






Third Edition

NAMA Guidebook

Manual for practitioners working with mitigation actions

MINISTRY OF ENVIRONMENT, GREEN DEVELOPMENT AND TOURISM

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THE NAMA GUIDEBOOK

-Manual for practitioners working with mitigation actions-

Third Edition – 2015

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List of acronyms

ADB	Asian Development Bank	**MOEJ**	Ministry of the Environment, Japan
AFOLU	Agriculture, Forestry and Other Land Uses	**MRV**	Measurement, Reporting and Verification
AIM	Asia - Pacific Integrated Model	**NAMA**	Nationally Appropriate Mitigation Actions
BAU	Business as Usual	**NAPA**	National Adaptation Programmes of Action
BUR	Biennial Update Report	**NAP**	National Adaptation Plans
CDM	Clean Development Mechanism	**NC**	National Communication
CHP	Combined Heat and Power plants	**NCA**	NAMA Coordinating Authority
CIP	Continuous Improvement Processes	**NCCC**	National Committee on Climate Change
COP	Conference of the Parties	**NDE**	National Designated Entity
CTCN	Climate Technology Centre and Network	**NDF**	Nordic Development Fund
DFI	Development Finance Institution	**NEE**	NAMA Executing Entities
ER	Emissions Reductions	**NIA**	NAMA Implementing Authority
GCF	Green Climate Fund	**NMM**	New Market Mechanisms
GEF	Global Environment Facility	**ODA**	Official Development Assistance
GHG	Greenhouse Gases	**QA/QC**	Quality Assurance / Quality Control
ICA	International Consultation and Analysis	**RD&D**	Research, Development and Demonstration
IDB	Inter-American Development Bank	**SDG**	Sustainable Development Goals
INDC	Intended Nationally Determined Contributions	**TC**	Transformational Change
IPCC	Intergovernmental Panel on Climate Change	**TEC**	Technology Executive Committee
JCM	Joint Crediting Mechanism	**TNA**	Technology Needs Assessment
JICA	Japan International Cooperation Agency	**UNDP**	United Nations Development Programme
KPI	Key Performance Indicators	**UNEP**	United Nations Environmental Programme
LCDS	Low Carbon Development Strategy	**UNFCCC**	United Nations Framework Convention on Climate Change
M&E	Monitoring & Evaluation	**WB**	The World Bank

Preface: Introduction to the third edition of the NAMA Guidebook

Three years ago we have decided to create a tool that can be useful for all those in the process of learning what Nationally Appropriate Mitigation Actions are. In retrospective, we were well aware about the continuously evolving character that NAMAs might pose, considering that everyone was experimenting or engaging in a 'learning-by-doing' process. In that sense, rather than writing recipes to conduct projects, we provided a platform for all those who wanted to share their experiences (good and bad) in the formulation and conduction of NAMAs.

It gives us great satisfaction to know the level of acceptance that the NAMA Guidebooks (first and second edition) have received, from both sides: Those who wanted to use this Guidebook as a reference material in trainings and capacity building activities, and those who shared knowledge by contributing experiences in the Guidebook. The current edition is in part, a result of this interaction.

In order to find the main theme for this edition, we have conducted a small research at the intersessional climate change meetings in Bonn. As a result, we found out that the focus was now moving towards the implementation of 'Transformational NAMAs'. Here, we restrain ourselves to provide a definition since many valuable concepts are provided in this edition, but we invite our readers to see how these concepts are becoming a key factor when designing NAMAs. In that sense, and similarly to the previous two editions, we provide some theoretical concepts in Section I and some case studies in Section II as a reference.

Given the importance of the transformational aspect in future NAMAs, we have also started a small survey in order to decipher what kind of challenges and issues in the design, planning and implementation of 'Transformational NAMAs' are faced by developing countries. Some preliminary results and conclusions are provided in the final section.

Miguel Jiro Ogahara
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Issues in the implementation of transformational NAMAs

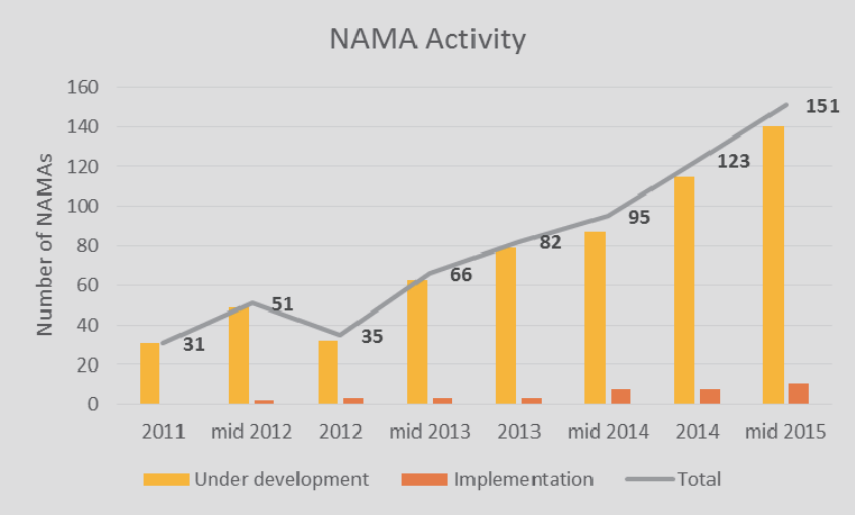
1.1 Transitioning NAMAs from planning to implementation

By Frauke Röser
NewClimate Institute

It has been eight years since the concept of NAMAs was first introduced in the Bali Action Plan in 2007. During this time, many governments, research and support organisations have engaged very actively in the topic to bring the NAMA concept to life. A significant number of countries has been developing NAMA concepts and proposals, and a whole range of knowledge sharing and readiness activities have been undertaken in order to build capacities for further development of NAMAs and to pave the way for the implementation of the mitigation actions.

Figure 1 tracks supported NAMA activities from 2011 to 2015 based on information from the NAMA database. It can be seen that NAMA activity steadily increased[1] from 31 NAMAs under development in 2011 to 151 NAMAs in 2015.

Figure 1: Supported NAMA activity 2011 to 2015



Source: www.nama-database.org

Two aspects are worth noting here: firstly, the activity shown is likely to be only a part of the NAMA development activity going on around the globe as not all activities are captured in the database (nor the official UNFCCC NAMA Registry); and secondly, only a very small proportion of supported NAMAs actually moving into implementation. Depending on one's definition of what implementation actually means – i.e. implementation of activities that directly reduce emissions (e.g. the installation of low carbon equipment and technologies) versus the implementation of preparatory or enabling activities which are important to prepare for emission reductions to happen in future – the number of NAMAs in implementation is likely to be even smaller.

This raises the question of why few NAMAs have actually been able to transition from planning to implementation. What can we learn from past NAMA activity that may help move a greater number of existing and future NAMA concepts to implementation? By looking at what has been achieved over the last years in terms of advancing NAMAs and drawing out some lessons learned, this section of the

[1] The drop in 2012 can be attributed to a redefinition of what was included as NAMA in the NAMA database.

guidebook attempts to derive some recommendations for future NAMA development to help the NAMA concept evolve into what it is meant to do: drive action to mitigate climate change in the context of sustainable development.

What has been achieved so far?

NAMAs have matured significantly over the last years. Both in terms of quantity as well as quality. Whilst the early NAMA concepts were relatively broad sketches and outlines of potential mitigation activities, many NAMA proposals now provide in depth analyses on the design of intervention options, finance instruments and associated MRV systems.

Capacities and awareness of mitigation actions and the benefits for development have increased amongst a range of stakeholders within and outside government. Also awareness of NAMAs has increased significantly amongst potential funding institutions and the wider community of researchers and practitioners. NAMAs have helped to shape thinking on technical and financial cooperation on climate change mitigation internationally as well as informed the design of other emerging funding mechanisms, including the Green Climate Fund (GCF).

NAMA readiness activities and the resulting increased capacities at the national level arguably helped to drive activities on the ground also beyond NAMAs. A significant number of new and often innovative concepts for mitigation activities have evolved in a large number of different countries, from emerging economies to least developed countries and small island states. These activities in turn have helped to inform other policy processes, including the (further) development of long term low emission development strategies as well as the formulation of national targets, including the Intended Nationally Determined Contributions (INDCs) to be presented at COP21 in Paris.

With the establishment of the NAMA Facility in 2012 by the German and British governments and now also supported by Denmark, the first dedicated NAMA funding source came into existence. The NAMA Facility by September 2015 has shortlisted nine so called NAMA support projects for implementation funding. Also other finance providers, including the GEF and several development banks, have moved towards financing NAMAs as parts of their climate finance activities (see for example the UNFCCC NAMA Registry for details on NAMA support available and provided).

Lessons from NAMA development

Whilst NAMAs have generally contributed to an increased pipeline of potentially fundable mitigation initiatives and actions, few of those have actually received finance and moved into implementation. This can be attributed to some extent to the widely debated finance gap, however, is also in many cases likely to be the result of a lack of financial readiness, both at the institutional level of the recipient as well as the NAMA proposal itself.

Many NAMAs are about policy change rather than the site specific implementation of technology or infrastructure alone. Policy change takes time and requires concerted action at various levels. In order to effectively address multiple barriers and achieve longer lasting, deeper change (i.e. transformation) an interplay of different measures and interventions is required. This makes NAMA proposals complex in terms of defining finance needs and designing effective implementation plans.

For supported NAMAs to successfully secure international financial support a detailed analysis of the planned intervention(s) and a robust implementation plan is required. The implementation plan should detail resource and funding needs as well as how the resources are planned to be deployed including institutional structures, roles and responsibilities as well as the design of any planned financial

mechanism and support scheme. Often, NAMA proposals fall short of what is termed a "bankable" NAMA, i.e. one that can be picked up readily by financial institutions for their appraisal process. As noted by an analysis of the NAMA Facility "many NAMA Support Project Outlines showed weaknesses with regard to their feasibility, specifically concerning a well-developed project structure, a theory of change and a concept for project finance." (BMUB, 2014). They further note that the early involvement of financial actors and the in depth preparation of the financial support mechanism presents a key challenge. Related to the lack of a detailed design of the finance mechanism seems a general detachment of NAMA activities from other international financial support processes and negotiations at the government level. Many international financial cooperation (ODA) projects are negotiated involving the Finance Ministry, Planning and line ministries, in well-established processes. As NAMAs are typically initiated and coordinated by the Ministry of Environment or the respective UNFCCC focal points, coordination with the usual government authorities involved in structuring international financial support happens to a limited extent if at all. At the same time, many NAMA projects link with or are very similar to traditional ODA funded programmes. A close integration of the process of designing NAMA finance schemes with existing international financial cooperation processes would likely increase the finance readiness of NAMAs and hence increase the likelihood of their implementation.

Given their origin and connection to the UNFCCC process and consequently close link to the national UNFCCC focal points, in many cases relevant line ministries are brought into the NAMA development process at a later stage. This can result in a reluctance by the line ministries to take up ownership of the NAMA process as they were either not involved from the start or may regard the international climate policy process with some suspicion. Especially policy or programme based NAMAs, for example in the energy, transport or agriculture sector, need to be fully owned by the relevant ministries and fully integrated into government planning if they are to move into implementation.

Along a similar line, NAMA development in many cases is driven and carried out by external, often international actors and support providers. This happens in particular in situations where awareness of NAMAs and capacities are still limited. Whilst these external activities are helpful to initiate and drive NAMA activities, it can prevent full national ownership of the NAMA process later on. Even in cases where the process is endorsed by the national government and stakeholders are closely involved experience has shown that obtaining or transferring full ownership of all parts of the NAMA to national stakeholders can be difficult. Again, especially NAMAs that require policy change need to be fully country driven and owned. Consequently, the successful transition of a NAMA from planning to implementation requires national stakeholders to be in the driving seat throughout. External expertise is helpful to build capacities and support the process but in a targeted and selective way.

Key recommendations and conclusions

Much has been achieved with NAMAs in terms of mobilising mitigation activities in developing countries. However, there is a notable lack of NAMAs that have actually moved into implementation to realise the vast mitigation potential outlined in the many NAMA concepts and proposals. Experience shows that a stronger focus on the design of financial support mechanisms and structures is necessary. Also, integrating NAMA development fully into policy planning processes of the finance, planning and line ministries, and shifting ownership away from the climate change focal points to the sector experts, is likely to increase the rate of implementation.

In more concrete terms the following aspects should be considered when developing NAMAs:

- Understand the barriers: in order to fully understand the specific barriers to implementing low carbon alternatives in the particular local context it is important to directly engage with those

stakeholders expected to undertake the investment in or implementation of mitigation projects and technologies. These are often private sector players but may also include government and civil society. In this context it is critical to get views from different stakeholder groups to ensure a balanced analysis.

- Design interventions on the basis of barriers identified: the barrier analysis forms the basis to define targeted interventions to address the identified barriers. Interventions can and should build on existing initiatives and policies to ensure an integrated policy approach in the targeted sector and sub sector. For each intervention a detailed implementation plan should be developed, including detailed costs and resource needs, timelines as well as roles and responsibilities of institutions and stakeholders expected to be involved in the implementation.
- Engage with and transfer ownership to national line ministries: to develop detailed cost and implementation plans for the NAMA activities it is important to fully involve the relevant line ministries of the target sector(s). The definition of resource needs – in particular national funds and resources – should be linked to the budgeting processes of the respective ministries. The involvement of the Ministry of Finance is particularly important here, also in view of defining and negotiating international support for the NAMA to complement any ongoing or planned international support activities.
- Engage with national and international financial institutions: in order to develop bankable NAMA proposals which can be readily picked up by financial institutions it is helpful to engage with potential national and international funders right from the beginning. Many financial institutions are able to provide direct support during the proposal development phase and are open to engage actively with NAMA developers to ensure that the proposed initiatives and schemes meet the requirements of the banks.

Fundamental to successful NAMA development is that the processes are fully driven and owned by national stakeholders. A clear indication of ownership is the inclusion of the NAMA activities in national and ministerial budgets and policy plans. In the end, NAMAs are not proposal documents but processes which can only come to fruition through concerted and continual action by the national stakeholders involved.

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1.2 Facilitating transformative change for resilient and inclusive growth

By Alexandra Soezer
United Nations Development Programme (UNDP)

Introduction

NAMAs are expected to change prevailing structures of a sector sustainably and allow for a broad paradigm shift. Such a sector-transformative change that occurs through a NAMA can be best seen through the application of a theory of change approach. The theory of change approach "defines all building blocks required to bring about a given long-term goal" (Center for Theory of Change, 2013). These building blocks shall have impacts beyond project scope, include institutional capacity building, private sector engagement, and replicability and scalability. Transformational NAMAs will be expected to include a number of embedded layers for change and the solutions to achieve a transformative change will need to be tailor-made in order to achieve lasting results (Wuppertal Institute for Climate, Environment and Energy & UNEP DTU Partnership, 2014). Table 1 explains the different layers of change that will have to be carefully considered at all stages, from the idea, the NAMA preparation to NAMA implementation.

Table 1: Embedded layers of change for transformational NAMAs

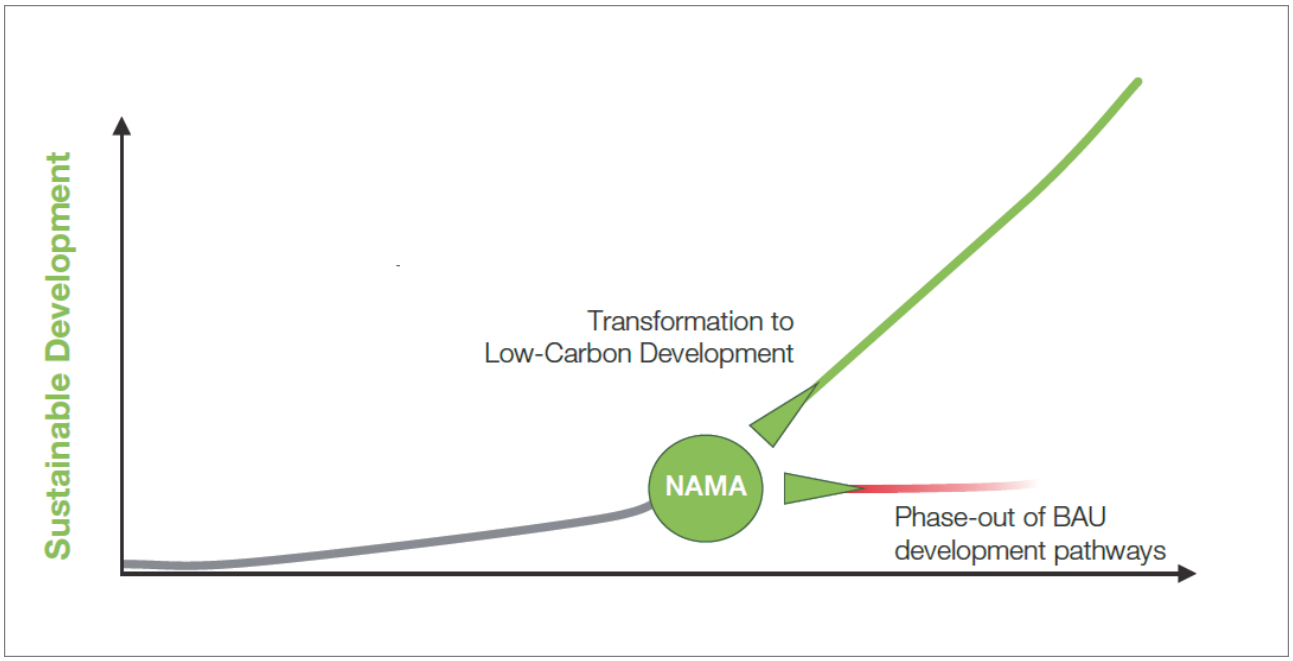
Vision	Transformational change starts with an ambitious vision of change.
Experimentation and Innovation	Transformational change involves risky decisions and investments that are not guaranteed to pay off.
	Governments can create the protected niches needed for TC-NAMAs to experiment with new solutions.
Actors and Coalitions	Transformational change needs actors of change: innovators, disseminators, advocates, policy-makers.
Instruments for Barrier Removal	TC-NAMAs overcome persistent barriers.
	TC-NAMAs need policy instruments that are tailor-made to circumstance, in order to create a mix of push by markets and pull by policy.
Systemic Change	Transformational change needs to strike a balance between depth of change and connectivity to established practice (and habits) within society.
	For Transformational change, a portfolio of interventions is needed that together aim at change in all societal dimensions.

Source: Wuppertal Institute for Climate, Environment and Energy & UNEP DTU Partnership, 2014

The Theory of Change describes in a change framework the exact building blocks or interventions that bring about the results. All outcomes are tied to an intervention in a set of connected building blocks which are known as a pathway of change (Center for Theory of Change, 2013). Using this approach will help to ensure that the NAMA focuses not just on emissions reductions but also on sustainable development, embedded in national development goals.

Exemplary NAMAs that demonstrate a rigorous focus on transformative change for resilient, inclusive growth in a sectoral niche are NAMAs that encourage energy access, rural development, and income generation. These NAMAs at the same time provide opportunities to change development pathways through the promotion of low carbon development.

Figure 1: NAMAs provide an opportunity to change development pathways

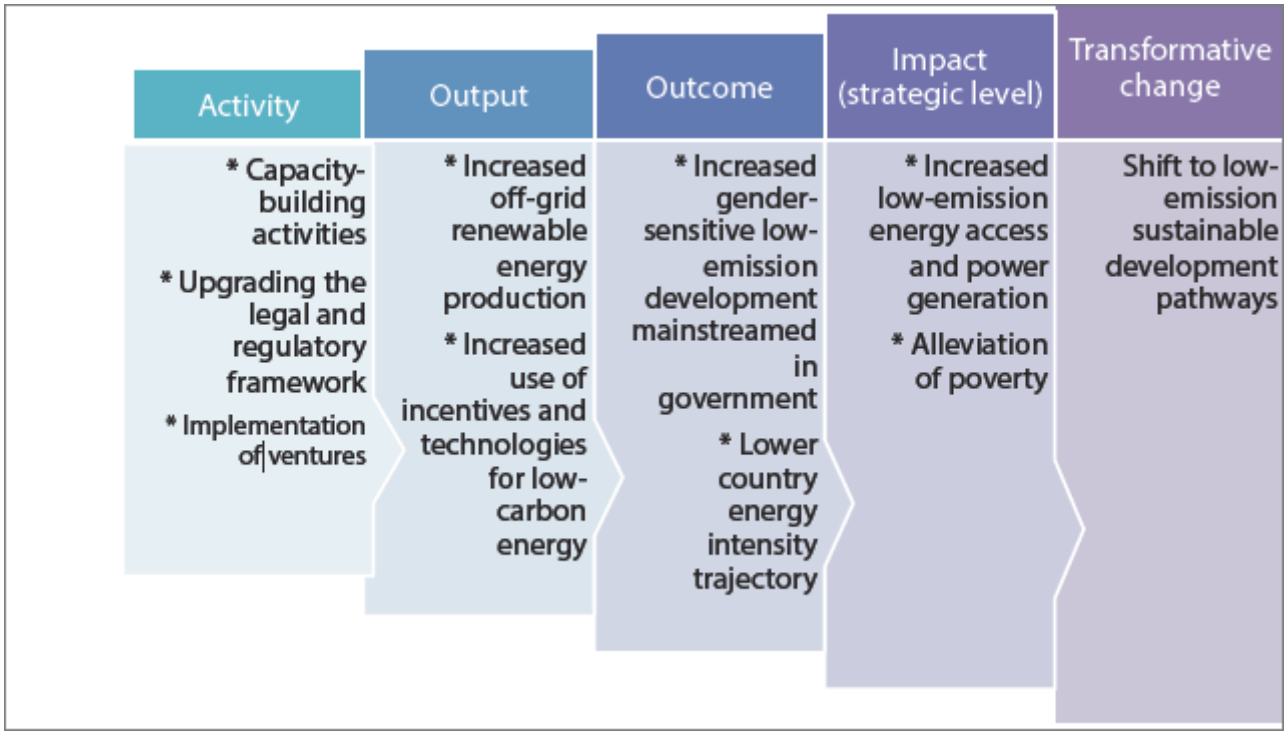


Source: Wuppertal Institute for Climate, Environment and Energy & UNEP DTU Partnership, 2014)

Measurement Reporting and Verification of Transformative Change

To visualize the transformation of change approach, the overall NAMA targets for an energy access NAMA for activities, outputs, outcomes, impacts and overall high-level paradigm shift are shown in Figure 2. Whether or not transformative change has occurred can be determined only at the end of a NAMA lifetime, once all of the NAMA Measurement Reporting and Verification (MRV) results are analyzed.

Figure 2: The theory of change approach to NAMA targets for an energy access NAMA



Source: Nationally Appropriate Mitigation Action: Rural Development in Namibia through Electrification with Renewable Energies, UNDP 2015

Relevance of Measurement Reporting and Verification for NAMAs

To set the stage, a baseline scenario will have to be established first, followed by the theory of change approach which will be employed to ensure that the NAMA is looked at in a bigger picture, helping to ensure transformation. The targets of the NAMA are developed in alignment with the priorities of national development plans.

MRV is crucial in the success of the NAMA as it helps to track the outcomes and impacts of the NAMA interventions. Data parameters for sustainable development indicators are regularly measured, recorded and verified. This data will then be used to determine the transformative change which will occur as a result of the NAMA activities.

A NAMA Coordinating Authority (NCA), which is usually the sector-relevant lead Ministry, in consultation with other Ministries and the NIA will be charged with interpreting the sustainable development data and applying it to wider components of transformative change, such as outcomes and impacts. These components cannot be measured annually but should be considered at the end of each phase and at the end of the NAMA' s lifetime. Tracking sustainable development outcomes will also help the NCA to continuously improve the NAMA design and increase the NAMA impact.

In order for an energy access NAMA to accomplish the transformative change which is integral to the success of the NAMA, a comprehensive and supportive regulatory and policy framework needs to be

established since the transformative change must occur in a fashion which is aligned with national development goals. In order to establish the enabling policy framework, the existing national documents must be assessed for gaps first and then, recommendations formulated to supplement these policies and regulations so that a supportive framework can be created.

Evaluation of Sustainable Development results

UNDP has developed a Sustainable Development Evaluation Tool to evaluate the transformative impact of a NAMA by assessing the sustainable development impacts of a NAMA. In order to do so, the tool looks carefully at the selected interventions that are applied under a NAMA framework.

A Sustainable Development Evaluation tool can be applied by the NCA and shall help to evaluate the performance indicators and results achieved by a NAMA over the NAMA' s lifetime. The tool shall allow policy makers to track and highlight the effects of a NAMA on national development goals. The SDGs shall eradicate poverty and transform economies through an integrated approach to economic, social and environmental sustainable development.
The evaluation of the sustainable development impacts are done through the following steps:

a) Identification of domains:

Four different domains are identified for the measurement of the sustainable development impacts:

a) Environment: This domain will cater to changes in the environment due to an intervention.
b) Social: This domain will cater to social aspects of the intervention.
c) Economic: This domain will evaluate the economic related benefits which can be measured directly.
d) Growth & Development (to highlight those impacts that have dual impacts on social and economic development) this domain will cater to the development aspects of the intervention without linking it to financial benefits.

Each domain is linked to the globally agreed Sustainable Development Goals (SDGs) and their targets to ensure that the impact of a NAMA is assessed against the overall sustainable development priorities of a country and that MRV of the sustainable development impacts of the NAMA can also track progress with the achievements of the national sustainable development priorities.

b) Selection of indicators:

Under each domain, the NCA will select indicators that reflect how the NAMA supports sustainable development. It is recommended to select a core list of indicators that are specific, measureable, and cost effective to collect in order to limit the burden on human and financial resources to measure and report data. Ideally, a NAMA should be able to track progress of at least 1 indicator per domain. For each selected indicator, a justification shall be provided. If more than one intervention is undertaken under the NAMA, indicators shall be selected for each introduced intervention.
All positive and potentially negative impacts of an intervention under the NAMA framework, shall be reported under the respective domain against each indicator. In order to do this, the effects of the intervention will be classified as positive or negative. Negative impacts need to be mitigated and monitored over the NAMA lifetime.

The exemplary energy access NAMA determined and justified the selection of indicators as follows:

Domain	Indicator	Identified impacts	Explanation of chosen indicator	Effect on indicator	Monitored (Y/N)
Environment	Air pollution/quality	Reduced indoor pollution	The NAMA will reduce consumption of kerosene/paraffin in lanterns which are associated with severe indoor air pollution from soot and noxious fumes.	Positive	No
	Climate change adaptation and mitigation	Avoidance of GHG emissions	The NAMA will partially replace electricity production from stand-alone diesel generators and reduce kerosene/paraffin consumption in lanterns, and thus GHG emissions are avoided.	Positive	Yes
Social	Health	Improvement of health and health care conditions	The NAMA will improve people's health by avoiding burning kerosene/paraffin, which causes severe indoor air pollution by emitting noxious fumes and soot. Kerosene lighting is extremely hazardous and is responsible for many burns and deaths. It will also improve healthcare conditions by providing lighting and refrigeration for rural clinics where vaccines could be conserved, blood storage refrigerators could be installed, operations could be carried out with sterilizations measures, diseases could be diagnosed and prevented, and pregnancies could be monitored.	Positive	Yes
	Livelihood of poor, poverty alleviation, peace	Poverty reduction	The NAMA will improve lighting conditions, allowing children to study at home, which has a significant impact on improving children's education in rural families and their future employability. Kerosene/paraffin lighting is extremely hazardous and is responsible for loss of property through fire, as well as many burns and deaths. Prevent loss of property due to natural disasters by giving the possibility of installing radio receivers, remote weather measuring, data acquisition and transmission (for example, river levels and seismographs) earthquake monitoring systems, emergency power for disaster relief, etc. Allow for the implementation of safety measures such as street lighting, security lighting, remote alarm systems, electric fences, road signs, etc., including electrification of police stations. Prevent loss of food thanks to installation of refrigeration appliances. Promote better food processing, adding value to the agricultural products (e.g. flour instead of grain). Promote creation of new income-generating activities thanks to electricity for lighting and running machines.	Positive	Yes
	Time savings/time availability due to project	Improved Productivity and economic diversification	With better lighting, adults may also pursue productive activities in the house after nightfall. The implementation of the NAMA will make people less dependent on kerosene/paraffin and will decrease the amount of income spent on fuel.	Positive	No
Economic	Income generation/ expenditure reduction/ Balance of payments	Enhanced productivity, efficiency and increased business opportunities; lower electricity expenditures	The NAMA will foster productivity, increase production efficiency and production time, enable added value activities and encourage new income-generating activities. The generation of income would enhance economic growth and provide the means to afford the electricity	Both	Yes
	Job Creation (# of men and women employed)	Jobs creation	The implementation of the NAMA will require the use of several local/national entities to undertake: renewable energy technology supply and installation, mini-grid operation, entry survey, awareness rasing, marketing, accounting and software development.	Positive	Yes
Growth and Development	Access to clean and sustainable energy	People less dependent on fossil fuels, having access to RE	Energy plays a critical role in economic development and poverty alleviation. In the absence of reliable grid electricity, people depend mostly on diesel generators and kerosene/parafin lamps for lighting. The implementation of the NAMA will make people less dependent on expensive fuels and will decrease income spent on fuel.	Positive	No
	Empowerment of women	More jobs to women	The NAMA will create opportunities for new income-generating activities for women, e.g. handicrafts, food processing, hair-dressing, starting small shops, sewing workshops, etc.	Positive	Yes
	Access to sustainable technology	New sales points for RE & EE technologies	The NAMA will result in direct contact with sustainable energy production and promotion of other efficient technologies and appliances.	Positive	Yes
	Energy security	Improved energy security	The NAMA will enable use of the local energy sources, creating independence from the geo-political situations.	Positive	No
	Capacity building	Increased knowledge sharing and capacity among rural communities	The NAMA will raise awareness and provide capacity building amongst the rural population regarding renewable energy technologies.	Positive	No

c) Formulation of parameters:

Following the indicator selection, the NCA will determine parameters for each monitored indicator. The parameters will build the basis for MRV of the sustainable development impacts and shall be carefully

selected as they must ensure transparent and precise MRV of indicators. For each parameter a unit of measurement and measurement approach (direct or indirect, through survey or literature value) shall be defined. For each parameter, a baseline value and target value to be achieved through the NAMA intervention has to be determined by the NAMA developer.
The exemplary energy access NAMA formulated the parameters, baseline and targets for monitored parameters as detailed below:

Social	Health	1	Clinics provided electricity	+	# of clinics connected to the mini-grid	Direct	0	8		#	100%		
	Livelihood of poor, poverty alleviation, peace	1	Job created	+	# of new jobs created	Direct	0	320		#	100%		
	Affordability of electricity												
	Access to Sanitation and clean drinking water												
	Food security (Access to land and sustainable agriculture)	1	Irrigated land area	+	Number of hectares irrigated using water pumped by NAMA ventures	Direct	0	120		Hectares	100%		
	Quality of employment	1	SMMEs operating	+	Number of operating SMMEs using energy from the venture	Direct	0	160			100%		
	Time savings/time availability due to project												
	Provide vulnerable groups access to local resources and services								Domain Average:		100%		

Growth and Development	Access to clean and sustainable energy	2	Renewable energy generation	+	Electricity generation provided to customers	Direct	0	53		MWh/yr	100%		
			Households with RE access	+	Households connected to the mini-grid or provided batteries	Direct	0	400		#	100%		
	Education		Schools provided electricity	+	Schools connected to the mini-grid	Direct	0	4		#	100%		
	Empowerment of women		New jobs created for females	+	# of new jobs created for females	Direct	0	160		#	100%		
	Access to sustainable technology, Capacity development		Trainings about sustainable technologies provided	+	# of trainings about sustainable technology provided	Direct	0	8		#	100%		
			Equipment use in the RPZ	+	# of hours of use of individual pieces of income-generating	Direct	0	1556		hrs/yr	100%		
	Energy security		Operating renewable energy systems	+	# of renewable energy ventures which are operating and providing	Direct	0	8		#	100%		
	Capacity building		Trainings provided	+	# of trainings provided	Direct	0	25		#	100%		
	Equality (quality of jobs given, job condition for men/women)		Percentage of new jobs created which are for females	+	% of new jobs created which are for females	Direct	0	50		%	100%		
									Domain Average:		100%		

Economic	Income generation/expenditure reduction/Balance of payments												
	Asset accumulation and investments												
	Job Creation (number of men and women employed)												
									Domain Average:				
									TOTAL AVERAGE:		100%		

d) Evaluation of NAMA improvements through Nationally Appropriate Improvements (NAIs) approach:

The determination of a baseline value, realistic estimation of a target value, and robust MRV, will allow the NCA to determine the contribution of the NAMA to the country' s sustainable development priorities, the overall sustainable development impacts of the NAMA and the success of the NAMA interventions to contribute to growth and development.

e) MRV of parameters and QA/QC:

The NAMA Implementing Authority (NIA) shall establish a QA/QC system to ensure good quality of data. The quality control (QC) procedures are used for compiling, developing and maintaining the required datasets and the quality assurance (QA) procedures for ensuring the overall quality of the datasets by assessing the conformity and the effectiveness of the QC system, based on data quality objectives and

general provisions.
For a proper QA/QC process, the following data quality objectives should be followed:

- Relevance: collect data and information required for the establishment of baseline and mainly activity data and information applicable for the assessment of impacts;
- Completeness: include all relevant activity data and information to produce "true and fair" representative data;
- Consistency: present the same data in the same definition/scope/format and make the datasets compatible with other related data;
- Credibility: identify and utilize authoritative data sources. Collected data/information should always reference their sources (examples of sources: data providers, NAMA's implementer, government authorities, peer-reviewed international statistics documents, research institutes, individual academic research work institutions, technology supplier);
- Correctness: utilize the most recent data available in a sector in order to reflect the current economic and technological practices (one to 3 years before the submission of the NAMA);
- Accuracy: reduce errors and uncertainties as far as it is practical and cost-effective;
- Objectivity: avoid biased, prejudiced and partial information;
- Conservativeness: ensure to use a conservative approach in case of missing or incomplete data;
- Transparency: disclose sufficient and appropriate data and processes to allow monitoring of the quality of the compiled datasets;
- Traceability: document all data sources.

The exemplary energy access NAMA detailed MRV and QA/QC as follows:

Serial number	**1**	
Indicator Name	Health	
Domain	Social	
Parameter Name	Health clinics electrified	
Baseline Value	0	
Way of monitoring	How	Mini grid connection and electricity provision contract between the Intervention Implementer and the Clinic
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	1	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	**2**	
Indicator Name	Livelihood of the poor, poverty alleviation, peace	
Domain	Social	
Parameter Name	Households electrified	
Baseline Value	0	
Way of monitoring	How	Mini grid connection and electricity provision contract between the Intervention Implementer and the household
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	100	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	3	
Indicator Name	Access to clean and sustainable energy	
Domain	Growth and development	
Parameter Name	People with access to RE electricity	
Baseline Value	0	
Way of monitoring	How	measured
	Frequency	3 years
	By whom	Intervention Implementer´s records, in cooperation with the local constituency (local census, local survey)
Project Value	600	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	4	
Indicator Name	Education	
Domain	Growth and development	
Parameter Name	Schools electrified	
Baseline Value	0	
Way of monitoring	How	Mini grid connection and electricity provision contract between the Intervention Implementer and the School
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	1	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	5	
Indicator Name	Income generation/expenditure reduction/Balance of payments	
Domain	Economic	
Parameter Name	New income-generating activities (enterprises)	
Baseline Value	0	
Way of monitoring	How	Mini grid connection and electricity provision contract between the Intervention Implementer and the business, and local survey in cooperation with the local constituency
	Frequency	3 years
	By whom	Intervention Implementer, in cooperation with the local constituency
Project Value	5	
QA/QC procedures	QA	Confirmation of the data in cooperation with the local constituency
	QC check done	Nama Implementer

Serial number	6	
Indicator Name	Income generation/expenditure reduction/Balance of payments	
Domain	Economic	
Parameter Name	New jobs (total)	
Baseline Value	0	
Way of monitoring	How	Nama Implementer´s records on number of internal new employees and reports on numbers of new employees from Intervention Implementers and other relevant stakeholders
	Frequency	3 years
	By whom	Nama Implementer
Project Value	2	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	7	
Indicator Name	Job Creation (number of men and women employed)	
Domain	Economic	
Parameter Name	New jobs for women	
Baseline Value	0	
Way of monitoring	How	Nama Implementer´s records on number of internal new employees and reports on numbers of new employees from Intervention Implementers and other relevant stakeholders
	Frequency	3 years
	By whom	Nama Implementer
Project Value	1	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	1	
Indicator Name	Livelihood of poor, poverty alleviation, peace	
Domain	Social	
Parameter Name	Households having access to electricity services	
Baseline Value	0	
Way of monitoring	How	Data of the local constituency
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	30	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	2	
Indicator Name	Access to clean and sustainable energy	
Domain	Growth and development	
Parameter Name	People with access to RE electricity services	
Baseline Value	0	
Way of monitoring	How	Data of the local constituency
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	180	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	3	
Indicator Name	Empowerment of women	
Domain	Growth and development	
Parameter Name	New women enterprises in the EZ	
Baseline Value	0	
Way of monitoring	How	Energy Zone´s rent/electricity provision contract with the entrepreneur
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	1	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	4	
Indicator Name	Access to sustainable technology	
Domain	Growth and development	
Parameter Name	New sales point for RE&EE technologies	
Baseline Value	0	
Way of monitoring	How	Nama Implementer
	Frequency	3 years
	By whom	Nama Implementer
Project Value	1	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	5	
Indicator Name	Income generation/expenditure reduction/Balance of payments	
Domain	Economic	
Parameter Name	People with new income-generating activities (enterprises)	
Baseline Value	0	
Way of monitoring	How	Energy Zone´s rent/electricity provision contract with the entrepreneur
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	2	
QA/QC procedures		
	QC check done	Nama Implementer

f) Sampling:

For monitoring parameters which are determined using a survey, the approach should follow simple random sampling and the minimum sample size should be determined by the NIA as per the guidelines[1] below:

- Project target population < 300: Minimum sampling size 30 or population size (whichever is the smallest),
- Project target population 300 to 1000: Minimum sample size 10% of group size,
- Project target population > 1000: Minimum sample size 100.

Conclusion

As the global population heads towards 9 billion by 2050, the decisions we make today will lead countries into a growth trajectory that may or may not be sustainable in the future. Care must be taken to ensure that our energy systems, infrastructure, cities, factories and farms are designed, managed, and regulated as efficiently as possible to wisely use natural resources while supporting the robust growth developing countries still need. Economic development during the next decades will continue to focus on poverty reduction and improving access to health, education, and infrastructure services. It is in this context that NAMAs must provide a direction for countries to make farsighted policy changes that acknowledge natural resource constraints and enable the world's poorest and most vulnerable to benefit from efficient, clean, and resilient growth. NAMA concepts that put an emphasize on transformative change for resilient, inclusive development can help countries acknowledge that like other forms of capital, natural assets are limited and require accounting, investment, and maintenance in order to be properly harnessed and deployed.

The application of a tool that allows for precise and transparent MRV of sustainable development impacts, will allow policy makers to monitor the progress of SDGs at national level, improve the ability of a NAMA to contribute to a country's national sustainable development priorities and encourage NAMA implementers to put an emphasize on green growth and development.

References:

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[1] The sampling approach is based on the Gold Standard methodology: http://www.goldstandard.org/wp-content/uploads/2013/11/GS-simplified-micro-scale-cookstove-meth.pdf

1.3 NAMA integrated "MRV + M&E" system to track transformational impacts for NAMA implementation

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Introduction

What distinguishes a transformational NAMA

A transformational NAMA is a NAMA that brings a paradigm shift in how a sector operates, which in turn defines the fate of old and new companies in this sector. The key impact of this transformation is a radical transition to lower-carbon technologies and practices. But these innovative approaches deployed through the NAMA can contribute massively to other sustainable development and economic competitiveness priorities besides and beyond GHG emission reductions. Transformational NAMAs should therefore bring in additional positive impacts, usually referred to in the NAMA context as 'SD benefits' or 'co-benefits'.

The transformational NAMA should involve a structural change that alters the interplay of institutional, cultural, technological, economic and environmental dimensions of the sector, unlocking new development paths, social practices, and worldviews.

For those who are involved into NAMA design, we suggest undertaking the following steps to ensure that a NAMA has transformational impact and to facilitate its transition towards implementation:

- Understand the key domestic policy objectives that the NAMA implementation would support and contribute to (highlighting the fact that "N" in NAMA stands for "national", and "A" stands for "appropriate");
- Identify and describe existing needs, challenges and problems to achieve those key policy objectives, and define the mitigation actions and enabling activities that will be required within the scope of the industries/sectors that will be covered by the NAMA;
- Identify and describe potential social, economic and environmental co-benefits that the NAMA will bring along with GHG emission reduction targets;
- Find out who would benefit from the NAMA (NAMA beneficiaries), and describe the level of importance of such benefits for them, i.e. in terms of the perceived willingness of these NAMA beneficiaries to pay to create or receive such benefits (e.g. through setting up policies, regulations, providing technical assistance, etc.);
- Describe what kind of incentive system would be required to create sufficient motivation to implement the NAMA; and
- Define the key performance indicators (KPIs)/metrics to measure NAMA's success and establish for this purpose an integrated measuring, reporting and verification plus monitoring and evaluation (MRV + M&E) system.

The importance of NAMA co-benefits

The policy objective of line ministries that are involved into NAMA design and operation is often largely unrelated to climate mitigation, same as the business purposes of companies operating in the targeted sector (i.e., potential NAMA implementers). However, the impacts of climate mitigation actions in the sector could have a number of benefits that may be very relevant and positive for them. For example,

actions that increase energy efficiency and thus reduce the consumption of coal can improve country' s energy security (from the perspective of policy makers), reduce local air pollution (from the perspective of local people and environment agencies) and lower production costs (from the perspective of companies and consumers of the manufactured goods).
From the view of non-climate related NAMA stakeholders (i.e., a line ministry managing the NAMA; a private industry player; or the local authorities and communities), who are usually not familiar with the international climate policy process and nomenclature, a NAMA should therefore be seen mainly as a means to a (different) end. In order to ensure their buy-in, it is important to show them clearly how a NAMA creates outcomes that are relevant to them: achieving domestic policy objectives, developing new business opportunities, improving living conditions and welfare, etc.
In many cases, the domestic NAMA beneficiaries are unknown in the early phases of NAMA design. They need to be identified as early as possible because they should be involved into the process and might be an important source of financing for NAMA-related incentives. To illustrate this point, Box 1 provides an example of importance of identifying SD co-benefits and potential beneficiaries for a successful (and transformational) NAMA.
For international supporters of GHG emission reduction, SD targets set by the NAMA are becoming similarly important as climate mitigation targets. The Green Climate Fund (GCF) or NAMA Facility, for instance, provide support only to those climate projects and programmes that have a broader set of sustainability objectives and higher potential for a paradigm shift or transformational change of the current development model.

Box 1: The importance of identifying NAMA co-benefits and beneficiaries as a means to create a successful NAMA

An assessment of non-climate related impacts associated with mitigation actions under a (future) NAMA within the Waste Sector of Bangladesh (recycling, composting of organic waste) has been recently completed. It was found that for each ton of CO_2eq saved, an equivalent of 90 USD of direct value could be created as the result of increased agricultural productivity from the conversion and use of organic waste to organic fertilizer.
While responsibility for NAMA design and implementation rests with the Ministry of Environment (responsible for waste), the primary beneficiaries operate under the jurisdiction of the Ministry of Agriculture. As a consequence, it was recommended to integrate the Ministry of Agriculture into the NAMA design process (UNESCAP 2015).

NAMA design elements and NAMA types

NAMA key design elements as per international rules

A systematic, step-wise approach is strongly advisable for designing NAMAs. South Pole Group has developed such a step-by-step NAMA design methodology and condensed it into its 'NAMA Development Toolkit' . The Toolkit has been successfully applied in a wide range of real case studies and NAMA design initiatives, including GIZ-supported NAMA Concept Design for Agricultural and Forestry Sectors in Tunisia, NDF-supported Cement Sector NAMA in Vietnam, UNDP-supported NAMAs for Rural Electrification with Renewable Energy in Gambia and Renewable Energy in Fiji, IDB-supported Agriculture Transport and Cookstove NAMAs in Honduras, and many other cases around the World.

The NAMA Development Toolkit suggests that NAMA design should consist of the following key elements:

- **NAMA objectives, scope, mitigation actions, enabling activities[1] and targets:** its overall objective and scope/boundaries (the economic activities and entities targeted by the NAMA), the mitigation actions and enabling activities to be pursued; the greenhouse gas (GHG) emission reduction and the policy targets (i.e. how the NAMA will contribute to achieving the national policy objectives);
- **NAMA baseline:** assessment of baseline GHG emissions and SD benefits that will be required to draw the business as usual (BAU) and the mitigation scenarios, so appropriate NAMA targets and key performance indicators (KPIs) can be identified for the next steps;
- **NAMA MRV + M&E system:** the integrated MRV + M&E system will measure, report and verify (MRV): (i) the GHG emission reduction impact; (ii) the SD impacts (environmental, economic and social); and (iii) the efficiency of the investment/support (MRV of finance). The NAMA will also have to incorporate a NAMA monitoring and evaluation (M&E) system to track and evaluate: (i) the effectiveness of implementation and the impact of the proposed mitigation actions and enabling activities; (ii) continuous improvement process (CIP) indicators; and (iii) NAMA' s transformational impact; to be in line with the most advanced international best practices;
- **NAMA regulatory and institutional framework:** defines how the NAMA will ensure alignment with domestic policy objectives, the legal and regulatory framework, and the NAMA institutional setup that will define and govern NAMA operations in relation to: a) the entities that are expected to implement mitigation actions, b) the interaction and roles of involved (domestic) government entities to ensure alignment with domestic policy objectives, and c) international supporters. In addition, it describes the set-up, operating model for the NAMA Operating Entity;
- **NAMA financial architecture:** NAMA business plan and incentive structure to encourage a) participation in NAMA related MRV + M&E activities and b) implementation of mitigation actions. Such incentives can include command & control regulation (part of regulatory and institutional framework), financial incentives, market-based approaches (e.g. carbon market schemes). It describes how the provision of incentives is re-financed, disbursed, replenished, how cash-flow is managed and fiduciary and guarantee procedures are set up;
- **NAMA needs assessment/risk management strategy:** technical, institutional, regulatory, policy/political, social and financial needs to reach implementation, with a focus on risk mitigation and contingency plans; and capacity building gap analysis;
- **NAMA implementation roadmap:** work plans, timelines and budgets for each mitigation action, enabling activity, and for the NAMA as a whole;
- **NAMA capacity development strategy:** the capacity building and training plan to close capacity gaps defined above on NAMA operation & management, MRV + M&E system, required policy/regulatory interventions, institutional coordination and UNFCCC reporting, accessing international climate finance and donors requirements to support the NAMA; and other issues.

NAMA type of funding and related regulations

International climate process under the UNFCCC decisions differentiates between two types of NAMA

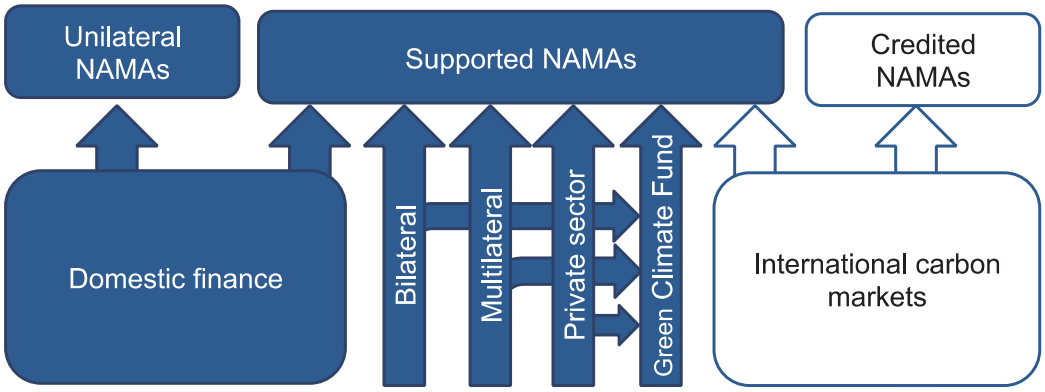
[1] By **mitigation actions** the authors understand actions that have direct impact on emission reductions (i.e, physical interventions, clean energy technologies, reforestation activities, etc.). Whereas **enabling activities** are interventions that create favorable conditions for the uptake of these mitigation actions (e.g. policies, financial incentives, institutional set-up, MRV + M&E system provision, capacity building or technical assistance measures) that have usually an indirect impact on emission reductions, which is more difficult to measure directly and therefore is treated differently.

funding:

- **Unilateral or domestic NAMAs:** financed solely by domestic sources.
- **Supported NAMAs:** receiving financial, technical and/or capacity-building support from international donors (international development institutions, climate and clean energy funds and facilities, governments of developed countries, foreign banks and foreign private companies). Supported NAMAs typically also include a domestic finance component.

A NAMA can also be integrated with carbon finance instruments, for example New Market Mechanisms (NMM), a concept already introduced -but not yet specified- within the international climate policy process. A NMM approach could be based on existing carbon market models, such as CDM or voluntary carbon market standards, but operated under the regulatory authority of a NMM implementing country. The discussions on NMMs under the UNFCCC are ongoing, and no standards or requirements have been adopted so far.
A NAMA using a market-based mechanism can still be considered a domestic or supported NAMA as long as the carbon credits originated within such a scheme are used to contribute towards the domestic GHG emission target of the NAMA operating country, including targets set for domestic sub-national levels or even at entity level. If carbon credit units are used to contribute to GHG emission targets in other, third party jurisdictions, the NAMA would be referred to as **a "credited NAMA"**.

Figure 1: NAMA types and sources of financing



Source: Adapted from 'Developing Financeable NAMAs: A Practitioner's Guide, IISD, 2013'

A different set of requirements applies to different types of NAMAs because of political demands regarding transparency and accountability act as pre-conditions to receiving international support. For example, supported (and credited) NAMAs may require a comprehensive MRV + M&E system that provides evidence of the flow of funds to mitigation actions and evidence of the impact of implemented actions on GHG emissions, domestic policy objectives and to ensure that a NAMA has transformational impact. The level of detail and complexity of MRV + M&E system largely depends on the expectations of the international donor that is funding the NAMA On the other side, domestic or unilateral NAMAs are able to set their own MRV + M&E requirements, as there are no commonly agreed rules on NAMA MRV. The Table 1 below summarizes the requirements and procedures applicable to NAMA design elements under the different NAMA types.

Table 1: Key requirements and procedures applicable to the different NAMA types in relation to NAMA design elements

NAMA elements	NAMA Types		
	Unilateral (domestic)	Supported	Credited
Objectives	Climate mitigation, SD and other objectives aligned with domestic policies.		
Targets, actions and activities	Unconditional sectoral targets. Actions/activities that could be financed domestically.	More ambitious targets, subject to international support, and additional, high-cost mitigation actions that could be co-financed from the international sources. NAMA structure should satisfy requirements of the international donors.	NAMA structure should satisfy requirements of the international donors and allow participation in the international carbon market (i.e. NMMs). This should also be reflected in more ambitious objectives and mitigation actions.
Baseline	Data collection should satisfy international UNFCCC reporting requirements.	Baseline projections should include supported mitigation actions.	Baseline projections should include scenario with the carbon market-based financial mechanism.
MRV + M&E system	MRV + M&E system under domestic rules[2].	Need to meet requirements of international supporters, usually linked to international standards or best practices. This goes beyond MRV of GHG ER to cover SD co-benefits, financial flows[3] ; and M&E system to track progress, performance, and transformational change.	Need to meet requirements of international carbon markets, which are usually linked to the international standards and mechanisms (such as CDM, VCS, Gold Standard, and such). The MRV of GHG ER will have to be complemented by MRV of SD co-benefits, financial flows; and an M&E system to track progress, performance, and transformational change.
Regulatory & Institutional framework	No need for an entity that would manage the international support and report to international donors.	Requires an entity that would coordinate and manage the international support and report to international donors.	Requires an entity that would operate the international support and report to international donors, and regulatory & institutional framework for the carbon market mechanism.
Financial architecture	Sources: ・Domestic public and private.	Sources: ・Domestic public and private ・International private ・International multilateral and bilateral public finance.	Sources: ・Domestic public and private ・International private ・International multilateral and bilateral public finance ・International carbon markets under UNFCCC or bilateral agreement.

[2] Domestic guidelines -- The guidelines intend to provide general, voluntary, pragmatic, non-prescriptive, nonintrusive and country-driven guidance on their design and implementation (1/CP.16 and 2/CP.17); "…Developing Country parties are encouraged to utilize existing domestic processes, arrangements, or systems; otherwise, they may wish to voluntarily establish domestic processes…" (FCCC/CP/2013/10/Add.2)

[3] "...Supported NAMAs will be subject to international measurement, reporting and verification in accordance with guidelines adopted by the Conference of the Parties..." (Copenhagen Accord, 2/CP.15)

Needs assessment, Risk management	Basic needs/risk assessment procedure.	Additional assessment of needs and external risks related to receiving international finance.	Needs/risks related to linking a NAMA with the international carbon market should be analysed. Projects supported through crediting mechanisms should have risk mitigation strategy as per international requirements.
Implementa-tion roadmap	A roadmap will include only mitigation actions and enabling activities that could be financed through domestic sources.	A roadmap should include implementation of actions that require international support, setting up necessary framework and readiness activities.	A roadmap should entail phased introduction of carbon market mechanisms and readiness activities.
Capacity development strategy	Basic capacity development strategy.	Additional capacity development activities (e.g. on preparing proposals for foreign donors, foreign technical assistance, etc.).	Additional capacity development activities on establishing, operating and participating in the international carbon market.

Source: Authors' own elaboration

Before taking a decision about suitability of one NAMA type over others in a specific context, it' s important to assess what drives such suitability. The arguments should include:

- **Administrative feasibility:** is the sector able to meet the expectations of the international supporters (i.e., with regards to the level of scrutiny of the MRV + M&E system)?
- **Availability of funds:** availability of domestic funding and possibility to incentivise domestic private finance vs. availability and requirements of international donors to fund mitigation actions.
- **Governance:** the implications of operating a supported NAMA is that NAMA supporters will demand a participation in the oversight of a NAMA under their requirements, and the question is whether this is acceptable for the sector and government entities on the national and provincial level.

In reality, it is not easy to make a clear distinction between different NAMA types. For example, NAMA design and readiness stages can be funded internationally, while implementation should be financed (at least in a very significant proportion) from national (public and private) sources. Most often, the same NAMA has both unilaterally-funded and supported elements, as finance comes from various donors interested in supporting specific NAMA interventions. In our view, it' s better to differentiate at the NAMA design stage which elements, mitigation actions and enabling activities can be financed domestically and which will need additional international support.
In order to attract finance from foreign sources, domestic buy-in, commitment and action are essential. International donors will be more interested in projects that have strong political support and are co-financed from domestic sources or projects that are already at advanced stages of development (this is a key criterion of the NAMA Facility or the Green Climate Fund, for instance). They would be more willing to support specific NAMA elements and enabling activities, usually around the technical assistance aspects and components (for example, the cost of setting up the MRV + M&E system, the NAMA operating unit, the cost of delivering capacity to the national stakeholders, to establish certain mitigation levers with MRV-able SD benefits, etc.) instead of financing the NAMA as a whole.

How to present the NAMA concept to different stakeholders

The term and concept of a NAMA is very technical and has a meaning only to the participants of the international climate negotiations, which is typically limited to a few officials of ministries of environment involved into the UNFCCC process. At the same time, NAMAs are developed and implemented within key economic sectors that are administered/governed by line ministries, with no or very little exposure to the international climate change talks. Mitigation actions are implemented by companies that are even further away from this international climate policy process.

Therefore, for non-climate related stakeholders it' s better to explain the idea of a NAMA in a simple and business-oriented way. For this audience, more familiar with a business plan format, South Pole Group has designed the so-called NAMA Opportunity Canvas. It addresses all NAMA design elements and provides a very clear communication that is suitable to creating the "buy-in" of relevant stakeholders in relation to their willingness to participate in NAMA design and eventually implementation.

Below is a generic table that shows how such NAMA Opportunity Canvas could be designed.

Table 2: Generic NAMA Opportunity Canvas

<table>
<tr><td colspan="2">What are the key domestic objectives, problems, needs or desires that are to be addressed?
Which national policy objectives fall into the scope of a NAMA?
What are the key impacts to the national policy objectives that a NAMA can make?</td><td colspan="2">Who is responsible for providing solutions (prioritize those for whom this is the most central/ important)?
Who will be willing/able to pay to have NAMA in place?
Who are the key NAMA beneficiaries?</td></tr>
<tr><td colspan="4">What is the proposed design of a NAMA (in terms of providing a solution to solving these problems/ contributing to achieving these relevant policy objectives?
How NAMA elements should be designed;
Creation of incentive mechanisms: a new solution to organise the transfer of resources from those who benefit to those who produce the impact;
Financial mechanism/architecture using results-based approach (money for impact);
NAMA MRV + M&E system, KPIs;
Demonstrate the mitigation benefit of a NAMA.</td></tr>
<tr><td colspan="4">What resources and capabilities would a NAMA operating entity need to implement this solution (within a NAMA framework)?</td></tr>
<tr><td>Which resources and capabilities exist already?
Assess current policy, regulatory, institutional capabilities and financial resources available for NAMA against NAMA requirements.</td><td>What resource and capabilities can be added internally?
What are the functional requirements of a NAMA operating entity?</td><td colspan="2">What resource and capabilities need to be provided by domestic and international partners?
Which measures should be taken to close policy, regulatory, institutional and financial gaps?
Who will implement these measures and provide financial and technical support?</td></tr>
<tr><td colspan="2">What are the costs of operating?
NAMA budget (cost of NAMA actions and activities to achieve the set objectives).</td><td colspan="2">What are the key sources of revenue?
NAMA financial architecture including domestic and international sources of finance (state budget, funds, international donors, user fees, etc.).</td></tr>
<tr><td colspan="4">What are the measures of success and how are they measured and reported?
Identify KPIs (established with the context of designing the MRV + M&E system).</td></tr>
</table>

Source: South Pole Group 'NAMA Toolkit 2.0', 2015

To present a NAMA for climate-savvy audience (climate policy experts and broad international climate community, including potential donors), we recommend to use a more technical NAMA Outline template (see below), also designed by South Pole Group. NAMA Outline template is a summary sheet that briefly describes main NAMA design elements and building blocks. It can be adapted to specific requirements of a potential donor.

Table 3: NAMA Outline template

NAMA Title	
Objective:	
Summary	
Structure	NAMA objectives: linked to national SD policies NAMA scope: boundaries of the program NAMA mitigation actions, enabling activities and related objectives
Eligibility criteria	
NAMA targets	
Integrated MRV + M&E system	SMART KPIs for: GHG ER; SD impacts; finance; implementation progress, CIP, and transformational change.
Baseline and Mitigation Scenarios	
Institutional & regulatory framework	
Financial architecture	
Needs assessment / Risk management	
Implementation roadmap	
Capacity development strategy	

Source: South Pole Group 'NAMA Toolkit 2.0' , 2015

Integrated NAMA MRV + M&E system

Setting up a credible, accurate and comprehensive MRV + M&E system is one of the key design elements for achieving an effective NAMA. It is critical for the following reasons:

- MRV + M&E system enables tracking the effectiveness of the NAMA, which in turn allows to fine-tune its design by addressing the gaps at implementation stage.
- MRV + M&E system provides a third party, reliable, transparent and independent verification of impacts (GHG emissions reduction, SD co-benefits, transformational change) that can be trusted by the partners and donors.
- MRV + M&E system ensures the alignment of the NAMA with the country GHG emissions reduction, SD and policy targets, and allows estimating how much the NAMA is contributing to them and how it is bringing the required transformational change within the sector.

The objective of MRV + M&E system is to define a set of targets, key performance indicators (KPIs), and describe the related monitoring, reporting, and verification (MRV) plus monitoring & evaluation (M&E)

procedures for tracking the progress against them. KPIs will have to follow as much as possible the SMART principles and be[4] :

- **S**pecific – define clearly what to measure,
- **M**easurable – measure the actual value and compare it to the set targets,
- **A**chievable – motivate to reach the targets that are possible to reach,
- **R**elevant – contribute to the assessment of the overall NAMA performance,
- **T**ime phased – linked to a certain time period.

MRV + M&E of NAMAs, whether unilateral or internationally supported, is a part of international requirements. However, the system requirements and level of detail and stringency might vary depending on the main source of funding, as it was shown in Table 1 above.

NAMA elements under MRV + M&E system

A starting point for setting up a comprehensive MRV + M&E framework for a NAMA is to figure out what to be measured, reported and verified / monitored and evaluated.
Most NAMA design concepts to date have a "narrow" understanding of the MRV system. They include only MRV of GHG emission reductions complimented with (often, but not always) MRV of SD impacts of mitigation actions and MRV of finance (tracking of NAMA support flows), as suggested, for instance, in GIZ MRV Tool[5] .
In our understanding, NAMA developers should go beyond a mere MRV to a comprehensive MRV + M&E system. A NAMA (especially transformational NAMA) requires also a monitoring & evaluation (M&E) framework that can track its implementation progress, continuous improvement and transformational impact.
The MRV + M&E Tool, which is a part of South Pole' s NAMA Development Toolkit, allows the user to track the following 6 key aspects of NAMAs:

1. MRV of GHG emissions and emission reductions (MRV of GHG ER);
2. MRV of sustainable development benefits (MRV of SD benefits);
3. MRV of support (M&E of finance);
4. M&E of NAMA implementation progress;
5. M&E of continuous improvement processes (CIP);
6. M&E of transformational change.

MRV of GHG emission reductions

There exist a lot of information, guidelines and methodologies on how to MRV GHG emissions and their reductions for various sectors, for example guidelines of the Intergovernmental Panel on Climate Change (IPCC)[6], CDM methodologies, and voluntary carbon methodologies[7] . Even though the NAMA aspects of GHG ER MRV may have a higher degree of flexibility than usual CDM-like MRV, and some specific provisions regarding the reporting to UNFCCC or third-party independent verification will have to be

[4] http://www.lltcorp.com/content/kpi-s-m-r-t-rule

[5] GIZ, (2013), MRV Tool: How to Set Up National MRV Systems, Draft 4.1. Retrieved from the website of International Partnership for Mitigation Momentum: http://mitigationpartnership.net/sites/default/files/u1585/mrv-tool-20-10-2014.pdf

[6] Available at: http://www.ipcc-nggip.iges.or.jp/public/index.html

[7] South Pole Group is the world' s leading carbon project developer, having achieved over 30 million of CO_2eq emission reductions under a variety of standards, which in turn makes it one of the most advanced company in relation to MRV services and technologies related to GHG ER.

defined specifcially under the NAMA context, there is relative clarity of what this would involve. On the other side, however, not much has been said about a concrete way of assessing other NAMA impacts beyond carbon reduction, which in turn results in negligence of these impacts in NAMA design, or weaker indicators and MRV system provisions. The sections below will therefore focus and provide more details on how an integrated MRV + M&E system should track the non-GHG related components of the NAMA.

MRV of sustainable development co-benefits

Measurement and reporting of the sustainability benefits is essential to assess NAMA's transformational impact. Moreover, sustainable development co-benefits of a NAMA can be a decisive factor for international donors and domestic policy makers in prioritizing NAMAs for financing and implementing. A few methodologies exist to track SD benefits of mitigation actions, for example Gold Standard SD Matrix[8] or CDM SD Tool[9]. However they have certain limitations when applied for a NAMA. The most comprehensive methodology, which has been recently developed by South Pole Group for UNDP and aimed specifically for NAMAs, is the NAMA Sustainable Development Tool (NAMA SD Tool[10]). It has been designed to assist NAMA developers and policy makers to evaluate the sustainable development performance indicators and sustainable development results achieved over the lifetime of the NAMA. The NAMA SD Tool can also help to demonstrate to external parties a level of commitment and NAMA impacts in relation to co-benefits, and to give donor institutions confidence that their support is being utilized effectively.

The indicators in the tool are linked to Sustainable Development Goals (SDGs) and are grouped under four domains: 1) environmental conservation, 2) economic opportunities, 3) growth and development and 4) social welfare. The SD benefits are identified and broken down across the specific impacts for each of the domains. Then for each impact the relevant parameter or measuring indicator is defined, as well as its relative importance, to evaluate the co-benefits of each intervention for a specific monitoring period. This allows to establish a baseline, a BAU scenario, and a "high impact" scenario for each indicator. Target values can be set for each impact in relation to specific NAMA activities to be able to monitor, report and verify the achieved results and how they compare to the targets.

Using the NAMA SD Tool, NAMA developers can choose the indicators that are most relevant to their domestic policy objectives, to the type and nature of the desired mitigation actions, and to various factors affecting the practicality and feasibility of MRV activities.

The tool is universal and standardized yet flexible enough to ensure compatibility and adaptability across a variety of possible NAMA designs and national development goals. It has already been proven in a number of NAMA design projects, including NAMA for Rural Electrification with Renewable Energy in Gambia[11], Energy Efficiency NAMA in the Garment Industry in Cambodia[12] and NAMA for Rural Development in Namibia[13]. Figure 2 shows how SD impacts of mitigation actions and their MRV are

[8] Gold Standard, (2011), Guidance on Sustainability Assessment. Retrieved from: thttp://www.goldstandard.org/wp-content/uploads/2011/10/Annex_I.pdf

[9] CDM Sustainable Development Tool: http://cdmcobenefits.unfccc.int/Pages/SD-Tool.aspx

[10] South Pole, UNDP, (2014), Sustainable Development Tool. Retrieved from: http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMA-sustainable-development-evaluation-tool.html

[11] UNDP, South Pole Group, (2015), NAMA Design Document for Rural electrification with Renewable Energy in the Gambia. Retrieved from: http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/MDG%20Carbon%20Facility/The%20Gambia%20NAMA%20final%202.pdf

[12] UNDP, (2015), Energy Efficiency NAMA in the Garment Industry in Cambodia. Retrieved from: http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/MDG%20Carbon%20Facility/Cambodia%20NAMA%20final.pdf

[13] UNDP, (2015), NAMA Rural development in Namibia through electrification with Renewable energies. Retrieved from: http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/MDG%20Carbon%20Facility/NAMIBIA_final%20NAMA.pdf

reflected in the tool.

Figure 2: A snapshot of suggested MRV for selected SD impacts in NAMA SD Tool (example of Renewable Energy NAMA in Gambia)

Serial number	3	
Indicator Name	Biodiversity & Food Security	
Domain	Environment & Social	
Parameter Name	Types of crops	
Baseline Value	0	
Way of monitoring	How	HH survey / National census
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	2	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	4	
Indicator Name	Biodiversity	
Domain	Environment	
Parameter Name	Number of threatened Species/Habitat	
Baseline Value	80	
Way of monitoring	How	Forest Maps/GIS Images
	Frequency	3 years
	By whom	Intervention Implementer
Project Value	50	
QA/QC procedures		
	QC check done	Nama Implementer

Serial number	5	
Indicator Name	Health	
Domain	Social	
Parameter Name	Avoided gas explosions or fire burns	
Baseline Value	1000	
Way of monitoring	How	
	Frequency	HH survey / National census
	By whom	Intervention Implementer
Project Value	500	
QA/QC procedures		
	QC check done	Nama Implementer

Source: South Pole Group for UNDP, 2015

One should keep in mind, however, that the MRV of non-GHG related impacts can impose further burdens and extra costs on those involved into NAMA design and operation. In Vietnam, for example, stakeholder consultations for developing the cement sector NAMA showed that the cement plants and the key line ministries don' t have enough motivation and capacity for monitoring and reporting additional, non-GHG related data. They consider adding non-GHG impacts in general and especially SD benefits to NAMA sector-level and entity-level MRV as a burden that should be avoided or at least minimized.

This barrier should be taken into consideration when designing an MRV + M&E system for the NAMA. Special awareness raising activities for NAMA actors to explain the importance of including co-benefits into NAMA design and capacity development measures for their MRV should be taken. Eventually policymakers have to provide various incentives for the sector to implement mitigation options in a way that harnesses SD benefits and provide incentives to report data not only on GHG emission reductions, but on SD impacts as well.

MRV of support (M&E of finance)

MRV of support is related to measuring, reporting and verifying flows and effectiveness of provided financial resources, technology transfer and capacity development activities for a NAMA. MRV of support is necessary to:

- keep track of contributions for a NAMA, their delivery and spending;
- build trust among NAMA supporters, including private sector, through improved transparency and

accountability of NAMA financial flows;
- provide a clearer overview of support flows, trends, sources, and purposes.

There are no international requirements for MRV of support yet. Indicators are usually determined by the type and nature of support and the donor's requirements, either domestic or international. Based on our experience, MRV of support should include information on:

- forms of support (finance, capacity development, technical assistance, technology transfer),
- purpose of support (specific NAMA mitigation actions or enabling activities),
- scale of contributions, their sources and instruments;
- disbursement of support, scale, channels and instruments;
- effectiveness (cost-benefit impacts in relation to GHG mitigation and SD benefits and leverage effect for catalysing domestic private finance). South Pole Group' s approach is to use a set of KPIs developed around result-based finance consideration. Verification of support effectiveness should involve comparing MRV data from contributors and recipients of support.

M&E of NAMA implementation progress

To measure the progress of NAMA implementation, a set of KPIs tracking 1) policy-level objectives, 2) the level of uptake/implementation status of specific mitigation actions and readiness activities and 3) setting up NAMA framework has to be developed.

Tracking overall NAMA objectives

KPIs should relate to the high-level objectives of the NAMA, which are usually linked to the existing policy targets. Examples of such KPIs include: new renewable energy installed capacity, MW (for a renewable energy NAMA); share of alternative fuels in the total energy mix, % (for an industrial sector NAMA); total forest cover, % (for a forestry NAMA).

Tracking individual NAMA mitigation actions and enabling activities

The implemented actions/activities under the NAMA must be assessed against what has been planned. The KPIs will help to measure more precisely how the set targets linked to NAMA actions and activities are achieved. Indicators can be quantitative or qualitative (but ideally should follow the SMART rule). For example, if the NAMA is about creating solar plants and bridging capacity, KPIs will be linked to "x plants built and operational" and "y workshops carried out" or "average score after the workshop completion on the technical test is z% higher than before taking it".

Tracking establishment of NAMA framework

The progress in setting up a supporting NAMA framework should also be measured. For example, the establishment of a NAMA Operating Entity can be assessed through such indicators as staffing and funding of the NAMA entity, or through a capacity/skills assessment of the NAMA entity staff. To show the degree of advancement in setting up the MRV + M&E system, NAMA developers can use the parameters evaluating a number of monitoring sites, templates for the reporting system, verification process, operation of knowledge management/IT system, etc. To show the level of uptake of a given incentive, or the level of replication or scale-up of the mitigation actions, of course, an effort on data retrieving and management will be needed.

M&E of continuous improvement processes (CIP)

The MRV + M&E system can also serve the purpose of tracking if the NAMA implementation

is continuously improving. To be able to do that, there should be KPIs that can track that the implementation of a NAMA becomes progressively more effective. This means that, over time, a NAMA will have to create more impact in terms of GHG emission reductions and SD benefits for the same amount of finance provided, or in less time. This is part of the continuous improvement process (CIP) methodology and management system.
It is worth mentioning that beyond improving the efficiency, speed or volume of the NAMA implementation, the MRV + M&E system itself can also be continuously improved throughout NAMA implementation as per the following examples (GIZ, 2013):

Measurement/Monitoring:
- Increasing efficiency of data collection and processing;
- Measuring new data previously not available;
- Improving methodologies for measuring;
- Revising baseline assumptions.

Reporting:
- Improving efficiency through developing standardized tools and guidelines.

Verification
- Developing an improvement plan based on the feedback from NAMA participants and third party reviewers;
- Developing QA/QC procedure to improve cost and time efficiency of verification.

M&E of transformational change

M&E of transformational change is important to evaluate how the NAMA is indeed bringing a paradigm shift/transformational impact across the sector where it is being developed and ultimately implemented. Transformational change is a process that happens across multiple dimensions of a given system (in this case, the NAMA sector). As we have seen, some NAMA elements, e.g. GHG emission reductions, the economics dimensions and some ecological aspects, can be measured quantitatively; others can best be described in qualitative terms, e.g. rules, roles and power relations within the institutions or like how people perceive the new mitigation solutions, what NAMA co-benefits they believe are important to them (BEPA, 2011).

Thus, transformational change involves not only changes in the outcomes, but also changes in the processes with which these outcomes are achieved and how people perceive and therefore support (or reject) such changes; the feedback loops and path dependencies that impact how stocks and flows of the system are connected and influence its behaviour. Without identifying and controlling these intangible drivers, the NAMA intervention will likely not generate the intended transformational impact and might also run into unexpected barriers, resistance, or generate unintended side-effects.
As a consequence, transformational change of the NAMA can be measured only in part, and should also be qualitatively assessed across the following three dimensions:

- Technical-economic-ecological aspects,
- Socio-political aspects,
- Cultural and behavioural aspects.

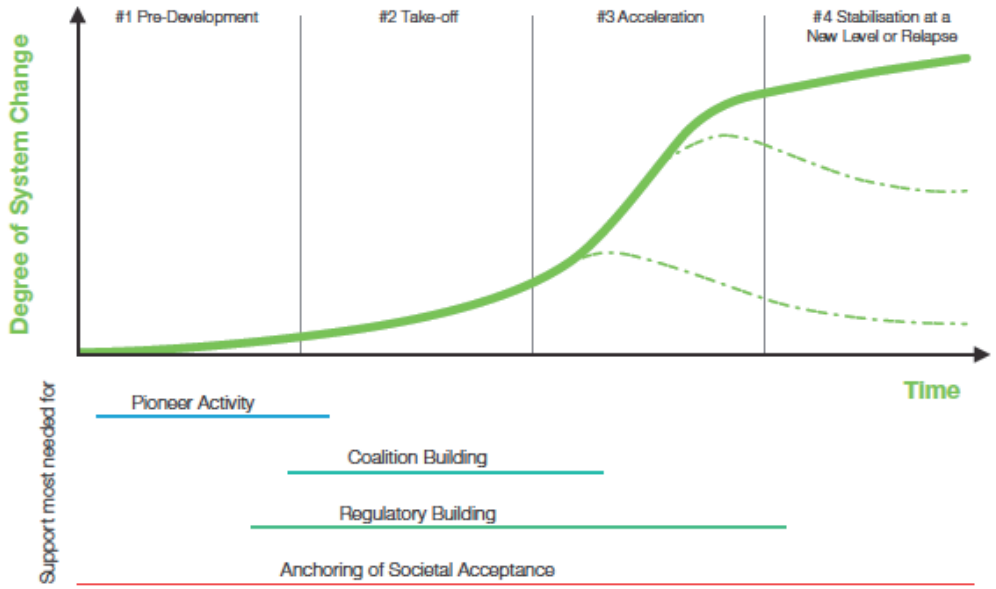
The indicators for the assessment (especially socio-political and cultural) will have to be defined in

accordance to the specific NAMA context. They can describe such aspects as the intensity of change, drivers of change and time frames for change.
South Pole Group recommends the use of 3 tools to assess, track progress and actually carry out transformational change:

1. **Systems analysis and mapping.** It's a set of maps that have to be drawn around the proposed intervention and before it takes place, then fine-tuned after the piloting and carried through full-scaled operation. Examples of such maps include:
   - NAMA institutional set-up organigrams – the current arrangements ("as is") vs. recommended ("to be"),
   - NAMA financial architecture map,
   - NAMA risk management matrix that identifies the core problems, barriers and challenges, and defines a strategy to overcome them,
   - Casual loop system map describing cause and effect relationships and dynamics of the intervention.

   Systems analysis requires close involvement with a wide range of stakeholders to build a shared understanding of the nature and dynamics of the intervention, to ensure the quality of the overall NAMA design and to stimulate organizational as well as individual learning processes, which are all prerequisites to unlock a true paradigm shift in the sector.
2. **Phase model.** It's a visualization tool for identifying the state of the system you want to change (i.e. the sector in which NAMA is to be implemented), assuming that the intended intervention (i.e. the NAMA) should be geared towards transforming development approaches into sustainable, specifically low-carbon and resilient pathways.
   The phase model is helpful especially for structuring and facilitating group discussions, to develop and agree on common views, particularly in relation to identifying the current state and the direction of the intervention progress. It builds on the assumption that every transformative process a system undergoes can be depicted as a (stylized) S-curve, that could be broken down into phases (which are not incremental steps, but rather overlapping and continuous phases of a process). The phase model can help to identify appropriate actions that correspond to the specific aspects of different phases of transition processes.
   The phase modelling should be carried out in close relation and right after systems analysis. It is proposed therefore to be included as an additional item to be discussed openly through the same consultative process and with the same periodicity as the system analysis and mapping exercise described above, and as an integral part of the NAMA Stakeholder Engagement Strategy.

Figure 3: Phase model



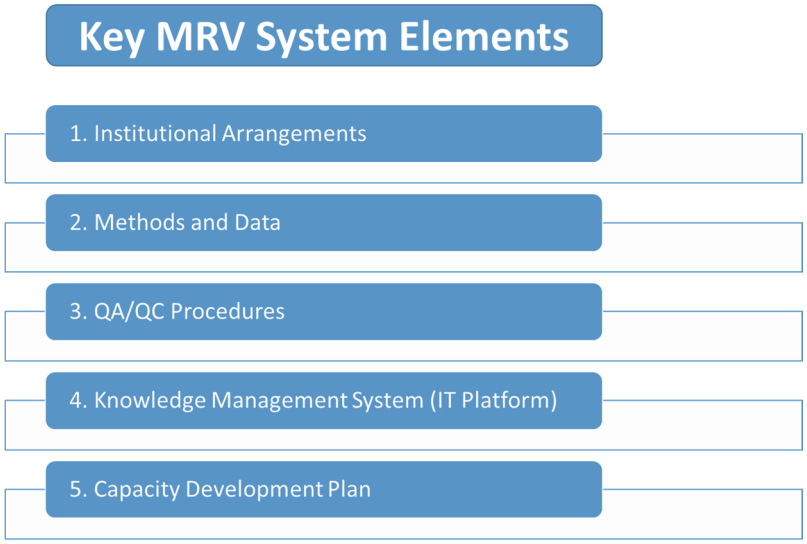
Source: UNDP-DTU Partnership, 2014, adapted from other sources

3. **Backwards mapping.** The backwards mapping is a process planning tool that uses a Theory of Change (ToC) approach to allow for a comprehensive, holistic and multi-stakeholder methodology for strategic planning, monitoring and evaluation. At the outset and at the heart of a ToC analysis is the definition of the "big picture", a long-term vision or goal of what is ultimately to be achieved. Then, working backwards from this goal, pathways to reach that goal are outlined (this process is called "backwards planning" or "backwards mapping"). The tool breaks down long-term vision into more immediate, concrete actions, developing a portfolio of activities and actions over a timeline, but goes beyond the typical logical framework approach and tries to reflect synergies and interactions across activities and their joint contribution to the common overarching objective. This tool therefore facilitates the identification of collaborative approaches with other development organizations, government agencies or other stakeholders, which are crucial elements in the context of NAMAs.
   South Pole Group usually proposes to carry out the backwards mapping at the end of the NAMA piloting phase to define the specific programming of each NAMA implementation phase. This exercise should be repeated at the end of each implementation phase to facilitate and inform the programming of the next period.

Key components of the MRV + M&E system

The key components of MRV + M&E system are summarized in the following Figure 4. Although it is derived from an inventory workbook, so it' s focusing on the MRV of GHG ER, it could be equally applicable for a more comprehensive MRV + M&E system that involves and takes into account all the aspects and considerations that we have included above.

Figure 4: Key components of MRV system



Source: Authors adaptation based on USEPA, 2011

Institutional arrangements

A comprehensive NAMA MRV + M&E system will require integration of data from a variety of public and private sector institutions. Therefore, institutional arrangements for MRV + M&E system should:

- Formalize system for data collection and QA/QC procedures, including roles and responsibilities of entities;
- Build-in country institutional and technical capacity;
- Ensure institutional memory and long-term sustainability of MRV + M&E framework and enhanced efficiency of the processes;
- Meet UNFCCC reporting requirements.

In our view, for countries with the complex institutional landscape, the most efficient approach is when a line ministry in charge of operation of a specific sectoral NAMA is responsible for collecting data and drawing up an inventory of activities coming within its responsibility. At the same time, there is an overarching country-level entity that defines standard reporting rules aligned with the international (UNFCCC) reporting requirements, supports line ministries and collects information from for them for the National Communications and Biennial Update Reports (BURs) and then submits these reports to UNFCCC.

In Indonesia, for example, Ministry of Environment is responsible for coordinating the preparation of GHG emissions inventories and developing guidelines and methodologies of MRV of mitigation actions. At the same time, each ministry is responsible for the monitoring of data for the respective NAMA. The Help-Desk of the Climate Change National Coordination Team – the inter-ministerial body coordinating climate change mitigation and adaptation actions in the country – provides technical support to line ministries, as well as to the representatives from subnational government agencies for the sector-level NAMA MRV.

Methods and data

The guidance and methodology for preparing the national GHG emissions inventory is available in the form of IPCC guidelines for various sectors. The methodology for MRV + M&E of other, non-GHG related impacts of a NAMA is explained in previous section. Based on national circumstances, countries are encouraged to use whatever methods are available and appropriate. The methodology will define the scope/boundary, key metrics/indicators for baseline setting (ex-ante) and subsequent monitoring (ex-post).

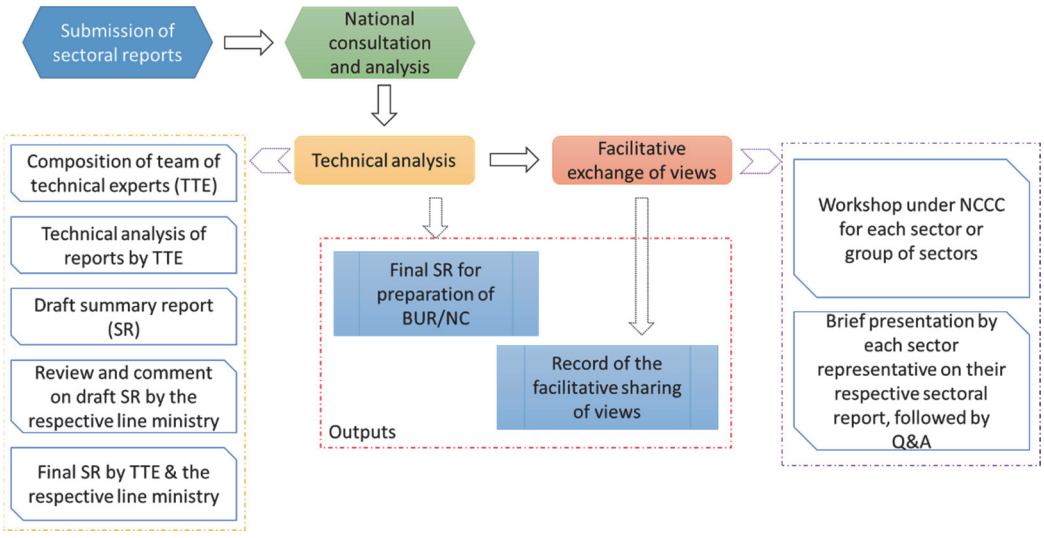
QA/QC procedures

The QA/QC procedures encompass the reporting and verification requirements. They should include, but not limited to, the following aspects:

- Data gathering, input and handling measures;
- Data documentation;
- Calculations;
- Methods and assumptions,

A country could consider organizing a wide public consultation process. In addition to a web process (where national – and potentially international – stakeholders could provide written comments), public sessions could be held in different parts of the country in order to ensure participation as wide as possible (this would be the national version of the facilitative exchange of views).

Figure 5: QA/QC process for national MRV system



Source: Authors adaptation based on UNFCCC, 2014

Knowledge management system (IT platform)

In order to ensure proper management of the vast quantity of data involved in the MRV + M&E process, an IT-based knowledge management system will be required. An IT platform will:

- Aid the collection and transfer of data/information across entities and geographies;
- Ease the performance of QA/QC function;
- Expedite report preparation;
- Enable archiving of data/information; and
- Facilitate access to the relevant stakeholders.

In countries with different line ministries providing/possessing activity data for different sectors, and many different sectors undertaking different NAMAs, a standardized specification for electronic reporting is advisable. It will enable cost-effective leverage of existing systems and consolidation of monitoring data at the national level.
The European Union faced a similar problem, when their EU ETS was already running in its second phase, and many member states had developed their own IT infrastructure to process the yet to be harmonized MRV cycles. Once the Union decided to progress towards a unified MRV standard and integrated registry, it saw itself confronted with the reality of a fragmented IT landscape and many different systems which were already in place and being used by the different member states. The EU ETS addressed this challenge by defining a standard for electronic reporting, called the EU ETS reporting language.

Capacity development plan

Capacity development is the process of strengthening the abilities of individuals, organizations and societies to make effective use of the resources, in order to achieve their own goals on a sustainable basis. In the context of setting up a national MRV + M&E system and sustaining it would require bridging of the capacity gap through a detailed training plan. This capacity building program will be essential to improve the limited know-how about climate change and related MRV + M&E requirements of the involved individuals and organizations. Further, it also helps its continuous improvement.

Lessons learnt and way forward

- The transformational NAMA should bring a paradigm shift; this is a structural change that alters the interplay of institutional, cultural, technological, economic and ecological dimensions of the sector in which it is being implemented, unlocking new development paths, social practices, and worldviews, and particularly opening up new opportunities for low-carbon, sustainable development in the sector.
- For a NAMA to have the transformational impact, it will be crucial to understand the domestic policy objectives that the NAMA implementation would support, and what additional sustainable development benefits (co-benefits) it can bring to the various stakeholders.
- The importance of NAMA GHG emission reductions and SD co-benefits is not the same for different stakeholders. Companies implementing mitigation actions are mostly interested in economic benefits, therefore various incentives (regulatory, financial, technical support, etc.) will be needed to motivate them to take additional actions that have climate change mitigation and other SD impacts. On the other side, co-benefits could be a key concern for donors, line ministries, local communities and NGOs. Due to these different perceptions, the identification of NAMA co-benefits and who will benefit from them (NAMA beneficiaries) should be undertaken at early stages of NAMA design, and these beneficiaries should be involved into NAMA development and supporting its implementation since the first steps.

- The stakeholder engagement strategy and the presentation of the NAMA concept should be customized and adapted to the various stakeholder groups. In order to receive their buy-in, it will be key to show them clearly how a NAMA creates outcomes that are relevant to them, whether these are achieving domestic policy objectives, developing new business opportunities, improving the living conditions and welfare of the local communities, etc.
- A comprehensive, ambitious yet realistic NAMA that wants to achieve a transformational change in the sector in which it will be developed should have an integrated measuring, reporting and verification plus a monitoring and evaluation (MRV + M&E) system with a set of defined key performance indicators (KPIs)/metrics to track GHG emission and other impacts (SD co-benefits, financial support, implementation progress, continuous improvement, and transformational change).
- Obtaining the data required by an integrated MRV + M&E system usually goes beyond the existing practices of NAMA implementing entities. The gaps in data needs and practices related to MRV + M&E of non-GHG emission impacts are significantly larger than for MRV of emissions. Closing these gaps will require extra resources, skills and commitments from NAMA beneficiaries/users, line agencies, and central coordination entities. This will imply the provision of additional technical assistance, in the form of training, incentives and regulations from the side of authorities to put the proposed MRV + M&E system in place.

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Case studies

2.1 CTCN technical assistance as one of supporting schemes for NAMA implementation – a case study and prospect of further development

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Background

The Climate Technology Centre and Network (CTCN) – the operational arm of the UNFCCC Technology Mechanism – promotes the accelerated transfer of environmentally sound technologies for low carbon and climate resilient development at the request of developing countries (CTCN 2015a). As described in the Second Edition of the NAMA Guidebook (OECC 2015), the CTCN works as one of various schemes which contribute to developing countries in preparing, elaborating, and implementing their NAMAs with regard to climate change technology development and transfer. The CTCN does not provide funding directly to developing countries, but rather aims to support the development and transfer of mitigation and adaptation technologies in developing countries through expert technical assistance (CTCN 2015b). Developing countries could make requests through their National Designated Entities (NDEs) to the Climate Technology Centre (CTC), and responses to those requests would be categorised into a "quick response" (less than USD50,000) or a "response project" (up to about USD250,000) depending on a scale and a scope of each request. The quick response would be provided by the CTC together with its 13 Consortium Partners from all over the world while the response project would be delivered by organisations from the Climate Technology Network (CTN) with supervision of the CTC. There are 62 organisations registered as the CTN members which have various expertise and experiences in addressing climate change mitigation and adaptation, including Global Environment Centre Foundation (GEC), Overseas Environmental Cooperation Center (OECC), Research Institute of Innovative Technology for the Earth (RITE), Japan Environmental Sanitation Center (JESC) and Institute for Global Environmental Strategies (IGES) from Japan as of 20 August 2015 (CTCN 2015c). The CTCN started to receive requests for the technical assistance since early 2014 and there have been 32 requests formally submitted, consisting of 20 mitigation, 9 adaptation and 3 cross-cutting (having components of both mitigation and adaptation) requests (CTCN 2015d). Such information is open to the public in the website of the CTCN while more requests are in the pipeline to be elaborated among the NDEs and the CTC.

How the CTCN and NAMAs are linked

Some noticeable linkages between the CTCN and NAMAs could be found in COP decisions and official documents of the CTCN. The CTCN is designed to take into account NAMAs when it provides the technical assistance as clearly stated in the modalities and procedures of the CTCN elaborated and adapted in the COP19 sited in the Box 1 (UNFCCC 2013).

Box 1: NAMAs in the modalities and procedures of the CTCN

"In performing the functions described in decision 1/CP.16, paragraph 123(a)(i–iii) and (c)(iii), with regard to the management of requests from developing country Parties submitted through their NDEs, the modalities will consist of, inter alia, the following:
(a) Support countries in developing draft proposals into fully articulated proposals, building on their technology needs assessments (TNAs), national adaptation programmes of action (NAPAs), other national climate change strategies including research, development and demonstration (RD&D) related activities, to enable implementation and action, also in the form of nationally appropriate mitigation actions and national adaptation plans, in collaboration with the financial mechanism of the Convention, international financial institutions, and the private sector".

Reflecting upon the modalities and procedures, the prioritization criteria of the CTCN (2013) for responding to requests from developing countries indicates that the Director of the CTCN shall ensure that all requests for assistance approved by the CTCN demonstrate that the support provided will contribute to increased resilience and /or mitigate emissions, and is aligned with national plans, which include NAMAs. The CTCN operating manual for NDEs (CTCN 2015e) also suggests that the NDEs shall coordinate with other national focal points of UNFCCC Mechanisms including National Focal Points for NAMAs, to enhance effectiveness and scope of the CTCN interventions and leverage international funding for adaptation and mitigation activities. Consideration of these other national planning processes would help ensure that the request is in line with national development and climate strategies.

Case study

There is one ongoing CTCN technical assistance to support implementation of NAMAs, which is "Development of a Mechanical-Biological Treatment (MBT) pilot project of the Waste NAMA" requested by Colombia (CTCN 2015d). There are also four technical assistance requests which are at a stage of planning its NAMAs or indicate certain consideration for NAMAs in their requests, namely "Green Cooling Africa Initiative (GCAI)" jointly requested by Ghana, Kenya, Mauritius and Namibia, "Technology Guidance and Support for Conducting the Technology Needs Assessment (TNA)" by Pakistan, "Assessment and identification of technology needs and best practices for reducing the GHG emitting potential of the energy sector in Mauritius" and "Building Capacity for promoting a greenhouse gas mitigation strategy for the proposed power generation facility in Mauritius" both by Mauritius. For a case study in this section, the technical assistance requested by Colombia is selected to illustrate the support provided by the CTCN for concrete implementation of NAMAs.

In Colombia, the waste sector produces 10 million tCO_2e which is equivalent to 5.7% of its total greenhouse gas (GHG) emissions, and such emissions are to grow significantly under the business-as-usual scenario (CCAP 2013). There is also an expectation that economic values of solid waste streams are not fully utilised and thus could be better maximised with various means such as recycling, composting and converting to fuel (CCAP 2013). However, improvement of the situation has been of great difficulty due to an absence of a coordinated national solid waste management policy as well as a city-level action plan for integrated waste management policies in Colombia (CTCN 2014). Given

the issues associated with the waste management as illustrated above, Colombia has been aiming to promote a Solid Waste Sector NAMA so as to transform the waste sector with realising both GHG emission reductions and maximising generation of economic values. This would in turn contribute to Colombia' s national sustainable development objectives.

As a part of the Solid Waste Sector NAMA, introduction of new policies and technologies has been considered, and the Colombian government recognised the Mechanical-Biological Treatment (MBT) technology could effectively address the issues in the sector. The MBT is used to process waste diverted away from landfills and produce commodities such as recyclables, compost and refuse derived fuel (RDF) that could be sold to cement kilns or other industrial consumers to replace fossil fuels consumptions. The use of RDF could contribute to a dual GHG emission reductions benefit by reducing landfill emissions and avoiding emissions from combustion of fossil fuels. With the concrete benefits associated with the introduction of the MBT, the government of Colombia planned three phases to introduce such MBT facilities throughout Colombia – construction of the facility in a city of Cali in the first, in cities of Barranquilla, Medellín and Bucaramanga in the second, and in any other Colombian cities interested in participating in the NAMA in the third phase.

Starting the implementation of the Solid Waste Sector NAMA, the Colombian government has requested the CTCN to conduct the technical assistance to prove the technical and financial feasibility of the selected technology, the MBT as a municipal solid waste (MSW) treatment plant, as a pilot project in Cali, and to help facilitate the implementation of the project. This request from Colombia is one of the most earliest one submitted to the CTCN, and the request was accepted as two-step implementation: the quick response at first and the response project afterwards. In the response plan developed by the CTCN and its partner organisations, the quick response is planned to verify the feasibility of the MBT plant as the alternative MSW management technology for Cali as well as to secure initial sources of funding to implement the project (CTCN 2014). Outputs that this quick response aims to deliver include 1) the verified feasibility of the MBT in Cali, 2) the elaborated institutional, commercial and management structures of deploying the technology taking into account the needs of key stakeholder groups including an informal sector, and 3) the elaborated business model of the installation of the MBT with developing a plan to access finance as well as securing initial sources of funding. After successful completion of the quick response, the response project aims to provide more specific support to the pilot plant installing the MBT technology based on the issues identified within the quick response. The response project also includes activities for capacity building for operational management of the plant, as well as additional studies for facilitating replication and upscaling of such technology to other cities in Colombia for the further phases of the Solid Waste Sector NAMA (CTCN 2014).

As a result of the technical assistance conducted by the CTCN, the response plan expects various benefits including: increased private investments in the MBT technology as an alternative treatment method, strengthened national confidence for the technology, job creation, more efficient waste sector, and a successful model of the alternative waste treatment method to be replicated in the other region (CTCN 2014). This technical assistance is currently under implementation and it is expected that the results and outcomes are not open to the public yet until the evaluation of the project by is finalised. Analysis of such results and the outcomes would be of significant use for upscaling and replication of the project, and the lessons learned should be effectively disseminated as the first NAMA-related technical assistance conducted by the CTCN.

The Way Forward

Since its establishment, the CTCN has been expected as a vehicle to provide technical support for developing countries, and the number of the technical assistance requests to the CTCN has been growing. Therefore the number of the requests to the CTCN associated with implementing NAMAs is also expected to increase significantly in the near future, given the limited number at this stage. With this regard, comprehensive analysis should be made when such type of request is to be increased. Meanwhile, NAMAs might not have been fully recognised by the NDEs in developing countries that are responsible to select, prioritise and in turn submit their requests to the CTCN yet. Given this situation, broader and deeper recognition of NAMAs should be better raised as an important source of information forming their requests. The developing country NDEs would better off by considering if their technical assistance requests are in line with their NAMAs before submitting to the CTCN so as to enhance synergies and coherence among different institutional arrangements for mitigation actions. Also in developing countries there should be stronger consideration on their NAMAs in the identification phase of the requests to the CTCN. These could be addressed with enhanced coordination among the NDEs and National Focal Points for NAMAs in developing countries as suggested by the CTCN (CTCN 2015e). The CTCN side could also make a stronger signal for developing country NDEs to take into account their NAMAs by enhancing its consideration of NAMAs when prioritising mitigation-related technical assistance requested by the NDEs. Promoting such stronger linkages between the CTCN and NAMAs with such measures could enhance effective delivery of implementing NAMAs as well as technology development and transfer globally, and in turn concrete mitigation outcomes would be ultimately achieved.

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2.2 Updates of the Joint Crediting Mechanism

By Makoto Kato
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JCM and NAMAs

As mentioned in the 1st and 2nd edition of the NAMA Guidebook, developing countries have sought various kinds of financial resources and support tools to implement NAMAs, and the JCM has been regarded as important one of them[1]. Also, in the context of capacity building support for preparing for NAMAs, JCM project development have been conducted in several countries to realize the achievement of GHG mitigation planned.

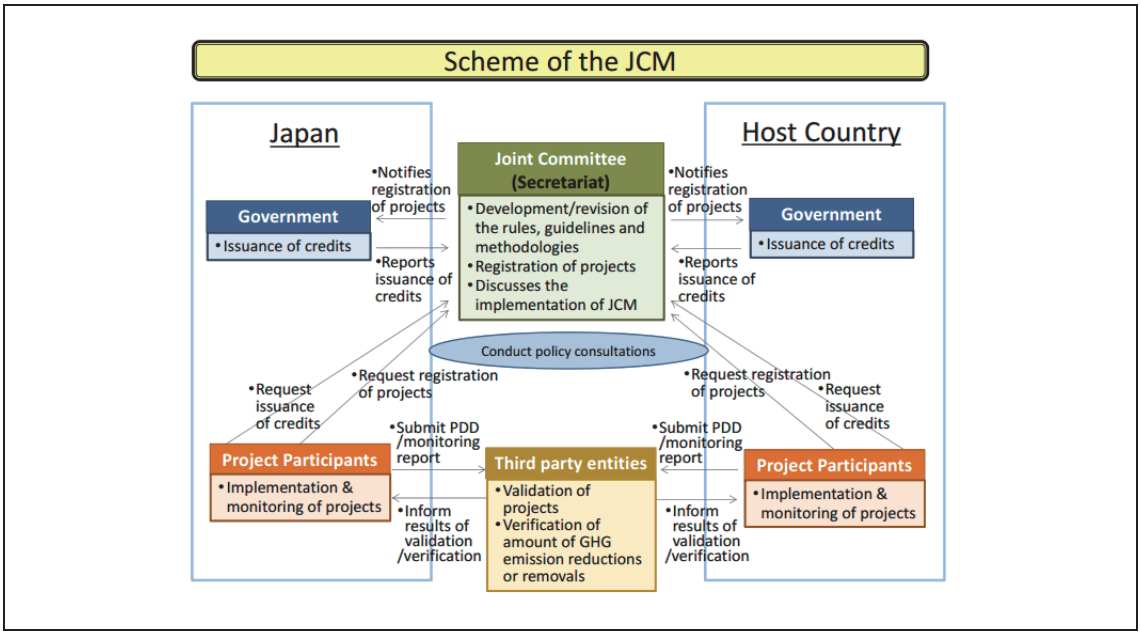
JCM projects registered at the Joint Committees

As of October 19, 2015, there are 15 countries which have signed a bilateral document with Japan,[2] and while design and formulation of institutional infrastructure are still ongoing, actual JCM projects have started being registered at the respective Joint Committees established by host developing countries and Japan.

[1] For example, in the "Memorandum of Cooperation on Low Carbon Growth between the Japanese side and the Vietnamese side" of July 2nd, 2013, it is explicitly mentioned that emissions reductions by JCM projects can be used for NAMAs. Also, in other cases without such specific mention on NAMAs, it is regarded that the JCM can support implementation of NAMAs as well.

[2] Mongolia, Bangladesh, Ethiopia, Kenya, Maldives, Vietnam, Lao PDR, Indonesia, Costa Rica, Palau, Cambodia, Mexico, Saudi Arabia, Chile, Myanmar. Other than this, Thailand approved by its cabinet on October 13, 2015 that the Government would sign the bilateral document with Japan.

Figure 1: Model for the Joint Committee organized by a host developing country and Japan



Source: Government of Japan (2015)

The below table shows the first batch of JCM projects registered at the respective Joint Committees, established by the host countries and Japan as of October 19, 2015. To date, the number of the projects and host countries are limited since it is more at the embryonic stage. Also it applies to the scale of GHG emission reduction. However, in the pipeline, there are a considerable number of potential projects to be developed and some of them are expected to achieve relatively large scale of GHG emission reduction.

Table 1: JCM projects Registered at the Joint Committees (as of October 19, 2015)

Project title				Name of project participants (Host)	Name of project participants (Japan)
Status	Reference number	Registration date	Emission Reductions (Average)		
Introducing High Efficiency Refrigerator to a Frozen Food Processing Plant in Indonesia				PT. Adib Global Food Supplies, PT. Mayekawa Indonesia	MAYEKAWA MFG. CO., LTD.
Project registered	ID003	29 Mar 15	21		
Introducing High Efficiency Refrigerator to a Food Industry Cold Storage in Indonesia				PT. Adib Global Food Supplies, PT. Mayekawa Indonesia	MAYEKAWA MFG. CO., LTD.
Project registered	ID002	29 Mar 15	120		
Centralization of heat supply system by installation of high-efficiency Heat Only Boilers in Bornuur soum Project				ANU-SERVICE CO.,LTD	SUURI-KEIKAKU CO.,LTD.
Project registered	MN002	30 Jun 15	206		

Small scale solar power plants for commercial facilities in island states				Subproject 1: Western Caroline Trading Company, Subproject 2: Surangel and Sons Company	Pacific Consultants Co., Ltd. (PCKK), InterAct Inc.
Project registered	PW001	21 Apr 15	227		
Saving for Air-Conditioning and Process Cooling by Introducing High-efficiency Centrifugal Chiller				PT. Primatexco Indonesia	Nippon Koei Co., Ltd. (Focal Point), Ebara Refrigeration Equipment & Systems Co., Ltd.
Project registered	ID001	31 Oct 14	114		
Eco-Driving by Utilizing Digital Tachograph System				Nippon Express (Viet Nam) Co., Ltd.	Nippon Express Co., Ltd.
Project registered	VN001	04 Aug 15	296		
Installation of high-efficiency Heat Only Boilers in 118th School of Ulaanbaatar City Project				ANU-SERVICE CO.,LTD.	SUURI-KEIKAKU CO.,LTD.
Project registered	MN001	30 Jun 15	92		

Source: https://www.jcm.go.jp/

JCM Financial Programme

In order to help materialize the real GHG emission reduction through the transfer of low carbon technologies, a number of studies and financial, technical, and capacity building support have been in place. Especially, the introduction of the Financing Programme by the Ministry of the Environment, Japan (MOEJ), together with the Ministry of Economy, Trade, and Industry (METI), have made a significant impact to boost the JCM in the study stage up to the implementation stage.

For example, MOEJ' s Financing Programme for JCM Model Projects financially support the implementation of projects which reduce CO_2 emissions by saving energy and/or introducing renewable energy in developing countries with leading low carbon technologies, providing up to 50% of the initial investment cost. The MOEJ also established a collaborative finance scheme with Japan International Cooperation Agency (JICA), and the Japan Bank for International Cooperation (JBIC), and the Trust Fund at the Asian Development Bank.

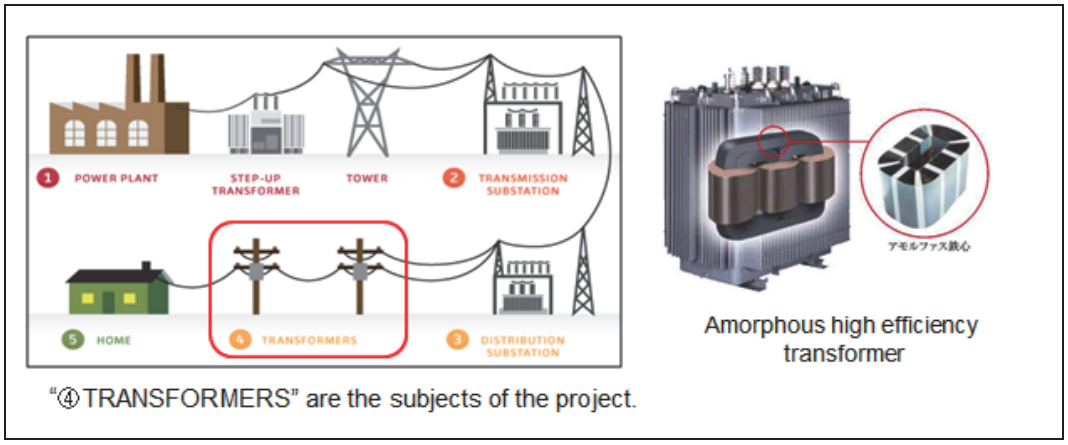
As mentioned above, as of today, the number of projects, host countries, as well as GHG emission reduction amount are limited and very small. However, some of scope of these financial schemes, such as the collaborative finance and the ADB Trust Fund are dedicated to a large scale projects. In this regard, it is expected that project developers will start utilizing this schemes in the coming years. (See the Annex I JCM projects adopted by the MOEJ for its Financial Programme (as of October 19, 2015))

Transformation to low carbon infrastructure and scaling up of mitigation actions in developing countries

In order to lead to establishing a low carbon society, it is effective to intensify works on low carbon infrastructure. Recently, an interesting case has been found in Vietnam, to drive “low carbonize” infrastructure of power distribution systems, and apply a set of such infrastructure in multiple locations of the country.

In the project introducing amorphous high efficiency transformers in the transmission and distribution network of southern Vietnam (EVN Southern Power Corporation jurisdiction), enables to achieve a reduction of transmission and distribution losses and contribute to GHG emission reductions (see the below image).

Figure 2: Image of Amorphous high efficiency transformers in power distribution systems



Source: GEC (October 2015)

The uniqueness of the project is that the replacement of a number of old transformers with higher efficiency transformers made with amorphous material can be seen as more like a “programme” of GHG emission activities. Under the umbrella of the EVN Southern Power Corporation, this low carbon infrastructure have been introduced in a wide spread manner.

At the same time, this kind of project can be applied in other part of the countries, and regions. And if this is the case, host countries can successfully experience transformation of infrastructure into high carbon to low carbon mode. This kind of approach will encourage host developing countries to gradually but steadily implement NAMAs, at the same time, to scale up GHG mitigation amount. Currently, similar projects are in pipelines, and it is expected to apply this experience to other parts of the countries, as well as other host countries.

2.3 Recent development of NAMAs in Mongolian energy sector

By
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FEASIBILITY STUDIES ON NAMAS IN ULAANBAATAR ELECTRIC TRANSMISSION AND DISTRIBUTION

Background of Feasibility Studies on NAMAs

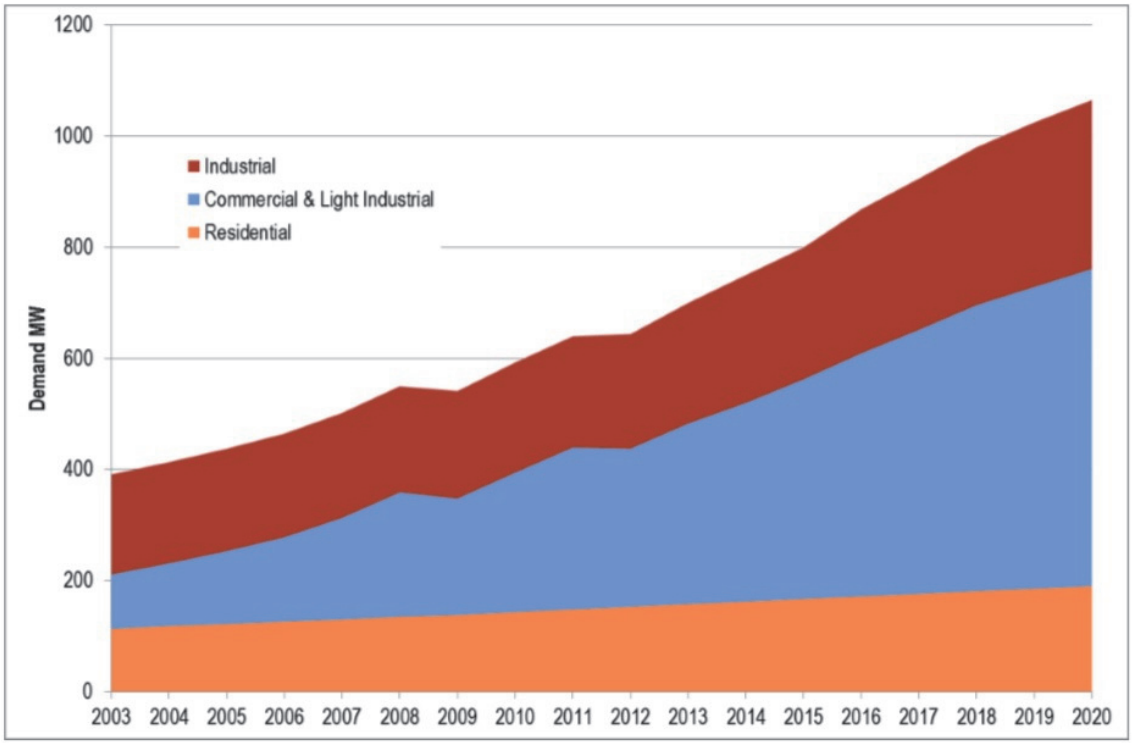
Mongolia is a landlocked country between China and Russia, located in East Asia. The climate of the country is continental and has four distinct seasons. The East Asian country has an extremely harsh winter climate, with winter temperatures ranging from -10°C to -30°C in the daytime during mid-winter (late December and January). Further, temperatures can drop to as low as -40°C at night. The long and harsh winter weather subsequently creates an unusually long heating season, with a total of eight months from the middle of September to the middle of May. Ulaanbaatar City (UB) is the coldest capital city in the world and where almost half of the country's population resides. UB residents depend on a reliable heating system to meet survival needs. Reliable heating service is not merely a utility for residents, business entities and government organizations. Thus, a safe, clean, and reliable heating supply in winter months is a critical need. Mongolia has experienced rapid economic growth (11.5% in 2013 *1) led by mining development and electricity and heat consumption has increased exponentially. For instance, we conducted a survey on the electricity supply of the Central Energy Systems (CES) including UB in 2013 is as follows.

Table 1: Outline of the CES in Mongolia

(a) Ulaanbaatar Thermal Power Plant No. 1 (CHP-1): Decommissioning (Coal-fired type)
(b) Ulaanbaatar Thermal Power Plant No. 2 (CHP-2): 21.5MW (Coal-fired type)
(c) Ulaanbaatar Thermal Power Plant No. 3 (CHP-3): 148MW (Coal-fired type)
(d) Ulaanbaatar Thermal Power Plant No. 4 (CHP-4): 580MW (Coal-fired type)
(e) Darkhan Thermal Power Plant (Darkhan CHP): 48MW (Coal-fired type)
(f) Erdenet Thermal Power Plant (Erdenet CHP): 28.8MW (Coal-fired type)
(g) Erdenet Mining Thermal Power Plant (EMC CHP): 5MW (Coal-fired type)
(h) Salkhit Wind Power Plant: 50MW (Renewable Energy)
Total Electricity Supply of the CES: approx. 880 MW

However, the electricity demand forecast of the CES by the Asian Development Bank (ADB, *2) is the following figure.

Figure 1: CES Demand Forecast



Source: The Asian Development Bank. (2013), Updating Energy Sector Development Plan, Manila.

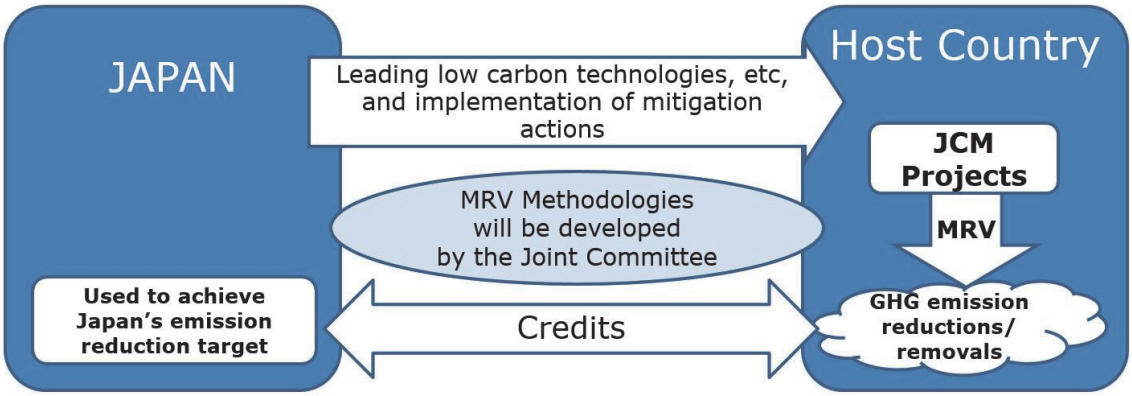
Due to massive increase in energy demand for central grid of Mongolia, a current countermeasure was turbine and boiler expansion in existing coal-fired Combined Heat and Powers (CHPs): CHP-3 (approximately 50 MW) and CHP-4 (approximately 120 MW) in 2013 and 2014, but it was not enough to satisfy their energy demand. In order to overcome the potential supply shortage, the government plans to build a new CHP-5 in suburb of Ulaanbaatar through a public-private-partnership (PPP) model. Generally, it is not recommended to install coal-fired power plant if you are concerned about environmental and climate change aspects. However, Mongolia doesn't have mineral oil refinery and gas field. Moreover, it is possible to import oil and gas from China and Russia, but the country is c between the two big countries so there is a risk in terms of energy security. Thus, the best possible solution to satisfy the energy demand and climate change mitigation is to build CHP-5, new transmission line, distribution facility and district heating system from CHP-5 to the center of UB City.
To achieve further greenhouse gas emission reduction and contribute to Mongolian Nationally Appropriate Mitigation Actions (NAMAs), we conducted the feasibility studies (FS) on electric transmission and distribution sector to find NAMAs potential. Also in order to be able to bankable NAMAs, we conducted a survey on relevant finance schemes and finally identified an Asian Development Bank (ADB) finance scheme, which is Japan Fund for Joint Crediting Mechanism (JFJCM).

Background of the Joint Crediting Mechanism (JCM) and JFJCM

The Joint Crediting Mechanism (JCM) facilitates diffusion of leading low carbon technologies, products, systems, services, and infrastructure as well as implementation of mitigation actions, whereby contributing to sustainable development of developing countries. The mechanism evaluates Japan's contributions to GHG emission reductions or removals in a quantitative and appropriate manner with the application of methodologies for measurement, reporting and verification (MRV).
The JCM contributes to the ultimate objective of the United Nations Framework Convention on

Climate Change (UNFCCC) by facilitating global actions for GHG emission reductions or removals, thus complementing the Clean Development Mechanism (CDM) of the Kyoto Protocol. Mongolia established a bilateral agreement on the JCM with Japan in Ulaanbaatar on January 8, 2013, becoming the first JCM signatory country in the world. 11 other developing countries have followed suit thus far. Consequently, the total number of the JCM signatory countries has reached to 12 as of April 2014.

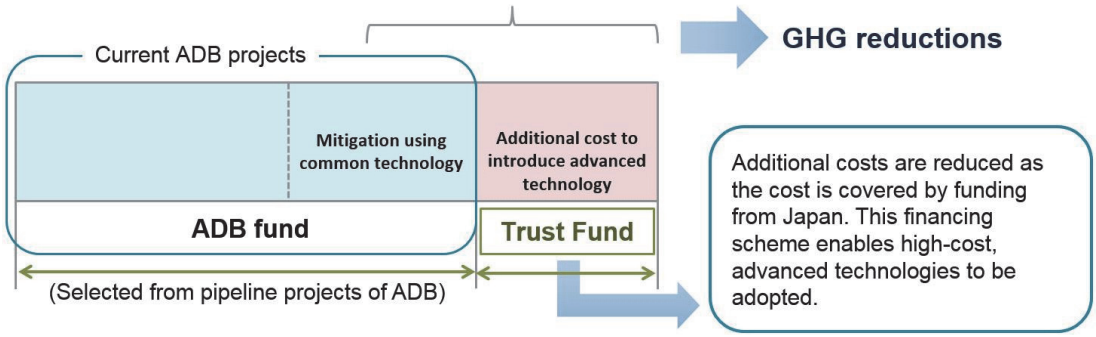
Figure 2: Basic Concept of the Joint Credit Mechanism (JCM)



Source: Government of Japan. (2015), Recent Development of the JCM, Tokyo.

In June 2014, ADB and Japan signed a Letter of Intent for Cooperation on Environmental Issues. One of the agreed elements of the letter is cooperation to implement the Japan Fund for the Joint Crediting Mechanism (JFJCM). The JFJCM is a new trust fund of ADB with a grant from the Ministry of the Environment, Japan (MOEJ). The JFJCM will help finance advanced low-carbon technologies including those relating to renewable energy and energy efficiency for ADB-financed projects in the JCM signatory countries.

Figure 3: Basic Concept of JFJCM



Source: Government of Japan. (2015), Recent Development of the JCM, Tokyo.

Identification of NAMAs potential

First of all, to identify NAMAs, we conducted onsite survey on the electric transmission and distribution systems in Ulaanbaatar City under, then we prepared a list of potential technologies and equipment to be introduced as part of the project. The table below showed a long list of such technologies and equipment:

Table 2: Long list of potential technologies and equipment for introduction

Electric Transmission	Mobile substations
	Replacement of existing transmission line conductors
	Expansion of existing 110 kV substations
	Direct current (DC) power transmission lines
Electric Distribution	Distribution Network Information Management System (DNIMS)
	Amorphous Core Transformers
	Automatic Meter Reading System
	Relay Protection and Remote Control

Source: Authors' own elaboration

Secondly, we selected the technologies and equipment to be introduced through the project in light of Mongolia's national circumstances, decisions taken at meetings of the JCM Joint Committee, and the requirements of the JFJCM. Thirdly, we collected relevant data and documents and estimated the greenhouse gas emission reductions achieved by the project. Fourthly, we identified project components suitable for the JFJCM. Finally, we evaluated the identified project components in terms of reliability, availability, effects of greenhouse gas emission reductions and associated co-benefits.

Result of Study

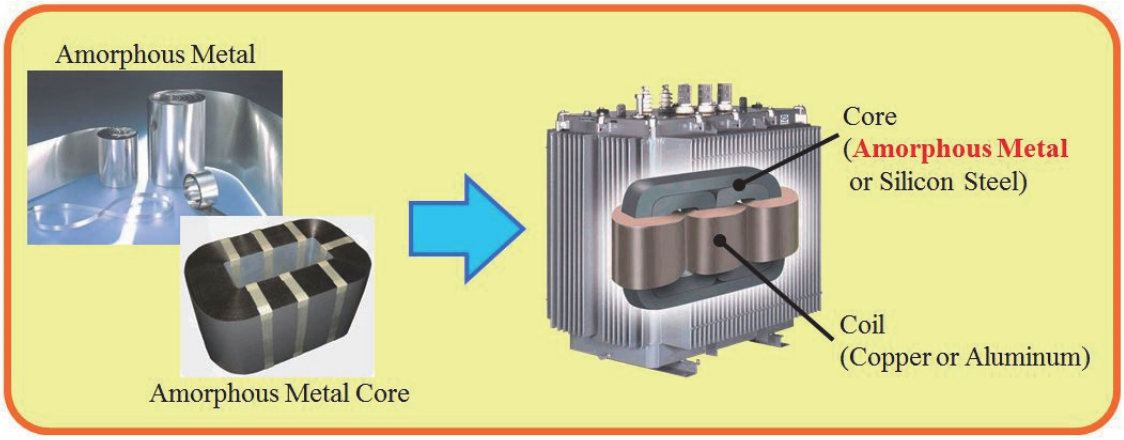
We identified that we can replace approx. 1000 units of aging and less energy efficient Silicon Steel Transformers (SST) which are currently deployed in power distribution network in Ulaanbaatar city with Amorphous Core Transformers (ACT) which are advanced energy efficient transformers. It can significantly reduce electricity loss in transformer and associated carbon dioxide (CO_2) emission. The estimated greenhouse gas emission reduction was 5000 t-CO_2/year. While SST uses silicon steel material core, ACT material core applies "an amorphous" which is an alloy of iron with boron, silicon, and phosphorus in the form of thin metal.

Table 3: Structure of Transformer

Type of Loss	Generation Part	Cause of Loss	Characteristic	How to Reduce?
No-Load Loss	Core	Magnetic Flux	Constantly generated	Amorphous Metal or High-Grade Silicon Steel
Load Loss	Coil	Electric Resistance	Fluctuated depending on Load Factor	Optimization of Conductor Size

Source: Authors' own elaboration

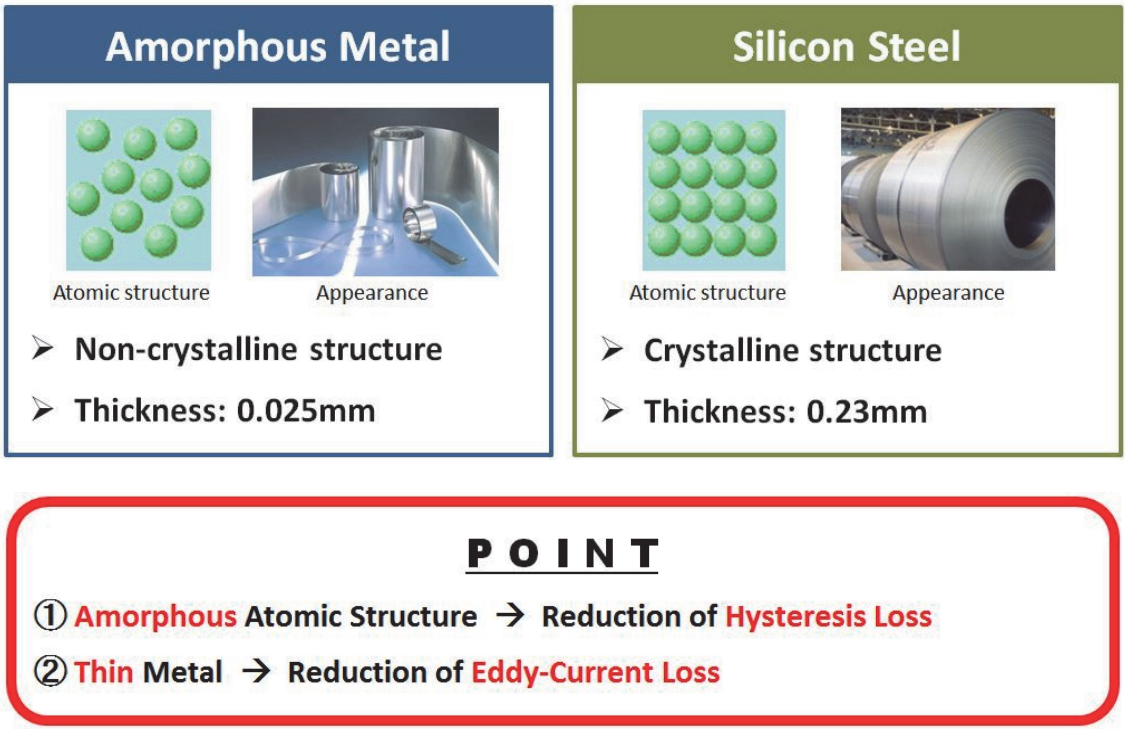
Figure 4: Structure of Transformer



Source: Authors' own elaboration

Compared to ACT with a crystalline allayed atomic structure with thick steel core, amorphous core has a random and non-crystalline structure with around the one-tenth thinner metal core (Figure 4). Such unique feature of ACT (loosely arrayed atomic structure and thinner core) improves inductance and resistance, and reduces energy loss up to approximately 75% in non-load loss and 21% in load loss.

Figure 5: Comparison between Amorphous Metal and Silicon Steel



Source: Authors' own elaboration

Regarding the greenhouse gas emission and emission reduction of this project, SST is considered as reference transformer technology as it is widely deployed in power distribution system in Mongolia, while a few ACTs have been introduced for pilot testing purpose, and non-load loss benchmark standard in transformer procurement is based upon SST.

GHG (greenhouse gas) emission and emission reduction
Reference reduction: 「RE_y」
Project emission: 「PE_y」
Total emission reduction: 「ER_y」

$$ER_y = RE_y - PE_y$$

GHG emission reduction measures	Reduction of No-load loss by installing Project Transformer (ACT) for a replacement of Reference Transformers (SST).
Calculation of reference emissions	Calculation of GHG emission due to No-load loss of Reference Transformer.
Calculation of project emissions	Calculation of GHG emission due to No-load loss of Project Transformer.
Monitoring parameters	This monitoring methodology requires the following monitoring occasions to accomplish project emission calculations: 1.When the Project Transformers installed; - No-load loss rate (W) of Project Transformers; and, - Specifications of each Project Transformers installed. 2.At the time of end of fiscal year; - Latest CO_2 emission factor (tCO_2/MWh) of the Grid published by Authority; - Blackout rate of the Grid during the year 'y' (%); and, The number of transformers which are installed and in operation. All data collected as part of monitoring are archived electronically and kept until the end of monitoring period.

Future Prospect

The Mongolian Government, the ADB and the Government of Japan are now discussing the structure and institutional arrangement of this project. The Ulaanbaatar Electricity Distribution Network (UBEDN), the state owned power distribution company, is the implementing agency for the project under the supervision of Ministry of Energy (MoE) and Ministry of Environment, Green Development and Tourism (MEGDT), Mongolia. It will be the Coordinating Management Entity for the project, and will be responsible for day-to-day project implementation, and baseline and monitoring survey for energy loss reduction as well as CO_2 and related air pollutant emission saving. After the scheme has been finalized in detail, the Ministry of Finance, Mongolia and the ADB will start the loan negotiation. The entities are planning to start the scheme from 2016 or 2017.

PARTNERSHIP FOR ACTION ON GREEN ECONOMY (PAGE) IN MONGOLIA

With its high economic growth and associated challenges, Mongolia is now at a crossroads of its development. Despite strong economic growth, Mongolia has not yet managed to create job opportunities and distribute wealth equally. Mongolia struggles to convert its newfound opportunities into sustainable development results while social tensions and persistent high poverty incidence persist. Moreover, Mongolia faces a number of serious environmental problems of land and ecosystem degradation, including pasture, forest and water, desertification, loss of biodiversity and air pollution in urban areas partly due to mining and herding practices but also due to climate change, and deforestation. Investment in a sustainable future for its citizens through awareness building, good governance, policy reform and functioning coordination mechanisms has become the key factors that will determine whether Mongolia can eradicate poverty and overcome the "natural resource paradox" and convert its wealth into a

recourse efficient, socially equitable and low carbon economy. The Partnership for Action on Green Economy (PAGE) started in response to The United Nations Conference on Sustainable Development (UNCSD), also known as Rio 2012, Rio+20, or Earth Summit 2012 aim of at reconciling the economic and environmental goals of the global community. PAGE founding members - the United Nations Environment Programme (UNEP), the International Labor Organization (ILO), the United Nations Industrial Development Organization (UNIDO) and the United Nations Institute for Training and Research (UNITAR) - will work jointly with UNDP in Mongolia in supporting a series of activities to advance Mongolia' s Green Development Strategy. The PAGE accomplished and plans the following activities and milestones in 2013-2015 period:

- Preparation of a Stock-taking Report;
- PAGE Inception Workshop and High Level Forum;
- A green jobs mapping exercise;
- PAGE Implementation Workshop;
- Preparation of Inception and 2014 Implementation Report;
- Green Economy Modeling; Green learning, Green economy indicators; Green Procurement; Green school building;

The aim of the report is to support Mongolia in refining and implementing its Green Development Strategy (GDS) approved by Parliament in June 2014. The Report assesses potential opportunities and options to promote a green economy in Mongolia and will provide a blueprint for coordinated multi-year support of PAGE and other development partners and is expected to serve as a basis for mobilizing national and international resources. The report has been developed on the basis of a series of PAGE activities to advance Mongolia' s Green Development Strategy, the existing draft outline of the report and more refined work plan developed by project stakeholders.
In addition, this report will be used as the basis for the capacity building and other activities related to PAGE initiative in Mongolia beyond 2014. The sections on the Stocktaking and Green job mapping reports provide information with respect to the initial country specific situation and readiness in terms of transition and absorbing capacity. Furthermore, based upon the initial agreement among PAGE partners, the PAGE Implementation report contains:

- Mongolia specific development of PAGE work streams in 2014 and beyond;
- Information Compendium that discusses the PAGE background and best practices to provide Mongolia with overview of existing programmes and ideas concerning the establishment and implementation of coordination mechanisms;
- Concluding comment to summarize the current project period development and underline the progresses that predicate the future direction for project implementation;

Enabling conditions for a green economy: Currently, enabling conditions are heavily weighted towards the prevailing brown economy, which depends excessively on fossil fuels, resource depletion and environmental degradation. Therefore, specific enabling conditions will be required to make the transition to a green economy. These enabling conditions consist of national regulations, policies, subsidies and incentives, as well as international market and legal infrastructure, trade and technical assistance. When moving from traditional to green economy, three changes take place in an economy' s structure and content. First, the environmental impacts (ecological footprint) of economic activities are reduced. Second, the share of green goods and services is growing and eventually accounts for a lion' s share of the economy. Third, the benefits from these above two changes are shared equitably among

different groups of society expressed as better and more job opportunities, better health, etc for all.
Green Investment Scenario: Research shows that investing annually 2 percent of global GDP into ten key sectors for a transition towards a low-carbon, resource-efficient economy would reduce ecological footprint by nearly 50 per cent in 2050, as compared to business as usual. Accompanying benefits include enhanced wealth & natural capital, higher rates of GDP growth over time, decent employment, and reduced poverty and enhanced natural capital. Under the green investment scenarios modeled in Towards a Green Economy, global energy intensity (in terms of Mtoe/US$ GDP) declines by 36 per cent by 2030, and the cumulative global energy-related CO_2 emissions would be considerably mitigated by 2050. Under G2, emissions are approximately 60 percent lower in 2050 as compared to BAU. In absolute amounts, this corresponds to a decline from 30.6 Gt of energy-related CO_2 emissions in 2010 to about 20 Gt in 2050.
Role of banking in green growth: The role of the banking and finance sector for a transition to a green economy is to enable economic growth and investment while increasing environmental quality and social inclusiveness. Critical to attaining such an objective is to create the conditions for public and private investments to incorporate broader environmental and social criteria in order to achieve greater social inclusion, sustainable livelihoods and poverty eradication. In addition, new finance mechanisms such as the Green Climate Fund need to be set up to support mitigation, adaptation, technology and capacity-building activities in developing countries. Related to this, international and national development finance institutions need to revisit their procedures and commit to applying environmental criteria, as well as more ambitious targets, for green lending in target industry sectors. The financial services and investment sectors control trillions of dollars, and pro-active investment institutions are taking the lead by committing themselves to the UN-backed Principles for Responsible Investment (PRI).

The report of PAGE with a vision and strategic framework that outlines Mongolia' s pledge to pursue its commitment and duty to evolve as an advanced nation having built the conditions of sustainable development to be inherited by next generations by creating economic growth based on green development concept and active involvement of citizens. The PAGE intervention through its technical assistance is to contribute to Mongolia' s achievement in terms of resource efficient, low carbon, production and consumption, and maintaining ecological balance and reduce environmental degradation while intensifying reclamation activities and environmental protection. In addition to these it is also designed to address the sector development policies, strategies and programmes to achieve sustainable use of natural resources and control of damages emanating from climate change.

THE STRATEGIES FOR DEVELOPMENT OF GREEN ENERGY SYSTEMS IN MONGOLIA

"The Strategies for Development of Green Energy Systems in Mongolia" was prepared by the Government of Mongila and Global Green Growth Institute (GGGI) in collaboration with the Stockholm Environment Institute – U.S. Center.

The study presents plausible Mongolian green energy systems that would reduce GHG emissions, improve air quality, and facilitate other socio-economic benefits. This report is part of ongoing collaboration between GGGI and the Government of Mongolia of green development for Mongolia: green energy systems; i.e., those that minimize carbon emissions, local air pollution, and other environmental impacts. The report focuses on the potential for renewable energy and energy efficiency to reduce fuel

use, energy costs, greenhouse gas emissions, and other pollutant impacts. The focus is on renewable energy and energy efficiency because of Mongolia' s significant renewable resources and potential for energy efficiency improvements and because these options already have considerable momentum in the country. This report does not focus as much on some other sources of energy or GHG reductions: nuclear, due to less in-country focus on this technology at present; natural gas, due to limited domestic resources, as well as because of limited potential for GHG reductions (relative to renewables); and carbon capture and storage (CCS) due to high costs and uncertainty about the efficacy of this technology.
The report includes recommendations based on an analysis of 4 different scenarios forecasting Mongolia' s energy supply and demand within the industry, transport, buildings, and agriculture sectors.

- *Reference Scenario*
  The reference scenario forecasts a Mongolia that continues to rely on mineral extraction for its primary source of energy, both for export and domestic consumption. This scenario sees total energy demand more than doubling in Mongolia between 2010 and 2035, with demand for electricity and petroleum products growing especially fast. In the reference scenario, overall GHG emissions rise to approximately 56 million tons of carbon dioxide by 2035 from a benchmark of just over 15 million tons in 2010.
- *Recent Plans Scenario*
  This scenario describes the potential impact to energy supply and demand in Mongolia as a result of the successful implementation of renewable energy and increased energy efficiency plans adopted by the Ministry of Energy and Ministry of Environment and Green Development. The recent plans scenario would see total GHG emissions rise to about 46 million tons of carbon dioxide by 2035.
- *Expanded Green Energy Scenario*
  In this scenario, Mongolia makes a stronger transition to renewable energy and implements extensive energy efficiency measures across its economy. These initiatives help reduce energy demand by 32% when compared to the reference scenario, while the realization of multiple hydro, solar PV and wind power projects, increase the contribution of renewable energy to electricity production to more than 40%. Reductions in energy demands coupled with increases in renewable energy production provide Mongolia with the option to phase out aging coal-fired power plants, and possibly avoid new plants altogether. As a result, GHG emissions would be half, or 28 million tons, of those forecast in the reference scenario.
- *Shifts in Energy Export Scenario*
  The shifts in energy export scenario realizes the same reduction in energy demand as the expanded green energy scenario, and differs only in that Mongolia has divested itself from mineral-based energy exports, in favor of renewable energy exports. The shift scenario would increase Mongolia' s "low-carbon competitiveness" within a global market where demand for fossil fuels has declined due to increasing concerns over climate change.

Based on previous achievements and current needs of the Government of Mongolia in promoting green energy systems, GGGI is initiating **the second phase of the project** with the main objectives to:

1. Support implementation of the long-term strategy of Mongolia for greener energy sources with a focus on Comprehensive Heat Planning Alternatives;
2. Collect data and update the LEAP model for Mongolia to align with the Strategic Objective One of the National Green Development Policy (NGDP) targets on green energy and energy efficient

buildings;
3. Build institutional capacity for effective energy management and planning and conducting environmental, social and economic impact assessment of alternative energy systems.

STRATEGIES FOR GREEN PUBLIC TRANSPORT IN MONGOLIA

One of the most critical environmental issues in Mongolia today, particularly in Ulaanbaatar (the UB city), is air pollution. In the UB city, the daily average concentration of a particulate matter can reach 70 to 85 times higher than the maximum daily exposure recommended by the World Health Organization (WHO). While this is largely due to the consumption of coal for heating, another major source for air pollution in the UB city stems from the transport sector, and specifically rapid motorization. The number of registered vehicles has been increasing rapidly for the past 20 years, and the total number of vehicles now stands around 292,000 in the UB city. Currently, however, only 2.1% of these are for public transit, while almost 60% of the citizens use public transport daily. Various types of buses are operated by 26 companies in the UB city. However, most of the bus vehicles in the UB city use diesel fuels, which exacerbate the air pollution. Furthermore, the development and implementation of effective traffic management strategies to encourage passengers to use more public transport have been slow.
There is therefore a strong need for a sustainable green public transport plan, which coincides with national policies of Mongolia. The "New Development Medium-Term Target Program" stated that public transport must be ecologically clean in order to mitigate air pollution in the UB city. This program includes the replacement of 800 large bus and 1,500 small bus engines with those that consume eco-friendly fuels. In the "National Action Program on Climate Change," one of the strategic objectives is to mitigate GHG emissions and establish a low-carbon economic policy through the introduction of environmentally friendly technologies and improvement in energy efficiency.
This project was initiated through consultations between the Global Green Growth Institute (GGGI) and the Mongolian government. GGGI and the Ministry of Nature, Environment and Tourism (MNET) of Mongolia, which has been restructured into the Ministry of Environment, Green Development and Tourism (MEGDT) in late 2014, signed a memorandum of understanding (MOU) in November 2011 to confirm their commitment for cooperation in green growth.

Objectives of the Project

The overall goal of the project is to promote green (i.e., low carbon) public transport in the UB city, and thereby contribute to reducing GHG emissions and to improving air quality. Broadly, the strategies for green public transport investigated in this project include 1) reducing GHG emissions by fuel type replacement for public buses and enhancement of regulations for vehicle inspection, and 2) increasing public transport ridership and reducing traffic congestion by improving operations.
The key outcomes of the project are:

- Overview of the current public transport system in the UB city
- Report on the current fuel and gas usage for public transport
- Evaluation of the technical and economic feasibility of replacing current diesel engine buses with eco-friendly fuel engine buses
- Recommendations for enhancement of inspection rules and regulations for emission control in public transport and their impacts on GHG emissions
- Recommendations for strategies for encouraging modal shift from passenger vehicles to ecofriendly public transport to reduce traffic congestion and total emissions

- Recommendations for plans for encouraging foreign direct investment or public private partnerships for green public transport and urban planning
- Recommendations for overall strategic policies for promoting green development in public transport and urban planning

Analysis of the Potential Effects on GHG Emissions Reduction

Traffic congestion exacerbates air pollution since vehicles emit more pollution when accelerating and breaking than maintain a certain speed. Therefore, effective management and operation strategies for encouraging public transport ridership are important for both the air quality and the efficiency of the urban transport system. The effects of each public transport strategy on air pollution are analyzed in this project.

A 3% modal shift from private passenger vehicles to public transport through the bus route reform could reduce GHG emissions by 2,030 t-CO_2/year, while a 33% modal shift would reduce it by 16,000t-CO_2/ year. Implementing the integrated fare system with smart cards would reduce CO_2 emissions by around 1,700 t-CO_2/ year at 2.5% modal shift and 18,600 t-CO_2/ year at 27.5% modal shift. A traffic speed improvement of 40km/h through ITS adoption would reduce CO_2 emissions by 49,000 t-CO_2/year. A 22% modal shift caused by BRT system adoption could reduce emissions by 15,000 t-CO_2/year.

Furthermore, it is expected that the reduction effects may show some synergy effects if the four strategies are implemented in an integrated and systematic manner. To better analyze the effects of these strategies, traffic congestion, service quality for public transport, management capacity for transport operation, developing transport infrastructure, implementing a monitoring system, and developing a database for modeling CO_2 emissions are required to for further analysis as well as for long-term sustainability.

Conclusion

This project aims to develop and analyze strategies that can accelerate the green transition in the public transport system in the UB city as part of the efforts to promote green growth in the transport sector in Mongolia. To this end, the project executed following tasks:

- Reviews of current transport system and infrastructure;
- Reviews of clean fuel and vehicle technologies;
- Analyses of technical and economic feasibility to replace diesel fuel vehicles with clean vehicles in public transport sector;
- Reviews and analyses for vehicle emission control regulations;
- Reviews of current public transport management systems;
- Analyses on public transport strategies and their environmental effects; and
- A proposal for eco-station development projects.

By reviewing the current transport system, infrastructure, socio-economic conditions, and the future growth prospects of the UB city, the project identified several issues that need to be improved. First, investments in the transport sector have been inadequate in responding to demand. The unbalance causes economic losses due to traffic congestion and health impacts due to air pollution. Second, supply of public transport has been lacking in quantity and quality. Therefore, it is not effective at encouraging passengers to shift from private passenger vehicles to public transport and reduce air pollution in the UB city. Third, many transport plans are active in the UB city at the national and local levels in cooperation with international organizations. However, there are some imbalances between the plans for optimal resource allocations. Therefore, some measures for coordinating transport plans should be

developed.
The project reviewed selected alternative fuels for public transport including clean diesel, CNG, LPG, and electricity, and chose CNG as the most suitable alternative fuel for public transport in the UB city. Furthermore, this project analyzed the technical and economic feasibility for replacing current diesel fuel buses with CNG ones. The results of an economic feasibility analysis with 36 scenarios showed that the B/C ratio ranged from 0.53 to 0.88. Although the results of B/C analysis render the policy of replacing diesel fuel buses with CNG buses economically unattractive, the ultimate decision should be based on not only economic analysis results but also other policy considerations. To regulate vehicle emissions, this project reviewed the current vehicle inspection regulations of Mongolia. The project recommended strengthening vehicle emission standards to be equivalent to European standards to improve air quality in the UB city. Furthermore, the study suggests reflecting production years and adopted technologies to control vehicle emissions and to collect taxes for improving efficacies of vehicle inspection and vehicle emissions reduction. Other recommendations were suggested such as installing additional inspection stations to secure effective management of vehicle emissions and enhancing regulations for imported second hand vehicles to reflect vehicle emission and safety standards. With improvement measures, enhancement of GHG emission reduction and vehicle safety are expected. Also, other automobile industries could be stimulated in the process of installing more inspection stations.
Strategies for public transport management and operation are suggested by reviewing and analyzing current conditions of the public transport system in the UB city as well as benchmarking Korea' s public transport reform cases. The strategies are categorized into a bus route system, fare system and smart card, intelligent transport system, and BRT. Even though the synergy effects of integrated implementation for the public transport strategies are expected to exceed the costs of implementation, the cost itself might be burdensome. Therefore, this project suggested phase-based implementation plans for the strategies. Also, to maximize the impacts given cost constraints, the project recommended comprehensive public transport master plans at the national and local levels for coordinating each strategy, relevant organizations, and governments.
Furthermore, this project estimated reduced volume for CO_2 emissions in the transport sector from implementing these public transport management and operation strategies: ITS, BRT system, fare system, and bus route reform. The results show considerable impacts on CO_2 emissions for each the four strategies. Also, it is expected that the reduction effects may show some synergies if the four strategies are implemented in an integrated and systematic manner.
Finally, an eco-station development project was suggested to integrate public transport planning with urban planning using a TOD concept. The eco-station will be facilitated with multimodal-transfer centers, park and ride, city air terminals, facilities for non-motorized transport, and other uses and amenities including housing, offices and stores, and entertainment facilities.

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2.4 Thailand's Nationally Appropriate Mitigation Actions (in energy sector and transport sector) and its MRV system

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Thailand Greenhouse Gas Management Organization (TGO)

Introduction

As part of the global action to tackle Climate Change, Thailand became the 58th developing country to voluntarily submit its NAMA declaring an intention to achieve ambitious mitigation target in line with national development plans. Thailand pledges, on a voluntary basis, to reduce its GHG emissions in energy and transport sectors within a range of 7-20% below the business as usual (BAU) level in 2020, subject to the level of international support in the form of technology development and transfer, finance, and capacity building for NAMAs preparation and implementation.

Thailand is in the process of developing its industries, developing its large cities, and growing national income per year to raise the quality of life of the people. As a result, the country is now been facing with the problem of environmental degradation and natural resources, particularly the increase in energy consumption which has led to major greenhouse gas emissions in Thailand.

Therefore, Thailand needs to develop in parallel the goals of both raising the standard of living of the people and protecting the environment at the national and regional level. Sustainable development is the main objective in order to maintain a balance between these two goals. Examination of greenhouse gas emissions in the energy sector, showed that significant greenhouse gas emissions came from: 1) sourcing and processing of power (manufacturing and electricity), followed by 2) burning of fossil fuel in transportation, and 3) fuel combustion in industry. The increasing rate of greenhouse gas emissions from such activities from the year 2002 to 2010 was 30.03%, 12.47% and 18.78%, respectively. Therefore, it is recommended that policy mitigation measures in the energy sector should be focused on energy conversion processes, combustion processes in industry and transport, and also conversion of waste to energy.

Thailand has prepared policy frameworks for the country in order to address this ongoing global challenge. Thailand Greenhouse Gas Management Organization (TGO) under the Ministry of Natural Resources and Environment in collaboration with relevant academic and governmental agencies decided that energy and transport are the most important sectors for effective and significant reduction of GHG emissions. The research project "The potential of Thailand's NAMAs" focusing on both domestically and internationally supported mitigation actions was initiated with participation of multiple stakeholders.

Energy Policy Development for mitigation actions

The aims of the Ministry of Energy, Thailand, are energy security, promotion of alternative energy and an increase in energy efficiency in the end-use sector. Three main national strategies were released as follows.

1. **Thailand Power Development Plan (2010 – 2030):** Substantially focused on security and adequacy of power systems along with the policies of the Ministry of Energy (MoEN) on the issues of environmental concern, energy efficiency and renewable energy promotion in line with the 10-Year Alternative Energy Development Plan (AEDP 2012 - 2021). Parenthetically, cogeneration system were recognized as systems to be promoted in terms of efficient electricity generation.

2. **Alternative Energy Development Plan (AEDP 2012-2021):** To promote usage of alternative energy to 25% within 10 years, replacing fossil fuel such as oil and natural gas and at the same time reducing dependency on energy imports. Each year, Thailand imports more than 60% of energy used commercially, including 80% of total domestic oil usage, and the import portion tends to increase as local petroleum fails to catch up with escalating demand. On the other hand, alternative energy development will also help diversify fuel procurement and mitigate risk for power generation purposes.
The promotion of alternative energy development, aiming for 25% usage within 10 years, is a strategic plan that will seek a variety of appropriate alternative energy sources that can be categorized as follows:

   1) Alternative energy for power generation
   2) New types of energy for power generation, with potential for commercial development
   3) Alternative energy in transportation sector (fuel substitution)
   4) Renewable Heat to promote renewable energy such as biomass, waste, biogas, and solar to produce heat for usage in the industrial sector, replacing fossil fuel

   If the targets are attained, alternative energy could eventually turn into mainstream energy sources and increase the country' s energy security as well as promoting the innovation of new energy technologies to compete in the global market and make Thailand a prototype of green community.

Table 1: Potential of renewable power generation in the AEDP plan.

Renewable energy	Adders plan (MW)	
	2008-2011	2017-2022
Solar	55	500
Wind	115	800
Wastes to energy	78	160
Biomass	2,600	3,700
Small hydroelectricity	165	324
Biogas	60	120
Total	3,073	5,604

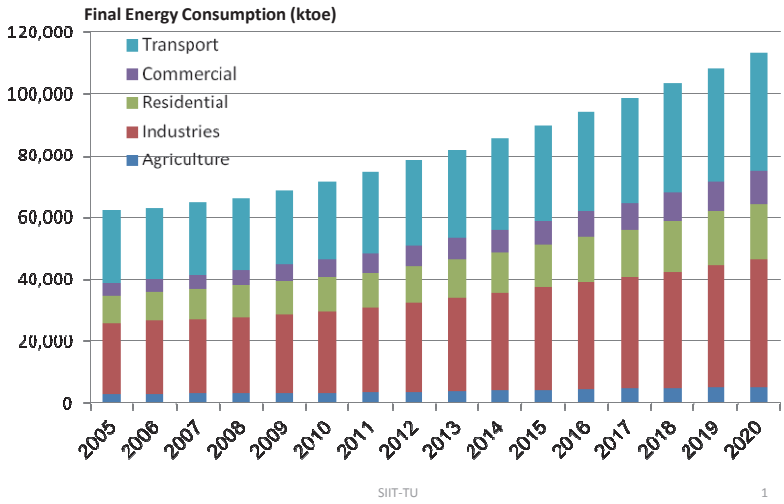
Source: Department of Alternative Energy Development and Efficiency, 2011

3. **Energy Efficiency Development Plan:** EEDP 2010 – 2030: This 20-year Energy Efficiency Development Plan (EEDP) is formulated with the target of reducing energy intensity by 25% by 2030, compared with that in 2005. This is equivalent to a reduction of final energy consumption by 20% by 2030. It aims at targeting energy savings in the residential, commercial, industrial and transport sectors. It includes promotion of awareness and consciousness of energy conservation, provision of financial incentives to the private sector to retrofit energy efficiency equipment, peak load cutting in the commercial sector, R&D in minimum energy performance standards, building energy codes and mass transit systems. The energy efficiency will result in less investment in energy supply.

BAU Projection

In the energy sector, the energy conversion process in the power plants for electricity generation is a main contributor to large CO_2 emissions, followed by combustion processes in industries, and transportation. During 2002 - 2010, the corresponding CO_2 emissions increased by 30.03%, 18.78% and 12.47% in the power sector, industries, and the transport sector, respectively.

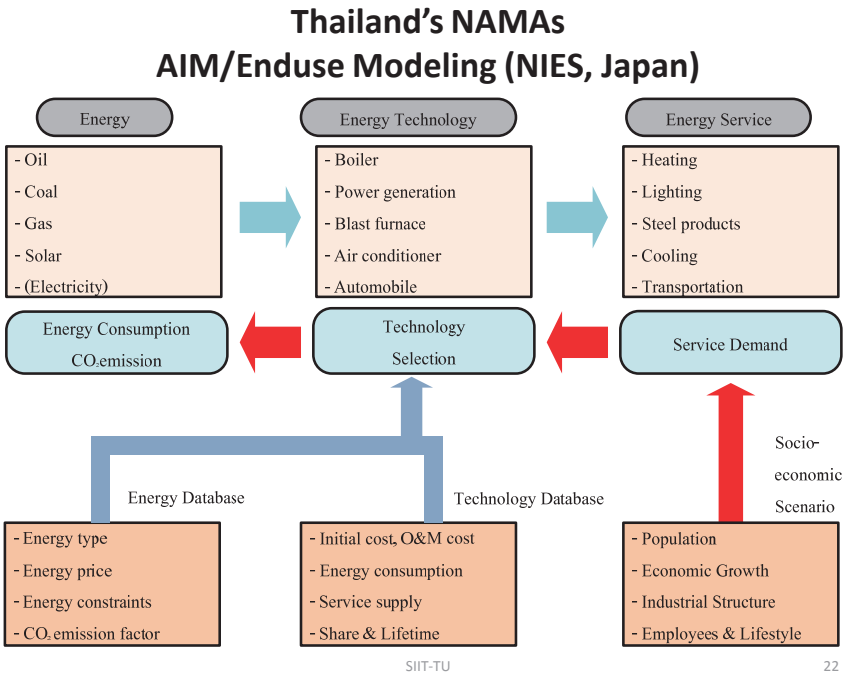
Sectoral Energy Consumption in Thailand in the BAU 2020



Source: Thailand Greenhouse Gas Management Organization, 2013, "Potential of Thailand's Nationally Appropriate Mitigation Actions", by SIIT

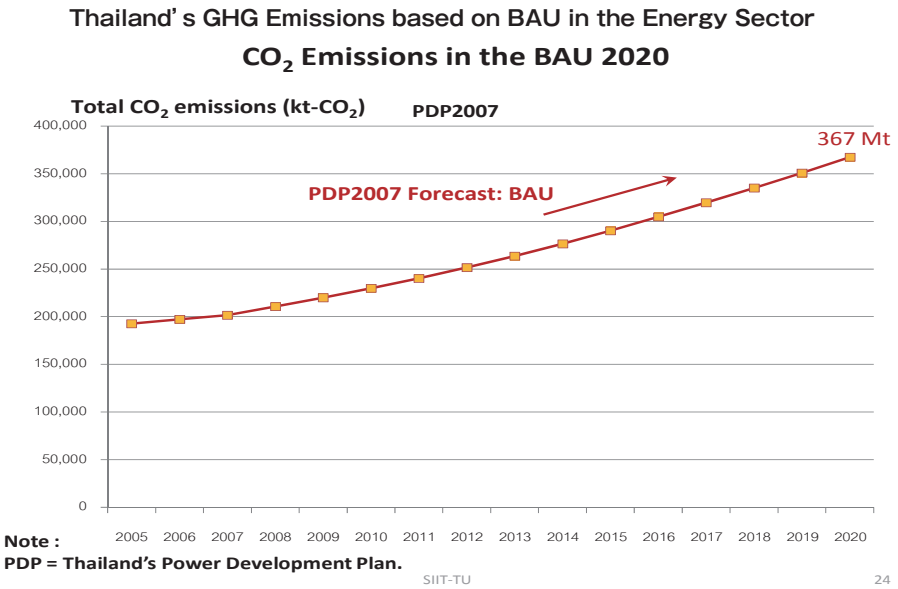
Analysis Tool for Thailand's NAMAs and Baseline Development

The methodology for development of Thailand's NAMAs is based on a bottom - up modeling tool called the "AIM/Enduse" model. The Asia - Pacific Integrated Model (AIM) has been developed by the National Institute for Environment Studies (NIES) Japan as the first and only integrated assessment model focusing on Asia which was used to evaluate policy options on sustainable development particularly in the Asia Pacific region. The AIM/Enduse is a bottom - up optimization model with a detailed technology selection framework within a country's energy - economy - environment system. It can analyze mitigation scenarios by using both the AIM/Enduse model and AIM/Enduse tools. Energy technology refers to a device that provides a useful energy service by consuming energy. Energy service refers to a measurable need within a sector that must be satisfied by supplying an output from a device. It also can be defined in either tangible or abstract terms, thus service demand refers to the quantified demand created by a service; i.e. service outputs from devices satisfy service demands.
In this study, the structure of AIM/Enduse for Thailand's reference energy system has been created using socio - economic assumptions obtained from related agencies such as the Office of the National Economic and Social Development Board (NESDB), Electricity Generating Authority of Thailand (EGAT), and Department of Alternative Energy Development and Efficiency (DEDE). Then selected CO_2 countermeasures are analyzed. The AIM family tools could handle the problems in both general equilibrium and partial equilibrium modeling.



Source: Thailand Greenhouse Gas Management Organization, 2013, "Potential of Thailand's Nationally Appropriate Mitigation Actions", by SIIT

The steps of analyses of Thailand's NAMAs are as follows: i) Reviews of national policy measures related to CO_2 countermeasures; ii) Data collection and verification; iii) Data processing, analyses, and modeling by the AIM/Enduse tool; iv) Development of CO_2 emissions as baseline in the business - as - usual (BAU) scenario; v) Analyses of CO_2 countermeasures; and vi) Discussion as well as determination of CO_2 countermeasures under NAMAs.



Source: Thailand Greenhouse Gas Management Organization, 2013, "Potential of Thailand's Nationally Appropriate Mitigation Actions", by SIIT

Development of Thailand' s NAMAs

The Thailand Greenhouse Gas Management Organization (TGO), in collaboration with Sirindhorn International Institute of Technology (SIIT), Thammasat University and relevant academic and governmental agencies, decided that energy and transport are the most important sectors for effective and significant reduction of GHG emissions. The project was divided into the following steps:

Step I: Primary Data Analysis

The TGO, in coordination with the Department of Alternative Energy Development and Efficiency, Ministry of Energy, Office of Transport and Traffic Policy and Planning, Ministry of Transport and Sirindhorn International Institute of Technology (SIIT), Thammasat University conducted an analysis as follows:

1) Reviewing national plans and policies in order to identify the potential of domestic GHG reduction. Those plans and policies include the national strategy, the Renewable & Alternative Energy Development Plan to increase the share of alternative energy up to 25% in 10 Years (2012-2021), the 20-year Energy Efficiency Development Plan, the Master Plan for Sustainable Transport and Climate Change Mitigation, and relevant industrial plans or policies;
2) Carrying out cost-benefit analysis and identifying potential technologies for emissions reduction in relevant sectors; and
3) Considering the possibility of conducting Measurement, Reporting and Verification (MRV) of greenhouse gas emission reduction on the ground

Step II: Public Participation

The TGO, the Department of Alternative Energy Development and Efficiency, Ministry of Energy, and the Office of Transport and Traffic Policy and Planning, Ministry of Transport co-organized a series of public hearings and consultations with the participation of all stakeholders. Recommendations and suggestions provided by those forums regarding this project were presented to the TGO' s Board of Directors. Subsequently, the TGO' s Board of Directors at its 10th meeting on 18 October 2012, agreed to submit the research project to the National Climate Change Board for consideration.

Step III: Evaluation and Conclusion

For both the energy and transport sectors, the evaluation was considered in light of national strategies including the Renewable & Alternative Energy Development Plan (Electricity sector) (referenced Power Development Plan: PDP2007), Energy Efficiency Development Plan, and the Master Plan for Sustainable Transport and Climate Change Mitigation for transport sector.
Based on existing plans and policies, the potential of GHG emission is approximately 73 Million tons CO_2eq or 20 percent by 2020, with the aim of reducing at least 61 Million tons-CO_2eq in the energy sector (particularly electricity, industry and waste-to-energy sub-sectors) and at least 12 Million tons-CO_2eq in the transport sector. The reduction of 73 Mt of CO_2-eq could be divided into two types of mitigation actions, domestically supported actions of about 23 Mt of CO_2-eq and internationally supported of about 50 Mt of CO_2-eq.
The project was later submitted to the Sub-Committee on Climate Change Technical Support and the Sub-Committee on Climate Change Negotiation for consideration. After the endorsement of these sub-committees, the project has been used as a framework for relevant agencies in order to reach emissions reduction targets in Thailand.
As a result, as part of the global actions, Thailand has become the 58th developing country to voluntarily

submit NAMAs declaring its intention to achieve ambitious mitigation targets in line with national development plans. Thailand pledges, on a voluntary basis, to reduce its GHG emissions in energy and transport sectors within a range of 7 – 20% below the business as usual (BAU) level in 2020, subject to the level of international supports in the forms of technology development and transfer, finance, and capacity building for NAMAs preparation and implementation.

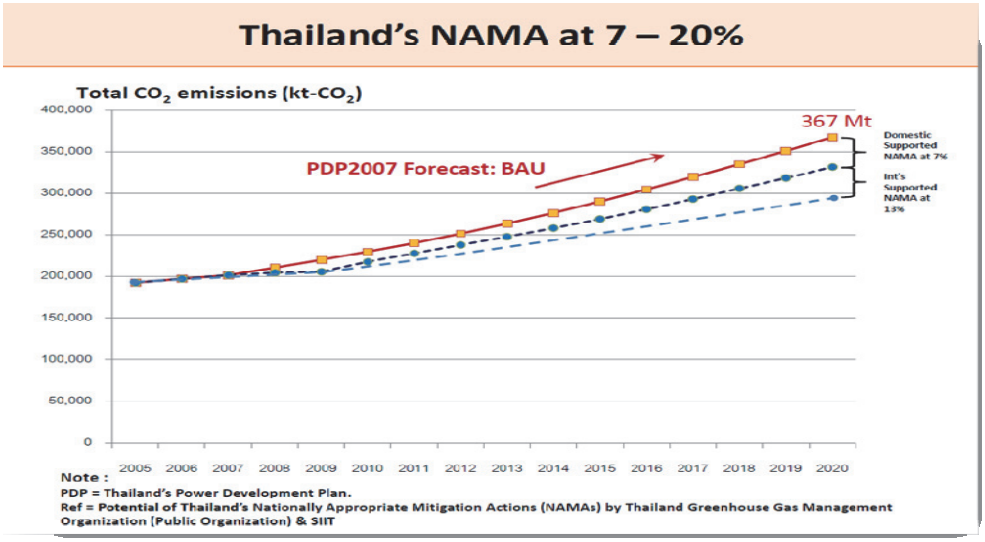
"Thailand will endeavor, on a voluntary basis, to reduce its GHG emissions in the range of 7 to 20 percent below the Business as Usual (BAU) in energy and transportation sectors in 2020, subject to the level of international support provided in the forms of technology development and transfer, finance, and capacity building for NAMAs preparation and implementation."

Table 2: Identified CO_2 countermeasures and total CO_2 mitigation in Thailand's NAMAs

NAMAs	CO_2 Countermeasures	CO_2 reduction in 2020 ($kt\text{-}CO_2$)
Domestically Supported NAMAs	RE Power (MAC)	
	EE Large Industries (MAC < 10$/$t\text{-}CO_2$)	
	Building Codes (Large buildings)	
	Transport/Ethanol (AEDP 2012)	
	Transport/Biodiesel 1st Gen (AEDP 2012)	
	Sub-total	**23,330 $kt\text{-}CO_2$**
Internationally Supported NAMAs	RE Power (MAC > 10$/$t\text{-}CO_2$ plus AEDP)	
	EE Large Industries (MAC > 10$/$t\text{-}CO_2$)	
	Transport/Biodiesel 2nd Gen (AEDP)	
	Environmental Sustainable Transport	
	Sub-total	**49,658 $kt\text{-}CO_2$**
Total Domestic and Supported NAMAs		**72,988 $kt\text{-}CO_2$**
Total emissions in 2005		**192,724 $kt\text{-}CO_2$**
Total emissions in BAU2020		**367,437 $kt\text{-}CO_2$**

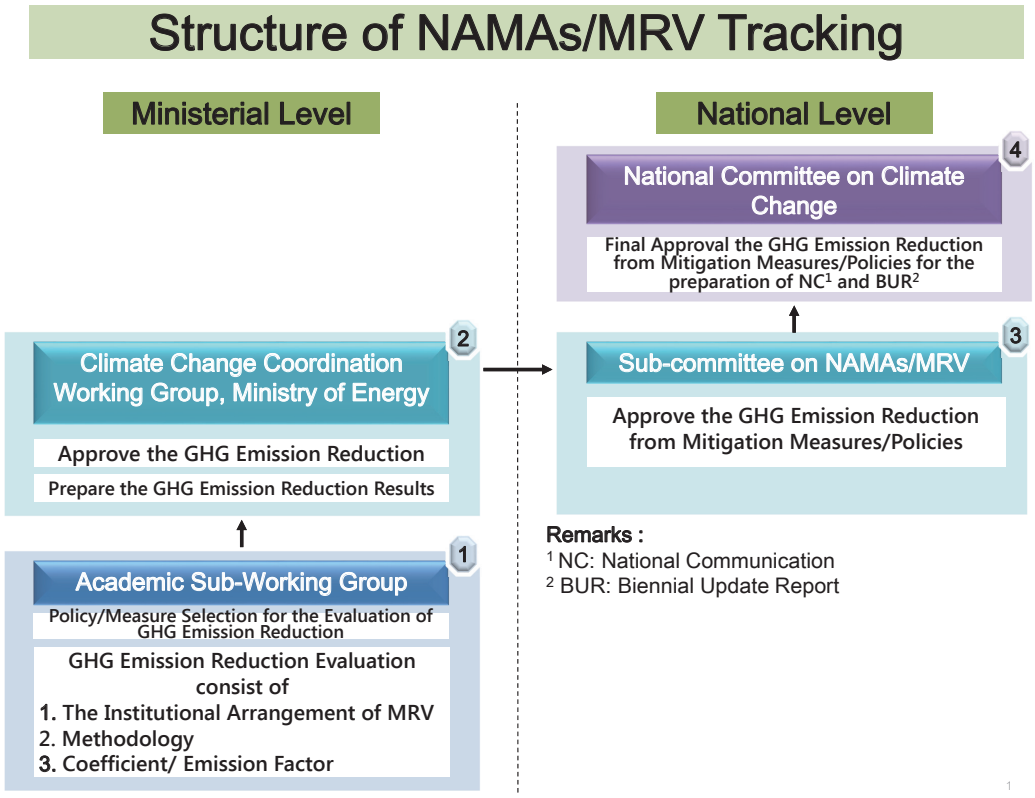
Source: Thailand Greenhouse Gas Management Organization, 2013, "Potential of Thailand's Nationally Appropriate Mitigation Actions", by SIIT

Potential of Thailand's Nationally Appropriate Mitigation Actions, 2013 TGO by SIIT



Source: Thailand Greenhouse Gas Management Organization, 2013, "Potential of Thailand's Nationally Appropriate Mitigation Actions", by SIIT

Thailand Steps on MRV Institutional Arrangement



Source: Office of Natural resources and Environmental Policy and Planning, 2015, "National Committee on Climate Change meeting agenda on 26 June 2015"

The Measurement, Reporting and Verification (MRV) system is an important process to ensure the credibility, transparency, accuracy, consistence, completeness and comparability of the performance of greenhouse gas reduction. The relevant authorities shall develop and operate the MRV system concurrently with the implementation of greenhouse gas reduction.
In this regard, the Ministry of Energy in cooperation with the Ministry of Natural Resources and Environment recognizes the importance of developing NAMAs and its MRV system for the implementation of Domestically Supported NAMAs from the Renewable Energy and Energy Conservation Measures. The MRV system was developed based on the principles of the MRV General Guidelines according to the UNFCCC COP decision 21 / CP.19.
The scope of the National MRV system for NAMA Tracking covers the operational activities to reduce greenhouse gases under the NAMAs related to energy policy and planning of Thailand, which are:

1) **Alternative Energy Development Plan 2012-2021 (AEDP)**
2) **Energy Efficiency Development Plan 2011-2030 (EEDP)**

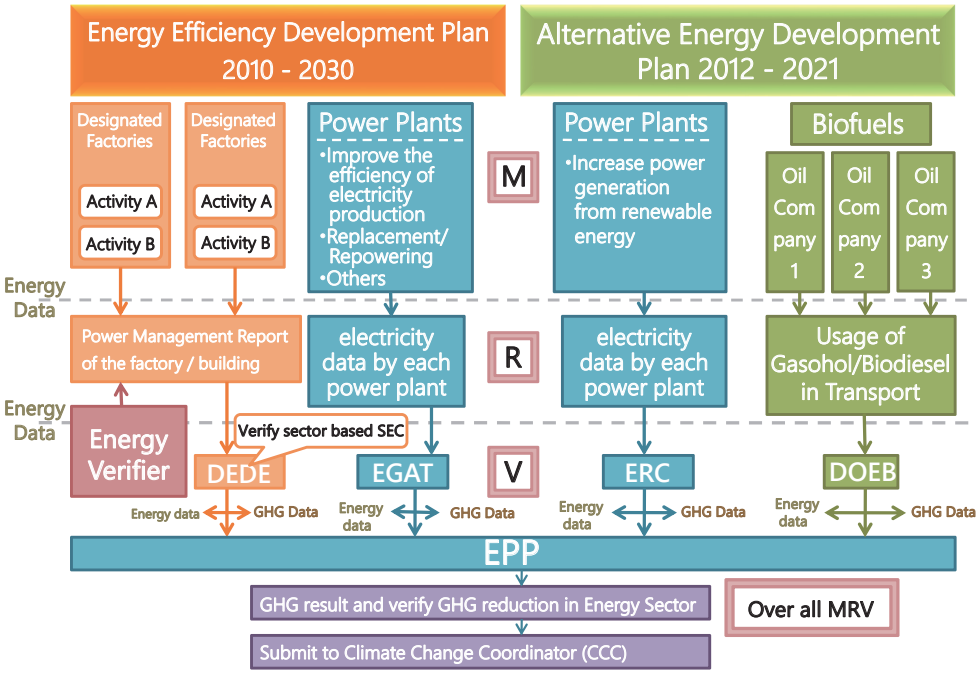
The 4 main mitigation measures for the MRV system under the Energy Policy and Plans are categorized by type of methodology used. Which are:

1. The use of biofuels and fossil fuels substitution
2. Increase of energy efficiency in buildings
3. Increase of energy efficiency in the manufacturing sector

Relevant Agencies for NAMAs and MRV system
The role of the agencies involved in considering the implementation under the NAMAs Tracking/MRV system under the above mentioned measures are:

1) Energy Policy and Planning Office (EPPO)
2) Department of Renewable Energy and Energy Efficiency (DEDE)
3) The Department of Energy Business (DOEB)
4) Energy Regulatory Commission (ERC)
5) The Electricity Generating Authority of Thailand (EGAT)
6) The Provincial Electricity Authority (PEA)
7) The Metropolitan Electricity Authority (MEA)
8) Thailand Greenhouse Gas Management Organization (Public Organization) (TGO)

NAMAs Tracking System and MRV processes



Source: Thailand Greenhouse Gas Management Organization

Challenges and Opportunities

- The national circumstance is the key factor in deciding budget allocation. The national budget needs to be allocated according to national priorities.
- The cost of renewable technologies is still too high to be utilized and invested country wide. International support for NAMAs are needed, as some measures require high investment cost and advanced technology, such as solar and wind energy, energy efficiency technologies in large Industries, 2nd Gen Biodiesel and measures in Environmental Sustainable Transport Master plan.

Conclusion

The identified CO_2 countermeasures under Domestic NAMAs show that Thailand have taken responsibility and prepared for voluntary mitigation under the low - carbon development pathway. However, Thailand and other developing countries need capacity building to prepare CO_2 countermeasures under the NAMAs. In addition, developed countries should support developing countries in terms of capacity building, technology transfer for CO_2 CMs, and financial supports in order to overcome barriers to accelerate the transformation of the country to a low carbon economy / low carbon society.

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Consultation:

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2.5 Case study of NAMAs in the waste water sector of Vietnam - Van Phuc slaughterhouse

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Background

Wastewater from slaughterhouses contains highly soluble and insoluble organics. It will cause water pollution if it is left untreated or improperly treated before release into the environment. In developed countries, slaughterhouses often discharge their wastewater in municipal sewers after some level of chemical pretreatment (Massé and Masse, 2000). These preliminary treatments are not sufficient to reduce pollutant levels below municipal standards. Thus, they must pay a surcharge to have their wastewater further treated at municipal treatment plants. In Vietnam, there is regulation of wastewater standards. However the enforcement of this regulation is not strict enough. As a result, most slaughterhouses do not install wastewater treatment systems. Several slaughterhouses have their own simple wastewater handling systems, but they actually do not work properly. Consequently, most wastewater from slaughterhouses is directly discharged into the environment. In order to strengthen the enforcement of wastewater regulation and to encourage slaughterhouse owners to voluntarily handle wastewater, climate change mitigation such as CDM, JCM or especially NAMAs could be viable solutions. Support from those mechanisms could narrow existing gaps and overcome barriers to the implementation of wastewater handling in Vietnam. These gaps and barriers might be the lack of advanced and cost-effective technologies, the lack of awareness of the cost-benefits of environmental protection, the lack of capacity to operate wastewater handling systems, or the lack of support or initiatives for environmental protection.
Handling wastewater from slaughterhouses, which generally contains a number of contaminants, may

require various appropriate methods such as physical, chemical, physical-chemical and biological methods. Among these, biological treatment appears to be a promising technology because it not only effectively treats wastewater, but also through an anaerobic process may provide methane that can be utilized as a renewable energy resource (Yi Jing Chan *et al.*, 2009). Biological methods can be developed using a number of technologies. Among them, MBR technology is a potential treament system for slaughterhouses' wastewater. A preliminary study for a NAMA in the wastewater sector in Vietnam proposes to apply gas-lifted MBR technology with a combination of aerobic and anaerobic processes to handle wastewater from Thinh An slaughterhouse. This case study will focus mainly on GHG emisisons and reductions analysis from the proposed wastewater treatment technology.

Selection of a pilot NAMA and proposed technology

a) Selection of a pilot NAMA

The scale, environmental situation and the availability of data are the main criteria to select the pilot NAMA. Van Phuc slaughterhouse is located in Van Phuc Commune (Figure 1) with Thinh An Joint Stock Company as one of its investors. It is one of the biggest slaughterhouses in the North of Vietnam. According to survey data, the area of Van Phuc slaughterhouse is around 8,000m^2 and it is designed with a capacity of 1,500 pigs/day-night. It has been operating since 2012. After three months in operation, its productivity was 600 - 700 pigs/day-night, reaching over 50% of the designed capacity. The productivity sometimes reaches 900 pigs/day-night but it has never operated at its full capacity. Its wastewater discharge fluctuates between 80-120 m^3/day. In order to treat wastewater, the company installed a temporary pipeline, a 2,200m^3 biogas treatment system with two settling tanks and a biogas tank. Because of this incomplete wastewater treatment system, wastewater from Van Phuc slaughterhouse is mostly discharged into the Red River. The large scale in terms of capacity and wastewater discharge implies that Van Phuc slaughterhouse could be a model for technology application and may have high potential for GHG emisison reductions.

Figure 1: Location of Van Phuc slaughterhouse

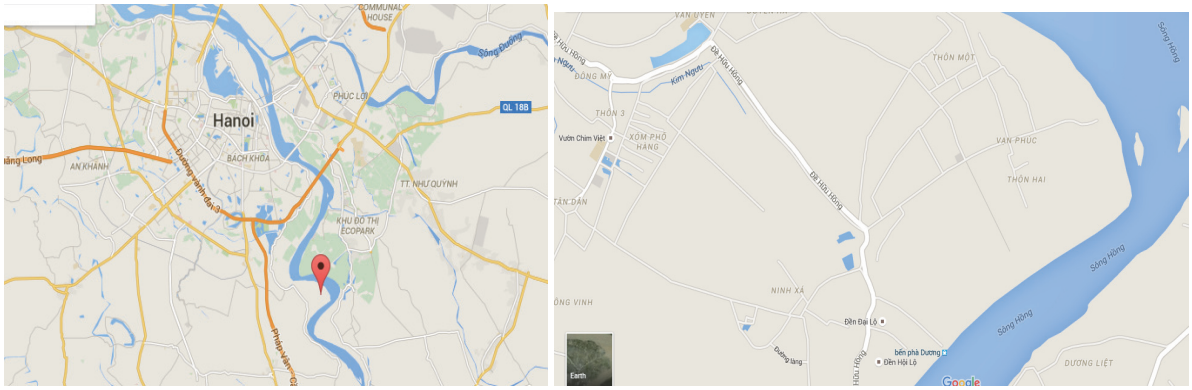


Table 1: Wastewater Characteristics of Van Phuc slaughterhouse

Parameters	Units	Sample 1	Sample 2	Vietnamese standards - QCVN 40:2011/BTNMT (column B)
COD	mg/L	1875	2050	150
BOD_5	mg/L	1005	1010	50
TSS	mg/L	520	980	100
DO	mg/L	0,1	0,17	-
pH		6,4	6,01	5,5 - 9
NH_4^+-N	mg/l	88,4	92,4	10
TN	mg/l	252	336	40
PO_4^{3-}-P	mg/l	47,75	32,1	-
TP	mg/l	65,2	34,1	6

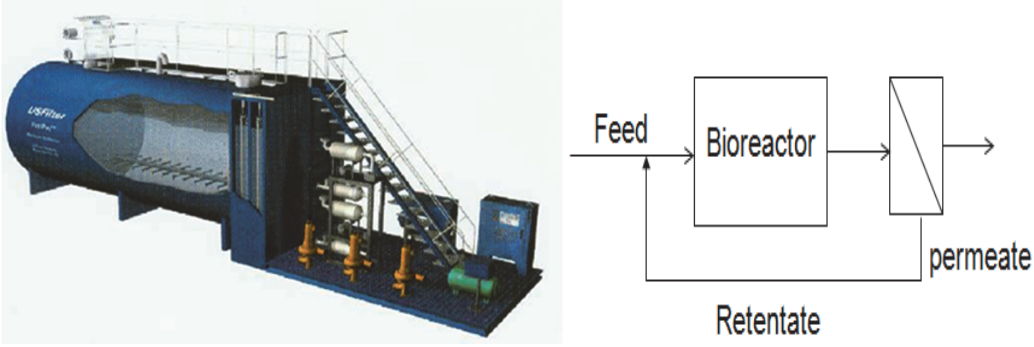
Notes:
- Sample 1: samples collected at the positions right after surgery (not yet through processing of organs)
- Sample 2: samples collected at the positions after completion of the surgical stages (including processing of organs)
COD: Chemical oxydation demand; BOD_5: Biological oxygen demand; TSS: Total suspended solid; DO: Disoveld oxygen; TN: Total Nitrogen; TP: Total Phosphate.

The characteristics of wastewater from Van Phuc slaughterhouse can be analysed with the data in Table 1. These figures show that wastewater discharged from the slaughterhouse exceeds Vietnamese standards in most of the parameters. Some parameters are 10 to 20 times higher than the standards -- COD and BOD5, for instance. It indicates that the wastewater treatment system at Van Phuc slaughterhouse is ineffective or not working properly. That is another reason why Van Phuc slaughterhouse should be chosen as a pilot NAMA in the wastewater sector. The third reason is that the necessary data for calculating emissions and mitigation potential of the slaughterhouse were surveyed under another project and are available for use.

b) Proposed technology

The major wastewater handling technology proposed for Van Phuc slaughterhouse is gas-lifted MBR with some characteristics: a combination of biological process and membrane filtration process; membranes are microfiltration (MF) or ultrafiltration (UF). This is currently one of the most promising bioreactor technologies. A few of its recognised advantages can be named:

Figure 2: MBRs technology

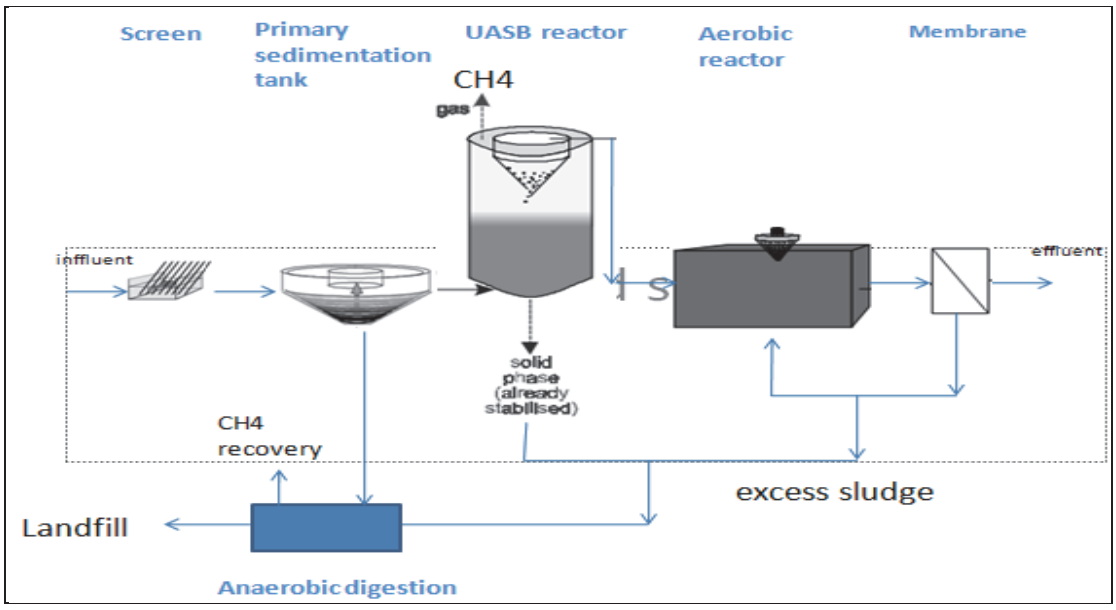


Source: Authors' own elaboration

(1) Particle-free effluent (removal of pathogenic protozoa, colloids, suspended solids; high quality effluent); (2) Absolute barrier for retention of biomass (high biomass and microbial activity (5-10X); gravity-settling clarifier eliminated); (3) Decoupling of HRT and SRT (retention of slower-growing microbes (e.g., nitrifiers and methanogens); retention of more recalcitrant substrates (particulate or higher-MW substrates) to permit slow degradation); (4) Remote-monitoring and control appropriate (on-site landfill leachate treatment); (5) Potential for bioaugmentation (can utilize and fully-contain microbes "trained" to break down select contaminants), etc. However, the application of gaslift MBR currently faces two challenges, which are high energy consumption for pumping and fouling of the membrane. The configuration of gaslift MBR could be the solution for those two challenges. The biogas produced in anaerobic processes could be utilized to lift the wastewater through a membrane module. The gas could create continuous turbulence and increase shear over the surface of the membrane, thereby reducing fouling of the membrane and the pressure inside it. That results in reducing energy needed to pump water through the membrane.

We proposed a gaslift MBR for Van Phuc slaughterhouse, described in Figure 2. The wastewater was first pretreated by a screen and sedimentation, then treated by anaerobic processes in a UASB, then by an aerobic process in an aeration tank. The aeration tank is coupled with a gaslift membrane. Figure 2 shows that the energy was able to be recovered by collecting and utilizing biogas in the UASB in the wastewater treatment process and in an anaerobic biodigester for the sludge-handling process. The use of a membrane is not only for enhancing the quality of water but also for retaining the biomass in the system, which will eventually be transported to, and treated in, the anaerobic digester, thereby enhancing energy recovery. All the sludge collected in the sedimentation tank, UASB and aeration tank is treated in an anaerobic biodigester. The biogases produced are collected and used for gas lift and power-generation purposes. The summarised efficiencies and operational conditions of the systems are shown in Table 2.

Figure 3: Proposed wastewater handling process for Van Phuc slaughterhouse



Source: Authors' own elaboration

Table 2: Several Designed Parameters

Parameters/Reactors	Anaerobic reactor	Aerobic reactor	Membrane
COD removal efficiency	50%	99%	Tubular membrane; ultrafiltration (UF)
Sludge concentration	6000 mg/l	8000 mg/l	
HRT	36h	12h	
SRT	60 days	16-20 days	

* COD: Chemical oxygen demand; HRT: Hydraulic retention time; SRT: Solid retention time.

GHG calculation methodologies

The case study applies CDM methodologies, namely AMS-III.H and AMS-III.I for either anaerobic or aerobic treatment of wastewater. AM-III.H methodology (Small-scale Methodology - Methane recovery in wastewater treatment, version 17) is applied to calculate the methane emission potential and the recovery and use of this amount of methane. AMS-III.I methodology (Avoidance of methane production in waste water treatment through replacement of anaerobic systems by aerobic systems, version 08) is applied to estimate emission reductions by an aerobic process.

Baseline scenario (BAU): There are two baseline scenarios which are:

1. *Baseline emissions BE1- without the proposed wastewater treatment system (or current situation)*

$$BE_{y(1)}=BE_{ww,discharge,y} \quad (1)$$

Where:

$BE_{y(1)}$ = Baseline emissions in year y (t CO_2e)

$BE_{ww,discharge,y}$ = Baseline methane emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (t CO_2e).

2. *Baseline emissions BE2- withproposed wastewater treatment system but without CH_4 capture system and power generator*

$$BE_{y(2)}=BE_{ww,treatment,y}+BE_{s,treatment,y}+BE_{ww,discharge,y}+BE_{s,final,y}+BE_{ww,treatment,y(aerobic\ reactor)} \quad (2)$$

Where:

$BE_{y(2)}$ = Baseline emissions in year y (t CO_2e)

$BE_{ww,treatment,y}$ = Baseline emissions of the anaerobic wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (t CO_2e)

$BE_{s,treatment,y}$ = Baseline emissions of the sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y (t CO_2e)

$BE_{ww,discharge,y}$ = Baseline emissions from degradable organic carbon in treated wastewater discharged into sea/river/lake in year y (t CO_2e)

$BE_{s,final,y}$ = Baseline emissions from anaerobic decay of the final sludge produced in year y (t CO_2e)

$BE_{ww,treatment\ (aerobic\ reactor)}$ = Baseline emissions during the biological aerobic treatment of wastewater (t CO_2e).

Table 3: Results for baseline emissions

Factor	Value(t CO_2e)
$BE_{ww,discharge,y}$	33.297
$BE_{ww,treatment,y}$	133.189

$BE_{s,treatment,y}$	28.154
$BE_{ww,discharge,y}$	16.649
$BE_{s,final,y}$	17.596
$BE_{ww,treatment\ (aerobic\ reactor)}$	19.630

Project emissions: Project boundary is the physical, geographical site where the wastewater and sludge treatment takes place in baseline and project situations. It covers all facilities affected by project activities including sites where processing, transportation and application or disposal of waste products as well as biogas take place. When a methane recovery system is added, recovered methane is collected and combusted to generate electricity. Methane emissions will then become CO_2 emissions. Project emissions with the proposed wastewater treatment system, a CH_4 capture system and a power generator consist of:

$$PE_y = PE_{fugitive} + PE_c - ER_{eg} \quad (3)$$

Where:

PE_y = Project emissions in the year y (t CO_2e)

$PE_{fugitive}$ = Methane fugitive emissions due to inefficiencies in capture system (or emissions from CH_4 release in capture systems) (t CO_2e)

PE_c = Emission due to methane combustion (t CO_2e)

ER_{eg} = Emissions reduction equivalent to generated electricity from methane recovery (t CO_2e);

Table 4: Calculation results of factors for PE calculation

Factor	Value (t CO_2e)
$PE_{fugitive}$	10.761
PE_c	22.490
ER_{eg}	4.143

Source: Authors' own elaboration

Potential GHG emission reduction until 2020

Emissions reduction:

$$ER = BE - PE \quad (4)$$

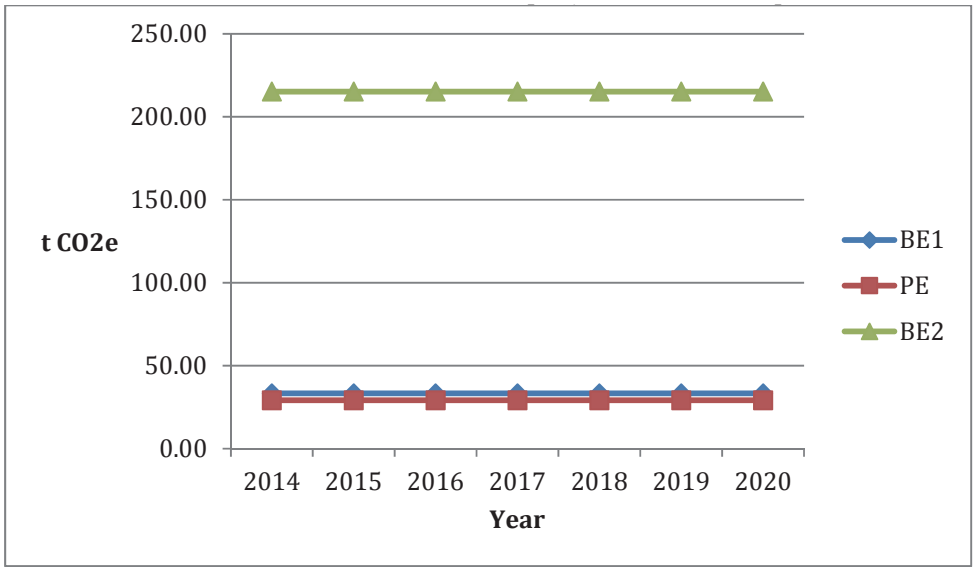
It is assumed that Van Phuc slaughterhouse will not plan to increase its operational capacity in the next ten years. Therefore, there will be no change in wastewater volume in the period 2014-2020. Results for the period 2014-2020 are shown in Table 5 below.

Table 5: Results of emission reductions (Unit: tCO_2e)

Year	2014	2015	2016	2017	2018	2019	2020	Total
BE_1	33.30	33.30	33.30	33.30	33.30	33.30	33.30	**233.08**
BE_2	215.22	215.22	215.22	215.22	215.22	215.22	215.22	**1506.52**
PE	29.11	29.11	29.11	29.11	29.11	29.11	29.11	**203.76**
ER_1	4.19	4.19	4.19	4.19	4.19	4.19	4.19	**29.32**
ER_2	186.11	186.11	186.11	186.11	186.11	186.11	186.11	**1302.76**

Source: Authors' own elaboration

Figure 4: Emission reduction, baseline and project emissions, period 2014-2020



Source: Authors' own elaboration

In this case study, there are two baseline emissions including: BE_1- without a wastewater treatment system; and BE_2, a wastewater treatment system without a CH_4 capture system and power generator. The authors have suggested a NAMA project emission – PE – applying MBRs technology for a wastewater treatment system, combined with CH_4 capture system and a power generator. The emission reduction ER_1 and ER_2 for BE_1 and BE_2 respectively have been also calculated. The results show that emissions from BE1 are slightly higher than emissions from PE (only 29.32tCO_2e). This is because most of the wastewater in BE_1 is freely released into the environment. However, this scenario is not considered the baseline scenario as the slaughtershouse has to apply the wastewater treatment process according to regulations. Therefore, the baseline scenario in this casestudy is BE_2 - a wastewater treatment system without a CH_4 capture system and power generator. In this way, emission reductions will be up to 186.1 tCO_2e/yr or 1,302.8 tCO_2e in the period 2014 – 2020.

Conclusions: Lessons learned and the way forward

With the current status of wastewater treatment at slaughterhouses in Vietnam, the paper has analyzed GHG reduction potential with MBR technology in Van Phuc slaughterhouse. This process is a combination of anaerobic and aerobic treatment, with a CH_4 capture system and a power generator. The results indicate that the application of MBR technology combined with a biogas recovery system and power generators in slaughterhouses could be a transformational NAMA. Success in applying MBR technology will contribute to enabling either a significant evolution in terms of scope (e.g. scaling-up or replication), or enabling a faster and/or a significant change in handling slaughterhouses' wastewater. The pilot implementation of the NAMA will be a role model for applying large-scale treatment of wastewater from slaughterhouses with gas-lifted MBR technology and biogas recovery and use. There are more than 20,000 slaugherhouses in Vietnam. Most of them don' t have wastewater treatment system which result in severe pollutions to the evironment and a huge source of greenhouse gases. If the gaslift MBR could be upscale applied for the whole countries, that will benefit not only the GHG emission reduction but also environment.

Additionally, regarding social aspect, the NAMA could potentially contribute to job generation for local residents in the project area, improvement in working-environment conditions, or in community capacity in wastewater treatment. It would be much beneficial for the slauterhouse particularly in ensuring to meet the requirements in standardized wastewater treatment, also for the private company that would invest in developing technology and for some other relevant parties such as the third party involving to the verification process after NAMA implementation.

Currently, there are some legal basis which would facilitate to this NAMA implementation, including many policies related to wastewater management in Vietnam such as Decision No. 1930/QD-TTg on approving the development orientation of urban drainage and Industrial Zone in Vietnam by 2025 with a vision to 2050; Decree of the Government No. 67/2003/ND-CP on environmental protection charges for wastewater or Decree No. 80/2014/ND-CP on wastewater drainage and treatment. In addition, a wide range of programs, projects related to climate change mitigation in waste sector would also support the NAMA, namely the National Target Program to Respond to Climate Change (NTP-RCC), Support Program to Respond to Climate Change (SP-RCC), National GHG inventory reports, Biennial Update Report 1 (BUR1) of Vietnam, etc.

Although MBR technology has high efficiency in wastewater treatment with many advantages and the application of the gaslift MBR configuration could be very promising, it is still facing several challenges, especially in applying for developing countries like Vietnam such as high initial cost. Lack of domestically produced technology, lack of experience, skills in technology application are several gaps in this proposed NAMA as well. Therefore, the international support namely in capacity building as well as technical and financial aspects should levarage the implementation of this NAMA. Further research should also be conducted for technical improvement in order to harmonize costs and benefits in applying this technology in Vietnam wastewater treatment.

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2.6 Transformational change and NAMAs in the agriculture, forestry and other land use sector

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Background

Agriculture needs to undertake substantial measures to adapt to climate change if it is to produce enough food to meet current and future global demand. Today, nearly 795 million people are chronically undernourished (FAO *et al.*, 2015). According to FAO estimates, by 2050 global food production will need to increase by 60 percent over 2005/2007 levels to feed the expanding population and meet changing food consumption patterns (Alexandratos *et al.*, 2012). Agriculture is highly vulnerable to changes in climate. Climate change causes fluctuations in food supply and prices, damages infrastructure, creates food safety hazards and reduces opportunities for agricultural communities to generate income and strengthen livelihoods.

The Agriculture, Forestry and Other Land Uses (AFOLU) sector is responsible for 22-24 percent of total greenhouse gas (GHG) emissions. Agriculture accounts for 10-12 percent and forestry and other land use for 12-14 percent. Over the last few decades, there has been a significant increase in global GHG emissions from agriculture, while emissions from deforestation have been decreasing (IPCC, 2014). Population growth and changes in food consumption patterns (e.g. higher demand for milk and meat products) will lead to a continued increase in GHG emissions from the agricultural sector unless changes are made in production systems. Methods need to be found to reduce the emission intensity of agricultural outputs. In other words, it is necessary to generate fewer GHG emissions per kilogram or litre of agricultural product. To reduce the emission intensity of agricultural products, a critical look must be directed at agricultural systems and practices to identify opportunities for transforming the entire agriculture sector and related value chains.

In principle, there are two options in agriculture for developing mitigation actions: reducing and removing emissions. There are many options for reducing GHG emissions in agriculture, such as using nitrogen fertilizers more efficiently, improving livestock health and feeding practices, reducing tillage and drainage on organic soils, improving irrigation management and reducing deforestation and forest degradation caused by expanding farmlands. Options for removing GHG emissions in the agricultural sector include improved nutrient and waste management, improved pasture and rangeland management, the adoption of agroforestry systems and crop rotation.

Status of AFOLU NAMAs

NAMAs can be useful vehicles for reducing net GHG emissions and transforming the agriculture sector, as they are intended to achieve multiple objectives. NAMA development in agriculture has the potential to simultaneously address climate change mitigation, productivity, food security and sustainable rural development.

Until recently, there have been few NAMA concept notes and proposals prepared for the AFOLU sector. However, the situation is changing. As of August 2015, 16 percent of the 101 NAMAS registered in the NAMA registry are in the AFOLU sector.

NAMAs should clearly identify links between mitigation actions and sustainable development. It is particularly important that NAMAs in the agriculture sector be connected to national agricultural

development plans and strategies.

Table 1 presents some examples of AFOLU NAMAs that are being prepared or implemented in different countries. They focus on emission reductions mostly from the livestock sector (e.g. Costa Rica and Uganda) and the forestry sector (e.g. Georgia, Mali, Tajikistan and Uruguay). Several countries have already obtained financing for their agriculture NAMAs. The financing has been used to conduct detailed analyses of GHG mitigation potential and to design concrete implementation plans, and to develop Measurement, Reporting, and Verification (MRV) systems.

Table 1: Examples of AFOLU NAMAs.

Country	Title	Timeframe	Status
Burkina Faso	Biomass Energy NAMA Support Project*	5 years	Financially supported by the Inter-American Bank and NAMA Facility
Chile	Implementation of a National Forestry and Climate Change Strategy, including the development and implementation of a Platform for the Generation and trading of forest carbon credits	4 years	Seeking support for implementation
Costa Rica	Livestock NAMA	15 years	Financially supported by the Inter-American Bank
	Low carbon coffee *	5 years	Financially supported by the Inter-American Bank and NAMA Facility
Dominican Republic	Blue Carbon NAMA: Conserve and restore mangroves	18 months	Seeking support for preparation
	Reducing GHG emission in pig farms	15 years	Seeking support for implementation
Georgia	Adaptive sustainable forest management	2 years	Financially supported by the Government of Austria
Mali	Forestry NAMA	-	Seeking support for preparation
Tajikistan	Forestry NAMA*	6 years	Financially supported by the NAMA Facility
Uganda	Developing appropriate strategies and techniques to reduce methane emissions from livestock production	6 months	Seeking support for preparation
Uruguay	Expansion of electricity generation from sustainable forestry biomass by-products	13 years	Seeking for recognition
	Sustainable production with low-emission technologies in agriculture and agroindustry production chains	24 months	Seeking support for preparation

Source: Submitted NAMAs to the UNFCCC registry and NAMAs financed by the NAMA Facility*, as of August 2015

In addition to substantially lowering GHG emissions, AFOLU NAMAs can provide significant socio-economic benefits. For instance, the Low Carbon Coffee NAMA in Costa Rica, a sector-wide project designed to bring about a climate-friendly transformation of the entire coffee value chain, has the potential to reduce emissions by 1.85 million tonnes of carbon dioxide equivalent over 20 years. In addition, it will also enable farmers and millers to develop sustainable livelihoods, potentially improving the living standards of more than 400,000 people. By providing grants, loans and guarantees that will enable coffee farmers and millers to use GHG-efficient fertilizer and adopt improved milling technologies, the Costa Rica project offer incentives to the private sector to make investments in climate-friendly

innovations[1].
The Forestry NAMA in Tajikistan is planned to sequester 2.01 million tonnes of carbon dioxide equivalent by 2030 and support biodiversity conservation, climate change adaptation and ecosystem services. The Tajikistan NAMA will create new jobs and generate income, mobilize private sector finance, and catalyse additional national funding[2].

Barriers and challenges of transformational changes in AFOLU NAMAs

Transformational change is defined as "a structural change that alters the interplay of institutional, cultural, technological, economic and ecological dimensions of a given system. It will unlock new development paths, including social practices and worldviews" (Mersmann *et al.*, 2014).
The concept of transformational change gained increased attention with the launch of the Green Climate Fund, which is intended to "*In the context of sustainable development, [···] promote the paradigm shift towards low-emission and climate-resilient development pathways by providing support to developing countries to limit or reduce their greenhouse gas emissions and to adapt to the impacts of climate change, taking into account the needs of those developing countries particularly vulnerable to the adverse effects of climate change*" (UNFCCC, 2011).
Transformational change is a concept that is expected to contribute to long-term sustainable development. The concept is evolving as countries gain more knowledge and experience. Fostering transformational change has become an explicit ambition of international NAMA financing. Development pathways are considered conducive to transformational change if they:

- contribute to the change of prevailing structures of a sector with high emissions;
- allow for a significant shift from business-as-usual practices;
- propose an innovative approach and response;
- have a catalytic effect beyond a one-off project or programme investment;
- can be scaled up and replicated;
- are supported by local ownership and political commitment;
- engage the private sector;
- contribute to learning and generally increase knowledge; and
- create an enabling environment for the long-term implementation.

Due to the complex nature of the AFOLU sector, there are several challenges that can be expected to be encountered in meeting the requirements for transformational change.
The key to enabling transformational change in agriculture centers on enhancing productivity. Strategies to increase the productivity and sustainability of agricultural practices must consider both the risks and socio-economic costs and benefits for a large and diverse group of people living in landscapes with different ecological conditions, and both the public and private sector interests.
The implementation of transformational change is a challenging undertaking in the AFOLU sector given the limitations of land and trade-offs that need to be made to ensure the sustainable management of forests and natural resources. Furthermore, limited risk management mechanisms and uncertainty about the likely benefits can discourage stakeholders from carrying out mitigation actions. To overcome this barrier, the provision of risk guarantees or insurance schemes are needed. To cover upfront investment

[1] http://www.nama-facility.org/projects/costa-rica.html
[2] http://www.nama-facility.org/projects/tajikistan.html

and maintenance costs, stakeholders will need easy access to affordable capital. Generating tangible co-benefits, such as increased productivity, can make NAMAs more attractive to stakeholders.
The high number of group and individual stakeholders in the AFOLU sector is a potentially limiting factor for achieving sector-wide transformation. To reach this large number of people, substantial changes at the policy level or in the operations of private companies will be required. The introduction of government subsidies or taxes supporting the adoption of climate-friendly agricultural practices, or the decision of private companies to only purchase products produced in a carbon-neutral way, are two examples of actions that can trigger transformational change in the AFOLU sector.
Identifying the stakeholders in the forestry sector can also be challenging. Access and ownership rights are fundamental policy issues in multiple-use forestry. Good governance is crucial for achieving sustainable development in this sector.
Because of the diversity of the ecosystems and production systems, and the extremely wide range of agricultural and forestry activities and practices worldwide, there is a broad range of possible options for AFOLU NAMAs. Thus, site-specific management practices should be tested and applied.
The formulation of NAMA strategies requires data and information on which to base the MRV systems. Thus, countries should develop a national monitoring and reporting system capable of collecting all the information needed to assess the impact of NAMAs.

FAO support in the AFOLU NAMA process

FAO, through the Mitigation of Climate Change in Agriculture (MICCA) Programme, supports countries in the preparation and development of NAMAs and MRV processes with a number of tools and capacity development activities.
FAO is actively participating in the regional UNFCCC capacity development workshops on NAMAs. It is fully engaged in the NAMA Partnership mainly contributing, among others, to the Compendium on Baselines for Mitigation for the AFOLU sector.
The FAO "Learning tool on Nationally Appropriate Mitigation Actions in the agriculture, forestry and other land use sector" has been launched recently to support countries in the identification, development and implementation of mitigation actions in the context of national sustainable development.
Several workshops at regional and country level have been carried out to enhance capacity in data collection and assessing emissions for the AFOLU sector that should serve both the national GHG inventory and the MRV process.
Moreover, FAO has organized in-country workshops to start up NAMA processes in Viet Nam and Kenya.

Box 1: A new NAMA in Kenya aims to transform the dairy sector

At the global scale, livestock supply chains emitted approximately 7.1 gigatons CO_2-eq in 2005, which represents 14.5 percent of all human induced greenhouse gases (GHG). Such emissions originate from four main processes: enteric fermentation, manure management, feed production and energy consumption. Emissions from the milk supply chain account for 20 percent of the total livestock sector emissions. The technical mitigation potential in the livestock sector is estimated to be around 30 percent, or about 1.8 gigatons CO_2-eq, compared to the baseline scenario (Gerber *et al.*, 2013).

In Kenya, the emissions from the livestock sector are approximately 30 percent of the total GHG emissions (Stiebert 2012). Enteric fermentation accounts for over half of the livestock emissions, and approximately one quarter of the enteric fermentation emissions originate from milk production (FAOSTAT, 2015). The Kenyan Ministry of Agriculture, Livestock and Fisheries has initiated a process to make the dairy sector more efficient and climate-friendly through nationally appropriate mitigation actions. FAO' s MICCA programme in collaboration with the CGIAR centers and the CGIAR Climate Change, Agriculture and Food Security Programme is supporting the Ministry in its efforts.

The aim of the dairy NAMA in Kenya is to improve the productivity and efficiency of the sector in a sustainable manner, which means producing and processing more milk with reduced emissions. During the past four years FAO, through the MICCA pilot project in Western Kenya, collected information for providing concrete evidence that milk yields can significantly increase if proper management practices are put in place. Moreover, FAO together with partners developed a method for quantifying the GHG emissions from the dairy value chain. These results can support the dairy NAMA development in Kenya.

The NAMA activities in Kenya will first focus on raising awareness and enhancing capacity among the dairy sector stakeholders through a designated multi-stakeholder platform. This platform will enable stakeholder engagement and the identification of jointly agreed mitigation options. Additionally, the platform will facilitate discussion on institutional arrangements and potential financing mechanisms to support the adoption of measures that will boost a sustainable increase in milk production. FAO' s Global Livestock Environmental Assessment Model (GLEAM) will support the generation of national emission factors and identification of cost-effective mitigation actions for the dairy sector. GLEAM will also support the development of a monitoring system tested at farm, cooperative, county and national level.

The dairy NAMA proposal is expected to be ready by mid-2016.

Conclusion

The AFOLU sector constitutes a substantial proportion of GDP and is an important source of employment in developing countries. NAMAs provide developing countries with a flexible structure to integrate the AFOLU sector into climate change mitigation actions and implement national sustainable rural development plans that follow low-emission and climate-resilient development pathways.

Due to the complex nature of the AFOLU sector, there are barriers and challenges for designing and implementing appealing mitigation actions capable of bringing about transformational change. Nevertheless, NAMAs do have the potential to be an instrument to support the transformation of the

AFOLU sector while at the same time reducing GHG emissions.
By capitalizing on synergies between national development plans and mitigation strategies, countries can use the development of transformational AFOLU NAMAs to leverage climate financing that can contribute to meeting national objectives related to food security and sustainable rural development.

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2.7 Case study Namibia – NAMA on rural development in Namibia through electrification with renewable energies

By Alexandra Soezer
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A NAMA's ability to achieve lasting results

The success of a NAMA to achieve lasting results will depend on its ability to facilitate transformative change. The design of the NAMA paths the way for an effective and sustainable implementation of a mitigation programme that can lead to green and sustainable growth.

The NAMA on Rural Development in Namibia through Electrification with Renewable Energies' overall target is to support Namibia in achieving the goal defined in the Off-Grid Energisation Master Plan (OGEMP), namely to provide access to appropriate energy technologies to everyone living or working in off-grid areas. More specifically, the NAMA aims at giving access to electricity for regions, households and companies which are currently without access to electricity, as well as improving the share of renewable energies. The NAMA goes beyond its desired impact on GHG emission reductions to include the achievement of significant sustainable development goals that can benefit the country and its inhabitants as a whole.

The NAMA's 10 key success factors to transform the sector and achieve sustainable development impacts are highlighted on the following pages:

1. The NAMA will spur the development of an environment which facilitates transformative change in the energy sector: An enticing regulatory and policy environment which incentivizes the private sector will be created. Initial interventions will catalyse private sector development and the creation of local jobs. The business models associated with the NAMA interventions will be easily replicable in other communities across the country.

2. The NAMA is fully embedded in national development strategies and targets: The transformative change must occur in a fashion which is aligned with national development goals. The overarching objectives and targets of Namibia as a country are defined in the Vision 2030. According to this document, adopted in 2004, the target is to have "a prosperous and industrialized Namibia, developed by her human resources, enjoying peace, harmony and political stability" by 2030 (NPC, 2004—Summary, p.15).
The NAMA objectives are designed to support Namibia in achieving its strategies for rural electrification and to complement ongoing activities in this field:

NAMA objective	National strategy & target
Improve electricity access	The section on public infrastructure in NDP4, states: "By 2017, Namibia will have in place adequate base load energy to support industry development through construction of energy infrastructure and the production capacity would have expanded from 400 to more than 750 MW to meet demand." Although the activities planned under the NAMA are not grid-related and therefore do not directly contribute to the achievement of this target, they will indirectly contribute to this target by offering a solution to the problem of supplying electricity to areas which cannot be reached by the electricity grid. Also, under this objective demand side management is addressed by promoting electricity-saving technologies. This is a key prerequisite for a successful implementation of mini grids. The OGEMP foresees electrification of rural public institutions with the aim of reaching all public institutions (including schools, churches and government buildings) within five years.
Improve the share of renewable energies	The OGEMP envisages: The roll-out of Energy Shops, creating one Energy Shop in each of the 13 provinces in each of the first two years of the plan and opening a total of 156 Energy Shops by 2027. Providing funding for households and communities through the Solar Revolving Fund.
Reduce GHG emissions	Since Namibia is a net sink in terms of GHG emissions, the country has no particular target for reducing emissions and in dealing with climate change focuses more on adaptation than mitigation measures. Nevertheless, Namibia is "committed to reducing its GHG emissions where this is financially and environmentally feasible" (MET, 2011, p.9).
Provide income generation and new business opportunities	The section of NDP4 on poverty states as a desired outcome that "by 2017, the proportion of severely poor individuals has dropped from 15.8 per cent in 2009/10 to below 10 per cent". As poverty is mainly a problem in rural areas, employment opportunities in rural areas are a key to achieving the poverty reduction target.
Improve private sector involvement	The section of NDP4 on the institutional environment states as a desired outcome that "by the year 2017, Namibia is the most competitive economy in the SADC region, according to the standards set by the World Economic Forum". The need to increase Public-Private Partnerships (PPPs) was identified as a key strategy for achieving this competitiveness. PPPs will also have an important role in establishing mini grids under the NAMA.
Achieve additional SD benefits	Additional SD benefits are only mentioned vaguely in the Vision 2030 and NDP4.

3. The NAMA details concrete actions to achieve the policy targets: The NAMA will be operationalized through 2 different interventions: Under Intervention A, mini grids will be established in rural communities. These mini grids will preferably be in the vicinity of schools and potential future tourism projects, such as eco-lodges. The mini grids will use renewable energy sources (solar, wind, hydro) and will provide the following services.

Households: electricity for daily lighting (two lamps minimum), radio and phone charging will be provided.
Public buildings: electricity for lighting and internet (schools, government buildings, health centres), computers/printers, mobile charger stations and basic clinic instruments in health centres).
Rural Productivity Zones (RPZ): The mini grid will provide capacity for income generation opportunities for entrepreneurs and community projects. The concept of the RPZ is based on the paradigm of an integrated approach to sustainable rural development. It consists of setting up an energy system and associated infrastructure in a rural area that provides power for a range of activities that lead to income enhancement and social development. The resulting economic activities generate money, which in part goes into paying for the investment, and the operation and maintenance of the energy system and infrastructure. In this manner RPZs increase the ability of consumers to make consumer payments, by allowing for more community level income generation.

(UNDP, 2014b).

Under Intervention B, the concept of Energy Shops will be further developed into Energy Zones (EZs). The OGEMP defined the concept of Energy Shops. Energy Shops are established within a reasonable distance of targeted communities and sell suitable, approved energy products and compatible appliances to consumers. Energy Zones will promote new entrepreneurial activities by providing space and electricity for Internet cafes, sewing workshops, ice-making, agro-processing, etc.;

4. The NAMAs eligibility criteria for participation and receive funding are clearly defined: Any mini – grid will need to meet the following eligibility criteria.

Eligibility criterion	Description
Location	Any off-grid area as defined in the REDMP (MME, 2010, p. 40) is eligible. Locations in pre-grid or grey areas are not eligible. The mini grid must be at least 10 km away from the nearest power line. The 27 potential localities earmarked in the REDMP (MME, 2010, p. 162) are eligible.
Technology[23]	Energy supply: the mini grid will be operated with solar PV or a combination of solar PV and wind power.
	Battery: batteries are recommended for a steady electricity supply.
	Backup: fossil-fuel back-up systems are allowed; however, the share of electricity from renewable energies must be at least 75 per cent.
Connections	The mini grid must connect a minimum of 20 households.
Service level	Dwellers: the minimum service level provided to dwellers needs to include at least two sources of lighting, radio and phone charging.
	Income generating activities: the mini-grid must include opportunities for income generating activities. The following types of activities are recommended to be included: • Agro processing units • Ice-making units • Cooperative milling • Solar cooker production • Bakeries • Internet access • Charging of phones. Activities will be considered via the Point Score System (for details on the Point Score System, see Table 25).
	The mini grid must provide electricity 24 hours per day.
Point Score	A project must reach a total Point Score of at least 200 (see details on Point Score System in Table 25). The sub-score for income generating activities must be at least 80.
Implementation	Mini grids must be operational within 18 months of contract award.
Funding	Maximum grant funding is 80 per cent of total investment costs. Operating costs must be covered from income from electricity sales.

In order to be able to receive funding under the NAMA, an Energy Zone will have to meet also certain eligibility criteria as outlined below:

Eligibility criterion	Description
Location	The Energy Zone must be off-grid as defined in the OGEMP.
Energy Zone Operator	Must have been in business for at least three years. Must provide information to prove the business's stability.
Space	There must be minimum space of 50 m^2 for income generating activities in the company's building or in adjacent buildings (whose distance from the building of the operator must be no more than 50m). Alternatively, there should be space to erect additional buildings to host income generating activities.
Technical feasibility	It must be technically feasible to install solar PV and the related battery storage. Roof-mounted solar PV is preferred.
Income generating activities	The operator must provide a list of potential income generating activities with an estimate of approximate demand.

5. The NAMA is cost effective and provides best value for money: The method, which will be applied to select the mini grids is reversed auctioning. Under reversed auctioning, offers are accepted – starting from the cheapest offer – until the budget available for the specific auction is used up. In the case of the mini grids, auctioning will be based on value for money. Proposals will be ranked by their Value for Money Index (VMI), which will be calculated as "grant support requested (in N$) per one OGEMP Point Score".

The point scores for each mini grid applying for funding will be based on the Point Score System used in the OGEMP to determine priorities for rolling out the Energy Shops (UNDP, 2007). The same system will be used for evaluating the Energy Zones. In addition to the scoring system developed under the OGEMP, points will be given for income generating activities.

Using the Point Scoring System, the Value for Money Index (VMI) will be calculated for each of the mini grids applying according to the following formula:

$$VMI = \frac{\sum Point\ Scores\ for\ mini\ grid}{Grant\ requested\ in\ N\$\ million}$$

Mini grids will be ranked according to their VMI in descending order. Proposals with higher VMIs will be given priority over projects with lower VMIs. Projects will receive funding as long as funds from the budget are available. This method overcomes the problem of setting the "right" percentage when providing grant funding to projects. If the percentage of grant funding is set too high, projects will receive more funding than required and make an extra profit at the expense of the grant provider. If the percentage is set too low, no project will apply for grant funding, as revenue expectations will not be met. A reverse auction can overcome this problem.

6. The NAMA has a robust approval structure for participating interventions to ensure transparent disbursement of funds: The following approval process for intervention A – mini grids will be applied:

No.	Step	Description
1	Elaboration and promotion of tender	The NAMA Implementing Entity (NIE) will develop a tender document, which will set out the following: • Background to the tender • The tendering process • Expected outputs (implementation and operation of mini grids) • Tender budget and disbursement • Eligibility criteria • Evaluation criteria • Proposal requirements • Expected financial capacity of applicants • Expected experience and expertise of applicants The upcoming tender will be promoted by the NIE and the Namibia Energy Institute (NEI) to key stakeholders involved in the implementation and operation of mini grids. Promotion will be done through the internet, presentations at conferences/ workshops, newsletters, etc. Focus will be on the following stakeholders: • Regional Councils; • REDs; • Private companies.
2	Registration of potential NEEs	Stakeholders (potential NAMA Executing Entities—NEEs) will be invited to register with the NIE. On registration, potential NEEs will be included in a database, allowing them to receive direct information on further steps of the process either from the NIE or the NEI.
3	Publication of tender	The tender will be published (according to national requirements for tendering). Registered stakeholders will receive direct information on the tender.
4	Information activities and support to potential NEEs during the tendering process	Information meetings will be held in all regions to inform the key stakeholders about the details. Potential NEEs will be able to have open questions clarified. The NIE and the NEI will actively promote the tender to those stakeholders, such as REDs, who have been identified by the NIE as prospective candidates for the implementation of mini grids. All stakeholders registered with the NIE can request technical support for the elaboration of their proposals. This support mechanism will be actively promoted by the NEI. Special focus will be on supporting stakeholders in identifying income generating activities as well as receiving concessions for the mini grids.
5	Submission of proposals	Potential NEEs will submit their proposals to the NIE. Proposals will have to include: • A technical description of the mini grid, confirming its compliance with the eligibility criteria. • A description of its current status of development. • The identification of income generating activities. • The implementation schedule. • The commercial proposal (including the tariff system for consumers). • A description of the project partners and their background.

6	Evaluation of proposals	The NIE, with the support of the NEI, will evaluate the proposals. The first step will be to check whether proposals meet the eligibility criteria. Proposals not fulfilling all criteria will be excluded. For eligible proposals, the VMI will be calculated and all eligible proposals will be ranked by their VMI in descending order. The evaluation will also include a section analyzing the capacity of the tenderers to implement their proposed projects. Evaluation criteria will include (weighting to be decided): • years of experience of the project stakeholders in implementing mini grid, renewable energy or rural electrification projects; • years of experience of the project stakeholders in operating energy or electricity projects; • applicants' financial capacity to cover their own contribution to the project • status of implementation of proposed project; proposals which do not reach 70 per cent of the maximum number of points will be excluded.
7	Approval of proposals	The list of proposed mini grids ranked by their VMI will be sent to the NAMA Coordinating Authority (NCA) for approval. Based on the budget, NCA will approve the list of mini grids eligible for funding.
8	Disbursement of funds	Funds will be disbursed by the NIE. The NIE will monitor implementation to ensure that it has taken place according to the regulations of the NAMA or other country rules.

For intervention B – Energy Zones, the approval process is defined as follows:

No.	Step	Description
1	Creation of long-list	Regional Councils have already played an important part in selecting the Energy Shops implemented under the OGEMP. They have good information about potential locations for additional Energy Shops[27] and potential partners. The NIE will invite Regional Councils to investigate and come up with a long-list of potential partners for Energy Zones and collect information on these partners. This information should include: • Name • Location • Contact details • Core business • Year of establishment • Number of employees • Approximate turnover per year • Space available (in m^2) for income generating activities The list should contain between three and six potential locations in each region.

No.	Step	Description
2	Information for potential Energy Zone partners	The NEI will prepare a toolkit on Energy Zones and send this to each of the potential partners. The folder will contain a general description of the concept of Energy Zones, the requirements that potential Energy Zone partners must meet, and the financial implications of running an Energy Zone. The NEI will follow up with each potential partner by phone to answer any questions.
3	Expression of Interest	Potential partners for Energy Zones long-listed by the Regional Councils will be invited to prepare an Expression of Interest, which will commit them to operate an Energy Zone if selected. As the operators of Energy Zones will be Executing Entities under the NAMA, the Expression of Interest will also include acceptance of general terms and conditions for the operation of Energy Zones under the NAMA (general terms and conditions will be developed by the NIE). These general conditions will mainly regulate requirements for the operation of Energy Zones, financial implications and reporting requirements under the MRV.
4	Evaluation of long-list	As in the case of the Energy Shops, the long-list provided by the Regional Councils will be evaluated by the NEI. The evaluation of the NEI will be based on the eligibility criteria as well as interviews with potential operators of Energy Zones. All potential partners not fulfilling eligibility criteria for "location" and "space" will be excluded. The NEI will prepare an evaluation based on the following criteria (weighting to be decided): • Stability of business • Technical feasibility • Number of income generating activities • Number of women employed The NEI will propose a ranked shortlist of three potential Energy Zones.
5	Selection of Energy Zones	The ranked shortlist will be discussed between the Regional Councils and the NEI and a final ranking will be jointly decided. The ranking will be forwarded to the NIE for approval.
6	Approval of proposals	Based on the budget, the NIE will approve the list of Energy Zones eligible for funding.
7	Disbursement of funds	Funds will be disbursed by the NIE. The NIE will monitor implementation to ensure that it has taken place according to the regulations of the NAMA and other country rules.

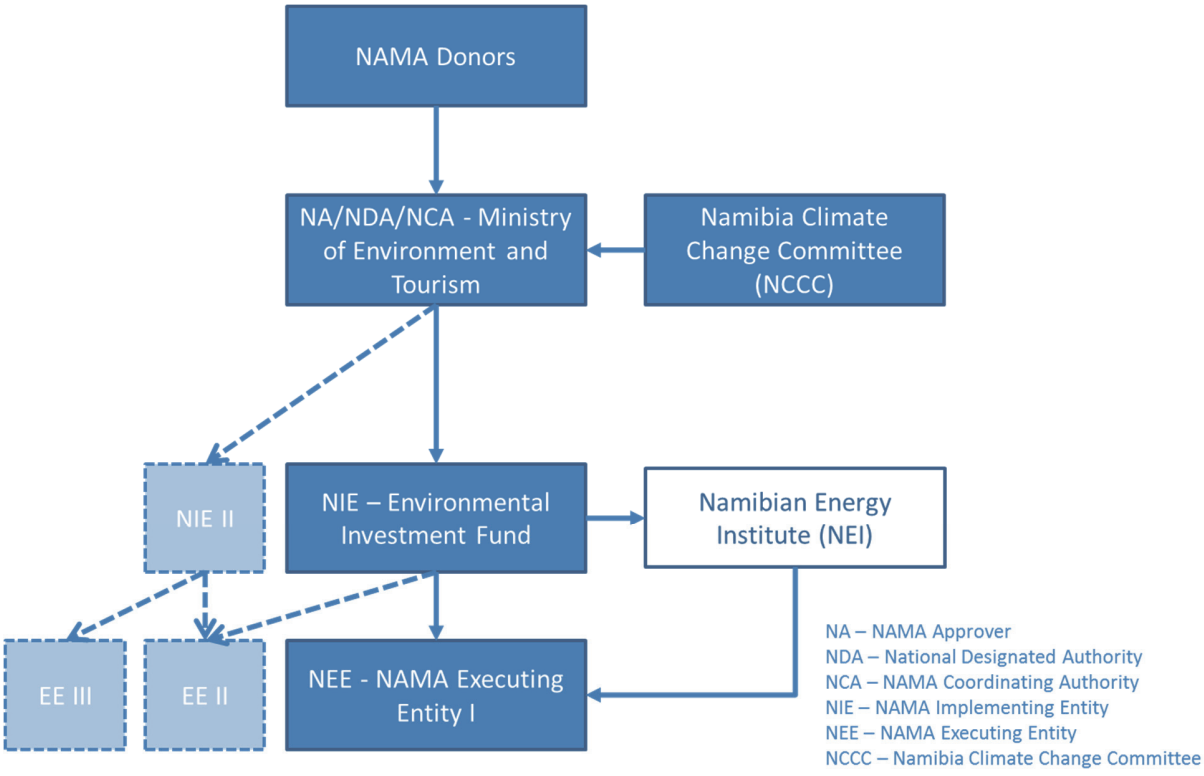
7. The NAMA coordination and implementation structure is carefully designed to allow for a smooth implementation of the NAMA: The institutional structure of the NAMA is based on the following principles.

Ensuring the strong involvement of national stakeholders to create country ownership and political commitment.
Using existing and experienced entities organizational systems which are already in place and allow for prompt and smooth implementation of the NAMA.
Ensuring that the institutional structure is appropriate for the receipt of international private and/or public donor funding.

The institutional structure for the NAMA shall include the following institutional bodies at the country level:

- NAMA Coordinating Authority (NCA);

- NAMA Implementing Entity (NIE);
- NAMA Executing Entities (NEEs).



The NAMA Coordinating Authority (NCA) is the entity which coordinates the proposed NAMA on rural electrification. In addition to the role as NAMA Approver and UNFCCC Focal Point, the Ministry of Environment and Tourism will also acts as NAMA Coordinating Authority (NCA).
The NIE needs to have a strong background and good track record in financing. The Environmental Investment Fund (EIF) will take the role of the NIE. The EIF was established by an act of parliament as a statutory entity outside the public service. The EIF is run by a board of directors, which receives advice from a technical advisory panel. The EIF offers grants, green soft loans and green concessional loans. The EIF was accredited by the GCF in July 2015. The EIF will be supported by technical experts of the Namibian Energy Institute (NEI). The NEI was launched in 2006 following the signing of a cooperation agreement between the Polytechnic of Namibia (technical university) and the Ministry of Mines and Energy (MME).

The existing Namibia Climate Change Committee (NCCC) will act as the supervisory board for the NAMA. The NCCC consists of relevant ministries and stakeholders (including the Ministry of Environment and Tourism, the Ministry of Mines and Energy, and Nampower). The NCCC has the powers to establish working groups and subcommittees as needed. It is recommended that a working group on the NAMA is created, which also includes additional key stakeholders (industry representatives, NGOs).

8. The NAMA' s intensive Capacity Development programme will facilitate transformative change: The capacity development will build the robust basis for the successful implementation of the activities and ensure lasting results beyond donor support.

The proposed NAMA capacity development programme will consist of two components:

Component 1 will target support for the launch and implementation (e.g. definition of laws and processes, preparation of documentation) of the NAMA and will provide capacity-building for the involved (semi-) governmental entities (such as the NIE).
Component 2 will focus on the **awareness raising, marketing side of the NAMA after implementation** and will provide general capacity development to create a common awareness for the NAMA; as well as specific stakeholder-oriented capacity-building.

9. The NAMA' s financial management is a cornerstone of a NAMA: The focus of the NAMA is to build and integrate a reliable and transparent structure of financial governance into the NAMA and manage the financial flows and the controls required to ensure a sustainable use of funds. The basis of this NAMA is a co-financed effort between the Government of Namibia and international partners/NAMA donors. Therefore, this NAMA considers two primary tracks of finance, national finance and international finance.

National Finance: is defined as financial flows or capital directly influencing the interventions and incentives designed under the NAMA, and which are within the operational control of the national Government.
International Finance: is defined as financial flows or capital directly influencing the interventions designed under the NAMA and which originate from and are controlled by international partners (consisting of multilateral financing institutions and/or multilateral/bilateral programmes). The capital provided by international partners will be used only for direct investment grants in Interventions A and B. The contributions will be channeled directly from the partners to the NIE (the Environmental Investment Fund), which will then disseminate the funds to Executing Entities (EE) in both, Intervention A and Intervention B.

For each of the tracks, there are two components: 1) the management and governance of capital and 2) the disbursement of funds. This means that there must be established bodies to provide for strategy, oversight and governance, implementation and operation. Since the NAMA is based on the principle of Output Based Aid (OBA), it is very important that the expectations of the NAMA stakeholders and their outputs are clearly and realistically defined at the start of NAMA implementation.

10. The NAMA applies transparent and robust MRV for GHG Emission Reductions and Sustainable Development Impacts: In order to determine the GHG emission reductions, the NAMA builds on the CDM methodology AMS-I.L. and takes into consideration the issue of suppressed demand. To take account of suppressed demand the parties to the UNFCCC asked the Executive Board of the Clean Development Mechanism to explore the possibility of including in the baseline a scenario where future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host party (UNFCCC, 2012). This principle can be specifically applied to the methodology AMS-I.L.
The distinct emission factors for the different service levels of energy consumption (as defined in AMS-I. L.) take into consideration the baseline technologies used to meet basic household lighting energy needs, more extended household energy needs/micro enterprise needs, or public buildings and/or small, medium and micro enterprises (SMMEs). In light of the challenges for the NAMA actors of monitoring electricity generation per facility, a simplified and conservative baseline emission factor is chosen. For both interventions implemented under the NAMA framework, this will be 1.0 tCO_2/MWh.

In addition to GHG emissions, the MRV system for this NAMA will monitor the impact of the NAMA interventions on selected Sustainable Development (SD) indicators. In order to determine the SD impacts, the NAMA assessed the shortfalls in achieving some of the MDG goals. The selected SD indicators in the NAMA will support the achievement of the newly defined SDG goals.

Monitored SD parameters for Intervention A

No.	Parameter
1	Number of health clinics electrified
2	Number of households electrified
3	People with access to RE electricity
4	Number of schools electrified
5	New income-generating activity (businesses)
6	Number of new jobs (total)
7	Number of new jobs for women

Monitored SD parameters for Intervention B

No.	Parameter
1	Households having access to electricity services
2	People with access to RE electricity services
3	Number of new women's enterprises in the EZ
4	New sales point for RE and EE technologies
5	New income-generating activity (enterprises)

The main responsibility for the MRV system lies with the managing institution, which may delegate some of the tasks to the project implementers (PPPs, grid operators, equipment suppliers).

The goal of verification is to have an independent third party auditor ensure that the NAMA is operating as planned and that the measuring and reporting system is being implemented as planned. The verification also ensures that emissions reductions and SD benefits are real and measurable.
Auditors should be accredited entities. They can be entities accredited under the CDM or under another accreditation system acceptable to the Government of Namibia and the NAMA donor(s).
Verification should occur every two years. The verification will consist of:

desk review of documents;
site visits/interviews of key stakeholders;
the drafting of the verification report;

provision of feedback on the report by the NAMA Coordinating Authority;
finalization of verification report.

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Results of a survey on NAMAs and conclusions

3.1 Preliminary results of a survey on NAMAs

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With the exception of few initiatives, it has been well documented that the number of projects implementing Nationally Appropriate Mitigation Actions (NAMA) still remains small in comparison to those that had entered the planning stage. In this connection, OECC has started a small survey in some partner countries, in order to find out the current state of NAMAs and what kind of issues those countries are facing in the formulation and conduction of NAMAs.

Moreover, one of the aims is to determine if those countries are aware of the potential that NAMAs have beyond the conduction of mitigation actions, and if their project proposals can be categorized as "transformational". Although the sample is still very small and that our research is still on-going, OECC expects that the results will bring some hints on how to design support for NAMAs in the future.

The questionnaire of the survey was sent to OECC partner countries in July-August, 2015 and was answered by 5 countries: Cambodia, Kenya, Mongolia, Thailand and Viet Nam. These countries are also the JCM partner countries. The questionnaire was intended to put a spotlight on the issues developing countries are facing to overcome the barrier of advancing from the planning stage to the implementation stage of supported NAMAs. Although the sample is still small, through this survey, we expect to provide hints on how international support can be better organized and provided to developing countries.

Among the 5 countries, we were able to see different features: Countries that are planning NAMAs but are not yet implementing them and countries that are both planning and implementing NAMAs. Here we would name the countries in the former and latter, group A and group B, respectively. Group A is consisted by Cambodia and Kenya, and Group B by Mongolia, Thailand and Viet Nam. Both groups included NAMAs in the planning stage and in the implementation stage, with a concentration in the energy sector.

Figure 1: NAMAs in the planning stage

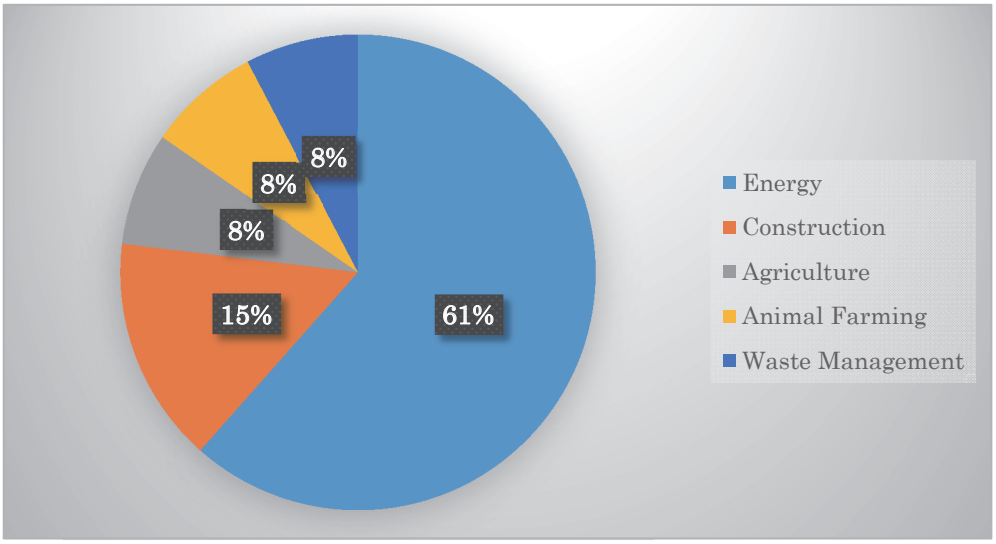
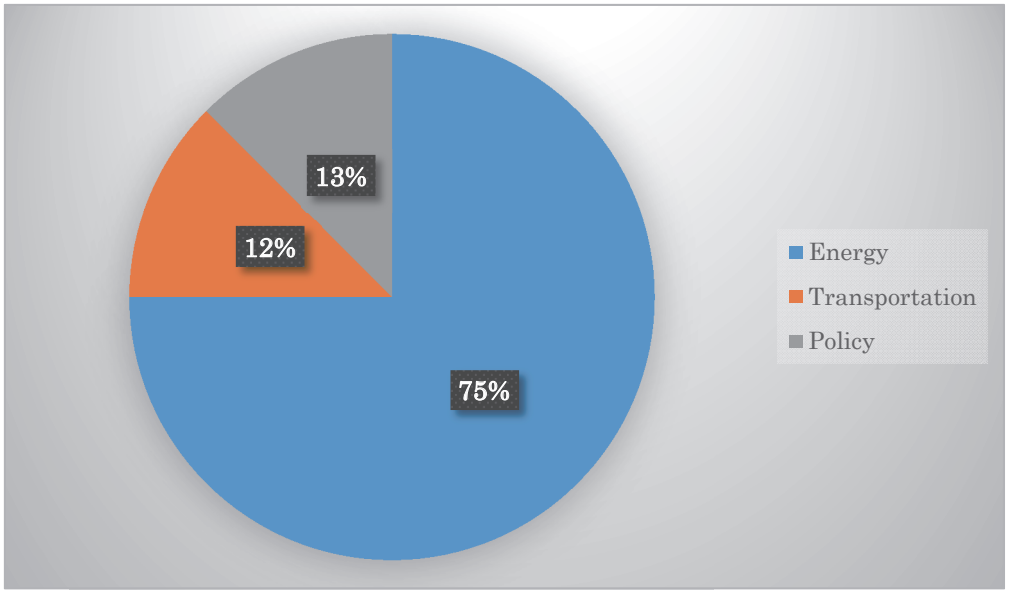


Figure 2: NAMAs in the implementation stage



Regarding group A, no financial support and very few support other than finance were offered. For domestic institutional arrangement to implement NAMAs, some coordination system/structure between central government and line ministries are established, although there is an impression that this remains to be weak. This group is expressing the need of stronger financial support and enhancement of knowledge and capacity of line ministries and stakeholders for capacity building.

All of the NAMA projects in the implementation stage of group B were funded either from domestic or international donors. There is even a country which all of their NAMA projects in the planning stage were funded, and receive support on capacity building to share lessons learnt and to implement a pilot study to increase scales. What made a big difference was the institutional arrangement of the countries of group B. All countries had existing sectoral strategies for NAMAs and they were all included in roadmaps, plans and strategies. Although an enhancement is still necessary, the existence of a coordination system/structure between central government and line ministries to propose/implement NAMAs were well organized.

Figure 3: Sources of financial support (per project)

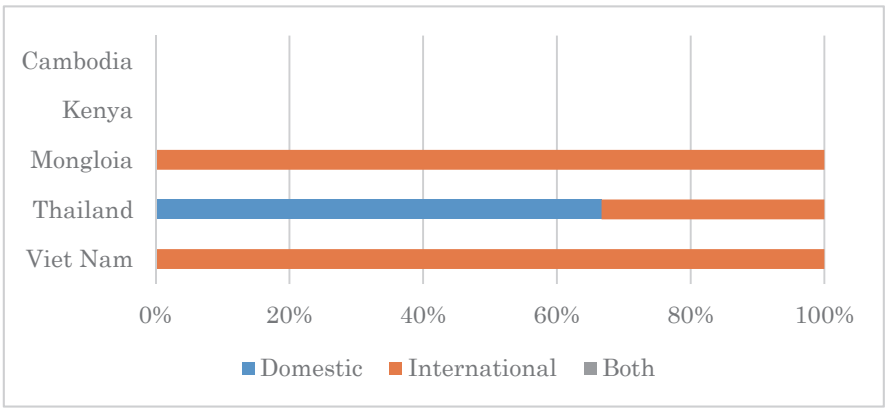
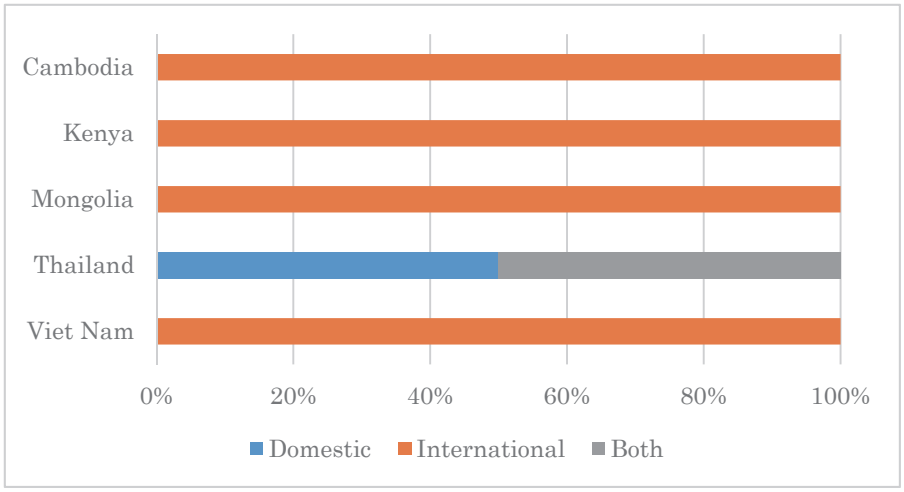


Figure 4: Source of other type of support (per project)



The foundations for national MRV system exists, however, the national MRV system for NAMAs has not been established yet. The system for implementing GHG inventory and national communication was not officially created[1].

Key elements regarding challenges that countries are facing to move forward from the planning stage to the implementation stage of NAMAs, and challenges to channel international support are summarized in Table 1.

Table 1: List of challenges described in the survey

Country	Challenges to move forward	Challenges to channel international support
Cambodia	- Knowledge and capacity of line ministries/ stakeholders needs to be enhanced - Budget for preparation and implementation of NAMA needs to be increased - Clear national/internal procedure/guideline for NAMA development is necessary	- Capacity building of NAMAs should be enhanced - Cooperation with international institutions to enhance technical/financial assistance is needed
Kenya		- Advice on kind/type of NAMA that can attract funding at the international level is required
Mongolia	- Domestic financial mechanism to implement NAMAs needs to be established - Clarification of financial resources at the beginning stage is needed	
Thailand (1)	- Improving allocation of national budget is necessary - Expansion of the accessibility of international support is needed - Matching the needs among international donors and host countries are crucial	- Enhancement of capacity building is necessary - Participation of stakeholders is essential
Thailand (2)[2]	- Focusing on existing policies is a key to success - Capacity building and financial support is necessary	- Planning at early stage is important

[1] As part of this survey and in cooperation with IGES, interviews will be conducted focusing on MRV systems and sectoral NAMAs.

[2] 2 questionnaires were received from Thailand. To distinguish the two, we decided to put a number.

Viet Nam	- Number of Staffs needs to be increased - Financial resource for the implementation of NAMAs needs to be enhanced - Access to climate change information needs to be improved - Policy framework/legal documents related to NAMAs needs to be established	- Support for development of mechanisms and policies is required - Enhancement of capacity building is necessary - Financial mobilization from donors are needed - Long term planning is important - MRV needs to be enhanced

From the survey, we have observed that there were not many NAMAs in the planning stage and less in the implementation stage. Also, one of the challenges affecting most of the countries are the lack of effective communications between ministries, which indicates the importance of conducting meetings between stakeholders but mainly capacity building activities.

Most of the challenges seen in group A were not seen in group B. Although group B countries recognized that they have experienced those challenges in the early stage of NAMA planning and implementation. It was suggested that sharing lessons learnt and good practices should help the countries in group A to overcome their challenges.

As for sources of financing, we considered important to highlight the potential of one of the sources which is the Joint Crediting Mechanism (JCM). Although JCM was not designed specifically to conduct NAMAs[3] but mitigation actions, some countries such as Vietnam and Mongolia understood the similarities, and in the case of the former, they have officially announced the conduction of NAMAs with the support of the JCM. In other words, JCM is part of their NAMA strategy.

The focus of the JCM does not rely on purely the financial support. Rather, it would be better recognized if it is taken as a mechanism that facilitates diffusion of leading low carbon technologies, products, systems, services, and infrastructure. However, we believe that the understanding of the potential of the mechanism can vary from country to country. This will be another aspect our research will be putting attention to, in our on-going research.

The team working in this survey is aware that since the number of samples are not sufficient, is difficult to provide some generalizations. Increasing the number of samples is necessary to pick up the actual situation of each country and to bring out practical and realistic countermeasures. An increase in the sample and conduction of further interviews are expected to continue until the end of fiscal year 2015.

Finally, through this article, we would like to thank Cambodia, Kenya, Mongolia, Thailand and Viet Nam for kindly cooperating with this survey[4].

[3] OECC (2015). The NAMA Guidebook. 2nd Edition. Published by OECC, Japan; pp. 21-22

[4] Contents of the survey do not represent the official position of the country.

3.2 Conclusions and key messages

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Transitioning NAMAs from planning to implementation

- NAMA activities have increased in the last few years. Although, many of these projects are not registered in any platform.
- There are less supported NAMAs in the implementation stage. This may be due to insufficient financial support.
- To successfully secure international financial support, a detailed analysis of the planned intervention and a robust implementation plan is required. Also, a close integration of the process of designing NAMA finance schemes with existing international financial cooperation processes should be important.
- Since awareness on NAMAs has increased, design of emerging types of technical and financial support have been increased as well.

Facilitating transformative change for resilient and inclusive growth

- NAMAs are being evaluated from the point of view of how much transformative change is produced. Some exemplary NAMAs show that they produce a transformative change for resilient and inclusive growth, through clear outcomes such as energy access, rural development, and income generation.
- MRV is crucial in the success of the NAMAs. By applying a tool that allows a precise and transparent MRV of sustainable development impacts will allow policy makers to monitor the progress of SDGs at national level , improve the ability of a NAMA to contribute to a country' s national sustainable development priorities and encourage NAMA implementers to put an emphasize on green growth and development.
- NAMAs must provide direction to policy formulation taking into account limited resources, but also an opportunity to access efficient, clean, and resilient growth.

NAMA integrated "MRV + M&E" system to track transformational impacts for NAMA implementation

- A transformational NAMA is a NAMA that will bring a paradigm shift and a radical transition to lower-carbon technologies and practices. These NAMAs should also bring additional positive impacts, usually referred as co-benefits.
- Due to different perceptions, the identification of NAMA co-benefits and who will benefit from them should be undertaken at early stages of NAMA design, and these beneficiaries should be involved into NAMA development and supporting its implementation since the first steps.
- A comprehensive, ambitious yet realistic NAMA that wants to achieve a transformational change in the sector in which it will be developed should have an integrated measuring, reporting and verification plus a monitoring and evaluation (MRV+M&E) system with a set of defined key performance indicators (KPIs)/metrics to track GHG emission and other impacts.

CTCN Technical Assistance as one of supporting schemes for NAMA implementation – a case study and prospect of further development

- The CTCN promotes the accelerated transfer of environmentally sound technologies for low carbon

and climate resilient development at the request of developing countries. In this sense, the CTCN has been designed to take into account NAMAs for the provision of technical assistance.

- Broader and deeper recognition of NAMAs should be better raised in developing countries. Also there should be stronger consideration on their NAMAs in the identification phase of the requests to the CTCN. These could be addressed with enhanced coordination among the NDEs and National Focal Points for NAMAs in developing countries as suggested by the CTCN.

Updates of the Joint Crediting Mechanism

- Increase in the number of signatory countries and project formulation under the JCM demonstrates the importance of this mechanism as an alternative to implement mitigation actions. Although it is still in an embryonic stage, registration of projects has already started.
- The Japanese government has conducted several efforts to in the form of financial, technical, and capacity building support, in order to materialize real GHG emissions reduction and to boost the implementation stage.

Recent Development of NAMAs in Mongolian Energy Sector

- The Mongolian government is putting a lot of effort in the development of NAMAs conducive to reduction of GHG emissions and to accelerate a green transition. By considering its potential, JCM projects are among the ones under study and also support from ADB has been obtained.
- Mongolia identified that they can replace appropriate 1,000 units of aging and less energy efficient silicon steel transformers (SST) which are currently developed in power distribution network in Ulanbaatar city with Amorphous Core Transformers (ACT) which are advanced energy energy efficient transformers.
- Compared to ACT with ac crystalline allayed atomic structure with thick steel, amorphous core has a random and non –crystalline structure with around the one-tenth thinner metal core. Such unique feature of ACT improves inductance and resilience, and reduces energy loss u to approximately 75% in non-load loss and 21% in load loss.

Thailand' s Nationally Appropriate Mitigation Actions (in Energy Sector and Transport Sector) and Its MRV system

- Thailand has been working towards developing a solid policy framework as well as at its institutions, to fully utilize benefits accompanying implementation of NAMAs, due to its growing population and its respective challenges.
- The methodology of developing of Thailand' s NAMAs is based on a bottom-up modeling tool called "AIM/Enduse" model.
- Thailand Greenhouse Gas Management Organization (TGO) in collaboration with relevant academic and governmental agencies decided that energy and transport are the most important sector to effectively and significantly reduce GHG emissions. The project was divided into: Step I: Primary Data Analysis, Step II: Public participation, Step III: Evaluation and Conclusion.
- The Ministry of Energy in cooperation with the Ministry of Natural Resources and Environment recognize the importance of developing NAMAs and have developed the MRV system for the implementation of Domestically Supported NAMAs from the Renewable Energy and Energy Conservation Measures. The MRV system was developed by the principles of the MRV General Guidelines in accordance with decision 21/CP.19, which aims to be practical, appropriate and consistent with conditions in such areas.
- Thailand and other developing countries need capacity building in preparing CO_2 countermeasures under NAMAs. Developed should support developing countries in terms of capacity buildings,

technology transfers of CO_2 and CMs, and financial support in order to overcome barriers to accelerate transforming the country into a low carbon society.

Case study of NAMAs in the waste water sector of Vietnam - Van Phuc slaughterhouse

- NAMAs have been considered as one potential solution to solve the problem of wastewater coming from slaughterhouses.
- Due to the number of contaminants from the wastewater, it has been determined that biological treatment can be a promising alternative, since not only provides treatment of wastewater but also can provide methane to be utilized as renewable energy.
- In light of the number of slaughterhouses and the potential of emissions reduction, by applying MBR technology combines with biogas recovery systems and power generators, this project can become a transformational NAMA.

Transformational change and NAMAs in the Agriculture, Forestry and Other Land Use sector

- There used to be only a few NAMA concept notes and proposals prepared for the AFOLU sector, however as of August 2015, 16 percent of the 101 NAMAs registered in the NAMA registry are in the AFOLU sector.
- NAMAs are recognized as useful vehicles for reducing net GHG emissions and transforming the agricultural sector, as they can achieve multiple objectives, and also integrate the AFOLU sector into climate change mitigation actions conducive to achieve sustainable rural development.
- Barriers and challenges of transformational changes in AFOLU NAMAs are as follows:
  - Considering both the risks and socio-economic costs and benefits for a large and diverse group of people living in landscapes with different ecological conditions, and both the public and private sector interests
  - Given the limitations of land and trade-offs that need to be made to ensure the sustainable management of forests and natural resources
  - The high number of group and individual stakeholders in the AFOU sector is a potentially limiting factor
  - Identifying the stakeholders in the forestry sector
- FAO supports AFOLU NAMA process through: Learning tool on Nationally Appropriate Mitigation Actions in the agriculture, forestry and other land use sector, workshops at regional and country level, and in-country workshops to start up NAMA process (done in Viet Nam and Kenya).

Case Study Namibia – NAMA on Rural Development in Namibia through Electrification with Renewable Energies

- UNDP has identified 10 key success factors of NAMA on Rural Development in Namibia through Electrification with Renewable Energies are as follows:
  - The NAMA will sour the development of an environment which facilitates transformative change
  - The NAMA is fully embedded in national development planning and targets
  - The NAMA details concrete actions to achieve the policy targets
  - The NAMAs eligibility criteria for participation and receive funding are clearly defined
  - The NAMA is cost effective and provides best value for money
  - The NAMA has a robust approval structure for participating interventions to ensure transparent disbursement of funds

- The NAMA coordination and implementation structure is carefully designed to allow for a smooth implementation of the NAMA
- The NAMA' s intensive Capacity Development programme will facilitate transformative change
- The NAMA' s financial management is a cornerstone of a NAMA
- The NAMA applies transparent and robust MRV for GHG Emission Reductions and Sustainable Development Impacts

- The overall target of this NAMA is to support Namibia in achieving the country' s goals of energization by providing access to appropriate energy technologies for everyone living in off-grid areas. In this sense, the NAMA represents an opportunity for mitigation but also for achieving sustainable development in Namibia.








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