	Describe the arrangements or relationship between Inventory Agency/Organization and UNFCCC Focal Point Agency, if different.

Table 2: National Inventory Management Team

Role	Name	Organization	Contact Information	Comments
Inventory Director/Coordinator				
Energy Sector Lead				
Archive (Data and Document) Manager/Coordinator				
QA/QC coordinator				
Uncertainty Analysis coordinator				
Other: e.g., GHG Policy Specialist who tracks capacity building efforts and IPCC processes				

Sectoral Roles and Arrangements

Table 3: Energy Sector Institutional Arrangements

Role	Organization	Contact(s) [Name]	Contact Information [E-mail, Phone, etc.]	Participated in meetings on GHG inventory development? [Yes/No]	Comments [See instructions above]
Technical coordinator (Could be source/sector lead from Table 1.2)					
Consultant compiling estimates					
Expert reviewer					
Data provider					
Other					

Potential Improvements

Sector	Strengths in Management Structure of National Inventory System	Potential Improvements in Management Structure of National Inventory System
Energy		
Other [Optional]		

Inventory Cycle, as per IPCC

APPENDIX IV. STAKEHOLDER CONSULTATION WORKSHOP (MAY 21, 2019)

No	Name	Title	Department
1	Daw Htay Htay Kyi	Assistant Director	DIC, MOI
2	U Kyaw San	Deputy Director	MoALI
3	U Kyaw Soe Lin	Assistant Engineer	DHI, MoEE
4	U Kyaw Zaw Hein	Assistant Director	DEPP, MoEE
5	U Kyaw Swar Tun	Director	BMD, MoC
6	Daw Sandar Myint	Staff Officer	ECD, MoNREC
7	Dr. Hla Myo Aung	Director	DRI, MoE
8	Daw Nyein Nyein Myint	Director	CBM
9	U Than Naing Lin	Deputy Director	MoEE
10	Daw Wah Wah Thaung	Deputy General Manager	MOGE, MoEE
11	U Htaung Deik Khaing	Deputy Director	Myanmar Custom, MoPF
12	Daw Aye Mya Khine	Staff Officer	DOT, MoC
13	U Thet Wai Tun	Assistant Manager	MoGE (Offshore)
14	U Kyaw San Lin	Assistant Engineer	MoGE (Offshore)
15	U Win Mg Mg	Assistant Director	DEPTSC, MoEE
16	Daw Swe Thi Htut	Assistant Director	DISI, MOI
17	U Tun Tun Khine	Research Associate	Myanmar Development Institute
18	U Tun Tun Zaw	Deputy General Manager	MHII
19	U Moe Thu Aung	Electrical Engineer	MOGE
20	U Arkar San	Staff Officer	ECD, MoNREC
21	Daw Soe Soe Nyein	Deputy Director	OGPD, MoEE
22	Daw Zin Mar Phyu	Staff Officer	ECD, MoNREC
23	Daw Thin Thuzar Win	Deputy Director	ECD, MoNREC
24	U Kyaw Myo Htut	Director	DOH
25	Daw Ei Khaing Myint	Staff Officer	DOH
26	U San Win	Assistant Director	ECD, MoNREC
27	Daw Su Su Lwin	Staff Officer	ECD, MoNREC
28	Daw May Eaindra Kyaw	Deputy Staff Officer	ECD, MoNREC
29	Daw Thi Thi Soe Min	Assistant Director	ECD, MoNREC
30	Daw Swe Lin Myint	Assistant Director	MPE, MoEE
31	U Mg Mg Thet	General Manager	HIE-3, MOI
32	U Aung Zaw Myint	Electrical Engineer	MPPE, MoEE
33	Daw Su Myat Thandar Phone	Staff Officer	ECD, MoNREC
34	U Han Thar Kyaw	Assistant Engineer	ESE, MoEE
35	Dr. Ei Ei Thant	Assistant Engineer	DRD, MoALI