Ministry of Environment,
Forest and Climate Change
Government of India

सत्यमेव जयते

India's First Nationally Appropriate Mitigation Action (NAMA) in the Forestry Sector

Final Report

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On Behalf of:

Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety

of the Federal Republic of Germany

India's First Nationally Appropriate Mitigation Action (NAMA) in the Forestry Sector

Final Report

September 2017

Imprint

Published by

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Registered Offices: Bonn and Eschborn, Germany

Development and Management of Nationally Appropriate Mitigation Actions in India
A-2/18, Safdarjung Enclave, New Delhi 110029 India

T: +91 11 49495353
E: info@giz.de
I: http://www.giz.de

Responsible

Dr. Ashish Chaturvedi, Project Director (GIZ)
E: ashish.chaturvedi@giz.de

Project Manager

Kundan Burnwal, Technical Advisor (GIZ)
E: kundan.burnwal@giz.de

Authors

Jochen Statz, Eduard Merger, Matthias Seebauer (Unique)
Swapan Mehra, Ashwin AS, Sriya Mohanti (IORA Ecological Solutions)
Kundan Burnwal (GIZ)

Photo Credits

GIZ and IORA Ecological Solutions. Forest image: Mayank Bhatnagar

In Cooperation With

IORA Ecological Solutions

UNIQUE forestry and land use

(September 2017)

Executive Summary

Background

In India, 200 million people are extracting fuelwood from forests annually (FSI 2011). This makes unsustainable fuelwood extraction a key driver of deforestation and forest degradation in the country. Taking cognizance of this, the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, is developing India's first Nationally Appropriate Mitigation Action (NAMA) in the forestry sector on 'Reducing Forest Degradation and Deforestation in Assam through Sustainable Fuelwood Management'. Given the immense scale of the problem and the regional nature of fuelwood use practices in India, a state level approach is considered feasible. The state of Assam was chosen as the first state to develop and implement this NAMA. As per the Census 2011, 72 per cent of Assam's households, i.e. nearly 4.6 million in number, are dependent on fuelwood for meeting their cooking energy requirements. This dependence leads to several negative impacts on human well-being and natural ecosystems in the state.

Indian Forestry and Climate Change

India is endowed with a rich diversity in forests, ranging from tropical wet evergreen forests in the North East and South West to the tropical dry thorn forests in central and western parts of the country. With four global biodiversity hotspots present in India, it is recognised as one of the 17 mega-diverse countries globally. Forest and tree cover is the second-largest land use category in India after agriculture (BUR, MoEFCC 2015). Protection and improvement of forests is a constitutional mandate in India, as exemplified by Article 48A of the Indian constitution which states that: 'The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.'

The national goal for the forestry sector, as stated in the National Forest Policy (NFP) 1988, is to 'have a minimum of one-third of the total land area of the country under forest or tree cover.' The particular aim for hilly and mountainous regions is to 'maintain two-thirds of the area under such cover in order to prevent erosion and land degradation and to ensure the stability of the fragile ecosystem'. In addition to this, the Government of India has acknowledged the critical roles that forests need to play in addressing climate change, thereby making it essential to have both climate adaptation and mitigation strategies for the sector (MoEFCC 2014).

In October 2015, India submitted its Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) in response to Conference of Party (COP) decisions 1/CP.19 and 1/CP.20. This document captured India's commitment towards addressing the threat of climate change. India further ratified the Paris Agreement in October 2016 which conveys its commitment towards addressing climate change and in implementation of its NDCs (MoEFCC 2016). The objectives and targets specified in the NDC are to be achieved through various measures. The Nationally Appropriate Mitigation Actions (NAMAs) is one such measure which can help countries realise the vision enshrined in their NDCs (Lütken, et al. 2016).

India's NDC assigns a sectoral target of creating 'an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030'. This indicates the key role that the forestry sector is expected to play in responding to climate change nationally.

The NAMA Selection Process

Under the ambit of Indo-German bilateral cooperation, MoEFCC and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) are implementing a project titled 'Development and Management of Nationally Appropriate Mitigation Actions (NAMAs) in India'. Under this initiative, MoEFCC identified two sectors, namely the forestry and the waste sector, for NAMA development in India. The process which was followed to select a focus and scope for the forestry NAMA to be developed in India is outlined below.

To begin with, a rigorous feasibility study was undertaken by GIZ India for the MoEFCC (Mehra, et al. 2015) with the objective of exploring 'possibilities of developing NAMAs in the forestry sector in India'. The feasibility study examined existing forest policies, programmes and projects in India that could be registered as domestic or supported NAMAs. The study proceeded in several steps: It started with extensive preparations in November and December 2014 to compile a list of NAMA options. Stakeholders were consulted through interviews from December 2014 to March 2015 to collect feedback on these options as well as on the list of criteria, indicators and parameters to be used for shortlisting the NAMA options.

This analysis led to a set of conclusions and recommendations which were presented at a stakeholder workshop in March 2015. Overall, the study followed a consultative approach for shortlisting the NAMA options, with an effort to include both top-down policy design considerations and bottom-up implementation considerations. While the feasibility study identified four promising NAMA options, only one NAMA option was selected in consultation with MoEFCC for development of a full-fledged bankable concept including MRV structure, capacity development strategy and financing approach. To arrive at this NAMA, consultations with MoEFCC were held to discuss in detail the advantages and disadvantages of the four options recommended by the feasibility study. This covered an in-depth review with aspects such as goal, additionality, MRV, international support and ease of implementation for each of the NAMA options.

The MoEFCC decided that India's first NAMA in the forestry sector will focus on 'sustainable fuelwood management'. This decision was made whilst keeping in mind India's NDC commitment which identifies 'reduction in consumption of wood/biomass as fuel' as a means to achieve its forestry sector goal (MoEFCC, 2015). The state of Assam was chosen by MoEFCC as the first state to develop and implement this NAMA. This selection was based on a multi-criteria assessment comparing all Indian states and union territories on factors such as fuelwood dependent population, number of people extracting fuelwood from forests, forest cover, fuelwood supply-demand gap, and area under open forests.

Objective and Scope of India's Forestry NAMA

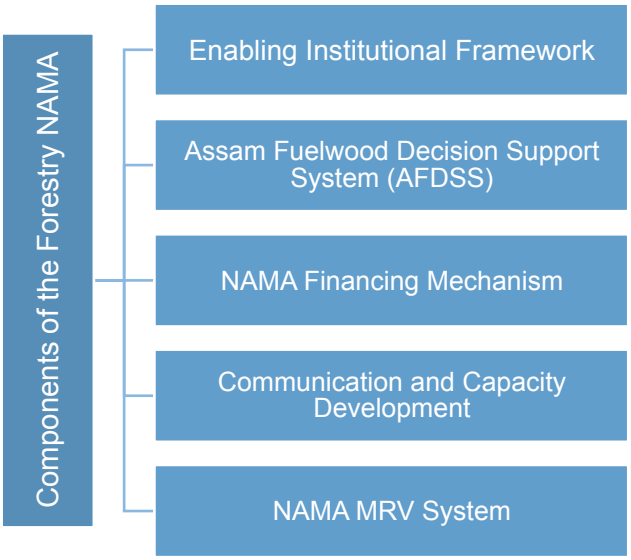
The objective of India's first NAMA in the forestry sector is to address the foremost unplanned driver of forest degradation and deforestation in the country and the state of Assam – unsustainable fuelwood extraction. This will be done by addressing knowledge, planning, financing and communication gaps towards:

- Increasing supply from earmarked fuelwood plantations to reduce fuelwood extraction from forests and
- Reducing demand by promoting fuelwood saving technologies. These will cover a wide range of technologies including successful models of Improved Cook Stoves (ICS), driers, LPG, biogas, electricity etc.

This NAMA deals with the complex subject of fuelwood supply-demand dynamics which is influenced by multiple economic, social and environmental factors. These have been taken into consideration while designing the NAMA concept, which consists of five key components (Figure 1). To ensure effective implementation, a phased approach for the NAMA has been designed:

- **Phase I:** NAMA Establishment Phase: This phase will develop and deploy the NAMA components within a limited geographical scope, focusing on selected districts, and two specific fuelwood consumer groups.
- **Phase II:** NAMA Expansion Phase: This phase will scale up the NAMA across the state of Assam and cover all the remaining fuelwood consumers including residential as well as commercial sectors.

Figure 1: Five Key Components of the Forestry NAMA

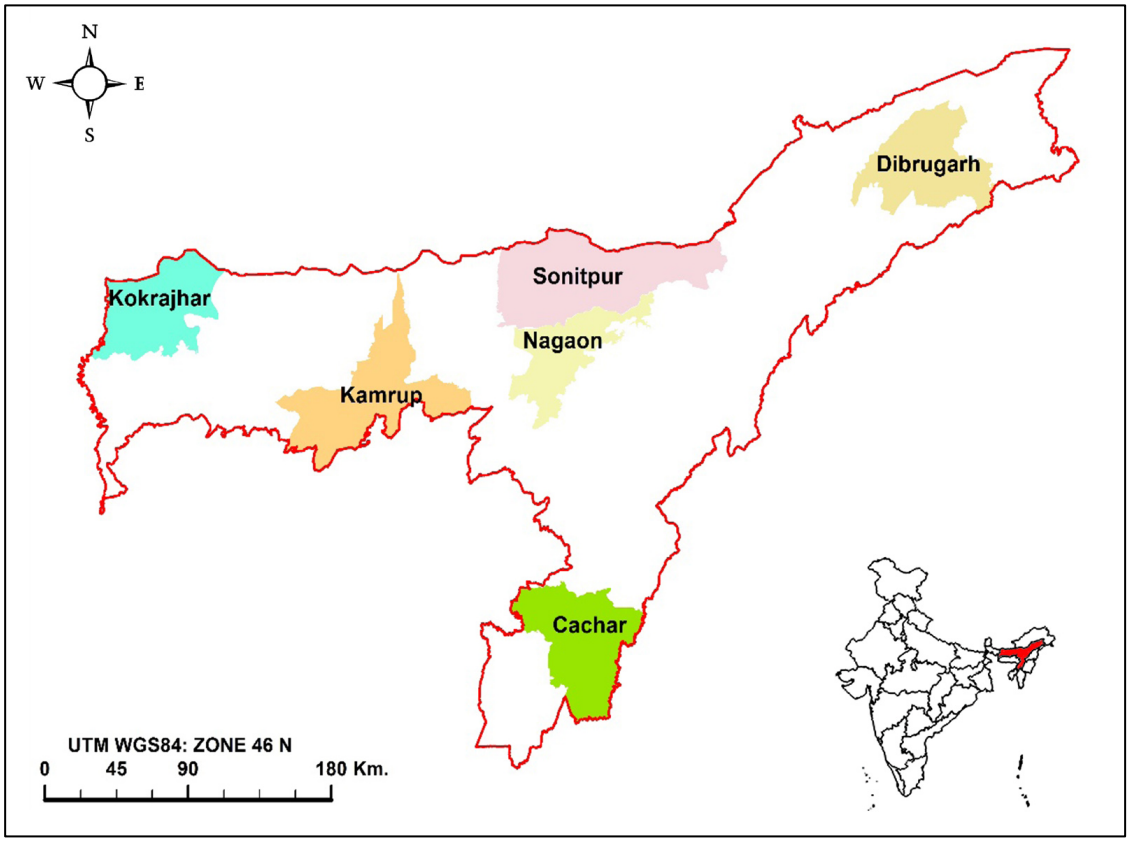


Geographical and Temporal Scope

The state of Assam has been chosen as the first state to implement this NAMA. An ethno-culturally diverse state in north-eastern India, Assam is part of the Himalayan biodiversity hotspot. It provides an interesting landscape for the NAMA and can help in developing the template for scaling up the NAMA in a diverse country like India. The NAMA will be deployed throughout Assam in a phased manner, in such a way that two key consumers of fuelwood and energy plantations in six districts of Assam will be covered in Phase I.

These six districts were selected based on a multi-criteria analysis using parameters such as presence of tea estates, forest cover, presence of forest villages and geographical representations. The six districts – Kokrajhar, Kamrup, Sonitpur, Nagaon, Cachar and Dibrugarh – represent the various dimensions for demonstrating effectiveness of the NAMA, and are geographically dispersed across the state to successfully capture all the cultural and physiographic variations in the pattern of collection and consumption of fuelwood (Figure 2). In Phase II, all the fuelwood consumer points and energy plantations will be covered for all the districts in the state.

Figure 2: Districts Selected for NAMA Phase I



The NAMA will be implemented over a total of thirteen years:

- **Phase I:** NAMA Establishment phase; for five years from 2018 till 2022 (covered in this report)
- **Phase II:** NAMA Expansion phase; for eight years from 2023 to 2030 (beyond this report)

Phase I of the NAMA will initiate the implementation by designing and operationalizing the five key components of the NAMA for the state and implementing the NAMA interventions across six districts towards: a) raising fuelwood plantations and b) deployment and sustained adoption of fuelwood saving technologies in a minimum of 1,000,000 households across two identified communities, namely tea estate tribes and rural villages. Phase I will support the establishment of a NAMA Programme Management Unit (PMU) to drive effective implementation and ensure a well-informed, coordinated and phased approach. It will also cover the development of a multivariate 'Assam Fuelwood Decision Support System' (AFDSS) for designing highly contextual investment strategies for fuelwood plantations and fuelwood saving technologies at a sub-state regional level. In addition, the financial mechanisms (including loans and grants) to support deployment of fuelwood saving technologies identified by the AFDSS will also be tested and piloted in Phase I. A region specific communication campaign will also be designed in Phase I.

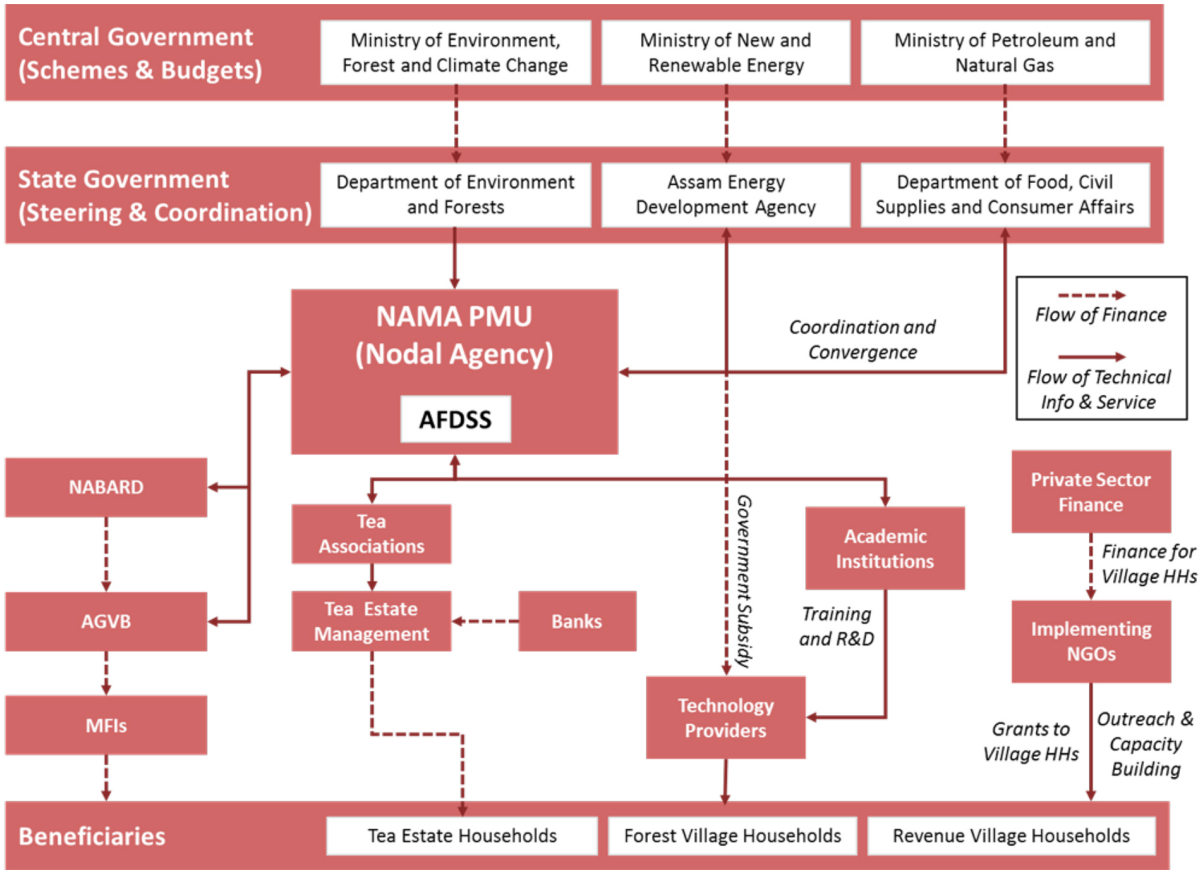
Building on this, Phase II will focus on covering the rest of the identified beneficiaries at both supply and demand sides. For ease of deployment, the demand side will be classified as commercial consumers (e.g. restaurants, agro-processing, etc.), residential (e.g. household heating and cooking) and community (e.g. religious cooking, hostels, schools). Deployment in these categories across Assam will take place until 2030. Energy plantations to ensure a steady supply of sustainable fuelwood which are already a part of Phase I, will also be scaled up to the whole state.

Proposed Institutional Architecture

To provide full support for the implementation of the Forestry NAMA an inter-departmental NAMA Steering Committee (NSC) comprising of relevant agencies involved in designing and implementing sustainable fuelwood management interventions is proposed. The NSC will guide the NAMA PMU and ensure effective convergence of government initiatives. The Department of Environment and Forest will oversee the constitution and functioning of a dedicated NAMA PMU.

Figure 3 presents the proposed institutional architecture for the NAMA Phase I. Based on successful implementation, this architecture can be expanded to meet the needs for implementing Phase II of the NAMA.

Figure 3: Proposed Institutional Architecture for NAMA Phase I



National Embeddedness of the NAMA

In recognition of the ill effects of fuelwood use, the Government of India launched the '*Pradhan Mantri Ujjwala Yojana*' in May 2016 for providing LPG connections to 50 million Below Poverty Line (BPL) households. Underlying this programme is the vision of freeing women living in poverty from the hardship of cooking with conventional, polluting fuelwood-inefficient cook-stoves which negatively impact their health and productivity (PIB, 2016). This NAMA aims to ensure that this

national priority is met effectively by bringing an underlying shift in the strategies and processes towards reducing fuelwood consumption.

Over the last few decades, the reduction of forest fuelwood consumption finds a mention as a goal across several national policies and programmes. However, fuelwood consumption has continued due to several barriers which the NAMA seeks to address. Provided the key technical and institutional gaps are met, the NAMA has the potential to unlock a significant quantum of finance from both public and private sectors.

The NAMA will contribute to improving the effectiveness of existing policies and initiatives and informing future policy development by:

- Creating objective and robust information datasets that can be used in investment planning by the concerned government agencies; and
- Establishing an effective coordination mechanism that facilitates adoption of a holistic and coherent approach by all relevant agencies

Important Co-benefits of the NAMA

This NAMA is founded on co-benefits to ensure its success. Reduction in fuelwood use is expected to lead to multiple benefits including:

- Improved forest and tree cover as 22 per cent of the fuelwood demand in Assam is met from forests (FSI 2011) leading to unplanned deforestation and forest degradation.
- Reduced GHG emissions which contribute to climate change. Fuelwood use reduction will be essential in meeting India's NDC commitments.
- Significant health benefits, especially for women and children in households which are currently dependent on inefficient and polluting fuelwood cook stoves. Smoke from cooking is one of the major causes of respiratory illness (e.g. tuberculosis) among women in rural India.
- Reduced drudgery from fuelwood collection leading to increased productivity and human health benefits.

At a household level, the immediate concern might not be decreasing GHG and stopping climate change, but financial resilience to changes and health benefits. This NAMA, though a GHG mitigation instrument in the forestry and energy sector, directly contributes to meeting the Sustainable Development Goal (SDG) 15 (halt deforestation and degradation) and SDG 13 (Climate Action). It also offers immense climate change adaptation benefits. Each of the co-benefits contributes towards meeting the state's SDGs. The two key co-benefits identified as directly having a huge positive impact through this NAMA are:

- Access to affordable, reliable, sustainable and modern energy for all (SDG7)
- Healthy lives and well-being for all at all ages (SDG3).

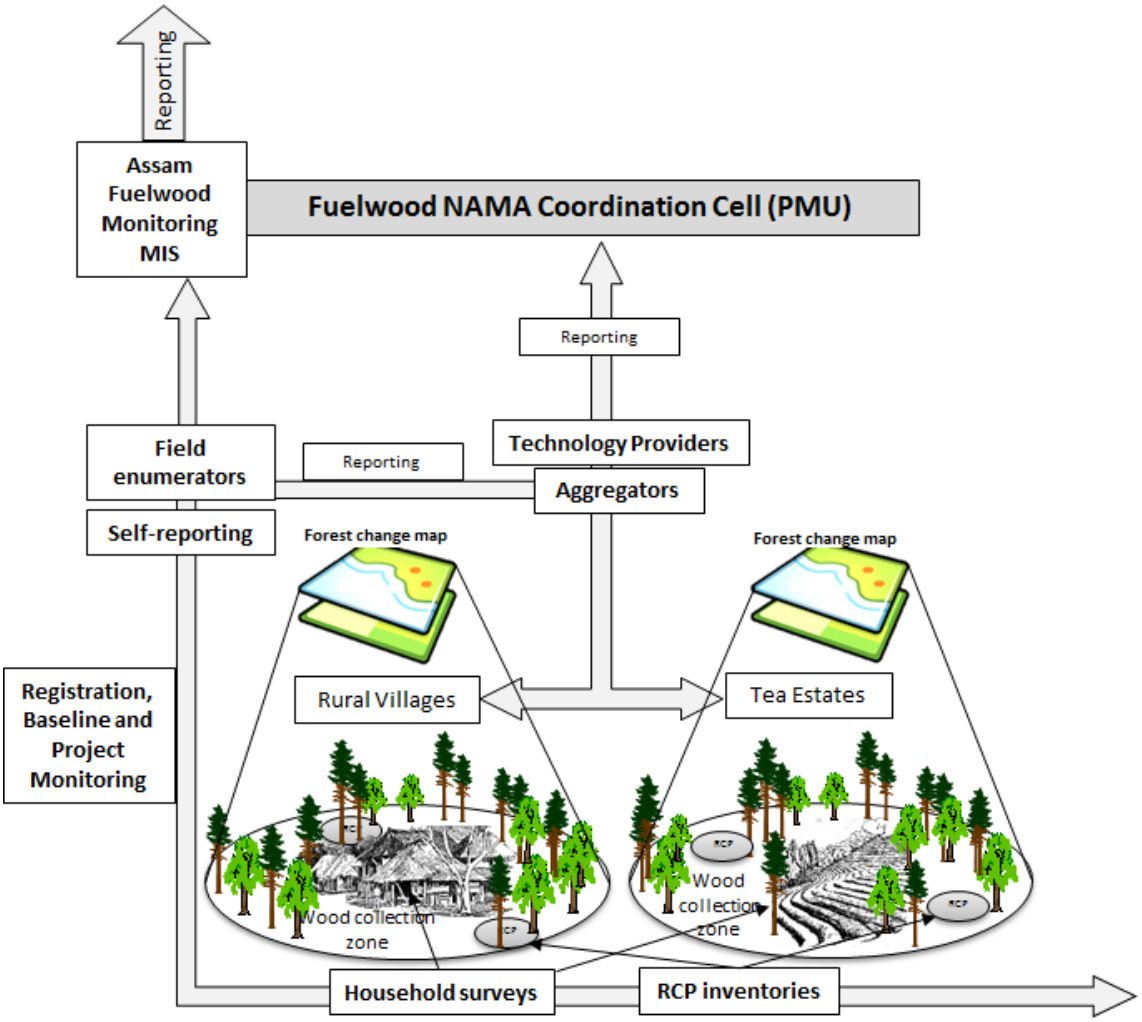
NAMA Baseline

For the establishment of a NAMA, the Business as Usual (BAU) baseline and an effective NAMA Measurement, Reporting and Verification (MRV) system are essential. The evaluation of the performance of the intervention versus the non-intervention scenario is a key step in defining a

baseline. The baseline scenario represents the fuelwood and other fuel consumption practices and its impacts on biomass sources that are most likely to occur in the absence of the NAMA in the geographical region assessed.

For each rural village and tea estate covered under Phase I of the NAMA, a specific baseline will be established using both activity data (e.g. usage rates for cook stoves, baseline fuelwood consumption, etc.) from a sample of households and publicly available data (e.g. efficiency rates for improved fuelwood cook stove types, carbon stock densities from the Forest Survey of India or FSI Carbon Report, etc.).

Figure 4: Structure of NAMA Baseline and Monitoring System



A central survey system proposed in this NAMA Baseline concept is the 'Registration and Baseline Survey' with the beneficiaries of the NAMA or end users such as forest villages, tea estates, rural villages etc. During this survey, the end users are first registered as potential adopters of fuelwood saving technologies and the registration is then used to also perform the baseline survey from a sample of the registered households.

The registration and baseline survey could be implemented using a customised Android-based survey application which can be easily used by the field enumerators. The data can be directly synced with a web-based fuelwood Management Information System (MIS).

The baseline approach demonstrates ex-ante emission reductions and removals which are modelled as clean cooking and subsequent forest impact scenarios. Both the clean cooking and forest impacts are sub-divided, providing a total of three different Emission Reduction (ER) scenarios related to household adoption of fuelwood saving technologies and the resulting impacts on the forest resource from reduced fuelwood extraction. Ex-ante emission reductions and removals within the NAMA are based on the assumption that as more households within rural villages and tea estates adopt fuelwood saving technologies (shifting from the traditional chulas) there will be a reduction in fuelwood extraction from neighbouring forests.

For the NAMA scenario, the baseline ex-ante calculations for emissions and removals assumes a 13-year modelling period until 2030. The three scenarios provide the NAMA with varying options based on the adoption rate of fuelwood saving technologies. The modelling periods show scenarios for adoption of 160,000, 220,000 and 5.8 million households with total emission reductions of 3.2 million, 4.3 million and 14.5 million tCO2-e respectively (see chapter 3 for a more detailed outline). Consequently, in the forest impact scenarios the resulting adoption of fuelwood saving technologies is reflected in the carbon stock changes within the fuelwood collection zones based on the three scenarios. The results show total emission reductions over the same 13-year period in the three scenarios totalling 1.8 million, 3.5 million and 13.5 million tCO2-e respectively.

Assam Fuelwood Decision Support System (AFDSS)

Sustainable fuelwood management can be achieved through a balanced mix of supply and demand side management options which are able to effectively meet the varying needs and patterns of fuelwood consuming regions and communities in Assam. To this end, a planning tool which can analyse, assess and prioritise the plausible interventions at a sub-regional level in Assam is required. This tool, i.e. the Assam Fuelwood Decision Support System (AFDSS), will help in designing scientifically planned investments for sustainable fuelwood management at a sub-regional level in the state.

The AFDSS will serve as an objective, scientific planning tool to:

- Assess the sustainability of existing demand-supply scenarios for fuelwood through a visual representation of its impact on the state's forest resources in the coming years.
- Choose from a list of criteria that can be used for building a sustainable fuelwood management strategy such as human health benefits, cost-effective measures, measures with high GHG abatement potential, user preferences, etc.
- Identify the most suitable solutions to address the unsustainable extraction of fuelwood through a mix of supply side (through dedicated fuelwood plantations) and demand side (fuelwood saving technology deployment) measures. These will be based on the final selection of the aforementioned criteria by the decision makers.

To achieve this, the AFDSS will use a whole systems based approach to effectively address the issues of unsustainable extraction of fuelwood from forests and low dispersion of fuelwood saving technologies in Assam through the use of system dynamics modelling. The AFDSS will be based on existing India's Forest Resource Decision Support Tool (iFoReST). This tool has been developed by NAMA Development team partner IORA Ecological Solutions under the Innovations in Ecosystem Management & Conservation (IEMaC) Program. They were supported by the United States Agency for International Development (USAID) under their Innovations for Forest Resources Management

(INFoRM) Program. iFoReST empirically studies the causal relationship between forest stocks and flows, their drivers and dynamics in Social-Ecological Systems.

Measurement, Reporting and Verification (MRV)

The MRV system concept for both mitigation and NAMA transformational performance is conceptualised based on the relevant reporting principles of the UNFCCC and the Intergovernmental Panel on Climate Change (IPCC) as outlined in their Good Practice Guidelines (IPCC 2006). Monitoring should provide substantive information regarding changes in fuelwood consumption at the household level as well as changes in carbon stocks in above ground biomass within the core fuelwood collection areas. The standardised approach of the parameters collected and data sources used guarantees a comparable approach throughout Assam ensuring a consistent and scalable approach, based on the normative IPCC core principles (see chapter 5).

The MRV system will implement monitoring in the field within rural village and tea estate households (or any new target group) as well as within the identified core fuelwood collection zones and will be conducted periodically by means of two survey instruments:

- The baseline and registration survey will be repeated periodically during NAMA implementation. This will be the Activity Based Monitoring Survey (ABMS) for the NAMA.
- A simple yet adequate forest inventory system – Random Control Plots (RCPs) – will be conducted to assess changes within the forest areas of the fuelwood collection zones to identify any changes in carbon stocks and to link these changes to the changes in household parameters assessed as part of the ABMS.

The first phase of the NAMA will be implemented in the first five years, in which the registration and baseline survey will be conducted followed by the first ABMS and RCP surveys covering those beneficiaries (rural village households and tea estate households) which are covered under the NAMA interventions.

The NAMA MRV aims to collect household data from the ABMS surveys and inventory data from the RCPs by means of a NAMA tailored Android based App, which represents an important quality control procedure for consistent and verifiable data collection throughout the NAMA's lifetime. The data will be uploaded into the NAMA MIS which hosts all the data from the baseline survey and the periodic ABMS and RCP surveys allowing for an automatic calculation of the emissions under the NAMA for a given year. This MIS will determine the resulting emission reductions by deducting the emissions from the average baseline emission scenario.

Financing

A fundamental component of the NAMA concept was to identify the financing needs and options for securing the requisite funding. A scale of one million households that could be targeted over a period of five years under NAMA Phase I was assumed for assessing the investment needs of the NAMA. This scale represents 23 per cent of the total fuelwood dependent rural households in the state. Using the existing distribution pattern of rural households in Assam, approximately 25 per cent of the target households will be located in tea estates (250,000 households) and 75 per cent are rural and forest village households. The technology mix for the adoption of fuelwood saving technologies is assumed to be 63 per cent of improved cook stoves, 23 per cent for biogas and 14 per cent LPG. These assumptions are based on estimates gathered during the stakeholder consultations and an

approximation of a realistic technology mix. In order to achieve this scale, investment on different levels will be required.

In total, the NAMA will require financing worth of USD 215 million as summarised in Table 1. Debt finance is recommended for NAMA interventions with a clear business case and revenue stream. Furthermore, subsidies from existing governmental schemes may be leveraged to incentivise the investment into the AFDSS recommended fuelwood saving technologies. Grant finance will be required for interventions with public good character that support the creation of an enabling environment for the adoption of fuelwood saving technologies and those that have no direct revenue stream. In total, this amounts to USD 32.6 million. The financing may come from different sources – private and public sources at national and international levels. Therefore, an analysis of the potential international and domestic financing sources was carried out as elaborated below.

Table 1: NAMA Financing Needs and Potential Funding Sources

Financing Source for Sustainable Forestry NAMA Implementation (in Million USD)	Domestic Finance Sources		International Climate Finance
	Private	Public	Public
Grant for cross-cutting and enabling environment, M&E and MRV		0.9m	8.2m
Grant for household aggregation, mobilisation and demand creation	15.2m		
Loans for fuelwood saving technology (rural villages) (CAPEX)	78.2m		
Operational costs of fuelwood saving technologies (rural villages) (OPEX)	58.6m		
Tea estates level investments fuelwood saving technologies (CAPEX) (from liquid assets and commercial banks)	26.1m		
Tea estates operational costs for fuelwood saving technology deployment (OPEX) (from tea estates households)	19.5m		
Grants from governmental incentives schemes for fuelwood saving technologies (CAPEX)		8.3m	
Sub-total financing sources	197.6m	9.2m	8.2m
Total financing sources	215.0m		

In India, there have been many domestic initiatives across national, state and sub-regional levels by the government, donor agencies, corporate and other civil society organisations to promote various aspects of sustainable fuelwood management. Some of the most relevant domestic funding sources for the NAMA which were examined include:

- Government subsidies and incentive schemes:
  - Unnat Chulha Abhiyan
  - National Biogas and Manure Management Programme
  - Randhanjyoti Scheme
  - Compensatory Afforestation Fund
  - National Afforestation Programme (NAP)

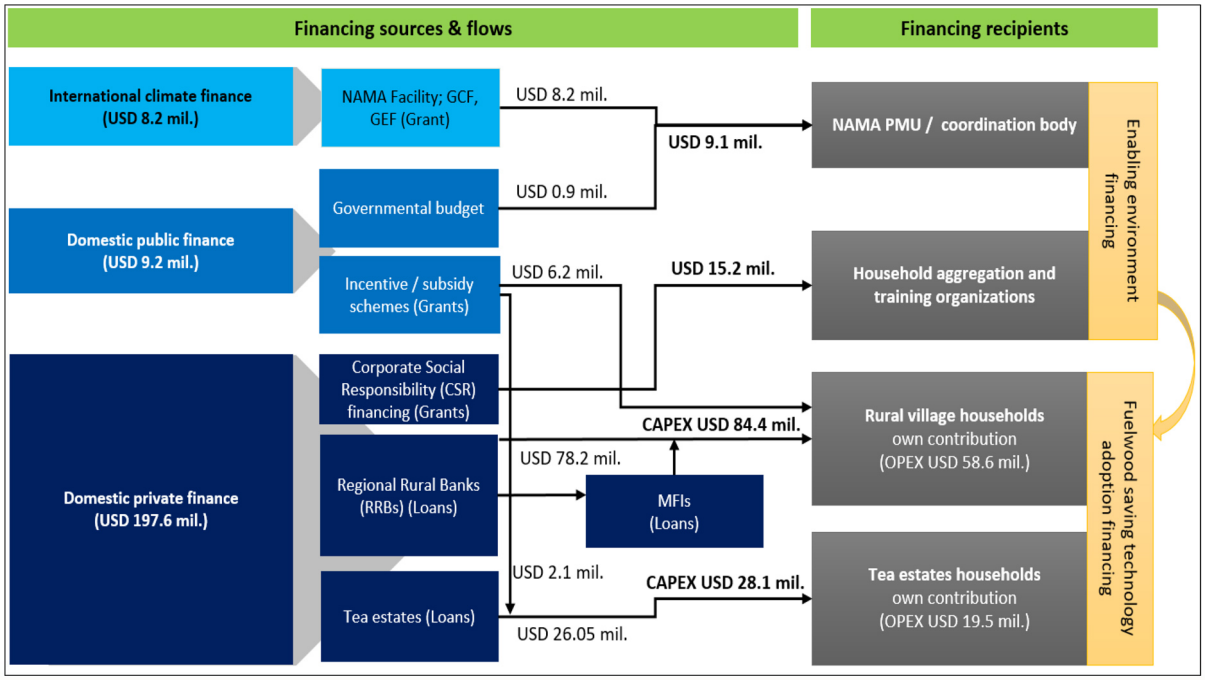
- Mahatma Gandhi National Rural Employment Guarantee Act Fund (MGNREGA)
- National Clean Energy and Environment Fund (NCEEF)
- National Adaptation Fund on Climate Change (NAFCC)

- Private sector funding sources:
  - Corporate Social Responsibility (CSR)

- Public and private financing sector:
  - Development Finance Institutions (DFIs)
  - Regional Rural Banks (RRBs)
  - Micro-Finance Institutions (MFIs)

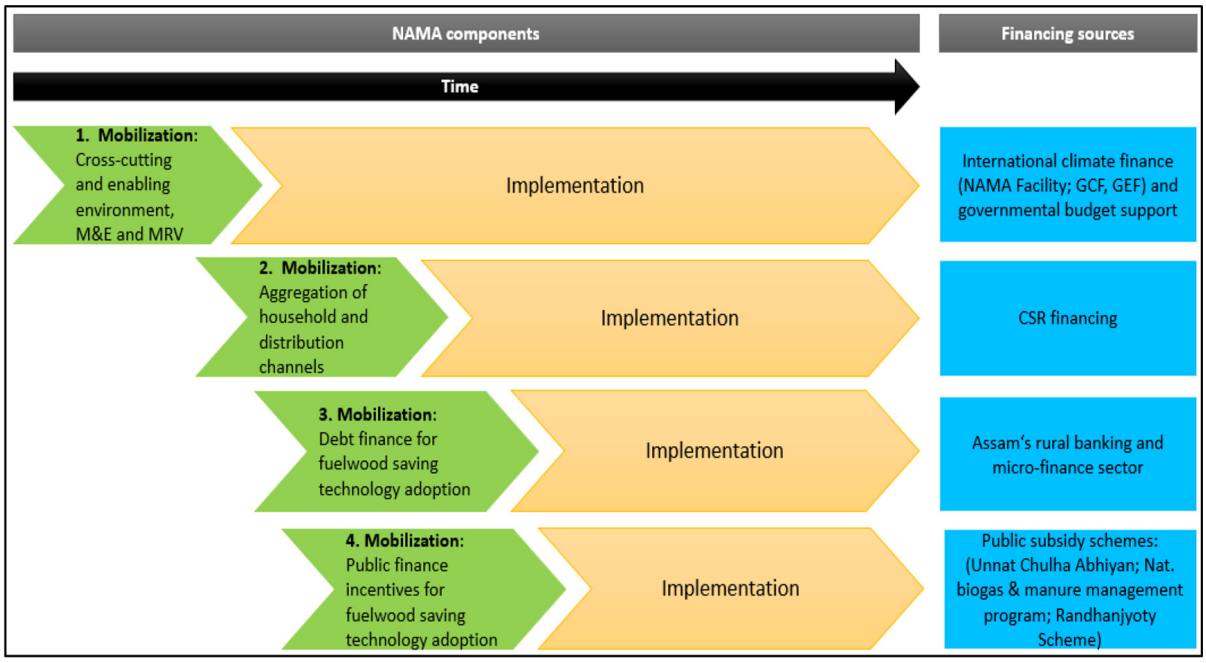
Of the estimated USD 215 million required for implementing the NAMA Phase I, about USD 24.2 million is required as grant finance for creation of an enabling environment for NAMA implementation. The remaining USD 190.7 million required for financing technology deployment can be sourced from the private sector. A summary of the financing mix and respective financial flows is presented in Figure 5.

Figure 5: Financing Sources and Funding Flow for Forestry NAMA Phase I (5 year period)



A targeted finance mobilisation strategy is required for the Forestry NAMA given multiplicity of potential funding sources. To begin with, the focus should be on securing the requisite funding for the cross-cutting and enabling environment creation of the NAMA. This component has a key enabling function for the NAMA implementation, and is a pre-condition for the needed household aggregation, awareness raising and the leverage of target group specific investment into fuelwood saving technologies. Furthermore, this component includes additional fundraising activities for the NAMA as part of the operationalization of the NAMA financing mechanism. Figure 6 conceptually illustrates the recommended chronological flow of the financing mobilisation for the different NAMA components.

Figure 6: Conceptual Strategy and Chronology of Fund Mobilisation Strategy



The NAMA will have several financial relationships between the different implementation and management entities (see chapter 6) underlying the key financial relationships between them, including the roles and responsibilities and eligibility criteria for fund disbursement.

Capacity Development

As one of five sets of activities to improve the enabling environment of the NAMA, awareness raising and capacity development were identified. This will include the development of capacities of all implementing organisations, rural households and technology providers. A key element of capacity development for this NAMA is creating awareness and clearly explaining the link between environmental degradation, fuelwood consumption and the use of fuelwood saving technologies. A clear understanding of the existing and required capacities is an important prerequisite to obtain access to sources of international finance.

For the NAMA capacity needs assessment, the following steps were taken:

- Analysing the existing technical and functional capacities of stakeholders
- Recognizing capacity and organisational gaps that could become obstacles to the implementation of the Forestry NAMA
- Identifying awareness gaps among stakeholders
- Designing strategies to overcome the identified gaps

The key findings from the capacity needs assessment in the form of activities to increase capacities are presented in Chapter 7 of the report.

To implement the capacity development strategy, existing village group structures such as women's groups, or cooperatives were identified as promising rural/village based aggregation points to create awareness on fuelwood saving technologies, execute demonstrations and establish linkages with

technology providers. The awareness creation and demonstration of fuelwood saving technologies needs to be carried out by selected and qualified NGOs, cooperatives, producer organisations, and community-based organisations. These will need to be identified, selected and trained at the inception of the implementation; part of the enabling awareness raising and capacity development budget will be used for this.

A Communication and Engagement Strategy and Plan (CESP) which specifically targets stakeholder communication and engagement was outlined for the Forestry NAMA. Clear, targeted communication is particularly important to implement the NAMA since a lack of awareness on sustainable fuelwood management practices was frequently mentioned as a gap or weakness in the capacity needs assessment. A key objective of the CESP is to enhance the communication between all stakeholders of the Forestry NAMA, so as to improve the effectiveness and ensure sustainability of the planned interventions as well as the efficiency with which the desired outcomes (primarily: reduced fuelwood consumption) are achieved. While the focus is predominantly on local actors, the purpose of the CESP is to inform, consult and involve all relevant stakeholders, in terms of decision-making, implementation, monitoring and evaluation.

Figure 7 below summarises three phases that are proposed to implement the communication and engagement plan.

Figure 7: Summary of the Three Phases of the Communication and Engagement Plan

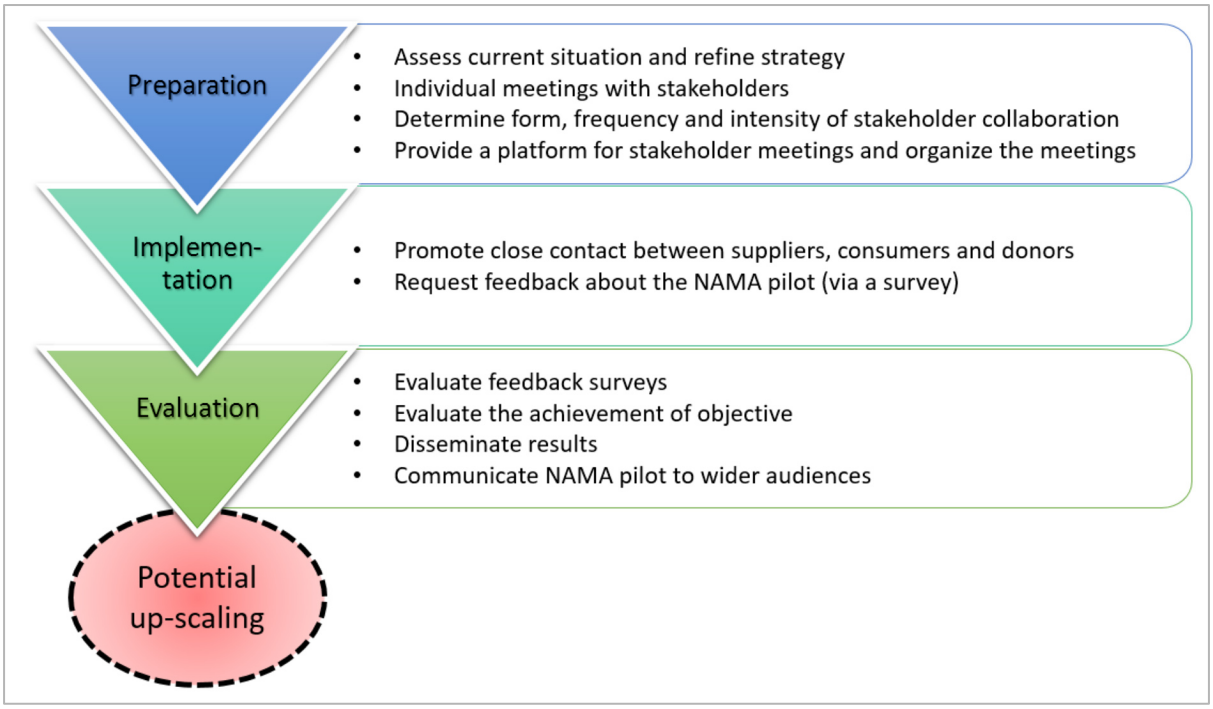


Table of Contents

List of Tables

List of Figures

List of Abbreviations

ABITA	Assam Branch of Indian Tea Association
ABMS	Activity Based Monitoring Survey
AEDA	Assam Energy Development Agency
AFDSS	Assam Fuelwood Decision Support System
AGB	Above Ground Biomass
AGVB	Assam Grameen Vikash Bank
BAU	Business as Usual
BPL	Below Poverty Line
BUR	Biennial Update Report
CD	Capacity Development
CDM	Clean Development Mechanism
CESP	Communication and Engagement Strategy and Plan
COP	Conference of Party
CSR	Corporate Social Responsibility
CV	Coefficient of Variation
DBH	Diameter at Breast Height
DFI	Development Finance Institution
DoEF	Department of Environment and Forests
ER	Emission Reduction
FSI	Forest Survey of India
FV	Forest Village
GCF	Green Climate Fund
GHG	Greenhouse Gas
GIM	National Mission for Green India
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ha	Hectare
ICCo	Innovative Change Collaborative
ICS	Improved Cook Stove
IEMaC	Innovations in Ecosystem Management & Conservation
iFoReST	India's Forest Resource Decision Support Tool
INDC	Intended Nationally Determined Contribution
INFoRM	Innovations for Forest Resources Management
IPCC	Intergovernmental Panel on Climate Change
ISFR	India State of Forest Report
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee

LDF	Logging Damage Factor
LPG	Liquefied Petroleum Gas
LULC	Land Use Land Cover
MFI	Micro-Finance Institution
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act Fund
MIS	Management Information System
MoEFCC	Ministry of Environment, Forest and Climate Change
MRV	Measurement, Reporting and Verification
NABARD	National Bank for Agriculture and Rural Development
NAFCC	National Adaptation Fund on Climate Change
NAMA	Nationally Appropriate Mitigation Action
NCV	Net Calorific Value
NRSC	National Remote Sensing Centre
NSC	NAMA Steering Committee
NSP	NAMA Support Project
NAPCC	National Action Plan on Climate Change
NCEEF	National Clean Energy and Environment Fund
NDC	Nationally Determined Contribution
NFP	National Forest Policy
NAP	National Afforestation Programme
PIB	Press Information Bureau
PMU	Programme Management Unit
QA/QC	Quality Assurance and Quality Control
RCP	Randomised Control Plot
RRB	Regional Rural Bank
SDG	Sustainable Development Goal
SOP	Standard Operating Procedure
tCO_2e	Tonnes of Carbon Dioxide Equivalent
TE	Tea Estate
TOF	Trees Outside Forests
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development

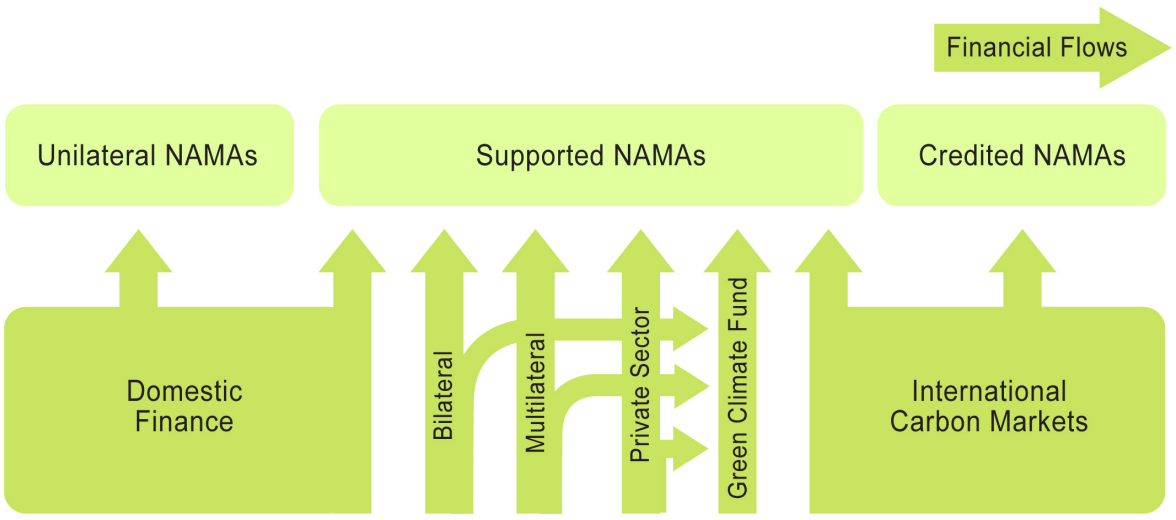
1. Introduction

1.1 Nationally Appropriate Mitigation Actions (NAMAs) under UNFCCC

Nationally Appropriate Mitigation Actions (NAMAs) were introduced under the United Nations Framework Convention on Climate Change (UNFCCC) in the Bali Action Plan in 2007 as a mechanism to increase mitigation action in developing countries. This mechanism provides a framework for developing countries to voluntarily design and implement Greenhouse Gas (GHG) mitigation actions in the context of sustainable development and enabled by technology, financing and capacity building support, in a measureable, reportable and verifiable (MRV) manner. (Decision 1/CP.13, UNFCCC, 2008) Subsequently the Cancun Agreements, resulting from UNFCCC negotiations in 2010, recognised three types of NAMAs (GIZ, 2013):

- 'Domestically supported mitigation actions' (unilateral NAMAs): These are financed with funds originating exclusively from the host country.
- 'Internationally supported mitigation actions' (supported NAMAs): These receive international support which can include financial, technical and/or capacity building support.
- 'Market-based mechanisms to enhance the cost-effectiveness of, and to promote, mitigation actions' (credited NAMAs): These generate offset credits as a form of results-based financing.

Figure 8: Types of NAMAs



Source: (Sawyer, et al. 2013)

In the Cancun Agreements it was also agreed to 'set up a registry to record nationally appropriate mitigation actions (NAMAs) seeking international support, to facilitate the matching of finance, technology and capacity-building for these actions'. A web-based registry was subsequently established which has the following sections (UNFCCC, 2014):

- 'NAMAs seeking support for preparation' (NAMA concept): A NAMA has not been formulated and financial or technical support are required to prepare it.
- 'NAMAs seeking support for implementation' (NAMA proposal): If the NAMA has already been formulated and it is ready to receive finance, technology and/or capacity building for implementation
- 'Other NAMAs, for recognition' (unilateral NAMA): NAMAs that will be implemented unilaterally by developing countries and, therefore, no support is being sought.
- Information on support for the preparation and implementation of NAMAs

NAMAs differ from other mechanisms in that they can constitute a diverse range of initiatives from policies to projects and can be implemented at different levels (national or sub-national levels). However, NAMAs should be aligned with the national level policies. Following are the types of NAMAs identified by the NAMA Registry (UNFCCC, 2014):

- **Nationally quantified goals**: These are quantified objectives to reduce GHG emissions or undertake any other activity which has an impact on emissions. As quantified objectives, these goals state an end result and do not specify measures to achieve it. They may be defined at the national, sub-national level or sectoral level and can be expressed in different manners.
- **Strategies**: These are comprehensive plans of measures and actions undertaken by governments that aim to achieve long-term mitigation objectives. They provide the overarching framework under which a set of mitigation measures can be undertaken. A strategy's most distinguishing feature is that it sets out a long term vision for nations, sectors or regions.
- **Programmes and policies**: These are concrete measures undertaken by governments to achieve a specific objective. Implementation is typically led by the public sector and linked to public budgeting and legislative processes.
- **Projects, or bundles of projects**: These are specific investments undertaken by the private or public sectors with fixed boundaries, clearly defined activities and a financial investment in services, infrastructure or machinery.

This flexibility makes NAMAs a highly adaptive instrument that developing countries can use to route investments into sectors and actions as appropriate.

Of the total 141 NAMAs registered in the UNFCCC NAMA Registry (UNFCCC, 2017) so far only seven are in the forestry sector. Apart from these, there are six other NAMAs in the forestry sector which have been identified from other databases (Ecofys, 2017) (NAMA Facility, 2017). Till date, only two of the 13 NAMAs in the forestry sector have received support and are under implementation. Some of these which are relevant to the NAMA in the forestry sector in India have been summarised in section 1.5.2 of this chapter.

1.2 Climate Change and Forestry in India

India is endowed with rich diversity in forests, ranging from tropical wet evergreen forests in the North East and South West to the tropical dry thorn forests in central and western parts of the country. With four global biodiversity hotspots present in India, it is recognised as one of the 17 mega-diverse countries globally. Its Protected Area Network includes 102 National Parks, 515 Wildlife Sanctuaries, 47 Conservation Reserves, 4 Community Reserves extending over 16 million hectares (ha), i.e. 4.9 per cent of geographical area of the country (MoEFCC, 2014).

Forest and tree cover is the second-largest land use category in India after agriculture (BUR, MoEFCC, 2015). As per the India State of Forest Report (ISFR) 2015, forest and tree cover was 79.42 million ha i.e. about 24 per cent of India's geographical area. Protection and improvement of forests is a constitutional mandate in India. Article 48A of the Indian constitution states that: 'The State shall endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country.' In addition, Article 51 A (g) makes it the fundamental duty of the citizen 'to protect and improve the natural environment including forests, lakes, rivers and wild life, and to have compassion for living creatures'. The Ministry of Environment, Forests and Climate Change (MoEFCC) is the apex agency for governing forests in the country.

In India, forests fall under the concurrent list which implies that the legislative and administrative powers are shared by the central government and the federal state governments. Management and protection of forests is the responsibility of State Governments, whereas the Central Government provides policy directions and guidelines for the sector. (MoEFCC, 2014). The constitutional powers assigned to the states give them significant control over their forest resources (Dhanuraj & Kumar, 2014). India's policy and legislative framework in the forestry sector include the National Forest Policy (NFP) 1988, Forest (Conservation) Act 1980, Indian Forest Act, 1927, Environment (Protection) Act 1986, Forest Conservation Rules 2003, Wild life (Protection) Act 1972 and Biological Diversity Act 2002. In addition, most Indian states have introduced additional legislations to meet the specificities of the respective states. India has adopted a participatory approach to promote sustainable management of forests. India's Joint Forest Management (JFM) model is based on a partnership between local communities and the Forest Department. There are over 100,000 JFM Committees (JFMC) involving around 20 million people managing over 22 million hectare of forest area in the country (MoEFCC, 2014).

The national goal for the forestry sector, as stated in the NFP 1988, is to 'have a minimum of one-third of the total land area of the country under forest or tree cover.' In addition, the aim for hilly and mountainous regions is to 'maintain two-third of the area under such cover in order to prevent erosion and land degradation and to ensure the stability of the fragile ecosystem'.

Further, the Government of India has acknowledged the critical roles that forests need to play in addressing climate change, thereby making it essential to have both climate adaptation and mitigation strategies for the sector (MoEFCC, 2014). Forests neutralised about 9 per cent of India's GHG emissions in 2010 (BUR, MoEFCC, 2015). The National Action Plan on Climate Change (NAPCC), introduced in 2008, served as India's guiding framework for addressing climate change. The Green India Mission, one of the 8 NAPCC missions, aimed at protecting, restoring and enhancing India's forest cover and responding to climate change through a combination of adaptation and mitigation measures (MoEFCC, 2014). Specifically, one key objective of GIM was to 'enhance annual CO2 sequestration by 50 to 60 million tonnes in the year 2020'. As noted in India's first Biennial Update Report to the UNFCCC, the Government of India is in the process of

developing its National REDD+ strategy. MoEFCC has prepared a draft national REDD+ policy and strategy. A REDD+ reference document has also been prepared. Further a REDD+ Cell has been established in MoEFCC which is responsible for coordinating and guiding REDD+ related actions at the national level, and discharging the role of guiding and collaborating with the State Forest Departments to collect, process and manage all relevant information and data relating to forest carbon accounting.

Recent UNFCCC negotiations resulted in the Paris Agreement which requires countries to prepare, implement and regularly update Nationally Determined Contributions (NDCs) as a means to jointly meet the global objective of limiting temperature rise 'to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels'. Further Paragraph 2, Article 4 of the Agreement required countries to 'pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions.' Article 13 of the Agreement focuses on introducing 'an enhanced transparency framework for action and support' which will require regular reporting on emissions, tracking progress towards NDCs and global goals, and as well as the support (financial, technology transfer and capacity-building support) channeled towards implementing and enhancing NDCs. These NDCs outline 'a country's vision of its own development through an alternative path which is 'cleaner' in terms of GHG emissions and that enhances a country's resilience to climate change. The objectives and targets specified therein are to be achieved through measures such as NAMAs. NAMAs are therefore a natural means to help countries realise the vision enshrined in their NDCs'. (Lütken, et al., 2016)

In October 2015, India submitted its Nationally Determined Contribution (NDC) to the UNFCCC in response to COP decisions 1/CP.19 and 1/CP.20. This document captured India's commitment towards addressing the threat of climate change. Further India ratified the Paris Agreement in October 2016 which conveys its commitment towards addressing climate change and in implementation of its NDCs (MoEFCC, 2016).

India's climate mitigation targets as outlined in its NDC are (MoEFCC - INDC, 2015):

- To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level
- To achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030 with the help of transfer of technology and low cost international finance including from Green Climate Fund (GCF)
- To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030

India's NDC assigns a sectoral target for forestry which indicates the key role that the sector is expected to play in responding to climate change nationally. The following national policies and actions have been identified as the means to achieve India's NDC target for the forestry sector (MoEFCC, 2015):

- Full implementation of Green India Mission
- Green Highways Policy: 140,000 km long 'tree-line' along both sides of national highways. 1 per cent of project cost to be earmarked for plantation
- Plantation along Rivers: part of the Namami Gange Mission
- Finance Commission (FC) Incentive for creation of carbon sink: devolution of funds to states from federal pool (attaches 7.5 per cent weight to area under forest).

- Reduction in consumption of wood/ biomass as fuel
- Funds from Compensatory Afforestation Fund Management and Planning Authority (CAMPA): USD 6 billion proposed to be given to States
- Other policies including:
  - REDD+
  - National Agro-forestry Policy (NAP)
  - Joint Forest Management
  - National Afforestation Programme

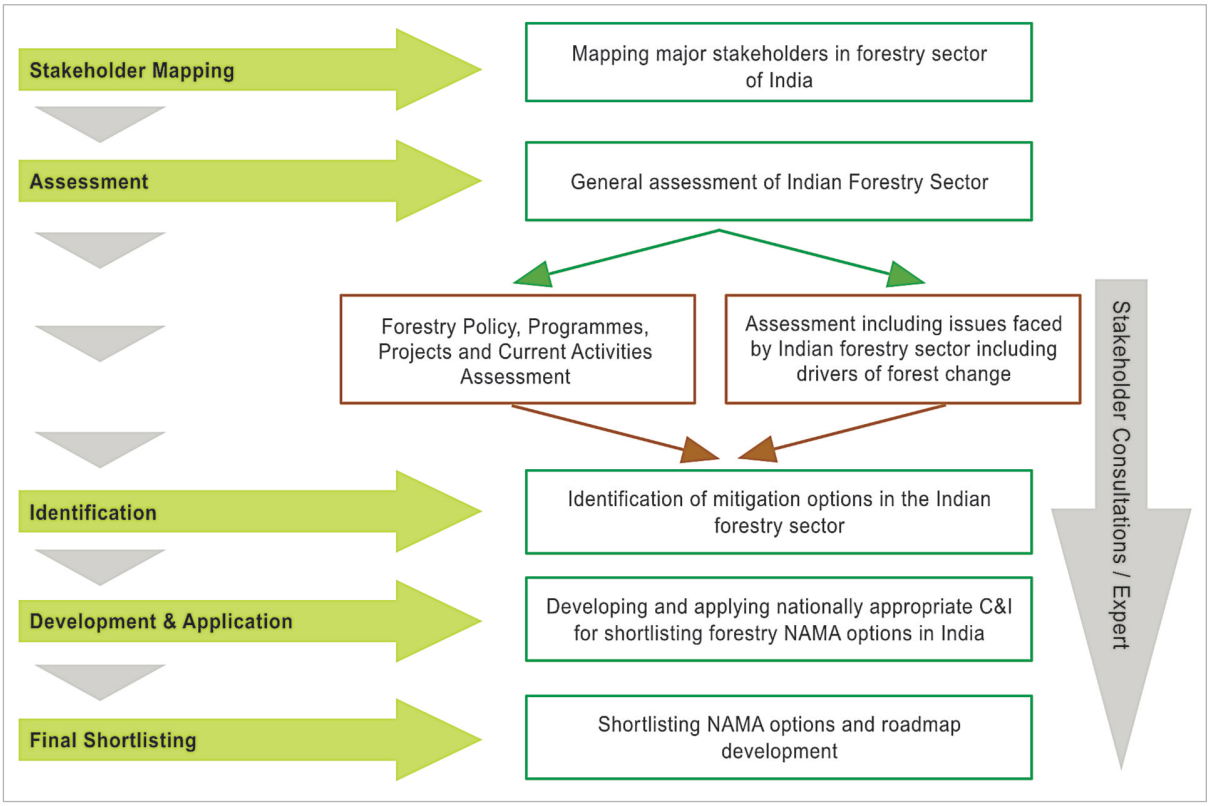
1.3 NAMA Selection Process in India

Under the ambit of Indo-German bilateral cooperation, the Ministry of Environment, Forest and Climate Change (MoEFCC) and GIZ are implementing a project titled 'Development and Management of Nationally Appropriate Mitigation Actions (NAMAs) in India'. Under this initiative, MoEFCC identified two sectors, namely the forestry and the waste sector, for NAMA development in India. The process followed in selection of a focus and scope of the NAMA to be developed for the forestry sector in India is outlined below.

Initially, a rigorous feasibility study was undertaken by GIZ India for the MoEFCC (Mehra, A. S., Hassan, & Burnwal, 2015) with the objective of exploring 'possibilities of developing NAMAs in the Forestry sector in India. The feasibility study looks into existing forest policies, programmes and projects in India that could be registered as domestic or supported NAMAs'. The study proceeded in several steps (see Figure 9 below). These included extensive preparation in November and December 2014 to compile a list of NAMA options.

The stakeholders were consulted through interviews from December 2014 to March 2015 to collect feedback on these options as well as on the list of criteria, indicators and parameters to be used for shortlisting the NAMA options. This analysis led to a set of conclusions and recommendations which were presented at a stakeholder workshop in March 2015. Overall the study followed a consultative approach for shortlisting of the NAMA options, with an effort to include both top-down policy design considerations and bottom-up implementation considerations.

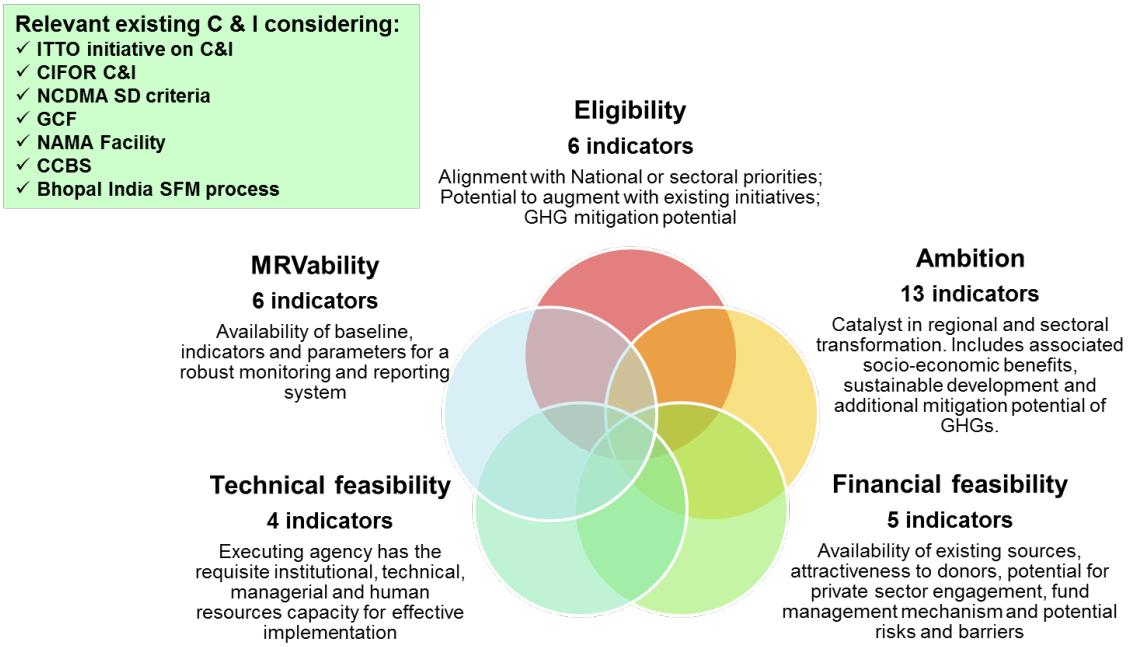
Figure 9: Approach of the Feasibility Study for the NAMA in the Forestry Sector in India



Source: Mehra, A. S., Hassan, & Burnwal, 2015

The detailed framework of criteria, indicators and parameters developed for shortlisting the NAMA options were based on accepted national and international standards (see Figure 10).

Figure 10: Criteria and Indicators (C&I) for Shortlisting Options in the Feasibility Study



Source: (Mehra, A. S., Hassan, & Burnwal, 2015)

The feasibility study identified four feasible NAMA options, based on multiple approaches including policy-based approach, market based interventions, and sectoral activities. These options have been summarised in the box below. More details on the assessment and the shortlisted options can be found in the study report.

Forestry Mitigation Action Options – Feasibility Study Outcome

Option 1: Supporting ecosystem restoration of degraded open forest and enhancing tree cover in urban and peri-urban areas under National Mission for Green India (GIM)

The aim would be to increase forest cover in urban areas through convergence of national level, state level and international finance, while ensuring community and biodiversity benefits and safeguards. It would fulfil or exceed afforestation and Trees Outside Forests (TOF) goals of GIM by 2022. Under this NAMA, states would have ultimate responsibility for the NAMA activity framework through existing (preferably) or proposed delivery mechanisms. The NAMA could provide states with technical capacity, MRV support and resources to carry out implementation tasks. The GIM activity plans, developed after much consultation and research would serve as a guiding framework for the states to implement this NAMA.

Option 2: Sustainable fuelwood management NAMA

This NAMA would aim to reduce pressure on forests from unsustainable fuelwood extraction through promotion of alternate energy technologies and FW plantations. The specific set of activities would be determined according to local circumstances in states. The NAMA activity framework would involve local communities, Joint Forest Management Committees (JFMCs) and State Forest Departments from project design to monitoring.

Option 3: NAMA to promote agroforestry in India

This NAMA would utilise the vehicle of the National Agroforestry Policy, and also borrow its activity framework from existing successful regional agroforestry schemes, particularly the Krishi Aranya Protsaha Yojane (KAPY) implemented in Karnataka. It would directly incentivise farmers based on the survival rate of trees planted, in such a way that the return on initial investment is ensured within the first three years. Such a scheme can promote fuelwood, fodder, fruit bearing and timber species with longer rotation in agricultural land under multi-cropping system. For its implementation, the NAMA would rely on existing institutional mechanisms such as JFMCs.

Option 4: Green forest credit NAMA

This NAMA would aim to develop a market mechanism to reward states for preserving and enhancing their forest cover. This will help achieving the national goal of 33 per cent land under forest cover. Under the NAMA, each state would have a goal, albeit considering ecological and developmental constraints. States surpassing their target will receive green credits for sale to underperforming states. The states could implement locally customised activities including eco-restoration, regeneration and afforestation for the NAMA activity framework.

Post the feasibility study, one NAMA option was selected in consultation with MoEFCC for development of a full-fledged bankable concept including MRV structure, capacity development strategy and financing approach. To arrive at this NAMA, additional stakeholder consultations with MoEFCC were held to discuss in detail the pros and cons of the four options recommended by the feasibility study. This covered an in-depth review with aspects such as goal, additionality, MRV, international support and ease of implementation for each of the NAMA options.

The stakeholder discussions led to the following key conclusion on each of the NAMA options:

- Option 1 on 'Afforestation and TOF' was found to be a regular option which the MoEFCC confirmed would take place in a business as usual scenario through domestic public financing channelled through the GIM and other afforestation programmes by the government. Therefore, this option was not found to be suitable for accessing international climate finance through a NAMA.
- Option 2 on 'Sustainable Fuelwood Management' was found to be a good option addressing the supply and demand side of fuelwood, which is the most prevalent driver of forest degradation in the country. This option could reap quick visible results and achievements. It would also lead to several sustainable development benefits especially human health and livelihoods while reducing pressure on forests. Further this option provides enough scope for engagement and investments by the private sector. International finance accessed through a NAMA on this option could help address the barriers which have impeded the success of past initiatives on sustainable fuelwood management by government and private sector. Overall, this was found to be a good option for further development as a NAMA concept.
- Option 3 on Agroforestry is already being covered by the National Agroforestry Policy in India which will be dealt by the Ministry of Agriculture. In addition, the MRV for the option will be much disaggregated in nature. Therefore, this option may not be attractive to donors and additionality could be an issue as well.
- Option 4 on Green Forest Credit NAMA is very innovative but has inherent challenges. In order to develop the market mechanism much background work needs to be done. For instance, setting up a platform for trading, defining rules and regulations, high political will of the participating states, how the non-performers can be dealt with, when and how we can have a cadre of verifiers and validators, are some major questions which would require a detailed review and extensive consultations to arrive at the NAMA design.

With these considerations in mind, the MoEFCC decided that India's first NAMA in the forestry sector will focus on 'Sustainable Fuelwood Management'. This decision was also made keeping in view India's NDC commitment which identifies 'reduction in consumption of wood/biomass as fuel' as a means to achieve its forestry sector goal.

More than 850 million people (FSI, 2011), i.e. 71 per cent of India's population (Census of India, 2011), depend on fuelwood to meet their cooking energy needs. Given the immense scale of the problem and the regional nature of fuelwood use practices in cooking, a state level approach was considered feasible for the NAMA.

The state of Assam was chosen by MoEFCC as the first state to develop and implement this NAMA. This selection was based on a multi-criteria assessment comparing all Indian states and union territories on factors such as fuelwood dependent population, number of people extracting fuelwood from forests, forest cover, fuelwood supply-demand gap, and area under open forests. The MoEFCC

communicated its recommendation to the State Government on developing India's first NAMA in forestry sector in the state of Assam. This was accepted by the State and an inception meeting for initiating the development of the NAMA was held on 7th September, 2016 under the aegis of the Principal Secretary, Department of Environment and Forest, Government of Assam in Guwahati. The process for development of the NAMA concept in Assam has been summarised in section 1.6 of this chapter.

1.4 Development Process for India's Forestry NAMA

As mentioned earlier, an inception meeting was held under the chairmanship of the Principal Secretary, Department of Environment and Forests, Government of Assam. This meeting was attended by officials of various departments, Government of Assam who were briefed on the NAMA selection process in India, the need for the proposed NAMA in the forestry sector on 'Sustainable Fuelwood Management' in Assam, and the available opportunity for accessing international climate finance. The participants at this meeting provided their inputs on the past efforts undertaken towards sustainable fuelwood management by various agencies in the state and the challenges faced. It was decided at this meeting that a NAMA Support Project (NSP) concept would be submitted under the 4th Call of the NAMA Facility (year 2016).

Based on inputs from the inception meeting and under the guidance of the Department of Environment and Forests, the nodal agency for the NAMA in Assam, a process for consultation with relevant stakeholders for development of the NSP and the NAMA was outlined. The stakeholders consulted and the purpose of these meetings is summarised in the table below. In addition, two stakeholder consultations were held in Guwahati, including a roundtable meeting to provide a progress update to key stakeholders on the NAMA concept development (held in December 2016), and another to validate the NAMA concept (held in April 2017).

For designing the NAMA interventions specific to the tea estate households, one of the two target beneficiary groups for the first phase of the NAMA, field visits to three tea estates were held in December 2016. The estates visited were Dikom Tea Estate in Dibrugarh district, Nalani Tea Estate in Tinsukia district and Dhekiajuli Tea Estate in Sonitpur district. Also with the support of ABITA, a meeting with 20 tea estate managers in Dhekiajuli, Sonitpur district was organised in March 2017 to further refine the NAMA interventions for the tea estate households. All these consultations helped enrich the NAMA concept design.

Table 2: Stakeholders Consulted for Forestry NAMA Concept Development

Stakeholder Consulted	Purpose of the Meetings
Department of Environment and Forests, Government of Assam	Several meetings to update on the NAMA concept development process, share highlights of the stakeholder consultations and gain feedback to refine the concept. The department officials were present in the consultations held in Guwahati.
Assam Energy Development Agency (AEDA)	Several meetings to refine and validate the NAMA concept design. The department officials were present in the consultations held in Guwahati.
Panchayat & Rural Development Department	Interview held to assess potential role in the NAMA development and implementation. Representative from the department was present at the inception meeting.
Assam Branch Indian Tea Association (ABITA)	Several meetings to refine and validate the NAMA concept design, specifically for the tea estate households to be covered under the first implementation phase of the NAMA. They were also present in the interim and final validation consultations held in Guwahati and supported in hosting the consultation with tea estate managers in Sonitpur district.
National Bank for Agriculture and Rural Development (NABARD)	Discussions on financial design of the NAMA and their role in its implementation
Assam Gramin Vikash Bank	Discussions on financial design of the NAMA and their role in its implementation
Two Micro Finance Institutions – RGVN and ASOMI	Discussions on financial design of the NAMA and their role in its implementation
Technology Providers including Greenway Grameen, Adarsh and Envirofit among others	Interviews to develop the NAMA concept for fuelwood saving technologies
Oil and Natural Gas Corporation (ONGC) – Public Sector Undertaking	Discussion on the potential to leverage Corporate Social Responsibility (CSR) financing for NAMA implementation
Innovative Change Collaborative (ICCo)	Several meetings for NAMA concept development and to discuss potential role in NAMA implementation
OKD Institute Of Social Change and Development	Interview to develop the NAMA concept

1.5 International Experience on Mitigation Actions in the Forestry Sector

1.5.1 Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM) under the Kyoto Protocol has played a significant role in supporting climate mitigation projects in India. By May 2017, the National CDM Authority (NCDMA) in India had approved about 3,000 projects (NCDMA, 2017), of which 56 per cent are registered with UNFCCC. In relation to the NAMA for the forestry sector in India, there are about 67 CDM projects in India which have focused on promoting clean cooking technologies such as improved cook stoves and biogas (GACC, 2017). Of these, there are only 13 projects with issued credits.

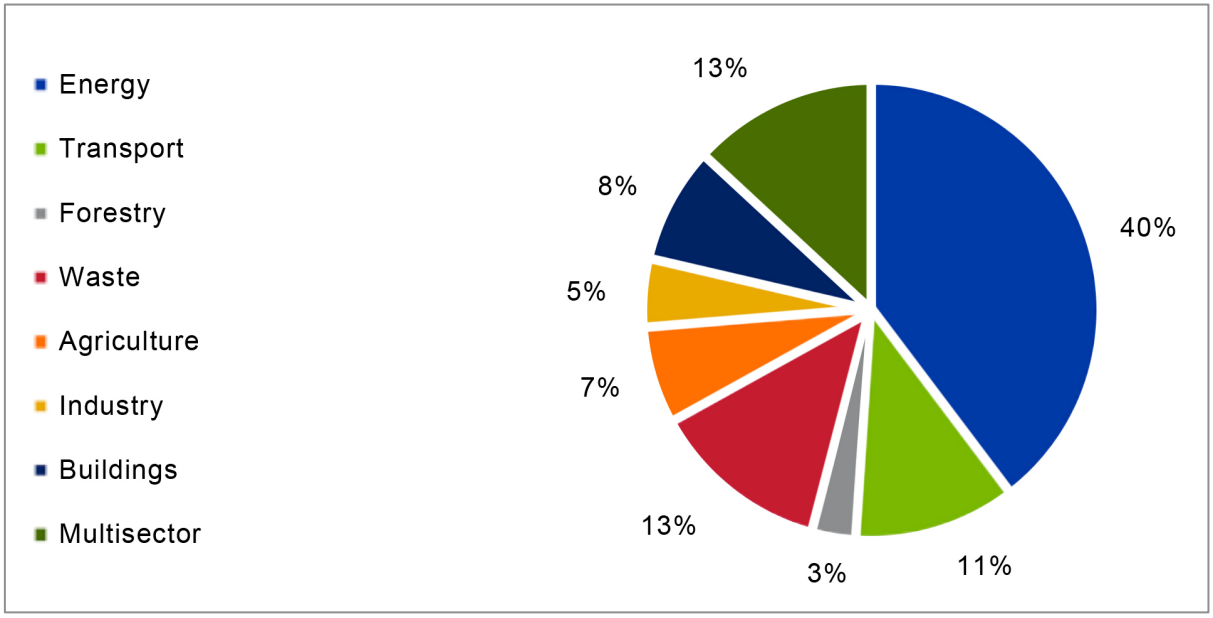
However, over the years, a progression from project-based to sector-based or programme-based approaches for climate mitigation has been observed globally and in India as well (Whalley &

Agarwal, 2015). NAMAs have evolved in line with this development. Based on various databases, there are about 250 NAMAs that are either under development (91 per cent of total) or in implementation (9 per cent of total) globally (UNFCCC, 2017), (NAMA Facility, 2017), (Ecofys, 2017).

1.5.2 Relevant NAMAs Worldwide

The forestry sector accounts for only 3 per cent of all the NAMAs (refer to Figure 11) and only two of the Forestry NAMAs have received support for implementation (refer to table below). However, the chosen option for developing India's NAMA in the forestry sector can draw from many other NAMAs belonging to other sectors but focussing on promoting sustainable fuelwood management. Amongst these, four NAMAs which have received support have been included in Table 3 as well.

Figure 11: Global Sectoral Overview of NAMAs



Source: Ecofys, 2017

Table 3: Supported NAMAs Relevant to India's NAMA in the Forestry Sector

Title	Objective	Country	Funder	Support Received
Adaptive Sustainable Forest Management in Borjomi-Bakuriani Forest District	The NAMA aims to generate a relevant climate change adaptation and mitigation impact in the Borjomi-Bakuriani pilot region as basis for upscaling and policy development at national level, and to improve the livelihood of people by supporting the sustainable development of forest ecosystems in Georgia.	Georgia	Austrian Ministry of Agriculture and Forestry, Environment and Water Management	Financial (EUR 1.5 million)
Tajikistan Forestry NAMA	The NAMA Support Project has several aims. These include forest renewal, conservation and sustainable management, contributing to climate change mitigation. Its other objectives are to maintain biodiversity, improve the livelihoods of local people and leverage public and private finance.	Tajikistan	NAMA Facility (Multilateral)	Financial (EUR 13 million)
Biomass Energy NAMA Support Project	The NAMA aims to reduce emissions associated with biomass use and respective deforestation e.g. for thermal energy use in the commercial sector by distributing more energy efficient cook stoves for traditional beer brewing and the production of *shea* butter and sumbala.	Burkina Faso	NAMA Facility (Multilateral)	Financial (EUR 13.5 million over five years)
Efficient Use of Fuel and Alternative Fuels in Indigenous and Rural Communities	The NAMA Support Project will help the implementation of Guatemala's National Firewood Strategy. It is designed to achieve scalability and long-term sustainability in the implementation of clean cooking technologies and for strengthening participatory governance.	Guatemala	NAMA Facility (Multilateral)	Financial (EUR 10.9 million over three years)
Revolving Loan Fund for the Uptake of Improved Institutional Cook Stoves (IICS) in Schools	The NAMA Support Project will help establish a Revolving Fund to provide financing of investment into IICS. Two different models are currently considered: provision of capital through the NAMA Facility to the revolving loan fund, which will then give out loans at no/low interest rates to schools or the creation of green funding lines with local/national banks, where the NAMA Facility will cover interest charged by the banks.	Uganda	NAMA Facility (Multilateral)	N/A
Rural household energy	The NAMA focuses on providing energy access to people living in rural Kenya, while at the same time creating and building momentum for a market for clean energy technologies. 28 energy productivity zones are to be established across the country that will provide infrastructure and support services for the private sector to invest in manufacturing and distributing clean energy technologies, namely solar PV-based lanterns and improved cook stoves, on a for-profit basis.	Kenya	Multilateral	N/A

There are various other NAMAs which are in advanced stages of development and are relevant to India's Forestry NAMA (see annexure). Most of these NAMAs are focussing on promoting deployment of improved cook stoves, fixed and portable models, for reducing the fuelwood consumption. Only one NAMA in Zimbabwe is focussing on promoting biogas technology. The Forestry NAMA in India can learn from the innovative market mechanisms which vary significantly across all these NAMAs. Some aim to reduce the cost of technology by providing a subsidy (such as the Unilateral NAMA in Gambia) while there are others which have designed debt instruments to achieve scalability in technology deployment. Refer to annexure for a brief on these relevant NAMAs.

1.6 Objectives of India's first Forestry NAMA

Assam is an ethno-culturally diverse state in the North-East of India. It is part of the Himalaya biodiversity hotspot. As per the Census 2011, 72 per cent of Assam's households (i.e. nearly 4.6 million), are dependent on fuelwood for meeting their cooking energy requirements. This dependence leads to several negative impacts on human well-being and natural ecosystems in the state. Therefore, reduction in fuelwood use can lead to multiple benefits including:

- Improved forest and tree cover as 22 per cent of the fuelwood demand in Assam is met from forests (FSI, 2011) leading to unplanned deforestation and forest degradation.
- Reduced GHG emissions which contribute to climate change. Fuelwood use reduction will be essential in meeting India's NDC commitments.
- Significant health benefits, especially for women and children in households which are currently dependent on inefficient and polluting fuelwood cook stoves. Smoke from cooking is one of the major causes of respiratory illness (e.g. tuberculosis) among women in rural India.[1]
- Reduced drudgery due to fuelwood collection leading to increased productivity and human health benefits.

In this context, India's first NAMA in the forestry sector will aim to design a holistic, multi-pronged approach towards promoting sustainable fuelwood management in the state of Assam by: a) increasing supply from earmarked fuelwood plantations to reduce unsustainable fuelwood extraction from forests and b) promoting fuelwood saving technologies to decrease the overall fuelwood consumption by all consumer groups, from residential and commercial sectors.

Fuelwood saving technologies would include a bouquet of alternative cleaner technologies and fuel sources which mitigate fuelwood consumption. This includes improved cook stoves, biogas, LPG and electricity based stoves among others.

[1] In 2010, approximately 1.04 million premature deaths and 31.4 million Disability-Adjusted Life Years (DALYs) were attributable to household air pollution (HAP) resulting from solid cooking fuels in India (Report of the MoHFW Steering Committee on Air Pollution and Health Related Issues)

[2] In Assam driers are used for processing of areca nut and spices. These driers are not efficient as fuelwood is directly fired under a platform over

1.7 National Embeddedness of the NAMA

In recognition of the ill effects of fuelwood use, Prime Minister Modi on 2nd October 2015 had said 'Today is the birth anniversary of Mahatma Gandhi and he will be happy if forests are saved by not cutting trees for fuelwood to cook food.' Subsequently, in May 2016, he launched the '*Pradhan Mantri Ujjwala Yojana*', a national scheme for providing LPG connections to 50 million Below Poverty Line (BPL) households, while noting his vision of freeing women living in poverty from the hardship of cooking with conventional fuelwood-inefficient cook-stoves which negatively impacts their health and productivity. (PIB, 2016) This NAMA aims to ensure that this national priority is met effectively by bringing an underlying shift in the strategies and processes towards reducing fuelwood consumption.

Over the last few decades, the reduction of forest fuelwood consumption finds a mention as a goal across several national policies and programmes (see the following table). However, fuelwood consumption has continued to increase due to several barriers, which the NAMA seeks to address. This requires substantial investments in scientific planning, communication and technology finance beyond current available resources in the sector and impossible to achieve without enhanced investments. Provided these key technical and institutional gaps are met, the NAMA has the potential to unlock a significant quantum of finance from both public and private sectors.

Table 4: Key Policies and Programmes Relevant to the NAMA

Policy / Initiative	Objective / Focus Area
National Forest Policy (NFP), 1988	India's guiding document on sustainable management of forests and biodiversity
National Mission for a Green India (GIM)	Respond to climate change through a combination of adaptation and mitigation measures in the forestry sector
Assam State Action Plan On Climate Change	An action plan by the state to mitigate climate change and build its adaptive capacity towards climate change
Unnat Chulha Abhiyan (UCA) Programme	Promote development and deployment of Improved Biomass Cook Stoves in India
Pradhan Mantri Ujjwala Yojana	Provide 50 million LPG connections in the name of women in BPL households in India
Randhanjyoti Scheme	Provide LPG connections to BPL households in Assam
National Biogas and Manure Management Programme	Support establishment of biogas plants for households mainly in rural and semi-urban areas
National Afforestation Programme	Develop forest resources with people's participation, with focus on improvement in livelihoods of the forest-fringe communities, especially the poor
National Agroforestry Policy	Encourage and expand tree plantation, in a complementary and integrated manner with crops and livestock
Mahatma Gandhi National Rural Employment Guarantee Act, 2005	Enhance livelihood security of households in rural areas by providing at least 100 days of guaranteed wage employment every financial year to every household whose adult members volunteer to do unskilled manual work
Assam 2030: In the light of Sustainable Development Goals (SDGs)	Achieve a set of 17 global sustainable development goals by 2030

The NAMA will contribute to improving the effectiveness of existing policies and initiatives and informing future policy development by:

Creating objective and robust information datasets that can be used in investment planning by the concerned government agencies; and

Establishing an effective coordination mechanism that facilitates adoption of a holistic and coherent approach by all relevant agencies.

Further details on many of the aforementioned initiatives and the potential opportunity for the NAMA to leverage them are provided in Chapter 5 on NAMA Financing.

2. NAMA Scope

2.1 NAMA Concept Summary

2.1.1 Introduction

The NAMA design was built on the learning from past initiatives promoting sustainable fuelwood management and the barriers that have impeded their successful implementation. Its concept has been designed after an extensive consultative process. Once the NAMA option for further development was selected, consultations with all relevant stakeholders were conducted to formulate the architecture of the NAMA and its key interventions. This stage was elaborate and involved consultations at multiple levels with the Central and State Governments, private sector (e.g. technology manufacturers, tea industry associations), non-governmental agencies and communities. These consultations helped develop, test and refine the NAMA concept design at every stage.

The concept development was quite a challenging process as it involved very diverse sets of priorities of different stakeholders and covered some sensitive subjects such as resource dependence and livelihood issues, tea labour rights, rights of fringe villages to access forest resources, cultural variations such as 'smoky' flavour of food, demographic variations, gender biases, developing a business case for sustained actions in the long term and ensuring objective decision support for selecting most appropriate technologies for a region to name a few.

These aspects, even though challenging, also ensured that the NAMA development team explored as many aspects as possible within the scope to create a well-rounded structure for effective implementation of NAMA.

The key components of the design captures all these challenges, and an introduction to them is given in the sub-sections below. The overall implementation strategy, stakeholders and co-benefits are explained in the latter part of this chapter.

2.1.2 Objective and Sectoral Scope

The objective of the NAMA is to address the foremost unplanned driver of forest degradation and deforestation in the country and the state of Assam – unsustainable fuelwood extraction. This will be done by addressing knowledge, planning, financing and communication gaps towards:

- **Increasing supply** from earmarked fuelwood plantations to reduce fuelwood extraction from forests and

- **Reducing demand** by promoting fuelwood saving technologies. These will cover a wide range of technologies including successful models of Improved Cook Stoves (ICS), fuelwood efficient driers[2], LPG, biogas, electricity etc.

The NAMA concept consists of five key components. To ensure effective implementation, a phased approach has been proposed:

- Phase I, NAMA Establishment: Development and deployment of the NAMA components in a pilot - within a limited geographical scope, focusing on select districts, and two specific fuelwood consumer groups.
- Phase II, NAMA Expansion: This phase will scale up the NAMA across the state of Assam and cover all the remaining fuelwood consumers covering residential as well as commercial sectors.

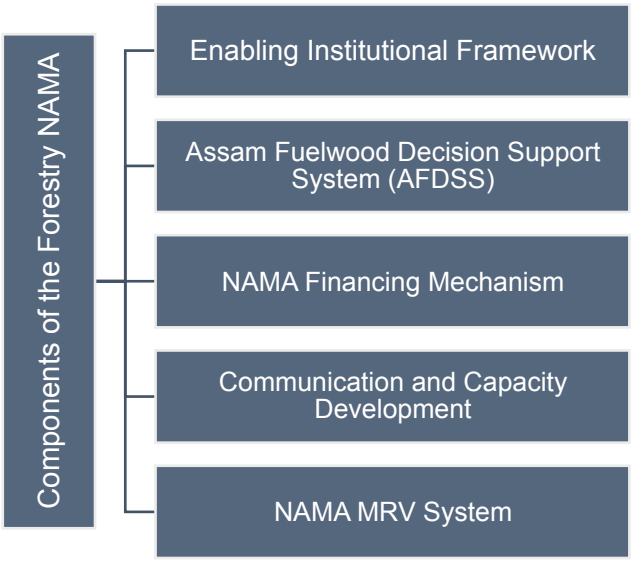
These phases and their boundaries have been described in detail in section 2.1.4 of this chapter.

2.1.3 Key Components of the NAMA

The NAMA will be managed by the Government of Assam through the Department of Environment and Forest. Other key stakeholders that have committed intent to actively participate in the NAMA include (a) Assam Energy Development Agency (AEDA), (b) Innovative Change Collaborative (ICCo), (c) Assam Branch of Indian Tea Association (ABITA).

The following figure depicts the five key components of the Forestry NAMA. These components are discussed in detail in the subsections below.

Figure 12: Five Key Components of the Forestry NAMA



[2] In Assam driers are used for processing of areca nut and spices. These driers are not efficient as fuelwood is directly fired under a platform over which the agriculture produce is spread to dry. This leads to considerable loss of thermal energy. Alternative fuelwood efficient driers have been developed that can help in reduction of considerable fuelwood consumption commercially.

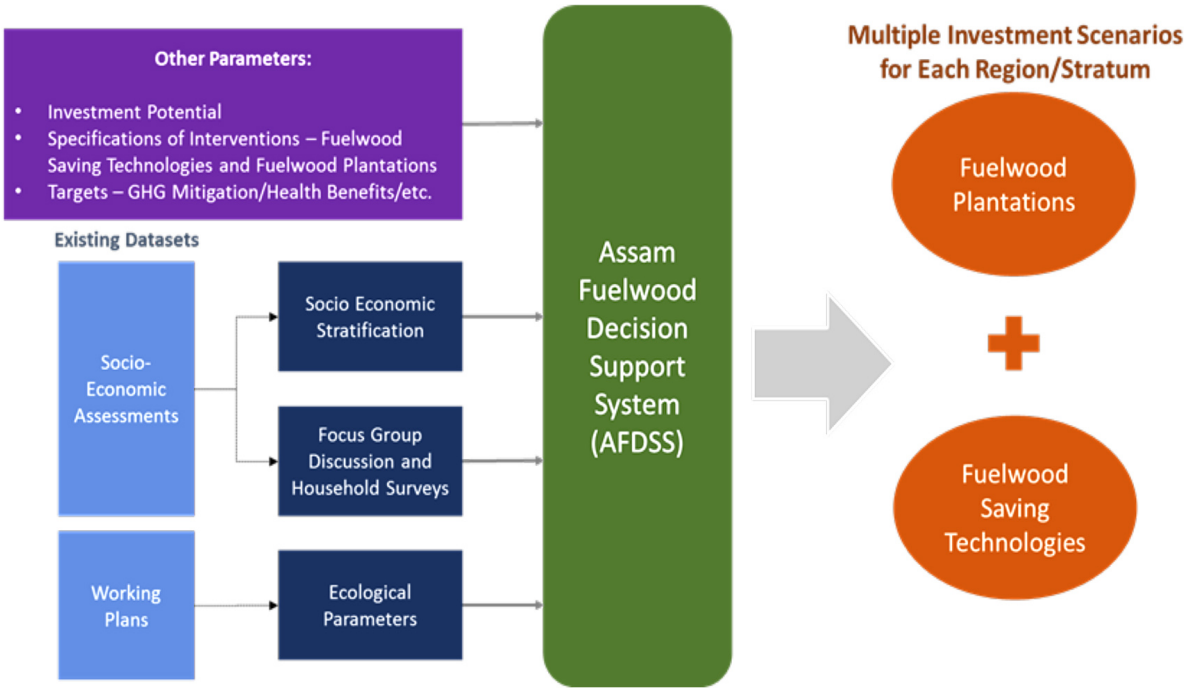
I. Creation of an Enabling Environment

Phase I of NAMA will support establishing a NAMA Programme Management Unit (PMU) under the Government of Assam. Section 2.3.7 below provides details of the proposed institutional or details of the institutional arrangement for this NAMA. The NAMA will support the engagement of a communication expert, training expert, MIS expert, gender expert, socio economic expert and forestry experts in the PMU. The PMU will ensure overall coordination for implementing the NAMA interventions in a timely and effective manner. Further the PMU will engage rural women mobilisers who will promote adoption of fuelwood saving technologies in the identified households, and also act as a bridge between beneficiaries and technology providers to spur customisation of technology. The PMU will ensure that the identified key barriers are adequately addressed within the NAMA period in order to ensure that a conducive environment for scaling up and replication is created under the NAMA.

II. Setting up the Assam Fuelwood Decision Support System (AFDSS)

The NAMA interventions will be guided by a web-based Assam Fuelwood Decision Support System (AFDSS), to be housed and operated under the NAMA PMU. This system will be based on principles of systems dynamic modelling and will assist public and private agencies to make strategic investments towards sustainable fuelwood management. It will result in the identification of region specific needs for fuelwood plantations and fuelwood saving technologies that can be deployed under the NAMA. Such a system has been successfully tried and tested in two landscapes in India, namely Mandla in the state of Madhya Pradesh and Sirsi in the state of Karnataka, where its outputs are being used to design deployment strategies for fuelwood efficient driers and improved cookstoves. The AFDSS will build upon and customise this model to support the NAMA implementation. Details of the AFDSS and its development process have been covered in Chapter 4.

Figure 13: Schematic for the AFDSS (Inputs and Outputs)



III. Establishment and Operationalisation of a NAMA Financing Mechanism (Phase I and Phase II)

Based on the AFDSS output, it is planned to identify a minimum of 1,000,000 households in tea estates and other rural villages for deployment of fuelwood saving technologies (including ICS, biogas and LPG) in 6 districts under the NAMA Phase I. This will be scaled up to all the consumer points in all the districts in NAMA Phase II. A detailed strategy has been designed to access public and private financing from international and domestic sources. The financing instruments to be deployed will include:

- Loans to commercial establishments dependent on fuelwood such as tea estates: There exists a strong business case for these consumer groups to shift to fuelwood saving technologies. Therefore, commercial or specialised debt instruments can be designed to help mobilise equity from these commercial establishments in adopting fuelwood saving technologies, and for raising fuelwood plantations in their private lands if feasible.
- Grants for targeted fuelwood dependent households such as forest villages and for raising fuelwood plantations: this will help bring down the cost for households to access fuelwood saving technologies. Raising and maintaining fuelwood plantations in public land will require grants as well. To ensure effectiveness of these interventions, performance based financing structures can be designed.

More details on the financing needs, potential financing sources and the financing strategy for the NAMA can be found in Chapter 6.

IV. Communication and Capacity Development

A multi-pronged communication strategy will be employed, addressing the specific capacity building needs of the three main stakeholder groups:

- **Communities:** Designing and implementing campaigns that are contextualised to the local needs highlighting health, economic and ecological benefits of fuelwood saving technologies. This will include development of various communication products, events and technology demonstrations; this will also include the training of trainers for community members.
- **Technology providers:** Supporting information dissemination through workshops, brochures, etc. on the most suitable regions for their technologies. The Assam Energy Development Agency (AEDA), ICCo India will support this exercise. Premier academic and research institutes in Assam, such as Indian Institute of Technology Guwahati and Tezpur University are potential partners who can help in dissemination of knowledge and capacity development.
- **Government officers:** Senior and mid-level officers will be trained on the AFDSS and development of region-specific investment plans for fuelwood plantation and fuelwood saving technologies.

Shortlisted technology providers will be supported in delivery of fuelwood saving technologies and monitoring their usage. Further, the financial institutions engaged in the NAMA implementation will be supported on development of investment appraisal methodologies, risk management and monitoring mechanisms.

Supporting and mentoring technology enterprises will be carried out to set-up viable business and encourage access to finance to increase technology choice and quality. Organisations such as ICCo

India, which already have a center of excellence in Assam for this purpose, will lead this activity.

V. Establishment of an MRV System

A participatory monitoring, reporting and verification (MRV) system, built atop existing monitoring and evaluation systems in the state will be designed, to encourage reporting and sustained use of the fuelwood saving technologies. For this, a web-based data entry platform (the NAMA MIS) will be designed as a two-way information system. The MRV system will play a dual role of (a) assessing changes in forest cover in the NAMA areas; (b) assessing technology adoption and use. In addition, the co-benefits arising from the NAMA will also be monitored over time. Under Phase I, indicators will be defined corresponding to the anticipated co-benefits of the NAMA. Data sources will be mapped for each of the indicators and these will be tracked on a regular basis to assess the impacts of the NAMA, illustrative examples of the monitoring of co-benefits is given below:

Indicator 1: Access to affordable, reliable, sustainable and modern energy for all (SDG7)

- **Baseline value:** 81 per cent of households in Assam use fuelwood for cooking.
- **Target value**: 20 per cent households in Assam use unsustainably extracted fuelwood for cooking by 2030 (i.e. all households have access to affordable, reliable, sustainable and modern energy for cooking).
- **Data source:** For baseline value: National Sample Survey Organisation (68th Round), Ministry of Statistics and Programme Implementation: Energy Sources of Indian Households for Cooking and Lighting, 2011-12; for target value: Updated reports by NSSO and MoSPI.

Indicator 2: Healthy lives and well-being for all at all ages (SDG3).

- **Baseline value:** 680 cases of chronic respiratory diseases/100,000 inhabitants diagnosed.
- **Target value:** Maximum of 340 cases of chronic respiratory diseases/100,000 inhabitants diagnosed in 2030.
- **Data source:** For baseline value: Annual Health Survey 2011/12, Assam by the Census of India, 2011; For target value: Monitoring reports on SDGs in Assam by the State Planning and Development Department.

Forest cover baselines and changes in area covered under the NAMA (defined as forest parcels within a buffer of 5-8 km around forest villages and tea estates where technology deployment takes place. An accepted region for fuelwood collection will be determined through a combination of remote sensing analysis and ground sampling) will be monitored.

The design principles for activity data baselines (current technology usage) and monitoring will follow a bottom-up approach. The monitoring data received from the targeted households will be used to ascertain the mitigation performance of the NAMA and help design the larger NAMA for the state.

The proposed MRV system will be conceptualised in a way that technology user-based activities are assessed and used as proxy indicators for the performance of mitigation activities. The system will be transparent for the stakeholders who are actively involved in any NAMA intervention activities. SMS-based and Android mobile phone apps has been developed for this purpose.

2.1.4 Geographical and Temporal Scope

Geographical Scope:

The state of Assam has been chosen as the first state to implement this NAMA. As an ethno-culturally diverse state in the North-East of India, Assam is part of the Himalayan biodiversity hotspot. It provides an interesting landscape for the NAMA and can help in developing the template for scaling up the NAMA in a diverse country like India. NAMA will be deployed throughout Assam in a phased manner, in such a way that two key consumers of fuelwood and energy plantations in six districts of Assam will be covered in Phase I.

These six districts were selected based on a multi-criteria analysis based on parameters such as presence of tea estates, forest cover, presence of forest villages and geographical representations. The six districts – Kokrajhar, Kamrup, Sonitpur, Nagaon, Cachar and Dibrugarh - represent the various dimensions for demonstrating effectiveness of the NAMA, and are geographically dispersed across the state to succesfully capture all the cultural and physiographic variations in the pattern of collection and consumption of fuelwood (see figure below). Phase II will scale up and cover all the fuelwood consumer points and promote energy plantations across the entire state of Assam. The figure and table below depict the selected districts for Phase I and their salient features with respect to the NAMA.

Figure 14: Proposed Districts for Forestry NAMA Phase I

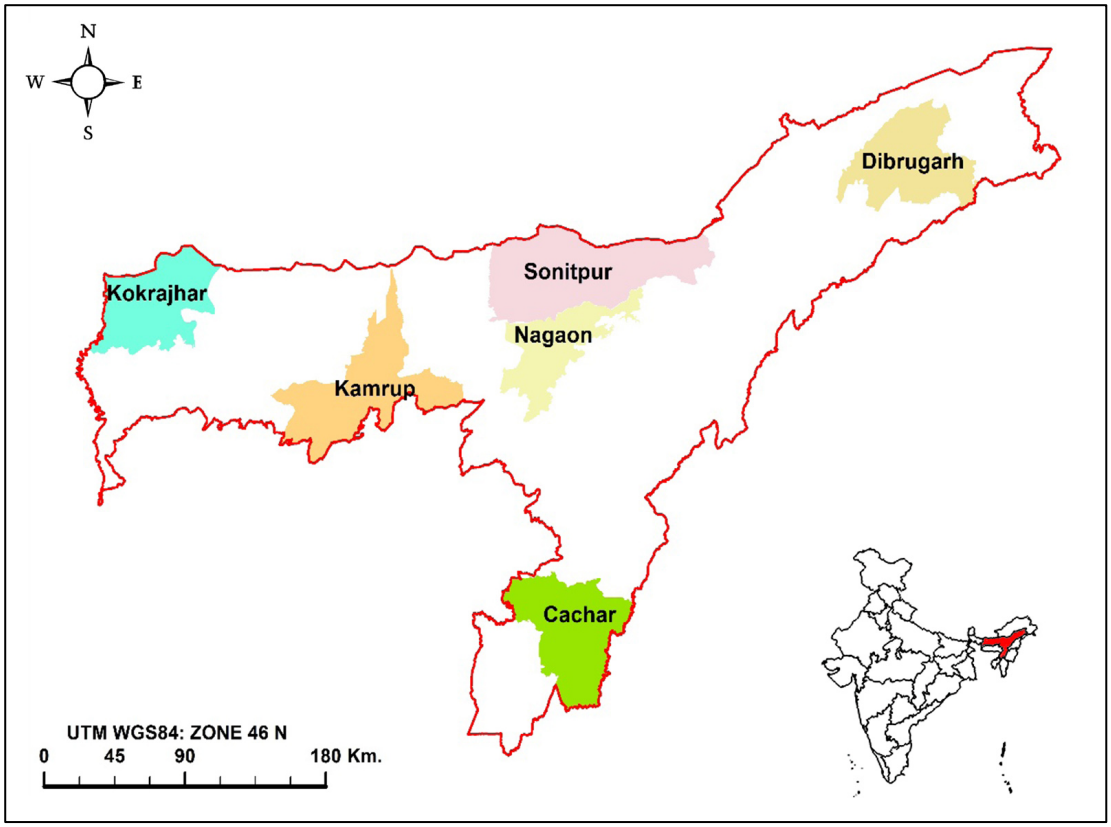


Table 5: Key Parameters of Districts where Phase I of NAMA will be Implemented

District	Region	Salient Features
Kokrajhar	West Assam	Represents the eastern part of the state, borders some important biodiversity habitats such as Manas. Also borders international boundary with Bhutan so as to map any traits in changes in forest resource utilisation because of well defined boundaries.
Kamrup	West-Central Assam	Kamrup is one of the most urbanised districts, the capital city Guwahati is within the district. Will enable mapping diverse consumption patterns, and will be our reference point in impementing financial instrument in urban, peri-urban landscape.
Sonitpur	North-Central Assam	High prevalence of Tea Estates, some examples of demonstrable energy saving measures, high dependence on shade trees for fuel. Scope for supply side energy plantations in private lands.
Nagaon	South-Central Assam	Mix of tea estates, forest villages, both slightly in less concentration as in other districts. Borders important bio-diversity habitats – Kaziranga National Park and Laokhowa Wildlife Sanctuary. Destruction of corridors due to unsustainable extraction of fuelwood will be one of the focuses, ample scope for supply side interventions such as energy plantations on public land.
District	Region	Salient Features
Dibrugarh	East Assam	Represents eastern part of the state. Rich in biodiversity and primary forests. One of the highest concentrations of tea estates.
Cachar	South Assam	Represents the southern part of the state, rich Sal and bamboo forests, different patterns of consumption as compared to Dibrugarh or Kokrajhar.

Temporal Scope and Phased Approach:

The NAMA will be implemented in two phases over 13years from 2018 till 2030:

- **Phase I:** NAMA Establishment phase; for five years from 2018 till 2022 (covered in this report)
- **Phase II:** NAMA Expansion phase; for eight years from 2023 to 2030 (beyond this report)

Phase I of the NAMA will initiate the implementation by strengthening its institutional architecture and by deploying and ensuring sustained adoption of fuelwood saving technologies in a minimum of 1,000,000 households across two identified communities: a) tea estate tribes and b) forest and other rural villages across six districts in 5 years. Phase I will complete the following key activities:

- Develop an institutional architecture and enabling environment for implementing and managing the NAMA.
- Develop systems and protocols on identification of beneficiaries and finalising corresponding NAMA areas (forests within 5-8 km of the beneficiaries in villages and tea estates).
- Develop a state-wide multivariate 'Assam Fuelwood Decision Support System' (AFDSS) for designing highly contextual investment strategies for fuelwood plantations and fuelwood saving technologies at a sub-state regional level.

- Designing and deploying the financial instruments (including loans and grants) for deployment of fuelwood saving technologies identified by the AFDSS under the NAMA in tea estates and villages.
- Finalise action plan for region specific communication campaigns.
- Develop the socio-economic data collection strategy, sampling plan and questionnaires for stakeholders for development the Assam State Fuelwood Decision Support System (AFDSS).
- Develop the MRV system for the NAMA.

Building on this, Phase II will focus on covering the rest of the identified beneficiaries at both supply and demand sides. For ease of deployment, the demand side will be classified as commercial consumers (e.g. restaurants, agro-processing etc.), residential (e.g., household heating and cooking) and community (e.g. religious cooking, hostels, schools). Deployment in these categories across Assam will take place untill the year 2030. Energy plantations to ensure a steady supply of sustainable fuelwood, which are already a part of Phase I, will also be scaled up to the whole state.

2.2 Theory of Change

The Theory of Change illustrates the transformational potential of the Forestry NAMA by depicting the pathway of changes that shall be initiated to achieve sustainable fuelwood management in the state of Assam. These changes will be triggered by adopting a phased approach for implementation.

In Phase I, the NAMA will aim to establish models and solutions to meet the technical, institutional, financial and communication gaps that impede sustainable fuelwood management. This phase will institutionalise systematic decision making towards sustainable fuelwood management investments, thus establishing a transparent, fact-based planning. A designated agency, the NAMA PMU, will lead this effort and coordinate with all relevant stakeholders to ensure effective convergence on investment planning.

The NAMA's focus on incentivising sustained use of fuelwood saving technologies will bring about a behavioural change in the way fuelwood is utilised. The technology agnostic approach of the NAMA is a novelty compared to traditional clean cooking programmes, which aimed at promoting one or few specific solutions. The NAMA will help establish a holistic understanding of the contextual nuances that impact fuelwood saving technology adoption. The adoption of these technologies will trigger a permanent shift in cooking habits towards a lower-carbon path dependency. A comprehensive Capacity Development (CD) strategy (outlined in Chapter 7) will further support the use of the NAMA's full transformational potential.

Successful models that demonstrate sustained adoption of fuelwood saving technologies and raising of fuelwood plantations in Assam will help build the confidence of public and private investors, thus attracting increased investments in future. This will help in scaling up the NAMA interventions under Phase II, the NAMA Expansion Phase.

Subsequently, the NAMA will help build a case for scaling up across India, thus bringing about a deep change in a society that still is heavily dependent on unsustainably sourced fuelwood.The NAMA has the potential to foster transformational changes at three levels – household, state and national level (see Table 6).

Table 6: Transformational Changes by Institutional Levels

Institutional Level	Transformational Change
Household Level	• Long term changes in cooking behaviour in favour of fuelwood saving technologies. • Awareness of health, environmental and economic benefits of fuelwood saving technologies. • Saving in time from reduced fuelwood collection which can be invested in more economically productive pursuits.
State Level	• Institutionalisation of a systemic decision-making tool for preparing localised investment plans for raising fuelwood plantations and deploying fuelwood saving technologies. • Improved inter-departmental and cross-sectoral coordination for investments in fuelwood plantations and deployment of fuelwood saving technologies. • Improved systems to monitor use of fuelwood saving technologies and allied changes in forest cover. • A financial mechanism to invest in deployment of fuelwood savings technologies. • Mechanisms for private sector leverage from tea estates, corporations and individual households. • Improved capacity of government officials, community members and fuelwood saving technology providers. • Targeted communication campaigns for sensitisation of all stakeholders involved across the fuelwood value chain. • Support towards achievement of the Government of Assam's efforts to implement the 2030 Agenda on Sustainable Development and the Sustainable Development Goals (SDGs).[3]
National Level	• Proven methodology to develop a DSS to support region specific development of fuelwood plantation and fuelwood saving technology investment scenarios nationwide. • Proven and replicable model which contributes significantly towards reaching India's NDC target for the forestry sector. • Proven and replicable model to address the most prominent unplanned driver of forest degradation and deforestation in the country. • Proven and replicable model to contribute towards the country's domestic forest policy goals. • Proven and replicable model to contribute towards achievement of the SDGs in India.

2.3 Key Stakeholders

2.3.1 Analysis of Stakeholder Landscape

To identify and visualise the relevant stakeholders for the Forestry NAMA, the actors of the sustainable fuelwood NAMA were classified as veto players, key, primary and secondary stakeholders after extensive multi-tiered consultations and meetings with the stakeholders:

- **Veto players:** Principal stakeholders with decision making powers who have a direct impact on the mitigation activity in question, with authority to direct the momentum of the project.

[3] Vision Assam 2030: Everything for Everyone – Achieving Inclusive and Sustainable Development. Government of Assam, 2016.

- **Key stakeholders:** Stakeholders that directly affect the demand/supply scenario of forest resources or have a strong influence on forestry project activities. They contribute significantly through their direct participation in the forestry NAMA, and are expected to be involved with the NAMA activities throughout. Their support is crucial in achieving the objectives of the NAMA.
- **Primary stakeholders:** these stakeholders can be affected by the results of the NAMA or are influenced by the forestry NAMA directly.
- **Secondary stakeholders:** Secondary stakeholders are temporarily involved or have indirect interest in the actual mitigation activity. Their actions may have an impact on the project. They are involved in different areas like research activities, capacity building and trainings and other forestry extension activities. They are usually organisations with technical know-how, but are not directly affected by the mitigation activities. The dissemination of knowledge regarding the aspects of the NAMA is a very important operation performed by the secondary stakeholders.

Table 7: List of Key Stakeholders for the Sustainable Fuelwood Management NAMA

Organisation (Key)	Affiliation	Area	Veto
Ministry of Environment, Forest and Climate Change (MoEFCC)	Central Government	Administration	V
Assam Environment and Forest Department	State Government	Administration	V

Table 8: List of Primary Stakeholders for the Sustainable Fuelwood Management NAMA

Organisation (Primary)	Affiliation	Area	Veto
Assam Energy Development Agency (AEDA)	State Government	Administration	
Financial Institutions	Public and Private	Financing	
Food, Civil Supplies and Consumer Affairs Department	State Government	Administration	
Fuelwood consumers: Tea estate households	No affiliation	Community	
Labour Unions (Assam Chah Mazdoor Sangha and Others)	No affiliation	Community	
Industry Associations[4]	No affiliation	Community	
Fuelwood consumers: Rural households	No affiliation/CBOs	Community	
Fuelwood consumers: Urban households	No affiliation/CBOs	Community	
Fuelwood consumers: Institutional	No affiliation/CBOs	Community	
Fuelwood consumers: commercial cooking	No affiliation	Industry	
Fuelwood consumers: commercial non-cooking energy	No affiliation	Industry	
Fuelwood consumers: religious	No affiliation/CBOs	Community	
Organisations: Technology Manufacturing	No affiliation	Industry	
Organisations: Technology Servicing	No affiliation	Industry	

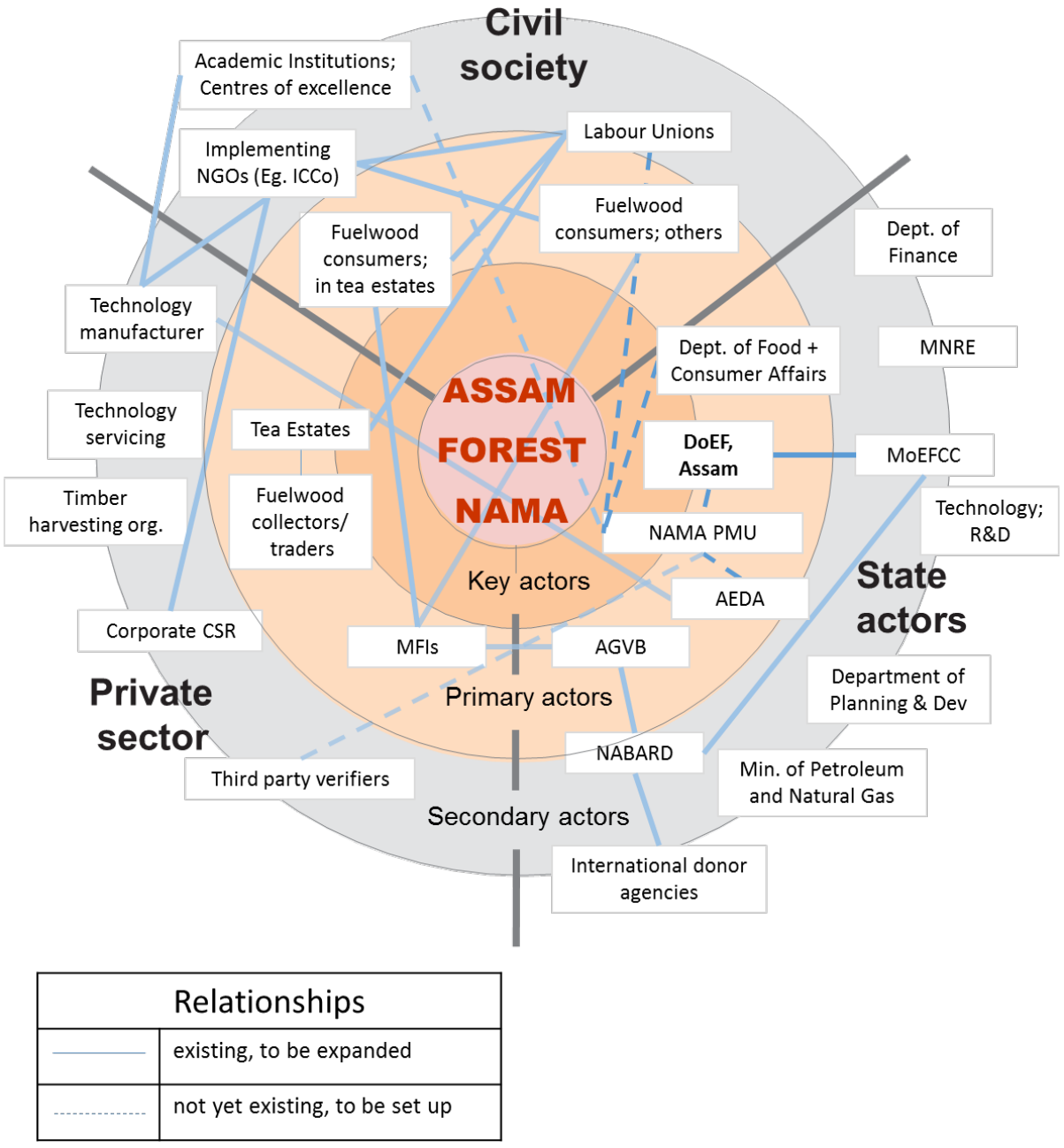
[4] Including tea associations

Table 9: List of Secondary Stakeholders for the Sustainable Fuelwood Management NAMA

Organisation (Secondary)	Affiliation	Area	Veto
Department of Planning and Development	State Government	Administration	
Department of Finance	State Government	Administration	
Department of Agriculture	State Government	Administration	
Department of Horticulture	State Government	Administration	
Department of Panchayat and Rural Development	State Government	Administration	
Farmers practicing agroforestry	No affiliation	CBOs	
Fuelwood collectors	No affiliation/CBOs	Community	
Fuelwood traders	No affiliation	Community	
Timber harvesting organisations	No affiliation	Industry	
Ministry of Petroleum and Natural Gas	Central Government	Administration	
Organisations: Technology R&D	State government, central government	R&D	
Ministry of New and Renewable Energy (MNRE)	Central Government	Administration	
Ministry of Panchayati Raj	Central Government	Administration	
Implementing NGOs (e.g. ICCO)	No affiliation		
Corporates (CSR funding)	No affiliation		
International Donors	No affiliation		

Figure 15 (on the following page) provides an overview of the full set of actors involved in the NAMA, allowing to draw conclusions and formulate hypotheses on the actors' influence on issues addresses in the NAMA and its change objectives. The mapping also highlights the roles played by different actors, providing insights into actual and potential overlap of interests and alliances.

Figure 15: Overview of Stakeholder Mapping



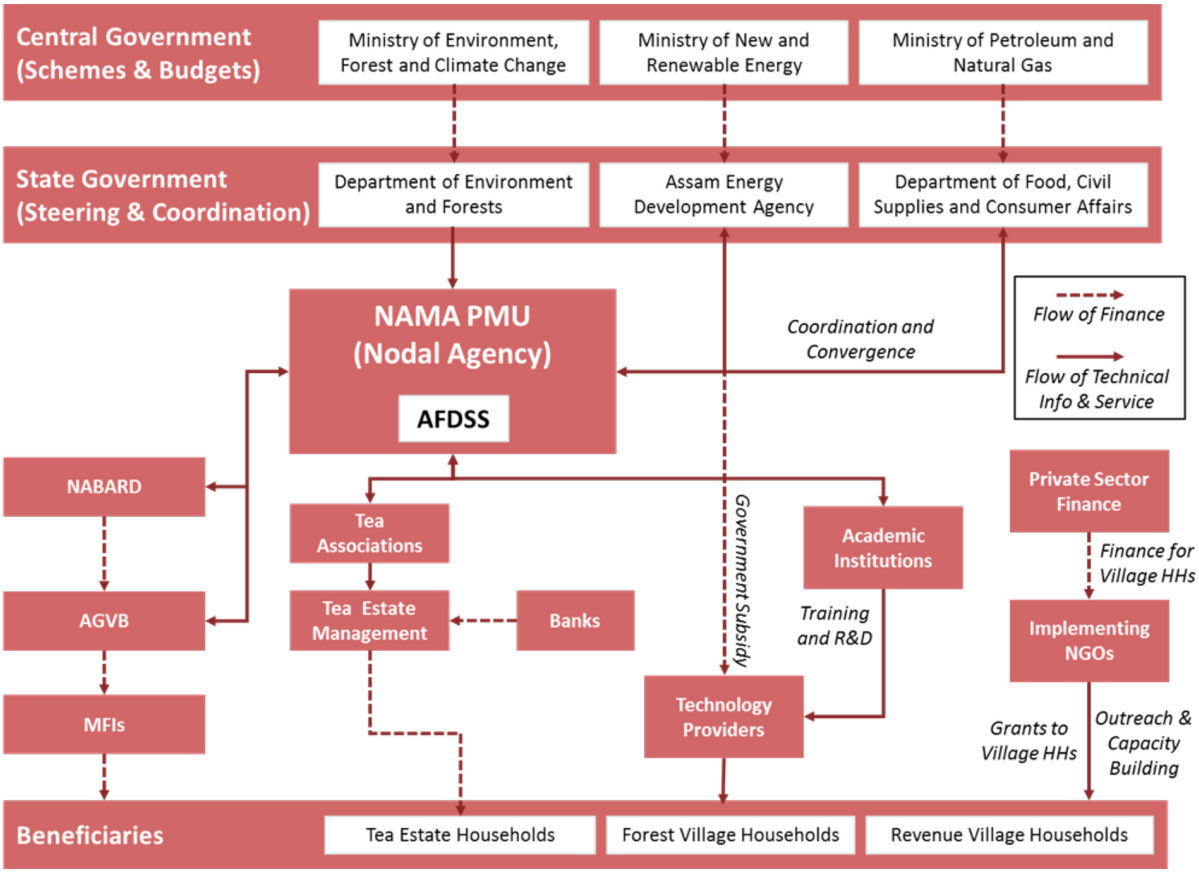
2.3.2 Proposed Institutional Architecture

To provide full support for the implementation of the Forestry NAMA an inter-departmental NAMA Steering Committee (NSC) comprising of relevant agencies involved in designing and implementing sustainable fuelwood management interventions is proposed. The NSC will guide the NAMA Programme Management Unit (PMU) and ensure effective convergence of government initiatives. The Department of Environment and Forest will oversee the constitution and functioning of a dedicated NAMA PMU.

A shift towards scientific investment planning and coordination will go a long way in leveraging and effectively tapping and deploying vast amounts of potential public and private investments.

The following figure presents the proposed institutional architecture for the NAMA Phase I. Based on successful implementation, this architecture can be expanded to meet the needs for implementing Phase II of the NAMA. Further, key stakeholders that will need to actively participate in the NAMA Phase I and their respective key responsibilities are described in the sections below.

Figure 16: Proposed Institutional Architecture for NAMA Phase I



The PMU will coordinate the NAMA's implementation by making sure that a) the required technological input will be provided by appropriate implementation partners and b) the required finance is put at the disposal of the beneficiaries. The PMU will also oversee the establishment and the utilisation of the AFDSS.

Tea Estates

Key actors who are directly involved with tea estates include the estate managers (individual tea estate managers and/or tea company management) as well as the plantation workers.

Tea estate managers are responsible for the overall management of tea plantations, including fuelwood sourcing and supply. These estates are customarily mandated to meet the cooking energy demands of their workers' households by providing free fuelwood. Their specific role in the NAMA Phase I is participation in awareness raising and demonstration campaigns. They are a key actor for investing in fuelwood saving technology as well as the management design and negotiation of an internal loan management system for workers (e.g. monthly deduction from salaries). It is anticipated

that plantation managers can provide data for developing a baseline and supporting MRV implementation.

Tea estate workers in Assam are categorised under three grades, namely permanent workers, sub-staff, and temporary workers. While the permanent workers and sub-staff are eligible to receive certain benefits from the tea estates, including fuelwood allocations, the temporary workers are not eligible to receive any fuelwood allocations. However, they may depend on the tea estate for meeting their fuelwood requirements. The specific role of tea estate workers in the NAMA Phase I includes participating in awareness raising and demonstration campaigns, investing in fuelwood saving technology, and participating in monitoring and reporting.

Rural Village Households

In Assam, 81 per cent (i.e. 4.3 million) of all rural households depend on fuelwood to meet their household cooking needs. These cover households in tea estates, revenue villages and forest villages.

Forest village households exert direct pressure on forests as all their energy needs are met from forest resources. They are therefore a key stakeholder whose specific role within the NAMA Phase I includes participation in capacity development and awareness raising campaigns, the use of JFMCs/EDCs or structured groups to access financial support for upfront investment in fuelwood saving technologies, repayment of the group loans, and the provision of data for the baseline and support of the MRV system implementation. The specific role of revenue village households within the NAMA Phase I will be very similar to that of forest village households. They will participate in capacity development and awareness raising campaigns, SHGs/JLGs from forest villages will purchase fuelwood saving technologies and take on group loans combined with income generating loans to finance technology procurement, they will repay group loans, and participate in developing the baseline and implementing the MRV system.

Government Agencies

The mandate of the NAMA PMU will be to lead the NAMA development, implementation and coordination. Its specific role within the NAMA Phase I will be to host the AFDSS and its operationalisation, develop a baseline, establish and operationalise an MRV system, support communication and capacity development, coordinate with designated financial institutions (FIs), and to coordinate with relevant departments for convergence with NAMA. The mission and mandate of the Department of Environment and Forests (DoEF), Government of Assam, is forest conservation, management and enhancement, as well as the implementation of the National Biogas and Manure Management Programme in Assam (NBMMP). The specific role of the DoEF within the NAMA Phase I will be to oversee the establishment and functioning of the NAMA PMU, convergence of NBMMP implementation with the NAMA, identification of the beneficiaries based on AFDSS recommendations, provision of data for baseline development, and provision of data (specifically ecological data) for the AFDSS. The Assam Energy Development Agency (AEDA) is a state nodal agency for implementing the National Improved Cook Stove Programme (*Unnat Chulha Abhiyan* UCA), and is therefore another key stakeholder. Its specific role within the NAMA Phase I will be to ensure the convergence of UCA implementation with the NAMA, the identification of the beneficiaries based on AFDSS recommendations, coordination with the NAMA PMU, provision of data for the baseline development (e.g. technology performance, technology diffusion rate, adoption rates, etc.), as well as the provision of data for the AFDSS development, especially regarding technology options and socio-economic parameters related to technology diffusion and adoption. The Food, Civil Supplies and Consumer Affairs Department is responsible for the implementation of

the state level programme on LPG deployment in poorest of the poor households – Randhanjyoti Scheme. It is furthermore responsible for the implementation of the national level programme on LPG deployment in BPL households – *Pradhan Mantri Ujjwala Yojana* (PMUY). The specific role of the Department within the NAMA Phase I is to enable the convergence of the Randhanjyoti Scheme and PMUY implementation with the NAMA. It will also identify beneficiaries based on AFDSS recommendations, coordinate with the NAMA PMU, provide data for baseline development (e.g. LPG supply scenario, adoption rates, etc.), and provide data for the AFDSS development, especially regarding LPG supply and socio-economic parameters related to LPG adoption.

Associations within the Tea Industry

The major tea associations, more than 100 years old, were formed to protect the interests of member tea planters. ABITA, TAI and other tea estate associations provide a common platform for tea estate owners and managers to discuss and decide on issues related to tea estate management. These associations play a role in negotiations with the tea estate workers' union on the amount of fuelwood provided every year, or compensation in case fuelwood is not provided. The main role of these associations within the NAMA Phase I will be to help in organising tea estates when it comes to creating awareness among the managers on fuelwood saving technology options and their business case for tea estates. However, the associations will furthermore actively support the tea estates in re-negotiating with the labour union on supporting their cooking energy needs through fuelwood saving technologies, support the baseline development and AFDSS, act as aggregators for monitoring and reporting, and support interested tea estates in accessing finance for upfront investment in new technologies.

Assam Chah Mazdoor Sangha is a trade union for tea workers. They support the workers in obtaining appropriate compensations in the form of wages and other benefits, including fuelwood for meeting their household cooking energy needs. Their specific role within the NAMA Phase I will be to actively support in spreading awareness on fuelwood saving technologies, as well as to support and handhold any last mile connectivity (*antyodaya*).

Academic Institutions

The mission of academic institutions, particularly Tezpur University, will be to support technology research and development. They will serve as incubators of ideas and technology, provide training and can act as testing centres for assessing technology performance. The specific role of academic institutions, as centres for excellence in training and information dissemination, will be to develop local specific technology based on the AFDSS inputs and to assist in extension work.

Non-Governmental Organisations (NGOs)

The mission/mandate of non-governmental organisations (NGOs) will be to support the development and mobilisation of local communities and/or ecosystem conservation. The specific role of NGOs within the NAMA Phase I will be to raise awareness and mobilise communities towards sustainable fuelwood management, to coordinate with the NAMA PMU, companies providing CSR investment and technology providers, to build the capacity of local entrepreneurs for effective NAMA implementation, support SHG/JLGs formation and access to finance, support individual households and local entrepreneurs in accessing finance, and to act as aggregators for monitoring and reporting.

Financial Institutions

National Bank for Agriculture and Rural Development (NABARD) has a mission to 'promote sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives.' Its specific role within the NAMA Phase I will be to act as the National Implementing Entity (NIE) for accessing funding through GCF and also potentially from other international finance sources.

Assam Gramin Vikash Bank (AGVB) has a mission to provide financing in rural areas; it has a coverage of 25 districts with 414 branches and 7 million clients. The role and responsibility of AGVB is linked to its core business – development driven provision of lending capital to rural household or to micro-finance institutes (MFIs) that will further on-lend to households. Under the NAMA it can support financing for households to access fuelwood saving technologies. In addition to this, AGVB will be responsible for investment management and due diligence of group loans mobilised by NGOs, investment appraisal and due diligence of MFIs and provision of (concessional) lending capital for fuelwood saving technologies, risk management and loan monitoring of household groups and of MFIs, development of credit lines, using existing ones, or modifying existing ones for fuelwood saving technology finance, as well as priority sector lending for relevant schemes such as the *Randhanjyoti* Scheme (for Rural Areas). The mission of micro-finance institutions is to provide financial services to low income populations. For the NAMA Phase I, MFIs are expected to lend to rural households to help them acquire fuelwood saving technology. Group lending has been identified as one effective tool to address the issues of small ticket sizes and high default risk; as such, MFIs are a particularly interesting stakeholder for the NAMA.

Technology Providers

The mission of technology providers, as empanelled under the NAMA, is to sell fuelwood saving technologies to all those who are interested in buying it. Their specific role within the NAMA Phase I is therefore to provide fuelwood saving technologies to selected households. The technologies will primarily include ICS, biogas and LPG.

2.4 Co-benefits

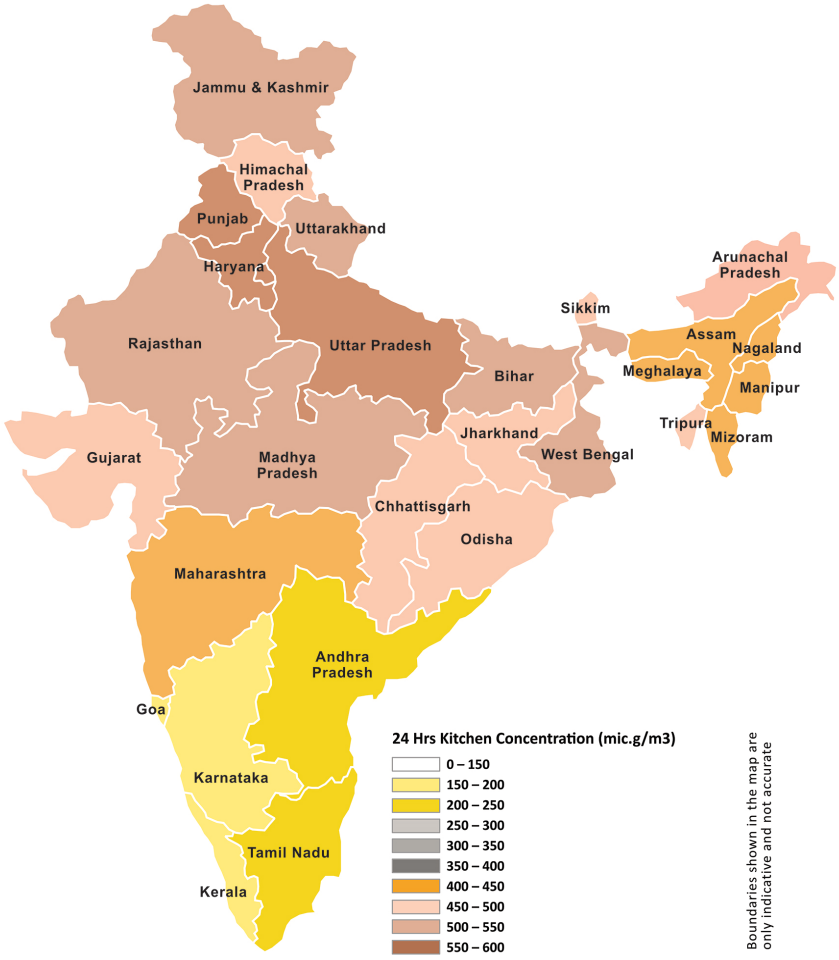
This NAMA is founded on co-benefits to ensure its success. At a household level, the immediate concern might not be decreasing GHG and stopping climate change but financial resilience to changes and health benefits. This NAMA, though a GHG mitigation instrument in the forestry and energy sector which directly contributes to meeting SDG 15 (halt deforestation and degradation) and SDG 13 (Climate Action), also offers immense climate change adaptation benefits apart from other co-benefits. Each of them feed into various elements of the state's SDGs[5]. The two key co-benefits identified as directly having a huge impact through this NAMA are:

- Access to affordable, reliable, sustainable and modern energy for all (SDG7)
- Healthy lives and well-being for all at all ages (SDG3).

[5] Assam is one of the first Indian states to publish state level SDGs with the target of achieving them by 2030.

One of the most significant social co-benefits of this NAMA is *improved health, especially of women and children in the targeted households*, which currently depend on fuelwood-inefficient and polluting cook stoves. The Global Burden of Disease 2010 comparative risk assessment exercise showed that together exposures to PM2.5 around households from use of solid cooking fuels (household air pollution – HAP) plus exposures in the ambient environment (ambient air pollution – AAP) was responsible for approximately 1.6 million premature deaths and 49 million Disability-Adjusted Life Years (DALYs) in India. Added together, HAP and AAP account for 9 per cent of the national disease burden, and comprised the single largest risk factor of the over 60 risk factors examined in the study. In Assam (see figure below), the household estimates of average PM2.5 exposures range between 400-450 $\mu g/m^3$ which is significantly above the current WHO air quality guideline interim targets (WHO-AQG IT-1) of 35 $\mu g/m^3$, or the Indian standard of 40 $\mu g/m^3$ (MoHFW, 2015).

Figure 17: Distribution of 24-hr Average Kitchen Area PM 2.5 Concentrations in Solid Fuel Using Households Across Indian States



Source: (Balakrishnan et al. 2013)

Therefore, adopting fuelwood saving technologies which have emissions below the permissible limits can lead to improvements in human health. In addition, reduced drudgery from fuelwood collection will lead to further health benefits. This could result in further *economic and social benefits for the targeted households* due to increased productivity and quality of life owing to more time available, given the long hours required for collection of fuelwood in the past.

The NAMA would result in conservation of forest ecosystems, which provide vital services to society. It would contribute in *protecting the rich biodiversity of Assam*, part of one of the four global biodiversity hotspots present in India, and allied ecosystem services.

The NAMA MRV system has an in-built monitoring system where parameters on these SDGs also will be monitored in the life of the NAMA.

The State of Assam has published state specific goals, and how NAMA helps achieving the Assam specific SDGs[6] is explained in the table below:

Table 10: NAMA will Help Achieve the State SDGs

Assam State's SDGs	How NAMA Helps Achieve Them
Goal 1 NO POVERTY: End poverty in all its forms everywhere	1. Not being dependent on fuelwood helps in financial resilience in multiple ways: 2. Time saved in collection of fuelwood can now be utilised for livelihood generation activities. In parallel to the NAMA awareness generation, focus also shall be on skill development and enterprise development to make use of available time. 3. Savings in cost connected to ill health due to indoor pollution. 4. Improved access to finance by exposure to micro-finance instruments will motivate people to save money and invest in improving standard of living. 5. Pollution free kitchens also has to power to light the desire for better standard of living, which can push people to strive for better financial management. The CBOs/NGOs involved in monitoring are expected to help in this.
Goal 2 ZERO HUNGER: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	This is closely connected to the points mentioned above as poverty and malnutrition/hunger go hand in hand. Efficient cooking devices and saved time from collecting fuelwood can also encourage people to invest time in cooking using diverse raw materials. Livestock/poultry is one of the livelihood options being promoted to utilise the saved time, which has direct positive effect on decreasing malnutrition/ hunger. This will also help in access to better food for women, who often face the brunt of lack of nutrition.
Goal 3 GOOD HEALTH AND WELLBEING: Ensure healthy lives and promote wellbeing for all at all ages	1. Decreased indoor air pollution, especially for children and women. 2. Decreased burden of travelling distances for collecting fuelwood.
Goal 4 QUALITY EDUCATION: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Adolescent children, especially girls, are often roped in to assist in fuelwood collection. Not having to collect as much fuelwood will free time for children to invest in education.
Goal 5 GENDER EQUALITY: Achieve gender equality and empower all women and girls	Many of the points are already explained on how access to better cooking will go a long way in empowering women. Under the NAMA the formation of women SHGs will be encouraged to facilitate easier access to finance. This will also help in financial equality to a certain extend.

[6] https://www.google.de/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiv1Nv_ucrVAhWJ8RQKHdP9DUcQFggyMAE&url=http%3A%2F%2Fdevalt.org%2FPdf%2FL2_SixThemePdfs%2FAssam%2520Vision%25202030%2520Review.pdf%3FTid%3D425%3FTid%3D127&usg=AFQjCNEFp-DV6ynZ7VLc8cwScpajwj6b5g

Assam State's SDGs	How NAMA Helps Achieve Them
Goal 6 CLEAN WATER AND SANITATION: Ensure availability and sustainable management of water and sanitation for all	The NAMA does not directly help in this goal.
Goal 7 AFFORDABLE AND CLEAN ENERGY: Ensure access to affordable, reliable, sustainable and modern energy for all	This is the central pillar of the NAMA concept – providing safe, clean and affordable energy to all. This document explains in length how this will be achieved.
Goal 8 DECENT WORK AND ECONOMIC GROWTH: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Through the NAMA, people will be trained by AEDA (called 'urjamitras' or energy friends) who will be responsible for manufacture, sale and maintenance of energy efficient cooking devices as well as be part of monitoring. This will also encourage entrepreneurs. Employment will also be generated in the form of energy plantation management.
Goal 9 INDUSTRY, INNOVATION AND INFRASTRUCTURE: Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation	Technology providers will be encouraged to innovate designs based on local conditions and demands. Every district/region will have an incubation centre to promote clean energy and to innovate in technology and manufacture them in the locality itself.
Goal 10 REDUCED INEQUALITIES: Reduce inequality within and among countries	Target will be to improve the standard of living and decrease inequalities.
Goal 11 SUSTAINABLE CITIES AND COMMUNITIES: Make cities and human settlements inclusive, safe, resilient and sustainable	The NAMA attempts to bring energy sustainability in urban and peri-urban regions by decreasing dependency on fuelwood being extracted from forests.
Goal 12 RESPONSIBLE CONSUMPTION AND PRODUCTION: Ensure sustainable consumption and production patterns	One key component of NAMA is ensuring sustainability at supply side of fuelwood. This is to be achieved through a mixture of energy plantations, agro-forestry and homestead plantations. This promotes responsible consumption.
Goal 13 CLIMATE ACTION: Take urgent action to combat climate change and its impacts	Another key pillar of the NAMA; explained in detail in this report on how GHG mitigation will be achieved along with Climate Change adaptation benefits.
Goal 14 LIFE BELOW WATER: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	NAMA does not directly help in this goal.
Goal 15 LIFE ON LAND: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	The third key pillar of the NAMA: to reduce emissions due to deforestation and degradation; and to conserve forests and terrestrial ecosystems.
Goal 16 PEACE, JUSTICE AND STRONG INSTITUTIONS: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	The NAMA does not directly help in this goal.
Goal 17 PARTNERSHIPS FOR THE GOALS: Strengthen the means of implementation and revitalise the global partnership for sustainable development	Establishing an enabling environment is a module under the NAMA, where close collaboration of technology providers, land managers, financing institutes, and beneficiaries will be institutionalised within NAMA PMU. National and international funding for activities will be channelled through this partnership in the PMU, which will also closely monitor the actions to ensure its successful implementation.

Benefits from the NAMA have been categorised into social, economic and environmental benefits which are explained in the following table:

Table 11: Social, Economic and Environmental Benefits of the Forestry NAMA

Category	Benefits
Social	✓ Health benefits for women and children. ✓ Less drudgery in collecting fuelwood, more time for other activities. Can be utilised for income generation activity by women and education in the case of children. ✓ Access to cleaner fuel improves the standard of living. ✓ Women empowerment: access to cleaner cooking ensures that women have a bigger say in the decision making at household level; less burden of energy security on women's shoulders. ✓ Capacity building, skill development
Economic	✓ Time which was spent in collecting fuelwood can be now used for livelihood generation activities. ✓ Employment and income generation for technology R&D, manufacturers, vendors, operation and maintenance staff, monitoring staff. ✓ Saved cost due to health problems arising from indoor pollution. ✓ Sludge from biogas can be used as fertilizer, saved cost on fertilizers.
Environmental	✓ Halt degradation and deforestation. ✓ Sustainable management of forest resources. ✓ Less pollution. ✓ Sludge from biogas can enrich soil nutrients.

3. NAMA Baseline Concept

3.1 Introduction

When establishing a NAMA, the business as usual (BAU) baseline as well as an effective NAMA MRV system and data availability are key considerations. The evaluation of the performance of the intervention vs. the non-intervention scenarios is a key step in establishing a baseline.

The associated emission reduction is the difference between the baseline and actual performance of the intervention measured through the NAMA MRV system. The UNFCCC formulates specific requirements for national performance and benefit system for climate mitigation actions. The convention particularly mandates the application of the IPCC guidelines to measure and report forestry related emissions at the national level. MRV practices such as capacity strengthening, development of accounting guidelines at programmatic and project levels (depending on the specific NAMA option and regional focus) including the increasing recognition of the relevance of approaches to measure increased GHG emission efficiency (i.e. decreased emissions intensity) along value chains, for instance fuelwood need to be developed for the specific national circumstances.

The baseline scenario represents the fuelwood and other fuel consumption practices and its impacts on biomass sources that are most likely to occur in the absence of the NAMA in the geographical region assessed. In general, there are three alternative approaches to characterising a baseline scenario for any project:

- **Option 1** ('no change' or continuation of current practices scenario): The situation in the project area immediately prior to the start of the project is taken as the baseline and it is assumed that this situation would not change throughout the GHG assessment period.
- **Option 2** (extrapolation of historical trends): Recent historical data prior to the start of the project is used to make a projection of trends that would be expected to happen in the project area in the absence of the project. This approach to baseline estimation assumes that the factors driving trends before the project started would continue in the absence of the project.
- **Option 3** (modelling future trends): Data on factors affecting GHG emission trends are used to make a projection of trends in factors (e.g. national policies or investment plans, changes in population, economic activity or other drivers of GHG emissions) that would be likely to happen in the project area in the absence of the project. Modelling future trends involves many assumptions, and should only be used where these assumptions can be justified as robust.

The approach to characterising the NAMA baseline scenario depends on the availability of data and judgment as to its quality. A key principle is that the baseline scenario should be conservative. A baseline scenario is conservative if the methods used to quantify GHG emissions in the baseline do not tend to overestimate baseline GHG emissions and do not tend to underestimate removals of atmospheric CO_2 by carbon sinks in the baseline scenario.

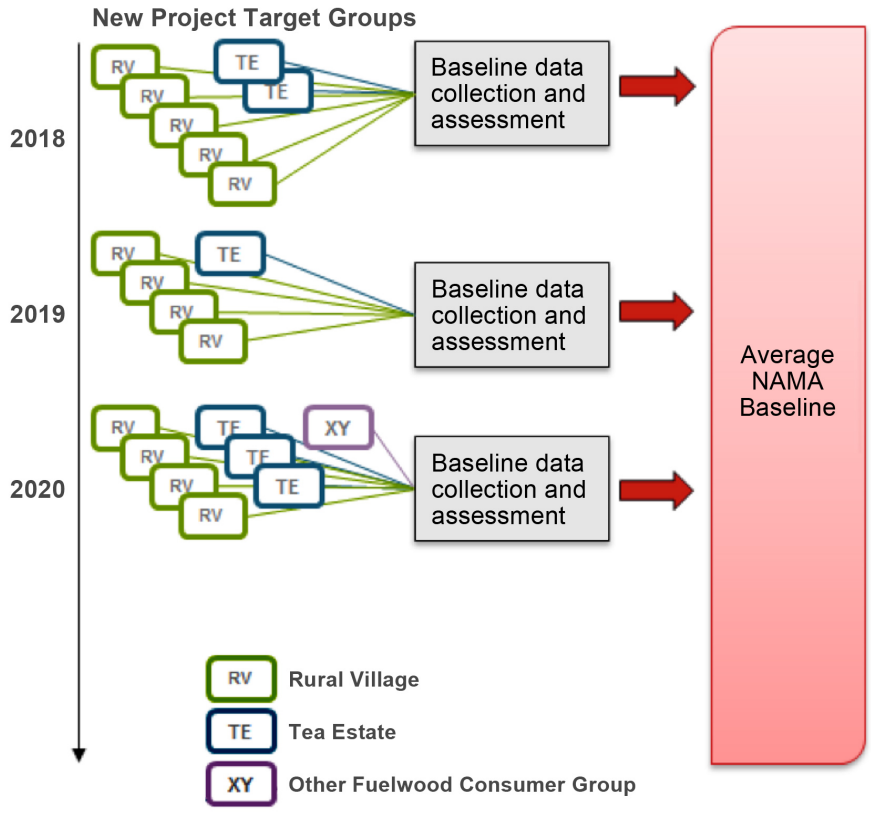
For the Forestry NAMA in Assam a mixed approach is proposed using Option 1 and Option 2: For the component of GHG emissions as a result of fuelwood and other fuel combustion within households covered under NAMA Phase I (in rural villages and tea estates), the 'no change' or continuation of current practices scenario is proposed. However, the demographic trend of population increase and structure of the population has been included.

For the component of carbon stock changes within forests surrounding the fuelwood consumer groups such as forest villages, tea estates and other potential user groups, Option 2 has been selected for the baseline where recent historical trends of deforestation and forest degradation (as well as forest improvement) is used to project future changes in the baseline.

The combined use of these two options is a pragmatic choice driven by the availability of data and judgment as to its quality.

The concept follows development of a baseline in phases. This implies that the baseline will be established in line with the phased implementation approach of the NAMA. As and when each of the fuelwood consumer group will be covered under the NAMA, the baseline concept proposed in this chapter will be implemented and the baseline information and data collected from these groups will be combined with any existing or new groups to derive an average baseline for the NAMA.

Figure 18: Logic of Roll-Based Baseline Concept



Source: UNIQUE

In order to ensure successful implementation of the Forestry NAMA, it is important to establish the baseline and MRV system which will be used to measure baseline emissions as well as the impactful changes due to NAMA implementation. The baseline and MRV concept for the NAMA Phase I will demonstrate how fuelwood consumption for household cooking needs is impacting forests

surrounding tea estates and rural villages. As other fuelwood consumer groups such as *dhabas* – small local eateries – or restaurants are targeted during the NAMA Phase II, the same baseline procedures and assessment will be applied leading always to an updated average NAMA Baseline. In this report, the baseline and MRV concept is proposed and presented for the NAMA Phase I covering two targeted fuelwood user groups, namely tea estate households and rural village households, across 6 districts in the State of Assam.

3.2 Methodological Approach

The scope of the NAMA GHG accounting system and the baseline respectively can be separated into two broad categories:

1. **Accounting Greenhouse Gas Emissions from Fuelwood Saving Technologies**: The amount of GHG emissions reduced can be achieved by deploying fuelwood saving technologies, in order of importance: switching fuel type, improving device efficiency and changing cooking practice (UNF, 2017).

    - **Improving device efficiency** – Device efficiency reflects how much fuel the stove consumes, how effectively it burns the fuel, and how long it takes to cook a meal. GHG emission reductions occur when a stove simply takes less fuel to cook, but also thanks to a more complete combustion of the fuel an efficient stove emits less gases into the atmosphere. In this NAMA the main focus will be on the efficiency of fuelwood used and its reduction due to fuelwood saving technologies.

    - **Switching fuel type** – Emission factors define the amount of GHGs emitted when a particular fuel is burned to produce a given amount of cooking energy. For example, biomass and charcoal emit on average twice as much GHGs as LPG to produce the same amount of cooking energy.

    - **Changing cooking practice** – This is the most complex variable to assess because it varies across households, largely due to differences in daily usage of fire/fuel and variations in kitchen conditions/habits. In the recent past, climate mitigation activities and projects focused on fuel and efficiency as means to control GHG emissions. Now, cooking practice is being increasingly recognised as an additional key element to be assessed because of its impact on health.

2. **Accounting of Greenhouse Gas Emissions by reducing non-renewable biomass sources**: Under this NAMA, it is critical to assess whether fuelwood used for cooking is collected primarily from renewable or non-renewable biomass sources. As outlined in the background chapter, the current situation in India and Assam is that most of the fuelwood originates from non-renewable biomass sources. Theoretically, if biomass is sustainably harvested, GHGs released during fuelwood combustion are considered to be balanced by GHGs absorbed during the growth cycle of the forests and trees where the fuelwood is being collected. Hence, by reducing fuelwood consumption through the NAMA, the amount of deforestation and/or biomass depletion in a region is reduced, thus making them eligible for carbon accounting. In order to establish the non-renewable nature of woody biomass in the geographical areas covered under the NAMA and the logic of reducing non-renewable sources by reducing fuelwood consumption rates as well as alternative energy sources, the following conditions are important to consider and justify in the baseline (UNF, 2017):

- Trends showing an increase in time spent or distance travelled for gathering fuelwood, by users (or fuelwood suppliers), or alternatively, a trend showing an increase in the distance the fuelwood is transported to the targeted area;
- Evidence showing that carbon stocks are depleting in the targeted area;
- Increasing trends in fuelwood prices indicating a resource scarcity;
- Trends in types of cooking fuel collected by users that indicate a scarcity of woody biomass.

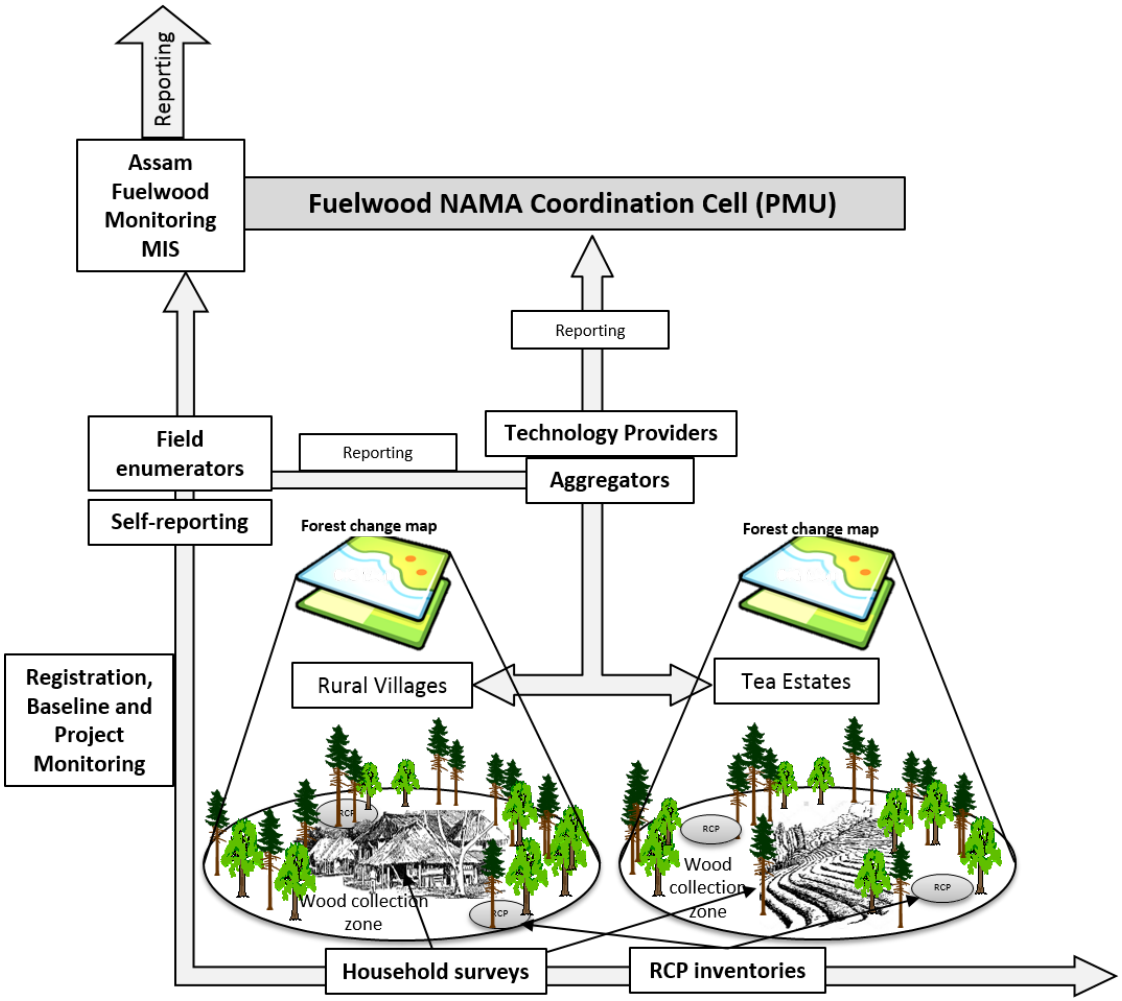
A standard methodological approach is proposed to establish the baseline for each of these two components outlined above and to monitor them over time. It is proposed that this baseline and MRV system will utilise a sub-region specific Management and Information System (MIS) to aggregate data/parameters being assessed in the baseline and monitored during the NAMA implementation.

For each rural village and/or tea estate to be covered under NAMA Phase I, a specific baseline will be established using both activity data (e.g. usage rates for cook stoves, baseline fuelwood consumption etc.) from a sample of households and publicly available data (e.g. efficiency rates for improved fuelwood cook stove types, carbon stock densities from the FSI Carbon Report; etc.).

The proposed NAMA baseline and MRV System will be housed and operated by the NAMA PMU, the coordinating agency for the NAMA implementation.

Implementation, training and extension for the system will be done in partnership with 'aggregators', such as the technology providers themselves or other local institutions such as NGOs or other CSOs at the grass-root level. The proposed web-based MIS represents the central data management, analysis and reporting platform to assess the impact achieved by the NAMA in line with the mandatory core indicators of the overall architecture. This depends on the ultimate financing and institutional architecture of the NAMA. For instance, the core indicators mandated by the NAMA facility, are GHG emissions reduced (M1); number of people directly benefitting from the project (M2); degree to which the supported activities catalyse impact beyond the project (potential for scaling-up, replication and transformation) (M3); volume of public finance mobilised for low-carbon investment and development (M4); and volume of private finance mobilised for low-carbon investment and development (M5).

Figure 19: Overall Structure of Forestry NAMA Baseline and Monitoring System



3.2.1 Registration and Baseline Survey

A central survey system proposed in this NAMA Baseline concept is the Registration and Baseline Survey with the beneficiaries (i.e. targeted fuelwood consumers) of the NAMA such as forest villages, tea estates, etc. During this survey, first of all, the beneficiaries are registered as potential adopters of fuelwood saving technologies and the registration is used to also perform the baseline survey from a sample of these registered beneficiaries. Parameters to be collected under NAMA Phase I would include, among others:

- Household composition - family members
- Baseline fuelwood consumption rates
- Baseline mix of energy sources for cooking and heating
- Baseline types of cook stoves
- Indicators to set up general health conditions in the baseline (pulmonary diseases from particulate matter due to burning fuelwood indoors),
- Distance of the wood collection zone

- Assessment of the relative importance of fuelwood collection within the wood collection zone compared to other uses of timber and forest products

Based on these parameters the baseline for a particular village or tea estate will be developed against which period monitoring surveys will assess the performance related to emission reduction as well as other core indicators such as health. Technically, the registration and baseline survey could be implemented using a customised Android based survey application which can be easily used by the field enumerators. The data collected will be directly synced with web-based Management Information System.

Sampling Size of the Survey

Regarding the sampling size, it is important to bear in mind that it is the spatial variability of a certain parameter such as fuelwood consumption and not the size of the area (size of villages) that determines the sampling size. Despite the fact that there is no specific precision level defined for NAMAs, the sample size (number of households per village/ tea estate) for the baseline as well as subsequent monitoring surveys should be determined based on an assessment of the precision level. As good practice guidance from other land use and energy projects, a precision level of around 10 per cent should be achieved for the key parameters such as fuelwood consumption (UNFCCC, CDM Guidelines, 2015).

The survey should be conducted following simple random sampling approach and the minimum sample size should be based on the following guidance (The Gold Standard, 2013):

- Target population in one village/tea estate < 300: Minimum sample size 30
- Target population in one village/tea estate 300 to 1000: Minimum sample size 10 per cent of group size
- Target population in one village/tea estate > 1000: Minimum sample size 100

The variability of the key parameters can be determined and the required sampling size can be adjusted accordingly. For instance, after calculating the mean value of baseline fuelwood consumption rate within a village and the standard deviation, the spatial variability should be characterised in terms of the Coefficient of Variation (CV) which is the standard deviation of the mean divided by the mean, expressed as a percentage. If the CV is small, the survey can rely on a smaller number of sample households and vice versa.

Once the CV is calculated, the number of sampling households for the survey at a 10 per cent precision and 90 per cent confidence interval, is given by (Willey & Chameides, 2007):

$n = [1.3/10 \times CV]^2$

Where,

n number of sample households needed

1.3 t number of standard deviation needed to achieve the desired confidence level, typically obtained from a t table.

10 allowable error (or uncertainty) in percent, and

CV coefficient of variation in percent.

Other drivers to be analysed in the fuelwood collection areas

Within the fuelwood collection areas, other drivers need to be identified which may also be contributing to deforestation and/or forest degradation. Based on literature reviews and information collected through the baseline survey, the relative importance of drivers of deforestation and/or forest degradation measured against the assumption that harvested wood is being predominantly used for cooking and energy needs. This will in essence tell us what are, if any, other contributors to deforestation and forest degradation in fuelwood collection areas surrounding tea estate and forest villages.

3.2.2 Calculation of GHG Emissions of Fuelwood Saving Technologies

Methodologically this component is straight-forward following typical accounting of carbon project activities under various carbon standards (e.g. CDM, VCS, Gold Standard) that introduce new and improved fuelwood burning cook stoves to reduce the use of non-renewable fuelwood or switch to alternative fuels to meet the thermal requirements for household cooking.

The basic logic of accounting applied is to monitor the reduction in fuelwood used as a result of efficiency gains due to new cook stove technologies and/or higher adoption (usage) rates compared to the baseline consumption of fuelwood in a particular village/tea estate. Therefore, typical baseline and monitoring parameters required relate to activity based household data from periodic surveys of a sample of households from each village in the project.

Following the logic of the roll-out based approach, a village/tea estate registration and baseline survey is conducted for each village entering under the NAMA. Once the village baseline is established, annual technology usage monitoring surveys are required to identify the reduction in fuelwood consumption. As shown in the Figure 19 above, the first survey should be done by trained enumerators, who are part of the NAMA partner organisations (for instance district level forest department staff members). Along with this, the aggregators, such as technology providers or CSOs which are also responsible for the actual implementation and extension activities, conduct the surveys as part of their interactions with village households. Ideally, to create self-learning structures and ownership among the target villages and tea estates, a system of self-reporting will be established where households periodically report on the required parameters to the MIS system of the NAMA.

The baseline scenario is the consumption of non-renewable fuelwood to meet cooking needs at the household level. The NAMA scenario is the adoption of fuelwood saving technologies by the beneficiaries in the six districts covered under NAMA Phase I to meet cooking needs at the household level. Different types of activities will be introduced, creating multiple implementation scenarios for the NAMA. This will be relevant based on the number of technology providers which currently occupy this sector.

The resulting change(s) would demonstrate the impact of the NAMA in terms of the fuelwood reduction achieved due to adoption of fuelwood saving technologies at the household level and how it impacts carbon stocks within forest resources surrounding the villages covered.

Improving Device Efficiency

Emission reductions (ER_{NAMA_EFF}) of this component will be calculated for year y using the following equation:

$$ER_{NAMA_{EFF},y} = \sum_{0\ to\ 1}^{x\ to\ y} N_{P,y} \times P_y \times U_{P,y} \times \left(f_{NRB,y} \times EF_{b,fuel,CO2} + EF_{b,fuel,non-CO2}\right) \times \left(1 - DF_{b,Stove,y}\right)$$

Where:

$N_{P,y}$ Number of NAMA fuelwood saving technologies of each age group operational in year y. Assessed through periodic (annual monitoring) at household level as well as based on the annual sales records; Unit: # of devices

P_y Quantity of fuelwood saved in tonnes per household in year y. Estimated indirectly based on baseline consumption and change in efficiency of cook stoves; Unit: average tonnes per hh in year y

$U_{P,y}$ Usage rate for fuelwood saving technologies in year y, based on adoption rate and drop off rate revealed by monitoring surveys Unit: fraction

$f_{NRB,y}$ Fraction of biomass, used in year y for baseline scenario, which can be established as non-renewable.

$EF_{b,fuel,CO2}$ CO_2 emission factor of fuelwood that is substituted or reduced.

$EF_{b,fuel,non\text{-}CO2}$ Non-CO_2 emission factor of fuelwood that is substituted or reduced.

$DF_{b,Stove,y}$ Usage of baseline cook stove during year y in NAMA scenario; Unit: fraction

Determination of quantity of biomass saved - P_y

Determination of the quantity of fuelwood that is saved will be done using the following equation:

$$P_y = B_{b,y} \times \left(1 - {}^{\eta_b}/_{\eta_{p,y}}\right)$$

Where:

$B_{b,y}$ Quantity of fuelwood consumed per household in the baseline scenario during year y. Derived as an average for each village/ tea estate using the registration and baseline survey; unit: tonnes per household per year

$\eta_{p,y}$ Efficiency of the NAMA fuelwood saving technologies in year y; unit: fraction

With reference to methodological guidance of GOLD and CDM Standards, $\eta_{p,y}$ is estimated as follows:

$$\eta_{p,y} = \eta_p \times \left(DF_\eta\right)^{y-1} \times 0.94$$

Where:

η_p Efficiency of fuelwood saving technologies (fraction) determined at the start of the NAMA implementation. Secondary data sources which show WBT results from different stove types will be used to determine different efficiencies (specific manufacturers will also have publicly available data regarding different cook stove models).

DF_η Discount factor to account for efficiency loss of NAMA fuelwood saving technologies per year of operation (fraction). The default value for this parameter is 0.99 i.e. 1 per cent efficiency loss/year.

0.94 Adjustment factor to account for uncertainty related to fuelwood saving technologies efficiency tests

η_b Efficiency of the baseline cook stove being replaced. A default value of 10 per cent shall be used if the replaced cook stove is a three stone fire, or a conventional device without a grate or a chimney i.e. with no improved combustion air supply or flue gas ventilation; unit: fraction

The fuelwood consumed in the baseline $B_{b,y}$ will be considered as the estimated average annual consumption of fuelwood per household in tonnes/year. This value will be derived using the registration and baseline survey.

Switching Fuel Type

This category comprises activities to displace the use of non-renewable biomass by introducing alternative fuels such LPG or biogas. Emission reductions of this component will be calculated for year y using the following equation:

$$ER_{NAMA_{SW},y} = B_y \times f_{NRB;y} \times NCV_{biomass} \times EF_{projected\ fossil\ fuel}$$

Where:

B_y Quantity of woody biomass that is substituted or displaced in tonnes

$f_{NRB,y}$ Fraction of biomass, used in year y for baseline scenario, which can be established as non-renewable.

$NCV_{Biomass}$ Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne)

$EF_{projected\ fossil\ fuel}$ Emission factor for the substitution of non-renewable woody biomass

B_y is calculated as the product of the number of appliances multiplied by the estimate of average annual consumption of woody biomass per appliance (tonnes/year); this will be derived from the baseline survey.

3.2.3 Village Based GIS Analysis of Historic Carbon Stock Changes Within Forested Fuelwood Collections

The baseline will be the change in carbon stocks in the forests that is attributed to extraction of fuelwood in an unsustainable manner that would have continued in the absence of the NAMA. To establish a cost efficient baseline for each village and tea estate, a rapid and user-friendly forest cover change procedure has been developed using publicly available data sets. The logical steps are summarised below:

- As part of the registration and baseline survey, the wood collection zone has to be assessed as a buffer around the villages/tea estates where the majority of fuelwood is being collected from forests. Based on literature, a typical zone ranges around 5 km in the surrounding of the village households (Pandey, 2002). For the same zone, also other timber and wood uses need to be assessed in order to understand the relative importance of fuelwood collection on wood extraction from any forests within this zone. This will be done through rapid appraisals and key informant interviews. This area is designated as the 'core fuelwood collection zone' and needs to be clearly delineated.

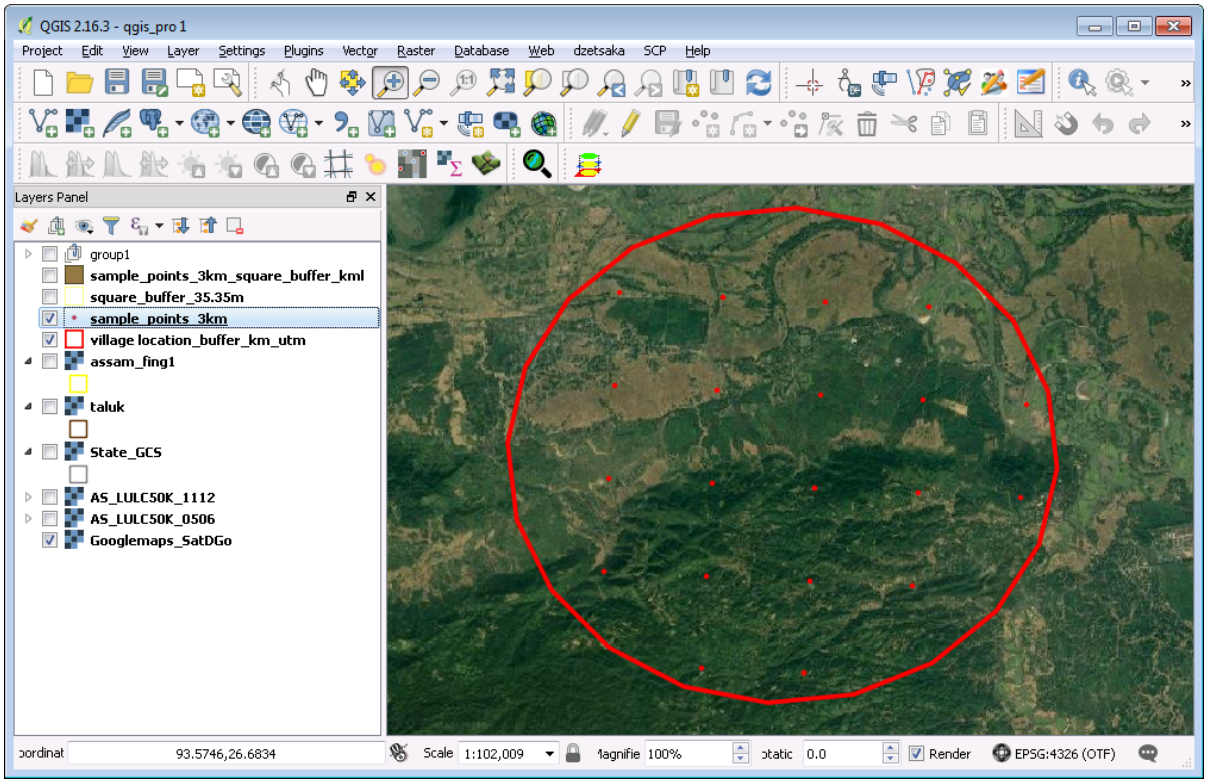
- For this zone, a forest cover change analysis will be done following the standard operating procedure elaborated for this project. The forest type and crown cover classification corresponds to the national/state level classification used in the FSI and the notified forest boundaries.
- Above ground biomass and associated carbon stocks from the latest FSI carbon report (Forest Survey of India, 2009) will be assigned to the corresponding forest type and crown cover classes for each year of the assessment in order to assess the change in carbon stocks for the wood collection zone representing the baseline for a particular village. This approach ensures consistency and comparability of different village and tea estate baselines in Assam irrespective of region or district.
- During implementation of the NAMA, the forest cover analysis will be periodically repeated in order to assess changes compared to the baseline. In addition, a set of randomised control plots (RCP) are established within the wood collection zones in order to verify changes in forest resources and to establish and verify the link between the NAMA activities and the forest cover changes (see chapter 5 on MRV).

To assess the land cover change (deforestation and forest degradation), normally wall to wall mapping using remote sensing images such as Landsat and RapidEye are used. Considering the in-house capacity of organisations to perform image analysis is not always feasible due to time and cost constraints, a quick land cover and change analysis is proposed using a statistical approach by analysing sample points and extrapolation to the fuelwood collection zone of a village/tea estate as well as the entire area covered by the NAMA (the sum of all collection zones in a particular year). In the proposed method we use Quantum GIS, Google Earth and Open office (freeware) as well as Excel for exporting data into a table format.

The area for assessment will be the core zone of fuelwood collection, as an example a buffer of 5 km around the village boundary or tea estate. The exact radius of this collection zone will be individually established for each village/tea estate after the baseline survey where this core fuelwood collection zone is assessed.

The first step is creating a regular sample point grid over the area covered under the NAMA; in QGIS set the distance between the two sample points to make sure there will be at least 25-30 samples in this zone.

Figure 20: Boundary of a 5 km Wood Collection Zone Around a Forest Village with Regular Sample Point Grid

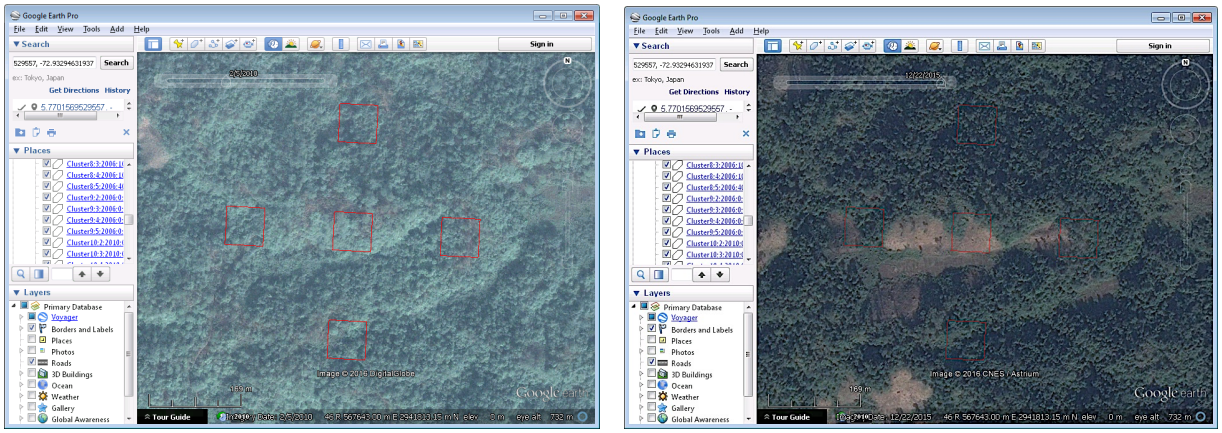


An area of 0.05 ha (based on the UNFCCC definition of forests in India) around each sample point will be analysed. The shape of the area for analysis around the sample point can be circular or square which will be further called sample plots. For the historic forest cover and land use change Google Earth has features to view historic images (depending on availability) with a slider which will be used to compare the land cover in two different time periods. Before continuing to Google Earth for further analysis, it is also recommended to analyse the sample plots on Land Use Land Cover (LULC) maps prepared and published by Indian National Remote Sensing Centre (NRSC). The recent NRSC LULC map(s) are published in 2005-06 and 2011-12 at 1:50,000 scale using Indian LISS-III images. The LULC maps follow the national forest type classification i.e. evergreen, semi-evergreen, deciduous and scrub forest. Using these classifications, deforestation can be analysed. However, forest degradation in terms of forest crown cover loss is not possible with these datasets, therefore this component can be done with Google Earth.

Analysing the sample plots in Google Earth, users have to follow the standard in writing observations on land/canopy cover for each sample plot. For example, let's say a sample plot has 100 per cent canopy cover in 2006 and 70 per cent in 2010 within a natural forest class. All sample plot analysis will be exported to Excel using QGIS software, for the actual land cover change (deforestation and forest degradation) analysis.

A detailed operational manual is presented below in the Annex, which outlines a step-wise procedure for analysing sample plots using Google Earth developed specifically for this NAMA.

Figure 21: A Cluster of Sample Plots (0.05 ha each) Assessed for Land Use, Forest Type and Crown Cover Changes Between 2010 (left) and 2015 (right)



3.3 Key Data Sources and Parameters

This section presents the recommended data sources for establishing the baseline in this NAMA, the fuelwood saving technology adoption as well as the carbon stock change assessment within wood collection zones. Further, the indicators and parameters assessed during the baseline and monitoring survey are presented, which can be integrated in an Android based survey app. An advanced version of this app has been developed as part of the tool box which is ready for field testing. Finally, the required parameters to estimate baseline emission and NAMA emission reductions are introduced along with proposed default values if local values are not available.

The following key reference sources are used as normative references for the methodological approach:

General methodological guidance:

- 2006 IPCC Guidelines for National Greenhouse Gas Inventories: http://www.ipcc-nggip.iges.or.jp/public/2006gl/;
- GHG Protocol for Project Accounting: http://www.ghgprotocol.org/standards/project-protocol/;
- The Policy and Action Standard: http://ghgprotocol.org/policy-and-action-standard/;

Specific guidance for accounting:

- The Gold Standard Simplified Methodology for Efficient Cook stoves: http://www.goldstandard.org/sites/default/files/documents/gs-simplified-micro-scale-cookstove-meth-2013.pdf;
- UNFCCC CDM Small-scale methodology - Switch from non-renewable biomass for thermal applications by the user: https://cdm.unfccc.int/methodologies/DB/9LFOR81TCT5FLI1AJYP46CQY8O2J79;

Next, the data sources to perform the GIS based historical analysis of carbon stock changes within wood fuel collection zones around forest villages and tea estates is presented:

- Since the use of the open source GIS software package QGIS is described in the procedure, QGIS can be downloaded: http://www.qgis.org/en/site/;
- National Remote Sensing Centre (NRSC) – Indian Geo-Platform of ISRO: http://bhuvan.nrsc.gov.in/gis/thematic/index.php;
- Google Earth (2017), download desktop version: https://www.google.com/earth/;
- Forest Survey of India Report 'Carbon Stocks in India's Forests'; chapter 5 'Forest Carbon Stock in States' to retrieve carbon stock densities for forest types in Assam. Click: http://fsi.nic.in/carbon_stock/chapter-5.pdf;

Indicators and parameters collected during the household based registration and baseline survey:

The table below summarises all parameters which will be collected during the household based registration and baseline survey. The same survey is applicable as any new fuelwood consumer group are included under the NAMA. Also, once the baseline is established this survey will be periodically repeated, now representing the monitoring survey. This survey is designed as a multiple impact baseline and monitoring survey, it therefore also includes indicators and parameters used to assess non-carbon impacts such as health impacts as well as providing information to set up the Assam Fuelwood Decision Support System. The survey will be implemented using the Android based survey app designed for the NAMA. Response categories outline the response structure of the survey app.

Table 12: Parameters and Response Categories for the Registration and Baseline Survey

Data/Parameter	Response Categories
Surveyor Name	Open entry
Survey Date	Date selection
District Name	Drop down list of districts
Type	Drop down list of fuelwood target groups, e.g. forest villages, tea estates
Fuelwood target group Name	Open entry
Name of Respondent	Open entry
Contact No	Open entry
GPS Location	Semi-automatic (pressing GPS 'button')
Respondent relationship with Head of the family	Self, Wife, Daughter, Son
Social Group	General, Schedule Cast, Schedule Tribe, Other backward caste (OBC)
Male family members	Open entry
Female family members	Open entry
Adults in family	Open entry
Children in family	Open entry
Main occupation of household	Permanent Labour to Tea Estate, Temporary Labour to Tea Estate, Agriculture/farmer, Government employee, Livestock Rearing, Fisher folk, Seasonal labour/Migrants, Micro Enterprise, Daily labour
Main Source of Fuel for cooking	Leaf/straw, Wood, Cow dung, kerosene, electricity, LPG, fuel efficient stoves, biogas
Fuel Arrangement	Self-collection, Provided from Tea Estate Management, From local market

Data/Parameter	Response Categories
Primary cooking device type	3 stone stove, Clay cook stove, Improved cook stove, electricity, LPG, Kerosene stove, other
Secondary cooking device type	3 stone stove, Clay cook stove, Improved cook stove, electricity, LPG, Kerosene stove, other
Cooking device other	Open entry
Cooking place	Indoor, Open/ outdoor, semi-open
Do any family members suffer from any chronic disease caused by air pollution?	Chronic Obstructive Pulmonary Disease (COPD), Ischaemic Heart Disease (IHD), Lung Cancer, Stroke, None
Do any children suffer from any chronic disease caused by air pollution?	Pneumonia, None
Wood used as fuel	Yes, no
Major source of fuel wood?	Home garden, Tea Estate, Trees on agriculture land, Village Woodlots, Forests
Wood collection zone unit	Km, hours
Wood collection zone distance	Open entry based on unit selected
Wood quantity unit	Kg, Backload small, backload big, Bunch, Sticks, Bags
Wood quantity assessed time period	Day (24 hours), Week, Month
Wood quantity used	Open entry based on units selected
Major tree component	Cut down live tree, Cut down dead tree, Branches from live tree, Branches from dead tree, Dead wood lying on ground, Not known, from market
Primary cooking device used on average over 24 hours	Open entry
Secondary cooking device used on average over 24 hours	Open entry
LPG used as fuel? any other target group	Yes, no
LPG quantity unit	Kg, Cylinder small, Cylinder medium, Cylinder big, Other
LPG quantity assessed time period	Day (24 hours), Week, Month
LPG quantity used	Open entry based on units selected
Kerosene used as fuel	Yes, no
Kerosene quantity unit	Kg, litre, other
Kerosene quantity assessed time period	Day (24 hours), Week, Month
Kerosene quantity used	Open entry based on units selected
Additional demand side data required for supporting the AFDSS	
Commercial fuelwood users in study area	Yes, no
Total number of commercial users in study area	Open entry
Institutional fuelwood users in study area	Yes, no
Total number of institutional users in study area	Open entry
Estimate of domestic fuelwood users in study area	Drop down list of per cent categories
Other fuelwood consuming activities	Yes, no
Which other fuelwood consuming activities?	Heating water, indoor space heating, NTFP processing, agri-processing
Quantity consumed of other fuelwood consuming activities	Open entry based on selected units above for cooking
per cent of total households engaged in other fuelwood consuming activities	Drop down list of per cent categories
Extraction of small timber from the same fuelwood collection zone	Yes, no

Data/Parameter	Response Categories
Use of small timber extracted from the same fuelwood collection zone	For fencing, For constructions, For implements, For furniture
Wood quantity unit	Kg, Backload small, backload big, Bunch, Sticks, Bags
Wood quantity assessed time period	Week, Month, Year
Wood quantity used	Open entry based on units selected

The following table lists all parameters to be determined as part of the calculation of GHG emissions of fuelwood saving technologies, as shown above; default values and sources of these are provided which can be used if no local values are available.

Table 13: Data and Parameters to be Determined to Estimate GHG Emissions of Clean Cooking

Data / Parameter	Data Unit	Description	Source of Data
$EF_{b,fuel,CO2}$	tCO_2/ tonne of fuelwood	CO_2 emission factor from fuelwood use in baseline scenario	1.747 tCO_2/tonne of fuelwood, IPCC default values, table 1.4 of chapter 1 of Vol. 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories
$EF_{b,fuel,\ non\_CO2}$	tCO_2/ tonne of fuelwood	Non-CO_2 emission factor from fuelwood use in baseline scenario	0.455 tCO_2/ tonne of fuelwood, IPCC default values, table 1.4 of chapter 1 of Vol. 2, 2006 IPCC Guidelines for National Greenhouse Gas Inventories
n_b	Fraction	Efficiency of cook stove being used in baseline scenario	10 per cent default can be used unless local information is available
n_p	Fraction	Efficiency of the fuelwood saving technologies being used in the NAMA scenario	Determined based on literature review of existing stoves or information from technology providers involved in the NAMA
$f_{NRB,b,y}$	Fractional non-renewability	Non-renewable status of fuelwood during the monitoring period	CDM default value of 86 per cent for Nepal can be used in Assam: https://cdm.unfccc.int/DNA/fNRB/index.html
$B_{b,y}$	Tonnes fuelwood per household per year in the baseline	Quantity of fuelwood consumed per household in the baseline scenario during year y	Derived as an average for each village/tea estate using the registration and baseline survey

3.4 Assumptions, Limitations and Management of Uncertainties

This section refers to the indicative establishment of the baseline for three different scenarios presented in section 3.6. It presents the default assumptions and default values used to establish the baseline and to ex-ante estimate potential emission reductions from both components, GHG emission reductions from fuelwood saving technology adoption as well as reducing the impact on carbon stock depletion within collection zones as a result of reduced fuelwood consumption rates. This assessment covers the households in rural villages and tea estates which will be covered under NAMA Phase I.

In addition, a discussion on uncertainties and how to manage uncertainty in the frame of the proposed core survey instrument – the registration and baseline survey – is discussed in more detail.

3.4.1 Assumptions and Default Values to Establish Baseline and Ex-Ante Estimation of Emission Reductions

Establishing the Geographical Boundary

For NAMA implementation, it is important to establish the geographical boundary to assess the impact of each intervention undertaken. Apart from the actual location of the fuelwood saving technology adopters, an assessment of the fuelwood collection area(s) is required where at least 90 per cent of the fuelwood is collected/produced. These areas will be the focus of analysis for tracking changes in carbon stocks based on fuelwood extraction and the resulting changes in canopy cover. Tentatively, a radius between 5 km and 8 km is proposed for such collection areas (Pandey, 2002). The proposed areas will be adjusted in the case that the registration and baseline survey reveals that this size is not suitable for areas surrounding tea estates and villages i.e. maximum distance individuals are willing to travel for fuelwood collection.

Forest areas in India and Assam are largely inhabited by tribal groups (Sonowal, 2007). The Ministry of Tribal Affairs provides a list of Forest Villages (FV) for each State on its website. According to this, there are 2,474 forest villages/habitations spread over 12 States in India. In Assam, presently there are 499 forest villages (Ministry of Tribal Affairs, 2017). This figure includes forest villages as well as so-called *taungya* habitations[7], however, it is based on a forest department census in 1984. In 2001, a general census revealed 564 forest villages (Sonowal, 2007). In a spatial dataset downloaded from National Remote Sensing Agency which shows all village boundaries as of 2001, the number of villages specified with acronyms F.V. and T.E. indicating forest villages and tea estates showed a total number of 171 forest villages and 757 tea estates in Assam. Another source indicates 830 tea estates in Assam based on the 2011 census (Goverment of India, 2015).

Six districts have been selected for NAMA Phase I, namely Cachar, Dibrugarh, Kamrup, Kokrajhar, Nagaon, and Sonitpur The table below summarises the indicative number of forest villages and tea estates within the six districts including demographic information based on the general census information in 2001 (Sonowal, 2007) and, in case of tea estates, based on communication with the forest department of Assam during field missions. The Nagaon district included here reflects the old district before it was bifurcated.

Table 14: Statistics of the Six Districts for NAMA Phase I

District	# Tea Estates	# Forest Villages	Total Households	Total Population
Cachar	58	79	11,986	58,733
Dibrugarh	155	24	35,183	172,399
Kamrup	2	70	6,629	32,481
Kokrajhar	4	164	39,453	193,317
Nagaon	21	32	8,299	40,665
Sonitpur	62	39	20,640	101,135
Total for Six Districts	302	408	122,190	598,730

[7] Taungya is a modified method of shifting cultivation, initiated by Dr. Brandis in the end of 19th century, in which people are permitted to raise crop in an area along with the forest species. Traditional taungya consists of land preparation for tree plantation, growing agricultural crops for 1 to 3 years after the tree plantation and moving on to another area to repeat the cycle.

The maps below display the locations of the six districts and exemplarily show locations of some forest villages and tea estates in these districts which were analysed in terms of carbon stock changes within fuelwood collection zones.

Figure 22: State Map with Selection of the Six Pilot Districts (for NAMA Phase I)

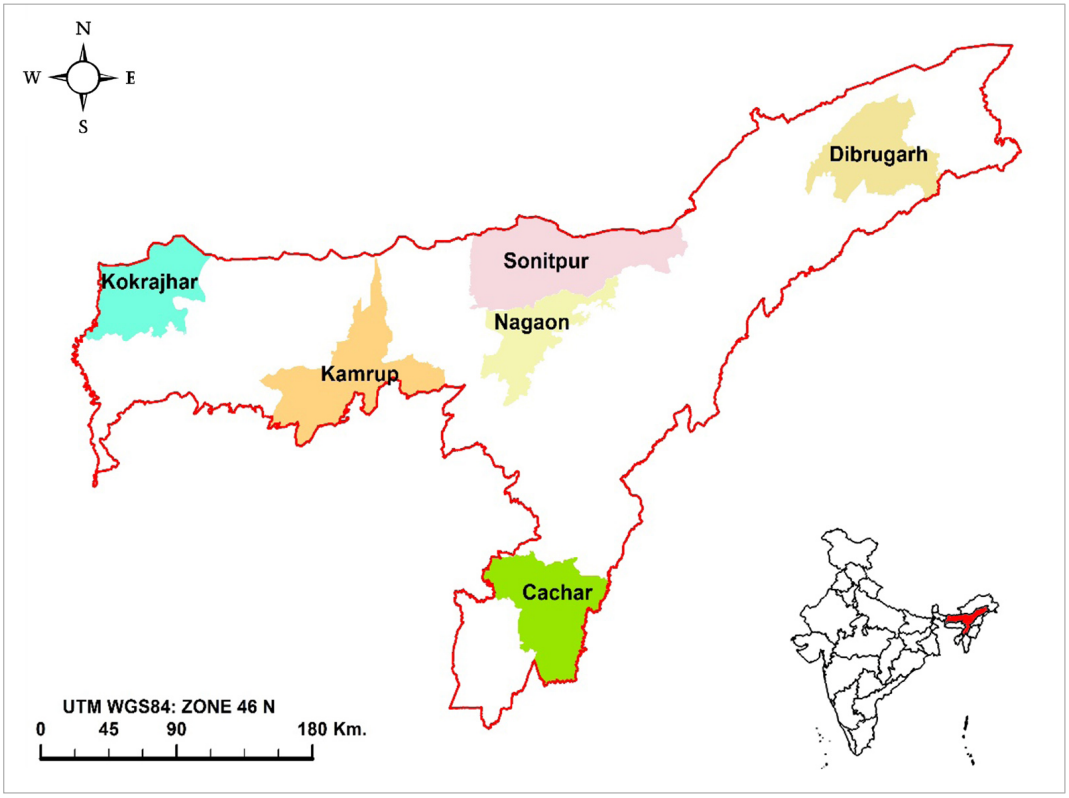


Figure 23: Forest Villages and Tea Estates in Cachar District

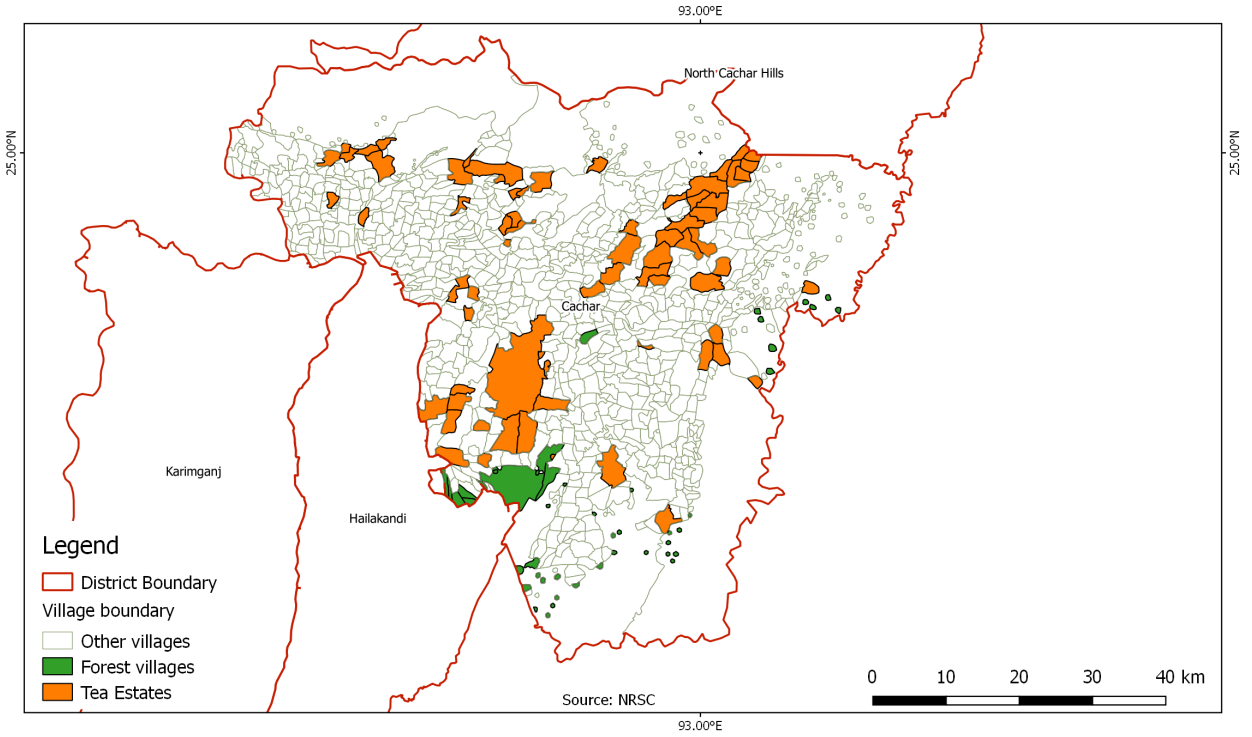
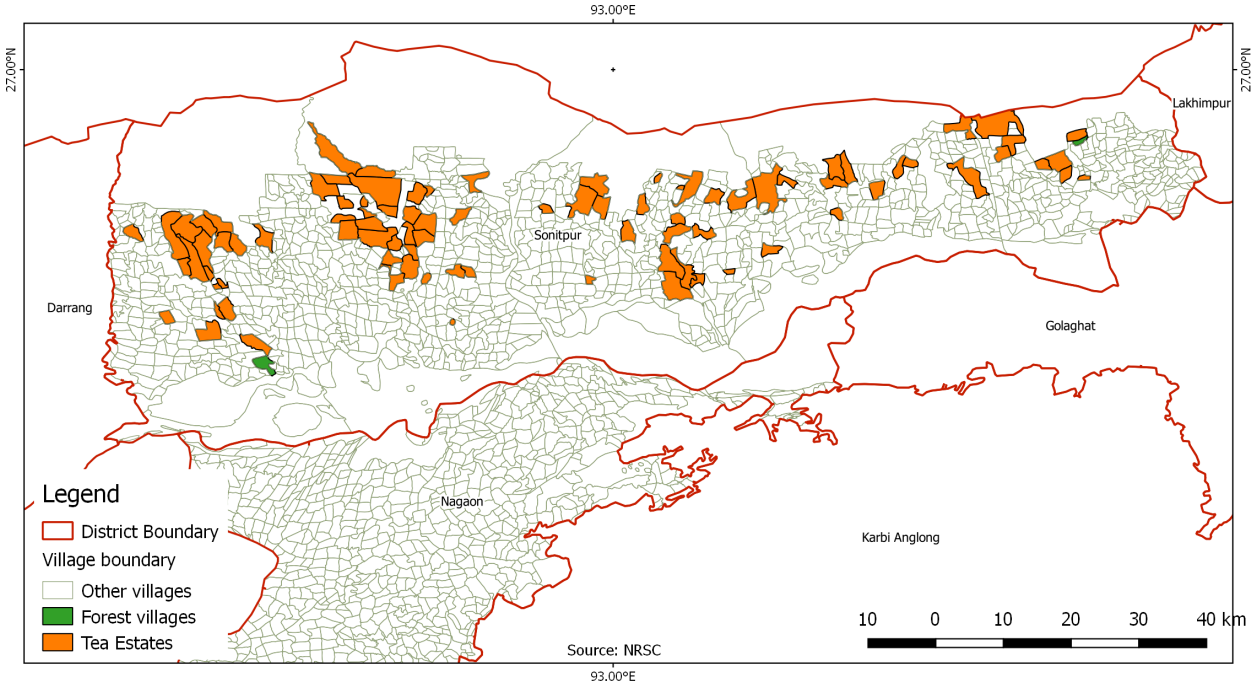


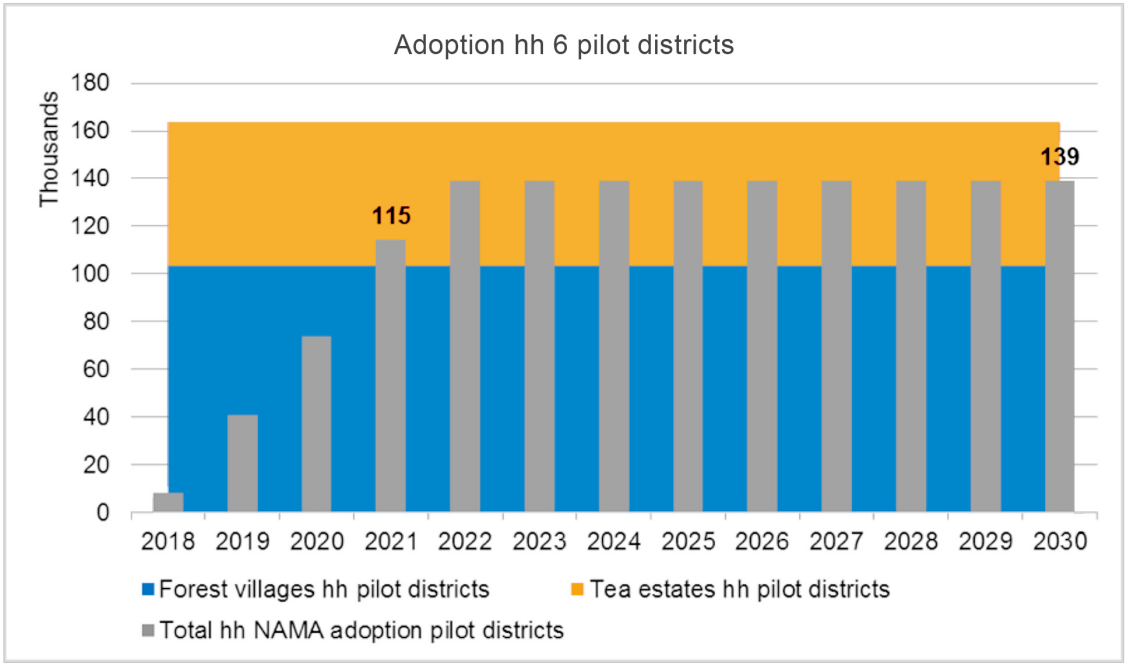
Figure 24: Forest Villages and Tea Estates in Sonitpur District



The baseline scenario projection as well as the ex-ante estimation of potential emission reductions is presented from 2018 to 2030, i.e. 13 years. For this period, a population trend analysis was included based on a projection of the historical trend 2001-2011 of 1.58 per cent increase per annum for Assam (Goverment of India, 2015). This trend was projected from 2001 to determine the expected population statistics in 2018. For establishing a conservative estimation, the population trend is not considered for the assessment period 2018–2030.

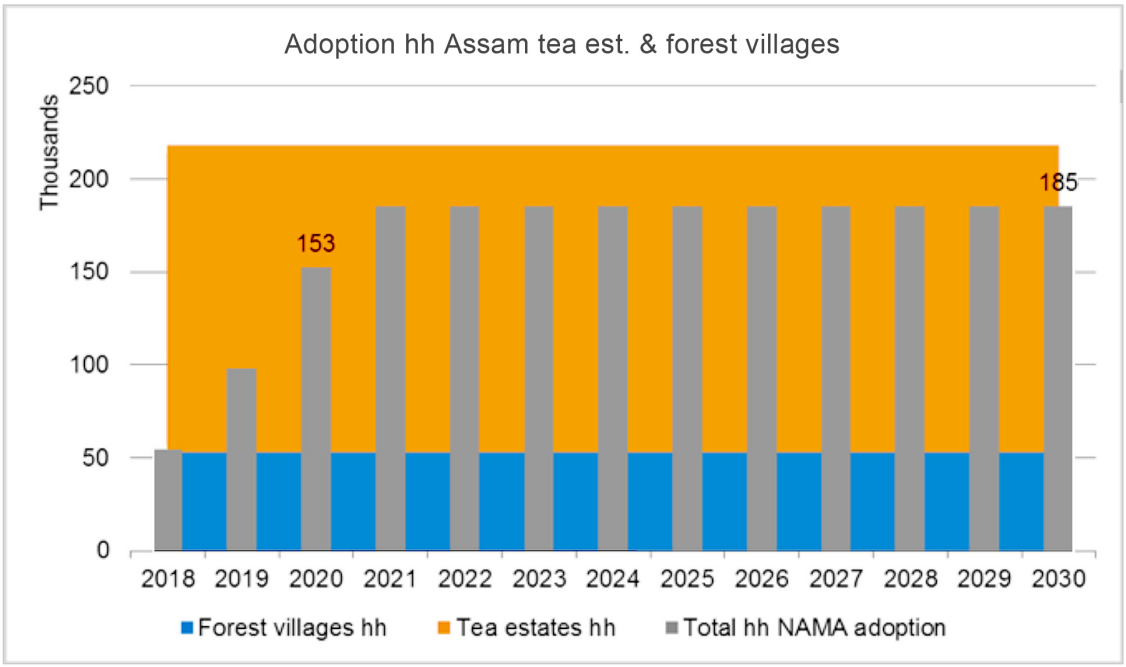
Next, the adoption rate of fuelwood saving technologies (fuelwood efficiency as well as fuelwood substitution) has been assessed during field missions in Assam and stakeholder consultations. Generally, a 5-year roll-out period of implementation is considered until 85 per cent of the households targeted within the villages and tea estates have adopted fuelwood saving technologies. The adoption rate is 5 per cent in year 1, followed by 25 per cent, 45 per cent, in year 2 and 3 and 85 per cent from year 6 onwards. Three different baseline and ex-ante NAMA scenarios are presented depending on the total targeted households: (1) rural villages and tea estates within the 6 pilot districts targeting around 160,000 households; (2) rural villages and tea estates within the total state targeting around 220,000 households, and (3) targeting around 5.8 million households in Assam (predominantly rural) dependent on fuelwood. In this third scenario a lower adoption rate is assumed with around 1 million of the targeted households (17 per cent) adopting the recommended fuelwood saving technologies after five years of implementation. The charts below display the three scenarios with the targeted households in forest villages (blue) and tea estates (orange) and their adoption in view of population trends.

Figure 25: Scenario 1 – Forest Villages and Tea Estates in 6 NAMA Phase I Districts



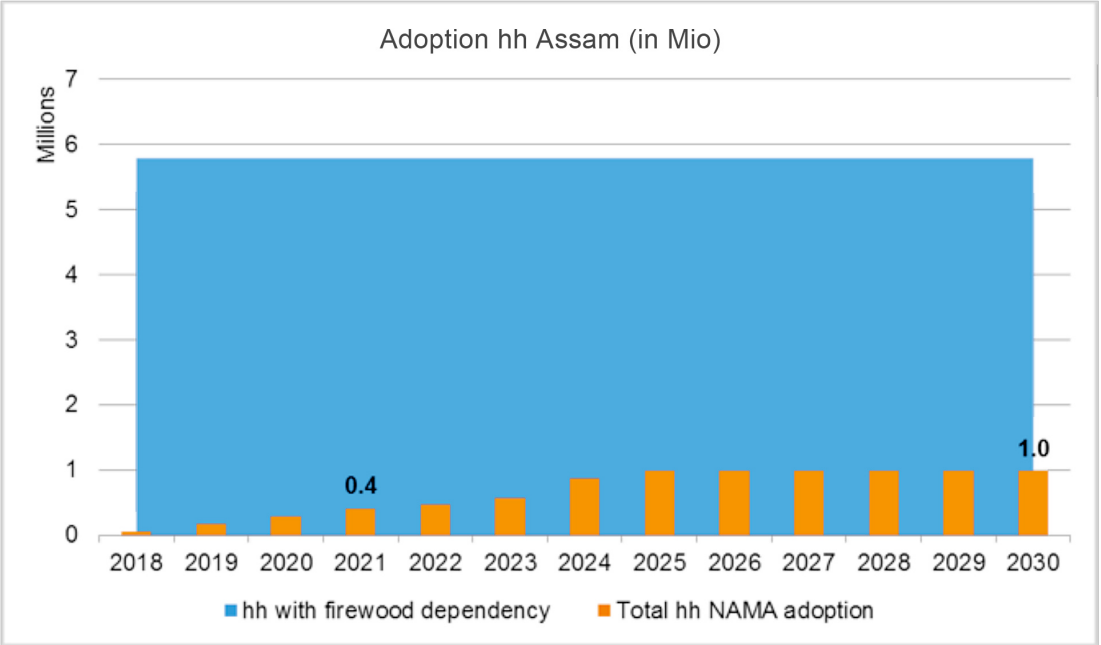
In this first scenario, it is assumed that after the roll-out period of five years 139,000 households are adopting fuelwood saving technologies as a result of the NAMA implementation.

Figure 26: Scenario 2 – Forest Villages and Tea Estates in Assam



In the second scenario, 185,000 households are adopting fuelwood saving technologies as a result of the NAMA implementation.

Figure 27: Scenario 3 – Fuelwood Dependent Households in Assam



In the third scenario, 1 million households are adopting fuelwood saving technologies as a result of the NAMA implementation.

Assumptions for Estimating Emissions Related to Fuelwood Saving Technology Adoption

To establish the baseline and estimate ex-ante emission reductions from adoption of fuelwood saving technologies for the three scenarios, a set of assumptions and default values is used with the equations introduced earlier. With reference to the baseline method, the 'no change' or continuation of current practices scenario is assumed for these assumptions and default values.

Baseline:

- Baseline annual fuelwood consumption: A value of 2.5 tonnes per household per year was used (Ministry of Statistics and Programme Implementation, 2014).
- Net Calorific Value (NCV) of fuelwood: 0.0156 TJ/tonnes based on table 1.2, chapter 1, volume 2, IPCC GPG (IPCC, 2006)
- fNRB: 86 per cent representing the CDM default value for Nepal was applied
- Emission Factor of fuelwood: 112 tCO_2/TJ based on table 1.4, chapter 1, volume 2, IPCC GPG (IPCC, 2006)
- Applying these default values, the baseline emissions due to combustion of fuelwood per household equates to 3.8 tCO_2 per household per year.
- Only emissions from fuelwood are considered in the baseline since the existence of alternative fuels in the baseline for cooking is assumed to be insignificant.

Ex-ante estimation of NAMA scenario:

- Based on a conservative assessment of previous studies and projects in India as well as stakeholder consultations in Assam the following technology mix of potential and feasible clean cooking options is assumed: Improved efficiency of cook stoves (ICS) adopted by 63 per cent of households; substitution of fuelwood using biogas adopted by 23 per cent of households; and substitution of fuelwood using LPG adopted by 14 per cent of households.
- Emission factor of Biogas: 54.6 tCO_2/TJ based on table 1.4, chapter 1, volume 2, IPCC GPG (IPCC, 2006)
- Emission factor of LPG: 63 tCO_2/TJ based on table 1.4, chapter 1, volume 2, IPCC GPG (IPCC, 2006)
- Based on stakeholder consultation and expert opinions, the fuelwood reduction as a result of adoption of ICS is assumed 50 per cent. This results in NAMA emissions due to combustion of fuelwood using ICS of 2.2 tCO_2 per household per year, a reduction of 42 per cent
- For those households adopting LPG, the NAMA emissions result in 2.4570 tCO_2 per household per year, a reduction of 35 per cent compared to the baseline.
- For those households adopting biogas, the NAMA emissions result in 2.1294 tCO_2 per household per year, a reduction of 43 per cent compared to the baseline.
- In addition, for the households adopting biogas, a reduction of methane emissions is also included in the NAMA scenario using a default value for NCV of biogas of 0.0504 TJ/tonnes. This results in additional emission reductions of 3.4 tCO_2 per household per year using a GWP of 25 for methane (IPCC, 2006).

Assumptions for estimating emissions and removals related to carbon stock changes within wood collection zones

Baseline:

Following the methodology presented above and the operational procedures presented in section 1, a sample of 6 forest villages and tea estates were randomly selected within the six districts to be covered under NAMA Phase I to assess the historical trend of carbon stock changes within the core wood collection zone. This historical trend was then used as baseline scenario projected from 2018 to 2030.

- For identification of the spatial location of each of these samples the dataset from NRSC was used.
- For each of these samples, a wood collection zone with a radius of 5 km from the centre of the village/tea estate was established and clusters of ground-truthing samples of 0.05 ha each (based on the definition of forests in India) were analysed using Google Earth images 2005 and 2016 to identify overall changes in forest types as well as changes in crown cover according to the national FSI crown cover classes dense forests (>70 per cent), medium-dense forests (40-70 per cent) and open forests (10-40 per cent).
- Altogether, 2,836 of such ground-truthing samples were analysed.
- Next, aboveground (AGB) carbon stock densities (tC/ha) for Assam from the FSI Carbon Report (Forest Survey of India, 2009) were assigned to the individual forest classes and crown cover classes. The AGB values for scrub forests and barren land was taken from the results of a landscape scale biomass baseline survey of these land uses in the frame of the Araku Valley Livelihoods

Project (see PD: http://www.vcsprojectdatabase.org/, page 40). The carbon densities for cropland was derived from a recent publication (Zomer, et al., 2016).

- By calculating the weighted average carbon stock densities in 2005 and 2016, the historic change is assessed for this 10-year period.
- The results of the land use and forest type cover changes in per cent of the 5 km wood fuel collection zone, and the estimation of the overall average carbon stocks (in tC/ha) for the years 2005 and 2016 are presented below. It is assumed that the fuelwood collection zone in the surroundings of forest villages and teas estates covers an area of 7,854 ha based on a radius of 5 km.

Table 15: Assessment of Land Use/ Forest Cover and Carbon Stock Changes in the Six Districts (Period 2005-2016)

Forest Types	Area in 2005 (ha)	Area in 2016 (ha)	AGB Carbon densities (tC/ha)	Weighted av. AGB C stock density 2005 (tC/ha)	Weighted av. AGB C stock density 2016 (tC/ha)
Plantation VDF	740	503	28.16		
Plantation MDF	187	158	22.50		
Plantation OF	334	249	12.70		
Deciduous forest VDF	1,090	1,061	21.09		
Deciduous forest MDF	275	334	19.43		
Deciduous forest OF	492	525	11.69		
Evergreen forest VDF	1,355	1178	33.58	17.9	16.8
Evergreen forest MDF	342	371	19.58		
Evergreen forest OF	612	583	7.72		
Scrub forest	53	75	6.8		
Barren	53	187	6.8		
Cropland	2,149	2,543	9		
Water body	172	87	0		

- Based on this assessment the historic carbon stock change is -0.395 tCO_2/ha/year; or on average -3,101 tCO_2/year for one fuelwood collection zone.
- Based on this, the baseline scenario for the next 13 years from 2018 until 2030 was extrapolated.

Ex-ante estimation of NAMA scenario:

- Ex-ante estimation of impacts of reduced fuelwood consumption on biomass resources within fuelwood collection zones with a predicted causal relationship is highly uncertain. Almost no studies exist which could be used for establishing this relationship. To avoid double counting, the reduction of fuelwood consumption rates (50 per cent reduction assumed, see above) has not been considered as reduction of extraction rate from forests.
- However, there is evidence that all logging activities cause damage to residual trees. A Logging Damage Factor (LDF) is used which accounts for the damage of tops and stump of the felled trees, plus trees incidentally killed or severely damaged surrounding the logging gap (Pearson T. R., Brown, Murray, & Sidman, 2017).
- The LDF factor of 0.57 tC per m^3 extracted timber for Asia was selected (Pearson T. R., Brown, Murray, & Sidman, 2017)

- Per capita consumption of fuelwood in Assam is 358 kg/year (Ministry of Statistics and Programme Implementation, 2014) which is 0.45 m^3/capita/year using an average wood density of 0.79 kg/m^3 for Assam (Kaul, Dadhwal, & Mohren, 2009)
- Based on the population trend analysis (see above) and the average fuelwood collection area of 7,854 ha, this results in an average per capita area of impact (to collect this 0.45 m^3) of 6.4 ha.
- It is conservatively assumed that the damage caused specifically through fuelwood extraction is 35 per cent of the LDF (Pearson T. R., Brown, Murray, & Sidman, 2017)
- Based on this, it is assumed that the damage caused by extracting fuelwood is 0.15 tCO_2/ha/year within a fuelwood collection zone.
- The NAMA reduction of this damage caused is assumed to be conservatively 20 per cent
- This results in a reduction of the overall degradation rate within one fuelwood collection zone to -2,868 tCO_2/ha/year compared to -3,101 tCO_2/ha/year (baseline).
- For scenario 3 with rural fuelwood dependent households adopting NAMA activities in Assam, a total of 26,395 villages (Goverment of India, 2015) was considered as potentially to be targeted.
- Based on these assumptions, the ex-ante estimation of the project scenario for the next 13 years until 2030 is extrapolated

3.4.2 Managing Uncertainties

When referring to the assumptions made to establish the baseline and estimate the ex-ante emission reduction of both components, it becomes clear that the major source for uncertainties are the different parameters required to assess activity data. Emission factors for emissions of combustion processes, GWPs, etc. are well-established and defined also for regions like Assam.

Activity data, such as fuelwood consumption, number of households adopting, number and types of fuelwood saving technologies, use rates of these technologies on a daily basis are all activity data which will only be available with verifiable evidence once the baseline survey is rolled out and repeated as monitoring survey throughout the NAMA's lifetime.

The establishment of the baseline carbon stock changes in fuelwood collection zones is straightforward using official and publicly available datasets. However, to establish the causal relationship and possible impacts within the forests as a result of fuelwood reduction also requires the survey data on characteristics of extraction. To monitor the impacts with a higher level of certainty, monitoring of forest resources in the NAMA through establishment of Randomised Control Plots (RCP) within the wood collection zones becomes inevitable.

In the following, potential sources of uncertainties and errors during the baseline and monitoring survey are discussed including ways to manage uncertainty.

Managing Uncertainties of the Baseline and Monitoring Surveys

Assessing and managing uncertainties would require to first identify the sources of uncertainties along the household based data collection of the registration and baseline surveys and the monitoring surveys. Typically, two concepts of uncertainty need to be distinguished:

- The quantitative uncertainty analysis is dealing primarily with random errors based on the inherent variability of the household energy systems and fuelwood collection and the finite sample size of the survey itself.
- In contrast to this, systematic errors may arise because of imperfections in the concept, the calculations applied, or just the survey and measurement techniques applied during implementation of the surveys.

Therefore, starting at the field level the survey procedures need to be analysed with regard to random errors associated with the sampling and monitoring design. The table below illustrates the statistical quantification requirements for quantitative data collected in the field through the baseline survey using the Android based survey app.

Table 16: Minimum Statistics Required for Fuelwood Consumption Rates (Illustrative Values)

Parameter	Number of Sampled Households	Mean Value	Standard Deviation	Standard Error of the Mean
Wood quantity used	122	2,434 kg/hh/year	1200 kg/hh/year	4 per cent

As a general guidance, the uncertainty, expressed as standard error of the mean, should be quantified and reported for each survey performed. Compared to typical carbon offsetting projects, which require normally uncertainties below 15 per cent, this NAMA has no specific uncertainty requirements. Nevertheless, the guidance from project standards such as CDM, VCS or Gold Standard could be followed for those parameters which drive the emission reduction impacts. Also, these standards provide guidance on how to discount estimated emission reductions if uncertainties are higher, see for instance page 28 of the CDM AR Tool 'Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/RCDM project activities' (https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v4.2.pdf)

Systematic Errors - the Interview Situation

Social empirical science distinguishes a set of potential error sources prevalent during any kind of questionnaire based surveys. Errors need to be recognised in order to be mitigated in the survey design. In general, the principle aim is to collect the 'true' value of a required parameter and to represent the whole 'population' (e.g. all households). Systematic errors have to be identified within the surveying procedure. These potential errors can be classified according to the cause, namely the respondent himself, the questionnaire design, the interviewer, and the environment or specific circumstances under which the interview is taking place.

- **Characteristics of the respondent:** The personality of the respondent will influence the survey. The respondent will be naturally biased by societal desires and norms. The respondents might use certain response sets, giving answers more or less independently from the actual content of the questions. Particular relevant is the 'say-yes' tendency with regard to deterministic questions (yes/no). This response set is often related to limited communication abilities. The presence of pretended or actual non-attitude (viewless) is also often generating errors. This attitude might be ex-pressed either as refusal of response (or indicating lack of knowledge) although the respondent does have a clear knowledge; or are response is given even though there is no knowledge at all.
- **Questionnaire design:** An optimal questionnaire design/ reporting format would result in a common understanding of the questions among all respondents. However, the formulation of the questions leads to different understandings and, in a worst case, to non-comparable responses.

Furthermore, influence on the response is caused by the order of questions as well as different categories of answers (items) sometimes given for each question. This predefined set of answers resembles a reference system against which the own response will be reasoned. The order of questions needs to be considered since during the survey particular responses are influenced by preceding questions.

- **Characteristics of the interviewer:** Every interview during the survey must be seen as a social situation with involvement of the respondent and the interviewer. Therefore, besides the effects mentioned above, the response might be influenced by the presence of the interviewer. In this respect, manifested and latent characteristics of the interviewer must be considered. The manifested or visible behaviour of the interviewer influences course of the interview. The way the question is articulated (literally vs. paraphrasing) is influencing the answer. In addition, gender, age, behaviour etc. will influence the answer. Latent or non-visible attributes of the interviewer with some influence include the experience in interviewing, the social status, the literacy and cognitive abilities and expectations of the interviewer. One important strategy to cope with these effects is to employ a highly experienced, heterogeneous group of interviewers. The latter will reduce biased answers related to gender or age.
- **Circumstances (environment) of the interview:** Major influences of the particular circumstances under which an interview will be conducted include the so-called sponsorship effect and the presence of persons other than the respondent and the interviewer. In combination with the effect of social desirability, the initiator of the survey (the project proponent) certainly raises expectations among the respondents and influences the responses. Ideally, the surveys should not be conducted with presence of other persons since this would create a form of social control mechanism for the respondent. In reality, it might be nearly impossible to exclude family members from the interview situation. As a rule, if this is not possible to avoid, it must at least be documented.

Pretesting & retesting the survey

When discussing the potential effects mentioned above in light of the survey design, there are certainly some effects which are less likely to occur than others. Since the household members are not requested to share their opinions on any sensitive issues, effects such as non-attitude are of less importance than, for instance, the influence the interviewer has considering the social desirability and sponsorship effect, his manifested and latent characteristics in combination with the 'yes' tendency among the respondents. In order to check the reliability of the reported parameters, a two-stage strategy is envisaged, namely (1) pre-testing and (2) retest monitoring.

Pretesting:

A pre-test is absolutely compulsory in order to check the quality and reliability of the questionnaire. 'If you don't have the resources to pilot test your questionnaire, don't do the study.' Besides this qualitative testing, the size of the sample can be determined based on the variance calculated from this pilot or pre-testing. To summarise the main tasks of the pre-testing include:

- Test the questionnaire design in an iterative process
- Check the wording of the questionnaire (clarity of questions)
- Calculate the variance (standard deviation) of certain parameters
- Check and identify all difficulties and potential errors sources during the interview situation

According to social science literature, the sampling size of the pre-test should be between 20 and 50 respondents. The selection of respondents should represent the project specific conditions, i.e. from different climate zones, different strata such as forest villages as well as from tea estates.

The interviewers should be trained in conducting face-to-face interviews. Social science theory proposes various methods to validate the elaborated questionnaire during the pre-testing. For the survey, a three-phased pre-test procedure is proposed using different techniques:

- **Standard pre-test and observation**: The elaborated questionnaire (using the survey app) will be tested in the same way as the actual survey, and no additional questions or comments (comprehension questions, etc.) are allowed. During the interview, the interviewer should carefully observe and briefly document all reactions and comments by the respondent as a result of the questions.
- **Follow-up probing**: In a second step, the interviewer will repeat each of the relevant questions of the survey including the answers/parameters provided. In addition, the interviewer has to pose supplementary questions to assess the understanding of the questions and to discover the process of information gathering (train of thought). One technique to assess the comprehension of questions is paraphrasing, i.e. the interviewer is asking the respondent to repeat the question in his own words. Another possibility is to ask the respondent to explain some technical terms mentioned in the questions. If such questions reveal that there is some kind of misunderstanding or misinterpretation, it is important to further identify possible causes of these issues. A technique to discover the process of information finding of a particular parameter, the interviewer could apply the so-called 'retrospective think aloud' method, where the respondent is asked to repeat his chain of thoughts in answering a particular question.
- **General probing**: Each interview will be concluded with a general round of discussion with the general request to name other issues and problems the respondent experienced during the interview. Likewise, this also includes that the respondent should also describe any uneasy feelings he experienced.

A detailed pre-testing protocol for each interview needs to be recorded for the subsequent analysis. The analysis should be carried out in a participatory way in group sessions among the project coordinator and all interviewers who will be responsible for the actual survey later on. The result should be a revised questionnaire which proofs to be valid and reliable with regard to the required parameters and which minimises all potential sources of error mentioned above.

Retest monitoring:

The retest monitoring serves to control potential bias of the survey over the lifetime of the project. It will be checked that the persons being interviewed within the frame of the survey do not receive special treatment with regards to training and adoption of selected project practices. Therefore, it is envisaged to select 10 per cent of the survey sample size. Having selected the households for retest monitoring, the survey will be conducted among them considering all steps and quality safeguards described above. In the event of a significant deviation of the results compared to the regular survey data, a sensitivity analysis with all survey samples is required. The households with extreme deviations from the retest results should be identified and replaced with new sample households. This could imply to increase the overall sample size or, and in an extreme case, that all sample households must be replaced with new ones.

3.5 Description of Measures to Avoid Leakage and Double Counting of GHG Mitigation

Leakage

Based on the CDM Methodologies 'Thermal energy production with or without electricity' (https://cdm.unfccc.int/methodologies/DB/JSEM51TG3UVKADPA25IPUHXJ85HE8A) and 'Energy efficiency measures in thermal applications of non-renewable biomass' (https://cdm.unfccc.int/methodologies/DB/DCO8WRRQVTGLH1GHQBCL035F5M13R8) leakage within a project needs to be considered under the following conditions:

- If clean cooking devices currently being utilised outside the project boundary are transferred to the project activity, then leakage is to be considered
- Project activities switching from baseline device using firewood to efficient project device using charcoal or switching from firewood to efficient project device using briquette shall take into account the leakage effects related to the charcoal or briquette production.
- In cases where the collection, processing and transportation of biomass is outside the project boundary and due to the implementation of the project activity biomass are transported over a distance of 200 kilometres, CO_2 emissions from the collection, processing and transportation of biomass to the project site shall be taken into account as leakage using with the latest version of the tool 'Project and leakage emissions from transportation of freight' (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf)
- Leakage emissions on account of the diversion of biomass from other uses (competing uses) shall be calculated as per the 'General guidance on leakage in biomass project activities' (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-16-v7.0.pdf)
- Leakage related to the non-renewable woody biomass saved by the project activity should be assessed based on ex post surveys of users and the areas from which this woody biomass is sourced. The potential source of leakage due to the use/diversion of non-renewable woody biomass saved under the project activity by non-project households/users that previously used renewable energy sources shall be considered. If this leakage assessment quantifies an increase in the use of non-renewable woody biomass by the non-project households/users, that is attributable to the project activity, then the baseline fuelwood consumption rate is adjusted to account for the quantified leakage. Alternatively, the value of fuelwood reduction in the project is multiplied by a net to gross adjustment factor of 0.95 to account for leakages, in which case surveys are not required.

Double Counting

To avoid double counting of emission reductions it is recommended that each fuelwood saving technology be issued with a unique identification or serial number. This allows each of them to be identified as belonging to the NAMA. The serial numbers of each installed technology are recorded in the centralised NAMA MIS, which will be programmed to not allow for repeat entries to be made.

3.6 NAMA Baseline and Ex-Ante Emission Reductions and Removals

First the baseline and ex-ante NAMA emission reductions for three different scenarios are presented followed by the emission reductions as a result of reduced fuelwood extraction impacts within collection zones.

3.6.1 Emissions Related to Fuelwood Saving Technology Usage

Based on the assumptions made above, the baseline emissions and ex-ante NAMA emission reductions of fuelwood saving technologies is presented for the three scenarios. In each table first the baseline emissions are shown followed by the emissions in the NAMA scenario. Column 3 presents the direct emissions reductions (NAMA minus Baseline). The additional reductions of methane emissions are displayed in column 4 for those households switching to biogas. The total ex-ante emission reductions from 2018 to 2030 is presented in the last column.

3.6.1.1 Scenario 1: Forest Villages and Tea Estates in Six Districts Covered Under NAMA Phase I

Table 17: Baseline and Ex-Ante Estimation of Fuelwood Saving Technology Adoption within the 6 Districts Covered under NAMA Phase I (Scenario 1 – Forest Villages & Tea Estates)

Year	Baseline emissions – annual (tCO_2e/yr.)	NAMA scenario emissions – annual (tCO_2e/yr.)	Fuelwood consumption emission reduction (tCO_2e/yr.)	Emission reduction from methane combustion (tCO_2e/yr.)	Total annual emission reductions (tCO_2e/yr.)
2018	614,958	602,296	12,662	324	12,986
2019	614,958	551,652	63,307	8,103	71,409
2020	614,958	501,007	113,951	26,253	140,204
2021	614,958	437,701	177,258	63,526	240,783
2022	614,958	399,717	215,241	93,668	308,909
2023	614,958	399,717	215,241	93,668	308,909
2024	614,958	399,717	215,241	93,668	308,909
2025	614,958	399,717	215,241	93,668	308,909
2026	614,958	399,717	215,241	93,668	308,909
2027	614,958	399,717	215,241	93,668	308,909
2028	614,958	399,717	215,241	93,668	308,909
2029	614,958	399,717	215,241	93,668	308,909
2030	614,958	399,717	215,241	93,668	308,909
Total	7,994,457	5,690,108	2,304,349	941,218	3,245,567
Total Annual					249,659
Total Annual Per Household					2.2

Considering the technology adoption within the six districts covered under NAMA Phase I, the total baseline emissions for around 160,000 targeted households in forest villages and tea estates up to year 2030 would amount to 8 million tCO_2-e. This represents annual emissions of 614,958 tCO_2-e/yr. Under the NAMA, adoption of fuelwood saving technologies would result in these total emissions

being reduced to 5.7 million tCO_2-e, and, including reduction of methane emissions, the total NAMA emission reductions is estimated with 3.25 million tCO_2-e by 2030. This represents an annual average of 249,659 tCO_2-e/yr.

3.6.1.2 Scenario 2: Forest Villages and Tea Estates in Assam

Table 18: Baseline and Ex-Ante Estimation of Fuelwood Saving Technology Adoption in Assam (Scenario 2 – Forest Villages & Tea Estates)

Year	Assam Baseline Emissions – Annual (tCO_2e/yr.)	Assam NAMA s Scenario Emissions – Annual (tCO_2e/yr.)	Assam f Fuelwood Consumption Emission Reduction (tCO_2e/yr.)	Assam Emission Reduction from Methane Combustion (tCO_2e/yr.)	Assam t Total Annual Emission Reductions (tCO_2e/yr.)
2018	819,334	802,465	16,870	432	17,301
2019	819,334	734,988	84,346	10,796	95,142
2020	819,334	667,513	151,822	34,978	186,800
2021	819,334	583,168	236,167	84,638	320,804
2022	819,334	532,560	286,774	124,797	411,571
2023	819,334	532,560	286,774	124,797	411,571
2024	819,334	532,560	286,774	124,797	411,571
2025	819,334	532,560	286,774	124,797	411,571
2026	819,334	532,560	286,774	124,797	411,571
2027	819,334	532,560	286,774	124,797	411,571
2028	819,334	532,560	286,774	124,797	411,571
2029	819,334	532,560	286,774	124,797	411,571
2030	819,334	532,560	286,774	124,797	411,571
Total	10,651,345	7,581,176	3,070,169	1,254,019	4,324,188
Total Annual					332,630
Total Annual Per Household					2.2

Considering forest villages and tea estates within the whole state of Assam (targeting around 220,000 households), the total emission reductions of this component increase to 4.3 million tCO_2-e, or an annual 332.630 tCO_2-e/yr.

3.6.1.3 Scenario 3: Fuelwood Dependent Households in Assam

Table 19: Baseline and Ex-Ante Estimation of Fuelwood Saving Technology Adoption in Rural and Urban Fuelwood Dependent Households in Assam (Scenario 3)

Year	Assam baseline emissions – annual (tCO_2e/yr.)	Assam NAMA scenario emissions – annual (tCO_2e/yr.)	Assam fuelwood consumption emission reduction (tCO_2e/yr.)	Assam emission reduction from methane combustion (tCO_2e/yr.)	Assam Total annual emission reductions (tCO_2e/yr.)
2018	21,729,930	21,640,451	89,479	458	89,937
2019	21,729,930	21,461,495	268,435	4,123	272,558
2020	21,729,930	21,282,539	447,391	11,453	458,843
2021	21,729,930	21,103,583	626,347	22,447	648,794
2022	21,729,930	21,014,104	715,826	29,319	745,144
2023	21,729,930	20,835,148	894,782	45,810	940,592
2024	21,729,930	20,387,759	1,342,171	103,073	1,445,244
2025	21,729,930	20,208,803	1,521,127	132,392	1,653,519
2026	21,729,930	20,208,803	1,521,127	132,392	1,653,519
2027	21,729,930	20,208,803	1,521,127	132,392	1,653,519
2028	21,729,930	20,208,803	1,521,127	132,392	1,653,519
2029	21,729,930	20,208,803	1,521,127	132,392	1,653,519
2030	21,729,930	20,208,803	1,521,127	132,392	1,653,519
Total	282,489,091	268,977,901	13,511,191	1,011,034	14,522,225
Total Annual					1,117,094
Total Annual Per Household					1.7

Finally, in this third scenario targeting around 5.8 million households in Assam, the total emission reductions in 2030 result in 14.5 million tCO_2-e which represents annual reductions of 1,117,094 tCO_2-e/yr.

The following table provides a sensitivity analysis of this component with different assumptions of potential fuelwood consumptions rates, always related to scenario 1 considering the 6 districts.

Table 20: Scenario 1 Total NAMA Emission Reductions in 2030 (After 13 Years) with Different Assumptions of Fuelwood Reduction Rates Compared to the Baseline Rate of 2.5 t/household/yr (50 per cent Reduction is Assumed in the Scenario Calculations Above)

90 per cent reduction of fuelwood consumption (tCO_2-e)	70 per cent reduction of fuelwood consumption (tCO_2-e)	50 per cent reduction of fuelwood consumption (tCO_2-e)	30 per cent reduction of fuelwood consumption (tCO_2-e)	10 per cent reduction of fuelwood consumption (tCO_2-e)
4,885,371	4,065,469	3,245,567	2,425,664	1,605,762

This rate of fuelwood reduction represents by far the most sensitive factor with regards to the potential emission reductions to be achieved. Even between 30 per cent and 50 per cent reduction, the result would vary by at least a million tCO_2-e. Also sensitive is the assumption related to the NAMA implementation and technology adoption rate. All the results are presented with a 5-year implementation, as planned under NAMA Phase I, and final adoption of at least 85 per cent of the

targeted households. If a 9 year roll-out with a final adoption of 85 per cent is assumed, the total emission reductions would be reduced by -21 per cent to 2.6 million tCO_2-e.

3.6.2 Emissions Related to Impacts on Forests within Collection Zones

The following three tables present the baseline as well as ex-ante emission reductions considering the reduction of pressure and damage to the forest resources within the fuelwood collection zone (5 km radius assumed for this study). As mentioned earlier, only the damage to the residual stand is considered here and not the reduction of the fuelwood biomass extracted.

The first column shows the baseline carbon stock changes from 2018 to 2030 projected using the historical land use change and carbon stock analysis for an average fuelwood collection zone of 7,854 ha. Column 2 presents the NAMA emission reductions for this collection zone assuming a 20 per cent reduction of the damage caused by fuelwood reduction while the last column scales these benefits up to the different scenarios. All results are shown as cumulative carbon stocks and changes.

3.6.2.1 Forest Impact Scenario 1 (Forest Villages and Tea Estates in Six Districts Covered Under NAMA Phase I)

Table 21: Baseline and Ex-Ante Estimation of Emission Reductions within Fuelwood Collection Zones of the 6 Districts Covered under NAMA Phase I (Scenario 1)

Year	Baseline carbon stocks - wood collection zone (tCO_2/wood collection zone)	ΔC (NAMA - Baseline) (tCO_2/collection zone)	ΔC (NAMA-Baseline) (tCO_2/districts) FV and TE
2018	480,476	231	8,210
2019	477,374	463	82,100
2020	474,273	694	22,1671
2021	471,172	925	459,762
2022	468,071	1,156	697,853
2023	464,969	1,388	837,424
2024	461,868	1,619	976,994
2025	458,767	1,850	1,116,565
2026	455,666	2,081	1,256,136
2027	452,564	2,313	1,395,706
2028	449,463	2,544	1,535,277
2029	446,362	2,775	1,674,847
2030	443,260	3,006	1,814,418
Total	443,260	3,006	1,814,418
Annual Emission Reductions			139,571

Within the 6 districts the potential impacts on the basis of one fuelwood collection zone seem to be marginal with a total of only 3,262 tCO2-e or 0.03 tCO_2/ha/year. However, if this rate is assumed for the adopted forest villages and tea estates within the six districts, the total NAMA benefits would result in 1.8 million tCO_2-e, or annually 139,571 tCO_2-e/yr.

3.6.2.2 Forest Impact Scenario 2 (Forest Villages and Tea Estates in Assam)

If this benefit is further up-scaled under Scenario 2 to forest villages and tea estates in Assam, the total emission reduction potential after 13 years is 3.6 million tCO_2-e, or annually 274,030 tCO_2-e/yr (Table 11).

Table 22: Ex-ante Estimation of Emission Reductions Within Fuelwood Collection Zones of Forest Villages and Tea Estates in Assam (Scenario 2)

Year	ΔC (Project-Baseline) (tCO_2/Assam)
2018	16,119
2019	161,194
2020	435,224
2021	902,688
2022	1,370,151
2023	1,644,181
2024	1,918,211
2025	2,192,242
2026	2,466,272
2027	2,740,302
2028	3,014,332
2029	3,288,362
2030	3,562,392
Total	3,562,392
Annual Emission Reductions	274,030

3.6.2.3 Forest Impact Scenario 3 (Fuelwood Dependent Households in Assam)

Table 23: Ex-Ante Estimation of Emission Reductions Within Fuelwood Collection Zones of Fuelwood Dependent Households in Assam (Scenario 3)

Year	ΔC (NAMA-Baseline) (tCO_2/Assam)
2018	61,043
2019	366,260
2020	915,650
2021	1,709,214
2022	2,441,734
2023	3,662,601
2024	6,409,552
2025	8,301,896
2026	9,339,633
2027	10,377,370
2028	11,415,107
2029	12,452,844
2030	13,490,581
Total	13,490,581
Annual Emission Reductions	1,037,737

Table 23 (on the previous page) finally presents the total emission reduction for scenario 3 – fuelwood dependent households in Assam – totalling 13.5 million tCO_2-e, or 1.0m tCO_2-e per year.

With regards to sensitivity, again the assumption of the potential reduction of the logging damage factor shows the highest changes in the overall NAMA benefits of this component. The following table compares degrees of reductions of the LDF for scenario 1.

Table 24: Scenario 1 Total NAMA Emission Reductions in 2030 (after 13 years) with Different Assumptions of Reduction of the Logging Damage Factor (LDF) (20 per cent Reduction is Assumed in the Scenario Calculations Above)

80 per cent reduction of LDF (tCO_2-e)	60 per cent reduction of LDF (tCO_2-e)	40 per cent reduction of LDF (tCO_2-e)	20 per cent reduction of LDF (tCO_2-e)
7,257,672	5,443,254	3,628,836	1,814,418

This assessment shows the huge impact of the LDF on the overall potential emission reductions. The actual impact can only be monitored in the field during NAMA implementation. Therefore, the low assumption of 20 per cent potential impact is justified for this component.

3.6.3 Total Ex-Ante NAMA Emission Reductions

The following table summarises the total ex-ante estimation of this NAMA for both components and all three scenarios for the period 2018-2030.

Table 25: Total Emission Reductions of Three Scenarios Considering Bot Components

Component	Scenario 1 – 6 districts of NAMA Phase I (tCO_2-e)	Scenario 2 – FV & TE in Assam (tCO_2-e)	Scenario 3 – Assam fuelwood dependent households (tCO_2-e)
Fuelwood Saving Technology Deployment	3,245,567	4,324,188	14,522,225
Impacts on forests within collection zones	1,814,418	3,562,392	13,490,581
Total	5,059,985	7,886,580	28,012,806

4. Assam Fuelwood Decision Support System

4.1 Background

Assam has an undulating topography comprising of both hills and plains with temperatures varying from 6°C to 38°C (DoEF, 2015). This North-Eastern Indian State is ethno-culturally diverse with a population covering 26 Scheduled Tribes, 22 Scheduled Castes and several religious groups. It is also rich in forest resources and is a part of the Himalaya biodiversity hotspot. While the levels of human development have improved in the last 15 years in Assam, the latest Human Development Index (HDI) in the state is still just about half of the desired level. These socio-economic and ecological factors have contributed to varying consumer needs and behavioural patterns in energy consumption in the state, especially in the case of household energy which has resulted in the continued reliance on conventional fuelwood inefficient stoves. These conventional stoves or *chulhas* are low-cost and designed to accommodate specific cooking styles, types of fuels, and available resources for maintenance and renovation (Khandelwal, et al., 2016). They meet the users' cooking needs and can be repaired or replaced easily.

To reduce this unsustainable dependence on fuelwood, it is essential for Assam to design a holistic approach that:

- Provides a sustainable supply of fuelwood (supply-side management) and
- Ensures efficient fuelwood consumption (demand-side management)

Effective adoption of this approach will lead to sustainable fuelwood management in the state.

Maintaining a sustainable supply of fuelwood would require a clear understanding of the renewable biomass stock from forests for meeting fuelwood demands over time as well as the potential for dedicated fuelwood plantations. While for achieving higher efficiency in fuelwood consumption, there are several alternative energy sources and technologies available which can cater to the varying consumer needs. Examples include improved cook stove, biogas, LPG and electric stoves. These alternative solutions are hereafter referred to as 'fuelwood saving technologies'.

Sustainable fuelwood management can be achieved through a balanced mix of these supply and demand side management options which are able to effectively sustainably meet the varying needs and patterns of fuelwood consuming regions and communities in Assam. To this end, a planning tool which can analyse, assess and prioritise the plausible interventions at a sub-regional level in Assam is required. This tool will help in designing scientifically planned investments for sustainable fuelwood management at a sub-regional level in the state. The Forestry NAMA aims develop and deploy such a planning tool in Assam.

Under the NAMA, a state-wide multivariate Assam Fuelwood Decision Support System (AFDSS) will be developed for producing highly contextual investment strategies for fuelwood plantations and fuelwood saving technologies at a sub-regional level.

4.2 Value Proposition

The AFDSS will serve as an objective, scientific planning tool to:

- Assess sustainability of existing demand-supply scenario for fuelwood through a visual representation of its impact on the state's forest resources in the coming years.
- Choose from a list of criteria that can be used for building a sustainable fuelwood management strategy such as human health benefits, cost-effective measures, measures with high GHG abatement potential, user preferences etc.
- Identify the most suitable solutions to address the unsustainable extraction of fuelwood through a mix of supply side (through dedicated fuelwood plantations) and demand side (fuelwood saving technology deployment) measures. These will be based on the final selection of the aforementioned criteria by the decision makers.

Based on the recommended measures by the AFDSS, highly contextual investment strategies for sustainable fuelwood management at a sub-regional level can be designed. The specific outputs of the AFDSS are as follows:

- Understanding of the extent and impact of fuelwood extraction on Assam's forest stock in different scenarios
- Improved forest management and conservation strategy of the state
  - Monitoring of fuelwood consumption
  - Investment decision support for planning sustainable fuelwood scenarios
  - INR amount per biomass saved
- Climate change mitigation and adaptation in the state
  - Result in carbon stock enhancement against the baseline
  - Enhance resilience of forest dependent communities through long term energy supply
  - Promote fuelwood saving technologies

Using the AFDSS, investment strategies can be designed based on a wide-range of priorities set by the decision maker. Following are examples of the investment decision making based on varying priorities:

- Ensuring cost-effectiveness: This would involve simulating different technology mix investment scenarios and their corresponding effects on biomass, carbon stocks, clean energy diffusion, etc. Based on this, a cost-effective scenario can be selected which meets desired goals for conserving forest biomass/carbon stock.
- Conserving forest ecology: This would involve simulating a scenario that eliminates extraction of non-renewable biomass from forests and its effect over time on the forest ecology. Interventions

could include determining the amount of renewable fuelwood that can be extracted from forests annually and identifying the requisite dedicated fuelwood plantations to meet demand.

- Assessing impact of policy interventions: Ex-ante or ex-post assessments of the impact of various policy approaches on sustainable fuelwood management can be simulated. These also include modelling effect of policies such as imposing limitations on extractions for a certain period to allow the forest to regenerate, increasing subsidy on certain technologies to increase its adoption and investments in technology awareness and demonstrations on adoption of clean technologies.

One or a combination of priorities can be chosen by a decision maker to simulate different scenario and identify the most optimum scenario for meeting the desired goals.

4.3 Design Principles for the Assam Fuelwood Decision Support System

The AFDSS will use a whole systems based approach to effectively address the issues of unsustainable extraction of fuelwood from forests and low dispersion of fuelwood saving technologies in Assam through the use of system dynamics modelling.

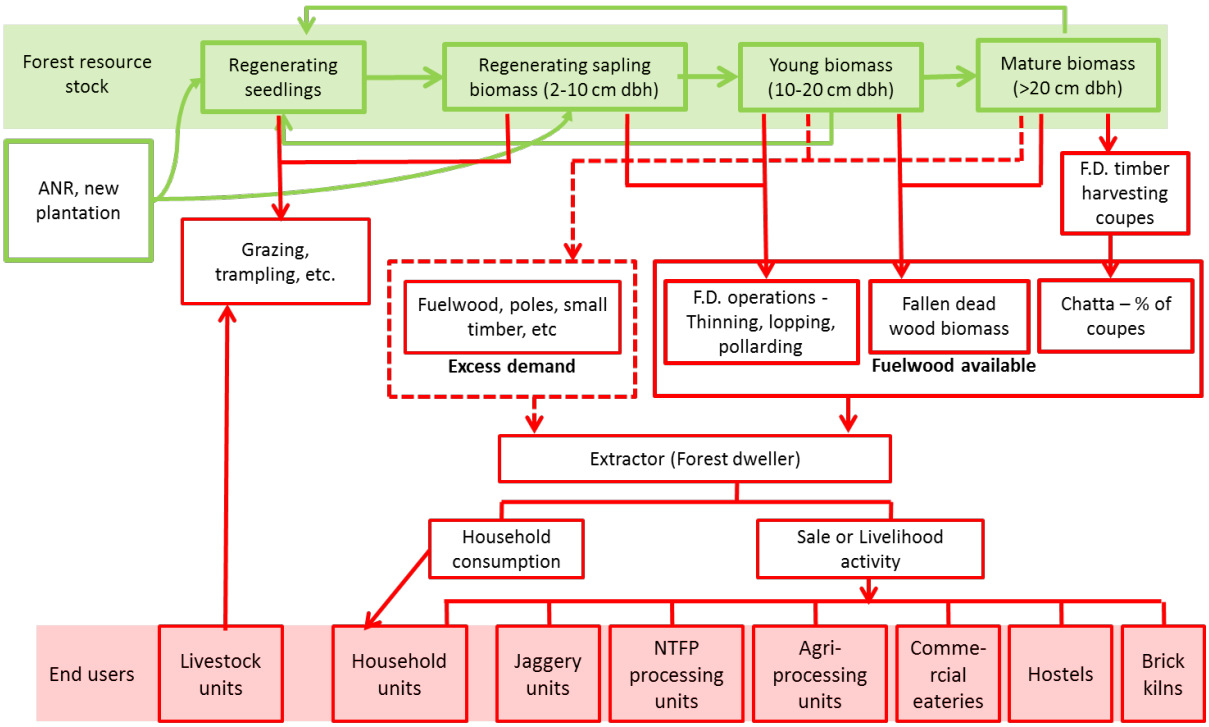
Systems analysis is an interdisciplinary field of science for analysing and managing complex feedback systems in nature and society. System dynamics modelling takes it one step further by transferring systems into dynamic numerical models, thereby enabling the exploration of alternative scenarios to cope with possible negative outcomes as well as their effective communication.

The AFDSS will be based on existing India's Forest Resource Decision Support Tool (iFoReST) which has been developed by NAMA Development team partner IORA Ecological Solutions under the Innovations in Ecosystem Management & Conservation (IEMaC) Program, supported by the United States Agency for International Development (USAID) under their Innovations for Forest Resources Management (INFoRM) Program.

iFoReST empirically studies the causal relationship between stocks and flows, their drivers and dynamics in Social-Ecological Systems. It considers a given set of indicators and parameters as inputs (forest stocks and growth, fuelwood uses, presence of clean technologies, alternative livelihood options, etc.) in a highly dynamic setup to illustrate different scenarios of fuelwood use and predict the sustainability of fuelwood extraction and forest regeneration within an area under different time-periods. The tool, tried and proven in two landscapes in India – Sirsi (Karnataka) and Mandla (Madhya Pradesh) – gives a sound basis for investment decision making with regards to technological, ecological and social interventions to reduce extractions from forests.

The AFDSS will take into account two core systems, the forest resource system and the end user system (see figure below). There are many sub-systems within these two systems. Further there are dynamic interactions between the systems and sub-systems which can be factored in using measurable parameters. Some of these parameters are generic in nature, while others can be more site-specific. The AFDSS will have to be developed with the generic parameters in-built into its model and allow customisation of the other parameters based on the site/region-specific context.

Figure 28: iFoReST System Map as per IEMaC Project Landscapes



Note: The supply side system, or the forest stand system, has been classified into 4 stages, as per diameter, which forms the tree growth stages. The biomass in trees grows over time based on parameters fed into the model. The demand side system of the model estimates quantity, technique and purpose of biomass extraction across various levels in the region.

Source: (Bharat, et al. 2015)

Illustration on Application of iFoReST

In this simplified example, the model analyses the impacts of investment strategies on carbon stock, livelihood generation, availability of fuel wood, and the natural and human systems that impact fuel wood consumption. The results in figure 3 demonstrates a scenario from a first iteration of the model studying the impact of drying collected Garcinia gummi-gutta using fuelwood collected from mature tree biomass forest stock in Sirsi. The (orange) line demonstrates the impact of drying collected Garcinia gummi-gutta, assuming that current conditions continue into the future (30 per cent of the households in the region are involved in the trade and are using X technology). From our on-the-ground surveys and interview data, it was found that, if the price for Garcinia gummi-gutta in the market is relatively high (or equivalent to what is known as a premium price) more households have a tendency to be involved in the trade. For the region under study in this example, the average price in 2015 of Garcinia gummi-gutta per kg was approximately INR 145, and it assumed that 30 per cent of all households in the region are involved in the trade. However, it was also found that if the price of Garcinia gummi-gutta reaches INR 270 per kg, then the share of households involved in the trade jumps to 40 per cent. Running this scenario (blue line) in the model demonstrates, unfortunately, that as price increases, more households engage in the activity and unless there is a change in technology, the mature stock of trees severely depletes over a fifteen-year period, so much so that it also impacts the ability for the forest to regenerate. The top line (green line) shows the impact of a technology (fuel efficient ASTRA drier) which is significantly more efficient; the model demonstrates that despite the higher engagement of the community due to high market price of Garcinia, even if 50 per cent of the households were to use the ASTRA drier the impact on the savings of long term mature biomass stock are significant.

Figure 29: Model Results of Ecological Sector (Total Biomass) for Different Strategies

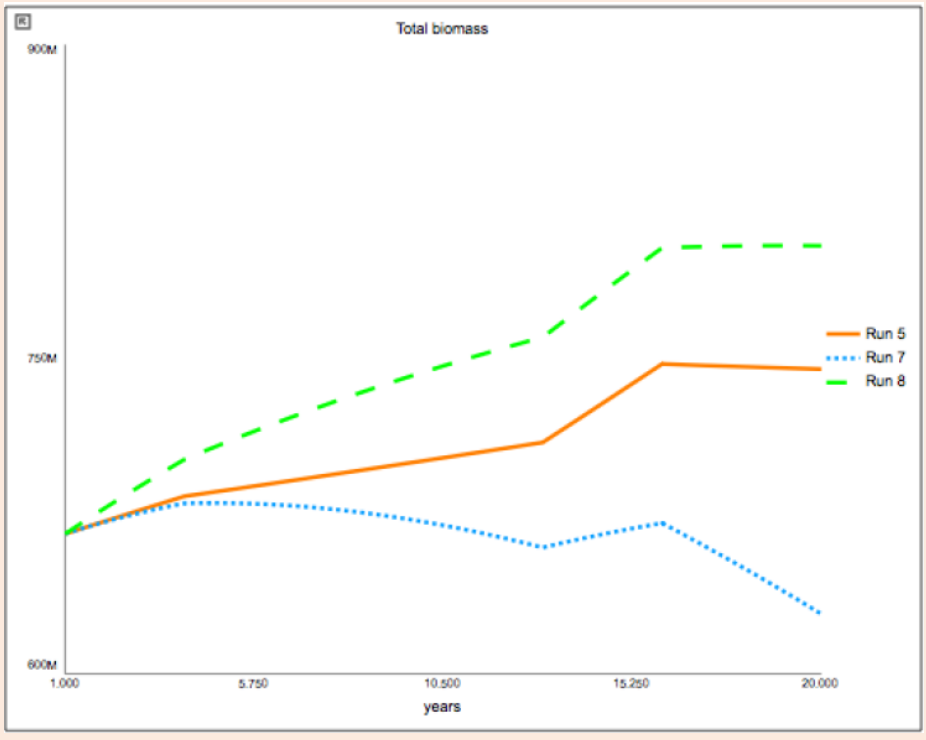


Figure 30: A Sample of a Portion of the IEMaC Model Demonstrating the Relationship Between Ecological and Market Dynamics

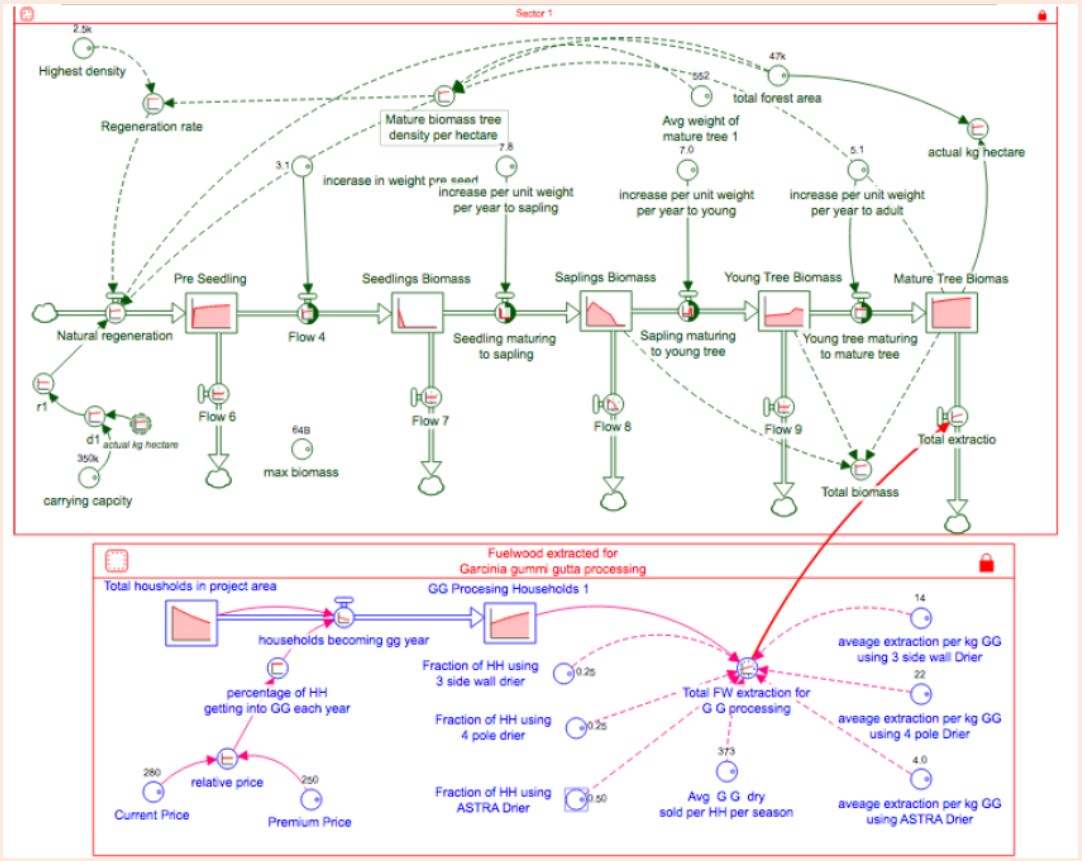
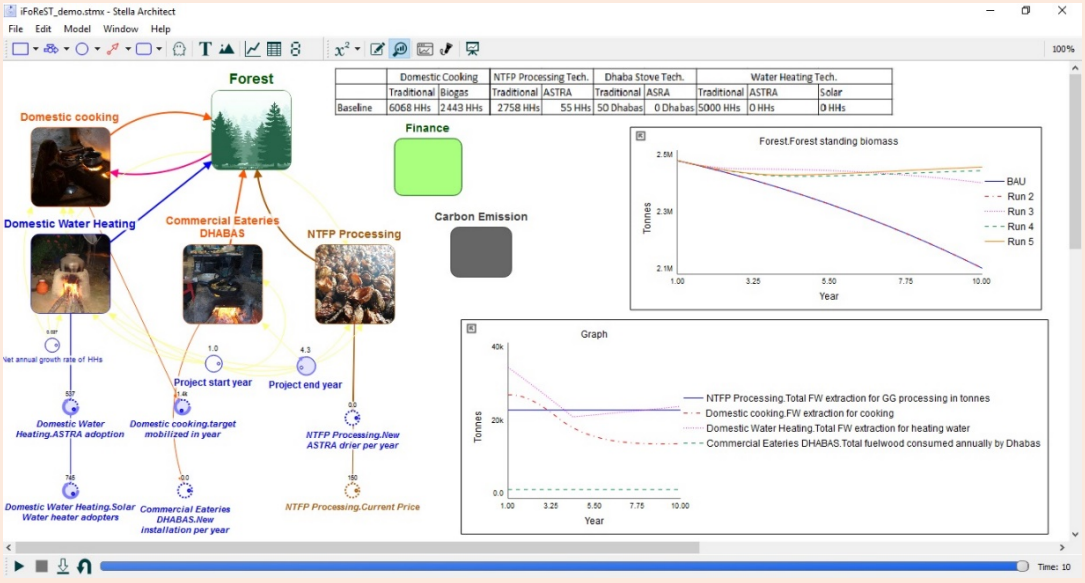


Figure 31: Screenshot of iFoReST Overview Showing All the Different Modules



4.4 AFDSS Development Process

Building on the existing iFoReST, AFDSS will be developed by the following process:

- Stratification of fuelwood consumers in Assam: As highlighted earlier, Assam is an ethno-culturally diverse state with varying needs and behavioural patterns for fuelwood consumption. Therefore, the first step would be identifying the various fuelwood consumer segments based on their needs and response to marketing or communication strategies relevant to sustainable fuelwood management. Information such as the consumer's demographic (age, gender, family size, ethnicity, income, education level), geography (their place of residence and work) and behavioural (purchasing power, consumption, usage including for commercial sectors and desired benefits) tendencies will be taken into account while determining the fuelwood consumption strata.
- Collection of detailed socio-economic and ecological data to determine the current fuelwood consumption dynamics in Assam: Collect data for the AFDSS supply side system (ecological parameters, land availability for dedicated plantations) and demand side system (socio-economic parameters to assess the existing fuelwood consumption patterns and usage for each of the identified fuelwood consumption stratum i.e. extraction quantity, extraction techniques, end user's demand and socio-economic factors influencing demand).
- Simulation of business-as-usual (BAU) scenario in the AFDSS: Model the causal relationship between the two core systems, the forest resource system and the end user system, and their sub-systems to simulate the baseline scenario of fuelwood resource use in Assam for each of the fuelwood consumption stratum. This will provide a visual representation of the sustainability of the current scenario by simulating the future forest stock under current fuelwood consumption patterns.
- Identification of potential interventions for sustainable fuelwood management: Create an inventory of fuelwood management interventions, including fuelwood species for plantations and fuelwood saving technologies by their types and models. These interventions and their respective details such as model-specific features (e.g. one or multiple burner cook stoves, LPG stoves), GHG emissions and investment requirements will be fed into the AFDSS.
- Generation of stratum specific investment scenarios for Assam: Generate stratum specific investment scenarios for the optimum deployment of fuelwood plantations and fuelwood saving technologies across Assam.

4.5 Operationalisation of AFDSS

A designated agency should be responsible for hosting and operating the AFDSS; utilising it for designing appropriate investment strategies; and coordinating with the relevant public and private entities for implementing the investment strategies developed. This will ensure ownership and long term sustainability of the AFDSS as an investment planning tool for sustainable fuelwood management in the state. Based on the proposed institutional structure for the Forestry NAMA (refer to Chapter 2 – NAMA Scope), the NAMA PMU will be best suited to house and operate the AFDSS.

Further, for effective implementation of the AFDSS recommended investment scenario, guidelines for investment planning, coordination and convergence amongst the relevant public and private agencies will have to be drafted. The NAMA PMU can play this role of assisting and coordinating with all the relevant agencies in implementing the NAMA interventions recommended by the AFDSS in a timely and effective manner.

To improve the effectiveness of the AFDSS over time, a mechanism for incorporating the learning from the NAMA MRV system into the AFDSS will have to be designed. The NAMA PMU can draft guidelines for such a process to be established in order to keep the AFDSS aligned with the monitoring and evaluation system of the Forestry NAMA.

Finally, to increase adoption of fuelwood saving technologies, a web platform can be developed and widely disseminated for building public awareness on the most optimum fuelwood saving technologies recommended by AFDSS for their region of interest in the state of Assam.

5. NAMA MRV System

5.1 Introduction

The UNFCCC formulates specific requirements for national performance and benefit measuring systems for climate mitigation actions. The convention specifically mandates the application of the Intergovernmental Panel on Climate Change (IPCC) guidelines to measure and report land based and energy emissions at the national level. While there are internationally recognised standards on GHG accounting frameworks, measurement of mitigation actions is hampered by inherent variability in land based emissions and removals and, in many countries, by a lack of available data and limited capacities for measurement.

Specific data requirements will vary between projects, but in all cases the generic procedures for planning GHG estimation through monitoring include defining the key performance indicators, defining the parameters for which data are required, and elaborating a monitoring plan. In the project context, data collection for GHG estimation should also be linked to data collection for other purposes, such as reporting of non-GHG effects, and for meeting the information needs of project managers and project stakeholders. Therefore, a MRV system for both mitigation and NAMA transformational performance is conceptualised based on the relevant reporting principles of the UNFCCC and the IPCC as outlined in their Good Practice Guidelines (IPCC, 2006). Monitoring should provide substantive information regarding changes in fuelwood consumption at the household level as well as changes in carbon stocks in above ground biomass within the core fuelwood collection areas.

The standardised approach of the parameters collected and data sources used guarantees a comparable approach throughout Assam ensuring a consistent and up-scalable approach for the whole sector. The concept is built along the normative IPCC principles:

- **Relevance:** The levels of accuracy and uncertainty associated with monitoring methods should reflect the intended use of the data and the objectives of the GHG project; some intended uses may require more accuracy than others
- **Completeness:** All primary effects and all significant secondary effects should be monitored or estimated. All monitoring methods and data collection procedures should be fully documented.
- **Consistency:** Methods used to monitor, check, and store data should be consistent over time to ensure comparability and verifiability.
- **Transparency:** All monitoring methods, calculations, and associated uncertainties should be explained. Monitoring must be sufficient to allow the transparent quantification of GHG reductions.

- **Accuracy:** Measurements, estimates, and calculations should be unbiased, and uncertainties reduced as far as practical. Calculations and measurements should be conducted in a manner that minimises uncertainty.
- **Conservativeness:** Where there are uncertainties in monitored data, the values used to quantify GHG reductions should be on the side of underestimating GHG reductions.

On a project operational level, specific emphasis is given to the following three core principles:

- **Cost efficient:** Periodic monitoring activities can lead to cost overruns if not planned properly. Where possible, existing data collection mechanisms will be used for collection of data for monitoring NAMA activities.
- **Multiple benefit monitoring:** The monitoring will cover broad array of parameters, to monitor performance of mitigation as well as any other project indicators.
- **Defined:** Easy to understand parameters, ideally to be collected by households and communities themselves; unambiguous and as far as possible quantifiable objective data collection techniques. If secondary data is used, open/transparent source of information will be used.
- **Realistic:** Relevant parameters should be practical to measure or achievable within the life of the project, and should change in a measurable way within the life of the project while being consistently measured with time and geography (e.g. the way a parameter is monitored should be consistent across Assam).

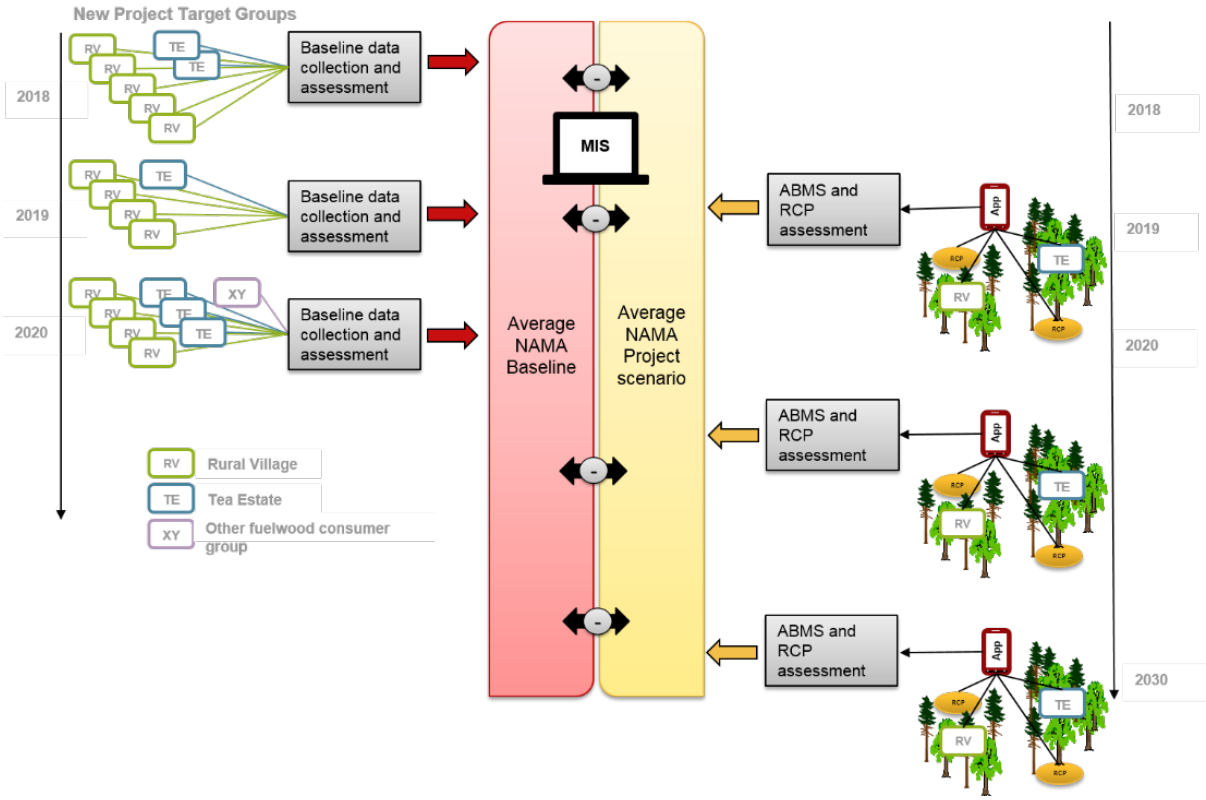
The overall concept of the Baseline and MRV system has been already introduced in Figure 19 in chapter 3. Monitoring in the field within forest village and tea estate households (or any new beneficiary group) as well within the identified core fuelwood collection zones will be conducted periodically by means of two survey instruments:

- The baseline and registration survey will be repeated periodically during project implementation, however, now referring to as Activity Based Monitoring Survey (ABMS).
- A simple yet adequate forest inventory system – Randomised Control Plots (RCP) – will be conducted to assess changes within the forest areas of the wood fuel collection zones to identify any changes in carbon stocks and to link these changes to the changes in household parameters assessed as part of the ABMS.

5.2 Approach

Figure 32 summarises the concept of the monitoring system in view of the baseline assessment introduced in chapter 3. During the NAMA Phase I implementation, the registration and baseline survey for new beneficiary groups to be covered in the NAMA (e.g. forest villages, tea estates, etc.) will be conducted as well as the first ABMS and RCP surveys for those groups which have already started implementing NAMA activities.

Figure 32: Overall Concept of the MRV System



Ideally household data from the ABMS surveys and inventory data from the RCPs will be collected by means of NAMA tailored Android based Apps which already represents an important quality control procedure for consistent and verifiable data collection throughout the NAMA's lifetime. The data will be uploaded into the NAMA Management Information System (MIS), which will host all the data from the baseline survey and the periodic ABMS and RCP surveys, thereby allowing for an automatic calculation of NAMA emissions for a given year. This will result in estimation of the NAMA emission reductions, calculated by deducting from the average baseline emission scenario.

5.3 Monitoring and Sampling Plan

The NAMA MRV system, described below, follows the structure of a monitoring and sampling plan usually required for carbon project activities under the CDM and other carbon standards (UNFCCC, CDM Guidelines, 2015). The monitoring plan should contain information relating to: (A) sampling design; (B) data to be collected; and (C) implementation plan. At this stage, the monitoring plan represents a draft version since some of its components can only be defined once the NAMA has been piloted and tested and is ready for full scale implementation.

5.3.1 Sampling Design

Activity Based Monitoring Survey (ABMS)

The Activity Based Monitoring Survey follows the same guidance as outlined in section 3.2.1 for the baseline survey. After implementing the baseline survey with the beneficiaries of NAMA, the same

survey will be performed as ABMS on a periodical basis post deployment of fuelwood saving technologies. Parameters to be collected will include, among others:

- Household composition - family members
- Fuelwood consumption rates
- Mix of energy sources for cooking and heating in households
- Types of cook stoves and fuelwood saving technologies
- Indicators to monitor general health conditions in the NAMA
- Distance of the fuelwood collection zone

By maintaining a consistent survey system to establish the baseline as well as to monitor fuelwood saving technology adoption over time, the subsequent monitoring efforts (t_1, t_2, t_3, …) are compared to the baseline (t_0) to identify the climate benefits. This approach has the advantage that the baseline and the subsequent calculation of mitigation benefits are based on the same data collection design which increases the quality, transparency and verifiability of the system.

Technically, the ABMS can be implemented using the same NAMA specific Android based survey app and the data can be directly synced with the web-based MIS allowing for an automatic climate benefit calculation (as well as other performance indicators).

As a good practice, the sampling effort should be conducted following a 90/10 precision guidance in accordance with the 'Standard for sampling and surveys for CDM project activities and programme of activities'. In other words, this means that the sampling of households should be designed to achieve an error with a mean value of 10 per cent or less and that there is a 90 per cent level of statistical confidence that the true amount of the surveyed parameter is at least the claimed amount.

Randomised Control Plot (RCP) Survey

This survey represents a typical yet simplified forest inventory in RCPs within all types of land uses where trees are cut, lopped for fuelwood purposes within the fuelwood collection zones established during the baseline. Typical parameters include:

- Species and numbers of trees and shrubs
- Diameters of the trees
- Damage of trees, i.e. sign of lopping
- Simple assessment of natural regeneration
- Simple assessment of deadwood

With these parameters the overall status of forest and tree conditions including the abundance of species can be assessed and compared to the average baseline conditions. The carbon stocks can be derived for a given year and compared to the baseline to assess any significant changes. The carbon from these woody perennials, including above and below ground biomass are calculated using the latest version of the CDM A/R Tool 'Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities'. The reliability requirements for this inventory should be also implemented with the aim of a 90/10 precision.

5.3.2 Target Population

Activity Based Monitoring Survey (ABMS)

The target population of the NAMA from which a sample of households is randomly selected are all end-users of clean cooking technologies in the project which are registered. Ideally the MIS system of the project has a full inventory of all end users from which the system can automatically select the sample of households to be surveyed in a particular year.

Randomised Control Plot (RCP) Survey

This survey will cover all the forested areas falling within the fuelwood collection zones of the targeted beneficiaries covered under the NAMA. Based on the indicative baseline assessed and analysed in chapter 3, this covers the following forest types:

- Plantations
- Deciduous forest
- Evergreen forest
- Scrub forest

Using these forest types as strata in this inventory, a representative number of RCPs will be selected.

5.3.3 Sampling Method

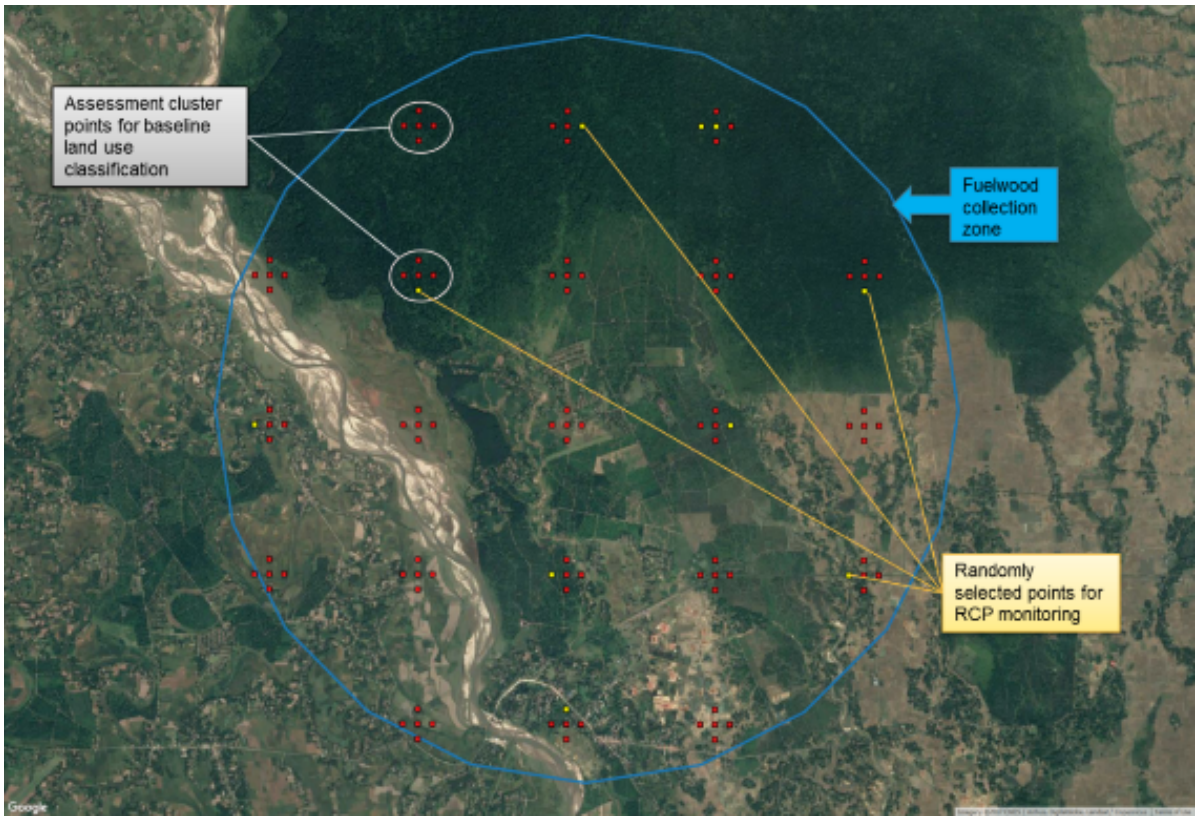
Activity Based Monitoring Survey (ABMS)

Fuelwood consumers to be targeted under the NAMA are not a homogeneous group and have varied energy needs being met by fuelwood currently. Hence, a stratified random sampling approach is proposed for the ABMS. The target groups such as forest villages and tea estates are defined as strata in the ABMS. Stratified random sampling is most applicable to this NAMA since the characteristics of target groups are more similar within groups than across groups (e.g. forest villages are likely to be more similar to one another in terms of cooking and fuelwood use than they are to tea estates)

Randomised Control Plot (RCP) Survey

The method for the RCP draws upon the assessment of the baseline forest and land use change assessment using GIS as outlined in chapter 3. It therefore represents a systematic sampling method using the grid of point clusters which were used to classify the land uses within the fuelwood collections zones. Figure 33 illustrates the approach. The NAMA database (integrated into the MIS) will have a list of all points and cluster locations, each of them attributed to a particular land use and forest type.

Figure 33: Selection of RCPs Using the Baseline Land Use Change Assessment Points



As a preparation for the RCP survey in a particular year, first those points in the database which fall within the identified forest types in the baseline (e.g. plantations, deciduous forest, evergreen forest, scrub forest, etc.) should be selected. From these points, a stratified random sample of points will be selected for the RCP survey. The strata to be considered for this inventory are the forest types as well as the different target groups. During any subsequent RCP monitoring the same exercise is performed.

Sample Plot Design

Circular RCP plots are established which are easy to locate, and its boundary can be established with less effort. The centre of each sample plot represents the point coordinate of the selected points as outlined above. The size of each plot (usually expressed as the radius of the circular plot) needs to be variable given the heterogeneity of forest types and crown cover classes within the fuelwood collection zones. As a general guidance, the sample circle is defined to capture at least 15 trees per plot. A common size of plots is 250 to 500 m^2. With a circular sample plot, this corresponds to a radius of 8.92 to 12.61 m. A general rule is that larger plots lead to smaller sampling errors. Possible plot sizes are presented in the following table. The default plot dimension is 250 m^2 with 8.92 m radius as this surface is suitable for moderate to dense vegetation.

Table 26: Plot Radius for Forest Inventory Plots (Pearson, Brown, & Birdsey, 2005)

Plot size [m2]	Plot radius [m]	Typical area per tree [m2]	Tree density
100	5.64	0 to 15	Very dense vegetation, stands with large numbers of stems small in diameter, uniform distribution of larger stems
250	8.92	15 to 40	Moderately dense woody vegetation
500	12.62	40 to 70	Moderately sparse woody vegetation
666.7	14.56	70 to 100	Sparse woody vegetation
1000	17.84	More than 100	Very sparse vegetation

The formula used to determine the size of the sample plot circles (CarbonFix Standard, 2008) are:

Formula to determine the size of sample plots:

A_{min} = 10,000 *n_{min} / n_e
M^2 = m^2/ha *trees / trees/ha

A_{min} = Minimum plot size
n_{min} = Amount of minimum trees required per plot (at least 10)
n_e = Amount of trees at the end of rotation / when forest reaches its equilibrium stand volume

Example:
When the forest reaches its equilibrium stand volume, it has been calculated that 333 trees/ha will still be on the area. It is known that the minimum amount of trees required per plot are 10

Amin = 10,000 *n_{min} / n_e
= 10,000 *10 / 333
= 300 m^2

The minimum size of the plot would be 300 m^2 which equals a radius of 9.78 m

Formula to determine the amount of trees remaining per sample plot:

n_e = s_r *r_r *n_s
trees/ha = % *% *trees/ha

n_e = Amount of trees at the end of the rotation / when the forest reaches its equilibrium stand volume
s_r = Estimated survival rate
r_r = Estimated removal rate
n_s = Amount of trees at the project start

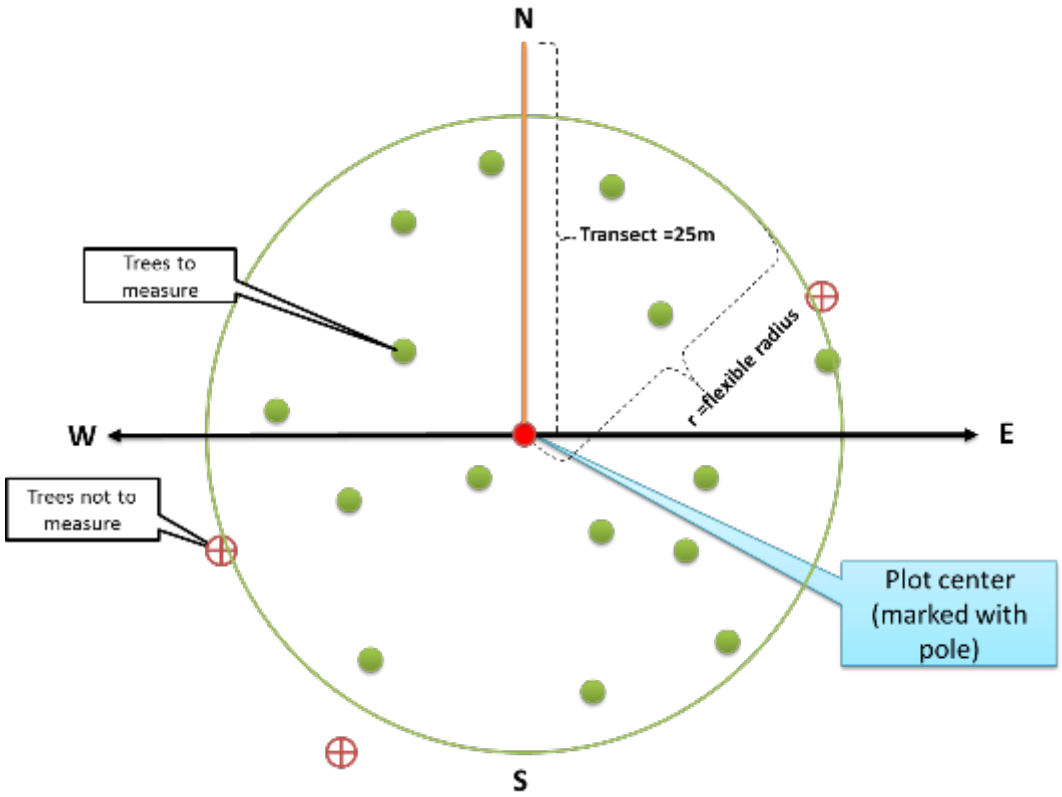
Example:
The project intends to plant trees with a distance of 3 x 3 meters. This leads to 1,111 trees per hectare. A survival rate of 80 per cent is expected. Furthermore, it is planned to remove 50 per cent of the trees during thinnings.

n_e = s_r *r_r *n_s
= 60% *50% *1,111
= 333 trees/ha

333 trees will remain per hectare at the end of rotation period / when the forest reaches its equilibrium stand volume

It is recommended to estimate the plot radius before each monitoring event at least for each of the different forest types and crown cover classes. Based on this, Figure 34 shows the sample plot layout proposed for the survey.

Figure 34: RCP layout



The plot is laid out in North-South direction. At least one 25m transect starting from the plot centre will be established in addition to the circular plot for the estimation of shrub crown cover and deadwood assessment. All trees above and equal to a minimum Diameter at Breast Height (DBH) within the sample plots have to be measured and recorded on the data sheet. The DBH (typically measured at 1.3m above ground) of all the trees in the sample plots above a minimum diameter is measured. The minimum DBH is often 5 cm, but can vary depending on the expected size of trees —for arid environments where trees grow slowly, the minimum DBH may be as small as 2.5 cm, whereas for humid environments where trees grow rapidly it could be up to 10 cm.

5.3.4 Sample Size

For the two surveys, the precision guidance is 10 per cent error at the 90 per cent confidence interval which should be kept in mind when performing the monitoring and selection of sample sizes in terms of households and RCP plots in the project. As mentioned in chapter 3, the sample size can be calculated based on the equation given there. However, since the variability of parameters of the ABMS as well as the RCP are not know in the beginning, the following step-wise procedure is recommended to calculate the sampling intensity required for the two survey systems.

- Selection of at least 15-20 samples per stratum to test the surveys and derive information on the variability of parameters. This means that in case of the ABMS, around 15-20 households in each

of the target group strata (and districts strata if more than one district is already implementing) should be randomly selected and the survey implemented. In case of the RCP, 15-20 plots should be selected following the guidance above and the inventory conducted. The mean parameter values as well as the variability calculated as standard deviations of the mean should be calculated in both surveys.

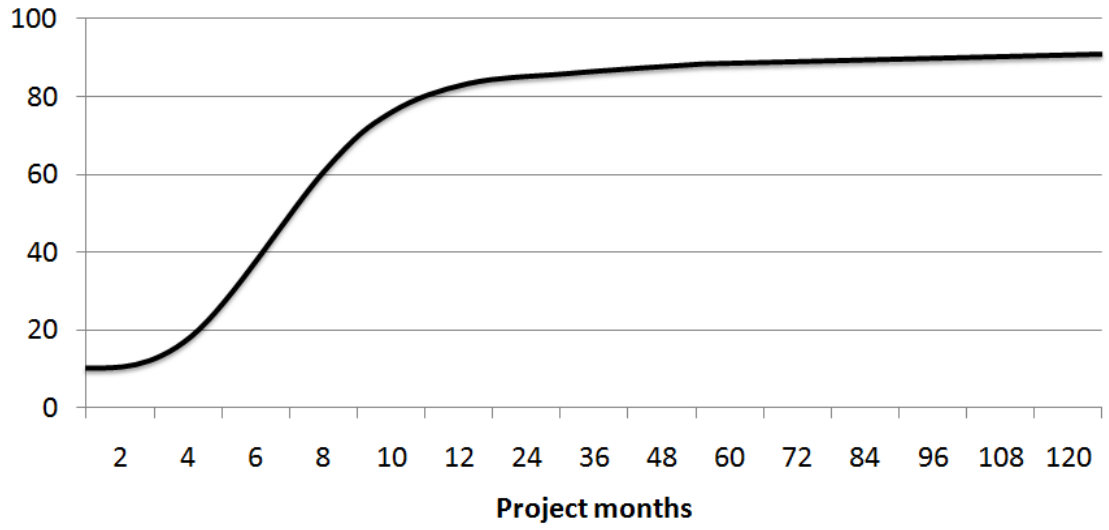
- The results of this set of samples can now be used to calculate the required sample size for each stratum and the whole project at a required precision level (90/10) using the equation provided in chapter 3. Alternatively, the UNFCCC provides an Excel based sample size calculator which can be used for both survey systems.
- Once the required sample size is estimated, the additional number of samples (households and RCP plots) can be selected as outlined above. This procedure should be repeated before each monitoring event.

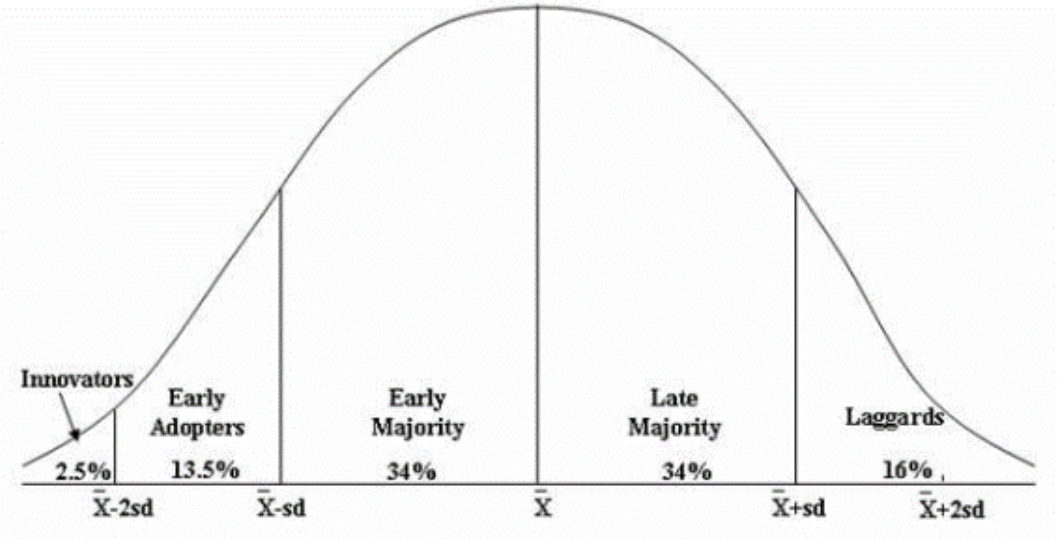
5.3.5 Sampling Interval

Activity Based Monitoring Survey (ABMS)

It is recommended to conduct the survey annually during the NAMA implementation. For instance, the ex-ante estimation in chapter 3 assumes that after 5 years, 85 per cent of the households have adopted the fuelwood saving technologies. Subsequently, the survey intervals can be expanded assuming that the additional adoption rates are small and households are maintaining the adopted practices. The technology adoption rate most likely will follow a bell-shaped curve over time and approach normality. Plotting the cumulative number of adopters this will result in an S-shaped curve. The statistical distribution can be described in five ideal adopter categories (see figure below).

Figure 35: Project Adopter Categories (below) and Cumulative Number of Adopters (on the following page) Over the First 10 years of the NAMA





This typical distribution indicates to reduce sampling intensity of the ABMS over time, i.e. starting with annual intervals and adopting 3-5 year intervals after 5 to 10 years, depending on the investigated adoption pattern.

RCP Survey

The recommended interval for RCP monitoring of changes in the conditions, structure and carbon within forested areas of the fuelwood collection zones should be every 5 years.

5.3.6 Data Collection Requirements

Activity Based Monitoring Survey (ABMS)

As already outlined, the ABMS survey represents a periodical continuation of the baseline survey. Therefore, the same data and parameters will be collected during the household surveys as outlined in the baseline chapter. The table below lists parameters to be determined as part of the calculation of GHG emissions of fuelwood saving technologies in addition to those presented in the baseline chapter, default values and sources of these are provided which can be used if no local values are available.

Table 27: Data and Parameters to be Determined to Estimate GHG Emissions of Clean Cooking

Data/Parameter	Data Unit	Description	Source of Data
U_p	Percentage	Usage rate of fuelwood saving technology in NAMA scenario	NAMA Management Information System (AF-MIS)
N_p	Number of fuelwood saving technologies across sampled households	Fuelwood saving technology deployed under the NAMA	NAMA Management Information System (AF-MIS)
DF_n	Fraction	Discount factor to account for efficiency loss of fuelwood saving technology	Default value of 0.99 (1 per cent efficiency loss per year)
$DF_{b,Stove}$	Fraction	Discount factor to account for the baseline stove used in NAMA scenario	Registration and baseline survey, continued monitoring surveys

In terms of quality control and managing uncertainty and errors during the interview situation, it is also referred to the chapter on baseline.

RCP Survey

The field measurement of selected data and parameters from the circular sample plots should follow a well-structured and standardised Standard Operating Procedure (SOP) explaining all necessary working steps. A draft version of such an SOP is presented later in this section. In the following table a draft list of data collected in the field is listed:

Table 28: Data and Parameters for NAMA GHG Emission Estimation

Variable	Description	Scale/Value [Precision]	Measurement/ Observation	Comment
SAMPLE_TEAM	Name of responsible team leader	Text		Or name of responsible writer
SAMPLE_DATE	Date of recordings	dd.mm.yyyy		
SAMPLE_TSTART	Start time of assessment	hh:mm		
SAMPLE_TEND	End time of assessment	hh:mm		
POINT_ID	Unique id number of sample point		No	IDs are predefined by the sampling design
POINT_XGPS	GPS measurement of the x-coordinate (easting) of the marked sample point	UTM coordinates	Long-term GPS measurement at the marked sample point location	Deviations from the planned target coordinate are important for later co-registration of remote sensing data! Just put the GPS receiver on the marked point and record the coordinates after ~5min
POINT_YGPS	GPS measurement of the y-coordinate (northing) of the marked sample point	UTM coordinates	Long-term GPS measurement at the marked sample point location	Deviations from the planned target coordinate are important for later co-registration of remote sensing data! Just put the GPS receiver on the marked point and record the coordinates after ~5min
STAND_MIX	Tree species mixture/Diversity of the stand or plot surrounding.	0=pure 1=mixed (2-5 species) 2=diverse (>5 species)	Counting of different tree species in the plot surrounding	
STAND_VERSTR	The vertical structure of the stand. Describes the variability of tree heights and the layering.	1=single layer, same heights 2=single layer, variable heights 3=multiple clear layers 4=variable structure in gaps, 5=complete variable structure	Visual estimation of mean condition around and on the plot area	

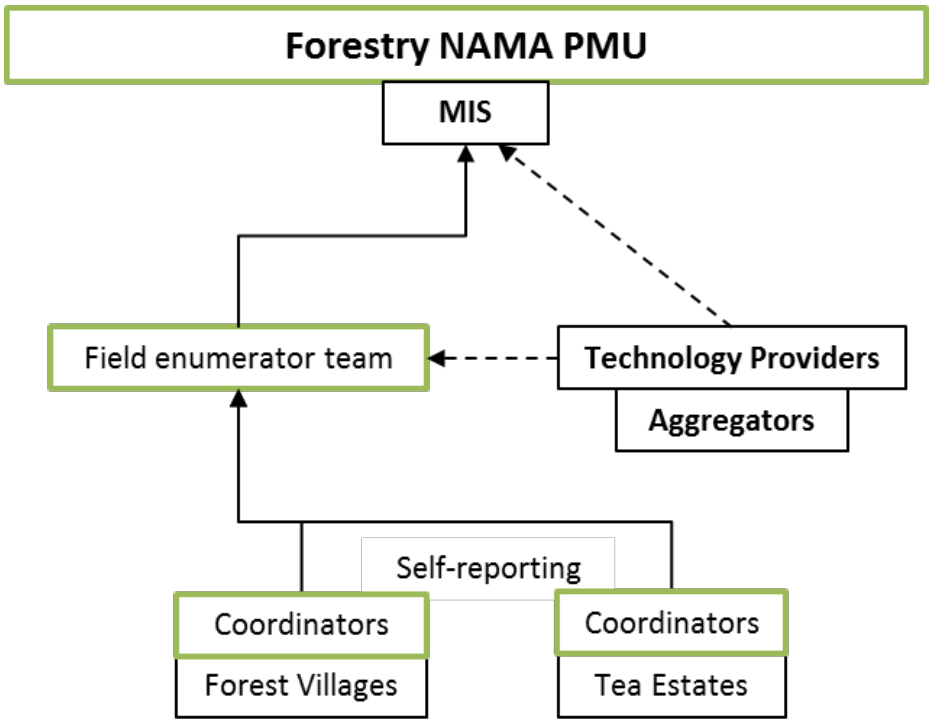
Variable	Description	Scale/Value [Precision]	Measurement/ Observation	Comment
PRELIMINARY_ STRATUM	Name, ID of the preliminary stratum the point belongs to	Text	Visual interpretation in the plot surrounding	
PLOT_SLOPE	Slope angle (gradient angle) of sample plot area	Degree (°) [Integer]	Slope angle is measured in mean slope direction between two opposite points along the sample plot radius	Measured with Vertex, Suunto or Silva Clinomaster. In case of higher terraces or abrupt changes in terrain, a mean slope angle is measured
PLOT_FORTYPE	Forest Type according to predefined official classification	Text	Visual interpretation in the plot surrounding	
PLOT_ CRCLOSE	Crown closure on the sample plot area	1=dense (overlapping crowns) 2=close (connected crowns) 3=loose (gaps < mean crowns) 4=open (gaps > mean crowns)	Visual estimation of mean condition on the plot area	
TREE_SPCODE	Species code	Code [Integer]	Prepare a species code list	If the respective code can be found in the code list, no other specification of species is necessary. If only the family can be identified, use higher level
TREE_DBH	Diameter at breast height (1.3 m)	Centimetre [mm] Example: 12,3	DBH is measured by diameter tape perpendicular to the stem axis at 1.3 m above ground	
TREE_DHDEV	Deviating height of diameter measurement	Centimetre [signed Integer] Example +25 or -15	Measured with the cm scale of the diameter tape or folding rule	In case of irregularities of the stem it might be necessary to measure a diameter at a height deviating from 1.3 m. In this case the deviation is recorded as signed integer
TREE_HEIGHT	Total tree height	Meter [Decimetre] Example: 15,8	Tree height is the vertical distance between tree top and the stem base	Measured with Vertex or laser hypsometer for: - 3 trees of main species (small, medium and large DBH) - one tree for each additional species
TREE_DAMAGE	Significant damages at tree stem or crown		Visual interpretation	Only significant damages should be recorded. Other damages can be specified in the comments field.
DEAD_ID	Unique ID number of each recorded piece of dead wood			

Variable	Description	Scale/Value [Precision]	Measurement/ Observation	Comment
DEAD_TYPE	Deadwood type	1=standing whole tree 2=standing broken tree 3=lying stem 4=lying branch 5=stump	Visual interpretation	
DEAD_LENGTH	Length of deadwood piece that is found along the 25 m transect	Meter [decimetre] example: 2.7	Measured with tape or Vertex for lying deadwood. For standing dead trees height is measured	In the case of standing deadwood and stumps height is measured in meter (to a decimetre), for lying dead-wood the length is measured. Only the section inside the plot is considered!
DEAD_D	Diameter of deadwood piece	Centimetre [Integer] example: 12	Measured with diameter tape. In case of ground contact estimated with folding ruler	For lying deadwood the dia-meter in the middle of the section that is inside the plot is measured. For standing dead wood DBH is measured. For stumps the mean diameter of the cross sectional area at cutting height.
REG_MIX	Regeneration species mixture	0=pure 1=mixed (2-5 species) 2=diverse (>5 species)	Counting of different regeneration species in the plot	
REG_COVER	Regeneration ground cover	1=< 10 per cent 2=10-30 per cent 3=30-50 per cent 4=50-70 per cent 5=>70 per cent	Visual estimation of mean condition on the plot area	
SHRUB_COVER	Meters of Shrubs covering the 25 m transect	m	Measured with tape	

5.4 Institutional Architecture and Implementation Plan

Phase I of the NAMA as outlined in chapter 2 will initiate the implementation by developing its institutional architecture and will support the strengthening of the NAMA PMU to ensure a well-informed, coordinated and phased approach. Along with this, the MRV system needs to be developed and strengthened organisationally and institutionally. Figure 36 presents the institutional structure and stakeholders to be involved in the design and implementation of the MRV system.

Figure 36: Proposed Organisational Structure of the MRV System



Institutionally, the MRV system should be embedded within the Forestry NAMA PMU which also hosts the NAMA MIS system. The PMU will be responsible for setting up a permanent system of field enumerators to carry out the ABMS as well as the RCP surveys. Once trained, these enumerators should be permanently engaged to ensure consistency over time.

The team should consist of district monitors directly appointed through the PMU, under the supervision of the project monitoring coordinator. On the ground, each village, tea estate or any other target group should select coordinators who are members of the same target groups. These coordinators should be trained over time in the monitoring processes so that a cost-efficient self-reporting system from the target groups can be achieved. This will allow the field enumerators at higher levels to shift their responsibilities from direct monitoring and data collection tasks towards the verification of a sub-sample of self-reported data (for example 5 per cent of the surveyed households and/or RCP plots) from the target groups.

AEDA is also overseeing clean energy (solar) skill development under the Suryamitra Skill Development Program[8]. People trained under this program, can also be trained in maintenance of clean energy installations, their performance monitoring and reporting. AEDA will play a key role in seamlessly linking '*suryamitras'* with the field enumeration team (refer figure above). This will help in employment and income generation in rural Assam. In this way, this monitoring structure will engage the target group households, provide crucial information to improve extension and self-

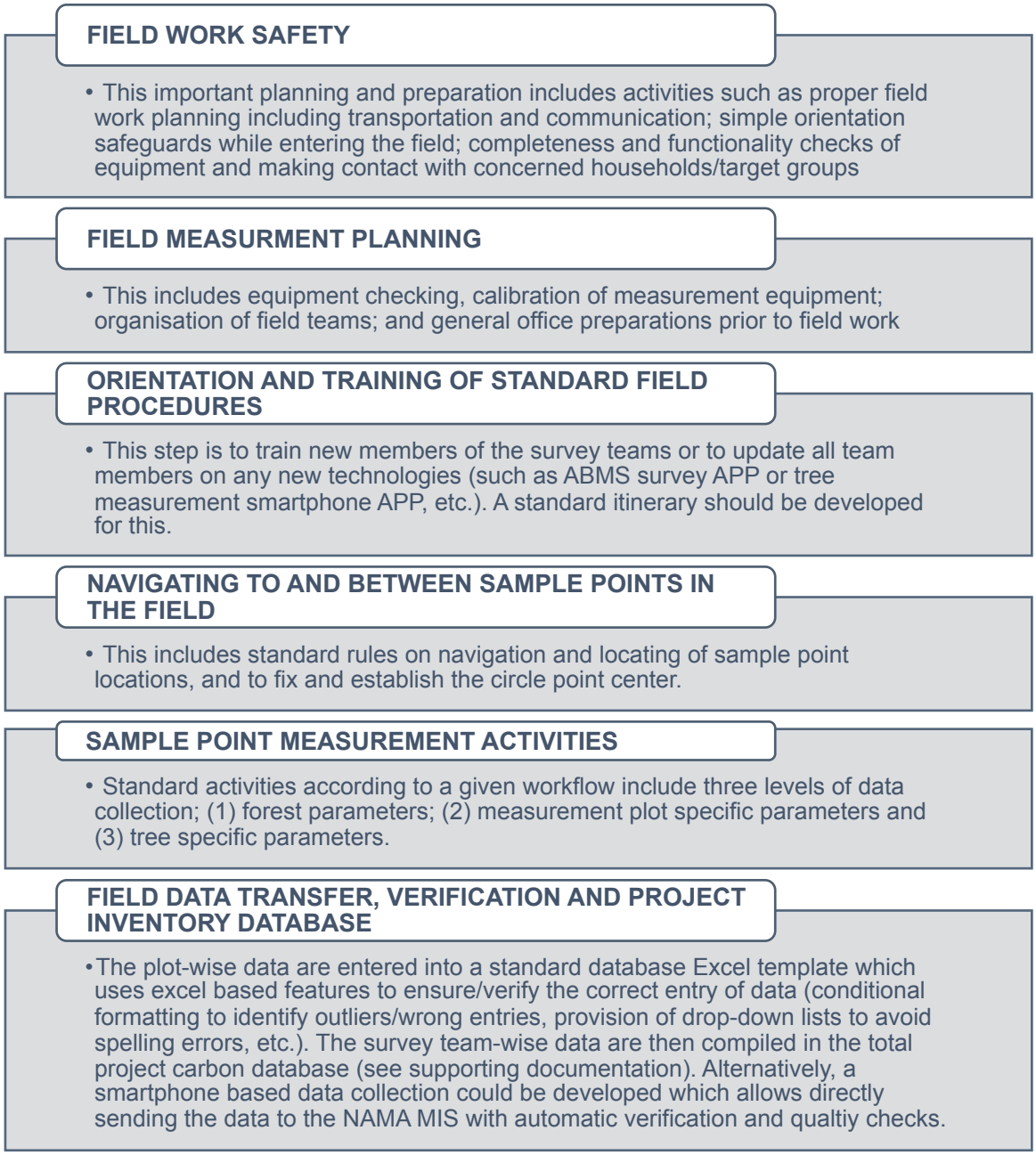
[8] Suryamitra, which literally means 'Friends of Sun' targets skill development and encourage entrepreneurship in rural India. The skill development will be done through State nodal agencies. AEDA is the nodal agency in Assam, and oversees the Suryamitra program in the state. More details of the program in Assam is given here: http://www.nbirt.org.in/informaton-for-participants-willing-to-joint-suryamitra-training-in-guwahati/

learning structures and create an environment of committing the target groups to the relevant NAMA activities. In addition to this standardised structure, all technology providers and aggregators should be also involved in the monitoring system in providing activity data which are required for measuring the performance in terms of NAMA GHG mitigation and other co-benefits.

5.4.1 Organisation of Data Collection, Recording and Analysis

A detailed description of the field data collection procedures for the RCP forest inventory can be found in the next section. The field measurement procedure should be standardised from the beginning of the NAMA and the main steps are summarised as follows:

Figure 37: Overview of a Standardised Field Measurement Procedure



Procedures for Internal Auditing and QA/QC

As stated in the IPCC Good Practice Guidelines for LULUCF, monitoring requires provisions for Quality Assurance and Quality Control (QA/QC) to be implemented via a QA/QC plan (IPCC, 2006). The plan will be part of project documentation and cover procedures as described below for:

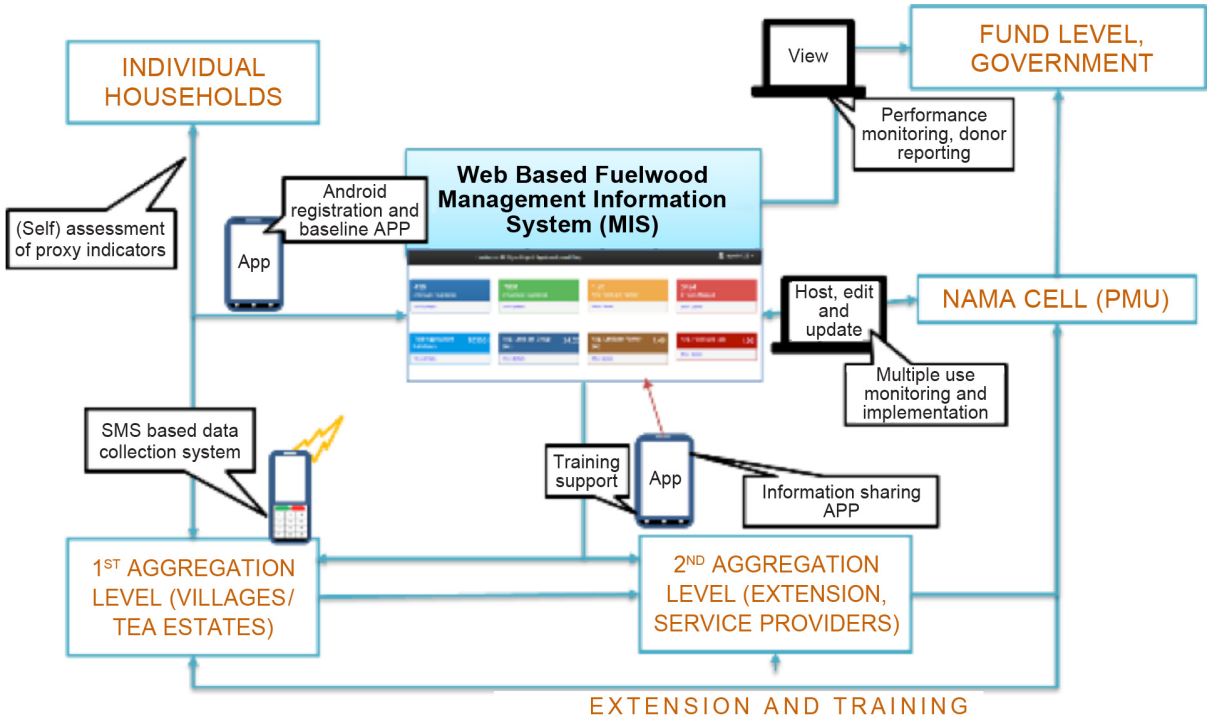
- Collecting reliable field measurements;
- Verifying methods used to collect field data;
- Verifying data entry and analysis techniques; and
- Data maintenance and archiving. This point is crucial, as time scales of project activities are much longer than technological improvements of electronic data archiving.

5.5 Products and Toolkits (Including Training Material)

5.5.1 Technical Features of the Monitoring System

Figure 38 presents an overview of the proposed MRV system and how it could be technically implemented to ensure robust and cost-efficient results.

Figure 38: Information Flow of the Monitoring System



The core system is the web-based NAMA MIS hosted by the NAMA PMU which aggregates, analyses and reports all monitoring information from the fuelwood consumers covered under the NAMA. Ideally, the MIS will be designed in a way that – apart from hosting the database for all monitoring data and information – each technology provider and/or extension organisation will be

provided with a standardised database system to upload its implementation data such as sale records (date and sale of fuelwood saving technologies, geographic area of sale, model/types of technology sold, name and contacts of bulk purchasers, retailers, as well as all end users). Technically this will be done through online editing within the MIS. Alternatively, a series of NAMA specific Android based Smartphone apps should be developed which allow to send such information to the MIS and at the same time is able to receive relevant information from the MIS to efficiently plan interactions with villages such as training needs assessment, adoption (usage) rates, etc.

On the household level, there are different options to collect data. During the registration and baseline survey a specific app will be developed allowing offline entry of data during the household interviews by the surveyors appointed by the NAMA PMU. The annual monitoring of fuelwood saving technology usage rates could be either done with the same app, however, a self-reporting and aggregated SMS based data submission to the MIS has been proven effective already in other smallholder conditions and represents a highly cost-efficient method. Household data are aggregated on an annual basis on the village/tea estate level initiated by the village/target group coordinator. He/she sends the village/tea estate summary data via SMS to the server. Such a system requires a rigorous SOP and quality assurance and quality control procedure to ensure credible submission of data. In addition, it is good practice to verify at least 5 per cent of the datasets through independent verification (by the enumerators). In the same way the measurement of the RCP inventory plots within the fuelwood collection zones can be technically organised. Any other project activities or synergies with other programmes such as the establishment of fuelwood plantations could be easily integrated in such a system as well as the measurement of other performance indicators including health conditions, gender specific issues, employment, etc.

5.5.2 Orientation and Training of Standard Field Procedures

All the surveyors and monitors engaged under the NAMA monitoring should understand the basic ideas behind the survey systems and how to use all the materials and equipment. To train the teams properly, a one-day orientation programme should be organised. Orientation should be carried out in two sessions, a theoretical one and a practical one in the field. Major activities to be carried out during the orientation programme in general are listed in the table below and described subsequently.

Table 29: Outline of a Standard Training for the RCP Inventory

S.N.	Activities	Time Allocation
1.	Introduction to the project monitoring system	15 minutes
2.	Importance of standard forest inventory measurement	15 minutes
3.	Forest carbon measurement procedures	30 minutes
4.	Demonstration and use of equipment and materials	30 minutes
5.	Field demonstration	3-5 hrs.

In the first session, all participants should be given classroom orientation on the importance of carrying out monitoring, the principles of forest carbon measurement, and standards of forest measurement. Every activity to be performed in the field should also be explained sequentially and in a very clear manner. In the classroom all the materials and equipment used during forest measurement should be demonstrated. Participants will get a clearer idea of use of materials and equipment once everything is demonstrated in the field.

Once classroom orientation is over, the whole crew should move to the field. Then all the activities explained in the classroom should be demonstrated. Care should be taken that all participants are actively taking part in the field demonstration. It is important to execute all the activities in the correct sequence, as outlined in the standard procedure

After all the equipment and materials have been gathered and the team given orientation on field measurement, the next key step is preparing a detailed action plan for field measurement activities depending upon human resources available. Planning should be carried out in a participatory manner. Date, meeting points, contact person, and target groups are agreed during the planning.

5.5.3 Tentative Operating Procedure for RCP Field Work

Field Work Safety

- **Security in the field**: Security and safety of all team members during practical field work, transport to the field sites and plot location has the highest priority! All members should be aware of the possible risks and the appropriate mode of behaviour to reduce any risk as far as possible. Every team member is responsible to constantly check his/her personal safety. Every team member is free to stop field work whenever he/she feels uncomfortable or insecure about a situation. Each team member must be aware that an accident in the field is a serious danger for the whole team and that irresponsible behaviour of single individuals is not acceptable.

- The most important measures that should be considered in order to reduce risk are proper planning of field work, including transport to the field. All decisions about planned field work should be taken with enough time and should be communicated to all team members. Avoid spontaneous changes in planning if possible. Always consider that time planning might be obsolete and be flexible to stop field work before it gets dark. Inform the district or project coordinator or the other enumerator teams about your daily working locations.

- **Orientation**: All members of a field team should know where they are working and should be able to describe their actual position whenever necessary. Regularly check the coverage of cellular phone network; eventually mark a waypoint for last connection on the GPS receiver. Track the way to a sampling location in difficult terrain in order to be more flexible on the way back! Take the safest way to a sampling location, not the shortest!

- **Equipment**: Completeness and functionality of equipment should be checked before going out to the field. This includes the charging status of batteries for GPS or mobile phones. A first aid set is part of the equipment.

- **Information**: Keep printed copies of an information handout that describes the background of the NAMA in simple words. Land owners or local communities might be very critical if strangers working on their land without proper explanation (for good reason)! If possible, establish contact to these groups before you actually go to the field and explain about the character of the inventory study in understandable terms. It may also be indicated to invite local people to accompany the field teams during their work and to help them to navigate to the plots in difficult terrain.

Field measurement planning

- **Equipment and materials**: The equipment used for fieldwork should be accurate, rugged, and durable to withstand the rigors of use under adverse conditions. The following list covers the necessary equipment for one survey team:

Table 30: Tentative List of Equipment for RCP Field Work

Devices/Materials	Number	Check/Comment
Backpack for devices	1	
GPS Receiver/Field GIS e.g. Garmin or other	1	Check batteries and whether all necessary data are uploaded on the receiver, in particular the points of the measurement plots
Compass (360°)	1	Check declination for study area
3 range poles 2 meters high (one with 1.3 m DBH-mark)	3	For navigation/ temporary marking of plot centre
Pole of 1.3 m length	1	For identification of the correct height of DBH measurement
Diameter tape (Pi band)	2	For measuring tree DBH
Measuring tape at least 20 m or distance measurement tools (DME)	1	For measuring plot size
Overview map / Roadmap / Topographic map	(1)	If available
Detail map of plot location or high resolution satellite imagery	(1)	Print the necessary sector in advance
Field forms + pencils	10	Depending on number of plots
Marking band	1	Mark tree closest to plot centre
Calculator	1	To correct slope for horizontal measurement
Chalk	3	Chalk to temporarily mark/number the Trees
Replacement batteries	4	Fresh batteries for GPS, or Others
Field manual and overview tables	1	
Short manual for complicated devices		GPS, Vertex, TruPulse360, Nikon Forestry laser, etc.
First aid kit	1	
1 Clipboard & pencil	1	for fixing and filling out tally-sheets

- Check daily, calibrate and test measurement equipment before the work starts! In case anything is broken replacement is required.

- **Organisation of field teams**: For efficient field work and for safety reasons a field team should be composed of at least 3 persons. Each person has a specific role and responsibility during plot location and measurements. The roles of team members could be changed from time to time to make fieldwork less tiring. The responsibilities for the different roles in a team are as follows:

  – **Navigator**: handles the GPS receiver and navigates to the sample point: Tracks the way from the closest road to sample point; Looks for the easiest and safest way to sampling location.

  – **Writer**: stands at the plot centre and records the reported values: Visual inspection and plausibility check of stand and plot variables together with measurer; Record all measurements

reported by the measurer in field forms; Visual interpretation of plot/plantation status together with measurer; Assists in other assessments.

– **Measurer (Jumper):** Goes from tree to tree (clockwise) and takes tree measurements; Announcing tree number (and mark tree number with chalk); Visual inspection and plausibility check of stand and plot variables together with writer; Visual inspection and plausibility check of plot/ plantation status together with writer; other assessments.

- **Inventory preparation in the office**: For the preparation of field work a GIS and respective information is required.
- Several work maps (Din-A4) – of different scale and having specific information for the field teams – should be prepared. The GIS administrator should support the monitoring team to prepare for the upcoming survey campaign. Depending on the field conditions, work can be prepared on a day by day basis or maps for a number of weeks have to be prepared in advance. Before commencing the field work the following questions have to be answered:
  - Where is the new working area (use of the total project area base map)?
  - Which project sites can be covered from this location?
  - How is the terrain (maps and/or satellite-images)?
  - What is the best (shortest or quickest) way to access each site (road situation)?
  - Where are good starting points to start boundary demarcation and the navigation to the first plot (map for each site 1:10.000)?
  - What is the best track from plot to plot (grid map 1:10.000)?
  - The sample plots for the field work must be uploaded as waypoint lists in the GPS or the smartphone using the plot identifiers as waypoint - names.
  - A grid map with all possible locations for sample plots, sample plots to be measured and the collection zone boundaries needs to be prepared

Navigating to and between Sample Points in the Field

- After the team is properly oriented and ready to carry out measurement activities, it has to navigate to the place where the RCPs (also referred to as sample plots) have been selected for a given monitoring event. As soon as the team reaches the plot, it needs to collect all relevant data to monitor the conditions of the forests.
- Navigation for one work day shall be prepared each evening with the help of the grid-map (1:10.000)
- RCP locations are stored as waypoint list on the GPS receiver. Field teams should carefully decide from which direction the plot location can be reached most easily. In mountainous terrain with steep slopes, it is recommended to approach the sampling location from below or parallel to the slope, as walking downhill might be a higher risk because of limited visibility and dangerous escarpments. In difficult terrain, the way from the car/nearest road should be tracked (GPS receiver is on)!

- To start the navigation to the RCP location, the waypoint is selected from a waypoint list. Depending on the GPS signal and the accuracy of positions, the team can navigate close to the sampling location by GPS alone.
- To navigate to the sample plots the 'Go To' function is used. Proximity should be set up so that the centre point of the RCP for every waypoint can be approached.

Figure 39: Navigating to Permanent Sample Plots in the Field Using GPS for Garmin-Etrex 10, 20, 30

Navigating to permanent sample plots in the field using GPS (GPS Map60CSx,Garmin)

- ✓ Press the Findkey, highlight Waypoints and press Enter
- ✓ When the waypoints' list appears, highlight the Waypoint involved and press Enter
- ✓ When the waypoint page is displayed, highlight GOTO and press Enter. On the map page you can see the direction and distance between you and the way point. You can approach the point on the ground following these instructions
- ✓ When you arrive near the radius of the point sought the GPS gives you the information by beeping until you reach the exact centre of the plot

- A long term measurement (~2-3 min, depending on signal reception) is taken at a fixed position in the direct surrounding of the sampling location.
- The remaining distance and direction angle to the target are used to locate the sampling point with compass and distance measure.
- Distance and direction angle to the target can be read from the GPS receiver and are used for ground based navigation with compass, sighting rod and rangefinder. It is important to measure horizontal distances in this case! See below on how to correct slope!
- In case of limited visibility or large distances, the total distance is subdivided in segments of appropriate length.

- For navigation with compass it is recommended to approach the target uphill because of better visibility.
- It is not recommended to locate the final position by walking around with the GPS receiver! A GPS receiver constantly calculates the mean position from signals received over a certain time interval. Therefore, walking around in different directions will not allow getting a more accurate position.

Marking the Plot Centre

Once the sampling location is determined with sufficient accuracy, it is marked temporarily with a marking pole. Additionally, the closest tree to the plot centre is marked with a coloured marker tape.

Start a long-term GPS measurement at the sample point (the centre of the measurement plot). Even if a GPS measurement was used to locate the sample plot, the coordinates of the marked position might still change. It is important to get an accurate position.

RCP Measurement Activities

- **Work flow**: All assessments on the plot should be done in a defined sequence. Taking the measurements in the same order and manner in each plot prevents from forgetting variables and is more efficient. After marking the plot centre and marking of nearest tree to the centre the subsequent order is as follows:
  - Record start time,
  - Start a long-term GPS measurement at the sample point (the centre of the measurement plot)
  - Measurement of slope angle and slope correction
  - Visual interpretation of variables related to the overall forest stand and conditions,
  - Start single tree measurements on TREE and SHRUB variables (start in north direction in clockwise sequence). Tree heights are measured separately after all other single tree data are recorded.
  - Start the 25 m transect in North direction
  - Implement any other assessments
  - Record end time.
- **Slope Correction**: Some of the planting areas might be characterised by steep slopes and a rough topography. All measurements are reported on a horizontal-projection basis. Therefore, the establishment of plots on sloping lands must use a correction factor. This correction factor accounts for the fact that when distances measured along a slope are projected to the horizontal plane, they will be smaller.
- Some devices used to measure distances are able to calculate the horizontal distance automatically (Vertex, Laser hypsometers and rangefinders). If these devices cannot be used, measurements of distances have to be taken with tape and the horizontal distance needs to be calculated in the field based on a measurement of the inclination angle.

- A clinometer can be used to measure slope angles. Most standard forestry compasses also contain a slope measure (Sylva compasses). Otherwise smartphone apps are available which can be used to measure slope inclination.
- A calculator can be used in the field to make the simple trigonometric calculation (distance on the sloping ground is equal to the cosine of the angle of the slope divided by the desired radius) necessary to determine the slope. Alternatively, a chart (shown below and shown on the field survey sheet) with horizontal distances calculated according to the slope angle could be taken to the field.

Table 31: Table with Slope Correction Factors

Slope (in degree)	Slope (in per cent)	Correction ($\cos \alpha$)
10	18	0.98
15	27	0.97
20	36	0.94
25	47	0.91
30	58	0.87
35	70	0.82
40	84	0.77
45	100	0.71

- For example, to establish the 11 m horizontal distance radius of the measurement circle under e.g. 20 degrees' slope conditions calculate: 11 m/ 0.94 (correction factor in the table above for 20 degrees) = 11.7 m; This means that you have to measure with your tape a radius of 11.7 m under 20 degrees' slope conditions to establish a sample circle of 11 m horizontal distance or 410 m^2 surface area.
- **Boundary trees**: Occasionally trees will be close to the border of the plots. Plots will be expanded to estimate biomass, carbon or other indicators on a per hectare basis. It is, therefore, important to carefully decide if a tree is in or out of a plot. If more than 50 per cent of the trunk is within the plot boundary the tree is in. If more than 50 per cent of the trunk is outside of the boundary it is out and should not be measured. If it is exactly on the border of the plot, flip a coin to determine if it is in or out. When a tree leans into the circle but has its base outside it will be excluded from the measurements.

Single tree measurement guidelines

- Single tree measurements start in north direction from the sample point and proceed in clockwise direction. All included trees are marked with a TREE_ID for later selection of height measurement (temporary with chalk).
- Diameter measurement: In each sample point the DBH measures of trees are taken. If possible, DBH are measured for all included trees. Diameter at breast height (TREE_DBH) is measured in 1.3 m height from the ground with a diameter tape. The tape must be tightened perpendicular to the stem axis. Climbers growing at the stem have to be removed.

Figure 40: DBH Measurement Using the Diameter Tape

Using a DBH tape: It is important that a DBH tape is used properly to ensure consistency of measurement:

- Be sure to have a staff or pole that is 1.3 m in length available so that the DBH location on the tree can be identified accurately. The pole should include a scale of heights which are below 1.3 m to measure special heights in case of irregular growth.
- DBH tapes often measure diameter on one side and circumference on the other. It is important that all measurers know which measurements to record.
- If the tree is on a slope always measure on the uphill side.
- If the tree is leaning, the DBH tape must be wrapped according to the trees natural angle, not straight across parallel to the ground.
- If the tree is fallen but is still alive, then place the measuring stick towards the bottom and measure at DBH just like if the tree was standing upright. Trees are considered alive if there are green leaves present.
- Please refer to the chart for measuring DBH under different conditions
- DBH for a multi-stemmed trees: Record each DBH as separate trees, with different tree IDs
- **Height measurement**: The use of a 3-5 m simple pole (e.g. bamboo) with markings serves as a good reference to estimate the heights of trees.

Figure 41: DBH Measurement Under Different Tree Growing Conditions

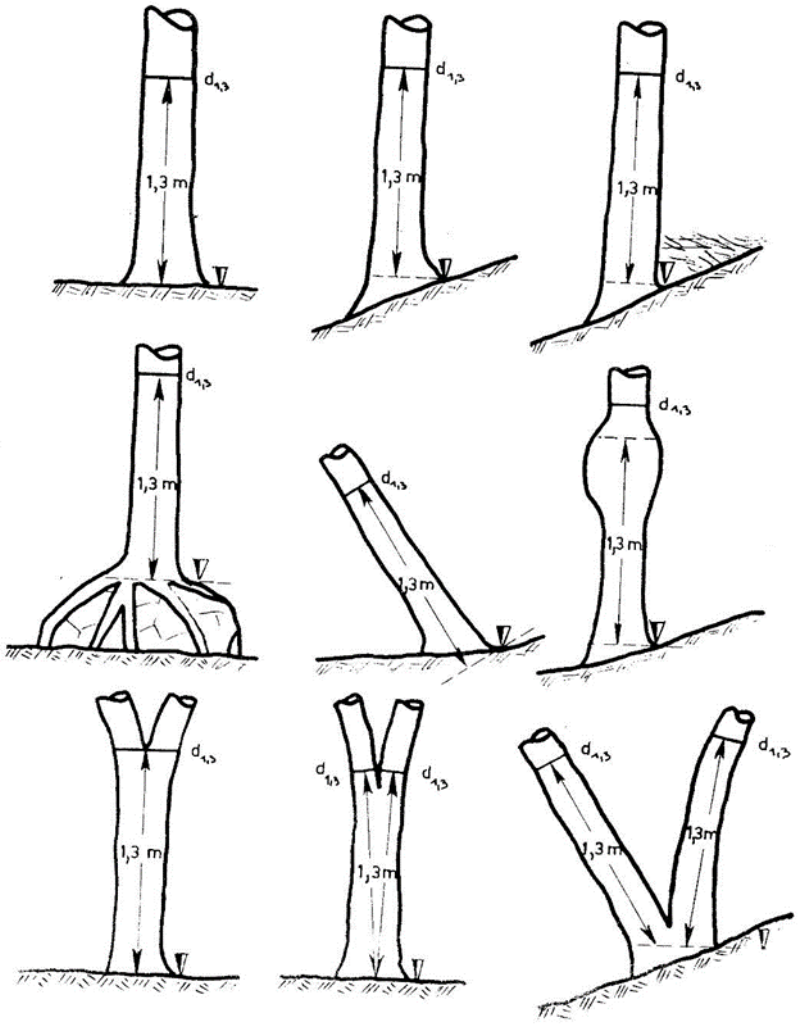
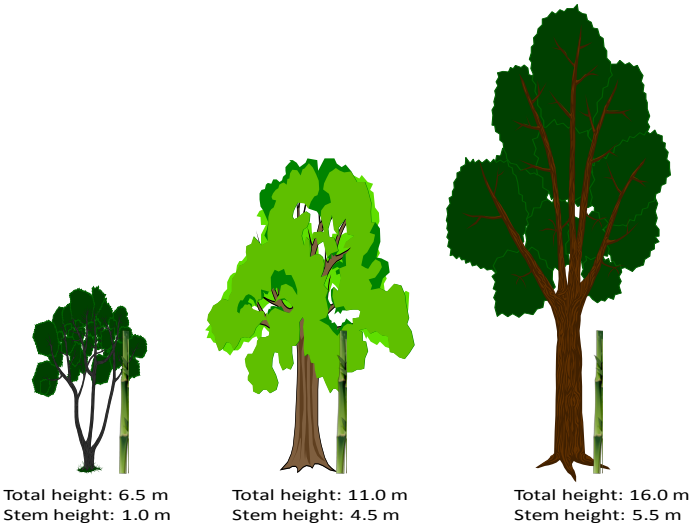


Figure 42: Height Estimation Using a Reference Pole

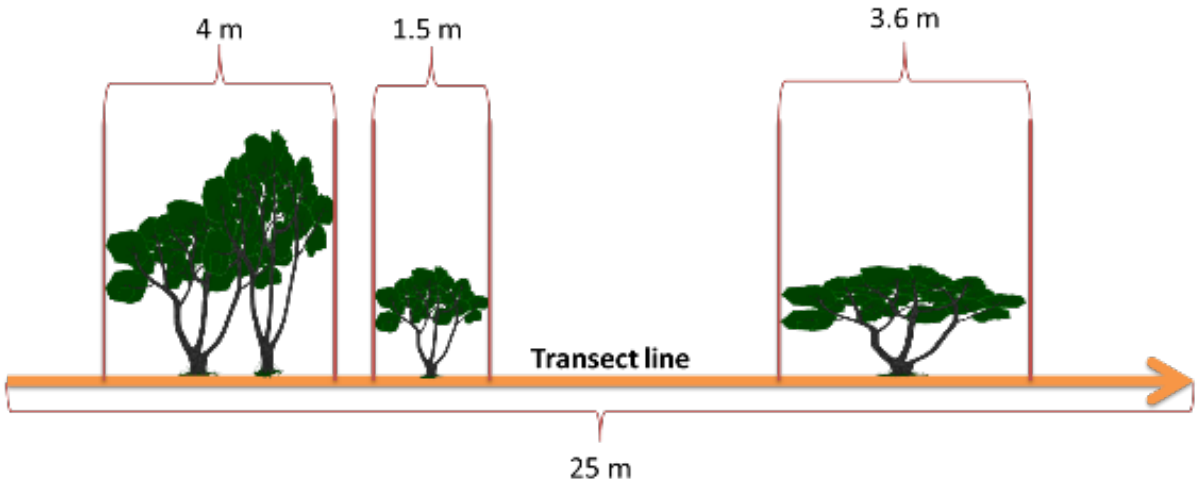


Shrub crown cover assessment: The crown cover estimation is done along the 25 m transect line starting at the plot centre. Along the transect lines; the distance of first contact to the last contact of the species which are crossing the transect line are measured. Ignore overlap of individuals of same species. Decide what to do with broken canopy within a shrub or tree. Usually, if there is a gap less than 10 cm ignore it, count gaps greater than 10 cm. The crown cover is calculated as:

$$\text{per cent } CCOVER\ shrubs = \left(\frac{\sum distance\ of\ all\ shrub\ spp\ along\ line}{\text{total distance transect (25 m)}}\right) \times 100$$

An example is given below.

Figure 43: Shrub Crown Cover Estimation

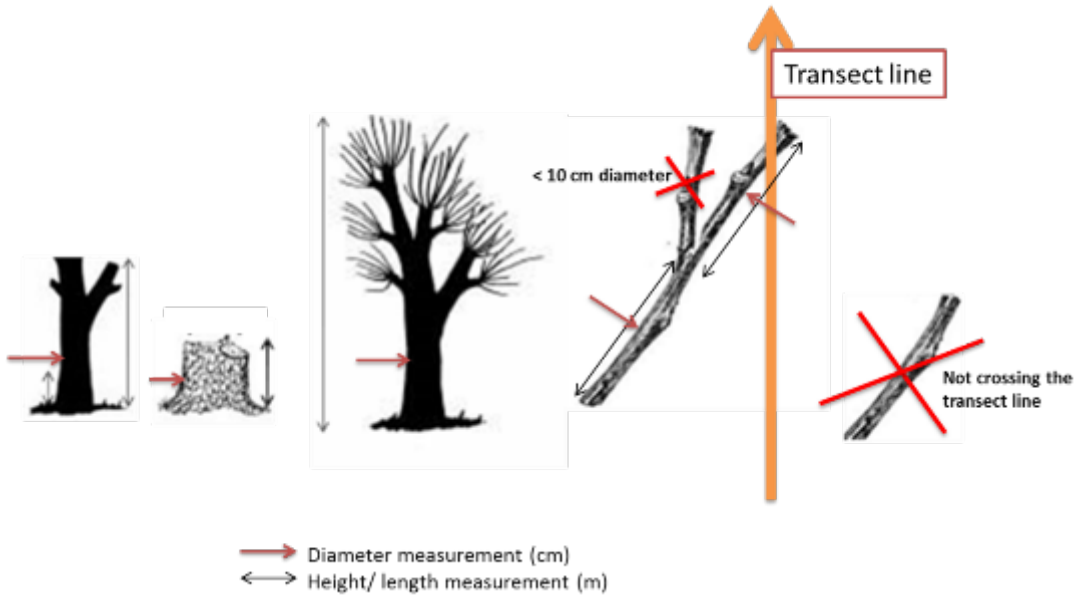


% Shrub crown cover = (4+1.5+3.6)/25 x 100 = 36%

Make sure that you consider slope correction for the 25 m transects.

Dead wood assessment: Standing and lying deadwood is assessed in the sample plots and along the 25 m transect line in the case of lying dead wood. The measurement for standing deadwood and tree stumps larger than 4 m height are measured in the same was as living trees. For stumps smaller than 4 m the middle diameter is measured. Lying deadwood is recorded along the transect line and only dead trees and branches with a middle diameter of larger than 10 cm which are crossing the line are recorded. In case of forked deadwood pieces of each segment is considered separately.

Figure 44: Deadwood Assessment



6. NAMA Financing

6.1 Introduction

This chapter provides a financial analysis for the Forestry NAMA in the State of Assam. To begin with, in the NAMA Establishment Phase, the focus will be on reducing fuelwood demand by two identified fuelwood consumer groups in the State of Assam for which the financing analysis and strategy is prepared.

On the fuelwood supply side, the NAMA will aim to support sustainable fuelwood production, providing planning tools that better leverage existing schemes and spending. The existing domestic financing options for this part are explored through a review of existing government incentive schemes for enhancement of fuelwood supply (section 6.4.1).

In this chapter, the business cases and investment needs for the key actor groups involved in the NAMA coordination and implementation are presented. Subsequently an analysis of the international and domestic financing sources is summarised. A financing strategy is then proposed, followed by concrete options to mobilise financing and a preliminary fund disbursement matrix.

6.2 Assessment of Investment and Financing Needs

In the state of Assam about 4.3 million (81 per cent) of rural households and 0.26 million urban households (26 per cent) are still dependent on fuelwood for cooking (Government of India, 2011). Of the rural households, approximately 1 million households are located in nearly 800 tea estates.

For the investment needs assessment, a scale of 1 million fuelwood consuming households is considered that can be covered over a period of five years (NAMA Establishment Phase). This represents 23 per cent of the total fuelwood dependent rural households in the state. Using the existing distribution pattern of rural households in Assam, approximately 25 per cent of the target households will be located in tea estates (250,000 households) and 75 per cent are rural and forest village households. The technology mix for the adoption of fuelwood saving technologies is assumed to be 63 per cent for improved cook stoves, 23 per cent for biogas and 14 per cent LPG (Table 1; see also section 6.2.3). These assumptions are based on estimates gathered during the stakeholder consultations and an approximation of a realistic technology mix.

Table 32: Assumed Forestry NAMA Adoption of Fuelwood Saving Technologies

Key variable	ICS	Biogas	LPG	Total
Technology adoption mix (households)	630,000	230,000	140,000	1,000,000

In order to achieve this rollout scale, considerable investment at different levels will be required. The financing need assessment is structured according to the key components of the NAMA and can be broadly summarised into the enabling environment for NAMA operation/management interventions and investments into adoption of fuelwood saving technologies. The table below summarises the key components of the programme, the identified suitable financing mechanisms, the financing recipients and the justification for the financing instrument.

Table 33: Forestry NAMA Components, Financing Instrument and Recipients

Purpose of NAMA Funding	Identified suitable Financing Instrument	Financing Recipients	Financing Instrument Justification
Enabling environment interventions for fuelwood saving technology adoption			
Coordination and management of the NAMA Development and operationalisation of Assam Fuelwood Decision Support System (AFDSS)[9] Implementation of the M&E & MRV system	Governmental forest sector budget lines and convergence of relevant schemes Technical assistance grant for capacity development & AFDSS development	Assam Department of Environment & Forests (DoEF)/NAMA Program Management Unit (PMU)	The Assam DoEF will require support in implementing the NAMA. Technical assistance will be required to support the DoEF and NAMA PMU in creating an enabling environment for meeting the objectives of the NAMA, raising fuelwood plantations and promoting adoption of fuelwood saving technologies. Investments towards this technical assistance will not have any revenue streams and will be for the public good
Awareness creation & demonstration of fuelwood saving technologies Linkage of target groups with appropriate technology providers	Technical Assistance and market development grants	Household aggregation & training organisations (NGOs, CSOs)	This investment will help mobilise the recipients to undertake public service that will not have any direct revenue stream. The investment will be critical to the success of the NAMA and will potentially unlock the desired private sector investment by addressing the key barriers to adoption of fuelwood saving technology
Fuelwood saving technologies investment & adoption			
Investment into deployment & adoption of fuelwood saving technologies	Loans Personal financing Subsidies	Tea estate households & rural village households	There is a business case for fuelwood saving technologies from the target group perspective. Loans can be repaid by cost savings from technology adoption Existing government subsidy programmes to incentivise technology deployment by reducing costs to users

[9] The AFDSS is presented in Chapter 3 and as a policy brief. In summary, the AFDSS will use system designs principles to produce highly contextual investment strategies for fuelwood plantations and fuelwood saving technologies at a sub-regional level in Assam.

6.2.1 NAMA Financing Needs to Create an Enabling Environment

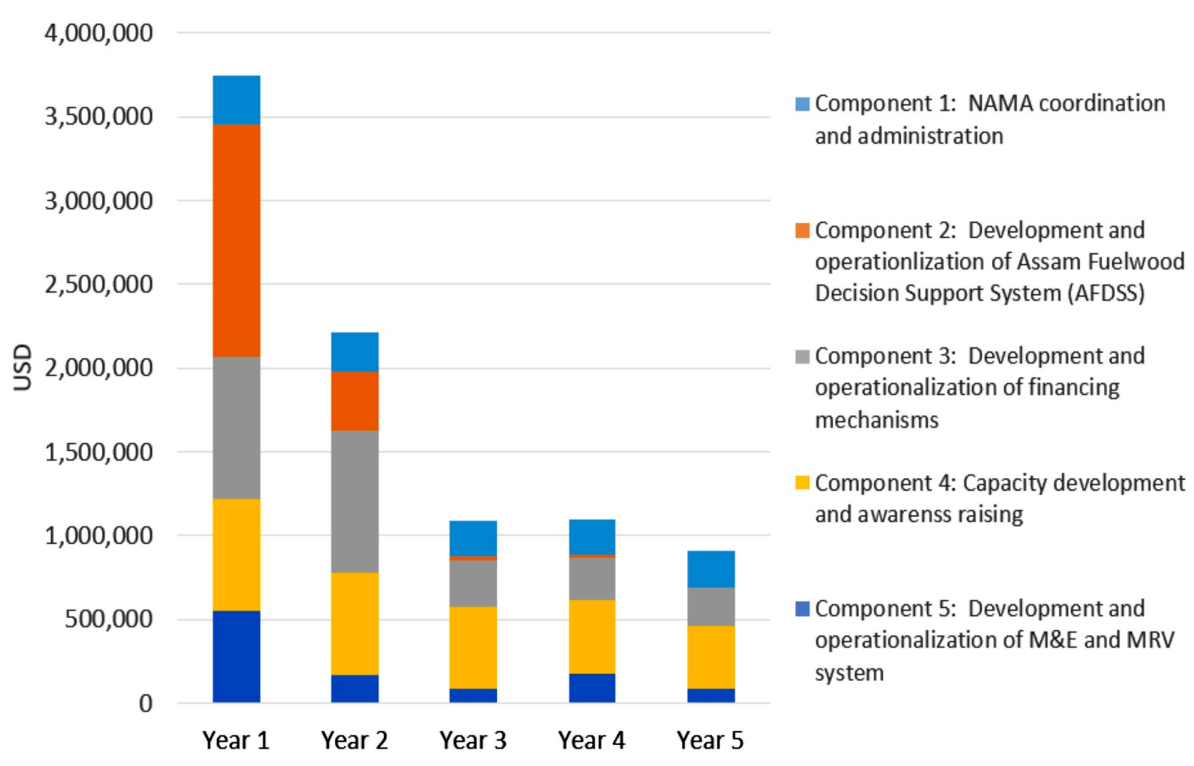
In order to trigger implementation of the NAMA, investment into the enabling environment will be crucial. This component contains five major sets of activities:

- NAMA coordination mechanisms, strategic and operational management, hosted by the DoEF.
- Development and operational management of an Assam Fuelwood Decision Support System (AFDSS).
- Support the operationalisation of financing institutions in establishing/modifying credit lines and strengthening understanding of fuelwood saving technology finance.
- Recruitment and capacity building of aggregators, training organisations (NGOs, CSOs) and technology providers to support NAMA implementation.
- Development and operationalisation of systems the NAMA Measurement, Reporting and Verification (MRV) System.

The estimated investment required for the NAMA Establishment Phase (covering 5 years) is USD 9.06 million[10]. This include costs for staff, travel, consulting services and material investments. The largest individual investment will be related to the AFDSS development and operationalisation in the first two years amounting to USD 1.74 million (Refer to Figure 45). The cost for MRV will add up to USD 1.07 million over a period of five years. The cost for NAMA coordination, capacity development and operationalising the financing mechanisms will add up to USD 6.21 million. In the first year the total investment will amount to USD 3.75 million which will reduce to USD 0.91 million in year 5.

[10] Currency exchange rate applied of USD 1 = INR 68.84

Figure 45: Cross-Cutting and Enabling Environment Investment Over Five Years

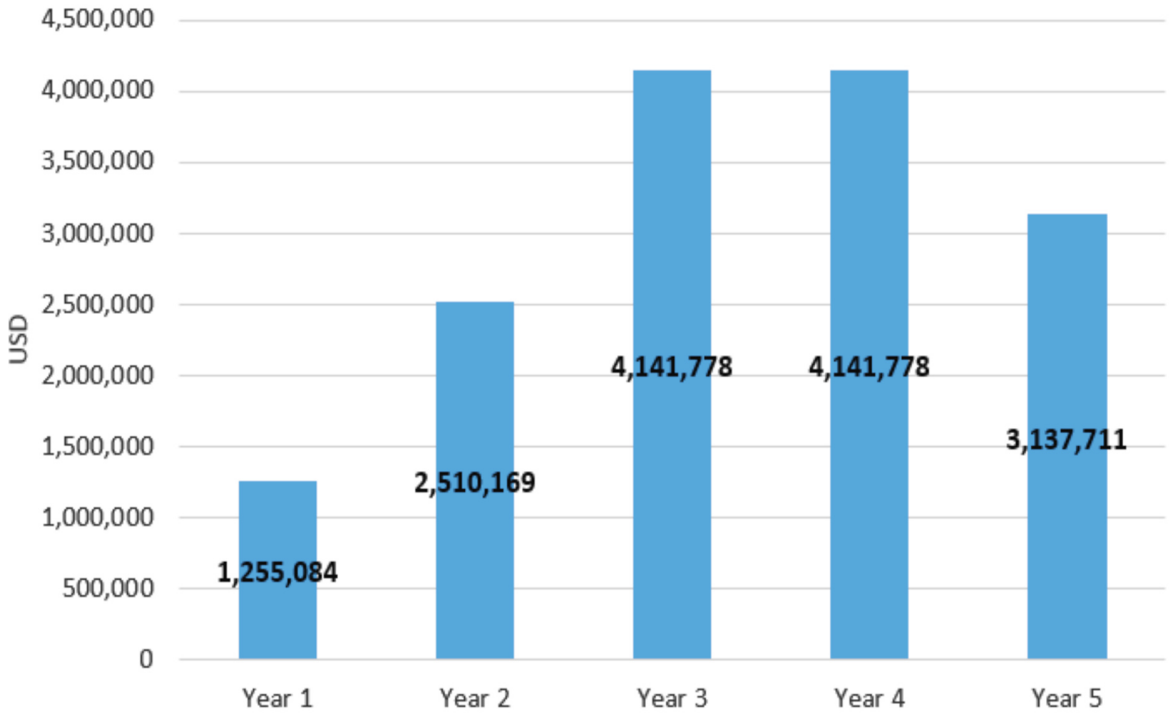


6.2.2 Investment Needs for Aggregating Households and Technology Distribution

As described in more detail in chapter 7 ('Capacity Development'), awareness raising about fuelwood saving technology options and their benefits will be required to create the market demand. This will require involvement of grassroots level organisations and creation of an efficient aggregation and distribution network for fuelwood saving technologies.

Assumptions for the related investment needs to achieve a scale of one million households are based on existing similar Indian experiences. It is assumed that on average one selected and contracted CSO or NGO will be able to mobilise about 16,500 households. In each district an intensive 2-year awareness raising and demonstration will be carried out. Based on these assumptions the average per organisation budget to undertake the activities is estimated at USD 125,500/year (including the overhead costs, staff costs and travel) and a per household investment costs for mobilisation and awareness raising of USD 15.2/household. In total the investment need to mobilise the one million households is estimated at USD 15.2 million over five years. Section 6.4 elaborates on the potential source of financing for this component.

Figure 46: Awareness and Household Aggregation Costs to Mobilise 1 Million Households



6.2.3 Business Models and Investment Needs of Rural Households

The target households usually have access to fuelwood at low or no costs. However, collecting fuelwood can consume a significant amount of time, especially for women, and harms family health due to indoor pollution. The annual cost to collect fuelwood amounts to about USD 497 per year taking into account the time and the minimum Indian daily wage rate of USD 3.6; average fuelwood collection of three hours per day per household and a per capita annual fuelwood consumption of 1.7 tonnes of fuelwood.

The adoption of fuelwood saving technologies will result in time savings in fuelwood collection and long-term health benefits to the entire family, especially women and children. This time can be devoted to alternative productive activities (e.g. revenues generating activities). The reduced time for fuelwood collection and investment in fuelwood saving technologies will result in significant net benefits. In order to demonstrate these benefits a baseline and scenarios with alternative fuelwood saving technology adoption (improved cook stoves, biogas and LPG) were compared.

Valuing reduced amount time for fuelwood collection with the minimum Indian wage and assuming the investment for fuelwood saving technologies and operational costs (see table below), the net financial benefit amounts to USD 122 to USD 354 annually per households[11] (including investment and maintenance cost for technology), as shown in Figure 47.

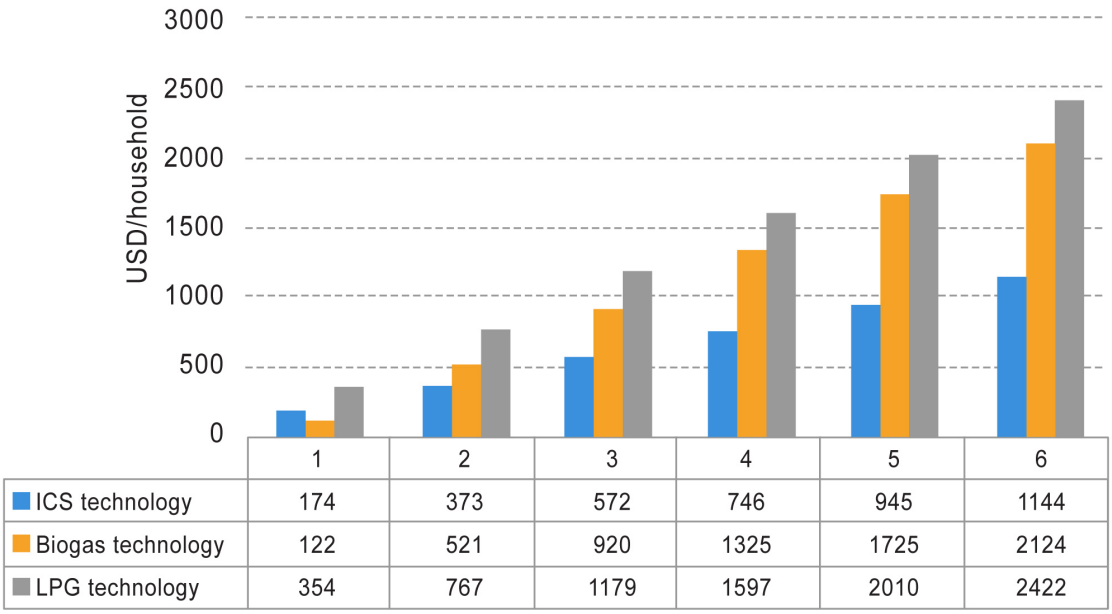
[11] Assume daily fuelwood collection time of 3 hours per day per household equivalent to 137 days/year/household = USD 497 labor cost per household is devoted to fuelwood collection.

Table 34: Key Financial Variables for Business Case and Financing Needs Assessment

Key Variable	ICS	Biogas	LPG
Per unit investment costs (USD/unit)	30.5	283	64
Average annual operational cost (USD)	0[12]	23	55
Assumed technology lifetime (years)	3	10	10
Potential public subsidy per unit (USD)	5.8[13]	160[14]	64[15]

Sources: AEDA, 2016; MNRE, 2016; GoA, 2015

Figure 47: Cumulative Household Benefits From Fuelwood Saving Technologies



	1	2	3	4	5	6
ICS technology	174	373	572	746	945	1144
Biogas technology	122	521	920	1325	1725	2124
LPG technology	354	767	1179	1597	2010	2422

Since the time spent for fuelwood collection is normally not a cash outflow to the household, households will face a cost and a negative financial outflow when investing in fuel saving technologies. This comprises an investment barrier for the household. This investment barrier can be covered by access to specialised financing services including loans (see sections on potential domestic financing sources – 6.3 and 6.4 – and the financing strategy – 6.5). The loans can be repaid by new revenues streams from increased household productivity and/or other productive and cash generating activities.

[12] Labour for fuelwood collection is not counted as operational technology costs, thus excluded from the financing needs assessment

[13] Unnat Chulha Abhiyan: The minimum subsidy available for AEDA approved ICS technologies is INR 400 (AEDA, 2016)

[14] National Biogas and Manure Management Program: The subsidy available for 2-6 m^3 biogas plants under the scheme is INR 11,000 for Assam (MNRE, 2016)

[15] Randhanjyoti Scheme: State level program providing 2 LPG cylinders with accessories to each beneficiary (GoA, 2015).

Another key incentive to invest into fuelwood saving technology is the long-term health benefits. To make sure this acts as a motivation to increase adoption of the new technology, significant awareness raising campaigns are required. Further, it is essential that the fuelwood saving technologies being promoted are able to meet the cooking needs and behavioural patterns of the targeted households. This key barrier must be addressed by the technology demonstration and the matching of the cooking habits of the local population with suitable technology options which will be addressed by the AFDSS.

For the design and identification of suitable financing instrument it will be crucial that the financing entity has a strong local presence to avoid high transaction costs for household debt financing. In this regard group financing structures have proven to successfully reduce debt cost on village and household levels in India as they increase the ticket sizes for financiers thereby reducing the transaction costs and making it economically viable.

Calculation of the financing needs were made assuming that 750,000 rural households invest into new fuelwood saving technologies assuming the following adoption rates:

- Improved cook stoves (63 per cent),
- Biogas (23 per cent), and
- LPG (14 per cent)

These assumptions are based on estimates gathered during stakeholder consultations.

Table 35: Assumed NAMA rural household participation key variables

Technology	Rural Household Technology Mix[16]	Amount of Rural Households
Improved cook stoves (ICS)	63 per cent	472,500
Biogas	23 per cent	172,500
LPG	14 per cent	105,000
Total	100 per cent	750,000

Based on these assumptions, the investments needed from rural households amounts to USD 84.4 million for technology purchase (CAPEX). Out of this, about USD 6.24 million would qualify under existing public subsidy schemes (Section 6.4.1). The largest investment will be for biogas worth USD 48.9 million, followed by investments for ICS (USD 28.8 million) and LPG (USD 6.7 million). The operational costs (OPEX) for the technology add up to USD 58.6 million considering the full assumed lifetime of the technologies.

6.2.4 Business Models and Financing Needs of Tea Estates

The tea estates supply a fixed quantity of fuelwood per permanent worker household, and in some cases even to the sub-staff households, in accordance with the prevalent trade union agreements between the Assam Chah Mazdoor Sangha and various tea associations in the state (Assam Chah Mazdoor Sangha, 1979). However, literature review and consultations held with tea estates indicate

[16] Assumptions are based on estimates gathered from stakeholder consultations

that meeting this demand has been and will continue to become increasingly difficult for tea estates. Given this scenario, it is in the business interest of tea estates to reduce their dependence on fuelwood through promoting adoption of fuelwood saving technologies amongst the fuelwood dependent households in their respective estates. This justifies a strong business case for tea estates to invest in fuelwood saving technology deployment, and as well fuelwood plantations if possible, under the NAMA.

As per the prevalent trade union agreements, the total quantity of fuelwood to be supplied per worker family annually is 228 cubic feet (cft) (equivalent to 6.5 m^3 of fuelwood or 3.3 tonnes of fuelwood). However, consultations held during the NAMA development process revealed that the household level demand in many cases can be over 3.3 tonnes of fuelwood per year.

Considering the household level demand of 3.3 tonnes of fuelwood per year and according to the existing market prices the annual average mandatory fuelwood supply cost borne by the tea estates amounts to about USD 239,686/year to serve on average 1,250 households/tea estate (total supply of 4,125 tonnes of fuelwood), though the scale may vary among tea estates. This annual cost is only limited to the tea estates contribution and household often need to invest in addition to cover their full demand. While tea estates are bound to maintain their expenditures for fuelwood provision, given the trade union agreement, they will still benefit from fuelwood demand reduction due to reduced health risk for their workers leading to higher workforce productivity and reduced cost for medical treatment. Another benefit will be the reduction of fuelwood collection pressure by the households that often collect and harvest trees on tea estates land thereby damaging the plantations. In addition, the households will benefit from improved health and reduced efforts to gather fuelwood. Considering that adoption of fuelwood saving technologies results in less demand for fuelwood and less work input to gather fuelwood, on a tea estate level, the net incremental benefit from reduced fuelwood consumption and reduced expenditures may range between USD 355,135 and USD 1.6 million depending on the technology adoption over a period of 6 years (see table).

Table 36: Overview tea estates business cases (average 1,250 households)

Technology	Assumed fuelwood savings compared to baseline	Required investment on tea estate level (USD)	Time when investment amortises (break-even)[17]	Cumulative financial net savings after 6 years (USD)
Improved Cook stoves (ICS)	40 per cent	38,150	Year 1	355,135
Biogas	75 per cent	458,672	Year 5	459,762
LPG	90 per cent	105,861	Year 1	1.6 million

The consultations with tea estates indicated that the upfront investment required for procuring fuelwood saving technologies is not likely to be a key challenge. To this end, various financing models have been successfully deployed for covering the upfront investment in procuring fuelwood saving technologies. For instance, one model that has worked is for the tea estate to cover the upfront investment and internally manage short-term loans for households to repay the technology cost. This repayment can be covered by taking a small share from the workers' weekly/monthly salaries. As an

[17] When cumulative net financial savings from reduced fuelwood delivery turn positive

alternative to the balance sheet investment, the tea estates could pre-finance the technologies through debt financing from their partner banks.

In addition to the tea estates investment, dedicated awareness raising, technology demonstration and linking/selecting high quality technology providers will be required in order to convince the households and tea estates to invest. This investment and service would be coordinated by the NAMA PMU and delivered by the aggregation organisations.

For the assessment of financing needs, the assumed investment needs per unit are identical to the rural village household assumptions. The total assumed scale of the tea estates households is 250,000 (see table below for a disaggregation according to technologies).

Table 37: Assumed NAMA Tea Estates Participation

Technology	Tea estate technology mix[18]	Tea estate households
Improved cook stoves (ICS)	63 per cent	157,500
Biogas	23 per cent	57,500
LPG	14 per cent	35,000
Total	100 per cent	250,000

Based on these estimates, the investment by the tea estates amounts to USD 28.1 million for technology purchase (CAPEX). Out of this about USD 2.08 million would qualify under existing public subsidy schemes (see section 6.4). The biggest investment will be for biogas worth USD 16.3 million, followed by ICS USD 9.6 million and LPG USD 2.2 million. The operational costs (OPEX) for the technology add up to USD 19.5 million considering the full assumed lifetime of the technologies.

6.2.5 Summary of Financing Needs

In total, the NAMA will require financing of USD 215 million over 5 years (Refer to Table 38). Beyond the five years, only operational expenditures (OPEX) for the fuelwood saving technologies will apply. Post the NAMA Establishment Phase, scaling up the programme to other fuelwood consumers will require additional investments.

For NAMA interventions with a clear business case and revenue stream debt finance is recommended. Also, subsidies of existing governmental schemes may be applicable to incentivise the investment into desirable technologies.

Grant funding will be required for interventions focusing on public good that have no revenue stream and support the creation of an enabling environment for NAMA implementation. This will amount to USD 32.6 million.

[18] Assumptions are based on estimates gathered from stakeholder consultations

The requisite financing can be secured from different sources – private and public sources at national and international levels. Therefore, an analysis of the potential international and domestic financing sources is carried out, as elaborated in the subsequent sections.

Table 38: NAMA Financing Needs According to Sources Summary Table

Financing source for Forestry NAMA implementation	Domestic finance sources		International climate finance
	Private	Public	Public
Grant for cross-cutting and enabling environment, M&E and MRV		0.9	8.2
Grant for household aggregation, mobilisation and demand creation	15.2		
Loans for fuelwood saving technology (rural villages) (CAPEX)	78.2		
Operational costs of fuelwood saving technologies (rural villages) (OPEX)	58.6		
Tea estates level investments fuelwood saving technologies (CAPEX) (from liquid assets and commercial banks)	26.1		
Tea estates operational costs for fuelwood saving technology deployment (OPEX) (from tea estates households)	19.5		
Grants from governmental incentives schemes for fuelwood saving technologies (CAPEX)		8.3	
Sub-total financing sources	197.6	9.2	8.2
Total financing sources	215.0		

6.2.6 Investment Needs for Scaling Up the Forestry NAMA in India

While the aforementioned estimates assume the implementation of the Forestry NAMA only in the State of Assam, this NAMA can be replicated throughout India. According to latest estimates from the Census of India (Government of India, 2011), 120.9 million households in India depend on fuelwood for meeting their cooking energy needs across all 29 Indian states and seven union territories. Assuming that a nation-wide NAMA will target the same ratio as in the State of Assam (23 per cent of all fuelwood dependent households for cooking), on the national scale this would amount to 27.8 million households.

In order to scale up the NAMA to the national level it is assumed that in each of the 29 Indian states and the seven union territories, a NAMA PMU will need to be established to implement the cross-cutting and enabling environment activities, including the development of Fuelwood Decision Support System and MRV. This would result in total of USD 326 million that needs to be invested nation-wide.

For the household aggregation, awareness raising and distribution, the investment needs are proportional to the scale of the households. Assuming an investment need of USD 15.2 per

household for aggregation and awareness raisingis, in line with the NAMA in Assam, a total of USD 422 million for the 27.8 million households will be required.

The investment needs for the fuelwood saving technology purchase (CAPEX) will add up to USD 2.59 billion while the operational costs (OPEX) will add up to USD 2.17 billion. This is assuming the same technology adoption ratio as in the State of Assam.

Based on these estimates, the total investment required to implement the demand side measures of the Forestry NAMA at a national scale will be USD 5.5 billion (Refer to Table 39).

Table 39: Investment Needs to Nation Wide Scaling up the Forestry NAMA

Component	USD billion
Cross-cutting and enabling environment incl. M&E and MRV investment needs (public investment)	0.326
Household mobilisation, awareness raising and demand creation (public investment)	0.422
Fuelwood saving technology investments (CAPEX)	2.594
Operational costs of fuelwood saving technologies (OPEX)	2.174
Total financing needs	5.517

6.3 Sources of International Climate Finance

6.3.1 Selection Approach of Climate Finance Sources

According to India's Nationally Determined Contribution (NDC), 'finance is a critical enabler of climate change action' (MoEFCC, 2015). Access to international climate finance is challenging. Each financing institution has its own focus areas, regions, access modalities and funding criteria. Thus, an excellent understanding of these different climate finance institutions can increase the effectiveness of climate finance mobilisation and inform the financing strategy for the Forestry NAMA. India has become the largest recipient of international climate finance at the global scale with over USD 1 billion (CFU, 2017).

For the identification of potential climate finance sources for the Forestry NAMA in India, a review of the existing international climate financing streams to India was carried out. Thereby a two-step approach was applied:

- A long-list of 14 multilateral and bi-lateral climate finance sources was assessed that are already operational or are likely to become operational in the near future (See Annexure 3). Scope of the review covered the potential eligibility of the climate finance institutions for investment into the thematic scope and potential to finance the grant-based enabling environment activities.

- A shortlist of the most promising financing sources for the NAMA was created and in-depth analysis was carried out covering:
  - Objectives thematic scope of the financing source
  - Eligible funding recipients/implementing partners
  - Project proposal funding volume ranges
  - Costs for preparing project proposals
  - Funding criteria and access modalities
  - Experiences on the effectiveness of the financing source

This in-depth analysis served as a basis to structure the financing strategy and developed recommendation on mobilising international climate finance.

6.3.2 Selection of Climate Finance Sources for the Forestry NAMA

Based on this review, a recommendation was derived whether each of the considered financing sources can cover parts of the Forestry NAMA financing needs. Out of this review, three promising key sources were identified such as the Global Environment Facility (GEF); Green Climate Fund (GCF); NAMA Facility. A summary of these source is presented in the Table 40. sources are multilateral in nature, while bi-lateral cooperation was not identified as a promising source to finance the NAMA.

In order to raise international climate finance, an upfront investment is required to carry out background analysis and to develop funding proposals by government entities or implementing entities[19] that are eligible to receive and manage the funds. International climate finance institutions expect a large share of domestic public and private finance leverage as a pre-condition for investment into a programme and concessional loans are normally preferred compared to grants. The subsequent section 6.4 elaborates on potential domestic financing sources. Further, all identified climate finance institutions normally provide financial resources for '*transformational*' or '*paradigm shift*' interventions of projects and programmes. International climate finance institutions require demonstration of strong political will and leadership to ensure local ownership. In the context of the Forestry NAMA, this implies that the cross-cutting and enabling environment interventions and investments are most promising components of the Forestry NAMA to apply for and receive international climate finance (see section 6.2.1).

The major differences among the international financing institutions are related to the available funding volumes, access modalities to the implementing entities and the required upfront investments as shown in the following table.

[19] Implementing entity refers to institutions that are accredited under the climate finance institutions to receive and manage climate finance on behalf of governments.

Table 40: Overview of International Climate Financing Institutions

Name	GCF	GEF	NAMA Facility
Inception year	2010	1992	2012
Thematic scope	Climate change mitigation and adaptation	Climate change mitigation, adaptation & environmental protection	NAMA piloting
Funding per project	USD ~5-250 million	USD 0.025-50 million	USD 5-20 million
Proposal investment	USD 150,000 - 200,000	USD 150,000 - 200,000	USD > 100,000
Financing instruments	Grants; concessional loans; guarantees; equity	Grants, concessional loans, guarantees, equity	Grants, concessional loans, guarantees, equity
Implementing entities in India	NABARD; GIZ, ADB; WB; KfW, UNEP, UNDP	ADB; UNDP; UNEP; WB	UN organisation, development banks, NGOs, foundations, public agencies
Funding criteria	Impact potential; paradigm shift; country needs; country ownership; efficiency and effectiveness, financial viability and co-financing	International conventions compliance; national priority; large co-financing, GEF priorities; wide stakeholder participation	Transformational change, financial public and private finance leverage; mitigation potential, feasibility of NAMA

In terms of available funds for a programme/project, GEF and GCF have significantly larger financing scopes compared to the NAMA Facility which has limited funding available and is very competitive (on average one 1 out of 10 proposals is selected for support).

Application for GEF and GCF funding would require that an implementing entity would need to be identified. In case of GEF funding, UNDP or WB would be most suitable as an implementing entity. In case of GCF, GIZ or NABARD would be the most suitable accredited entity to submit the proposal and manage a grant.

In case of NAMA Facility application GIZ would be the most suitable 'NAMA Support Organisation'. This is mainly due to a previous application for the project in 2016 and internal GIZ related quality assurance procedures. The NAMA interventions should fit into the programmatic country strategies of the implementing entities and complement their portfolio. GIZ with its previous involvement would be able to support the government in raising international climate finance from the GCF or NAMA Facility. As an alternative NABARD may consider to invest into proposal development for the GCF or the NAMA Facility if their internal resources can be mobilised. For GEF funding initial consultation with UNDP or the World Bank would need to be initiated by the government of India to assess whether the NAMA fits into their thematic and regional scope. A fund mobilisation strategy for each of the three potential international sources is elaborated in section 6.6.

6.3.3 Outlook for Additional International Climate Finance Sources

Multilateral Development Banks

In addition to the selected climate finance sources which all have multilateral character, multilateral development banks may also act as an additional climate finance source. In India, the World Bank (WB), the Asian Development Bank (ADB) and the recently founded New Development Bank (NDB) are operational and finance development projects. On one hand these institutions act as accredited/implementing entities to multilateral funds such as GCF, Adaptation Fund, GEF, among others. On the other hand, these institutions also source their own funding to design and structure projects based on requests of the host countries and may be an additional source of financing for the NAMA.

In the context among the three multilateral development banks and their thematic scope in India, only the WB could be a potential source for financing the NAMA. In case of the two remaining financing institutions' (ADB and NDC), the thematic scope in India and their country strategies are not complementary with the NAMA interventions. In the case of the World Bank, several projects have been carried out around the thematic focus on forestry and biomass generated energy efficiency, though not in the state of Assam. In order to explore potential opportunities to finance the NAMA, the government of India may consider to initiate a dialogue with the World Bank to assess their interest in financing the NAMA in Assam and explore potential synergies with their pipeline projects.

Another option to access co-financing from the WB is the selection of the WB as an implementing entity for a GEF or GCF project proposal. Since GEF and GCF expect a significant share of the total project costs as domestic and international co-financing, this options should be explored. This is in particular considerable if the scope (regional and/or addressing also the supply side through fuelwood plantation) of the NAMA will be further increased.

The Paris Agreement Article 6

The Paris Agreement offers Parties the opportunity to cooperate with one another when implementing their NDCs. The cooperation mechanisms enshrined in Article 6 of the Paris Agreement form the legal framework to allow use of market-based climate change mitigation mechanisms. Article 6 sets out several routes through which countries may wish to cooperate in implementing their NDCs (EBRD, 2017).

Cooperative approaches under Articles 6.2 and 6.3.: This refers to provisions allowing countries to implement collaborative market mechanisms that will lead to internationally transferred mitigation outcomes (ITMOs) that can be counted towards the achievement of countries' NDCs.

The UNFCCC-governed crediting mechanism under Articles 6.4 to 6.7: These articles refer to a centralised, international crediting instrument under the UNFCCC, with assured quality and legibility of the emission reductions. Emission reduction may then be used by all countries to meet their NDC.

The framework for non-market approaches under Articles 6.8 and 6.9: These articles recognise that the substantial portion of climate action does not engage market approaches, contributes to the achievement of NDCs, and needs promotion and coordination.

The Paris agreement provides potential opportunities to source new climate finance. Work on these has just begun through the UNFCCC, to develop guidance on operationalising the desired cooperation. These articles may be in particular interesting for performance based payments for

achieved emission reductions once the Forestry NAMA is operational. However, until countries are able to receive financing from such mechanisms, several years of development work will be required and large uncertainties exist. Thus, at this stage this source of international climate finance is not considered for the development of the financing strategy of the Forestry NAMA.

6.4 Sources of Domestic Finance

Over the last few decades, reduction of unsustainable fuelwood extraction from forests has been a goal across several national policies. In line with this, there have been many domestic initiatives across national and sub-national levels by the government, donor agencies, corporates and other civil society organisations to incentivise various aspects of sustainable fuelwood management in the country. In the following section, the most relevant government programmes and financing sources that align with the NAMA objectives and interventions are presented. This is followed by an assessment of potential funding opportunities from the domestic corporate sector including Indian companies and financial institutions.

6.4.1 Government Subsidies and Incentive Schemes

There are multiple government agencies that have been involved in programmes either focusing on increasing fuelwood supply through fuelwood plantation or in reducing fuelwood demand by promoting specific fuelwood saving technologies. Specifically, eight key government programmes have been identified for potential convergence with the Forestry NAMA. The following analysis (see table below) takes eight different governmental schemes into consideration that specifically focus on

- Fuelwood demand reduction incentive schemes by the Unnat Chulha Abhiyan (1), National Biogas & Manure Management Programme (2), Randhanjyoti Scheme (3).
- Fuelwood supply enhancement incentives schemes by the Compensatory Afforestation Fund (CAMPA) (4), National Afforestation Programme (NAP) (5), Mahatma Gandhi National Rural Employment Guarantee Act Fund (MGNREGA) (6).
- Cross-cutting energy and climate change incentive schemes by the National Clean Energy and Environment Fund (NCEEF) (7), National Adaptation Fund on Climate Change (NAFCC) (8).

Table 41: Overview of domestic government incentives schemes and financing options

Name	Focus	Financing Mechanism	Eligibility Criteria	Implementing Agency(s)
Fuelwood demand reduction incentive schemes				
Unnat Chulha Abhiyan	National programme to develop and deploy improved biomass cook-stoves	Subsidy on technology which differs by the type of the ICS and year of deployment. For FY 2013-14, the subsidy provided was at INR 600 (~USD 9) per ICS and in FY 2015-16 and FY 2016-17 it was INR 450 (~USD 7) per ICS. The average annual target for the state has been 20,000 for FY 2014-15 and FY 2015-16.	Rural, semi-urban and urban areas using biomass as fuel for cooking. Technology model has to be empanelled by the AEDA.	Assam Energy Development Agency (AEDA)
National Biogas and Manure Management Programme	National programme to deploy household level biogas plants	Subsidy on technology which differ by the size of the biogas plants and location. For North Eastern Region (NER) States except plain areas of Assam, the subsidy is INR 15,000 (~USD 234) for a 1 m^3 plant and INR 17,000 (~USD 266) for a 2-6 m^3 plant. In the plain areas of Assam, the subsidy is INR 10,000 (~USD 156) for a 1 m^3 plant and INR 11,000 (~USD 172) for a 2-6 m^3 plant. The average annual target for the state under the programme between FY 2012-13 to FY 2016-17 has been 7,420 biogas plants.	Specific technology models can avail this subsidy which are provided in the programme guidelines.	Implemented by the DoEF in Assam and the Biogas Development and Training Center (BDTC) for the region is the Indian Institute of Technology, Guwahati.
Randhanjyoti Scheme	State level program to provide domestic LPG connections to poorest of poor families across rural and urban areas.	Grant to provide LPG connection along with two cylinders and accessories per beneficiary household. In FY 2015-16, a total of 5,694 beneficiaries were identified out of a total of nearly 2 million BPL households in the state. The cost is INR 4,390 (approx. USD 68) per beneficiary.	Eligible beneficiaries are widows, woman member of SHGs, any other female member of Below Poverty Line (BPL) families, landless agricultural labourers, marginal farmers, slum dwellers and daily wage earners	Nodal agency: Food, Civil Supplies & Consumer Affairs Department, Government of Assam. Program implementation: District Administration/Autonomous Councils
Fuelwood supply enhancement incentives schemes				
Compensatory Afforestation Fund	National programme to undertake afforestation activities to compensate for loss of forest cover, regeneration of	Grant for the activities approved, management of the fund, monitoring and evaluation of activities supported by the fund. The fund can support (i) site-specific schemes	Executing agencies identified in the annual plan of operation approved by the Steering Committee at the state level and	State Forest Development Agency (SDFA), Forest Development Agency (FDA) and Village-level Joint

	forest ecosystem, wildlife protection and infrastructure development.	implemented by the state; (ii) artificial regeneration, forest management and wildlife protection; and (iii) protection and conservation activities in protected areas	Executive Committee at the national level.	Forest Management Committees (JFMCs)/ Eco-Development Committees (EDCs)
National Afforestation Programme (NAP)	National programme to develop forest resources with people's participation and a focus on improvement in livelihoods of forest-fringe communities	Grants to mobilise village-level JFMC, and micro-planning in project villages; afforestation programmes; soil and moisture conservation; entry point activity (for village development; average assistance INR 1.6 lakh per village) and; fencing, monitoring & evaluation, training, awareness raising, and overheads.	Eligible activities have to be approved 5-year perspective (5-Year Plan) and year-wise Annual Plan of Operation (APO) for treatment of the identified project areas, prepared in consultation with the JFMC/EDC/potential village members.	Forest Development Agency are constituted at the State level and function as federation of Forest Development Agencies in the State and; JFMCs/Eco-Development Committees (EDCs).
Mahatma Gandhi National Rural Employment Guarantee Act Fund (MGNREGA)	National programme to provide livelihood enhancement of households in rural areas by providing at least 100 days of guaranteed wage employment per year to every household whose adult members volunteer to do unskilled manual work.	Payment for labour/Employment guarantee Budgets are allocated annually to states and the budget for Assam has been increasing over the years. The approved budget for the FY 2016-17 in Assam was INR 408 Lakhs (~USD 0.64 million).	Activities eligible under the program include construction of vermi-compost tanks, plantations amongst others. These can also be activities on individual land of small and marginal farmers who constitute 89 per cent of the farming community, and individual lands of SC/ST/BPL/IAY beneficiaries.	Panchayat & Rural Development Department in Assam
Cross-cutting energy and climate change incentive schemes				
National Clean Energy and Environment Fund (NCEEF)	National fund to support any research and innovative projects in the area of clean energy technologies and clean environment initiatives	Viability gap funding and loans to any project or government scheme relating to innovative clean energy technology and clean environment initiative and/or research and development are eligible for funding (MoF, 2017). There are 15 categories of eligible projects listed in the revised guidelines for this Fund. There are no caps on the project funding request amount but there are three levels of approval forums: projects worth less than INR 150 crores (~USD 23.4 million), those falling between INR 150 crores to INR 350 crores (~USD 23.4	Project proposals can be submitted by individual or consortia of organisations in the public sector or private sector. All projects must be sponsored by a Ministry or Department of the Government. Proposals submitted to the concerned line ministry are evaluated on a case-by-case basis by the Inter-Ministerial Group (IMG). NCEEF assistance cannot exceed 40 per cent of the total	Cess is collected by the Central Board of Excise & Customs (CBEC) while Plan Finance II (PF-II) Division of the Department of Expenditure, Ministry of Finance (MoF) acts as the Secretariat for the NCEEF and is the agency responsible for disbursing the funds as well.

		million to USD 54.7 million), and those above INR 350 crores (~USD 54.7 million).	project cost. Projects funded by any other arm of the Government of India are not ineligible for funding under the NCEEF.	
National Adaptation Fund on Climate Change (NAFCC)	National fund to scale-up climate change adaptation interventions in accordance with the National Action Plan on Climate Change (NAPCC) and State Action Plans on Climate Change (SAPCCs)	Grants - Indicative cap for a project is up to INR 25 crores (~USD 3.9 million per project). Till date, the per project funding under NAFCC amounts to approximately INR 21 crores or USD 3.1 million.	Ministries/Departments of the Government of India and State Government Departments are eligible to submit proposals for accessing the fund. Guidelines identify six climate adaptation project components, as well as six programme management and execution components.	National Bank for Agriculture and Rural Development (NABARD) is the National Implementing Entity (NIE)

In order to support the fuelwood demand reduction side of the NAMA interventions, there are three public incentives schemes that can provide subsidies to the adoption of fuelwood saving technologies. Based on the planned annual targets of the program and available funding in the State of Assam, the three subsidy schemes could provide up to USD 8.3 million over 5 years as a subsidy to households (Refer to Table 42) to support the estimated USD 190.7 million investment needs for fuelwood saving technologies. This is equivalent to 4 per cent of total investment needs for fuelwood technologies (CAPEX and OPEX).

Table 42: Public Incentive Schemes Financing for the Fuelwood Saving Technology

Fuelwood demand reduction incentive schemes	Scope of incentive	Annual target in Assam	Financing volume in Assam (est. for 5 years)
Unnat Chulha Abhiyan	Subsidy for improved biomass cook stoves	20,000 households	USD 0.58 million INR 40 million
National Biogas & Manure Management Programme	Subsidy for household level biogas plants	7,420 households	USD 5.93 million INR 408.1 million
Randhanjyoti Scheme	Grants for LPG connections to Below Poverty Line (BPL) households (Assam)	5,700 households	USD 1.81 million INR 125 million
Total			USD 8.32 million INR 572.75 million

However, the following aspects have to be considered:

- The eligibility criteria for the beneficiaries varies across the programmes. For instance, the Randhanjyoti Scheme focuses on the low-income sections of society, predominately BPL households. The NAMA aims to cover all fuelwood dependent households. It will therefore only be able to leverage these programmes for a certain group of the society.

- The programmes focusing on deployment of improved cook stove and biogas plants have specific manufacturers and models which are approved. The NAMA, through the AFDSS, may cover a larger set of models which are not eligible to access the subsidies provided under these government programmes.
- The central government programmes follow a top-down approach with specific targets allocated to states for deployment of technologies. For instance, the UCA in Assam had an annual target of 20,000 households improved cook stoves. The NAMA aims to cover a much larger number of fuelwood dependent households.

With respect to the fuelwood supply side investment needs for establishment of fuelwood plantation, four public incentive schemes have been identified as potential financing sources – the Compensatory Afforestation Fund (CAMPA); the National Afforestation Fund (NAP); the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). The suitability and availability of financing under each of these schemes will depend on the location and socio-economic context of fuelwood plantation that will be recommended by the AFDSS.

In order to support financing of the cross-cutting and enabling environment components of the NAMA, the National Adaptation Fund on Climate Change (NAFCC) could serve as a source of domestic financing in case a change in the design will be made towards a stronger focus on adaptation that fits into the scope of the fund. However, this would imply a change in the design of the NAMA from a mitigation action towards a larger focus on adaptation action such as building the climate resilience of rural households by replacing inefficient and health damaging fuelwood burning practices. Therefore, at the current stage the NAFCC is not considered as a potential source of financing in the financing strategy.

6.4.2 Private Sector

Corporate Social Responsibility (CSR)

There are several private sector actors that can potentially finance components of the Forestry NAMA. These include corporates mandated to make CSR investments and commercial establishments dependent on fuelwood. Section 135 of The Companies Act, 2013 and The Companies (Corporate Social Responsibility Policy) Rules, 2014 (CSR Rules) came into effect on 1st April 2014. These regulations mandate that any company that operates in India and having net worth of rupees five hundred Crore (~USD 77 million) or more, or turnover of rupees one thousand Crore (more than USD 150 million) or more or a net profit of rupees five Crore (~ USD 770,000) or more during any financial year has to spend 2 per cent of its average net profits made in the preceding three years on CSR. In addition, Schedule VII of The Companies Act 2013 highlights ten activities[20] that can be carried out by a company to achieve its CSR obligations.

The proposed NAMA interventions have clear linkages to the objectives and recommended activities of the CSR regulation such as '*promotion of education; promoting gender equality and empowering women; reducing child mortality and improving maternal health; combating human immunodeficiency virus; ensuring environmental sustainability*'. Potential for leveraging CSR investments, of both private

sector companies and Public Sector Undertakings (PSUs) operating in Assam, for the following can be explored:

- Subsidising the deployment of fuelwood saving technologies and/or fuelwood plantations recommended by the AFDSS
- Supporting the engagement of civil society organisations under the NAMA for effective awareness generation, capacity building, and deployment and monitoring of fuelwood saving technologies/fuelwood plantations.
- Supporting capacity building of local entrepreneurs to build technology distribution networks and cadre of skilled service providers for operation and maintenance of the technologies deployed.

Tea companies in Assam which are mandated to make CSR investments can be engaged in mobilising these investments towards deployment of fuelwood saving technologies or supporting communities raising fuelwood plantations. Apart from these, a list of large corporates operational in Assam and mandated to invest in CSR is available in Annex 4. The Ministry of Corporate Affairs, in the Director's Report filed on MCA-21 Portal (as on 31st January 2016), estimated that a CSR investment of INR 147 billion (over USD 2.25 billion) was anticipated from 10,475 eligible companies in India. However, only 7,334 companies reported their CSR investments. Of these reporting companies, only 3,139 reported a CSR expenditure of approximately INR 88 billion (~USD 1.35 billion). This amount was only 74 per cent of the total prescribed expenditure (2 per cent formula) of approximately INR 119 billion (approx. USD 1.83 billion). This indicates the potential of this funding source to support the NAMA implementation. This report also stated that Assam ranked 14th out 36 states and union territories in India in terms of state-wise CSR expenditures with approx. INR 1.07 billion of CSR funding in the state.

Securing CSR funds requires either government endorsement of the program and guidance to companies to invest in it or a lengthy bilateral engagement with corporates. A new opportunity to source this funding source that allows to reach out to a larger group of corporates is the 'India Climate Responsibility Facility (ICRF)', which is currently in its establishment phase and is being supported by GIZ India. The objective of the facility is to pool CSR funds from multiple Indian companies and channel them into large scale, pan-India climate change programmes that would otherwise not be possible from a single financing source. This will significantly reduce transaction costs to mobilise and acquire CSR finance. The primary advantage for a company in investing in a facility like the ICRF is to participate in large scale programmes with greater impact. The ICRF will be centrally managed and administered through two hosts, one responsible for implementing mitigation programmes and the other for adaptation programmes.

Since the ICRF is still in the design phase, the funding volumes, implementation agencies, eligibility criteria and funding criteria remain to be defined. The major investment opportunity for the ICRF will be to fund the aggregation of households and finance eligible organisations in awareness raising and demonstration of fuelwood technologies. These activities would be implemented by selected organisations such as qualified NGOs, Cooperatives, Producer Organisations, and Community Based Organisations.

Commercial Establishments Dependent on Fuelwood

Beyond tea estates, there are other large local fuelwood consuming private sector players such as *dhabas*, restaurants, brick kilns and other institutions that may invest into fuelwood saving technologies and broaden the scope of the NAMA and significantly reduce the state level fuelwood consumption and increase the GHG mitigation potential. These players are not well organised and very dispersed throughout the country. Thus to integrate these into the NAMA they would need to be analysed in detail through extensive consultations and field visits which could be covered in the NAMA Establishment Phase.

Unlocking this investment would require provision of the necessary technical support towards awareness raising and capacity building of the fuelwood consumer groups to switch to fuelwood saving technologies, linking with the appropriate technology and service providers, and ensuring effective monitoring and evaluation of deployed technologies. For some of these commercial establishments, access to easy finance in the form of a specialised debt instrument for procurement of fuelwood saving technologies may help in improving their ability to invest in these technologies.

6.4.3 Financing Sector

The financing sector can be categorised into development financing institutions and regional rural banks (RRBs) from the public sector. From the private banking sector, micro-financing institutions complement the financing institutions that may provide financing services to the NAMA target groups for fuelwood saving technology adoption.

Development Financing Institutions (DFIs)

Development financing institution (DFI) is an 'institution promoted or assisted by Government mainly to provide development finance to one or more sectors or sub-sectors of the economy' (RBI, 2004). In India, under the Companies Act, 1956 certain existing institutions were categorised as 'Public Financial Institutions' (PFI) which serve the purpose of DFIs and there are over 50 institutions which have been categorised as PFIs in the country (RBI, 2004). Amongst these institutions, NABARD's work aligns well with the Forestry NAMA and hence it can potentially play an important role in its implementation.

National Bank for Agriculture and Rural Development (NABARD)

NABARD is a PFI with a total balance sheet of over USD 40 billion. It has the mandate of promoting sustainable agriculture and rural development through innovative, sustainable and equitable agriculture and rural prosperity by providing financial and technical support. Climate change financing is one of the key focus areas of NABARD and almost one-third of its cumulative disbursements are related to climate change adaptation and mitigation activities.

NABARD has built partnerships with other national entities, financial institutions and non-governmental organisations in order to implement innovative ideas through several financial instruments including loans, guarantees, blended finance and other structures in its focus areas. It is the only accredited NIE from India eligible to apply and receive international climate finance from the GCF, and could thus serve as an accredited entity to source international climate finance from the GCF. Under the GCF, it is accredited for project management, grants and lending scopes for large projects (> USD 250 million). NABARD also serves as the only accredited NIE from India for the Adaptation Fund.

Of all the NABARD financed programmes, the most relevant for the Forestry NAMA is the Umbrella Programme for Natural Resource Management (UPNRM). This development bank and programme is being implemented by NABARD, the German KfW and GIZ with the aim to promote environmentally sustainable growth by encouraging private investments that are pro-poor.

UPNRM promotes partnerships between private and public sector agencies that link rural businesses to existing value chains. The program helps to develop technical and managerial competencies of community based organisations required to enter into partnerships with corporates and the government and assists partnerships technically as well as financially. Its Credit Plus Facility provides a mixture of financial and technical support comprising of capacity building, marketing, infrastructure support and risk mitigation strategies like insuring assets and the life of the borrower. Under the programme, a combination of loans and grants are provided to NGOs, producer organisations, cooperatives and banks. By ensuring economic viability and sustainability, the risk of loan default is reduced. The loans must generate an income for the project participants, who pursue an appropriate business plan to ensure their repayment as well as the sustainable use of natural resources. Eligibility funding criteria are related to

- Engaging rural poor people,
- Protecting the environment,
- Promoting community participation,
- Strengthening decentralised governance,
- Integrating various disciplinary approaches that are responsive to community needs.

Regional Rural Banking sector (RRBs)

The idea of Regional Rural Banks (RRBs) was mooted by the Government of India in the year 1975 to bring about the desired uplift of the rural economy and accordingly promulgated an Ordinance which was subsequently replaced by the Parliament as Regional Rural Banks Act, 1976. Regional Rural Banks (RRBs) in India are integral to the rural credit structure of the country. In Assam, there are two relevant RRBs, of which Assam Gramin Vikash Bank (AGVB) is the largest covering 25 districts with 406 branches.

Assam Gramin Vikash Bank (AGVB)

Assam Gramin Vikash Bank (AGVB) was formally established in 2006 with its Head Office at Guwahati, state capital of Assam. The bank is owned by government (60 per cent) of India; Government of Assam (15 per cent) and United Bank of India (35 per cent). The Bank's key mission is to spread banking literacy to each household of its area of operation and initiate appropriate intervention for economic uplift of the people of Assam through Agriculture, Micro, Small and Medium Enterprises. AGVB has a presence in most of the districts and a client base of 7 million clients (> 20 per cent of total population) which is the largest banking network of branches in rural Assam. It has significant experience in providing direct credits to households and entrepreneurs, as well as channelsling low-cost debt capital to Micro Finance Institutions (MFIs). While the MFIs have a high loan repayment rate, their lending rates are high, ranging between 24-36 per cent of which normally about 10-12 per cent is needed for AGVB to cover the transaction costs of loans appraisal, management and monitoring. In addition, AGVB has supported promotion and credit linkage of Self-Help Groups (SHGs) in Assam, by forming 198,406 SHGs involving over 2 million people as of March 2016 and nearly 83 per cent of the total SHGs being credit linked (AGVB, 2016). Based on

consultations with the bank, the overall non-performing loans of the bank amount to 26 per cent. The loans are normally provided at an interest of 14 per cent at commercial rate. Ticket sizes range between 3,000-5,000 INR (USD 44-73). It provides concessional loans at 12 per cent for ticket sizes of 5,000 INR (~USD 73). Thus the RRB and MFIs can play a key role to channel the USD 78.2 million CAPEX for fuelwood saving technologies under the Forestry NAMA. The ticket size of ICS may be too low for individual households. Therefore, aggregation through Joint Liability Groups (JLGs)/SHG model or blending with other income generation loans can be explored to increase the ticket size.

Microfinance Sector

The MFIs complement the financing services of RRBs in rural areas. A range of lending models are practiced to deliver microfinance services across India and in Assam. These vary from getting refinance from larger national development or regional development financial institutions. Financing from the development banking at concessional lending rates is a key instrument by the public sector to reduce the MFIs' lending rates to the rural sector.

Other effective method to reduce lending cost to the rural population is the formation of JLGs/SHGs, sometimes supported by the MFIs, that generate internal funds and link with formal banks or MFIs for additional financing. The SHG model is one of the dominant approaches where groups of mainly poor women are expected to assume joint liability for loans taken by their clients. This model helps avoid high transaction costs and MFIs have been providing group lending or blending multiple income generating loans in Assam. Consultation with a MFI operational in Assam revealed that this model has reduced the debt cost significantly for them while maintaining non-performing loan at rates below 10 per cent. In Assam, the SHG movement has gained momentum over the years with a total of more than 560,000 SHGs being bank linked, of which nearly 44 per cent were credit linked in year 2015.

Summary and Implications for the NAMA Financing Strategy

The assessment of the financing sector has shown that financing in rural areas of Assam to tea estates and to other rural households is available either through the DFIs, RRBs, and commercial banks or through micro-finance institutions. The cost of debt to end consumers varies between 14 per cent (interest per annum in case of governmental subsidised NGO on-lending) and 20-30 per cent interest annually (in case of micro-finance institutions) and is mostly lent for short-term loans for income generating activities with a solid cash flow profile.

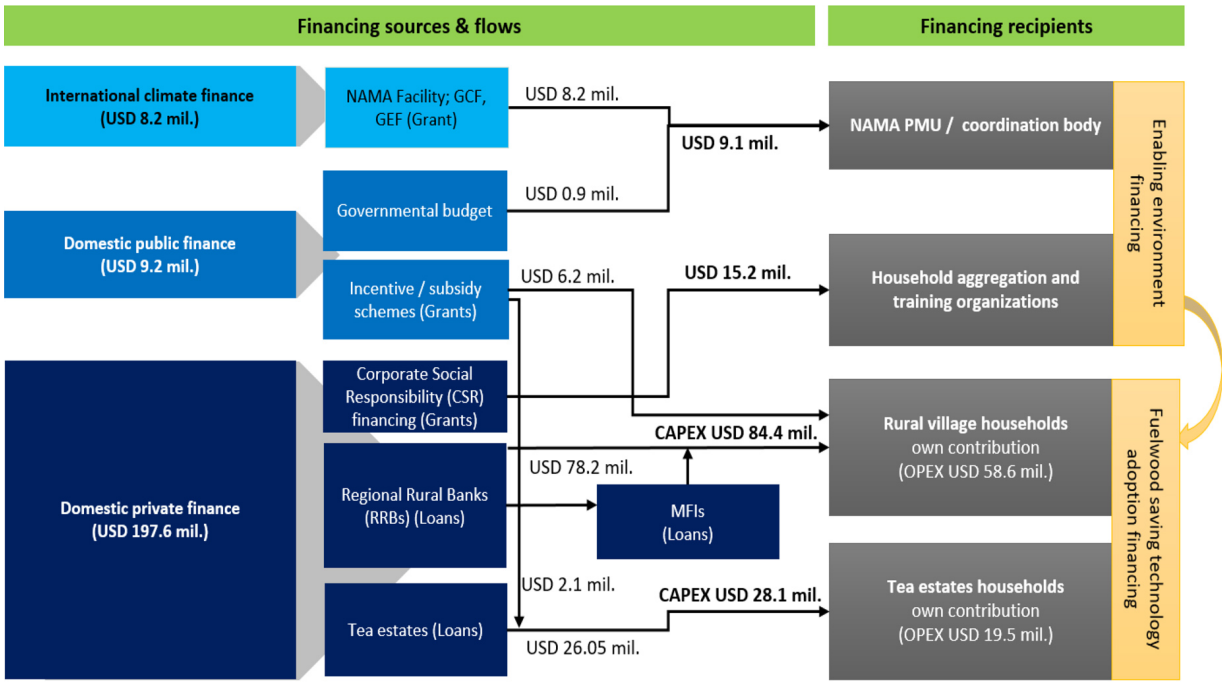
Debt finance to MFIs and rural banks is available at 4-6 per cent interest per annum, mainly either from RRBs or development financing institutions. The interest spread is the high cost of serving the clients in rural areas. In order to reduce the costs to the end consumer group loans and bundling of income generating loans with fuelwood saving technology loans are perceived to be an effective solution to address the relative low ticket sizes and the high transaction costs of debt. The ticket sizes can be increased through local interest group structures. This will require mobilisation and aggregation of the forest villages which can be supported by selected aggregation organisation.

In terms of financing the MFI sector, the regional rural banks may provide debt at relatively low costs and select appropriate institutions that can demonstrate sufficient finance management skills and track record that qualifies them to receive funding.

6.5 Financing Strategy for the Forestry NAMA

In the financing needs assessment section, a total financing need of USD 215 million on a scale of 1 million rural village households and tea estates households was estimated. Of this, about USD 24.2 million is required as grant finance for the enabling environment intervention and household mobilisation and awareness raising. The remaining USD 190.7 million can be sourced from the private sector. A summary of the financing mix and respective financial flows is presented in the following figure.

Figure 48: Financing Mix for Forestry NAMA Phase I in Assam (5 Year Period)



Financing Enabling Environment for NAMA Implementation

Following the roles and responsibilities of the institutions, investment into enabling environment related to NAMA coordination, development and operation of the AFDSS, capacity development, measurement, reporting and verification (MRV) will be the key for the transformational change and the investment and adoption into fuelwood saving technologies, thus is predestined for international climate financing. These investments do not have a direct revenue stream which justifies grant-based financing. Therefore, a climate finance proposal to the GCF or the NAMA Facility worth of USD 8.2 million combined with a governmental contribution of about 10 per cent (USD 0.9 million) for a Technical Assistance project though GIZ or NABARD would have a domestic finance leverage potential of USD 25.4 for every one USD invested by international climate finance. The total private finance leverage per publicly invested one USD amounts to USD 11.4.

The second enabling environment component is related to the rural villages' households and tea estates' awareness raising and demonstration campaigns of fuelwood saving technologies to create demand and trigger investment into fuelwood saving technologies by the target groups. This enabling environment investment package will require a total investment of USD 15.2 million and would be implemented by selected and trained NGOs, cooperatives and community based organisations

(CBOs) with a strong rural presence in the target districts. This set of interventions is a non-profit activity and qualifies for CSR financing. The direct impact will closely match with the recommended list of CSR activities under Schedule VII of the Companies Act, 2013 including the '*promotion of education; promoting gender equality and empowering women; reducing child mortality and improving maternal health; combating human immunodeficiency virus; ensuring environmental sustainability*'.

However, in order to mobilise corporates to invest their profits will require well-designed projects and clearly structured investment cases. This requires investment and resources to engage with corporates and will need the transformational financing from international sources and a functioning NAMA coordination body. In order to reduce the transaction costs for the mobilisation of the CSR fund raising the newly established ICRF could provide important services to the NAMA for mobilising and marketing of the project.

Financing Fuelwood Saving Technologies for Target Groups

The key for tea estates' and rural villages' investment decision into fuelwood saving technologies will be effective awareness raising campaigns and technology demonstration. CAPEX and OPEX for fuelwood saving technologies by tea estates and households investments are estimated at USD 190.7 million of which USD 8.3 million are expected to originate from public funding sources. The majority of the financing of fuelwood saving technologies for tea estate households can be sourced from tea estates' company budgets or financing by the households. Tea estates can cover the upfront investments into the fuelwood saving technologies. The repayment of these investments and short-term loans by its workers will be integrated into their core financial and personal management by retaining the investment cost from the salary over an agreed time period. This method will result in the least transaction and financing costs to households while benefiting tea estate management and the households in the long-run.

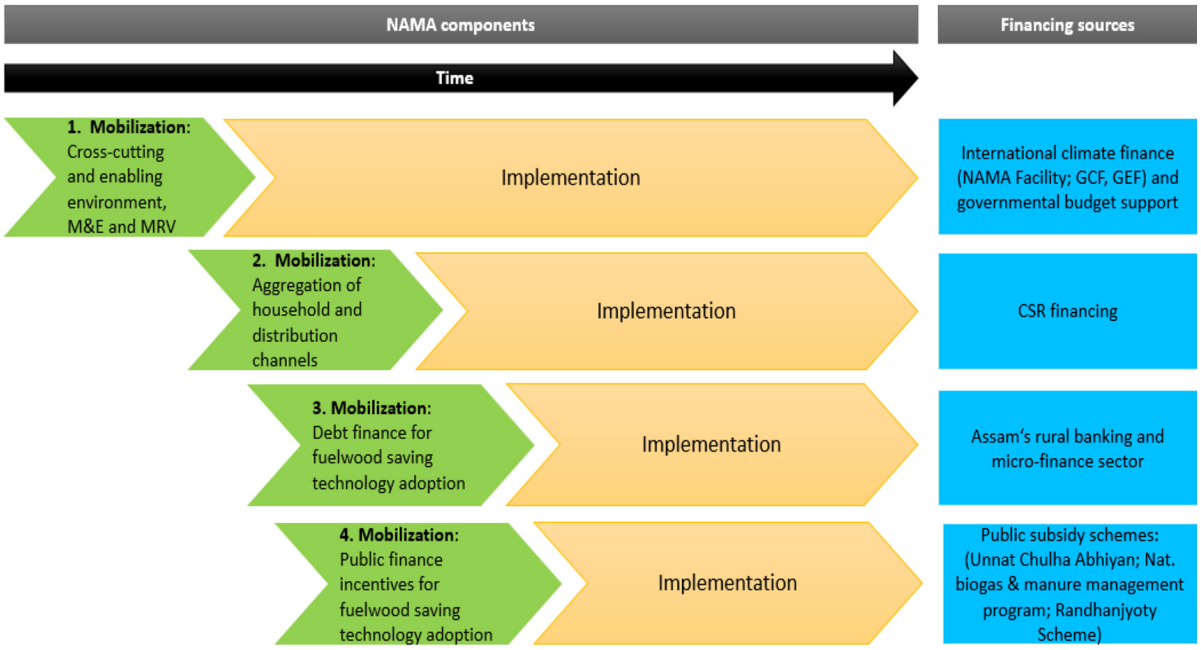
In the case of rural village households, the financing needs for fuelwood saving technologies investment (USD 84.4 million) are expected to be covered to a large extend by debt finance from RRBs and MFIs that provide small individual loans, group loans and/or blended income generating loans with fuelwood saving technology loans. Up to USD 6.2 million can be covered by existing subsidy schemes. Debt finance is most effective because household perceive the utility of the technology. Providing the technology free of cost would bear too high a risk of poor adoption of the technologies in the long-term, and has been proven not effective in the past (Subramanian, 2014). For this rural villages households will need access to financing services. Thus local presence of financing service agents is the most decisive criterion to structure the financing strategy for this target group. The Assam Gramin Vikash Bank (AGVB), a Regional Rural Bank, has an excellent network covering most of the district and provides debt capital to micro-finance institutions in the state as well. Consequently, AGVB and the MFIs will be the agents to provide the required financing services to the target group in rural village households.

6.6 Recommended Actions for Finance Mobilisation

The Forestry NAMA will require a targeted finance mobilisation strategy to secure funding from the various potential public and private financing sources identified. Considering that finance mobilisation requires significant resources, it is suggested to initially focus on the cross-cutting and enabling environment financing of the NAMA. This component has a key enabling function for the overall NAMA implementation, and is a pre-condition for the desired household aggregation,

awareness raising and the leverage of target group specific investment into fuelwood saving technologies. Furthermore, this component includes additional fund raising activities for the NAMA as part of the operationalisation of the NAMA financing mechanism (see section 6.2.1). The figure below conceptually illustrates the recommended chronological flow of financing mobilisation for the different NAMA components.

Figure 49: Strategy and Chronology of Fund Mobilisation Strategy



A set of recommendations and interventions is summarised below with regard to the required NAMA financing.

6.6.1 Mobilising International Climate Finance

With the Government of India's endorsement on the NAMA concept, international climate finance will need to be mobilised first to initiate the cross-cutting and enabling environment activities of the NAMA. As outlined in previous sections, international climate finance can be sourced mainly from three institutions such as the NAMA Facility, GCF or GEF.

For NAMA Facility funding mobilisation or a Technical Assistance project (USD 8.2 million) (assuming there will be a fifth call for NSP outlines in October 2017):

A NAMA Facility application is only recommended if the NAMA Facility feedback is addressed in the design. While majority of the comment and suggestions were addressed in the design, one of the key criticism was the lack of a proof of concept which requires a pilot to demonstrate feasibility of the NAMA concept and elaborate a competitive NAMA Support Project Outline.

The following key steps would be required to mobilise financing:

- Assuming the Government of India and GIZ decide to submit an application to the NAMA Facility call in 2017, update the NSP proposal from 2016 and integrate the key feedback points of the 2016 submission and modify the proposal to a Technical Assistance grant without a Financial

Assistance component as the limited financing barriers do not justify and NAMA Facility loan component (due to sufficient domestic finance).

- In order to demonstrate readiness and feasibility of the NAMA, the following key task would increase the chance to be selected:
  - Design a pilot in one district showcasing the applicability of the NAMA design and its key components that should be carried out.
  - For readiness demonstration purposes, it is recommended to continue discussion with AGVB on the NAMA and sign an MOU for the NAMA implementation.
- Depending on the selection and feedback by the NAMA Facility, a Detailed Preparation Phase (DPP) will need to be carried out to structure the implementation and fill the knowledge gaps. The NAMA Facility provides funding up to USD 150,000-200,000 for the DPP phase which allows to become ready for implementation. The DPP is subject to approval by the NAMA Facility.

GCF Funding Mobilisation for a Technical Assistance Project (USD 8.2 million):

For GCF funding, significant additional resources will be required for proposal development. In case the Government of India decides to submit a proposal to the GCF the following steps would need to be carried out.

- Selection of an accredited entity that manages the proposal development and submits on behalf of the Indian government. There are two options for an accredited entity - NABARD and GIZ. In the case of GIZ a lengthy internal selection and due diligence procedures would apply. The chances of being selected within the next 1-2 years are low because of an already existent GIZ GCF proposal pipeline. Thus this is not recommended. In the case of NABARD the Indian government would need to engage with the institution and agree on the submission of the GCF proposal.
- Once the accredited entity is identified, a project preparation grant from the GCF (Project Preparation Facility) can be sought. Alternatively, the Government of India or the accredited entity can invest their own resources into proposal development or even seek support from GIZ.
- Pilot activities to demonstrate readiness and feasibility would provide early lessons and increase the chance to receive funding.
- Development of a concept note can be considered to receive feedback from the GCF. Post this, a full scale proposal development and approval process will have to be followed in line with GCF's processes.

For GEF Funding: Mobilisation for a Technical Assistance Project (USD 8.2 million)

For GEF funding, significant additional proposal development costs would occur. Also a GEF agency would need to be identified that can prepare the project proposal on behalf of the Indian government (e.g. UNDP, UNEP, WB, ADB). Following this, the GEF Agency would initiate the project preparation steps starting with the preparation and submission of the Project Identification Form (PIF). The key steps outlined below:

- GoI would need to engage with one potential GEF Agency and enter into an agreement to prepare and implement the NAMA on behalf of the Indian government.
- Once the GEF Agency is selected, it needs to prepare a project concept in consultation with relevant country institutions and other relevant partners, and submit it to the GEF Secretariat through the PIF. The PIF has to be endorsed by the country operational focal point which is the MoEFCC in India.
- The Government of India and selected GEF Agency can also decide to apply for a project preparation grant depending on the project size (limit for USD 6-10 million projects is USD 200,000).
- Assuming the approval of the PIF by the GEF Secretariat, a project framework document needs to be prepared and submitted to the GEF Secretariat which will be considered for inclusion of the project into the work programme.

6.6.2 Mobilising CSR Funding

Once international climate finance is sourced and NAMA implementation initiated, one of the prioritised interventions will be the mobilisation of CSR finance including the identification of aggregation organisations, identification of pilot areas, structuring of investment cases, engagement with the companies mandated to make CSR investments as per The Companies Act, 2013. According to existing experiences with corporates, raising CSR funding is a relatively lengthy process and requires well designed, structured and concrete proposals, in which the key partner organisations are identified and the target regions are clear. CSR funding mobilisation can be carried out through three channels, i.e. through the India Climate Responsibility Facility (ICRF) or by directly approaching large corporates in the State of Assam to present the project proposals or through government directive to companies to invest in the NAMA.

ICRF CSR Funding Mobilisation Strategy

- Assuming that the ICRF will become operational and raise substantial funding for project investments, the NAMA PMU will need to prepare concept notes and proposals in line with ICRF's strategy. For this the ICRF will most likely provide guidance as it will have a clear understanding of investors' needs. This will enable the ICRF to present clear investment opportunities to corporates and understand their willingness to support the project.
- Depending on corporates positive response, prepare project proposal with clearly identified partner organisations, target areas and financing plans, the basis for further negotiation and project preparation.

Direct CSR Funding Mobilisation

- In case of direct CSR funding strategy, same as under ICRF, targeted concepts and proposals on the NAMA for CSR should be prepared. Afterwards, corporates companies can be approached. A list of potential companies is prepared in Annexure 4.
- Once interested corporates are identified, continue with the preparation of project proposals that meet the needs of the NAMA and the needs of corporates.

Government Directive to Companies

- Engage with the state government to introduce a directive/circular to companies that are mandated to make CSR investments in the state to fund the NAMA.
- Identify the specific areas where these investments will be channellsed and the financing mechanism to receive the CSR funds and disburse them.

6.6.3 Mobilising Debt Finance from Banking Sector and MFIs

Mobilisation of existing debt finance from Assam's rural banking and microfinance sector can be achieved through continued engagement with AGVB, identification of additional financing partner institutions and appraisal missions for promising financing institutions that are interested to provide financing services to rural households. The following concrete steps are suggested:

- Based on an approval of the NAMA by the government, continue discussion with AGVB and sign an MOU or partnership agreement for NAMA implementation. This should include the willingness of AGVB to provide debt finance in the form of low cost loans to the micro-finance institutions and to household groups that are participating in the NAMA implementation.
- In case international climate finance is mobilised, support structuring work to the use of existing credit lines for fuelwood saving technologies and the credits lines to MFI to support this activity.
- Identify potential additional MFIs in the state of Assam and provide training and awareness creation on the NAMA and the business opportunities to MFIs.
- Define and agree on eligibility criteria for MFI finance that meet AGVB fiduciary standards and have presence in the target districts/villages.

6.6.4 Mobilising Public Finance from Subsidy Schemes

The mobilisation of the subsidies from the government programme is closely linked to the investments into the fuelwood saving technologies and depend on the technology to be adopted by the target group. Each subsidy scheme has its own specifics on eligible technology, implementing partner and access modality. Thus, the subsidy applicant will need to closely follow these access procedures.

6.7 Matrix of Fund Disbursement Mechanisms for NAMA Implementers

The NAMA will have several financial relationships between the different implementation and management entities. The following table summarises the key financial relationships, including the roles and responsibilities and eligibility criteria for fund disbursement.

Table 43: Fund Matrix of fund disbursement mechanisms for NAMA implementers

Funding source	Funding recipient	Financing instrument	Roles and responsibilities of recipient	Eligibility criteria for fund disbursement
International climate finance institution	Accredited entity (implementing entity)	Grant	• Overall management of the Technical Assistance grant from NAMA Facility or GCF • Investment into AFDSS, capacity development, support financing mechanism, selection of household aggregation/awareness raising institutions	• Approved funding proposals by the funding source institution which meets its results and management frameworks • Relevant governmental approvals between GIZ, government and funding institutions
Accredited entity /implementing entity	NAMA PMU/ Forestry Department	Grant	• Overall coordination of the NAMA, operation of the AFDSS, and M&E and MRV system operation	• Funding can only be provided to non-governmental staff members for consulting services, material investment, travel costs • Compliance to accredited/implementing entity rules and procedures
	Private or non-profit service providers (non-governmental)	Grant	• Development of AFDSS for the state of Assam and training of governmental staff to operate AFDSS • Other various consulting services	• Competitive tender process and identification of entities that can demonstrate sufficient topic related technical track record and skills • Must be a non-governmental entity • Sufficient financial management capability to manage contract above USD 0.5 million
Corporates regulated by the CSR regulation under The Companies Act, 2013	Household aggregation/awareness raising organisations	Grant	• Mobilisation of households • Awareness raising campaigns and demonstration of fuelwood saving technologies • Participation in implementing entity trainings to execute the work • Interaction with technology providers and the AFDSS	• Local presence in the target district and villages • Basic financial grant management skills and track record with similar assignment • Trained staff that underwent training by the implementing entity and have sufficient capacities and knowhow for technology demonstration and awareness raising

Funding source	Funding recipient	Financing instrument	Roles and responsibilities of recipient	Eligibility criteria for fund disbursement
Regional rural bank (RBB)	Individual households or household groups	Loans	• Loans application, loan agreement signature and loan repayment • Purchase of eligible fuelwood saving technology based of AFDSS information	• Households (groups) must undergo the RBBs general credit appraisal process • Participation in demonstration/awareness raising campaigns
	MFIs	Loans	• Provision of lending capital and credit management to rural households for eligible fuelwood saving technologies based on AFDSS information • Modification of credit product/group lending, low interest loans to target groups	• MFIs must undergo RBBs general credit appraisal process • Participation in demonstration/awareness raising campaigns by implementing entity and register as a eligible partner
MFIs	Individual households or household groups	Loans	• Loans application, loan agreement signature and loan repayment • Purchase of eligible fuelwood saving technology based of AFDSS information	• Households (groups) must undergo the RBBs general credit appraisal process • Participation in demonstration/awareness raising campaigns

7. Forest NAMA Capacity Development Strategy

7.1 Introduction

International support that mitigation actions receive can include financial, technical and/or capacity building support. The last chapter identified investments that will be required for the implementation of the NAMA. As one of five sets of activities to improve the enabling environment of the NAMA, awareness raising and capacity building were identified, including the development of capacities of all implementing organisations and technology providers.

Capacity Development (CD) refers to building upon existing abilities of an individual or community in order to be able to implement specific activities associated with a given target or project. This generally implies the passing on and accumulation of knowledge and skills which are available but not necessarily practiced by stakeholders. In the context of the Forestry NAMA, capacity development will address knowledge and skills pertaining to fuelwood availability, the selection of appropriate species when raising fuelwood plantations, fuelwood consumption, as well as the use of clean cooking technologies. A key element of capacity development for the NAMA is creating awareness and clearly explaining the link between environmental degradation, fuelwood consumption and the use of fuelwood saving technologies. Capacity development will take place on three distinct levels:

1. Individual

2. Organisation

3. Society and political frameworks

This holistic approach differentiates capacity development from capacity building; the latter focuses on the improvement of knowledge and skills on an individual level only. By simultaneously targeting three levels, capacity development aims to improve the knowledge and skills of an entire system, therefore making it more sustainable in terms of its knowledge management. This approach is suitable for large, long-term projects and furthermore emphasises the exchange of information between relevant actors. Ultimately, the desire to learn more and innovate must come from within a system, that is, the actors should feel a strong sense of ownership toward the processes taking place. While it is not uncommon for additional capacities to be acquired from external sources (e.g. from individuals/organisations dealing with similar topics but operating in other countries, or external experts), these external actors merely serve as catalysts to promote capacity development.

Capacity development is also required for the Forestry NAMA to overcome exisiting institutional, awareness and knowledge gaps, primarily about the interlinkages between forest degratation and associated fuelwood consumption. The section below will go into further details about capacity gaps and needs; suffice to say at this point that capacity development on the individual level will gradually enable organisations to operate more innovatively and will have an impact on the overall societal

understanding of sustainably managing and conserving forests. Including the political level will facilitate spreading the message of the Forestry NAMA and will also be crucial to up-scaling activities to the national level. Therefore, for the Forestry NAMA, 'capacity' refers to the ability of the main NAMA stakeholders (people, organisations and the wider society) to manage their own sustainable development processes and adapt to changing circumstances for the implementation of the NAMA.

A clear understanding of the required and existing capacities is also an important prerequesite to get access to sources of international finance.

7.2 Institutional Landscape and Stakeholder Groups

The institutional landscape and stakeholder groups were presented in greater detail in Chapter 2 – Scope. However, in order to provide a clear understanding of the stakeholders who are included in the capacity development strategy, a quick review is provided below.

As described in Chapter 2, the stakeholders are classified according to different levels, depending on their degree of involvement and influence. These levels are:

- Veto players
- Key stakeholders
- Primary stakeholders
- Secondary stakeholders

While the capacity development strategy mainly focuses on the three central stakeholder levels (i.e., veto players, key stakeholders, and primary stakeholders), the strategy will also include secondary stakeholders to some extent. Particularly those stakeholders who are on the verge between primary and secondary stakeholders will be considered in the strategy (e.g. NABARD, NGOs, academic institutions and technology providers). The Table 44 lists the stakeholders who are addressed through the CD strategy and briefly presents their mission and/or responsibilities.

Table 44: Stakeholders Included in the CD Strategy

Stakeholder	Mission and/or Responsibilities
Tea estates	
Plantation managers	Plantation managers are responsible for the overall management of tea plantations, including fuelwood sourcing and supply. These estates are customarily mandated to meet the cooking energy demands of their workers' households by providing free fuelwood.
Plantation workers	Tea plantation workers include permanent workers, sub-staff, and temporary workers. While the permanent workers and sub-staff are eligible to receive certain benefits from the tea estates, including fuelwood allocations, the temporary workers are not eligible to receive any fuelwood allocations.
Rural households	
Forest village households	Forest village households exert direct pressure on forests as all their energy needs are met from forest resources. They are therefore a key stakeholder whose specific role within the NAMA Phase I includes participation in capacity development and awareness raising campaigns.
Revenue village households	The specific role of revenue village households within the NAMA Phase I will be very similar to that of forest village households. They are therefore presented as one group.
Government entities	
NAMA Program Management Unit (PMU)	The mission and mandate of the NAMA PMU is to lead the NAMA development, implementation and coordination. Its specific role is to host the AFDSS and its operationalisation, develop a baseline, establish and operationalise an MRV system, support communication and capacity development, coordinate with designated financial institutions (FIs), and to coordinate with relevant departments for convergence with the NAMA.
Department of Environment and Forests (DoEF), Government of Assam	The mission and mandate of the DoEF is forest conservation, management and enhancement as well as the implementation of the National Biogas and Manure Management Program in Assam (NBMMP).
Assam Energy Development Agency (AEDA)	AEDA is a state nodal agency for implementing the National Improved Cook Stove Programme (Unnat Chulha Abhiyan; UCA), and is therefore another key stakeholder. Its specific role will be to ensure the convergence of UCA implementation with the NAMA, provision of data for the baseline development, as well as the provision of data for the AFDSS development, especially regarding technology options and socio-economic parameters related to technology diffusion and adoption.
Food, Civil Supplies and Consumer Affairs Department	This department is responsible for the implementation of the state level programme on LPG deployment in BPL households – Randhanjyoti Scheme. It is furthermore responsible for the implementation of the national level programme on LPG deployment in BPL households – Pradhan Mantri Ujjwala Yojana (PMUY). Its specific role is to enable the convergence of the Randhanjyoti Scheme and PMUY implementation with the NAMA.
Associations	
Assam Branch India Tea Association (ABITA), Tea Association of India and other tea industry associations	These associations provide a common platform for tea estate owners and managers to discuss and decide on issues related to tea estate management. These associations play a role in negotiations with the tea estate workers' union on the amount of fuelwood provided every year, or compensation in case fuelwood is not provided.
Assam Chah Mazdoor Sangha	This is a trade union for tea workers. They support the workers in obtaining appropriate compensations in the form of wages and other benefits, including fuelwood for meeting their household cooking energy needs.
Academic Institutions	
Tezpur University	The mission of academic institutions, particularly Tezpur University, is to support technology research and development; they serve as incubators of ideas and technology, provide training and can act as testing centres for assessing technology performance.
Indian Institute of Technology (IIT) Guwahati	

Stakeholder	Mission and/or Responsibilities
Non-governmental organisations (NGOs)	
NGOs in general	The mission/mandate of NGOs is to support the development and mobilisation of local communities and/or ecosystem conservation. The specific role of NGOs is to raise awareness and mobilise communities towards sustainable fuelwood management.
Financial institutions	
National Bank for Agriculture and Rural Development (NABARD)	NABARD's mission is to 'promote sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives.' Its specific role is to act as the National Implementing Entity (NIE) for accessing funding through GCF, as well as to enable the convergence of NABARD's existing initiatives such as UPNRM, Tribal Development Fund, and promotion of micro-enterprises by SHGs for products of rural artisans/entrepreneurs (handloom/handicrafts).
Assam Grameen Vikash Bank (AGVB)	AGVB's mission is to provide financing in rural areas. Its role and responsibility is linked to its core business – development driven provision of lending capital to rural household or to micro-finance institutes (MFIs) that will further on-lend to households.
Micro-finance institutions (MFIs)	The mission of MFIs is to provide financial services to low income populations. For the NAMA Phase I, MFIs are expected to lend to rural households to help them acquire fuelwood saving technology.
Technology providers	
Technology providers in general	The mission of technology providers, as empanelled under the NAMA project, is to sell fuelwood saving technologies to all those who are interested in buying it.

7.3 Capacity Needs Assessment

For the NAMA capacity needs assessment, the following steps have been taken:

- Analysing the existing technical and functional capacities of stakeholders
- Recognising capacity and organisational gaps that could become obstacles to the implementation of the Assam Forestry NAMA
- Identifying awareness gaps among stakeholders
- Designing strategies to overcome the identified gaps

To collect the information required for the capacity needs assessment, a series of meetings was conducted with key stakeholders. The stakeholders were interviewed to understand their current capacities, define the role they will need to play in the implementation of the NAMA and identify capacity gaps to perform these tasks. The following assessment is therefore referring to the role of the stakeholders in the NAMA only and does not consitute a judgement on their overall skills and capacities. Based on the assesment and the perceived capacity gaps, activities to increase stakeholder capacities were formulated.

7.3.1 Tea Estates

Plantation Managers

The capacities which tea plantation managers require in order to implement the NAMA include the following:

- Managers need to have sufficient capacities and knowledge to build awareness of tea estate workers on technologies, health impacts and other benefits, and to facilitate adjustment to newer/different technology.
- Knowledge on how to maintain shade trees and raise new fuelwood plantations.
- Knowledge of climate change vulnerabilities in tea estates and adaptation options for continued productivity.
- Ability to operate monitoring systems on fuelwood consumption patterns in every labour line of the tea estate.
- Knowledge on financing systems to facilitate the loans that the tea workers will be paying indirectly through the tea estates.
- Knowledge on how to respond to workers who report on the performance of fuelwood saving technologies as clean cooking technology options.
- Ability to collectively manage maintenance systems for fuelwood saving technologies.

Table 45 indicates what the strengths, gaps, barriers and/or weaknesses of the plantation managers are and provides a list of potential activities to help increase their capacities.

Table 45: Strengths/Weaknesses of and Capacity Building for Plantation Managers

Strengths	• Tea estate managers recognise fuelwood supply as an issue; they are willing to participate in pilot projects. • Tea estates are likely to contribute upfront financing to the communities, if convinced by the technology, workers' interests and other economic considerations such as improved workforce productivity. • CSR funding of tea companies can be channelled (dependent on eligibility). • Managers are able and willing to implement MRV system to monitor their investments.
Gaps, barriers and/or weaknesses	• Lack of awareness and confidence in fuelwood saving technologies, which prevents investments into these technologies. • Some tea estates may lack financial resources for upfront investment in fuelwood saving technologies.
Activities to increase capacities	• Workshops and outreach activities on technology options and socio-economic benefits of technologies. • Targeted trainings on MRV and technology financing. • Structuring targeted loans to tea estates, combined with technical assistance and awareness raising campaigns. • IT solutions (applications, excel sheets) to help in collecting and organising data.

Beyond the aforementioned capacity building activities, interactions between the different stakeholder levels will have to be supported. With regard to tea estate managers, this means that they will:

- Coordinate with the households within the tea estates to ensure the success of the deployed technologies.
- Coordinate with the tea estate associations on the technology and fuelwood supply scenario.
- Interact with the trade unions on innovative incentive mechanisms for sustainable fuelwood management interventions.

- Interact with corporates to access and converge CSR funds towards sustainable fuelwood management interventions.

Tea Estate Workers

This group of actors includes permanent and temporary workers and the sub-staff. To implement the NAMA, these groups require a similar set of capacities, namely:

- Information to increase awareness on fuelwood saving technology options and their benefits.
- Operation and maintenance of adopted technologies.
- Information to increase awareness on available financing options and ability to acquire finance.
- Information to increase awareness on MRV implementation.

Table 46 indicates what the strengths, gaps, barriers and/or weaknesses of the tea plantation workers are and provides a list of potential activities to help increase their capacities.

Table 46: Strengths/Weaknesses of and Capacity Building for Tea Plantation Workers

Strengths	• Temporary workers are likely to have economic interests to invest in fuelwood saving technologies as they receive no allocations from the estate.
Gaps, barriers and/or weaknesses	• Benefits may not be immediately apparent to the workers. • Lack of technical knowledge on fuelwood saving technologies, which prevents investments into these technologies. • Inability to pay for fuelwood saving technologies or to maintain them. • Uncertain about willingness to participate in MRV, as there are no specific incentives for all.
Activities to increase capacities	• Targeted trainings and outreach activities on: • Technology options and benefits of technologies. • MRV and technology financing. • Maintenance and overall operating of the alternative technology.

Although the capacity building activities should be linked to interactions between different stakeholder groups and levels, tea plantation workers' main (or only) point of contact will be with the tea estate managers regarding the installation and monitoring of alternative fuelwood saving technologies.

7.3.2 Rural Households

Forest and revenue village households

The capacities which forest and revenue village households require in order to implement the NAMA include the following:

- Information to increase awareness on fuelwood saving technology options and their benefits.
- Support in group formation, then using the group to mobilise fuelwood saving technology demand and to manage loans towards technology procurement.
- Information to increase awareness on available financing options.
- Information to increase awareness on MRV.

Table 47 indicates what the strengths, gaps, barriers and/or weaknesses of rural households are and provides a list of potential activities to help increase their capacities.

Table 47: Strengths and Weaknesses of and Capacity Building for Rural Households

Strengths	• Assam has successfully deployed the SHG/JLG model to channel financing in rural areas. This mode is used especially for financing income generating activities and can be utilised for financing technology deployment under the NAMA.
Gaps, barriers and/or weaknesses	• Fuelwood is available freely or at negligible monetary value and does not take into account the opportunity cost of the effort and time spent in its collection. • In some cases, access to fuelwood is limited. • The majority of potential buyers in the forest villages may not be able to afford fuelwood saving technologies. • A key challenge will be the creation of awareness of and demand for fuelwood saving technologies.
Activities to increase capacities	• Significant investments into community facilitation and awareness raising on technology options and socio-economic benefits of technologies. • Structuring targeted financing mechanisms for forest villages. • Targeted trainings on MRV and technology financing. • Training in other livelihood programmes to help villagers utilise the extra time they have on their hands.

For forest and revenue village households, collaboration between different levels/types of stakeholders will be in the form of interaction with aggregators, technology providers and financial institutions. In addition to this, the villagers are already involved in complementary activities by other projects/actors in the same line of action. Synergies may be supported through the existing activities.

7.3.3 Government Entities

NAMA Programme Management Unit (PMU)

The following set of capacities has been identified as being required for this newly formed unit to implement the NAMA, including:

- Ability to lead the AFDSS development and its operationalisation.
- Technical knowledge of baseline development.
- Technical knowledge of MRV systems, the ability to host and operate the MIS for the NAMA, and the ability to keep the AFDSS up-to-date based on feedback from the MIS system.
- Preparation of investment strategies in consultation with relevant departments and FIs.
- Lead implementation of the communication and capacity development strategy.
- Lead development of the NAMA concept for subsequent phases.

Table 48 indicates what the strengths, gaps, barriers and/or weaknesses of the NAMA PMU are and provides a list of potential activities to help increase their capacities.

Table 48: Strengths and Weaknesses of and Capacity Building for the NAMA PMU

Strengths	• The Forest Department can support the formation of the NAMA PMU, but the process will be subject to co-financing from external sources. • The Forestry NAMA PMU can be formed from the existing departmental committee and therefore doesn't require a new structure
Gaps, barriers and/or weaknesses	• NAMA PMU needs to be constituted and operationalised.
Activities to increase capacities	• Recruitment of the following staff for the PMU (only required in the event that the PMU will not be formed within the existing departmental structures): – Chief of PMU – Communication expert – Community engagement (women mobiliser) – Project coordinator – Training coordinator – Programme associate – Junior research fellows – Programmer, IT professional – Administrative assistant • Planning for the joint utilisation of hardware, software, internet connectivity, servers, etc. and procurement of additional equipment (if required, at all) • Establishment and operation of the NAMA PMU infrastructure (office establishment, utilities and supplies) • NAMA website development • C&I for identification of technology providers, NGOs

As a core entity, the NAMA PMU will be responsible for overseeing the overall implementation of the programme. It will therefore have to interact with all relevant stakeholders and maintain consistent, clear communication lines. With regards to complementary activities by other projects/actors, the NAMA PMU could greatly profit from close collaboration with the Forest Department, since it already undertakes monitoring and evaluation activities and has experiences with IT systems.

Department of Environment and Forests (DoEF)

In order to implement the NAMA, the DoEF will require the following capacities:

- Ability to build capacity of the NAMA PMU.
- Understanding the AFDSS and its outputs in order to design an investment strategy for the NBMMP.
- Ability to develop guidelines for data sharing to support the baseline development and AFDSS development.

Table 49 indicates what the strengths, gaps, barriers and/or weaknesses of the DoEF are and provides a list of potential activities to help increase their capacities.

Table 49: Strengths and Weaknesses of and Capacity Building for the Department of Environment and Forests

Strengths	• DoEF can support the formation of the NAMA PMU but the process will be subject to co-financing from external sources. • It has advanced technical capabilities in forest mapping and monitoring systems. • Experienced in the deployment of biogas technology under the NBMMP and can provide associated data/learning for the NAMA
Gaps, barriers and/or weaknesses	• Low understanding of NAMA and international climate finance. • Lack of understanding of the AFDSS
Activities to increase capacities	• Designate officials to oversee NAMA PMU establishment and functioning. • Develop and implement standardised protocols for data sharing and participation in NAMA implementation.

Assam Energy Development Agency (AEDA)

In Phase I of the NAMA, the Assam Energy Development Agency (AEDA) will ensure the convergence of Unnat Chulha Abhiyan (UCA) implementation with the NAMA, the identification of the beneficiaries based on AFDSS recommendations, coordination with the NAMA PMU, provision of data for the baseline development (e.g. technology performance, technology diffusion rate, adoption rates, etc.), as well as the provision of data for the AFDSS development, especially regarding technology options and socio-economic parameters related to technology diffusion and adoption. Against the background of this diverse role, the capacities required by AEDA to implement the NAMA include:

- The agency will need to understand the AFDSS and its outputs so as to design an investment strategy for the UCA.
- It will need to develop guidelines and protocols for data sharing to support the baseline development and AFDSS development.

Table 50 indicates what the strengths, gaps, barriers and/or weaknesses of AEDA are and provides a list of potential activities to help increase their capacities.

Table 50: Strengths and Weaknesses of and Capacity Building for AEDA

Strengths	• AEDA is very experienced with the deployment of fuelwood saving technologies under the UCA and can provide associated data/learning for the NAMA.
Gaps, barriers and/or weaknesses	• Lack of understanding of the AFDSS and its utility in designing investment strategies for the UCA.
Activities to increase capacities	• Develop and implement standardised protocols for data sharing and participation in NAMA implementation.

Food, Civil Supplies and Consumer Affairs Department

The capacities required by the Food, Civil Supplies and Consumer Affairs Department to implement the NAMA include the following:

- The Department will need to understand the AFDSS and its outputs so as to design an investment strategy for the Randhanjyoti Scheme and Pradhan Mantri Ujjwala Yojana (PMUY).
- It will need to develop guidelines and protocols for data sharing to support the baseline development and AFDSS development.

Table 51 indicates what the strengths, gaps, barriers and/or weaknesses of the Department are and provides a list of potential activities to help increase their capacities.

Table 51: Strengths and Weaknesses of and Capacity Building for the Food, Civil Supplies and Consumer Affairs Department

Strengths	• It is very experienced with LPG deployment in the state and can provide associated data/learning for the NAMA.
Gaps, barriers and/or weaknesses	• Lack of understanding of the AFDSS and its utility in designing investment strategies for the Randhanjyoti Scheme and PMUY.
Activities to increase capacities	• Develop and implement standardised protocols for data sharing and participation in NAMA implementation.

7.3.4 Associations

Tea Industry Associations

While ABITA, Tea Association of India and other tea estate associations are well-established and organised, they will require the following capacities in order to implement the NAMA:

- Understanding of fuelwood saving technology options and their benefits in order to negotiate better with labour unions and government.
- Manpower to support awareness raising.
- Manpower and computing resources if the associations agree to act as aggregators.
- The ability to develop guidelines and protocols for data sharing to support baseline development and AFDSS development.

Table 52 indicates what the strengths, gaps, barriers and/or weaknesses of the tea estate associations are and provides a list of potential activities to help increase their capacities.

With regard to different stakeholder levels, the tea estate associations represent the tea industry for the NAMA, and will readily coordinate with the NAMA PMU and other relevant actors.

Table 52: Strengths and Weaknesses of and Capacity Building for TAI and Other Tea Estate Associations

Strengths	• Pan-Assam presence between the major associations covers a large majority of the tea estates; estimates suggest 94 per cent of tea estates are members of at least one association in Assam. • Considerable influence over the tea estates; better posed in building consensus and securing buy-in from tea estates. • Access to tea estate unions for negotiating fuelwood and associated compensations.
Gaps, barriers and/or weaknesses	• Not the final decision making body, even though they hold considerable influence over the tea estates. • Limited resources to effectively execute the desired responsibilities under the NAMA. • Lack of knowledge on fuelwood saving technology options, manufacturers and service providers, and their business case for tea estates.
Activities to increase capacities	• Recruitment of dedicated resources to: – Coordinate with the NAMA PMU – Aggregate data for baseline creation, AFDSS development, monitoring and reporting of technologies deployed in tea estates – Coordinate with technology providers and financial institutions – Provide advisory services to tea estates for accessing finance to cover upfront investment of technologies

Assam Chah Mazdoor Sangha

Capacities required by Assam Chah Mazdoor Sangha (Assam Trade Union for Tea Workers) to play their assigned role in the implementation of the NAMA comprise:

- Sensitisation on NAMA and fuelwood saving technology options.
- Detailed information about the technology, preferably provided by demonstrations with the help of technology providers.

Table 53 indicates the strengths, gaps, barriers and/or weaknesses of Assam Chah Mazdoor Sangha in this context and provides a list of potential activities to help increase their capacities.

Table 53: Strengths/Weaknesses of and Capacity Building for Assam Chah Mazdoor Sangha

Strengths	• The trade union is able to reach out to all tea estate workers. • Very influential among the tea estate workers.
Gaps, barriers or weaknesses	• Lack of awareness on fuelwood saving technology options and their benefits.
Activities to increase capacities	• Workshops in the establishment phase.

The anticipated interactions of Assam Chah Mazdoor Sangha are mainly with the tea estates and the government through the labour department and workers.

7.3.5 Other Implementing Agencies

Academic Institutions

Academic institutions, such as Tezpur University and IIT Guwahati, can support technology research and development under the NAMA. The main capacity which they require for the NAMA implementation will therefore be in the form of human resources so that they may commence/continue with extension activities.

Table 54 indicates what the strengths, gaps, barriers and/or weaknesses of academic institutions are and provides a list of potential activities to help increase their capacities.

Table 54: Strengths/Weaknesses of and Capacity Building for Academic Institutions

Strengths	• Excellent research wing which has been tried and tested on the ground.
Gaps, barriers and/or weaknesses	• May not have enough resources for detailed extension activities on their own.
Activities to increase capacities	• Training modules and training of master trainers to help build their capacity • Allocate dedicated resources to contribute to NAMA implementation.

Academic institutions, particularly Tezpur University, will interact with the DoEF on extension activities. Current complementary activities are existing research and extension work. Tezpur University might be able to build upon these activities to expand on NAMA extension activities.

Non-Governmental Organisations (NGOs)

To fulfil their role as developers and mobilisers of local communities, non-governmental organisations (NGOs) will require the following capacities in order to implement the NAMA:

- Have a good understanding of fuelwood saving technology options and their benefits.
- Have a good understanding of financing options to cover upfront investment costs of fuelwood saving technologies.
- The ability to establish networks with technology providers and FIs.

Table 55 indicates the strengths, gaps, barriers and/or weaknesses of NGOs and provides a list of potential activities to help increase their capacities.

NGOs will act as the conduit between households, technology providers and FIs. Any existing complementary activities by other projects/actors will be identified at a later stage of the NAMA.

Table 55: Strengths and Weaknesses of and Capacity Building for NGOs

Strengths	• Local NGOs have existing knowledge of the landscape and networks with the communities. • Can form very successful community linkages, especially in creating awareness and forming a social safety network.
Gaps, barriers and/or weaknesses	• May lack understanding of the fuelwood saving technologies and associated financing options. • May have limited resources for effective participation under the NAMA.
Activities to increase capacities	• Training of trainers and community mobilisers on fuelwood saving technology options and their benefits. • Provision of toolkits and communication materials for awareness raising of communities. • Supporting capacity building and protocols for dedicated resources to: – Coordinate with the NAMA PMU – Aggregate data for monitoring and reporting of technologies deployed in tea estates – Coordinate with technology providers and financial institutions – Provide advisory services to households, entrepreneurs and SHGs/JLGs for accessing finance to cover upfront investment of technologies

7.3.6 Financial Institutions

National Bank for Agriculture and Rural Development (NABARD)

NABARD does not require any particular (additional) capacities in order to implement the NAMA; there are no apparent gaps, barriers or weaknesses and therefore also no activities in order to increase its capacities. NABARD's key strengths which will be utilised for the NAMA implementation include its experience in accessing GCF finance as well as its experience in providing credit to rural areas. NABARD will interact with the NAMA PMU and other FIs.

Assam Gramin Vikash Bank (AGVB)

- The specific capacities which AGVB requires in order to implement the NAMA include:
- The ability to integrate group lending for fuelwood saving technologies into existing credit lines.

The ability to develop new credit lines tailored to meet the NAMA requirements, for example, lending to MFIs.

Table 56 indicates the strengths, gaps, barriers and/or weaknesses of AGVB and provides a list of potential activities to help increase their capacities.

Table 56: Strengths and Weaknesses of and Capacity Building for AGVB

Strengths	• Strong presence throughout the state. • Experience in provision of credits to SHGs. • Experience in provision of credits to MFIs for onward lending in rural areas.
Gaps, barriers and/or weaknesses	• Lack of understanding of fuelwood saving technologies and their financing needs.
Activities to increase capacities	• Workshops to build awareness during the NAMA establishment phase.

As is the case with NABARD, AGVB will interact with the NAMA PMU and other FIs.

Micro Finance Institutions (MFIs)

To fulfil their role in the NAMA, micro-finance institutions will need:

- A good understanding of fuelwood saving technologies and their financing needs.
- Knowledge of appropriate fuelwood saving technologies financed under the NAMA.

Table 57 indicates what the strengths, gaps, barriers and/or weaknesses of MFIs are and provides a list of potential activities to help increase their capacities.

Table 57: Strengths and Weaknesses of and Capacity Building for Micro-Finance Institutions

Strengths	• Strong presence throughout the state. • Experience in provision of credits to SHGs. • Experience in provision of credits to households.
Gaps, barriers and/or weaknesses	• Lack of understanding of fuelwood saving technologies and their financing needs.
Activities to increase capacities	• Workshops in the establishment phase.

Since there are already established lines of communication and operation, MFIs will predominantly interact with AGVB for the NAMA implementation.

7.3.7 Technology Providers

The main capacities required by the technology providers in order to implement the NAMA include:

- Understanding the market for respective technologies.
- Ability to provide after sale services and to monitor deployed technologies.
- Development of technology provider networks and the linkage of these with NGOs and/or technology distributors and service providers.

Table 58 indicates what the strengths, gaps, barriers and/or weaknesses of technology providers are and provides a list of potential activities to help increase their capacities.

Technology providers will need to focus on better interaction and handholding with beneficiaries/customers for a longer duration, and with FIs for a seamless deployment of the technology. Many complementary activities by other projects/actors exist, for example, government subsidy schemes such as the Unnat Chulha Yojana; links should be established with these initiatives so as to create synergies and promote convergence.

Table 58: Strengths and Weaknesses of and Capacity Building for Technology Providers

Strengths	• Financing for business development/expansion is not an issue. • Technology innovation. • No monopolies. • Knowledge on exiting subsidies.
Gaps, barriers and/or weaknesses	• Cases where there are low margins per unit can lead to earmarking a lower amount for advertisement of the technology and awareness creation. • There is no clear brand recognition/technology recognition; this has resulted in lower trust among customers on success of the stoves. • No clear accountability on failure of technology. • No monitoring or maintenance commitments as per the current business practices in fuelwood saving technologies for households. • Poor understanding of the market for their technologies.
Activities to increase capacities	• Training and dissemination workshops on: – Appropriate markets for the different technologies based on outputs of the AFDSS – After sale services and monitoring of technologies deployed • Development of technology provider networks and the linkage of these with NGOs and/or technology distributors and service providers

7.4 Capacity Development Strategy

As outlined in chapter 4 ('financing') awareness raising and demonstration of fuelwood saving technology options and effectiveness will be required before initiating the investments into fuelwood saving technologies. This will require a strong organisational presence in the respective target villages and tea estates by organisation that could deliver these services. This will also require an efficient aggregation and distribution of technologies.

For this, existing village group structures such as women's groups, or cooperatives were identified as promising rural/village based aggregation points to create awareness on fuelwood saving technologies and execute demonstration and linking with technology providers. The awareness creation and demonstration of fuelwood saving technologies needs to be carried out by selected and qualified NGOs, Cooperatives, Producer Organisations, Community Based Organisations. These will need to be identified, selected and trained at the inception of the implementation; part of the enabling awareness raising and capacity development budget will be used for this.

The strategy has been designed for a scale of one million households and, assumptions are based on existing experiences in the Indian context. It is assumed that on average one selected and contracted CSO or NGO will be able to mobilise about 16,500 households. In each district and village an intensive two-year awareness raising and demonstration campaign will have to be carried out.

The awareness raising and demonstration campaign will focus on the following key stakeholders:

- **Communities**: Designing and implementing campaigns that are contextualised to the local needs highlighting health, economic and ecological benefits of fuelwood saving technologies. This will include development of various communication products, events and technology demonstrations; this will also include the training of trainers for community members.

- **Technology providers**: Supporting information dissemination through workshops, brochures, etc. on the most suitable regions for their technologies. The Assam Energy Development Agency (AEDA), ICCo India, IIT Guwahati and Tezpur University will support this exercise.
- **Government officers**: Senior and mid-level officers will be trained on the AFDSS and development of region-specific investment plans for fuelwood plantation and fuelwood saving technologies.

Shortlisted technology providers will be supported in delivery of fuelwood saving technologies and monitoring their usage. The identified regional rural banks (RRBs) and micro finance institutions (MFIs) will be supported on development of investment appraisal methodologies, risk management and monitoring mechanisms.

7.5 Communication and Engagement Strategy and Plan (CESP)

7.5.1 Principles of the CESP

A Communication and Engagement Strategy and Plan (CESP) needs to be developed in order to connect different stakeholders implementing the sustainable fuelwood management NAMA (e.g. government, citizens, NGOs) in a decision-making partnership. It commits the stakeholders to work with each other to empower local people and improve local outcomes. Since the focus is largely on local actors, the CESP will commence from the perspective of the locality and the people who will be directly affected by the NAMA, not from the perspective of separate organisations and services. This approach enables engagement with regard to local aspirations, issues and improvements that require joint stakeholder collaboration. Overall, the CESP provides a framework that enables stakeholders to bring together their understanding of and vision for work engagement.

Engaging civil society organisations for effective awareness generation is also an important object of CSR funding; the building of capacities of local entrepreneurs to build technology distribution networks and a cadre of skilled service providers for operation and maintenance of the technologies deployed is another important field of CSR fund allocation.

At this point in time, the communication and engagement strategy can only be outlined. It will be up to the respective stakeholders to meet and negotiate the definitive communication and engagement strategy. As the name suggests, the CESP specifically targets stakeholder communication and engagement. Clear, targeted communication is particularly important to achieve this NAMA pilot since a lack of awareness about sustainable fuelwood management and fuelwood saving technologies was frequently mentioned as a gap/weakness in the capacity needs assessment. At present, the majority of stakeholders say they are not sufficiently informed about fuelwood saving technology options and benefits, as well as their specific link to a reduced fuelwood consumption.

The CESP aims to enhance the communication between all stakeholders of the NAMA pilot in Assam, so as to improve the effectiveness of the planned project and the efficiency with which the desired outcomes (primarily: reduced fuelwood consumption) are achieved. As mentioned above, while the focus is predominantly on local actors, the purpose of the CESP is to inform, consult and involve all relevant stakeholders, in terms of decision-making, implementation, monitoring and evaluation.

The key actors for the CESP are the NAMA PMU, the management of the participating tea plantations, the households of tea plantation workers, and the forest village households. Since the NAMA PMU is the central coordination unit through which all stakeholders can be contacted and connected, much of the responsibility for the CESP will lie with them. The NAMA PMU can refer to the actors' map (presented in the chapter 2, 'Scope') as well as the capacity needs assessment (in this chapter) to ensure that relevant stakeholders are brought together to be informed about and discuss fuelwood saving technology options. The tea plantation managers, tea plantation workers and forest village households, on the other hand, are the ones who will ultimately be responsible for a reduced fuelwood consumption.

The communication and engagement strategy is therefore to progress from the current situation to the desired future situation, as outlined in the table below. The process of how this will be achieved is presented in the following sub-chapter concerning the communication and engagement plan.

Table 59: C&E Strategy – Progressing from the Current to the Future Situation

Objective The CESP aims to enhance the communication between all stakeholders of the sustainable fuelwood NAMA pilot in Assam, so as to improve the effectiveness of the planned project and the efficiency with which the desired outcomes (primarily: reduced fuelwood consumption) are achieved. The purpose of the CESP is to inform, consult and involve all relevant stakeholders, in terms of decision-making, implementation, monitoring and evaluation. In general, the objective is therefore to move from the current situation to the desired future situation as outlined here:	
Current Situation	**Desired Future Situation**
• Limited information about available fuelwood saving technologies and specifications, markets and benefits • Limited knowledge on the impact of fuelwood saving technologies on fuelwood consumption • Advanced fuelwood saving technology exists, but there is insufficient marketing to promote the products • As a result, the demand for this technology has remained low • No direct/targeted line of communication between stakeholders	• NAMA PMU to initiate targeted communication between stakeholders • Increased understanding and awareness about fuelwood saving technology, especially amongst consumers • Increased demand for fuelwood saving technologies • Adoption of fuelwood saving cooking technologies boosted as a result of the end users' own interest to adopt them (multiplier effect)

Key contents to be conveyed by the CESP are the multiple benefits of the NAMA and namely:

- **Economic and social benefits for households**: Increased productivity and quality of life owing to more time available, given the long hours required for collection of fuelwood in the past.
- **Health benefits**, especially to women and children in the targeted households, which currently depend on conventional fuelwood-inefficient cook stoves. Smoke from cooking is one of the major causes of respiratory illness among women in rural India[21]. In addition, reduced drudgery from fuelwood collection will lead to further health benefits.

[21] In 2010, approximately 1.04 million premature deaths and 31.4 million Disability-Adjusted Life Years (DALYs) were attributable to household air pollution (HAP) resulting from solid cooking fuels in India (Report of the MoHFW Steering Committee on Air Pollution and Health Related Issues)

- **Economic benefits for technology providers**: Information from the AFDSS will enable technology providers to target appropriate regions for their products and services. This will help sustain their businesses in the long run.
- **Environmental benefits**: Reduction of deforestation, forest degradation and allied biodiversity and ecosystem service conservation in the State of Assam.

7.5.2 CESP Implementation – A Phased Approach

The communication and engagement plan for the actual implementation of the strategy can be structured according to three distinct phases, 1) pilot preparation (with an estimated duration of three months), 2) pilot implementation, and 3) pilot evaluation.

After successful piloting the CESP shall be scaled up and implemented in an increasing number of project sites.

Pilot Preparation

During the preparation phase, the preliminary strategy will be further refined by the NAMA PMU. This step will include a more detailed assessment of the current situation, based mainly on the capacity needs assessment. Following this, the NAMA PMU will meet with representatives of different stakeholder groups to explain the purpose of the NAMA pilot, the deployment of fuelwood saving technology, as well as the roles and responsibilities of stakeholders. The communication will focus on different aspects, depending on which stakeholders are included:

- **Village households**: design and implement campaigns that are contextualised to the local needs which highlight health benefits of clean cooking technologies, as well as their economic and ecological benefits. This will include the development of various communication products, events and technology demonstrations; it will also include the training of trainers for community members.
- **Technology providers**: support information dissemination through workshops, brochures, etc. generated by the AFDSS on the most suitable regions for their technologies. AEDA, ICCo India, IIT Guwahati and Tezpur University will support this exercise.
- **Government officers**: senior and mid-level officers will be trained especially on the use of the AFDSS and the development of region-specific investment plans for fuelwood plantation and fuelwood saving technologies.

These stakeholder interactions should be used to further discuss and confirm the communication and engagement strategy, and can be developed into a stakeholder matrix. A stakeholder matrix is one method of documenting the roles and responsibilities of each stakeholder, and of making sure that there is an exchange between stakeholders regarding a given topic. Once the individual meetings have been conducted, the NAMA PMU will proceed to determine which stakeholders need to work together (i.e., communicate) either directly or indirectly, and to what extent (frequency and intensity of interaction). The NAMA PMU will provide a platform for the ensuing stakeholder meetings; this includes organising the meetings in terms of participants, venue, moderation, content, expected outputs, documentation, etc.

Engaging the stakeholders works best by first explaining what the negative effects of an unsustainable fuelwood management are, especially in terms of current cook stoves. Using this as the starting point, a clear case needs to be made for better regulation of fuelwood consumption, again, with a particular

focus on fuelwood saving technologies. The benefits of using improved technologies need to be presented as evidently as possible so that incentives such as reduced fuelwood costs and improved health encourage the stakeholders to participate in the project. Presenting the benefits of the various fuelwood saving technologies can be tailored according to the stakeholder group being addressed. For example, the government may benefit through NAMA acceptance and funding, tea estate managers will benefit from reduced fuelwood costs, village households will benefit from reduced fuelwood costs and an improved health situation, MFIs may benefit from an increase in small loans, etc.

The purpose of first fully explaining the issue at hand and then pointing out the benefits for each of the stakeholders will ensure gradual support from the stakeholders. However, several reiterations may be required to fully explain the NAMA pilot and to convince the stakeholders to participate. It is furthermore important to react to as many stakeholder questions as possible. This will help to reduce doubt and therefore increase their willingness to participate.

Another motivating, albeit costly approach to supporting stakeholder engagement would be to organise exchange trips to NAMA sites (e.g. in neighbouring districts) that already implement newer fuelwood saving technologies and have realised the benefits for themselves. It will be easier to encourage engagement if the stakeholders can see for themselves what the NAMA pilot is about.

Pilot Implementation

This phase of the communication and engagement plan will be defined by close contact between suppliers (e.g. technology providers, MFI) and consumers (e.g. village households), as well as tea estate managers, government entities and representatives of private companies (as a source of CSR money). The NAMA PMU will not only continue to support stakeholder communication, but will also supervise the flow of information throughout the process of promoting fuelwood saving technologies. Ideally, the NAMA PMU will create a short survey for different stakeholder groups, to be conducted once purchased fuelwood saving technologies have been in use for at least one month, in which the following questions will be addressed:

- Was sufficient information provided beforehand?
- Did the NAMA pilot provide a transparent, clear process (was it easy to understand and follow)?
- How high is the fuelwood demand when using fuelwood saving technologies? How high is the demand for funding and fuelwood saving technologies?
- What is the health status of village households?
- How motivated are the village households to participate in the pilot? What are their first impressions of the pilot?
- Do the stakeholders have any suggestions to improve the process?

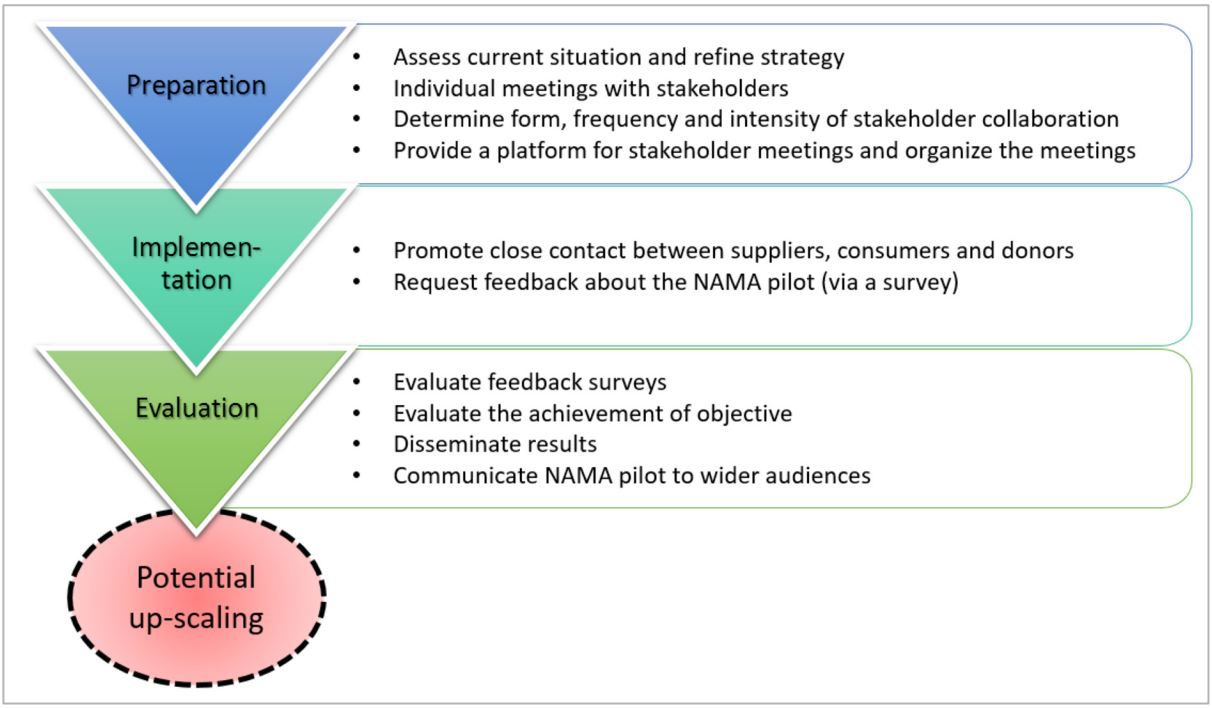
The first and last question are particularly important; while the first directly asks for feedback about prior communication, the last question aims to enhance the communication amongst the stakeholders. Communication is intended to travel in several directions; it is neither purely top-down nor bottom-up, but rather, at the very least a two-way communication. Once the NAMA pilot has entered the implementation phase, the stakeholders will be able to provide some form of feedback to the NAMA PMU about the information which they were given, how they were involved in the process, and what needs to be changed, should the NAMA pilot be up-scaled.

Pilot Evaluation

The evaluation phase will be based in part on the feedback received through the stakeholder surveys, and in part on re-examining the objective of the communication and engagement strategy. It will be important to determine whether or not the level of stakeholder awareness with regards to fuelwood saving technologies was increased through the NAMA pilot, and quite specifically, through the communication and engagement plan. One indication that the pilot has succeeded will be if village households spread information about the project of their own accord (i.e., without communication efforts through the NAMA PMU) and if the demand for fuelwood saving technologies also increases in neighbouring communities, which were not included (multiplier effect fuelled by the intrinsic interest of the end users). This phase will furthermore include the task of communicating the results of the pilot to wider audiences. This can be supported and achieved by posting signboards in participating villages, advertising in other districts (this would be the responsibility of the Government of Assam), and/or by providing factsheets to outline the entire process and results. Provided that positive results are achieved, disseminating the information is an important step in scaling up the pilot.

Figure 50 summarises three phases that are proposed for the communication and engagement plan.

Figure 50: Summary of the Three Phases of the Communication and Enagagement Plan



The benefits of a fully detailed communication and engagement strategy and plan are manifold and include:

- Reduced inefficiency and duplication in engagement practice
- Strengthened working partnerships
- Increased stakeholder satisfaction levels

- Improved accountability
- Better knowledge of existing engagement practice and resources
- Stronger links between communities and decision-makers
- Bottom-up approach to improve implementation
- Improved CAA ratings, both locality assessments and organisational assessments
- Improved outcomes for stakeholders (especially local people)

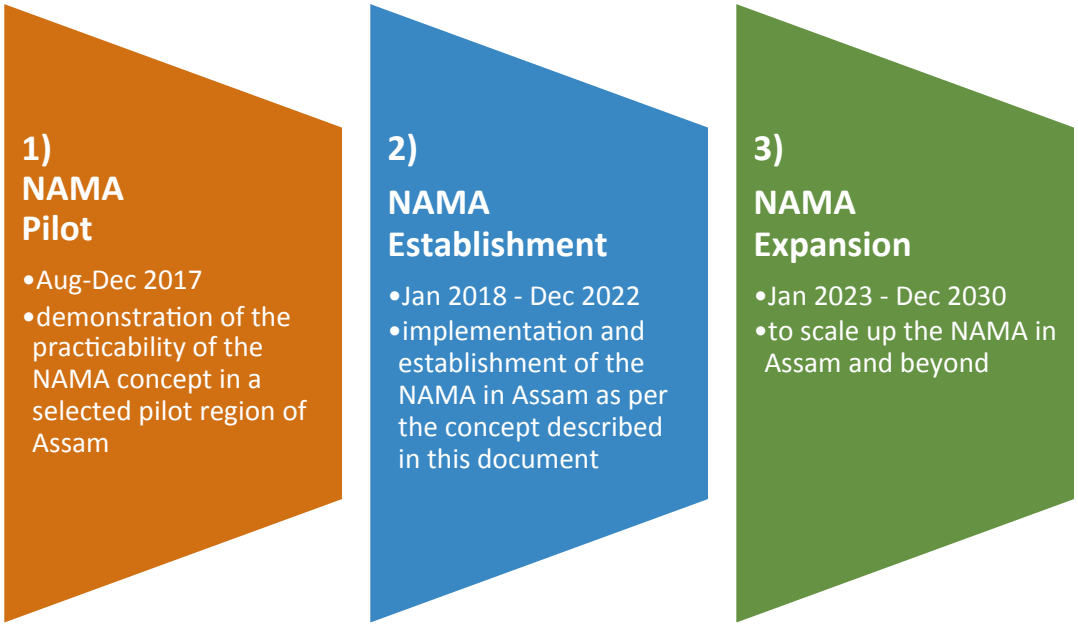
In order to provide a starting point to develop the communication and engagement plan, a template has been included as annexure.

8. NAMA Action Plan

8.1 Introduction

This chapter outlines the work plan for implementing the Forestry NAMA effectively in Assam. The NAMA will be implemented in three phases: 1) Pilot Phase II) Establishment Phase and 3) Expansion Phase which will be deployed in the following manner:

Figure 51: Three Phases of NAMA Implementation (Year 2017-2030)



A NAMA Pilot will be implemented in a selected sub-region in Assam to demonstrate the practicability of the NAMA concept. This will be completed in August 2017 to December 2017.

- Post successful implementation of the pilot, the NAMA implementation starting with the NAMA Establishment Phase will occur over five years, from January 2018 to December 2022. This period will also cover developing the plan for scaling up across the state in the NAMA Expansion Phase.
- Implementation of the NAMA Expansion Phase over eight years, from January 2023 to December 2030.

Effective implementation of the Forestry NAMA will require the following key elements to be developed, deployed and scaled up in a timely manner:

- Institutional Framework
- Baseline and Monitoring, Reporting and Verification (MRV) System
- Assam Fuelwood Decision Support System (AFDSS)
- Financial Mechanisms and Sources
- Communication and Capacity Development
- Partnerships with Implementing Agencies

The subsequent sections provide an action plan for these key elements and their deployment in the three phases of the Forestry NAMA.

8.2 NAMA Pilot Phase

The duration of the pilot phase will be five months, from August, 2017 until December 2017.

8.2.1 Objective of the NAMA Pilot

The objective is to test the practicability of the NAMA concept and demonstrate its readiness for full scale implementation. This pilot will focus on deployment and sustained adoption of fuelwood saving technologies in five tea estates and five forest villages in a selected sub-region in Assam.

The stakeholder consultations and feedback received during the NAMA concept development stage, specifically from the Department of Environment and Forests (DoEF) and AEDA in Assam, was to design a NAMA pilot programme to test the concept developed at a much smaller scale, covering a cluster of five tea estates and five forest villages.

The targeted goals of the pilot are:

- Promote adoption of fuelwood saving technologies in five tea estates and five forest villages in Assam.
  - Many past initiatives have primarily focused on deployment, with little or no focus on sustained adoption. This pilot will conduct a rigorous exercise in identifying the appropriate technologies for the chosen cluster using a scientifically based Decision Support System (DSS). In addition, communication and capacity building strategy will be carried out in the chosen cluster to increase awareness of the targeted households on fuelwood saving technologies and create a demand for them.
- Secure financing to deploy fuelwood saving technologies in at least 50 households in each tea estate and the forest village cluster.
  - These could include one or multiple sources from public (e.g. government subsidy programmes) and private sectors (e.g. CSR, financing from tea estates engaged in the cluster and personal financing by the consumer households).

- Establish channels for technology distribution, service delivery to ensure Operation and Maintenance (O&M) of technologies and MRV to monitor performance of the technologies deployed.
- Demonstrate local ownership by engaging relevant stakeholders ranging from households to government agencies to ensure sustainability of the interventions and promote scaling up of successful models.
  - AEDA, the state nodal government agency for promotion of improved cook stoves, and ABITA, a tea estate association with the largest membership in Assam, have shown a keen interest in the NAMA and would like to see it being successfully implemented.

8.2.2 Scope of the NAMA Pilot

The NAMA pilot will demonstrate the readiness of the NAMA concept by carrying out the following key work packages:

- **Work package A**: Identify a cluster of tea estates and forest villages for the pilot NAMA
- **Work package B**: Define baseline for the chosen cluster
- **Work package C**: Design and implement awareness generation, communication and capacity building strategy
- **Work package D**: Develop excel based Decision Support System (DSS) for the chosen cluster
- **Work package E**: Support deployment of fuelwood saving technologies
- **Work package F**: Develop a monitoring and reporting system for the pilot NAMA

Work package A will focus on engaging with the relevant stakeholders, including the Assam Department of Environment and Forest (DoEF), AEDA and ABITA among others, to identify a cluster of 5 tea estates and forest villages for implementing the NAMA pilot. Work packages B, C and D will cover detailed research and extensive consultations and field visits to the chosen cluster in order to develop a robust baseline, design a communication strategy for sustainable fuelwood management in the cluster, develop an excel based DSS that can be used by decision makers to plan investment strategies for sustainable fuelwood management in the cluster and identify technology providers and at least 50 beneficiary households in the selected tea estates and forest village clusters for the deployment of fuelwood saving technologies. Work packages E and F will focus on coordinating the timely delivery of technologies, facilitating agreements for associated services by technology providers to ensure sustained adoption by beneficiary households and monitoring the progress on deployed interventions.

8.3 Institutional Framework

An institutional framework that can guide and oversee effective implementation of the Forestry NAMA is essential, and will be constituted in the Establishment Phase. An inter-departmental NAMA Steering Committee (NSC), comprising of relevant agencies involved in designing and implementing sustainable fuelwood management interventions in Assam will be constituted to guide the overall process. NAMA Programme Management Unit (NAMA PMU) will be the nodal executive agency for ensuring effective and timely implementation of all the activities. The Department of Environment and Forest (DoEF) in Assam will oversee the constitution and functioning of a dedicated NAMA PMU.

The following actions are required to ensure this key element of the Forestry NAMA is implemented effectively:

Component	Action	Responsible Stakeholder	Timeline
NAMA Steering Committee (NSC)	Constituting the NSC	Chief Secretary of Assam Department of Environment and Forest, Government of Assam;	First quarter of 2018
	Meetings of the NSC to finalise the operational guidelines and action plan for NAMA	Department of Environment and Forest, Government of Assam;	Quarterly meetings in 2018
	Meetings of the NSC to review progress on the NAMA	NAMA PMU	Biannual meetings from 2019 to 2030
NAMA PMU	Hiring and training of staff for the NAMA PMU	Department of Environment and Forest, Government of Assam	First quarter of 2018
	Coordinating with DoEF and NSC	NAMA PMU	Ongoing till 2030
	Reporting on implementation progress to NSC	NAMA PMU	Biannually from 2019 to 2030

8.4 Baseline Development and Monitoring, Reporting and Verification (MRV) System

A baseline for the NAMA will be developed to map the dynamics of fuelwood consumption in Assam. The baseline will be critical in determination of the potential impacts of the Forestry NAMA and sustainable development benefits before the actual implementation of NAMA actions (ex-ante assessment). In line with this, a Monitoring, Reporting and Verification (MRV) system will be designed to ensure reporting on use of the fuelwood saving technologies and success of fuelwood plantations.

The following actions are required to ensure this key element of the Forestry NAMA is implemented effectively:

Component	Action	Responsible Stakeholder	Timeline
Baseline Development	Registration and Baseline Survey	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By mid-2018
	Developing Baseline for Establishment Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By end-2018
	Collecting data and developing Baseline for Expansion Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By end-2021
MRV System	Designing the MRV System for Establishment Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By end-2018
	Scaling up the MRV System for Expansion Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By end-2021
	Deploying the MRV System	NAMA PMU; External agencies for third-party audit	From 2018 till 2030

8.5 Assam Fuelwood Decision Support System (AFDSS)

A state-wide multivariate Assam Fuelwood Decision Support System (AFDSS) will be developed for producing highly contextual investment strategies for fuelwood plantations and fuelwood saving technologies at a sub-regional level. These investment strategies will guide NAMA implementation and support convergence of actions by public and private agencies towards sustainable fuelwood management in Assam.

The following actions are required to ensure this key element of the Forestry NAMA is implemented effectively:

Component	Action	Responsible Stakeholder	Timeline
AFDSS Development	Stratification of fuelwood consumers and collecting ecological and socio-economic data for Establishment Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By third quarter of 2018
	Modelling AFDSS and generating investment scenarios for Establishment Phase	Technical Agency engaged by the NAMA PMU	By end-2018
	Stratification of fuelwood consumers and collecting ecological and socio-economic data for Expansion Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By end-2021
	Scaling up the AFDSS to cover all consumer groups across the state and generating investment scenarios for Expansion Phase	Technical Agency engaged by the NAMA PMU	By mid-2022
Implementation	Developing guidelines for: 1. Investment planning, coordination and convergence 2. Linking with MRV System	NAMA PMU	By end-2018
	Coordinating and convergence on investment planning	NAMA PMU	Ongoing from end-2018 till 2030
	Developing a web platform for building public awareness on the most optimum fuelwood saving technologies for them	Technical Agency engaged by the NAMA PMU	By mid-2019

8.6 Financial Mechanisms and Sources

Considering that finance mobilisation requires significant resources, the forestry NAMA will require a targeted finance mobilisation strategy. The initial focus will be on the cross-cutting and creation of an enabling environment for the NAMA which includes the institutional framework, development of baseline, AFDSS and MRV systems. This component has a key enabling function for the overall NAMA implementation, and is a pre-condition for the desired household aggregation, awareness raising and the leverage of target group specific investment into fuelwood saving technologies. Furthermore, this component includes additional fund raising activities for the NAMA as part of the operationalisation of the NAMA financing mechanism (see section 6.6).

The following actions are required to ensure this key element of the Forestry NAMA is implemented effectively:

Component	Action	Responsible Stakeholder	Timeline
Financial Mechanism for Establishment Phase	Identifying financial institutions to be engaged in the NAMA financial mechanism and initiate discussions on their specific roles and responsibilities	NAMA PMU	By mid-2018
	Completing agreements with chosen financial institutions on deploying credit lines	NAMA PMU	By end-2018
	Finalising channel to access and deploy donor funding (international finance and CSR)	NAMA PMU	By end-2018
	Finalising channel to leverage funding from government schemes	NAMA PMU	By end-2018
Financial Mechanism for Expansion Phase	Financing needs assessment for Expansion Phase	NAMA PMU	By end-2021
	Completing agreements with chosen financial institutions on deploying credit lines	NAMA PMU	By end-2022
	Finalising channel to access and deploy donor funding (international finance and CSR)	NAMA PMU	By end-2022
	Finalising channel to leverage funding from government schemes	NAMA PMU	By end-2022

8.7 Communication and Capacity Development

A multi-pronged communication strategy will be employed, in order to address specific capacity building needs of the various key stakeholders to be engaged in the effective implementation of the NAMA.

The following actions are required to ensure this key element of the Forestry NAMA is implemented effectively:

Component	Action	Responsible Stakeholder	Timeline
Communication and Capacity Development Strategy	Developing a communication and capacity development strategy for the Establishment Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By mid-2018
	Completing agreements with implementing partners on communication and capacity development under Establishment Phase	NAMA PMU	By mid-2018
	Developing a communication and capacity development strategy for the Expansion Phase	NAMA PMU or a Technical Agency engaged by the NAMA PMU	By mid-2021
	Completing agreements with implementing partners on communication and capacity development under Expansion Phase	NAMA PMU	By end-2021
Implementation	Rolling out the strategy and monitoring performance of implementing partners for the Establishment Phase	NAMA PMU	From mid 2018
	Rolling out the strategy and monitoring performance of implementing partners for the Expansion Phase	NAMA PMU	From 2022

8.8 Partnerships with Implementing Agencies

Private sector agencies, academic institutions, Non-Governmental Organisations (NGOs) and Civil Society Organisations (CSOs) will be engaged in the implementation of the NAMA across the state. Their roles and responsibilities have been outlined in Chapter 7 of this report.

The following actions are required to ensure this key element of the Forestry NAMA is implemented effectively:

Component	Action	Responsible Stakeholder	Timeline
Partnerships with Technology and Service Providers	Recruiting partners and setting technology delivery norms for Establishment Phase	NAMA PMU	By first quarter of 2019
	Recruiting shortlisted partners and setting technology delivery norms for Expansion Phase	NAMA PMU	By end-2022
	Executing and monitoring field deployment	NAMA PMU	From 2019 till 2030
Partnerships with Academic Institutions	Completing agreements with Academic Institutions to act as Centres of Excellence and train technology providers	NAMA PMU	By mid-2018
Partnerships with Implementing NGOs and CSOs	Empanelling and training partners to act as field partners for Establishment Phase	NAMA PMU	By end-2018
	Empanelling and training partners to act as field partners for Expansion Phase	NAMA PMU	By end-2022
	Executing and monitoring field deployment	NAMA PMU	From 2019 till 2030

9. References

Chapter 1

BUR, MoEFCC. India's First Biennial Update Report (BUR) to UNFCCC. MoEFCC, 2015.

Census of India. Provisional Population Totals Paper 1 of 2011 India Series 1. Office of the Registrar General and Census Commissioner, India, 2011.

Decision 1/CP.13, UNFCCC. "Bali Action Plan." Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007. United Nations Framework Convention on Climate Change (UNFCCC), 2008.

Dhanuraj, D., and Rahul V. Kumar. A Critical Assessment of Forest Legislations in India. Center for Public Policy Research, 2014.

Ecofys. Browse Database. 31 May 2017. http://www.nama-database.org/ index.php/Main_Page.

FSI. India State of Forest Report 2011. Dehradun: Forest Survey of India (FSI), Ministry of Environment, Forests and Climate Change, 2011.

GACC. Project Database - Global Alliance for Clean Cookstoves (GACC). 2017. http://carbonfinanceforcookstoves.org/tools/projects/ (accessed May 31, 2017).

GIZ. NAMAs and REDD+: Relationship and main issues for consideration - with a focus on Southeast Asia. Bonn, Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, 2013.

Government of Gambia. Nationally Appropriate Mitigation Actions of The Gambia. n.d.

Harms, Natalie. "Burkina Faso Biomass Energy NAMA." International Partnership on Mitigation and MRV. 2017. https://www.transparency-partnership.net/sites/default/files/ws15223_burkina_faso_gpa2015_en_long-03.pdf.

"India's Voluntary Climate Mitigation Action." UNFCCC. 30 January 2010. https://unfccc.int/files/meetings/cop_15/copenhagen_accord/application/pdf/indiacphaccord_app2.pdf.

Lütken, Søren E., et al. Guidance for NAMA Design in the Context of Nationally Determined Contributions: A Tool to Realize GHG Mitigation Under NDCs. UNDP, UNFCCC, UNEP DTU and UNFCCC Secretariat, 2016.

Mehra, Swapan, Ashwin A. S., Zainab Hassan, and Kundan Burnwal. Feasibility Study for Forestry NAMA in India. New Delhi: GIZ India, 2015.

MoEFCC - INDC. India's Intended Nationally Determined Contribution: Working Towards Climate Justice. October 2015.

MoEFCC. Asia-Pacific Forestry Sector Outlook Study II: India Country Report. Ministry of Environment, Forest and Climate Change (MoEFCC), 2009.

—. India ratifies the Paris Agreement on Climate Change. 2 October 2016. http://envfor.nic.in/content/india-ratifies-paris-agreement-climate-change.

—. National Forest Policy. 1988. http://envfor.nic.in/legis/forest/forest1.html (accessed April 6, 2017).

—. National Mission for a Green India (GIM). 2014. http://www.envfor.nic.in/major-initiatives/national-mission-green-india-gim.

MoEFCC. National Policy on REDD+: Final Draft. Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, 2014.

—. "Presentation on INDC in Press Conference." Ministry of Environment, Forest and Climate Change (MoEFCC). 2 October 2015. http://www.moef.gov.in/sites/default/files/revised%20PPT%20Press%20Conference%20INDC%20v5.ppt.

MoEFCC. Reference Document for REDD+ in India. Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, 2014.

NAMA Facility. Projects. 31 May 2017. http://www.nama-facility.org/projects/?Region=&Sector=.

NCDMA. Sector Wise Approved Projects. 2017. http://www.cdmindia.gov.in/reports_new.php (accessed May 2017).

PIB. "Text of PM's address at the launch of 'Pradhan Mantri Ujjwala Yojana' at Ballia." Press Information Bureau (PIB). 01 May 2016. http://pib.nic.in/newsite/PrintRelease.aspx?relid=142612 (accessed May 10, 2017).

Sawyer, Dave, Jason Dion, Deborah Murphy, Melissa Harris, and Seton Stiebert. Developing Financeable NAMAs: A Practitioner's Guide. International Institute for Sustainable Development, 2013.

UNFCCC. "Manual of the NAMA Registry." NAMA Registry. 19 February 2014. http://unfccc.int/files/cooperation_support/nama/application/pdf/nama_registry_manual_19_february_2014.pdf.

—. Public NAMA - Home. 30 May 2017. http://www4.unfccc.int/sites/nama/SitePages/Home.aspx.

Whalley, John, and Manmohan Agarwal. World Scientific Reference on Asia and the World Economy Volume 1: Sustainability of Growth - The Role of Economic, Technological and Environmental Factors. World Scientific Publishing Company, 2015.

World Bank. India: Unlocking Opportunities for Forest Dependent People in India. World Bank: South Asia Region, 2006.

Chapter 3

Forest Survey of India. 2009. Carbon Stock in India's Forests. Dehradun: Forest Survey of India, Ministry of Environment & Forests.

Government of India, North Eastern Council Secretariat, 2015. Basic Statistics of North Eastern Region 2015. Report, Shillong: North Eastern Council Secretariat.

IPCC, IPCC Guidelines for National Greenhouse Gas Inventories. 2006. Volume 2 Energy. Japan: Institute for Global Environmental Strategies.

Kaul, M., V.K. Dadhwal, and G.M.J. Mohren. 2009. "Land use change and net C flux in Indian forests." Forest Ecology and Management 258 100–108.

Ministry of Statistics and Programme Implementation. 2014. Household Consumption of Various Goods and Services 2011-12. Report No 558, Government of India.

Ministry of Tribal Affairs, Ministry of Tribal. 2017. Development of Forest Villages. Accessed June 14, 2017. http://tribal.nic.in/Content/DevelopmentofForestVillage.aspx.

Pandey, Devendra. 2002. Fuelwood Studies in India Myth and Reality. Report, Jakarta, Indonesia: CIFOR.

Pearson, Timothy R. H., S. Brown, L. Murray, and G. Sidman. 2017. "Greenhouse gas emissions from tropical forest degradation: an underestimated source." Carbon Balance and Management.

Sonowal, C.J. 2007. "Demographic Transition of Tribal People in Forest Villages in Assam." Stud. Tribes Tribals 5(1) 47-58.

The Gold Standard. 2013. Simplified Methodology for Efficient Cookstoves. The Gold Standard.

UNF. 2017. The Global Alliance for Clean Cookstoves. Accessed June 8, 2017. http://carbonfinanceforcookstoves.org/about/the-global-alliance-for-clean-cookstoves/.

UNFCCC. 2015. "CDM Guidelines." 16 October. Accessed June 20, 2017. https://cdm.unfccc.int/filestorage/e/x/t/extfile-20151023152925164-Meth_GC48_-ver04.0-.pdf/Meth_GC48_%28ver04.0%29?t=RHd8b3M1cWZyfDAwL8-mJUuOLSJ7sdW6C-PQ.

Willey, Zach, and Bill Chameides. 2007. Harnessing Farms and Forests in the Low-Carbon Economy: How to Create, Measure, and Verify Greenhouse Gas Offsets. Durham: Duke University.

Zomer, Robert J., H. Neufeldt, Jianchu Xu, A. Ahrends, D. Bossio, A. Trabucco, M. van Noordwijk, and M. Wang. 2016. "Global Tree Cover and Biomass Carbon on Agricultural Land: The contribution of agroforestry to global and national carbon budgets." Nature.

Chapter 4

Bharat, Kunal, Satvant Kaur Saini, Karan Khosla, Swapan Mehra, and N. Ravindra. 2015. "System Dynamics Modelling for Forest Fuelwood Management in India." Ambient Science Vol. 02(2); 01-07. doi:10.21276/ambi.2015.02.2.ta01.

DoEF. 2015. Assam State Action Plan on Climate Change (2015-2020). Government Report, Department of Environment, Government of Assam, India.

Khandelwal, Meena, Matthew E Hill, Paul Greenough, Jerry Anthony, Misha Quill, Marc Linderman, and H.S. Udaykumar. 2016. "Why Have Improved Cook-Stove Initiatives in India Failed?" World Development. https://www.researchgate.net/publication/309762986_Why_Have_Improved_Cook-Stove_Initiatives_in_India_Failed.

Chapter 6

AGVB, 2016. 11th Annual Report. Assam Gramin Vikash Bank (AGVB). Availbale at: http://www.agvbank.co.in/annual/Annual-Report-2015-16.pdf

AEDA, 2016. Notification manufacturers of Unnat Chulha and their approved models. No. AEDA/445/2015, Assam Energy Development Agency. Available at: http://www.assamrenewable.org/tender/uca.pdf

Assam Chah Mazdoor Sangha 1979. Agreement Regarding Firewood and Dry Tea Benefit for Permanent Tea Garden Workers, Dated 10th November, 1979. Available at: http://assamchahmazdoorsangha.org/bilater1/39.html

Assam, D. o., 2017. National Afforestation Programme (NAP). Accessed 15 June 2017: http://assamforest.in/statistics/napReport.php

CFU, 2017. The Climate Funds Update - the latest information on climate funds. Heinrich Böll Stiftung North America and Overseas Development Institute. Available at: http://www.climatefundsupdate.org/

Das, S. K. (2013). A Brief Scanning on Performance of Mahatma Gandhi National Rural Employment Guarantee Act in Assam, India. American Journal of Rural Development, 1 (3), pp 49-61. DOI: 10.12691/ajrd-1-3-3

EBRD, 2017. Operationalising Article 6 of the Paris Agreement. Perspectives of developers and investors on scaling-up private sector investment. European Bank for Reconstruction. Available at: http://www.thesouthpolegroup.com/publications

EconomicTimes, T., 2017. Govt collects Rs 21,129 crore as Clean Environment Cess in Apr-Jan. Accessed 15 June 2017 http://economictimes.indiatimes.com/industry/banking/finance/govt-collects-rs-21129-crore-as-clean-environment-cess-in-apr-jan/articleshow/57731975.cms

GCF, 2014. Investment Framework. GCF/B.07/06, 9th May 2014. Green Climate Fund. Available at: http://www.greenclimate.fund/documents/20182/24943/GCF_B.07_06_-_Investment_Framework.pdf/dfc2ffe0-abd2-43e0-ac34-74f3b69764c0

GCF, 2017a. Project FP 045. Ground Water Recharge and Solar Micro Irrigation to Ensure Food Security and Enhance Resilience in Vulnerable Tribal Areas of Odisha. Green Climate Fund. Available at: https://www.greenclimate.fund/-/ground-water-recharge-and-solar-micro-irrigation-to-ensure-food-security-and-enhance-resilience-in-vulnerable-tribal-areas-of-odisha?inheritRedirect=true&redirect=%2Fprojects%2Fbrowse-projects

GCF, 2017b. Accreditation to the Green Climate Fund. Green Climate Fund. Available at: http://www.greenclimate.fund/documents/20182/319135/1.3_-_GCF_Accreditation_Introduction_November_2016.pdf/4d44997c-6ae9-4b0e-be5d-32da82e62725

GEF, 2016. GEF project cycle and program cycle policy. 50th GEF Council Meeting, June 07-09-2016. Washington, D.C. (GEF/C.50/08/Rev.01). Available at: http://www.thegef.org/sites/default/files/council-meeting-documents/EN_GEF.C.50.08.Rev_.01_GEF_Project_and_Program_Cycle_Policy_0.pdf

GEF, 2017. India - Country at a glance. Global Environment Facility (GEF). Available at: https://www.thegef.org/country/india

Government of India, 2011. Census Info India, 2011. HH10: Households by Availability of Separate Kitchen and Type of Fuel Used for Cooking. Office of the Registrar General & Census Commissioner, India. Available at: http://www.censusindia.gov.in/2011census/Hlo-series/HH10.html

GoA, 2015. Revised guidelines on Randhanjyoti Scheme for the 2015-16. No. 08.58f20061RJS-1'Pt-11f28. Dated Guwahati the 22nd April' 2015. Government of Assam, Directorate of Food, Civil Supplies and Consumer Affairs, Assam Guwahati Available at: http://fcs.assam.gov.in/downloadDocumants.htm?docIdPk=71

LTS, 2016. Mid-term evaluation of the NAMA Facility. Final report to GIZ. LTS International. Available at: http://www.nama-facility.org/publications/nama-facility-mid-term-evaluation-report/

Mehra, S., Bhan, M., Sharma, D., & A.S., A. Critical observations on National CAMPA Bill, 2016. Current Science. Accessed 15 June 2017: http://www.currentscience.ac.in/Volumes/111/07/1141.pdf

Ministry of Law & Justice. (3. August 2016). Compensatory Afforestation Fund Act. Accessed 15 June 2017: http://www.ukcampa.org.in/Docs/CAMPA%20Act%202016.pdf

MNRE, 2016. National Biogas and Manure Management Programme (NBMMP). Ministry of New and Renewable Energy (Biogas Technology Development Division) Available at: http://mnre.gov.in/schemes/decentralized-systems/schems-2/

MNRE, 2016-17. STANDING COMMITTEE ON ENERGY. NEW DELHI: LOK SABHA SECRETARIAT.

MoEFCC, 2015. India's Intended Nationally Determined Contribution: Working Towards Climate Justice. Available at: http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf

MoEFCC, 2009. National Afforestation Programme. Revised Operational Guidelines - 2009. Accessed 15 June 2017: http://naeb.nic.in/NAP_revised%20Guidelines%20English.pdf

MoF, 2016. Clean Environment Cess. Von Notification - Ministry of Finance (MoF): http://policy.asiapacificenergy.org/sites/default/files/Notification%20No.%201%3A2016%20-%20Clean%20Environment%20Cess.pdf

MoF, 2017. Expansion in the scope of eligible projects/schemes for financing under the National Clean Energy and Environment Fund (NCEEF). Ministry of Finance (MoF): http://mof.gov.in/the_ministry/dept_expenditure/plan_finance2/NCEEEF29032017.pdf

PIB, 2011. Creation of National Clean Energy Fund. Von Press Information Bureau (PIB): http://pib.nic.in/newsite/PrintRelease.aspx?relid=71517

PIB, GoI, 2016. Compensatory Afforestation Fund Bill, 2016 Passed by Rajya Sabha. Accessed 15 June: http://pib.nic.in/newsite/mbErel.aspx?relid=147937

Raha, D., Mahanta, P., & Clarke, M. L., 2014. The implementation of decentralised biogas plants in Assam, NE India: The impact and effectiveness of the National Biogas and Manure Management Programme. Energy Policy Volume 68, Pages 80–91.

RBI, 2004. Report of the Working Group on Development Financial Institutions. Reserve Bank of India (RBI).

Subramanian, M., 2014. Deadly Dinners. Nature, Vol 509, 29th May, 2014, pp. 548-551. Available at: https://www.nature.com/polopoly_fs/1.15286!/menu/main/topColumns/topLeftColumn/pdf/509548a.pdf

UNFCCC, 2012. Decision 3/CP.17. Launching the Green Climate Fund. FCCC/CP/2011/9/Add.1. Available at: http://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf#page=55

Annexures

Annexure 1: Relevant NAMAs Around the World

Burkina Faso – Biomass Energy NAMA Support Project

Status: Supported NAMA

Summary: The NAMA aims to reduce emissions associated with biomass use and respective deforestation e.g. for thermal energy use in the commercial sector by distributing more energy efficient cook stoves for traditional beer brewing and the production of shea-butter and sumbala. In three phases, the NAMA will target i) productive energy use, ii) domestic energy use, iii) alternative energy options and energy markets. The objective is to enable the biomass energy sector to become an economically viable and renewable sector in the context of sustainable low carbon development. Good practice elements of the project design include the level of cross-organisational coordination, the active participation of stakeholders, the market-oriented concept, and the combination of technical assistance and financial components.

Support Received: The NAMA received implementation support from the NAMA Facility in the second bidding round for NAMA support projects in 2014, a joint fund of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), the Department of Energy and Climate Change (DECC) of the United Kingdom (UK), the Danish Ministry of Climate, Energy and Building (MCEB) and the European Commission. The proposed budget is EUR 13.5 million over five years. The detailed financing scheme is currently being defined.

The aim is to leverage finance through NAMA Facility and existing donor finance channels in the country (such as the Environmental Investment Fund (FIE) supported by Luxemburg's LuxDev and Sweden's SIDA) to unlock investments into biomass production for energy use. NAMA implementation uses a results-based financing mechanism with distinct phases and milestones to trigger new funding rounds and private investment, e.g. from local breweries and investors in biomass energy for alternative fuels.

Guatemala - Efficient Use of Fuel and Alternative Fuels in Indigenous and Rural Communities

Status: Supported NAMA

Summary: Guatemala is committed to create improved conditions for sustainable and efficient firewood use and has set up a dedicated Firewood Commission to implement the National Firewood Strategy. A respective action plan proposes: (i) to enhance access to efficient technologies, (ii) to increase demand, and (iii) to promote an enabling environment for sustainable and efficient firewood use. With tailor-made financial and technical support mechanisms, the NAMA Support Project will help to sustainably stimulate the supply and demand for energy efficient cook stoves in Guatemala. Enhanced coordination and consolidation of national and international support is required to achieve scalability and long-term sustainability in the implementation of clean cooking technologies, and for strengthening participatory governance to implement the National Firewood Strategy, which is part of Guatemala's Nationally Determined Contribution (NDC) presented at COP21. Possible co-benefits include the reduction in forest degradation, increased health benefits, and improved economic conditions of households (through the reduced need to purchase fuel and/or time spent on collecting firewood) for approximately 1.1 million people, mostly indigenous women and children living in poverty.

Support Received: The NAMA received implementation support from the NAMA Facility in the third bidding round for NAMA support projects in 2015. The proposed budget is EUR 10.9 million over three years. The detailed financing scheme is currently being defined. The NAMA expects a contribution of EUR 14 million from the private sector in the form of credits and microcredits from private financial institutions to purchase clean cook stoves. The public sector will negotiate and allocate approximately EUR 5.5 million to increase the sustainable production of firewood through the National Forestry Incentive Programmes. In addition, an indirect funding of EUR 1.3 million is expected from the public sector through ministerial and other institutional actions (financing of experts, services, logistics and other expenses).

Uganda - Revolving Loan Fund for the Uptake of Improved Institutional Cook Stoves (IICS) in Schools

Status: Supported NAMA

Summary: This NSP is based on the 'Uganda Green Schools NAMA'. As part of integrated sustainable energy solutions for schools in Uganda, the NAMA identified a huge potential for GHG emission reductions through the introduction of Institutional Improved Cook Stoves (IICS). Under this NSP, IICS will be introduced in 15,750 Ugandan schools, which represents 75 per cent of all Ugandan schools. The main barrier for investments into energy efficiency technologies is the cost of capital in Uganda. At the current Prime Lending Rate of around 25 per cent there is little interest in investigating opportunities and considering investments, especially in

a public sector such as education. Therefore, a Revolving Loan Fund will be established to provide financing of investment into IICS. 2 different models are currently considered: provision of capital through the NAMA Facility to the revolving loan fund, which will then give out loans at no/low interest rates to schools or the creation of green funding lines with local/national banks, where the NAMA Facility will cover interest charged by the banks. A decision for one of the models (or a combination) will be taken in the Detailed Project Preparation (DPP) phase.

Support Received: The NAMA received implementation support from the NAMA Facility and is currently in the DPP phase.

Kenya - Rural household energy

Status: Supported NAMA

Summary: The NAMA focuses on providing energy access to people living in rural Kenya, while at the same time creating and building momentum for a market for clean energy technologies. Back in 2013, under the Mitigation Momentum project, the government of Kenya had requested continued support for NAMA development, and more specifically, the development of a NAMA for renewable energy, aligned with the Kenya Vision 2030, the National Climate Change Action Plan (NCCAP), as well as the Sustainable Energy for All (SE4ALL) initiative. This new NAMA foresees the manufacture and distribution of 1 million units of solar PV-based lanterns and improved cook stoves respectively in Kenya using an innovative market-based approach. 28 energy productivity zones are to be established across the country that will provide infrastructure and support services for the private sector to invest in manufacturing and distributing clean energy technologies on a for-profit basis. These zones will be self-sufficient in their electricity requirements thanks to a solar power plant with a total capacity of 500KW.

Support Received: Funding for the NAMA will come from a combination of international grants and loans as well as contributions by the country, and it will be implemented by the Rural Electrification Authority (REA). The REA is mandated to be changed into the National Electricity and Renewable Energy Authority (NERA) and be made responsible for all renewable energy activities in Kenya excluding geothermal and large hydro. NERA will be the 'one stop shop' for information and guidance to investors on renewable energy projects.

Georgia - Efficient use of biomass for equitable, climate proof and sustainable rural development

Status: NAMA Proposal

Summary: The objective of the NAMA is to foster climate resilient, low-carbon, sustainable rural development and poverty reduction in an inclusive way through building capacities and enhancing cooperation between stakeholders for promoting the use and up-scaling of Solar Water Heaters (SWH), Fuel Efficient Wood Stoves (FEWS), Energy Efficient Insulation (EEI) Measures in rural households and public buildings and sustainable forest management. A pilot project has been

planned with the installation of SWH and FEWS and implementation of EEI measures in 11.500 households, supported with a financial mechanism and sustainable forest management in 6 rural areas of Georgia. An estimated 60,000 FEWS, SWH and EEI can be installed potentially until 2030. The NAMA will contribute to transformational change in the energy supply of rural areas, which is based on inefficient use of biomass. The NSP aims for efficient use of biomass, by providing access to appropriate, innovative technologies through economically viable enterprises, who will continue production after the pilot project end in combination with a financial mechanism and a political mechanism for up scaling.

Support Sought: A total of EUR 5 million support is being sought for implementation of the NAMA. This includes EUR 2.3 million for technical support and EUR 2.7 million to facilitate the setup of the private service providers and production, for capacity building of stakeholders and for campaign about the NAMA and its benefits in the target areas through direct community mobilisation and an outreach campaign.

Gambia - Promote the use of energy-efficient cooking stoves

Status: Unilateral NAMA

Summary: This project aims to produce two hundred thousand (200,000) improved cooking stoves (100,000 of charcoal and firewood stoves) are targeted to be distributed by 2030. The project intents to train four persons (2 for charcoal and 2 for firewood) per region in making improved cooking stoves. The cost of each improved cooking stove will be subsided at USD 7 in order to make it more affordable. With the implementation of this scenario, 452,453 tonnes of wood and 419,486 tonnes of charcoal will be saved. A total of about 9 million tonnes of GHG emission will be save with the implementation of this policy scenario by 2030. The project also intends to sensitise the general public on the benefit of using improved cooking stoves through preparing informative leaflets, TV and radio panel discussion. The implementation of this policy is estimated at USD 1,405,000. Other support requested include capacity building and technical and technological requirements for the implementation of the project.

Zimbabwe - Efficient Biomass Stove Development, Dissemination and Commercialisation

Status: NAMA Concept

Summary: The objective of the NAMA is to promote the use of biomass in rural areas to replace, in part, wood fuel and avoid forest degradation. It is estimated that more than 6 million tonnes of wood fuel are consumed annually when the sustainable output of natural forests is 4.6 million tonnes translating to a loss of 330,000 hectares of forest area or over 60 million trees per year. Over-exploitation of wood resources has resulted in destruction of carbon sinks, severe land degradation, soil erosion and siltation of rivers and dams. The programme aims to: (1) reduce loss of woodlands which are carbon sinks that help to capture

carbon; (2) create awareness of advantages of use of efficient cook stoves as compared to open fire places; (3) train local artisans and builders in the construction of efficient cook stoves.

Support Sought: A total of USD 500,000 is being sought for the preparation of the NAMA. This includes: a) USD 350,000 for development of full NAMA proposal and the MRV system; b) USD 150,000 for institutional support for NAMA coordination, implementation and MRV. The duration for preparation of the NAMA will be 10 months.

Zimbabwe - Provision of Sustainable Energy through Use of Biogas

Status: NAMA Concept

Summary: The objective of the NAMA is to design and implement a national programme to promote the use of biogas and develop a market-driven sector. The overall aim of the programme is to: (1) create awareness of biogas technology in small holder dairy and piggery farming areas and in rural areas; (2) train builders in the construction and installation of digesters as well as loading and maintenance; (3) develop and adapt paraffin, LPG refrigerators and other appliances for use with biogas. In the domestic sector over 200 digesters have been constructed so far but the aim is to cover all the 57 rural districts in the country. 7,800 domestic digesters are expected in the first ten years. The programme also focuses on construction of digesters at public institutions; i.e. schools, prisons, and hospitals. 100 institutional digesters and 100 municipal digesters are expected to be constructed in the next 5 years.

Support Sought: A total of USD 300,000 is being sought for the preparation of the NAMA. This includes a) USD 200,000 to engage a consultant to carry out a baseline survey for NAMA development. The amount will be split between paying for consultant services and costs of workshops that will be held; b) USD 100,000 for training on monitoring and evaluation of completed digesters for Ministry of Energy personnel, and capacity building for biogas designers, builders and for maintenance procedures. MRV systems

Mexico - Efficient Cook Stoves

Status: NAMA Concept

Summary: This NAMA seeks to reduce the emissions associated with the consumption of non-renewable biomass and to significantly improve the health, the economy and quality of life of all the users through the provisioning of efficient stoves that allow them to cover all of their needs with in a sustainable manner. This NAMA aims to deliver the following results: (1) Considerable improvements on final users by avoiding that they breath pollutant particles; (2) Improvements on the final user's economy by reducing their expense on the wood buying and/or on its collection time; (3) Reduction on the deforestation rate of the country by consuming less non-renewable biomass; (4) Mitigate 1 million tCO_2e as a yearly average (20.2 million tCO_2e for the whole 20 years of lifetime of the NAMA).

Support Sought: Currently, the main document of the NAMA is under development. Nevertheless, financial support is required to finish the main NAMA document, design the MRV mechanism and design a pilot project. For this a total budget of USD 600,000 is proposed.

Uganda - Promotion of the Use of Efficient Stoves in Institutions

Status: NAMA Concept

Summary: This NAMA intends to reduce emissions through the promotion of the use of improved energy efficient cook stoves in educational institutions at all levels in the different regions of Uganda. It will begin by sensitising the main stakeholders, who are the Ministry of Education and Sports, to encourage the development of a policy instrument that ensures all educational institutions (EIs) in the country use energy efficient stoves. This policy instrument could include incentives in form of grants and loans for compliance. Sensitisation will then be directed towards district staff including the District Education Officer, the District Inspector of Schools, head teachers, teachers, school management committees and parents on the importance of mitigating GHGs through the use of energy efficient stoves. A database of schools and their energy status will be made and subsequently updated on a regular basis. From this database beneficiary educational institutions will be selected based on particular criteria that will include number of pupils, energy status, financial status and willingness to pay. The EIs will be divided into five groups corresponding to the intended year of installation. The first group of EIs will then be assisted to apply for subsidies and loans from microfinance institutions (MFIs) depending on their need.

The intent is to provide a subsidy for half the cost, and a loan for the remainder. The loans will be provided through a revolving fund, which will introduce an element of sustainability to the initiative. An amount of money will be available as a loan facility to the EIs through an MFI depending on their needs. This amount will enable the EIs to purchase the required number of stoves from manufacturers or their dealers, who will then be responsible for supplying and maintaining them. Manufacturers or their dealers will sign an installation and maintenance contract. The EIs will start repaying the loan after installing these stoves. Complete repayment should be between 6 and 9 months. This amount will then be available to the next group of EIs and thus become revolving. The NAMA will also support the development of a sustainable stove industry by providing entrepreneurs including technicians and artisans with loans through microfinance institutions to improve their businesses or start up new businesses. This loan facility will be accompanied with both technical skills in the manufacture and maintenance of stoves and financial and business skills in small and medium enterprise (SME) management. The NAMA will provide funds to MFIs and build capacity to develop business models for stove manufacturers. In order to assure the quality of stoves being produced, this NAMA will support the development of an appropriate standard for institutional stoves with Uganda National Bureau of Standards.

Support Sought: A financial support of USD 100,000 is being sought for preparation of the NAMA

Annexure 2: Products and Toolkits

Introduction of the registration and baseline survey App (beta version)

The idea of using smart phone based application (in this case Android) is to save time and other resources on data collection and at the same time improve the quality of data with inbuilt mathematical and logical validations while entering data. The app works offline and is divided into 3 major components: record new survey, review recently recorded information and export the data in excel or CSV.

The target groups considered for survey at this stage are tea estate and forest village households. The questions on fuel consumption and other details are flexible based on the selection of the type of respondent. Each survey starts with selection of date, district, village, GPS location, name and type of the respondent. The compulsory questions in the question are use of wood, LPG and Kerosene with option of Yes/No. Each category has multiple questions which appear on screen and which are mandatory to answer only if the categories are used as fuel.

To record the GPS location, users have to enable the GPS from the settings and check the box with caption GPS in the app. Once all questions are answered press Save button (given at beginning and end of the questionnaire in app) to save data in local database. All the recorded questions can be viewed in phone before leaving the place of survey just to ensure no question is missing. The data can be exported into excel which is saved with date and timestamp on SD-CARD in folder named NAMA. The exported file can be either copied to computer by connecting phone with cable or sent/shared with email/Bluetooth to database administrator. The App, Version 1.0, is available upon request.

Figure 52: Registration and Baseline Survey App

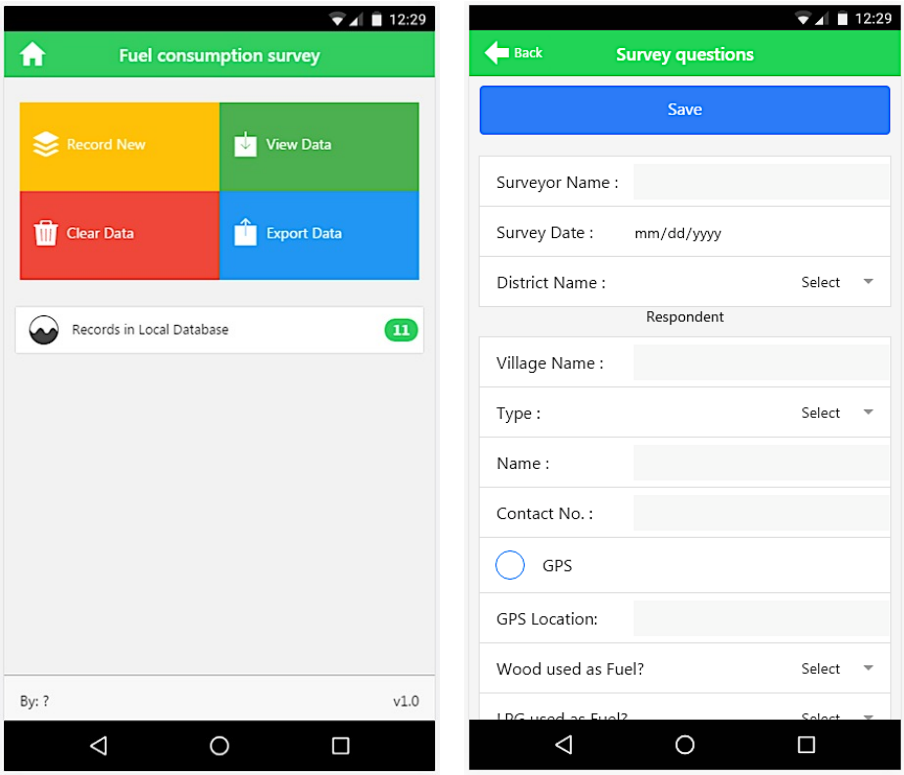
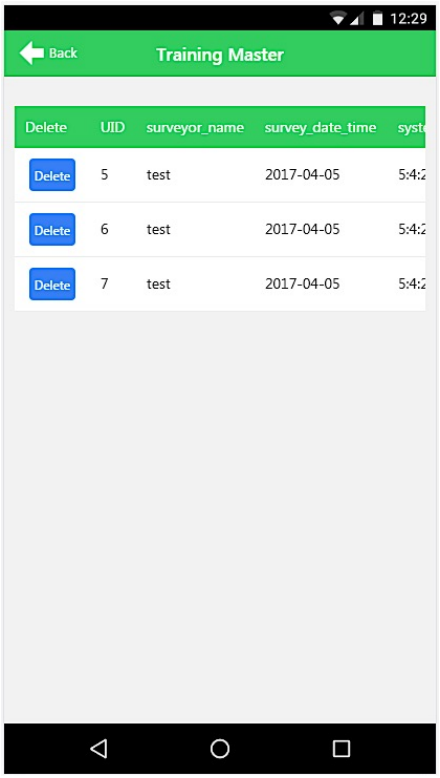
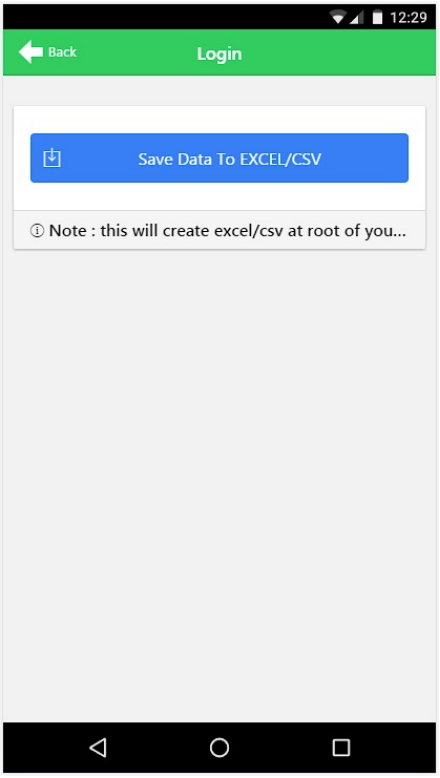


Figure 53 (Continued): Registration and Baseline Survey App

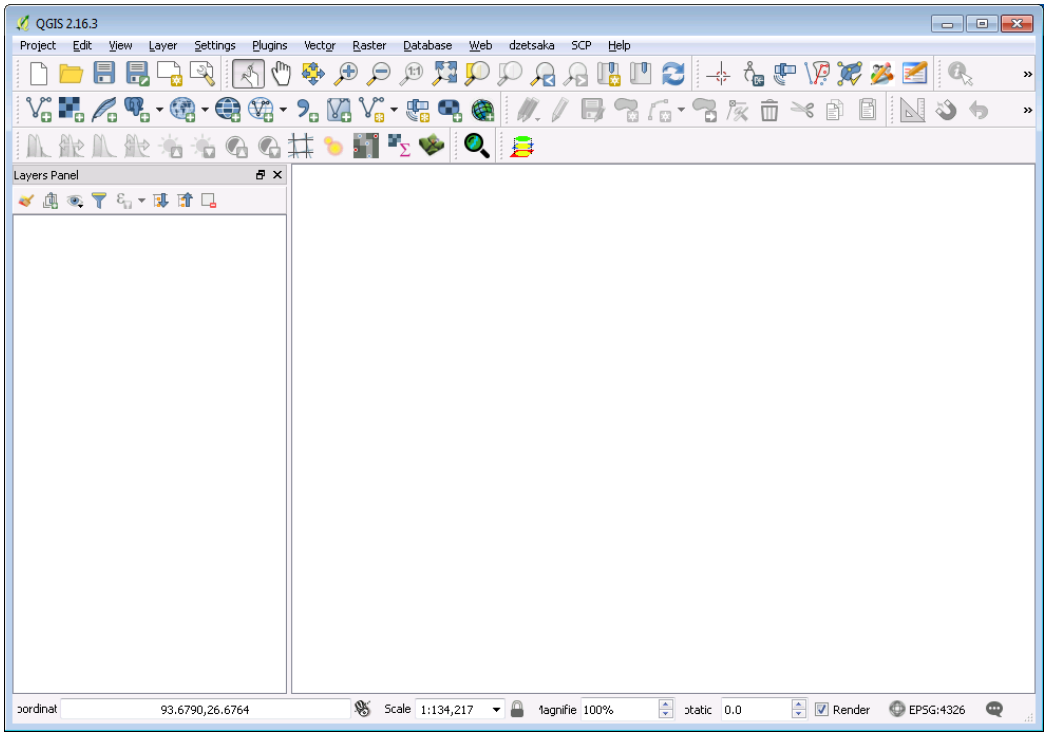




Operational Procedure – Land Use Change Analysis for Fuelwood Collection Zones

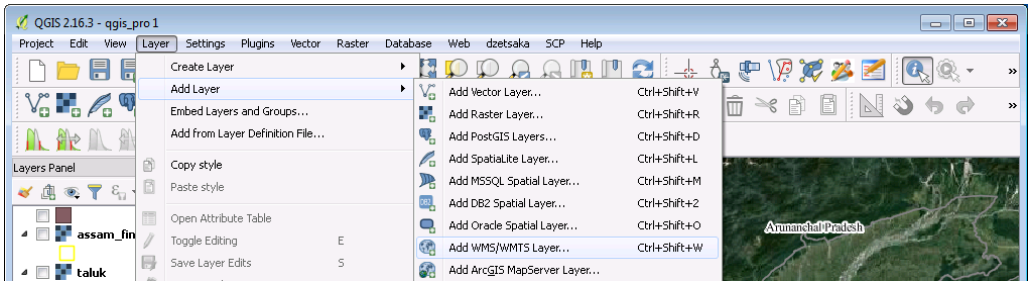
I - Defining Project Area Boundary

1. Start QGIS

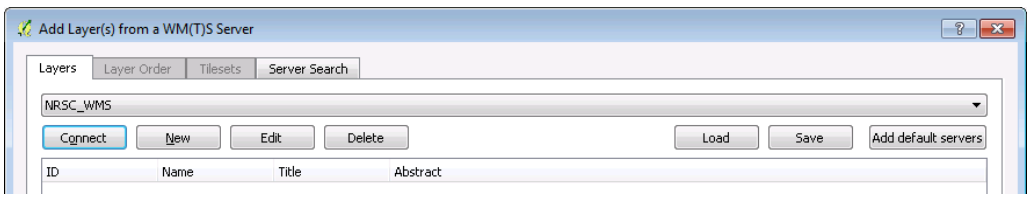


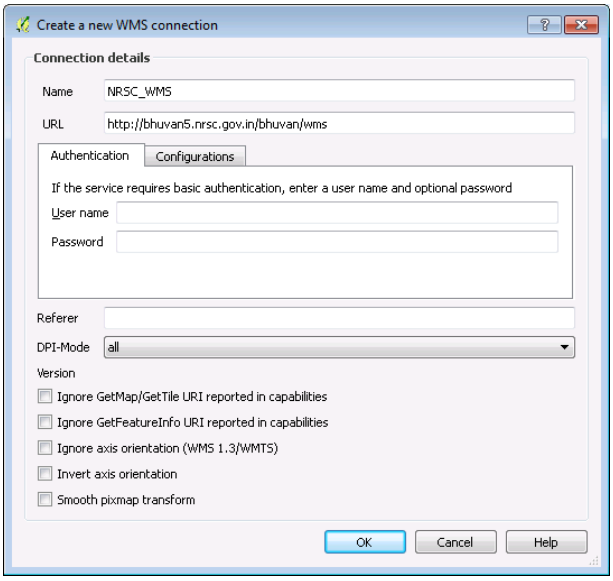
2. Add administrative boundaries of Assam (if shapefiles available or use NRSC WMS service of District, Taluk and Village boundaries)

Connection of NRSC WMS service in QGIS



Click on Layer › Add Layer › Add WMS/WMTS Layer

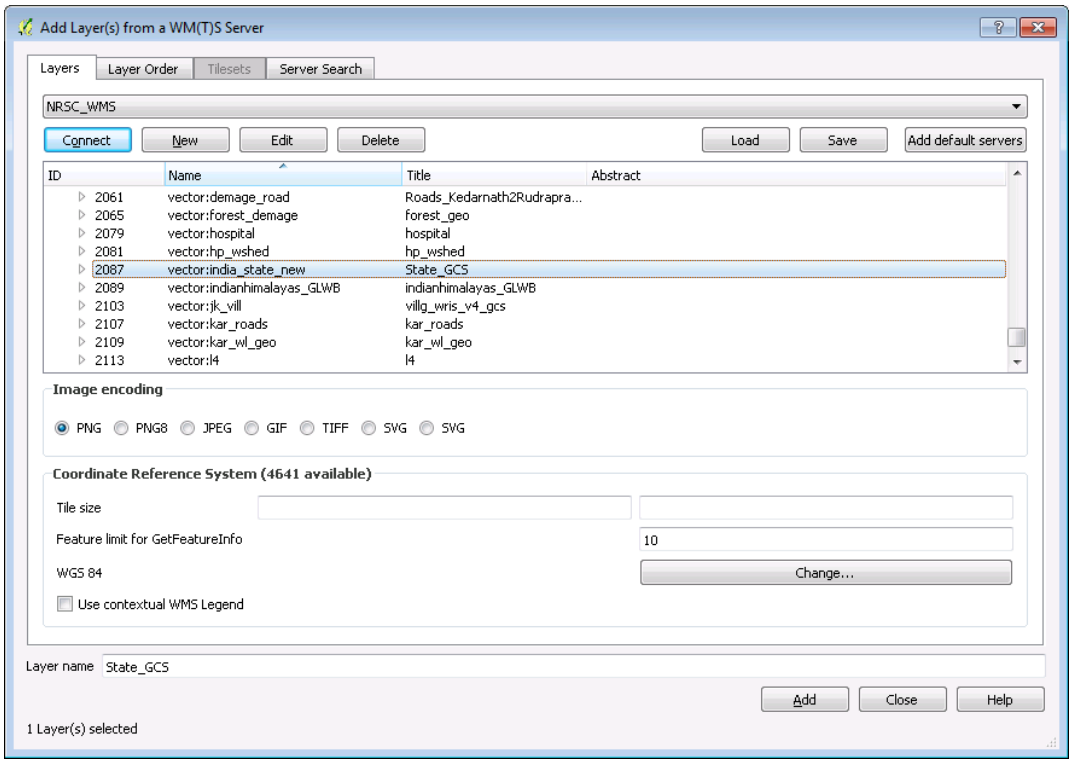




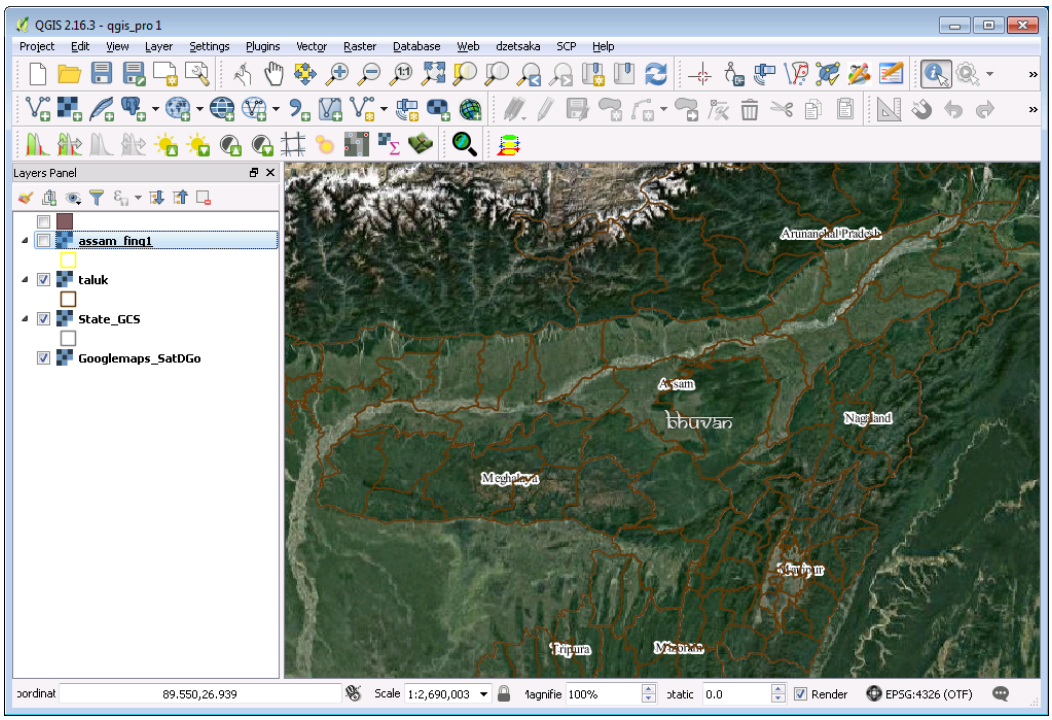
URL is: http://bhuvan5.nrsc.gov.in/bhuvan/wms

User name and password keep it blank and click 'OK'

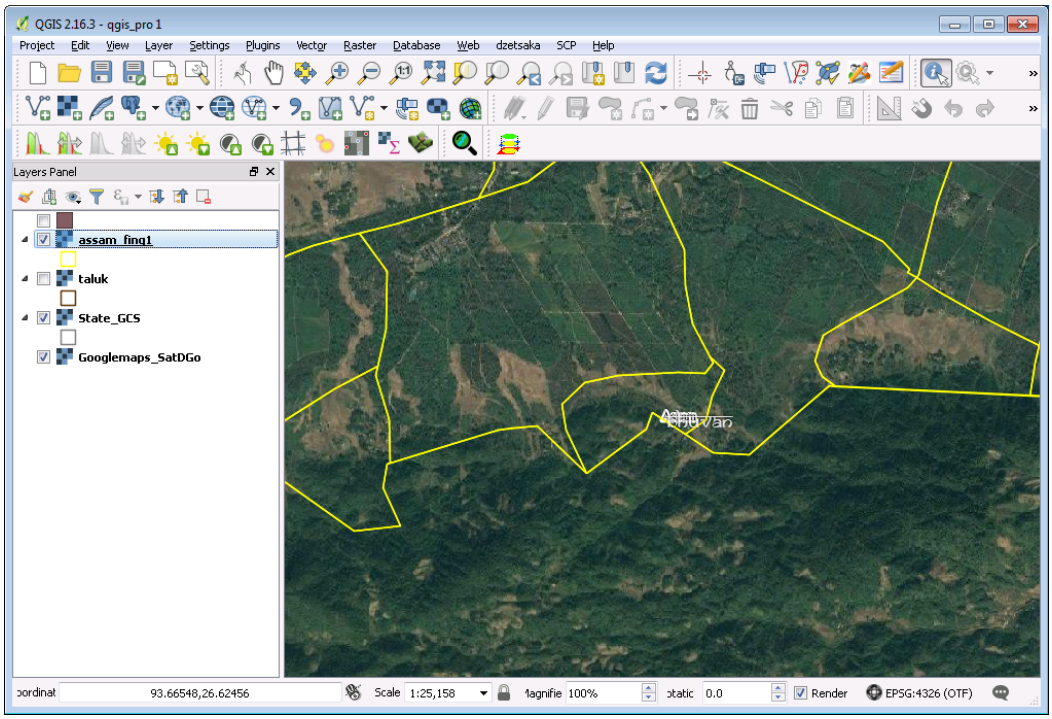
Find and select the State boundaries, Taluk and village boundaries named as following, **State_GCS, taluk and assam_fing1.**



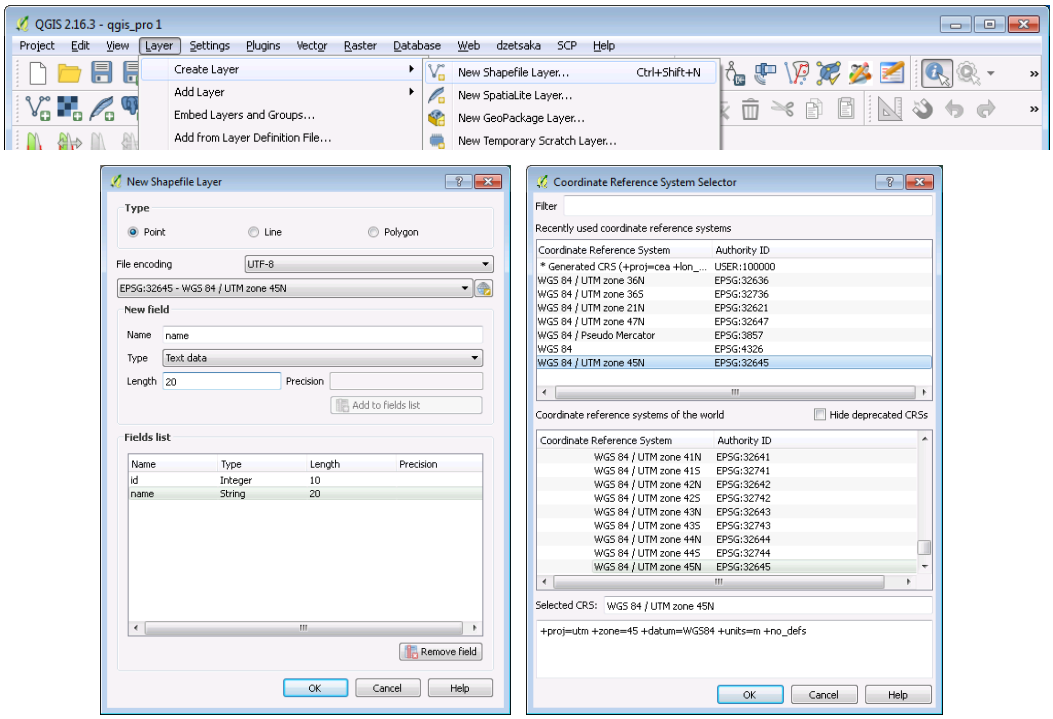
Select the layer in list and click 'Add'



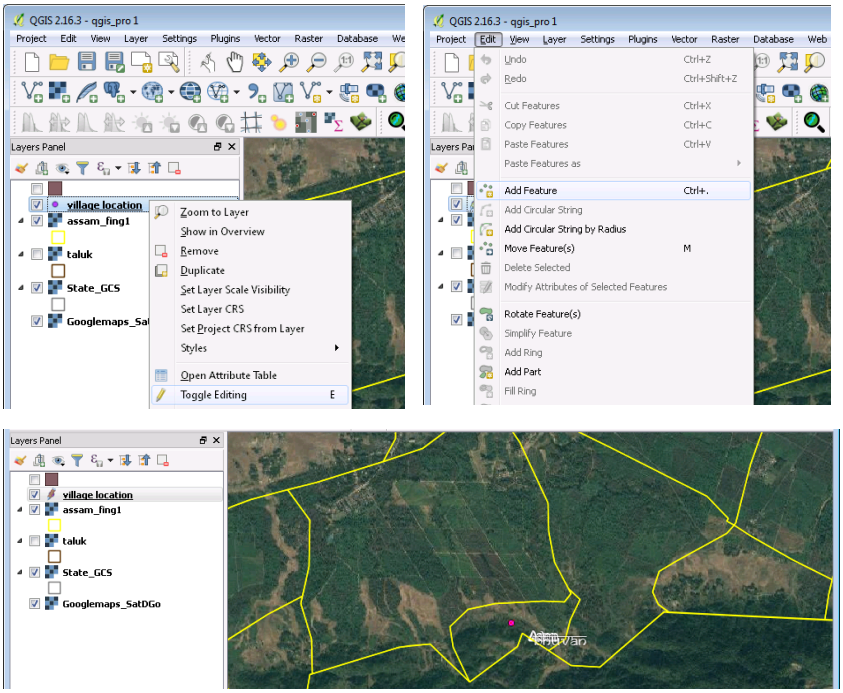
3. Locate the forest village or location of Tea estate, in example we used 'Geleka Pathar' village from 'Golaghat' Taluk



4. Create a new point shapefile to save the location of village and make buffer of X km

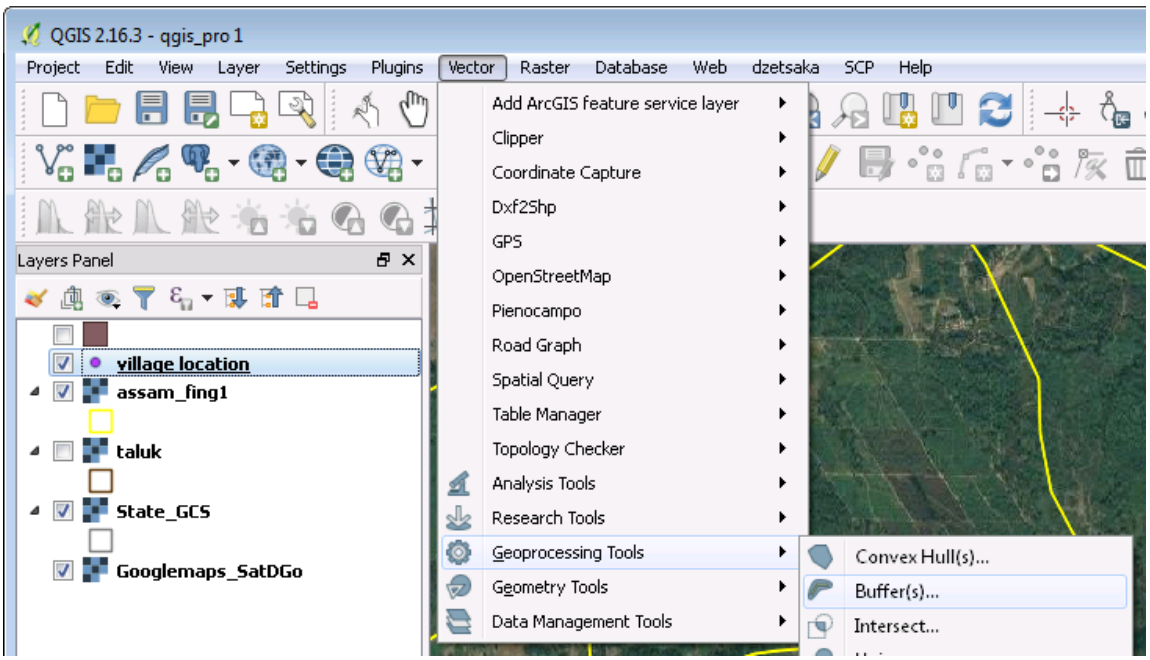


Select the correct project code from the list in this case it is UTM 45 N (fig 2)
After click on 'OK', choose the appripriate path to Save the shapefile

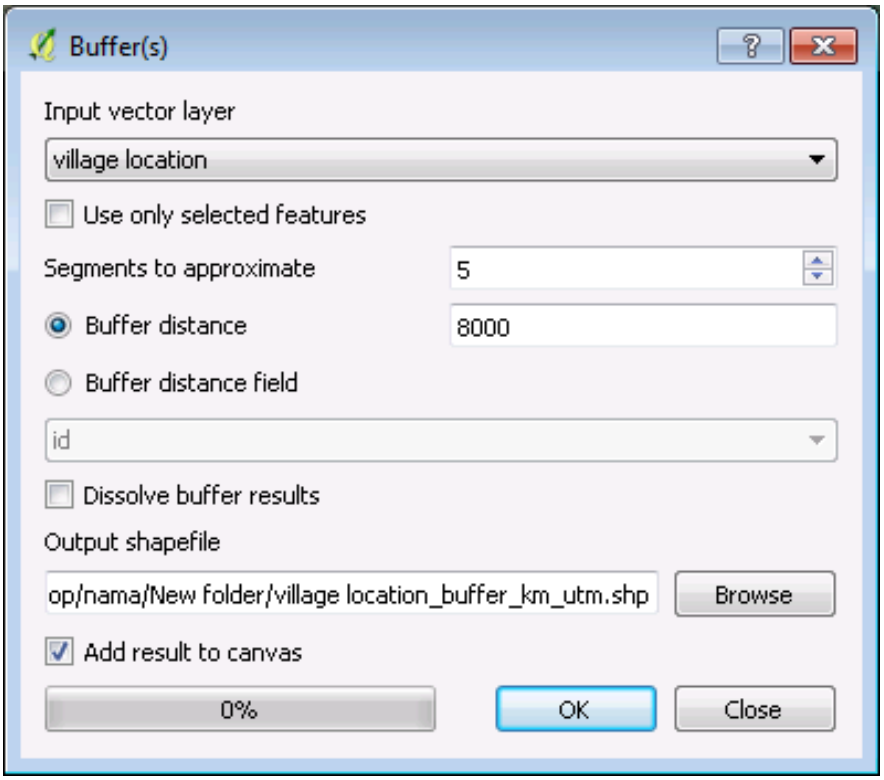


Right click on the Village location shapefile and click 'Toggle Editing' to start edit (fig. 1)
Go to menubar Edit › Add feature and then place a point on center of the village.
Stop and save edits in village location shapefile. (fig. 2)

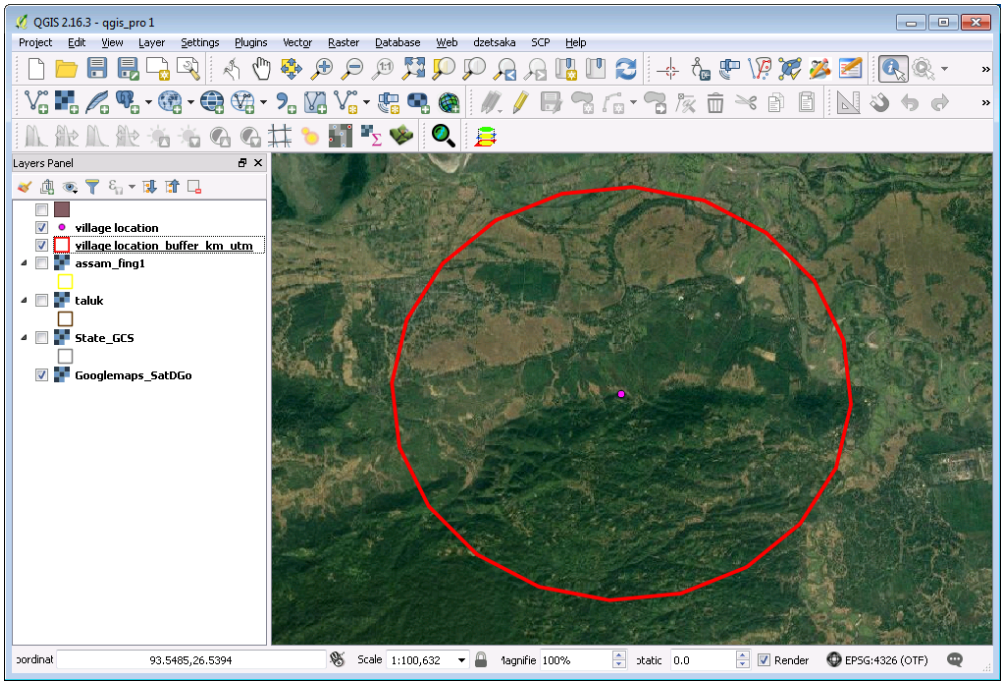
5. Creating buffer of X km around the village location for land cover change assessement



Select the input vector file as village location shapefile, set the buffer distance in 'meters' i.e. 8000 and Set the output shapefile path in appropriate folder



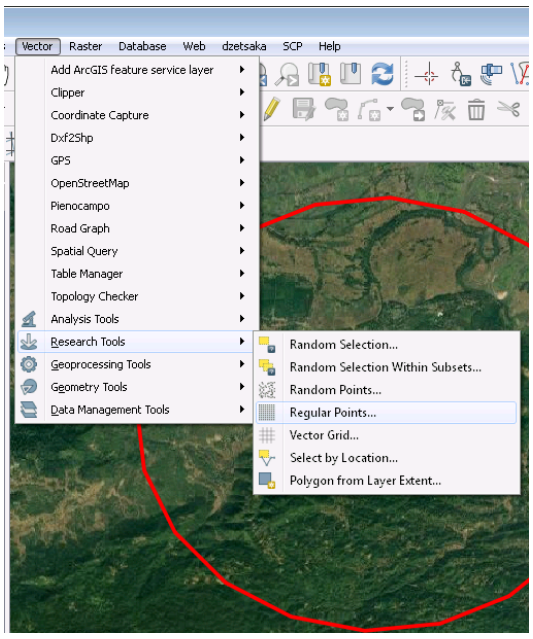
The buffer area will be called further as a Project area/region

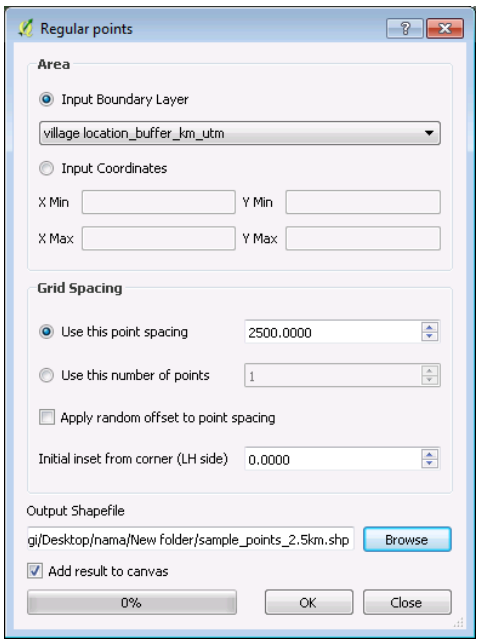


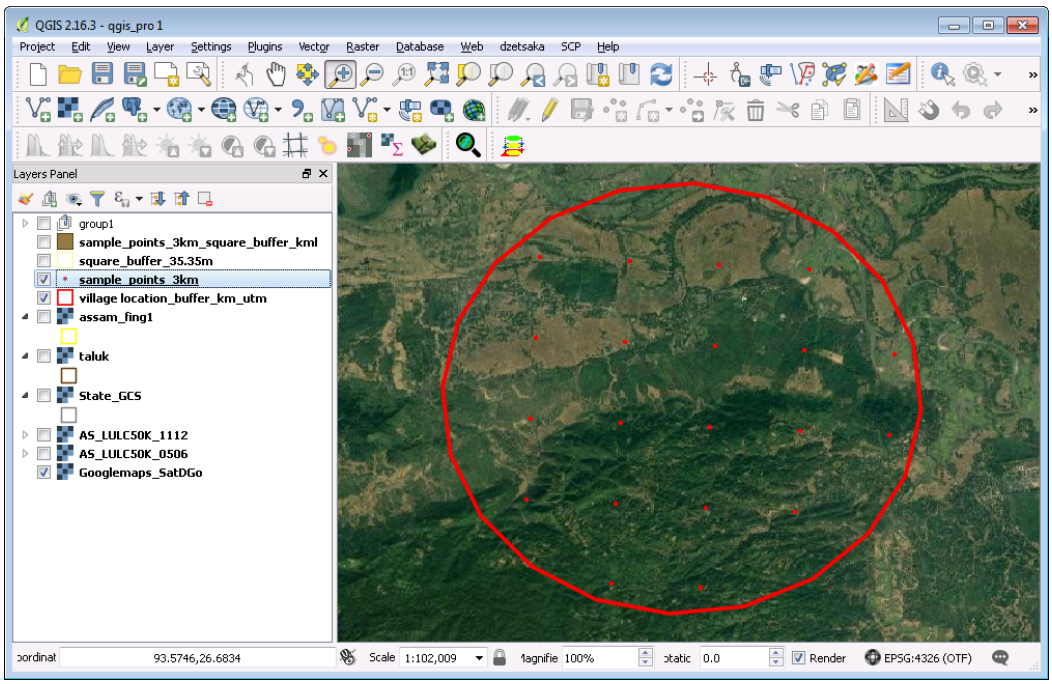
II - Prepare Grid of Sample Points/Plots

1. Creating regular points grid in project area

From Menubar Vector › Research tools › Regular points... (fig 1) Select the input boundary layer as village location buffer shapefile, set the point spacing in meters i.e. 3000. The distance between sample points can be changed as per project area and requirment (fig. 2)







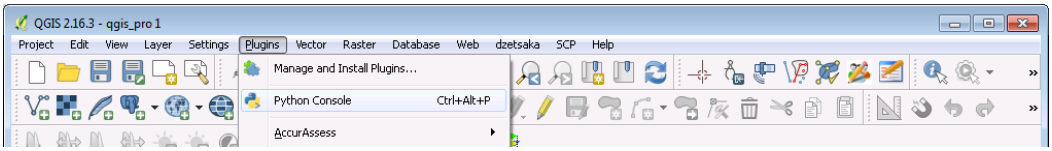
Delete the points falling outside the project area by 'Toggle Editing' > Select points > Delete

2. Cluster of Square plot

To establish square plot of 0.05 ha, side of square should be 70.7 m.

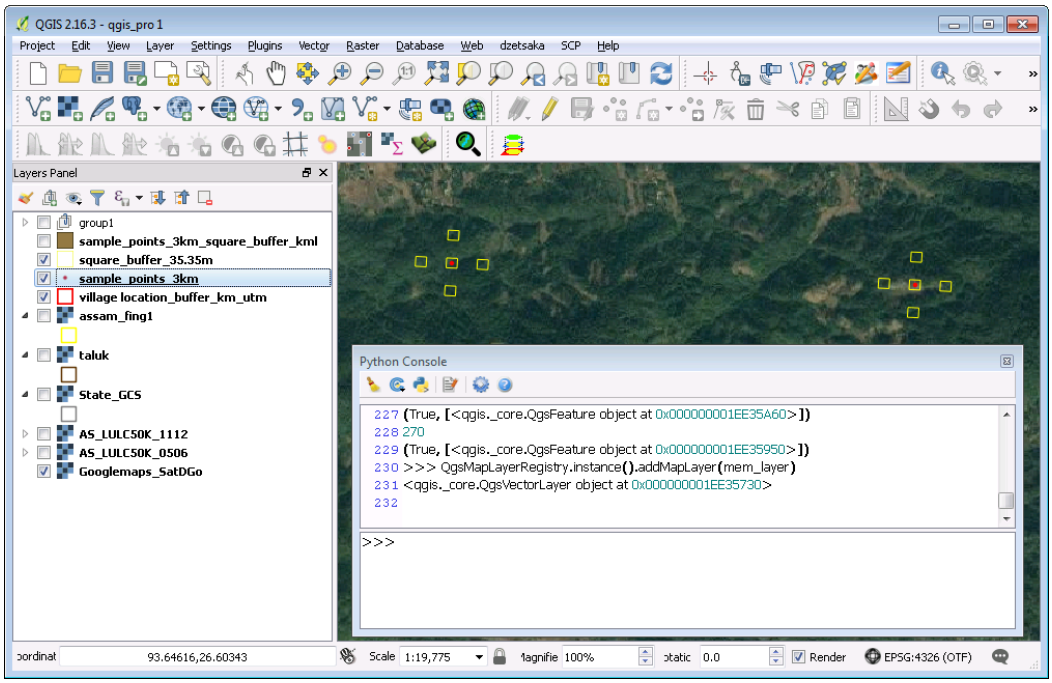
The sampling design proposed is sample plot which will have a cluster of 5 square plots in north, east, west, south and center of regular point at every 3 km distance. The distance between sample points can be changed as per project area and requirements.

There is no ready-made tool in QGIS to create a cluster sample of square plot around point therefore we propose following script that has to be executed in python console in QGIS.



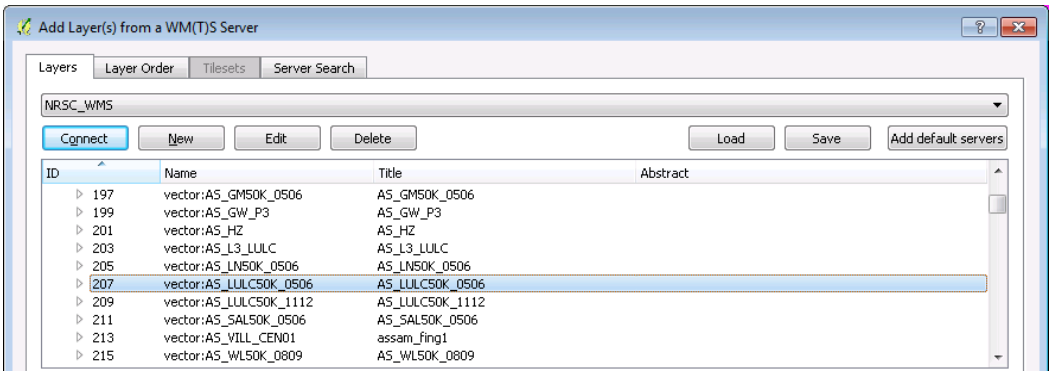
Script: copy and execute code in python console

```
def __getitem__(self,index):
   return self.bricks.bricksId[index]
def __setitem__(self,index,value):
   self.bricks.bricksId[index] = value

import math
distance = 200
buffer_distance = 35.35
bearing1 =  0
layer = iface.activeLayer()
feats = [ feat for feat in layer.getFeatures() ]
epsg = layer.crs().postgisSrid()
#uri = "Polygon?crs=epsg:" + str(epsg) +
"&field=id:integer&field=x:real&field=y:real&field=point_id:integer""&index=yes"
uri = "Polygon?crs=epsg:" + str(epsg) +
"&field=id:String&field=x:real&field=y:real&field=point_id:integer""&index=yes"
mem_layer = QgsVectorLayer(uri,'square_buffer_35.35m', 'memory')
prov = mem_layer.dataProvider()
for i, feat in enumerate(feats):
   point = feat.geometry().asPoint()
   new_feat = QgsFeature()
   new_feat.setAttributes(["Cluster" + str(i+1) + ";" + str(1)+";", point[0], point[1], feat.id()])
   tmp_feat = feat.geometry().buffer(buffer_distance, -1).boundingBox().asWktPolygon()
   new_feat.setGeometry(QgsGeometry.fromWkt(tmp_feat))
   prov.addFeatures([new_feat])

for i, feat in enumerate(feats):
   bearing1 = 0
   for j in range(1,5):
      print bearing1
      angle =     90 - bearing1
      bearing = math.radians(bearing1)
      angle =   math.radians(angle)
      point = feat.geometry().asPoint()
      new_feat1 = QgsFeature()
      new_feat1.setGeometry(QgsGeometry.fromPoint( QgsPoint(point[0] +(distance *
math.cos(angle)),point[1]+(distance * math.cos(bearing)))))
      point_new = new_feat1.geometry().asPoint()
      new_feat = QgsFeature()
      new_feat.setAttributes(["Cluster" + str(i+1) + ";" + str(j+1)+";",point_new[0], point_new[1],
feat.id()])
      tmp_feat = new_feat1.geometry().buffer(buffer_distance, -1).boundingBox().asWktPolygon()
      new_feat.setGeometry(QgsGeometry.fromWkt(tmp_feat))
      prov.addFeatures([new_feat])
      bearing1 = bearing1 + 90

QgsMapLayerRegistry.instance().addMapLayer(mem_layer)
```

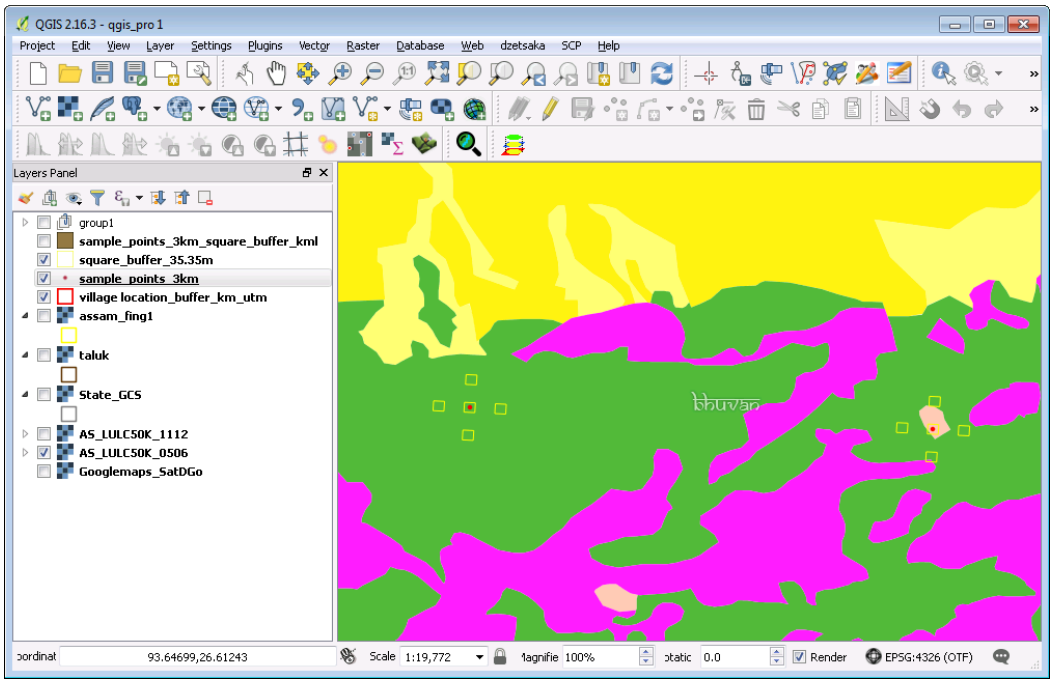


III - Analysis of Sample Plots on NRSC LULC Map of 2005-06 and 2011-12

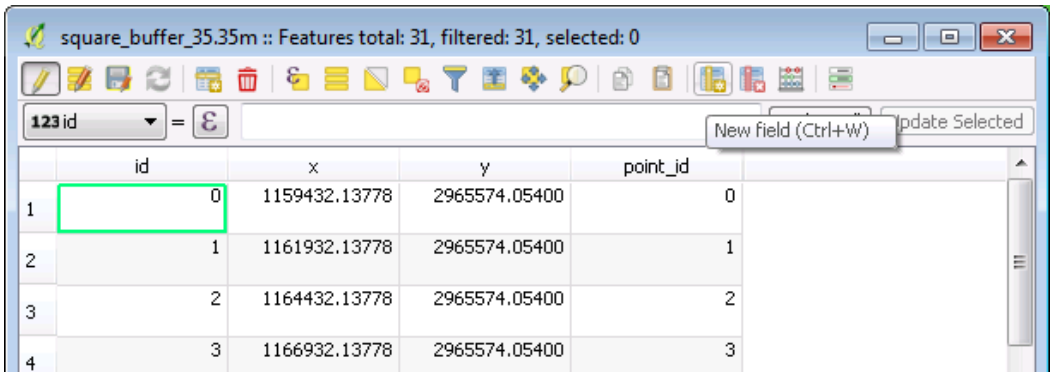
1. As stated in the chapter above, the NRSC LULC map can be rendered through WMS in QGIS



Using 'Add WMS/WMTS layer' connect to NRSC WMS server (refer to step 2 in section 2.1) Select AS_LULC50K_0506 then Add, same for AS_LULC50K_1112

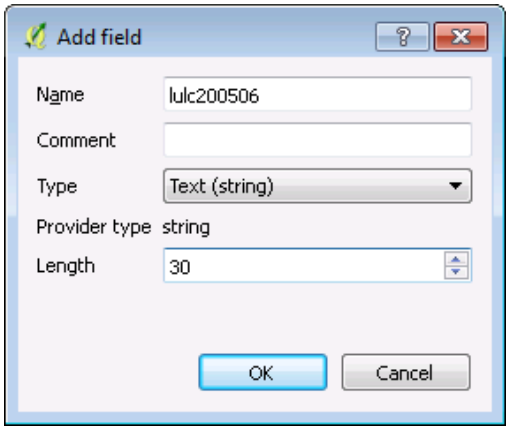


2. Add two columns for LULC class of 2005-06 and 2011-12 in sample plots shapefile



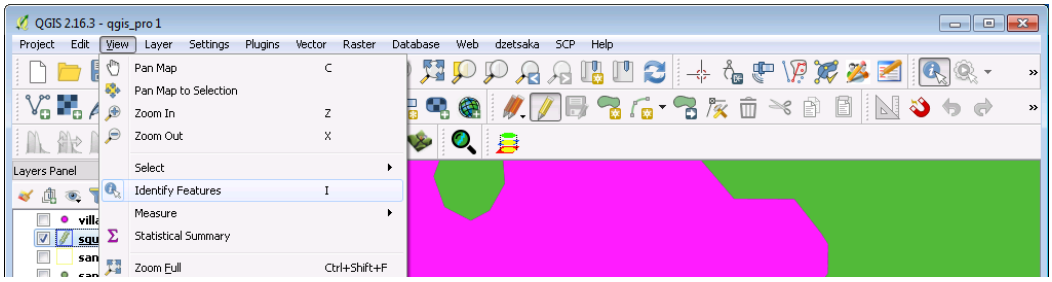
	id	x	y	point_id
1	0	1159432.13778	2965574.05400	0
2	1	1161932.13778	2965574.05400	1
3	2	1164432.13778	2965574.05400	2
4	3	1166932.13778	2965574.05400	3

Right click on 'Sample plots layer' click 'Toggle editing', Again right click on 'Sample plots layer' and open attribute table

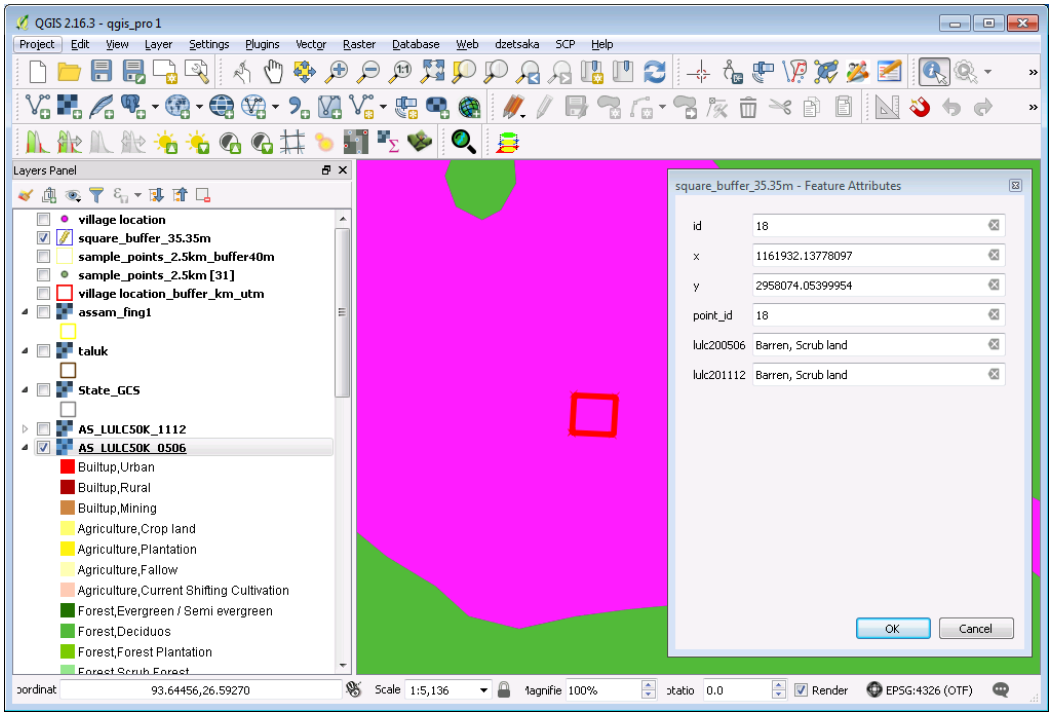


To add new column click on 4th tool from left on top tool bar of attribute table window. Enter column name 'lulc200506' (spaces and special characters allowed) and select type as 'Text(String)' as shown in figure. Create one more column with name 'lulc201112'

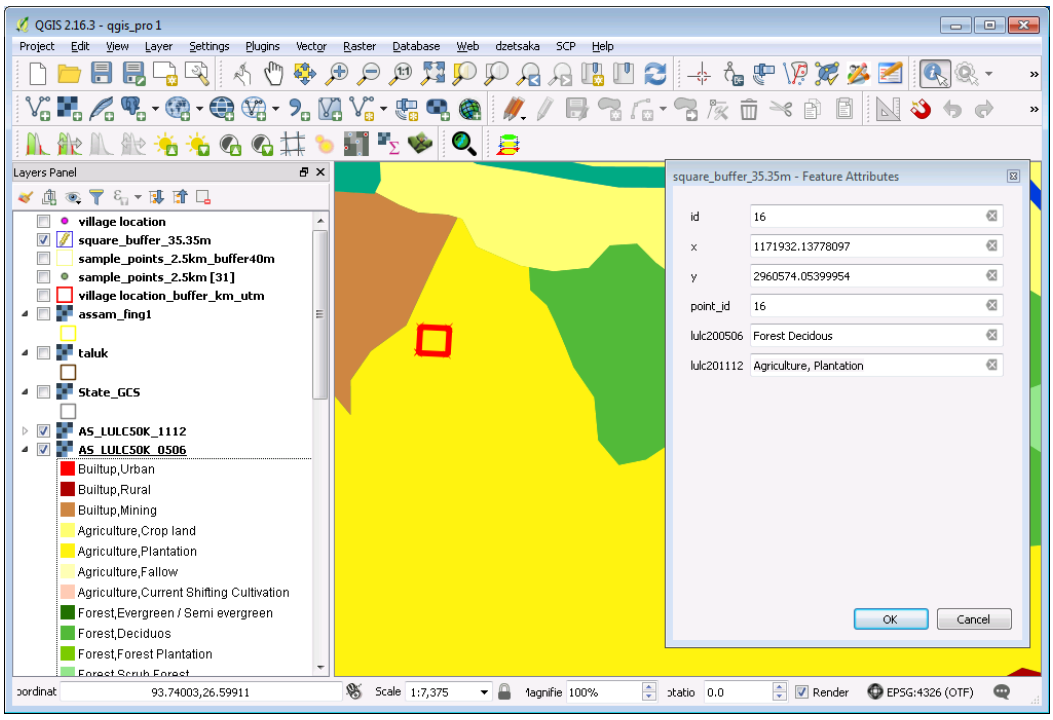
3. Assign LULC class from 2005-06 and 2011-12 to each sample plot



Use 'Identify' tool and click on the sample plot to which LULC class to be assigned.



In this sample plot LULC class did not change 'Barren, Scrub land' in 2005-06 and 2011-12

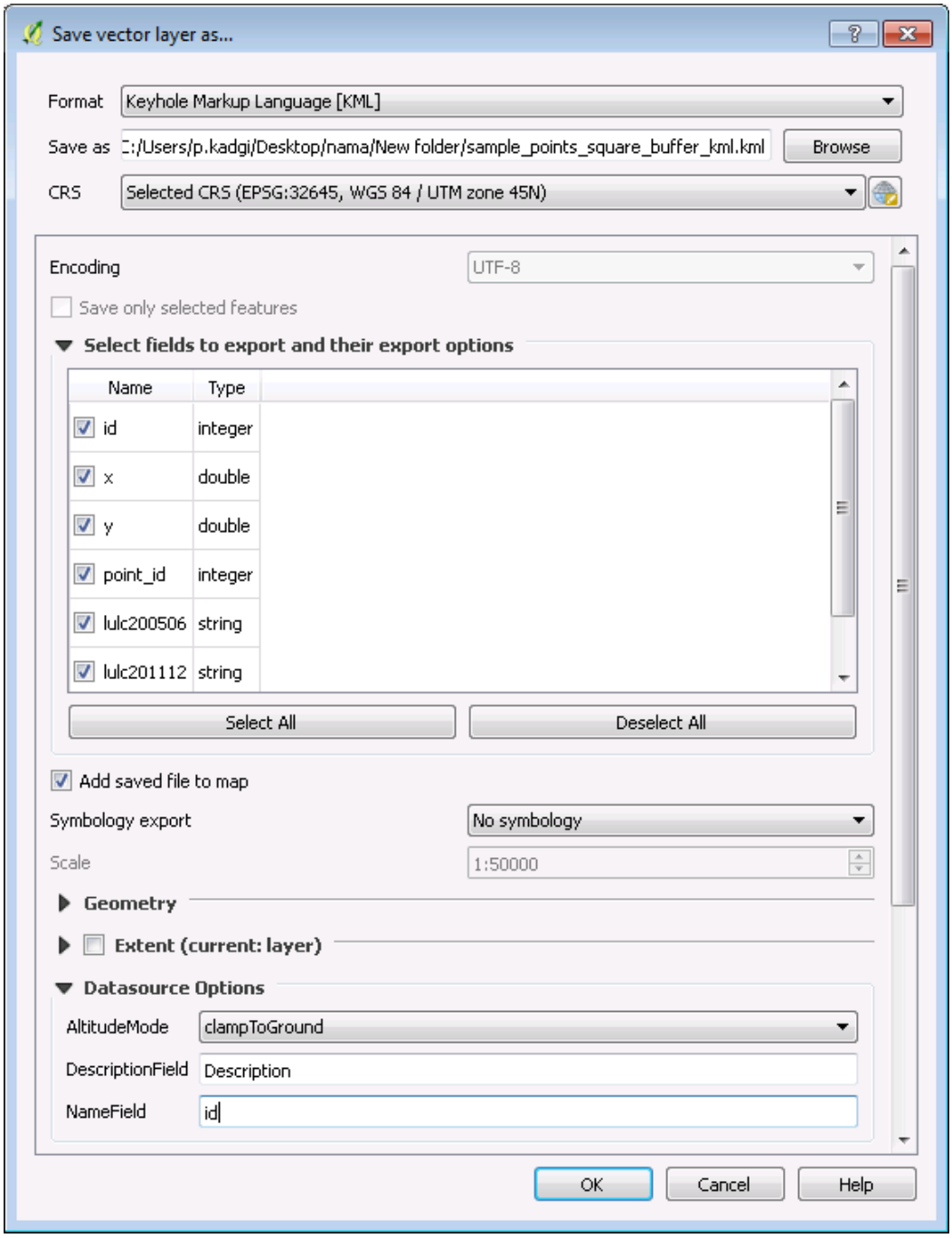


In this sample plot LULC class changed from 'Forest decidous' to 'Agriculture, Plantation' from 2005-06 and 2011-12

IV - Exporting Sample Plots to Google Earth for Further Analysis

1. To analyse the sample plots on Google Earth using historic image shapefile need to be converted to KML

Right on 'Sample plots layer' then click 'Save As'

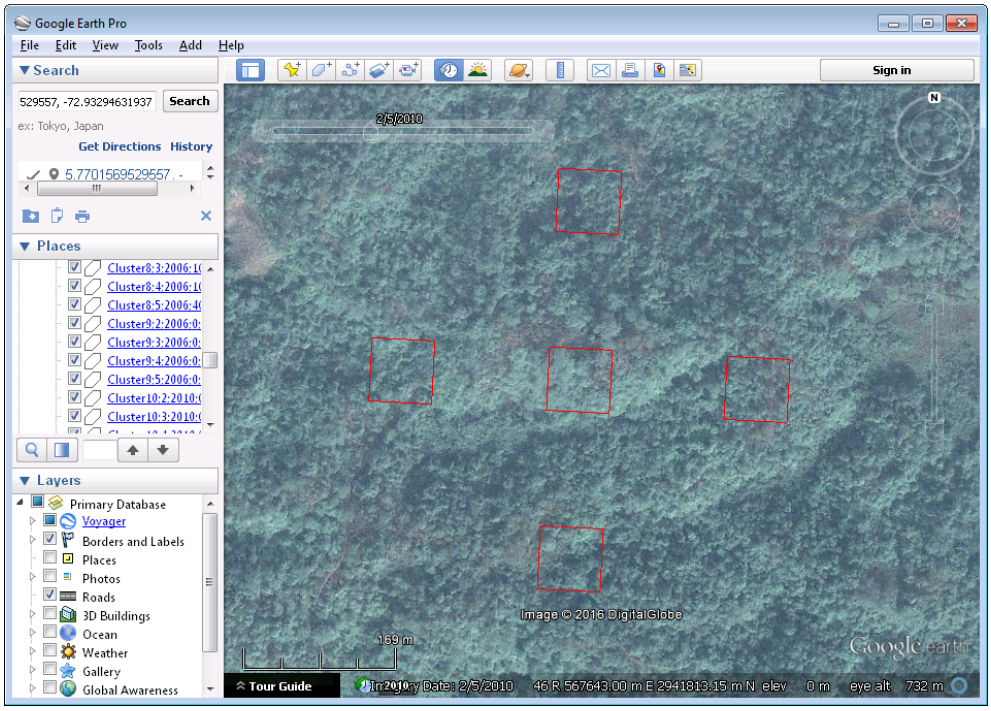


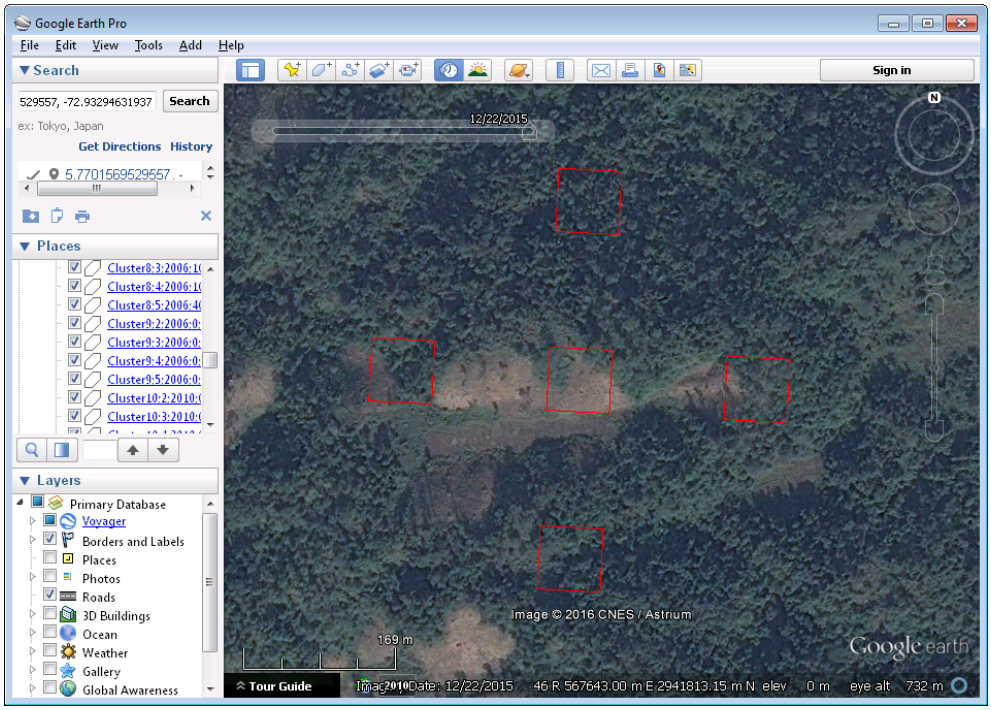
Note: Do not forget to write 'id' in NameField box (at bottom) before click OK

Open KML file in Google Earth

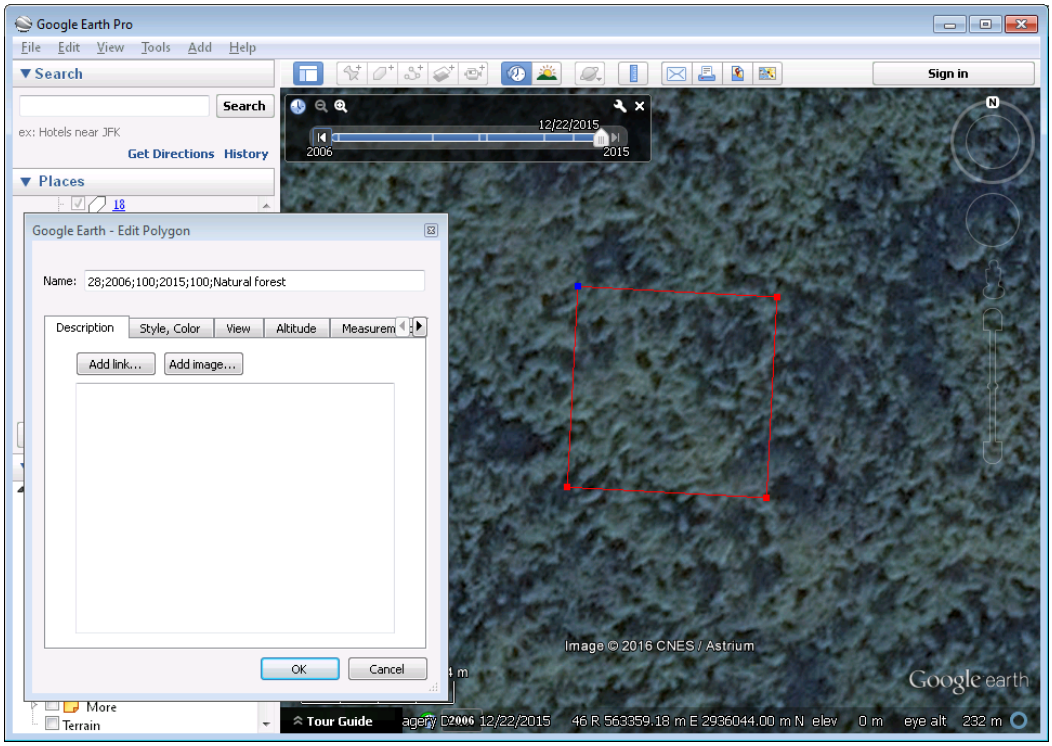
It is similar to the analysis done using NRSC LULC map of 2005-06 and 2011-12, the difference is analysis of Sample plot using high resolution images of different years (limited to available) in Google Earth.

Image Date: 2010 (above), 2015 (below)





2. Writing observations of sample plot



First of all, do not remove the original ID of the sample plot from the name box.

Due to limitation or time/expertise required to design the form to enter the attribute in more easy and sophisticated way. However using the standard protocol in writing information, later can be extracted to the table. Example: 28;2006;100; Natural forest; 2015;100; Natural forest; no other comment. Here ';' is used as seperator after each attribute

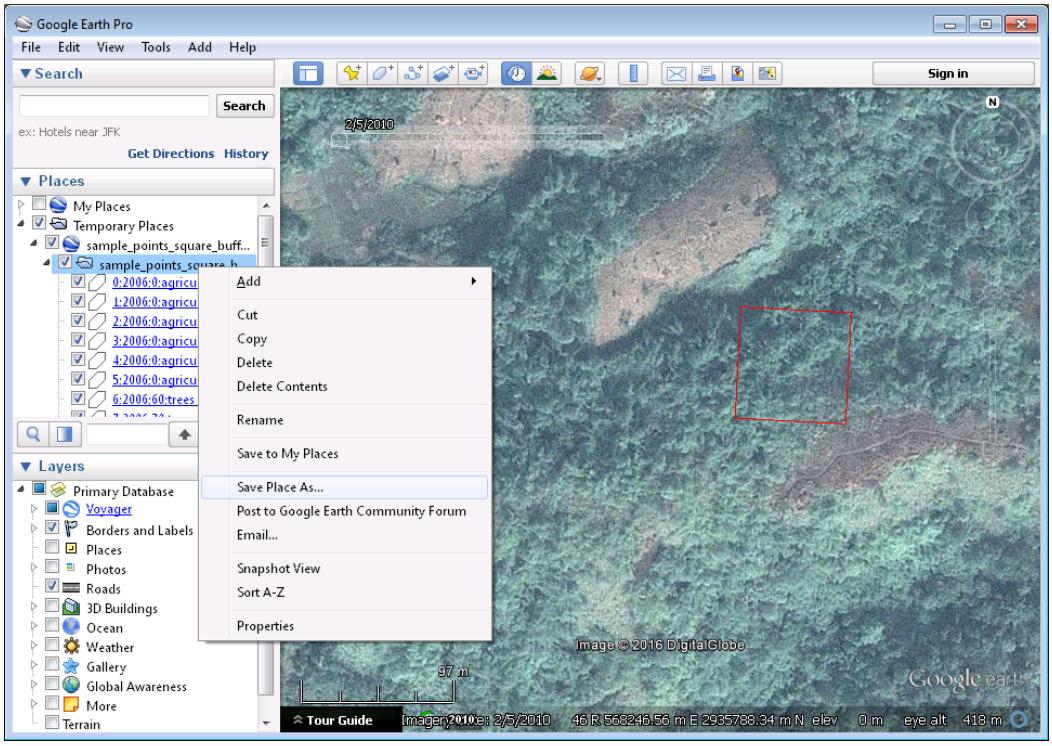
This will be read as:

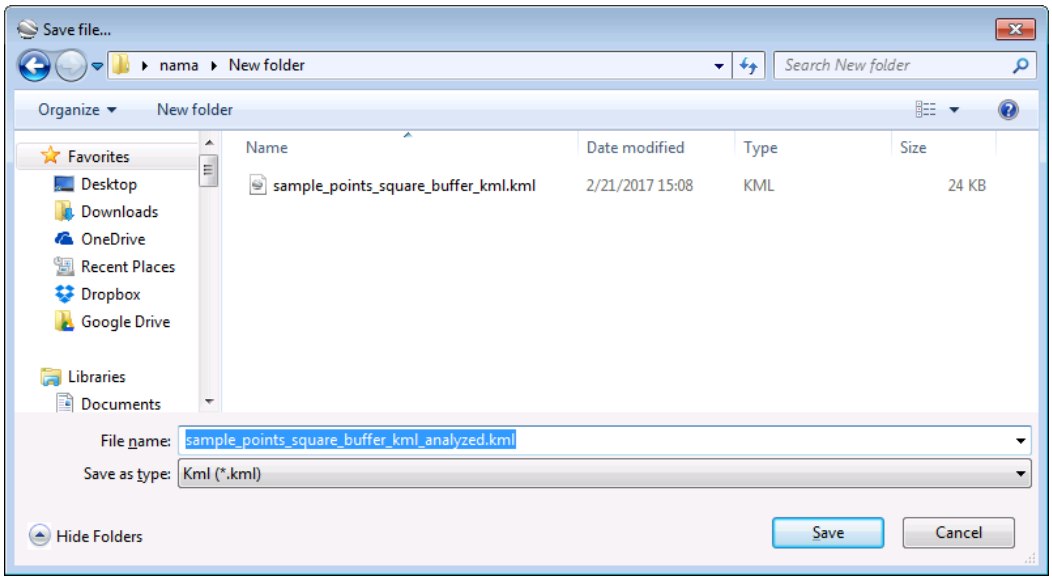
Sample ID	Year 1	Canopy cover in per cent year 1	Land cover year 1	Year 2	Canopy cover in per cent year 2	Land cover year 2	Other remark
28	2006	100	Natural forest	2015	100	Natural forest	No other comment
26	2010	100	Natural forest	2015	20	Barren land	Few more patches of deforestation

Note: In case of multiple landuse, write most dominent land cover in the sample plot or this comments can be covered in last observation column.

3. Saving observations

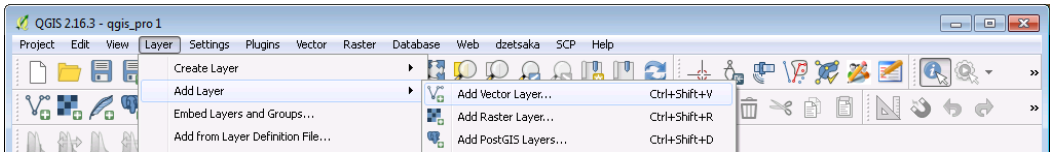
Right click on the Sample plot KML layer in Google Earth and click on 'Save as' a new file with appropriate name



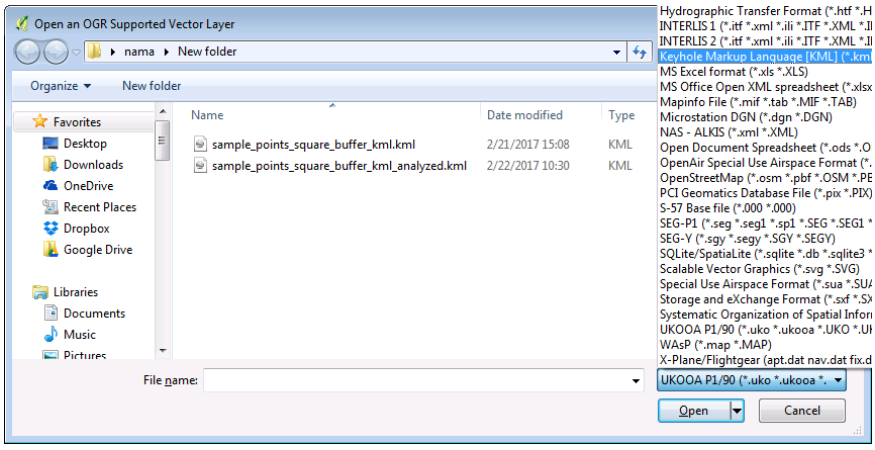


V - Import Observations from Google Earth to QGIS and Export to Excel Table

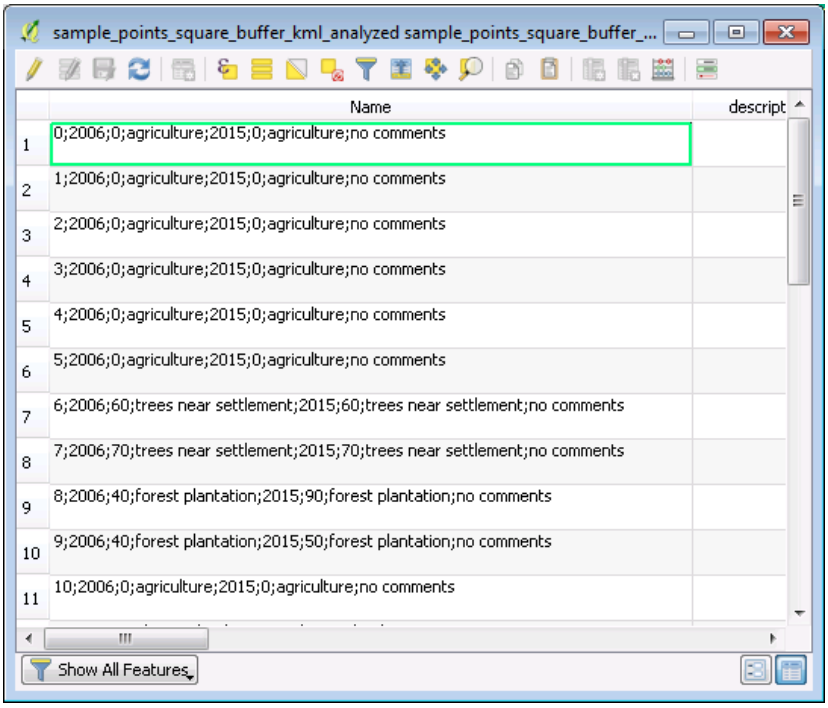
Start QGIS. Add KML file saved from Google Earth. Menubar Layer › Add Vector Layer..



Choose the right file filter to view KML in the selected folder

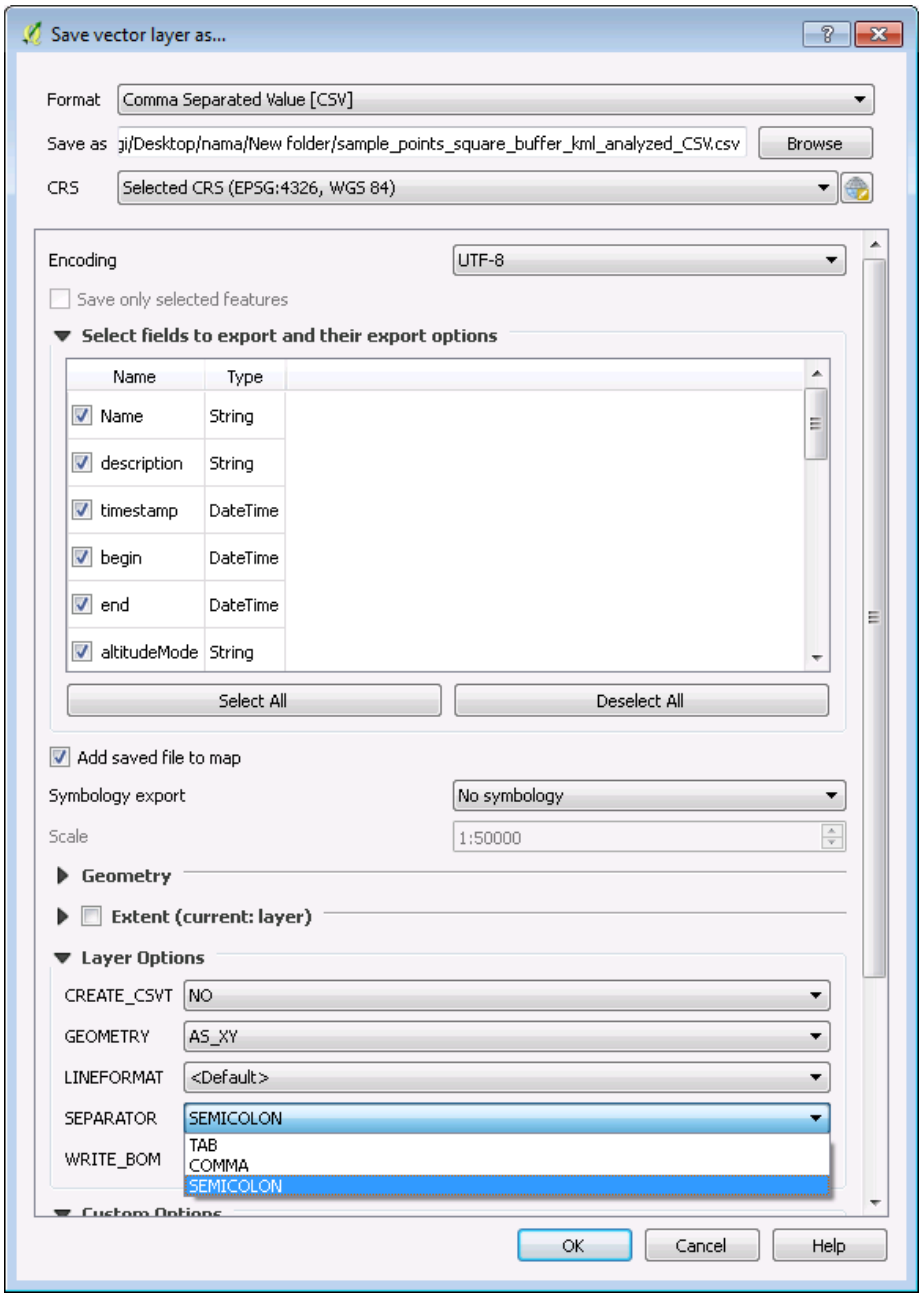


Check all the observations in attribute table of KML file

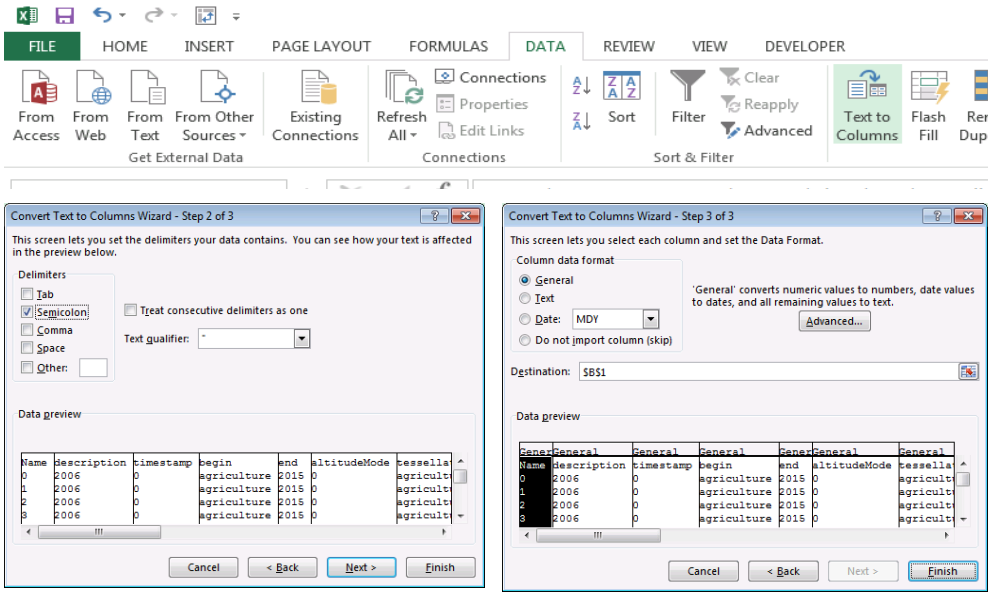


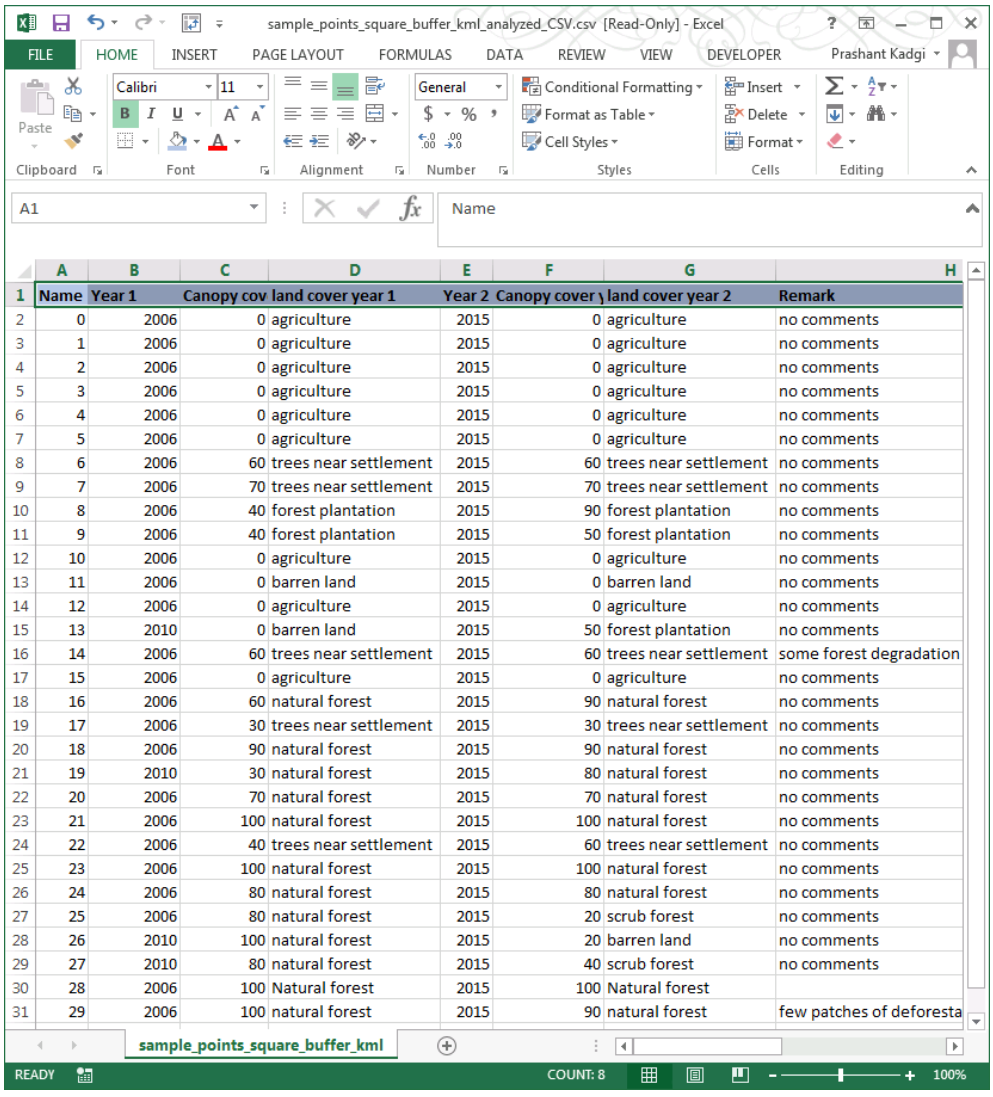
Right click on sample plots KML › Open attribute table

Now export this attribute table as CSV (Comma seperated values) file. Close attribute table and right click on Sample plots KML › Save as. Set output file format as CSV, select all colums to export and important select 'SEMICOLON' as column seperator.



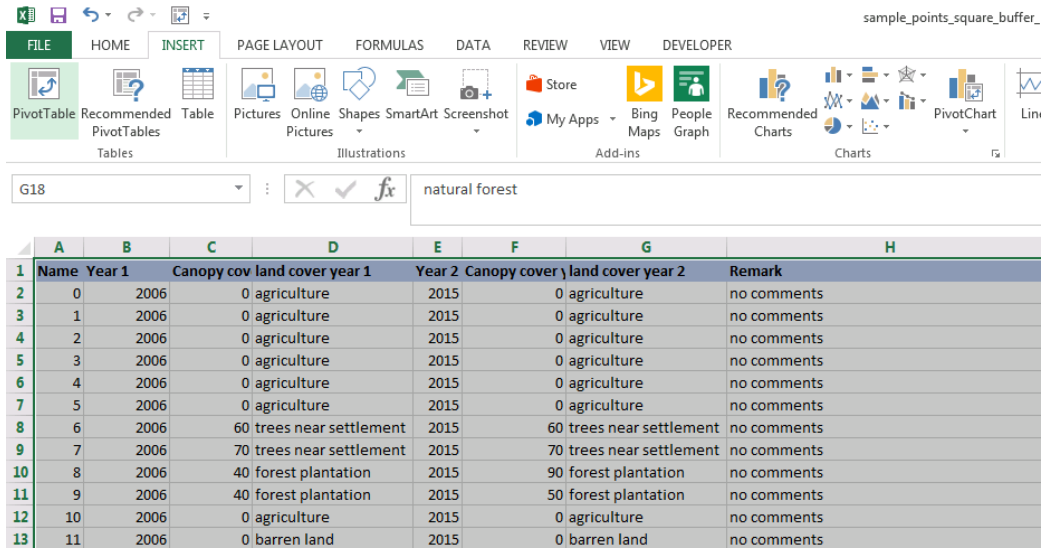
Open the CSV file in Excel



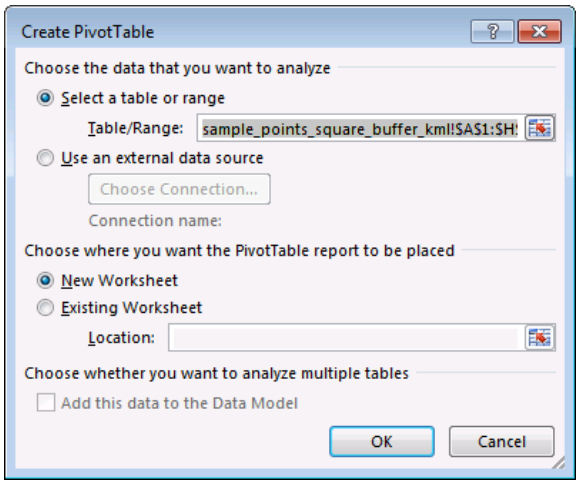


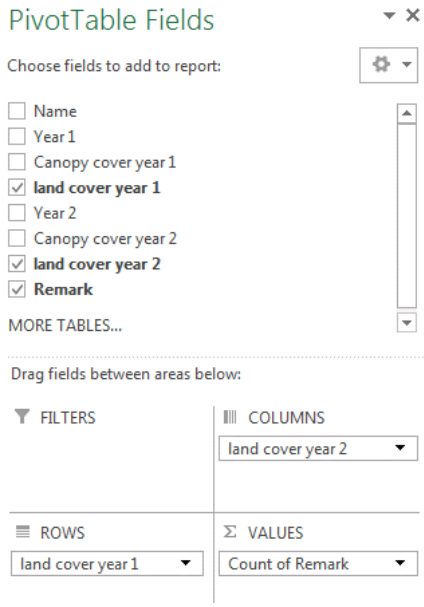
	A	B	C	D	E	F	G	H
1	Name	Year 1	Canopy cov	land cover year 1	Year 2	Canopy cover y	land cover year 2	Remark
2	0	2006	0	agriculture	2015	0	agriculture	no comments
3	1	2006	0	agriculture	2015	0	agriculture	no comments
4	2	2006	0	agriculture	2015	0	agriculture	no comments
5	3	2006	0	agriculture	2015	0	agriculture	no comments
6	4	2006	0	agriculture	2015	0	agriculture	no comments
7	5	2006	0	agriculture	2015	0	agriculture	no comments
8	6	2006	60	trees near settlement	2015	60	trees near settlement	no comments
9	7	2006	70	trees near settlement	2015	70	trees near settlement	no comments
10	8	2006	40	forest plantation	2015	90	forest plantation	no comments
11	9	2006	40	forest plantation	2015	50	forest plantation	no comments
12	10	2006	0	agriculture	2015	0	agriculture	no comments
13	11	2006	0	barren land	2015	0	barren land	no comments
14	12	2006	0	agriculture	2015	0	agriculture	no comments
15	13	2010	0	barren land	2015	50	forest plantation	no comments
16	14	2006	60	trees near settlement	2015	60	trees near settlement	some forest degradation
17	15	2006	0	agriculture	2015	0	agriculture	no comments
18	16	2006	60	natural forest	2015	90	natural forest	no comments
19	17	2006	30	trees near settlement	2015	30	trees near settlement	no comments
20	18	2006	90	natural forest	2015	90	natural forest	no comments
21	19	2010	30	natural forest	2015	80	natural forest	no comments
22	20	2006	70	natural forest	2015	70	natural forest	no comments
23	21	2006	100	natural forest	2015	100	natural forest	no comments
24	22	2006	40	trees near settlement	2015	60	trees near settlement	no comments
25	23	2006	100	natural forest	2015	100	natural forest	no comments
26	24	2006	80	natural forest	2015	80	natural forest	no comments
27	25	2006	80	natural forest	2015	20	scrub forest	no comments
28	26	2010	100	natural forest	2015	20	barren land	no comments
29	27	2010	80	natural forest	2015	40	scrub forest	no comments
30	28	2006	100	Natural forest	2015	100	Natural forest	
31	29	2006	100	natural forest	2015	90	natural forest	few patches of deforesta

VI - Deforestation and Degradation Analysis



	A	B	C	D	E	F	G	H
1	Name	Year 1	Canopy cov	land cover year 1	Year 2	Canopy cover y	land cover year 2	Remark
2	0	2006	0	agriculture	2015	0	agriculture	no comments
3	1	2006	0	agriculture	2015	0	agriculture	no comments
4	2	2006	0	agriculture	2015	0	agriculture	no comments
5	3	2006	0	agriculture	2015	0	agriculture	no comments
6	4	2006	0	agriculture	2015	0	agriculture	no comments
7	5	2006	0	agriculture	2015	0	agriculture	no comments
8	6	2006	60	trees near settlement	2015	60	trees near settlement	no comments
9	7	2006	70	trees near settlement	2015	70	trees near settlement	no comments
10	8	2006	40	forest plantation	2015	90	forest plantation	no comments
11	9	2006	40	forest plantation	2015	50	forest plantation	no comments
12	10	2006	0	agriculture	2015	0	agriculture	no comments
13	11	2006	0	barren land	2015	0	barren land	no comments





Count of Sample plots	Land Cover Year 2010							
Land Cover Year 2006	agriculture	barren land	forest plantation	natural forest	scrub forest	trees near settlement	Grand Total	Land cover % in 2006
agriculture	9						9	30%
barren land		1	1				2	7%
forest plantation			2				2	7%
natural forest		1		9	2		12	40%
trees near settlement						5	5	17%
Grand Total	9	2	3	9	2	5	30	
Land cover % in 2015	30%	7%	10%	30%	7%	17%		

The table shows that Natural forest has decreased from 40 per cent to 30 per cent in 9 years i.e. annual loss rate of 1.1 per cent

Count of sample plots	Canopy cover 2015											
Canopy cover 2006	0	20	30	40	50	60	70	80	90	100	Grand Total	Canopy cover %
0	10				1						11	37%
30			1					1			2	7%
40					1	1			1		3	10%
60						2			1		3	10%
70							2				2	7%
80		1		1				1			3	10%
90									1		1	3%
100		1							1	3	5	17%
Grand Total	10	2	1	1	2	3	2	2	4	3	30	
Canopy cover % in 2015	33%	7%	3%	3%	7%	10%	7%	7%	13%	10%		

Annexure 3: Review of International Financing Climate Finance Sources

Long-list of multilateral and bilateral climate finance options in India:

Agency	Eligibility for Forestry NAMA Financing	Description / Justification
Multilateral Climate Finance		
Adaptation Fund	No	Finances adaptation related projects and programmes, thus NAMA not eligible
Clean Technology Fund (CTF)	No	Operational in India since 2011; India prepared a CTF in association with the ADB investment plan focusing on electric power transmission capacity, i.e. out of the scope of the Forestry NAMA.
Special Climate Change Fund (SCCF)	No	Mainly focused on coastal protection and adaption to climate change by vulnerable people. No focus on energy efficiency and fuelwood saving technologies.
Global Environment Facility (GEF)	Yes	The largest institution providing climate finance in India
NAMA Facility	Yes	Specifically designed to finance NAMA implementation in developing countries and financed through Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) and the Department for Business, Energy and Industrial Strategy (BEIS) of the UK, the Danish Ministry of Energy, Utilities and Climate (EFKM) and the European Commission.
Green Climate Fund (GCF)	Yes	Financing instrument of UNFCCC, specifically designed to finance mitigation and adaptation in developing countries.
The World Bank (WB)	Yes	Maybe source of finance because projects and programmes are often in the forestry and renewable energy (biomass) sector with a strong poverty alleviation mandate and has project in the State of Assam.
Asian Development Bank (ADB)	No	Focuses mainly on energy, transport, water supply, and finance and finances mainly large infrastructure projects and renewable energy projects, thus is thematically beyond the scope of the NAMA and beyond ADB's country strategy. Thus ADB will not be able to provide financial support.
New Development Bank (NDB)	No	Focuses on large infrastructure project in India and is thematically beyond the scope of the NAMA, thus is not suitable as a financing source for the NAMA
Bi-lateral Climate Finance		
German Climate and Technology Initiative (DKTI) (BMZ funded)	No	Implemented through GIZ and KfW. The KfW funded focus is on energy efficiency related to solar power and renewable energy grid development, but not biomass mass related energy efficiency. If financing is provided through the GIZ German-Indo Environment Program or Indo-German Energy Program. The Forestry NAMA does not fall under the funding criteria of this financing window because a) it is limited in terms of technological innovation (rather use of existing ones) and b) because there is no clear linkage of the NAMA to the German markets (one of the key funding criterion)
Germany's International Climate Initiative (BMUB funded)	No	Finances only the development of NAMA, but not implementation directly. The implementation of NAMAs is financed through the specifically designed NAMA Facility as below outlined.

Agency	Eligibility for Forestry NAMA Financing	Description / Justification
UK International Climate Fund	No	Directly finances only solar power related renewable energy project. Indirectly finance the NAMA Facility.
Japan International Cooperation Agency (JICA)	No	In Assam, JICA is mainly active on water and power generation. In India JICA supports sustainable forest management projects, but no focus on fuelwood saving technologies. May provide support for reforestation and forest management activities in the state of Assam.
Norwegian Agency for Development Cooperation (NORAD)	No	NORAD in India active on energy, environment and climate change, but none of the programmes deal with fuelwood saving technologies promotion and focus on hydropower and solar. In the State of Assam NORAD is mainly focused on socio-economic empowerment but no direct linkage to the Forestry NAMA.

Global Environment Facility (GEF)

Background and objectives

The Global Environment Facility (GEF), established on the eve of the 1992 Rio Earth Summit, is the longest standing multilateral climate change fund and since 1994 it has been an operating entity of the financial mechanism of the UNFCCC.

Overview Global Environment Facility (GEF):

Implementing partners
Out of the 18 available GEF Agencies (mainly multilateral organisations) that create project proposals and then manage these projects on the ground, in India four entities have so far been executing projects and are familiar with project implementation, namely - Asian Development Bank (ADB); United National Development Program (UNDP); United Nations Environment Program (UNEP); The World Bank Group (WB)
Project proposal funding volume ranges
The average funding volumes can vary a lot from USD 25,000 small grant fund info up to more than USD 50 million. Co-financing is required for all GEF full-size projects (FSPs), medium-side projects (MSPs), and GEF programmatic approaches
Financing instruments
Grants, concessional loans, guarantees, equity
Funding criteria and access modalities
• ELIGIBLE COUNTRY: a) if the country has ratified the conventions the GEF and conforms with the eligibility criteria decided by the Conference of the Parties of each convention; or b) if the country is eligible to receive World Bank (IBRD and/or IDA) financing or if it is an eligible recipient of UNDP technical assistance. • NATIONAL PRIORITY: The project must be driven by the country (rather than by an external partner) and be consistent with national priorities that support sustainable development. • GEF PRIORITIES: The project has to address one or more of the GEF focal area strategies (Biodiversity, International Waters, Land Degradation, Chemicals and Waste, and Climate Change Mitigation, as well as cross-cutting issues like sustainable forest management). • FINANCING: The project has to seek GEF financing only for the agreed incremental costs on measures to achieve global environmental benefits. • PARTICIPATION: The project must involve the public in project design and implementation, following the Policy on Public Involvement in GEF-Financed Projects and the respective guidelines.

Key experiences and lessons learned on accessing GEF funding
• CO-FINANCING: GEF project require a high co-financing. The ratio for climate change projects has been 1:14 for each invested GEF USD and at least 6:1. Key source of co-financing is from the GEF Agencies (implementing partners) and to a smaller extent government budget. • TIMING: Due to the complexity of the GEF project cycles the project proposal development can take up to 60 months. Delays reflect both the complexity of GEF processes as well as the capacity of implementing agencies and recipient countries to develop proposals. • IMPLEMENTING PARTNER COMPLEXITY: The multiple lines of accountability of the GEF – from its Governing Council and its Assembly, to its implementing partners, and to wider global stakeholders – present a complex content for its operations and a very lengthy and bureaucratic climate finance provider.

GEF funds are available to developing countries and countries with economies in transition to meet the objectives of the international environmental conventions and agreements[22]. It is replenished every four years, and is now in its fifth cycle with more than USD 1 billion for climate change projects.

GEF support is provided to government agencies, civil society organisations, private sector companies, research institutions, among the broad diversity of potential partners, to implement projects and programmes in recipient countries. In India, GEF has executed 95 projects and carried a total GEF grant funding volume of USD 810.3 million (GEF, 2017).

Potential to finance the Forestry NAMA

Considering the GEF eligibility requirements, the Forestry NAMA project in India would be eligible to receive funding. Considering that GEF requires a large co-financing ratio and seeks to pay only for the incremental costs to address climate change, the most effective use with the highest possible leverage ratio would be grant finance of the cross-cutting and enabling environment components. However, also here the government of India would need to contribute with its own funding as well.

Sourcing finance from GEF for the NAMA implementation would also require identifying a new implementing agency and initiating the lengthy proposal preparation work (see also section 6.6 on financing mobilisation). This indicates that implementation could start at least in 1-2 years from the start of selecting the implementing agency.

Green Climate Fund (GCF)

Background and objectives

The Green Climate Fund is the operating entity of the UNFCCC. The operation of the GCF is a 'governing instrument' and is outlined in the annex to decision 3/CP.17 (UNFCCC, 2012). The objective of the GCF is to promote the shift towards low-emission and climate-resilient development pathways. The GCF Investment Framework aims to ensure coherence in the Fund's resource

[22] The Minamata Convention on Mercury, the Stockholm Convention on Persistent Organic Pollutants (POPs), the United Nations Convention on Biological Diversity (UNCBD), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC).

allocation and focus upon scalable projects that will help deliver paradigm changes across the developing world.

It provides support for both, mitigation and adaptation and strives to maintain a balance between adaptation and mitigation activities. Funding is made available for project-based and programmatic approaches that are well in line with national circumstances and political priorities – for example voiced though their respective climate change strategies and plans, such as national REDD+ strategies and action plans, low-emission development strategies (LEDS) including NAMAs, or national adaptation plans (NAPs).

In India there is currently only one project that has been approved by the GCF (GCF, 2017a). Funding is channelled through the National Bank for Agriculture and Rural Development (NABARD) that serves as an accredited entity.

Overview Green Climate Fund (GCF):

Implementing partners
The GCF channels its funding through a range accredited entities to channel its resource to project and programmes (GCF, 2017b). Such entities may be public and private, international, regional, national, or subnational, public or private institutions that meet the standards of the Fund. In the Indian context, there is currently only one national accredited entity - National Bank for Agriculture and Rural Development (NABARD). International accredited institutions applicable to India are GIZ, Asian Development Bank, World Bank, KfW, UNEP, UNDP.
Project proposal funding volume ranges
The funding volume of GCF project is flexible and range between USD 5 – 60 million per project that can be implemented up to a length of 10 years. As a pre-condition to the GCF a large share of co-financing is required either from domestic source or other bilateral or multilateral sources.
Financing instruments
Grants, concessional loans, guarantees, equity
Funding criteria and access modalities
• The GCF Investment Framework (GCF 2014) outlines the six key criteria based upon funding decision are made which need to be addressed in the funding proposal elaboration: • IMPACT POTENTIAL: Potential to the achieve the Fund's objectives and result areas (climate impact and sustainable development) • PARADIGM SHIFT POTENTIAL: Potential to catalyse impact beyond a one-off project or program investment (Replication, scaling up; learning and enabling environmental creation) • Needs of the beneficiary country/alternative funding sources through absence of alternative sources of funding, income levels of affected population) • Country ownership and institutional capacity to implement funded activities - policies, climate change strategies and institutions • EFFICIENCY & EFFECTIVENESS: Benefit cost ratio of activity: impact per USD delivered by the Fund - cost effectiveness; amount of co-financing, industry best practices • Financial viability (for revenue-generating activities): Financial soundness; project/programme financial return and other financial indicators exceed predefined benchmarks

Key experiences and lessons learned on accessing GCF funding
• READINESS AND FEASIBILITY OF PROJECTS: GCF funds only highly-developed, investment-ready projects. There are formal requirements to have detailed feasibility studies, environmental impact and risk assessments complete at the time of submitting a funding proposal. The Fund will prioritise and fast-track only the most mature proposals. • USE OF APPROPRIATE FINANCIAL INSTRUMENTS AND INSTITUTIONAL SET-UP: GCF foresees that in particular projects that generate revenues should be financed through concessional loans or even more advanced financial instruments rather than grants only. For low-income countries such as India, a combination of high concessional loans and grant will be more promising. Grants are only attractive if there is a large co-financing or private sector leverage of the project.

Potential to finance the Forestry NAMA

Considering the funding criteria on impact and paradigm shift of the GCF and the need for large co-financing ratios/private sector leverage ratios, grant based GCF finance would only be suitable to finance the technical assistance related NAMA activities such as the cross-cutting and enabling environment component or aggregation and awareness raising of households.

Concessional debt finance to the domestic banking sector to finance fuelwood saving investment could also be part of a project proposal, but only in case there are significant financing barriers for fuelwood saving technology investments.

Therefore, a potential GCF proposal would be most promising and most transformational for a grant component to finance the cross-cutting and enabling environment components of the NAMA, while the remaining part could be financed domestically. In case the government of India decides to mobilise international finance from the GCF, investment into the identification of an accredited entity and project proposal development would be required which would take at least 1-2 years (See more information on fund mobilisation strategy in section 6.6).

NAMA Facility

Background and objectives

The NAMA Facility is a joint programme of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), the UK Department of Energy and Climate Change (DECC), the Danish Ministry of Energy, Utilities and Climate (EFKM) and the European Commission, established in 2012. It was designed to support developing countries and emerging economies that show leadership on tackling climate change and that want to implement ambitious and transformational climate protection measures (NAMAs).

As of 2015, a combined total of EUR 202 million in funding had been made available by four donors for the NAMA Facility. The UK Department of Energy and Climate Change (DECC, now BEIS) and German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) established the facility and provided joint funding of EUR 120 million for the first and second calls for proposals. The Danish Ministry of Energy, Utilities and Climate (EFKM) and the European Commission (EC), joined the NAMA Facility as new donors in 2015. The third call saw contribution of additional funding of up to EUR 85 million by BMUB, DECC, EFKM and the EC, and they have jointly provided up to EUR 60 million for a fourth call of the NAMA Facility. An additional GBP 75 million of UK International Climate Fund (ICF) funding was earmarked for the NAMA Facility in 2015 (LTS, 2016).

Overview NAMA Facility:

Implementing partners
Eligible recipients for funding are so called NAMA Support Organisations (NSOs). NAMA Support Organisations (NSOs) are qualified legal entities, endorsed by the national government. NAMA Facility funding may not be provided directly to partner government institutions such as ministries, thus the NSOs will be the contractual partners of the NAMA Facility and recipients of funding. Eligible entities are: • INTERNATIONAL: regional or international development banks, United Nations (UN) agencies, bilateral and multilateral development agencies, international non-governmental organisations (INGOs), international foundations. • NATIONAL: development banks, development funds, public utilities, public agencies, foundations, national non-governmental organisations (NGOs).
Project proposal funding volume ranges
The funding volume per project should range between EUR 5-20 million over a period of 3-5 years. As a pre-condition for funding domestic public finance is an importation selection criteria as well as large private sector finance leverage.
Financing instruments
Grants, concessional loans, guarantees, equity
Funding criteria and access modalities
The NAMA Facility applies a set of 'ambition' and 'feasibility'. The ambition criterial relate to: Transformational change: Government commitment; Embeddedness; catalytic effect Replicability / Scalability / Sustainability FINANCIAL AMBITION: Direct and indirect leverage of public and private financing; Removal of financial/economic market barriers; participation of other financing institutions MITIGATION POTENTIAL: Direct and indirect GHG emission reduction, cost effectiveness Feasibility criteria refer to: • Project rationale: Plausibility of barrier analysis; project rationale; clear log frame; clear definition of target group, clear definition of synergies with other projects; clear scope of NSP, justification of NSP funds/additionality • Project design: Adequate institutional set-up; high level of readiness; feasible and appropriate technologies; plausible business model; appropriate financial mechanism and regulation; clearly defined technical assistance measures; reasonable funding request • Detailed preparation phase (DPP) concept: Adequate focus; comprehensiveness; adequacy of approach; realistic timeline; appropriate requested funding for DPP
Key experiences and lessons learned on accessing NAMA Facility funding
PROJECT PROPOSAL QUALITY: The NAMA Facility is a very competitive process which requires the submission of high-quality proposals and only well advanced project have a good chance to be selected. The ratio of submitted to selected NSP proposal ranges between 1:5-10 FEASIBILITY: NSP Outlines have to be considered to be 'ready for implementation', with a clear proof of concept, an attractive business model and a realistic financing mechanism. Therefore, pilots need to demonstrate the feasibility of the NAMA as a pre-condition. TIMEFRAMES: The timeframe from submitting of the initial NAMA Facility project outline until the start of implementation is relatively long, ranging between 29-37 months. FINANCING: Pure Technical Assistance grants are only financed if the host country can demonstrate large public and private financing domestically.

Potential to finance the Forestry NAMA

Considering the NAMA Facility fund criteria and the feedback received on the NAMA Support Project outline submission in year 2016, the most promising component to be financed by the NAMA Facility would be a Technical Assistance project for the NAMA cross-cutting and enabling environment component which has the largest transformational impact and public and private financing leverage. At the same time this component would also fit into the financing scope of EUR 5-20 million. However, competition is large and application should only be further advanced in case a pilot has been initiated with a proof of concept to demonstrate feasibility of the proposed Forestry NAMA.

Annexure 4

List of potential private sector companies under the Companies Act, 2013 obliged to undertake CSR activities in the State of Assam

Company Name	Areas of Operation in Assam	Business Product
Indian Oil Corporation Ltd.	Tinsukia, Kamrup, Chirang, Duliajan, Dibrugarh, North Guwahati, Kamrup, Cachar	Crude oil refining / Petrochemical / LPG Bottling
Oil India Ltd, Duliajan	Dibrugarh	Crude & Gas exploration
ONGC (Assam assets)	Nazira, Sivasagar	Crude & Gas exploration
Brahmaputra Valley Fertilizer Corporation Ltd	Namrup, Dibrugarh	Urea etc.
Cement Corporation of India Ltd.	Bokajan, Karbi -Anglong	Cement
Nagaon Paper Mill, Hindustan Paper Corporation Ltd (HPCL)	Morigaon	Papers
Cachar Paper Mill, HPCL	Panchgram, Hailakandi	Papers
Numaligarh Refinery Ltd	Numaligarh, Golaghat	Crude oil refining
Brahmaputra Cracker and Polymer Ltd (BCPL)	Lepetkata, Dibrugarh	HDPE/LLDPE
Godrej Consumer Pvt Ltd	Kamrup	Mosquito repellent coil
Hindustan Unilever Ltd	Tinsukia	Personal care products
Emami Ltd.	Abhoypur, Amingaon, Kamrup	Ayurvedic medicines, cosmetics etc
CALCOM Cement India Ltd (Dalima group)	Nagaon	Cement
Jyothi Laboratoray, EPIP	Amingaon	Liquid detergent
Progressive Fertichem	Kamrup	Fertilizer
Varun Beverage	Guwahati	Soft drinks & pet pre form/ pet bottles
Pidilite Industries Ltd	Kamrup	FEVIWIK & M Seal

Annexure 5: Sample Stakeholder Communication Matrix

Table 60: Sample Stakeholder Communication Matrix

Stakeholder	[Name and group (e.g. tea estate manager, micro-finance institute)]
Role	• How closely are they tied to the NAMA pilot (e.g. primary/secondary actor)
Responsibility	How will this stakeholder help to achieve the CESP objective and overall project goal?
Communicate with	• List of other stakeholders to be communicated with, for example: • MFIs for funding • Technology providers for fuelwood saving technologies • Tea plantation managers for (financial, material) support • Include frequency/intensity of exchanges
Main topics to be addressed	• For example: • Shared values and principles • Agreed targets and priorities • Shared resources, information and learning • Joint engagement activities • Access to funding (individual funding, group lending) • Organisational matters • Questions about the NAMA pilot

Communication and Engagement Plan Template

The following areas are those that are essential to think through and develop to ensure a well thought through and strategic communications plan for an organisation or representative body.

- Objective of the NAMA pilot project and its communication goals
  - State the goal and mission, and how the communication plan will help to achieve them.
- Top messages
  - Message development is important for consistency and branding. What are the top messages that the government, spokespeople and partners/ stakeholders should use, reiterate, and reinforce when speaking publicly?
- Targeting different audiences
  - Which stakeholders should be included in direct meetings and linked communication? Implementers? Donors? Media?
  - Ensure that each audience has messaging that is targeted to their interests and individual goals.
- Specific tactics
  - Events
  - Publications
  - Press releases (radio, newspaper)

  - Media interviews
  - Enlisting support from celebrities or important individuals
- Metrics for success
  - How will the communication success be measured? Increase in followers and engagement? Loans acquired or money raised? Number of fuelwood saving products distributed?
- Key dates
  - Check ahead of time if there are any interesting/important events to attend, or that could be created to promote awareness. Key international dates relevant to the work at hand could provide a suitable framework for this (e.g. Earth Day, World Pneumonia Day, International Women's Day)

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

A 2/18, Safdarjung Enclave
New Delhi 110 029 India

T: +91 11 4949 5353
E: ashish.chaturvedi@giz.de
I: www.giz.de