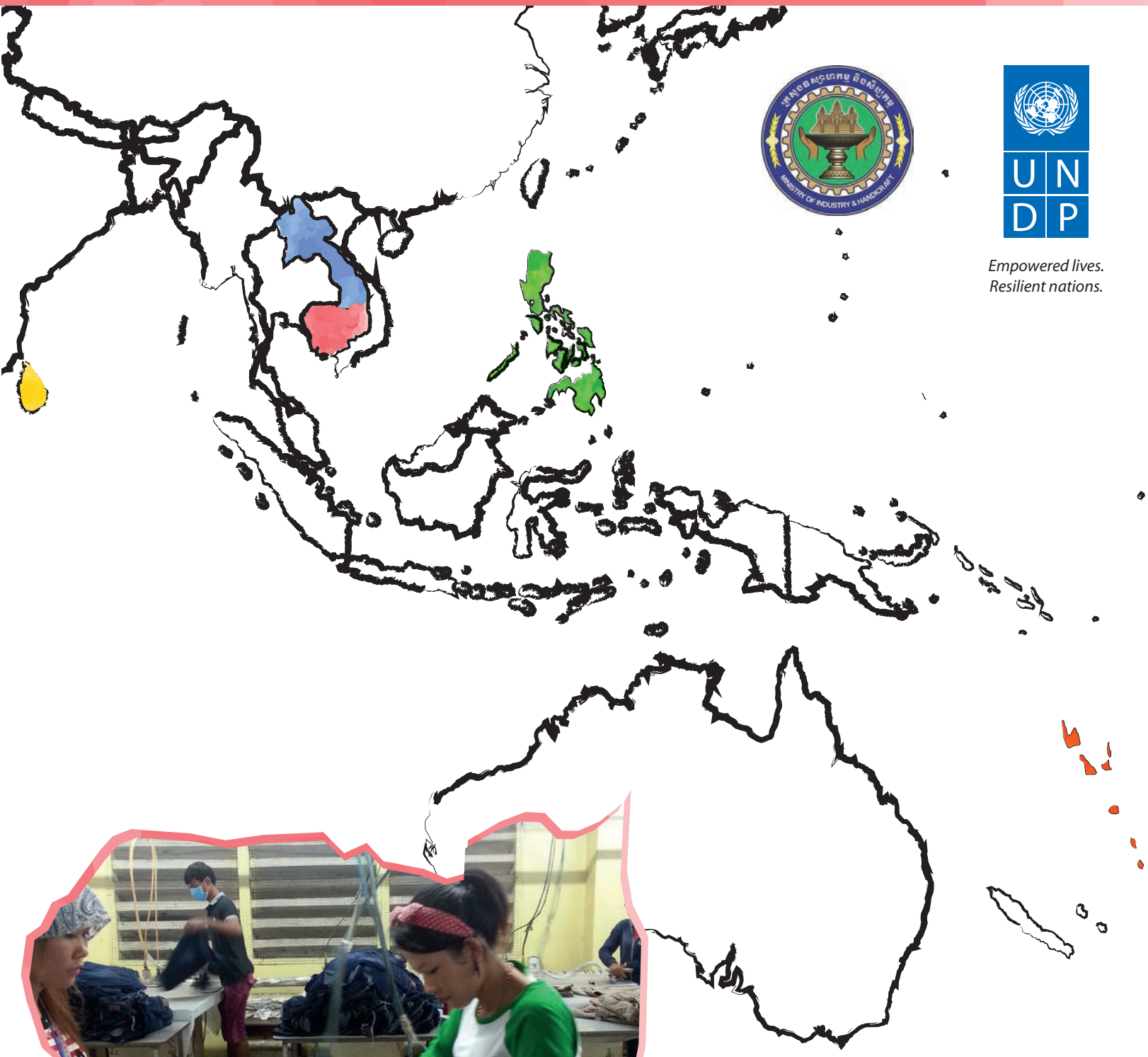

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ENERGY EFFICIENCY NAMA IN THE GARMENT INDUSTRY IN **CAMBODIA**

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FOREWORD

The garment industry is Cambodia´s most important manufacturing sector but the sector is in danger to lose its effectiveness in a global market due to inefficiencies in the production processes and high energy costs. There is a huge potential for energy efficiency measures at scale in this sector. Therefore, the NAMA for Energy Efficiency in the Garment Industry of Cambodia is designed to support the country to improve energy efficiency and energy security and while reducing GHG emissions.

The overall objective of the NAMA is to support Cambodia´s energy efficiency policy: To improve efficiency in the industrial sector and to build capacity in the field of energy efficiency.

During recent years, NAMAs have become a focus of climate change mitigation negotiations in the UNFCCC process. The NAMA modality can provide the essential holistic framework to overhaul a complete sector when framed within the context of sustainable development and beyond pure mitigation aspects. The focus on the sustainability of the entire sector is essential for achieving lasting results.

Moreover, the understanding of the NAMA concept is still evolving, and there is relatively little on-the-ground experience with respect to turning the concept into concrete actions. In this regard, UNDP's MDG Carbon Programme has supported the development of this NAMA in order to help Cambodia to achieve a transformative change and bring about energy security as long-term goal.

The outcomes of this NAMA with regards to Sustainable Development and GHG Emission Reductions are strongly interrelated building blocks as a pathway of a change framework that shall ensure that the NAMA is fully embedded in national development goals.

The NAMA design will provide the country with an accurate and credible information framework by applying a robust but simple MRV system for sustainable development impacts and GHG emission reductions. The calculation of GHG emission reductions are based on CDM methodologies while the MDG Carbon Sustainable Development Evaluation Tool will allow to quantify and monitor the sustainable development benefits.

This NAMA for Energy Efficiency in the Garment Industry in Cambodia is designed as an encouraging concept that will help Cambodia reducing GHG emissions but also increasing the competiveness of the industry, and improving energy security and affordability of electricity in the long-term.

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Abbreviations

BAU	Business as Usual
CCD	Climate Change Department
CCSP	Cambodia Climate Change Strategic Plan
CCTT	Climate Change Technical Team
CDM	Clean Development Mechanism
CFL	Compact Fluorescent Light
CO_2e	Carbon Dioxide Equivalent
COP	Conference of Parties
EMS	Energy Management System
EUEI PDF	European Union Energy Initiative Partnership Dialogue Facility
FD	Forced Draft
GCF	Green Climate Fund
GHG	Greenhouse Gases
GJ	Gigajoule
GMAC	Garment Manufacturers Association in Cambodia
ILO	International Labour Organization
ID	Induced Draft
LDC	Least Developed Country
LED	Light Emitting Diodes
MoE	Ministry of Environment
MoIH	Ministry of Industry and Handicraft
MoME	Ministry of Mines and Energy
MRV	Measurement, Reporting and Verification
NA	NAMA National Focal Point/National NAMA Approver
NAMA	National Appropriate Mitigation Action
NCA	NAMA Coordinating Authority
NCCC	National Climate Change Committee
NDA	National Designated Authority
NEE	NAMA Executing Entity
NIE	NAMA Implementing Entity
NSDP	National Strategic Development Plan
RECP	Resource Efficient and Cleaner Production
RGC	Royal Government of Cambodia
SAVE	Sustainable Action & Vision for a better Environment
SD	Sustainable Development
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
VSD	Variable Speed Drive

1 Executive Summary

Besides reducing greenhouse gas emissions, energy efficiency in industry confers multiple additional benefits in the area of sustainable development, such as the improved affordability of energy and increased energy security.

Cambodia´s garment industry contributes approximately 19 per cent to the national GDP and 72 per cent of the country's exports. The garment industry is therefore Cambodia´s most important manufacturing sector. However inefficiencies in the production process and a disproportionate consumption of high cost energy may lead the Cambodian garment industry to lose its competitive edge in a global market characterized by fierce competition.

Even though actors in the garment industry are aware of their comparatively high energy costs and the significant market potential for industrial energy-efficient products and services, they have so far failed to achieve energy efficiency of any scale because of insufficient technical capacity, lack of human and financial resources, lack of qualified local suppliers, and financing constraints.

This is one of the reasons why the Government of Cambodia has prepared a National Policy, Strategy and Action Plan on Energy Efficiency to improve energy efficiency and reduce GHG emissions in Cambodia. However it lacks the financial resources to implement the plan fully.

It is proposed that the energy efficiency NAMA described in this document be embedded in the national energy efficiency policy so that it will help the Government of Cambodia to provide financial incentives to interested garment manufacturing companies to implement energy efficiency measures by replacing old inefficient equipment with new more efficient technologies. These could include thermal energy technologies for the garment industry, such as efficient biomass boilers (plus insulation), and electricity technologies, such as sewing machines, washing machines, drying machines, compressors and lighting.

The financial incentives for technical interventions will be accompanied by a capacity-building programme. The first component of this programme will target the support of the set-up of the NAMA and will provide capacity-building for the governmental and semi-governmental entities involved in the NAMA. The second component of the capacity-building programme will focus on the awareness raising and marketing and will provide (i) general capacity-building to create a common awareness of the NAMA and (ii) specific stakeholder oriented capacity-building.

Efficient biomass boilers using agricultural waste streams as fuel input will decrease GHG emissions by displacing the use of non-renewable biomass. The introduction of efficient sewing, washing, drying machines and compressors will improve energy efficiency in motor driven systems and will decrease GHG emissions by reducing the use of electricity. The most important sustainable benefits of the NAMA will be improvements in energy security, income generation and asset accumulation.

The NAMA will be coordinated by the Ministry of Industry and Handicraft, which in turn will be supervised by the National Climate Change Committee. The Ministry of Environment will communicate and report to UNFCCC. Acleda Bank may take responsibility for disbursements to entities investing in new equipment

The total (investment and capacity-building) costs of the NAMA are expected to be approximately US$29.7 million. Public finance will contribute around US$6.9 million while private finance is expected to contribute the remaining US$22.8 million.

The NAMA will be implemented over a period of 6.5 years. Initial efforts will focus on securing national and international funding as well as establishing the institutional structure. There will be a five-year period for investment in new energy efficient equipment.

2 Introduction

2.1 Industrial Energy Efficiency and Development

Global industry currently consumes approximately 30 per cent of worldwide energy supply and is responsible for about 30 per cent of total greenhouse gas (GHG) emissions (IPCC, 2014, p.749).

Besides reducing GHG emissions, energy efficiency in industry provides multiple benefits for sustainable development such as enhanced affordability of energy, job creation, greater energy security and improved of industrial productivity and competitiveness (Ryan and Campbell, 2012 pp.3ff).

The global initiative Sustainable Energy for All, launched by UN Secretary-General Ban Ki-moon in 2011, is encouraging the international development community in their efforts to double the global rate of improvement in (general) energy efficiency by 2030.[1] UNIDO's ***Industrial Development Report 2011*** demonstrates that increased industrial energy efficiency may be one of the promising routes to sustainable industrial development worldwide, particularly in developing countries (UNIDO, 2011).

2.2 National Appropriate Mitigation Actions

2.2.1 History of NAMAs

Negotiations pursuant to the Bali Action Plan at the 18th Conference of Parties (COP18) in Doha in 2012 confirmed that developing country parties would take Nationally Appropriate Mitigation Actions (NAMAs) in the context of sustainable development, supported and enabled by technology, financing and capacity-building, aimed at achieving a reduction in GHG emissions relative to "business as usual" (BAU) emissions by 2020 (UNFCCC, 2008).

An open invitation for developing countries to communicate NAMAs aimed at achieving reductions in BAU emissions was included in Decision 1/CP.16, paragraph 50. So far, 57 countries, as well as the African Group, have done so. As part of the agreed outcome, the COP also decided to establish a registry to record information on NAMAs and support, and to facilitate the matching of NAMAs with available support.[2]

NAMAs can be incorporated as bottom-up contributions to the framework of Intended Nationally Determined Contributions (INDCs) that was agreed on at COP 20 in Lima 2014 and are to be submitted by all parties ahead of the COP 21 in Paris in NAMAs can be seen as a concrete pathway to achieving the agreed targets.

NAMAs are diverse and range from project based mitigation actions to economy-wide emission reduction objectives. Compared with the Clean Development Mechanism (CDM), which depends heavily on the international demand for carbon credits and the emissions reductions achieved by individual projects, NAMAs do not follow strictly defined rules and aim at reflecting the national circumstances in each country, thus offering more flexibility in mobilizing resources, especially in sectors that have remained underrepresented within the Kyoto Protocol framework.

1 See http://www.se4all.org.
2 This information is available at http://www4.unfccc.int/sites/nama/SitePages/Home.aspx.

2.2.2 An Energy Efficiency NAMA For the Garment Industry: An Opportunity for Cambodia

NAMAs can be seen as one of the most promising voluntary instruments for reducing GHG emissions in developing countries on a large scale with flexibility in terms of the interventions that can be employed. The objective of a NAMA must go beyond the desired impact on emissions reductions and achieve significant sustainable development goals that can benefit the country and its inhabitants as a whole.

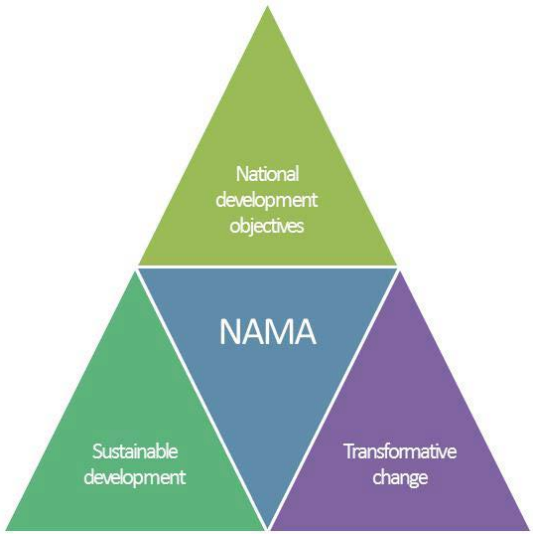
Even though NAMAs are often praised as an innovative new instrument of climate policy, the basic concepts are well known and established in developed countries in the form of national climate and environmental policies. The new elements are the adaptation to the special needs and circumstances of developing countries, and the international financial and technical support for their implementation from developed partners.

The garment industry plays a dominant role in Cambodia´s economy, as described below. Therefore Cambodia will benefit from this energy efficiency NAMA in the garment industry, not only because it will reduce GHG emissions but also because it will increase the competiveness of the industry, and improve energy security and the affordability of electricity.

The NAMA differs from traditional funding mechanisms which promote energy efficiency and renewable energy projects because of three key components, summarized in Figure 1.

- Alignment with country objectives. The interventions under the NAMA framework are prioritized in line with the objectives of the host country in terms of socio-economic development.
- Focus on sustainable development. The NAMA is designed with sustainable development benefits in mind.
- Facilitation of transformative change. The NAMA will spur the development of an environment which facilitates a transformative change in the industrial sector. Initial interventions will catalyse private sector development and the creation of local jobs.

Figure 1. NAMA Components



The NAMA framework is embedded in existing energy policies in Cambodia and will leverage established structures and relations in the garment industry. The NAMA will also build on the results of a similar initiative funded by the European Union, the Mainstreaming Energy Efficiency through Business Innovation Support (MEET-BIS) Cambodia,[3] by (i) applying the suggested technical standards for energy-efficient equipment and (ii) using the new institutional capacity (banks and suppliers of equipment) built up through this project. By creating an investment friendly environment (for energy-efficient equipment) such co-operation will ensure the long-term sustainability of the NAMA beyond the operational period funded by international donors.

3 The MEET-BIS proposes private sector based approaches for stimulating energy efficiency investments by small and medium enterprises in Cambodia. See http://www.meet-bis.org/cambodia/.

3 Background to Cambodia

3.1 Geography and Administration

Cambodia has a land area of 181,035 km^2 in the southwestern part of the Indochina peninsula. The capital city is Phnom Penh.

Figure 2. Map of Cambodia in Southeast Asian Region

International borders are shared with Thailand and the Lao People's Democratic Republic to the west and north, and the Socialist Republic of Viet Nam to the east and the southeast. The country is bounded to its southeast by the Gulf of Thailand. It consists of 24 provinces,[4] three of which have relatively short maritime boundaries, one municipality, 197 khan (districts), and 1,631 sangkat (communes). The country has a coastline of 435 km and extensive mangrove stands, some of which are relatively undisturbed.

The dominant features of the Cambodian landscape are the large Tonle Sap (Great Lake), the Bassac River Systems and the Mekong River, which crosses the country from north to south. Surrounding the Central Plains, which cover three quarters of the country's area, are the more densely forested and sparsely populated highlands, comprising: the Elephant Mountains and Cardamom Mountains of the southwest and western regions; the Dangrek Mountains of the North adjoining the Korat Plateau of Thailand; and the Rattanakiri Plateau and Chhlong Highlands to the east, merging with the Central Highlands of Viet Nam.

4 In 2015, the Royal Government of Cambodia decided to add a new province called Tbong Khmum province, bringing the total to 25.

3.2 The Economy

Cambodia is classified as a least developed country (LDC) by the United Nations and is a low income country according to the World Bank. Its per capita income exceeded US$1,000 for the first time in 2013. However there has been a nearly five-fold increase in the per capita income in the last decade. This means that the country could move out of least developed country status and become a low-middle income country soon.

Table 1. Main Economic Indicators of Cambodia, 2013

Indicator	Value
GDP (US$ million)	15,191
GDP growth (%)	7.6
GDP per capita (US$)	1,036

Source: RCG, 2014a.

In 2013, the main economic sectors were as follows.

Services: 40.8 per cent of GDP.

The tourism sector is one of the most important sectors, followed by the real estate sector. In 2013, over 4 million tourists visited Cambodia (Ministry of Tourism, 2014).

Agriculture: 33.5 per cent of GDP

Agriculture is mostly based on crops, livestock and poultry, fisheries, forestry and logging. Exported goods include fish, livestock, pigs and beef.

Industry: 25.6 per cent of GDP

The textile industry provides the majority of export revenues and approximately 19 per cent of GDP.

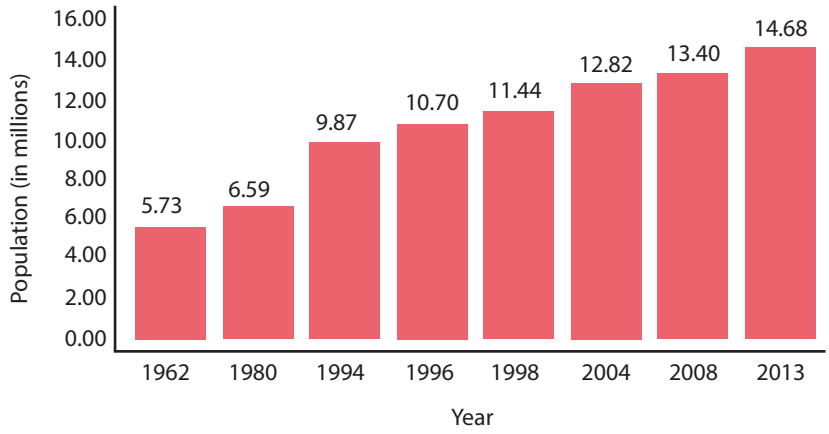
Exports of goods and services contributed 66 per cent of GDP in 2013. All major production sectors—textiles, tourism, livestock and meat production, and fisheries—are export-oriented and thus are vulnerable to external influences and thus potentially unstable. The main export destinations are the EU-28, the People's Republic of China and the United States of America (USA).[5]

3.3 Demography

The population of Cambodia has grown steadily over the past decades, as demonstrated in the figure below. Population growth has been higher in urban than in rural areas.

5 National Institute of Statistics, Bulletin No 05, July 2013.

Figure 3. Population Trends in Cambodia



Source: NIS, 2013.

The following table provides the key demographic indicators of Cambodia in 2013.

Table 2. Key Demographic Indicators of Cambodia, 2013

Population	14,676,591
females	7,555,083
males	7,121,508
Annual growth rate (%)	1.46
Population density (persons per km²)	82
Population in urban areas (%)	21.4
Population in rural areas (%)	78.6

Source: NIS, 2013.

Most of the rural residents live in the Coastal, Plateau and Mountain, and Tonle Sap regions, while the urban population mainly lives in the Plains region. The population density is higher in urban areas than in rural regions.

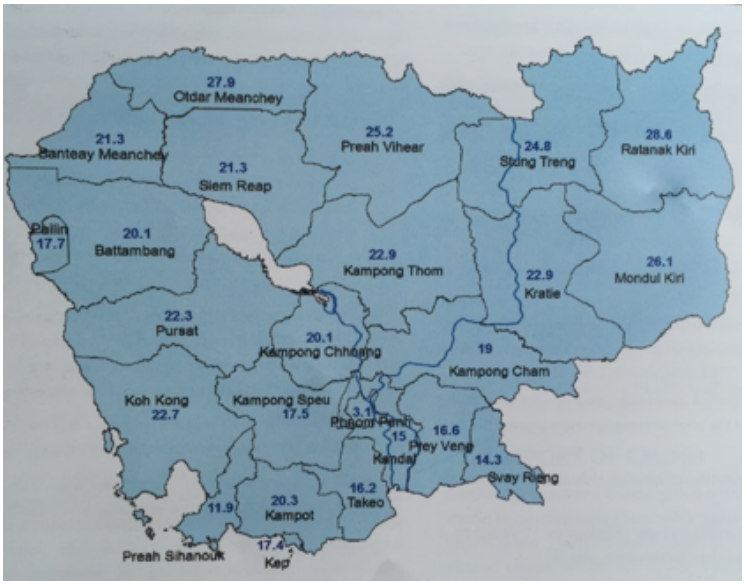
3.4 Socio-Economic Situation

Although the Cambodian economy is moving towards becoming a low-middle income country, poverty reduction is still a major goal. Results of the socio-economic surveys and studies conducted by the National Institute of Statistics show that Cambodia is still predominantly a rural and agricultural society.

In 2011 the poverty rate in the country was still 19.8 per cent (RGC, MOP, 2013). It had fallen from 47.8 per cent in 2007 and appears on track towards achieving the 19.5 per cent target by 2015.

The following figure shows the poverty rate in each of the provinces of Cambodia.

Figure 4. Poverty Rate by Province, 2011



Source: RGC, MOP, 2013.

According to the 2013 Inter-Censal Population Survey, the national unemployment rate was estimated at 1.7 per cent in 2013 (NIS, 2013). Nearly half of the labour force (over 60 per cent of the rural labour force) was employed in the agriculture sector (NIS/MOP, 2014).

Among the employed labor force the proportion in the agricultural sector has fallen since 2009 (when it was nearly 60 per cent), while employment the industry and services sectors has increased. As of 2013, the service sector absorbs more than two-thirds of the workforce living in urban areas (see Table 3, below).

Table 3. Employment by Sector

Sector	Cambodia	Urban[a]	Rural
Agriculture (%)	48.7	13.4	60.4
Industry (%)	19.9	18.8	19.2
Services (%)	31.5	67.9	20.4
TOTAL (%)	100.0	100.0	100.0

[a] *Excluding Phnom Penh*

Source: NIS/MOP, 2014.

Cambodia is ranked 136 out of 187 countries surveyed in the Human Development Index for 2013, with a score of 0.584 (UNDP, 2014).

3.5 National Development Strategies

Cambodia sets out its long-term socio-economic development visions through its Rectangular Strategies for Growth, Employment, Equity and Efficiency (currently at phase III 2014-2018), first launched in 2004. The National Strategic Development Plans (NSDP) are the roadmaps for the implementation of the Rectangular Strategies. They align sectoral strategies and planning cycles with the overall long-term vision of the Rectangular Strategies and guide external development partners to align and harmonize their efforts towards better aid effectiveness.

3.5.1 National Development Plans

The NSDP 2006-2010 (Royal Government of Cambodia, 2006) included strategies and actions on the energy sector and electricity but did not mention energy efficiency specifically. In 2008 the Prime Minister issued a circular[6] on the implementation of energy saving measures requiring all ministries and public institutions to participate in an electricity saving programme. The Ministry of Industry, Mines and Energy was required to issue detailed energy saving guidelines and the Ministry of Information was required to organize an awareness raising campaign on energy saving.

The NSDP 2009-2013 (Royal Government of Cambodia, 2009a) included a commitment to mitigate the adverse effects of energy consumption on the environment and society, and planned actions to develop a policy and a legal and regulatory framework for the energy sector and to encourage efficient use of energy. The National Climate Change Committee (NCCC) was established in 2006 with the aim of reducing greenhouse gas emissions and implementing projects inter alia in the fields of energy efficiency and renewable energies.

The NSDP 2014-2018 (RG C, 2014a) refers to strategies and policies for green development, climate change and energy efficiency in several sections of the document.

It stresses that all efforts should be made to ***"reduce the impact of climate change by strengthening the adaptation capacity and resiliency to climate change, particularly by implementing the Cambodia Climate Change Strategic Plan 2014-2023, National Policy on Green Development and the National Strategic Plan on Green Development 2013-2030"*** (RGC, 2014a, p.120).

The NSDP also points out the importance of continuing "to strengthen technical and institutional capacity to promote the mainstreaming of climate change responses into the policies, laws and plans at national and sub-national levels" (RGC, 2014a, p.120). Research is to be conducted to:

- ***"develop approaches that help minimize greenhouse gas emissions and also assess the impact on climate change" (RGC, 2014a, p.126); and***
- ***"prepare frameworks and mechanisms for carbon trading, strengthening the capability, preparation and implementation of climate change adaptation measures, assessment of the scope of the use of environmental financing mechanisms including payment for environmental services and environmental fund" (RGC, 2014a, p.135).***

6 A circular is "an administrative instruction which is used to clarify the works and affairs of government ministries". It is signed by the Prime Minister and relevant ministers (Peng Hor, Kong Phallack and Menzel, 2012, p.10).

3.5.2 Millennium Development Goals

The Government of Cambodia embraced the eight Millennium Development Goals (MDGs) officially in 2003 and added a ninth goal related to de-mining explosive remnants of war and victim assistance. The Government has integrated the MDGs into its national five-year plans. While enhanced industrial energy efficiency has many general positive effects on the sustainable development of Cambodia, the most direct link to the MDGs is through Goal 7 („Ensure Environmental Sustainability"). This NAMA promotes inter alia the use of energy efficient biomass boilers reducing the pressure on existing forests. While many MDGs have been met, there are difficulties in reaching goal No 7.

Table 4 summarizes the most important barriers and challenges to meeting the goal.

Table 4. Barriers to Achieving MDG 7

Goal and Indicators	Barriers & Challenges
Goal 7: Ensure environmental sustainability	
Reverse the loss of environmental resources	Key barriers are: Limited demarcation of land Limited physical, human and technical resources Economic concessions currently tend to have a negative impact on natural resources
Increase the proportion of people who have access to sanitation	
Reduce dependence on firewood for cooking	
Increase the proportion of people with secure land tenure	

4 Background to Energy Efficiency in the Garment Industry of Cambodia

Because of the years of war, the garment sector in Cambodia is comparatively young. It started in the late 1990s and has since become a key support of the nation's economy. It supplies jobs to a low skilled, mainly female, workforce. The key indicators of the sector are summarized in Table 5.

Table 5. Key Indicators of the Garment Industry of Cambodia

Indicator	Value
No. of workers (2013)	686,146
Garment industry output (billion riels) (2013)	20,840
% of exports (2013)	72

Sources: RGC, 2014a; GMAC, 2015.

4.1 Competitiveness and Productivity

The sector is subject to fierce global competition with other low-cost garment producers (such as Bangladesh, Burma, and Sri Lanka) fighting for market share. According to the Garment Manufacturing Association of Cambodia (GMAC), even though they produce good quality products, Cambodian workers are less productive than others in the region (100-120 shirts per hour per worker are produced in China and 60-70 shirts in Viet Nam, compared with 30-40 shirts in Cambodia) (Phnom Penh Securities, 2012). Regarding production costs, Cambodia is still cheap because of its low labour costs but other costs, especially for energy, are increasing.[7] The production environment is more stable (fewer strikes) and working conditions are better than in Bangladesh (Holly Robertson and Kang Sothear, 2014).

Cambodian industry is highly energy inefficient, with energy consumption per unit of output being higher than in many countries in the region and more than double that of developed countries. Average energy intensity is 42 GJ/ton of garments produced, which is very high compared with similar garment sectors in the region. Machines are typically operated inefficiently, and equipment maintenance is often inadequate. Lack of investment in maintenance, plus ineffective spare parts stock control, often leads to considerable lost production (GEF and UNIDO, 2010).

4.2 Energy Consumption

Garment factories have several energy intensive operations that require a variety of different energy sources. Energy is used during working hours of up to 10 hours per day, six days per week. In 2010, on average, energy accounted for 16.7 per cent of total production costs (varying from 6 per cent to 60 per cent). The average cost

7 According to the ILO (2014), as of January 2014, the minimum monthly wage in the garment industry in Cambodia was the fourth lowest among 25 countries investigated.

of energy needed to produce a ton of garments was US$560. There was a wide variance in energy costs among factories, ranging from US$30 to US$1,737 per ton of garments produced, which correlates strongly with factory and equipment age (ILO and IFC, 2009—due to its age the data cannot be regarded as other than indicative).

Energy costs are a bottleneck for Cambodia's garment industry. Access to low cost energy is the most critical point in maintaining garment and textile producers' competitiveness. Table 6 below compares electricity tariffs of Cambodia with various neighboring countries in 2011.

Table 6. Electricity Tariffs in Asian Countries

Country	Industrial Electricity Tariffs (US cents/kWh)
Brunei	3.82
Cambodia	**11.71-14.63**
Indonesia	5.38-10.14
Lao PDR	6.23-7.34
Malaysia	7.83-10.88
Myanmar	6.17
Singapore	10.95-18.05
Thailand	8.67-9.43
Viet Nam	2.30-8.32

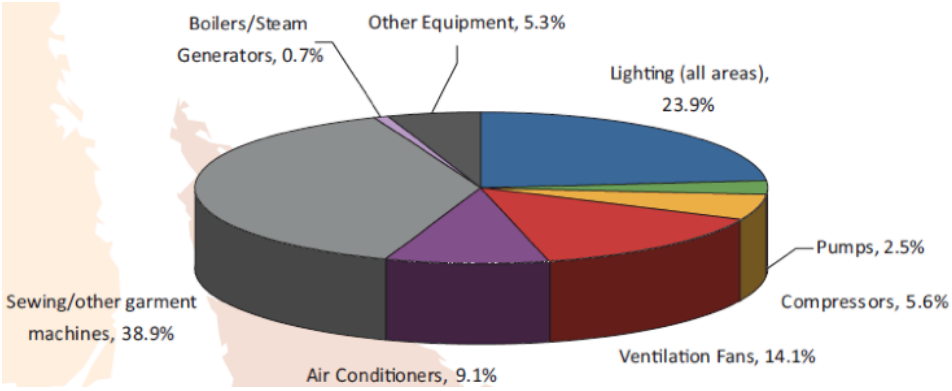
Source: Ellis and others, 2013.

Even though energy prices are high, energy management practices are not widespread in Cambodian garment factories, and neither are energy audits. Specific reports on energy consumption are limited.

Electricity and wood are the most commonly used types of fuel.

Electricity is used by all factories for their production processes and facilities as presented in Figure 5 below.

Figure 5. Electricity Consumption by Equipment Type in the Garment Industry



Sources: IFC and ILO, 2009, p.23.

Electricity is supplied from a number of sources:

- the electricity grid operated by Electricité du Cambodge;
- the owners of the garment factory complexes (supplying electricity, steam and backup for a monthly fee);
- small private electricity enterprises; and/or
- a backup generator.

36.2 per cent of electricity in the manufacturing sector comes from backup generators in the factories, delivering extremely expensive but readily available (backup) energy. This is due to the high prevailing prices and low availability of electricity as well as its poor reliability. Factory owners and investors are aware of price differences in neighbouring countries and border regions from which electricity can be imported to Cambodia at almost half the price paid in Phnom Penh (GEF and UNIDO, 2010).

Wood burning boilers are commonly used due to the low price of wood compared with other energy sources (coal, oil, electricity and gas). The cost of wood accounts for only 10 per cent of total energy costs per ton of product and is the cheapest source of energy. This is likely to change as natural resources become increasingly scarce due to their depletion. The large amount of wood currently used by industrial facilities contributes to natural resource depletion. Therefore the supply of wood for industrial production is not sustainable. Efficient processes and equipment are essential if this scarce resource is to continue to be used, as are management and certification systems to ensure sustainable biomass production.

4.3 Barriers to Adoption of Energy Efficiency

Even though actors in the garment industry are aware that their comparatively high energy costs have a negative impact on the competitiveness of the Cambodian garment industry and despite there being significant market potential for industrial energy efficiency products and services, Cambodian institutions and enterprises have so far failed to achieve energy efficiency on a large scale.

The major limitations currently hindering investment in industrial energy efficiency measures are (GEF and UNIDO, 2010):

- the lack of awareness among industry decision-makers of the economic potential for improvements in energy efficiency;
- insufficient technical capacity within enterprises and in the market to identify, develop and implement industrial energy efficiency projects and measures;
- the lack of human and financial resources to effectively promote and support energy efficiency in industry;
- the lack of qualified local suppliers of energy efficient technologies and after-sales services;
- financing and credit constraints faced by private enterprises (although this barrier is lower for the garment industry than for other industries in Cambodia because many garment companies are owned by foreign companies which have better access to finance; and
- the absence of policies or laws providing funding or other types of support for environmentally beneficial activities.

The NAMA proposed in this document is designed to overcome these barriers by combining investment incentives with a broad capacity-building programme.

5 The Policy Environment

The policy environment provides the framework in which the NAMA will be embedded in order to ensure full alignment with the country´s political goals and objectives. The most relevant policies for this NAMA are as outlined in Table 7.

Table 7. Overview of NAMA Policy Framework

Policy	Objectives
Cambodia Policy on Green Growth	Balance economic development with environment, society, culture and sustainable use of national resources
Cambodia Climate Change Strategic Plan	Aims to integrate climate change into national and sub-national level planning
National Policy, Strategy and Action Plan on Energy Efficiency	Aims to improve energy efficiency and reduce GHG emissions

These policies are described in more detail in the following sections.

5.1 Policies on Green Growth and Climate Change

The National Policy on Green Growth and the National Strategic Plan on Green Growth 2013-2030 (Danh, 2013) aims to strike a balance between the goal of economic development and the needs of the environment, society, and culture while ensuring the sustainable use of national resources The strategy focuses on nine areas (including green investment, green economy management and effective green technology management.) and refers to the reduction of greenhouse gas emissions under the third pillar, Blue Economy Development with Sustainability.

The Cambodia Climate Change Strategic Plan 2014-2023 (CCCSP) (NCCC, 2013) aims to integrate climate change into national and sub-national level planning. The development of the CCCSP was a significant step towards embedding climate change in the NSDP 2014-2018 and in the sectoral development plans of all relevant ministries. The CCCSP sets objectives for national entities and assists non-governmental organizations and development partners in developing concrete and appropriate measures and actions related to adaptation and GHG mitigation.

Two strategic objectives of the CCCSP that fall in the field of industry and energy efficiency and are relevant for the NAMA are summarized below.

Table 8. NAMA Related Objectives of the Cambodia Climate Change Strategic Plan 2014-2023

Strategic Objective	Relation to industry and energy efficiency
Strategic Objective No. 1	Promote climate resilience through improving food, water and energy security. Strategy f: "Promote renewable energy and energy efficiency to reduce GHG emissions and impacts on health."

Strategic Objective	Relation to industry and energy efficiency
Strategic Objective No. 4	Promote low-carbon planning and technologies to support sustainable development. Strategy a: Conduct sectoral analyses on low emission options and sources of emissions (in agriculture, energy, transportation, industrial, land-use and forest management, and waste management) Strategy b: Prepare low-carbon development policies, legal frameworks and action plans in conformity with national development priorities. Strategy c: Promote appropriate technology transfer for low-carbon development (e.g. improving energy efficiency, renewable energy, etc.) and facilitate their diffusion.

Source: NCCC 2013.

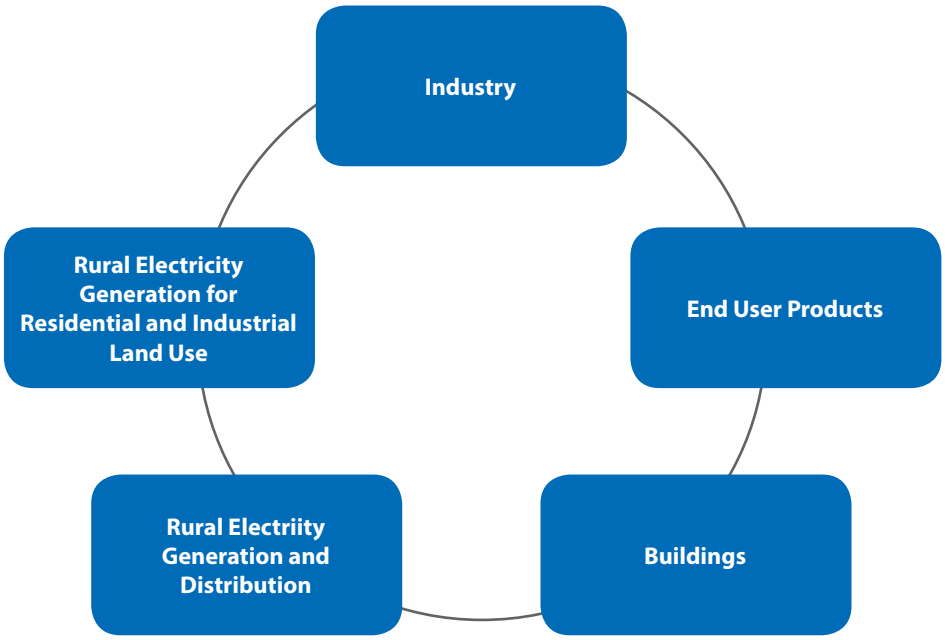
5.2 Policy on Energy Efficiency

The National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia (MIME 2013) has been developed over the past years. The overall objectives of the National Energy Efficiency Policy are as follows.

- *Reduce the future national energy demand by 20 per cent[8] by 2035 compared to business as usual projections.*
- *"Reduce national CO_2 emissions in 2035 by 3 million tonnes of CO_2"* (MIME 2013, p.7).

The five sectors identified as priority areas for the energy efficiency policy are represented in Figure 6.

Figure 6. Priority Sectors for Energy Efficiency Policy



8 The 20 per cent target has not been formally approved yet by the Royal Government of Cambodia.

For the industry sector expected efficiency potentials (specific energy input per specific output) range from 20 per cent (for garment factories) to 70 per cent (for ice factories). The estimate of the efficiency potential for the garment industry is based on the application of:

- efficient wood boilers;
- thermal insulation; and
- efficient sewing machines (MIME 2013, p.10)

Three strategic objectives for the industrial sector are defined as follows.

1. Energy intensity of the industrial sector is reduced by approximately 28 per cent;[9]
2. Capacity-building in the field of energy efficiency in industry is stepped up;
3. Factory owners/managers are induced to pay more attention to energy efficiency.

In order to achieve the above mentioned strategic objectives for the industry sector the National Energy Efficiency Action Plan proposes implementation of the activities summarized in Table 9 (MIME, 2013, pp. 25-26). The potential impact of each activity on achieving the national energy efficiency targets is ranked as high, medium or low and the feasibility of their implementation by colour (green=easy, yellow=medium, red=difficult).

Table 9. Potential Interventions Envisaged in the (Draft) National Energy Efficiency Action Plan

Objective	No.	Activity	Impact	Feasibility
1	1	improvement of energy data collection and processing in industry.	High	
	2	Promotion of good energy management practices in industrial enterprises.	High	
	3	Promotion of biomass use for decentralized production of energy (thermal or electrical) through gasification or bio-digestion.	Low	
	4	Implementation of voluntary standards on energy efficiency in industrial enterprises consuming more than a certain amount (to be determined) of energy per year.	High	
	5	Implementation of energy efficiency/conservation laws/ regulations on industrial energy use.	High	

9 The 28 per cent target has not been formally approved yet by the Royal Government of Cambodia.

Objective	No.	Activity	Impact	Feasibility
2	1	Support for the development of energy service companies (ESCOs).	Medium	
	2	Technical training for engineers and technicians in the field of energy efficiency, performing energy audits, establishing energy management systems and implementing energy saving measures in industry.	High	
	3	Support for the local development and manufacture of energy efficient equipment.	Low	
3	1	Organization of awareness raising campaigns about energy efficiency in industry.	High	
	2	Provision of financial incentives to companies to implement energy efficiency strategies and measures.	High	
	3	Support, especially to small and medium industrial enterprises, for auditing of their facilities and implementation of energy efficient solutions.	High	

Since the National Policy, Strategy and Action Plan on Energy Efficiency has not been approved yet, none of the listed activities has been implemented to date.

5.3 Policy Gap Analysis

Analysis of the policy environment in Cambodia shows that there exists an overall policy framework for the NAMA. What is recommended is that the Government makes legal provision for environmental subsidies or finance as described in section 8.1.1.

6 NAMA Baseline and NAMA Targets

6.1 NAMA Objectives—Complementing National Energy Efficiency Action Plan

The analysis of the Cambodian garment industry given above shows, that the cost of energy has an important impact on its international competitiveness. However, even though financially and technically feasible measures to save energy could be introduced, there are barriers to doing so.

The Cambodian Government has actively pursued the development of green growth, and policies on climate change and energy efficiency over the past few years. Specifically for the industrial sector the National Policy, Strategy and Action Plan on Energy Efficiency sets out the following strategic objectives.

1. The energy efficiency of the industrial sector is to be improved by 28 percent.
2. Capacity-building in the field of energy efficiency in industry is to be strengthened.
3. Factory owners/managers are to become more aware of energy efficiency.

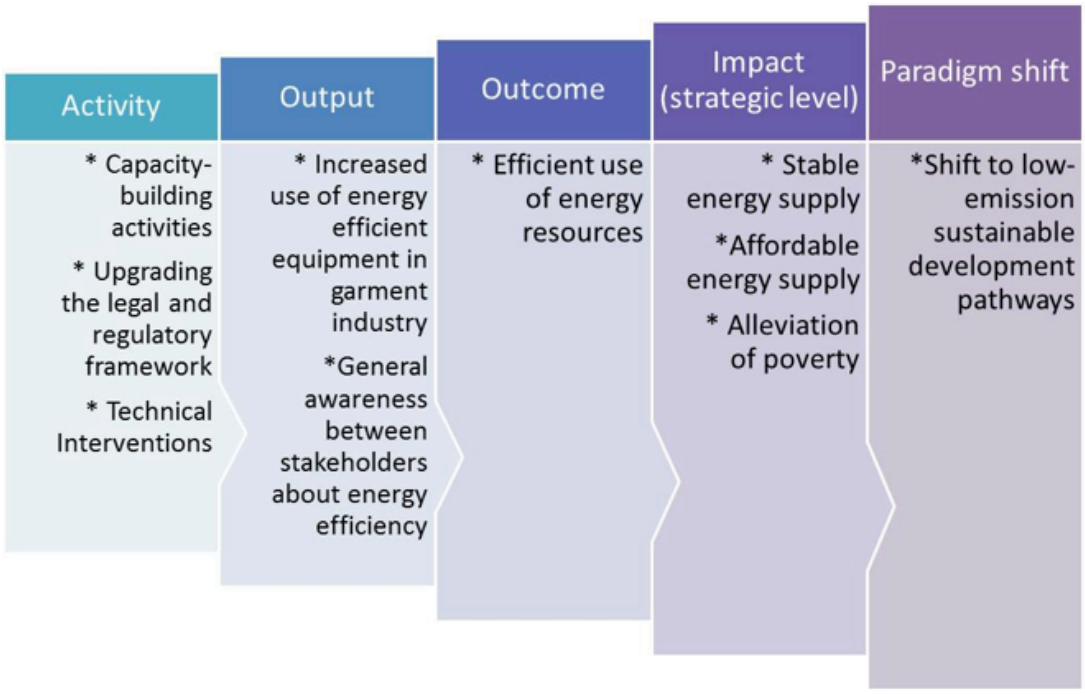
These objectives are to be achieved by means of the 11 activities outlined in Table 9 .

However, because of financial constraints, none of these activities has yet been implemented.

By supporting and complementing (inter alia through the introduction of a law on environmental funding) the implementation of Cambodia´s National Action Plan on Energy Efficiency, this NAMA will remove the barriers hindering effective investment in energy efficient processes and technologies in the garment industry and will have a substantial positive impact on Cambodia´s transformation to a low carbon economy.

The transformative change that a NAMA can induce can best be 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. This set of connected building blocks—interchangeably referred to as outcomes, results, accomplishments, or preconditions—is depicted on a map known as a pathway of change/change framework, which is a graphic representation of the change process" (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, national development goals and transformative change. This approach is also aligned with the Green Climate Fund (GCF) results framework (GCF, 2014). The overall hierarchy of objectives, outputs, outcomes, impact and paradigm shift for the NAMA can be seen in Figure 7.

Figure 7. NAMA Sector Transformation



Cambodia´s national stakeholders described in section 8.2.2 have decided to set the NAMA objective of providing financial incentives to interested garment manufacturing companies to implement energy efficiency measures (see Chapter 7 for details on the technical interventions) by replacing old inefficient equipment with new more efficient technologies. These could include thermal energy technologies for the garment industry, such as efficient biomass boilers (with insulation), and electrical technologies, such as sewing machines, washing machines, drying machines, compressors and lighting.

Making financial incentives available will remove the barrier of limited funding for investments in energy efficiency. It will be accompanied by a capacity-building programme (see Chapter 8 for details) targeting the other barriers mentioned in section 4.3, namely the lack of awareness among industry decision makers; insufficient technical capacity within enterprises; the lack of human and financial resources to effectively promote and support energy efficiency in industry; and the lack of qualified local suppliers of energy-efficient technologies and after-sales services.

6.2 NAMA Baseline

The baseline scenario of the NAMA is the hypothetical scenario describing what will happen in the absence of the proposed NAMA interventions.

Therefore the baseline scenario for this NAMA assumes the continuous use of inefficient old equipment in the garment industry.

The baseline scenario consists of two components, a GHG emissions reduction baseline and a Sustainable Development (SD) baseline. Setting the baseline scenario in this way allows the effects of the Nationally

Appropriate Improvements (NAI) to be properly assessed and quantified through the monitoring activities described in the Measurement, Reporting and Verification (MRV) system.

6.2.1 GHG Emissions Reduction Baseline

The specific baseline of GHG emissions reductions will depend on the type of technical intervention (e.g. the replacement of an inefficient biomass boiler has a different baseline than the implementation of efficient lighting technologies) and will be discussed in detail in Chapter 11 on the MRV system.

6.2.2 Sustainable Development Baseline

The Sustainable Development (SD) indicators were selected based on the Sustainable Development Evaluation Tool (SD Tool) provided by UNDP (UNDP MDG Carbon, 2014) [10] The SD Tool defines four different SD domains:

- Environment
- Social
- Growth and Development
- Economic.

The tool allows, an indicator to be selected for each of the interventions (such as air pollution, biodiversity or health outcomes). The impact of the NAMA on the chosen indicator can then be identified and explained and the effects (positive, negative or both) pinpointed. Whether monitoring has been undertaken is also indicated.

The NAMA interventions will comprise:

- efficient biomass boilers systems;
- efficient sewing, washing, drying machines and compressors; and
- efficient lighting applications.

The NAMA will contribute to the improvement of various sustainable development indicators as shown in Table 10.

10 This document applies the Nationally Appropriate Mitigation Action (NAMA) Sustainable Development Evaluation Tool and its approaches to identify, describe, monitor and verify sustainable indicators developed by UNDP. It can be downloaded at http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMA-sustainable-development-evaluation-tool.html .

Table 10. Sustainable Development Baseline Indicators

Domain	Indicator	Baseline	Target impact
Environment	Air pollution/ quality	Inefficient biomass boiler systems impair local air quality due to pollutants emitted by inferior combustion processes.	The installation and operation of efficient biomass boilers will decrease emissions by reducing the use of non-renewable biomass in thermal applications, thus improving air quality.
	Others (noise/ visibility)	Inefficient energy equipment, i.e. boiler systems, sewing machine motors, washing machines, drying machines, compressors and lighting equipment, causes an environmental burden, due to higher energy consumption than state of the art equipment. Higher energy consumption results in more combustion of fossil fuel, more air pollutants, and GHG gases are thereby be emitted into the atmosphere.	Use of efficient biomass boilers will lead to an improved combustion process, whereby fewer air pollutants (e.g. CO) will be emitted into the atmosphere, reducing the environmental impact arising from air pollutants. Also, in the case of fossil fuel driven electricity, energy efficient equipment consumes less electricity, which results in a lower environmental impact. All the NAMA interventions will reduce the adverse per capita environmental impact of cities.
Social	Health	The application of inefficient equipment driven by fossil fuel electricity contributes to Increased combustion of fossil fuels, which is responsible for air pollutants, such as carbon monoxide (CO), sulfur dioxide (SO2), nitrogen oxides (NOx) and toxic heavy metal, that have acute and chronic effects on human health. Also inefficient biomass boiler systems emit more emissions compared with efficient biomass boiler systems with optimized combustion processes.	A better and more efficient combustion process, resulting from use of efficient biomass boilers will reduce the air pollutant impact and thus reduce the negative effect on human health. Also, the application of energy efficient equipment, which runs on fossil fuel power, contributes to reduced fossil consumption a reduced air pollutant impact as well.
Growth and Development	Energy security	Energy inefficient equipment consumes more energy than state of the art energy efficient equipment, which strains the electricity network, especially at peak hours, and causes additional capacity generation demand. Inefficient boiler systems are potentially vulnerable to incidents and thus there are higher risks of energy shortages.	The application of energy efficient equipment contributes to energy security, due to less peak power demand, and thus relieves pressure on the electricity grid. The operation of energy efficient boiler systems reduces the risk of energy shortages and thus contributes to the energy security of the supply system.

Domain	Indicator	Baseline	Target impact
Economic	Income generation/ expenditure reduction/ balance of payments	The operation of inefficient equipment causes higher energy expenditures and maintenance costs compared with state of the art energy efficient equipment	The installation and operation of energy efficient equipment and boiler systems will potentially increase productivity and reduce the consumed energy costs / output <Means? "The cost of energy consumed per unit of output"?>. The associated energy savings will reduce expenditure and increase the funds available for new investments.
	Asset accumulation and investments	The operation of inefficient equipment causes higher energy expenditures compared with state of the art energy efficient equipment and thus impedes future investments.	Investment in new energy efficient equipment and boiler systems will promote technology transfer, disseminate environmentally sound technology and stimulate new investment.

The project's SD scenario and the targeted SD benefits for each NAMA intervention are summarized in the table below

Table 11. Project SD Scenario and Targeted SD Benefits from the NAMA Interventions

Parameter	Baseline	Target for all NAMA interventions
Number of new efficient biomass boiler systems installed	0	132
Number of new efficient sewing machine motors installed	0	17,186
Number of new efficient washing machines installed	0	661
Number of new efficient drying machines installed	0	331
Number of new efficient compressor machines installed	0	198
Number of new efficient lighting appliances installed (at US$16/unit)	0	500,000

6.3 NAMA Targets

While the NAMA is supporting the overall objective of Cambodia´s energy efficiency policy to improve efficiency in the industrial sector by 28 per cent and to build overall capacity to employ energy efficient practices, the NAMA target values need to be set in such a way that they can be used to quantify the impacts of the SD indicators:

The NAMA targets are therefore defined as shown in Table 12.

Table 12. NAMA Indicators, Impacts and Target Values

Indicator	Impact	NAMA Target Value
Climate change adaptation and mitigation	Tonnes CO_2e-	Expected emission reductions from all three interventions according to the MRV framework are approximately 120,000 tonnes of CO_2e in the years 2016-2021.
Income generation	Electricity payment reduction	Biomass boilers, energy efficiency 132 biomass boilers Sewing energy efficiency: Sewing: 17,186; Washing: 661; Drying: 331; Compressors: 198 Efficient lighting appliances: 500,000 (at US$16)
Asset accumulation		Investments Biomass: US$ 7,900,000 Sewing: US$ 10,873,450 Lighting: US$ 8,000,000

This NAMA meets the requirements for NAMAs set out in the UNFCCC Bali Action Plan.

- Developing country party. NAMAs are instruments for developing country party (Cambodia falls in the category of Least Developed Countries).
- Voluntary. Developing countries are not obliged to engage in NAMAs (this NAMA was proposed by national stakeholders in Cambodia).
- Nationally appropriate. NAMAs should be appropriate for the national circumstances and development needs of the country. (The garment industry is the most important industry in Cambodia and can increase its competiveness by reducing energy costs.)
- Sustainable development. NAMAs should be an integral part of a country's broader sustainable development strategies. (This NAMA takes into account all relevant policies related to sustainable development in Cambodia).
- Support. NAMAs can access developed country support (in the form of technology, finance and capacity-building).
- Measurable, reportable, and verifiable (MRV). NAMAs (as well as support for them from developed countries) are subject to international or internationally defined MRV criteria, and a detailed MRV framework is part of this document.[11]

11 The Bali Action Plan calls for enhanced national and international climate change mitigation actions, including "nationally appropriate mitigation actions by developing country parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner" (Decision 1/CP.13, para. 1, (b), (ii)).

7 NAMA Technical Interventions

For this NAMA Cambodia´s national stakeholders have agreed to prioritize the following technical interventions.

7.1 Efficient Biomass Boilers

Boilers in the garment industry in Cambodia usually produce heat for manufacturing processes only (they are not used for space heating). They are used in processes such as heating water for washing machines, drying and ironing.

This NAMA intervention comprises the replacement of existing, less efficient, biomass fuel fired boilers with new biomass based, more efficient boilers.

The technical requirements that need to be met by new equipment to be eligible for funding under this NAMA intervention are shown in Table 13. Table 14 presents a non-mandatory technical recommendation.

Table 13. Mandatory Technical Requirements: Biomass Boilers

<table>
<tr><th>Criterion</th><th>Mandatory Technical Requirements</th></tr>
<tr><td>Feedstock</td><td>The boiler is to be based on biomass only (fired tube boiler). Only biomass from agricultural waste, such as rice husks, coconut shells, bagasse, rubber and cashew nut plantation wastes, is to be used.</td></tr>
<tr><td>Efficiency</td><td>The efficiency of the boiler is to be at least 80 per cent.

The boiler is to include an inlet water heat increase system (condensate recovery system, economizer or solar water heater) to maintain its efficiency.

Pipes are to be insulated to reduce heat losses.</td></tr>
<tr><td>Fly Ash</td><td>The boiler is to be equipped with an ash handling system in order to reduce the amount of fly ash from the stack.</td></tr>
<tr><td>Feed Boiler Water Quality</td><td>Feed boiler water quality should consist at least of the following parameters:
<table>
<tr><th>Factor</th><th>0-20 kg/cm^2</th><th>21-39 kg/cm^2</th><th>40-59 kg/cm^2</th></tr>
<tr><td>Total dissolved solids, ppm</td><td>3000-3500</td><td>1500-2500</td><td>500-1500</td></tr>
<tr><td>Total iron dissolved solids</td><td>500</td><td>200</td><td>150</td></tr>
<tr><td>Specific electrical conductivity at 25 degrees Celsius</td><td>1000</td><td>400</td><td>300</td></tr>
<tr><td>Phosphate residual ppm</td><td>20-40</td><td>20-40</td><td>15-25</td></tr>
<tr><td>pH at 25 degrees Celsius</td><td>10-10.5</td><td>10-10.5</td><td>9.8-10.2</td></tr>
<tr><td>Silica (max) ppm</td><td>25</td><td>15</td><td>10</td></tr>
</table></td></tr>
<tr><td>Fan Control</td><td>The boiler is to include induced draft (ID) and forced draft (FD) fan control to control the air flow boiler to maintain complete combustion</td></tr>
</table>

Table 14. Non-Mandatory Technical Recommendation: Biomass Boilers

Criterion	Non-Mandatory Technical Recommendation
Efficiency	Biomass fuel should be stored indoors in order to prevent accumulation of moisture content, which causes boiler efficiency to drop.

7.2 Sewing, Washing and Drying Machines, and Compressors

Sewing, washing and drying are typical processes in the garment industry and are the major consumers of electricity. Compressors may be involved at various stages of the production process or may drive a whole pneumatic system in the facility.

The mandatory technical requirements for eligible interventions under this NAMA are summarized in Table 15, while two non-mandatory technical recommendations are presented in Table 16.

Table 15. Mandatory Technical Requirements: Sewing, Washing and Drying Machines, and Compressors

Type of Intervention	Mandatory Technical Requirements
Sewing machines This NAMA intervention comprises the replacement/retrofit of existing, less efficient motors of sewing machines with new, more efficient motors.	The new sewing machine is to be a Servo motor type and to include a Variable Speed Drive (VSD).
Washing machines: This NAMA intervention comprises the replacement/retrofit of existing, less efficient motors of washing machines with, new, more efficient motors.	The new washing machine is to include the installation of Variable Speed Drives (VSD) for motors.
Drying machines: This NAMA intervention comprises the replacement/retrofit of existing, less efficient motors of drying machines with new, more efficient motors.	The new drying machine will include the installation of Variable Speed Drives (VSD) for motors.
Compressors: This NAMA intervention comprises the replacement/retrofit of existing, less efficient compressors with new, more efficient compressors.	The new compressor will be a screw typed compressor.

Table 16: Non-Mandatory Technical Recommendations: Compressors

Criterion	Non-Mandatory Technical Recommendations
Efficiency	Installation of air dryers in order to remove water vapor from compressed air. Installation of compressors in shaded places to reduce their energy consumption.

7.3 Lighting Applications

This NAMA intervention comprises the (i) retrofitting of existing electric lighting fixtures, lamps and/or ballasts; and (ii) the permanent de-lamping of electric lighting fixtures with the use of reflectors.

The following lighting technologies are not eligible under this NAMA:

- T12[12] fluorescent light bulbs;
- magnetic ballasts;
- incandescent A-19 light bulbs; and
- Compact Fluorescent Lamps (CFLs) having less than 6,000 hours lamp life.

Eligible interventions are:

- switching from T12/T8 to T5;
- switching from T8/T5 to Light Emitting Diodes (LEDs); and
- de-lamping and installation of either skylights or solar tube lights.

Technical requirements

If LEDs are used to replace T8 or T12 lamps, the LEDs must initially provide 15 per cent more lumens than the existing T8s or 10 per cent more lumens than the existing T12s to account for lumen depreciation over time.

In general the lighting standards shown in Table 17 need to be met in Cambodia.

Table 17: Overview of Lighting Standards in Cambodia

Garment & Textile Activity	Average level of lighting (Lux)
Knitting	750
Cutting	750
Embroidering	1500
Sewing	1000

12 "T" stands for tube and the number after the "T" refers to the diameter of the tube.

Garment & Textile Activity	Average level of lighting (Lux)
Ironing	300
Quality Checking	1000

Source: Ministry of Social Affairs, Veterans and Youth Rehabilitation, Executive Regulation (Prakas) No. 484 of 23 December 2003 on Light and Illumination.

Collection, destruction and/or recycling of baseline devices are required in order to avoid any uncontrolled mercury pollution. One model could involve the collection of devices, their storage in either decentralized or centralized locations, and their destruction in a third-party recycling facility certified to dispose of salvaged and scrap materials.

Additional (non mandatory) technical recommendations are:

- skylights should be installed on the roofs of buildings;
- solar tube lights should be installed as an alternative solution to skylights on roofs (which usually cover about 20m^2/unit);
- LED/T5 tubes should be installed in the building, especially in the sewing areas (1.2m =28W);
- Task lights should be installed directly on the sewing machines so that TS/LED lights installed above the working areas can be saved (0.5W/light).

7.4 The NAMA Intervention Approval Process

The general NAMA intervention is defined as the installation of new, energy efficient equipment for the garment industry to replace old, inefficient equipment. The national stakeholders have already confirmed the specific types of equipment that should be funded through the NAMA as described above.

Therefore the approval process for the subsidy, incentive and disbursement of funds can effectively be done in seven steps only, as shown in Table 18.

Table 18. The NAMA Intervention Approval Process[13]

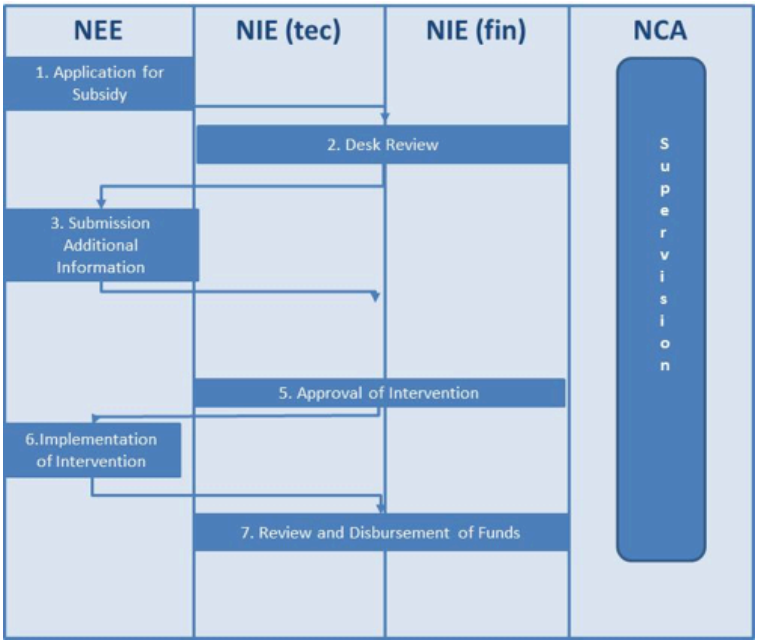
No.	Step	Description
1	Grant application by a NAMA Executing Entity (NEE)	The NEE will send either by post or email an application form requesting a grant for the purchase of a piece of equipment which is on the list for pre-approved energy savings measures and equipment. The grant application must be submitted before implementation of the energy efficiency measures starts. (Implementation starts with entry into force of the purchase contract.)

13 For a detailed explanation of each of the institutions involved in the approval process, see section 9.2.

No.	Step	Description
2	Desk review by financial and technical NAMA implementing entities (NIEs)[14]	The financial and technical NIEs will carefully review the grant application submitted by the NEE against predefined criteria (inter alia, the provision of information about the number, size, and operational lifetime of the equipment items and about their satisfaction of the technical requirements defined in sections 7.1-7.3 above).
3	Additional information request	If the application is not complete, the NIE(s) will contact the NEE to ask for additional information.
4	Project assessment report	The project assessment report will include a description of the equipment to be replaced and the equipment to be installed with a final recommendation for approval or rejection.
5	Approval or rejection by financial and technical NIEs	Based on the information provided, the NIEs will either approve the application for funding or reject it.
6	Implementation of energy efficient equipment by the NEE	The NEE will purchase the energy efficient equipment submitted for approval and install it. Purchase and installation has to follow pre-defined rules.
7	Disbursement of funds	The NIEs will assess whether the actual purchase/ implementation took place in line with the rules defined in the NAMA and approve the disbursement of funds.

Figure 8 illustrates the approval process graphically.

Figure 8. The NAMA Intervention Approval Process Illustrated



14 In this industrial energy efficiency NAMA, the NIE will consist of a bank (as that part of the NIE which is responsible for the financial flows) and a technical entity (as that part of the NIE which is responsible for technical matters).

8 NAMA Capacity-Building

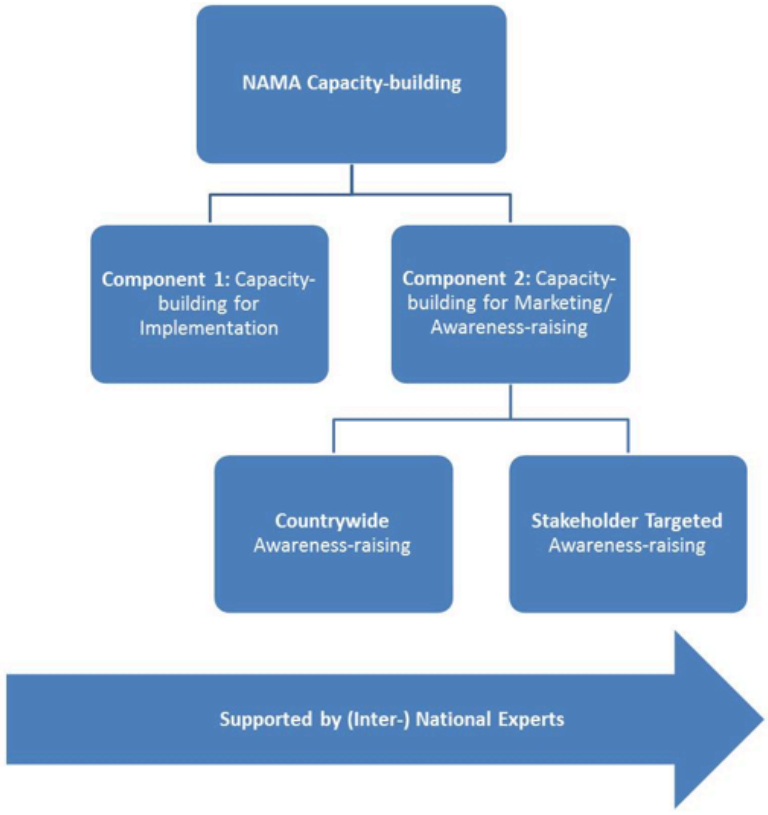
As outlined in Chapter 4, the NAMA capacity-building programme will act in conjunction with the financial incentives and will tackle the remaining barriers described in section 4.2. It will consist of two components.

The first component will focus on setting up the NAMA (e.g. definition of laws and processes, preparation of documentation) and will provide capacity-building for the governmental and semi-governmental entities involved (such as the NIEs or the NA).

The second component will focus on the awareness-raising and marketing side of the NAMA and will provide (i) general capacity-building to create a common awareness of the NAMA; and (ii) specific stakeholder oriented capacity-building.

The capacity-building programme will be led by international experts with the support of national experts. Under the second component the staff of the NCA and NIE trained during the first component will start to give seminars/ training sessions and workshops. The international experts will be hired either through the international donor(s), the NIE, or a multilateral entity.

Figure 9. Structure of NAMA Capacity-Building



8.1 First Component: Capacity-Building for Set-Up[15]

As mentioned above the capacity-building programme for the NAMA set-up will support:

- implementing NAMA-related laws, by-laws, guidelines and contractual terms;
- implementing NAMA processes (the technical and financial project cycle);
- preparing NAMA project documentation;
- recruiting and training staff for new vacancies under the NAMA.

This first component focuses on activities which have to be performed by the NAMA Coordinating Authority and the NAMA Implementing Entities, as further explained in section 9.2.

8.1.1 Laws, By-Laws and Guidelines, And Contractual Terms

National Law for Environmental/ Energy Efficiency Incentives/ Finance/ Subsidies[16]

Since there is no law yet which covers incentives (such as subsidies) for the implementation of environment-friendly technologies in Cambodia, the capacity-building programme will support the NCA in its preparation. At a minimum the new law will contain the sections listed in Table 19.

Table 19. Proposed Sections of the Law on Environmental Finance

Sections	Description
General goals	Explains the general goals of the law, such as (i) the law covers incentives for environmental protection and energy efficiency; and (ii) in considering whether subsidies/grants should be offered, their financial and technical feasibility and economic impact need to be taken into account
General requirements	Explains, for example, that (i) each environment-friendly activity has to meet the requirements of specific guidelines; (ii) the funding of each activity needs to be ensured before subsidies can be granted; and (iii) subsides cannot be transferred.
Use of funds	Explains how funds can be used/disbursed. For example, the law allows funding only as subsidies not as loans; and subsidies can be used only for capacity-building and for co-funding of investment costs up to a maximum of X%.
Definition of organization	Explains that the law will recognize specific types of organizations for specific types of support schemes, taking as its basis the organizational structure suggested in this NAMA.
Project cycle/ process steps	Explains the project cycle from identification to disbursement of subsidies.
Required by-laws	Explains which by-laws or guidelines will be required to give the necessary detail to the law.
Reporting by the Ministry	Explains the form, content and timing of reports prepared by the Ministry which has oversight of the law and to whom they should be addressed.

15 The first component of the capacity-building programme will be carried out by international/national consultants only.
16 This law should be designed in a generic way, so that it can also be used for other NAMAs in Cambodia.

Sections	Description
Applicants	Explains the general eligibility criteria that applicants for subsidies should meet.
Amount of subsidies	Explains how much funding is available for financing programmes.

By-Laws and guidelines

To maintain the flexibility of the general law for environmental and energy efficiency incentives, by-laws and guidelines (prepared by the NCA with support of the capacity-building programme) for specific NAMAs (but also other programmes) will provide additional details such as:

Table 20. Proposed Sections of By-Laws on Environmental Finance

Sections	Description
Definition of technical interventions for the NAMA	See Chapter 7.
Definition of items eligible for funding	Explains, for example, if value added tax, transportation costs or insurance costs are eligible to be funded through the NAMA.
Commercial eligibility	Explains, for example, whether every activity under the NAMA is eligible for funding; or whether only "additional" activities are eligible.[17]
Tender procedure	For purchase of eligible interventions (clarifies if and how beneficiaries need to follow tender procedures, when they buy eligible equipment).
Details on amount of subsidy	Describes the amount of subsidy and how it will be calculated.
Details on the process from application to loan disbursement	Explains inter alia timeframes, the institutions involved, and the documentation required.
Details on publication of guidelines	Sets out the media outlets where updates to the guidelines will be published.

The Support Contract

The support contract under this NAMA (to be signed by the technical NIE and the NEEs will be designed by the NIE (with support of the capacity-building programme) and will contain at least the details listed in Table 21.

Table 21. Content of the Support Contract

	Content of Support Contract
1	Name and address of legal entity asking for support
2	Description of the equipment to be purchased by the NEE
3	Amount of subsidy

17 An "additional" activity means an energy efficiency activity which is only implemented due to the NAMA and otherwise would have not been carried out.

	Content of Support Contract
4	Reference to the legal framework for this NAMA and approval decisions
5	Period for finalizing purchase of equipment and issuing invoice to the NIE
6	Reporting requirements for the NEE
7	Payment conditions

8.1.2 NAMA Processes (Financial and Technical Project Cycle)

The appointed financial NIE[18] will be supported during process set-up by:

- three training sessions on energy efficiency in general and the garment industry specifically;
- two training sessions on eligible energy efficient equipment under this NAMA;
- the development of a reporting structure to the NCA;
- preparation of a list of suppliers;
- design of the approval process within the NIE and the associated time frames

The appointed technical NIE will be supported during process set-up by:

- a "train the trainer" programme covering the objectives, benefits and procedures of the NAMA (the NIE will then be able to offer training to the general public, NEEs, banks and equipment suppliers);
- two sessions of case study training for project approval and verification;
- four sessions of training on MRV for GHG emission reductions and sustainable co-benefits;
- the development of a reporting structure to the NCA;
- design of the approval process within the NIE and the associated time frames;
- training in developing a facility safety and security plan to increase climate resilience for participating enterprises.

8.1.3 Documentation

The first component of the capacity-building programme will also include the preparation of templates such as:

- application forms (including the address of the applicant and information about the equipment to be purchased);
- due diligence notification from a bank (statement by the bank that the garment factory is not bankrupt or insolvent);
- brochures about the NAMA;
- template for invoices (NEE to NIE);

18 For an explanation of the roles and responsibilities of the financial and technical NIEs, refer to section 9.2.

- template for final payment (NEE to NIE);
- templates for reports from NIEs to the NAMA Coordinating Authority (NCA) and from the NCA to the National Climate Change Committee (NCCC) and NAMA funding international institutions.

8.1.4 Staffing

Hiring and training of staff for new vacancies at the NIEs will also be part of the capacity-building programme. It is expected that the technical/financial staff will consist of one part-time and three full-time employees.

8.2 Second Component: Capacity-Building for Marketing/Awareness-Raising

The second component of the capacity-building programme will again be divided into two sub-categories.

First, a countrywide generic marketing/awareness-raising strategy for the NAMA will foster a common understanding of the benefits of energy efficiency in industry and explain the NAMA's objectives and procedures.

Second, specific stakeholder oriented marketing/awareness-raising strategies will encourage widespread participation in the NAMA.

8.2.1 Generic Activities

The following table summarizes the planned generic activities and sets out responsibilities for their execution.

Table 22. Overview of Generic NAMA Capacity-Building Activities

Activity	Responsibility
Organizing the NAMA Launch Event	Organized by NIEs/NCA with support of international experts.
Designing/Maintaining the NAMA Website	Prepared by technical NIE with support of international experts.
Coordinating General NAMA Awareness-Raising Events	Prepared and carried out by technical NIE with support of international experts.
Preparing/Disseminating NAMA Marketing Material	Prepared and carried out by technical NIE with support of international experts.
NAMA Best Practice Award	Prepared and carried out by technical NIE with support of international experts.
Cooperation with Public Media	Prepared and carried out by technical and financial NIE with support of international experts.

Organizing the NAMA Launch Event

The launch event will mark the countrywide start of the NAMA and will convey information about its objectives, stakeholders and timelines. The target audiences for the launch event will be senior management from national

authorities, banks, business and media, who would also be the key counterparts and partners for the NAMA. A high level of participation from the target audience would ensure that attention is immediately drawn to the NAMA and feedback received from decision makers. The launch event will include a press briefing and will provide some informal networking opportunities.

Designing/Maintaining the NAMA Website

The web page will be one of the main communication tools of the NAMA providing information about:

- the qualification criteria for projects;
- case studies;
- best practice:
- success stories;
- templates;
- news and achievements of the NAMA; and
- donors.

Coordinating General NAMA Awareness-Raising Events

In addition to the launch event four general awareness-raising events will be organized per year (for the first three years of the NAMA). These will market the idea of energy efficiency, as well as the specific NAMA, its objectives and opportunities, and explain the NAMA procedures.

The agenda could include the following:

- brief introduction to renewable energy and energy efficiency, including the expected benefits;
- project types under the NAMA;
- presentation of the project cycle/approval process of the NAMA;
- current and potential future of project types in the country (and its dependence on appropriate laws, engineering expertise and so on);
- best practice nationally and internationally.

Preparing/Disseminating NAMA Marketing Material

Examples of the materials to be disseminated are leaflets, pens, notepads, a best practice guide, folders and banners.

NAMA Best Practice Award

The most ambitious efficiency projects judged by the savings achieved and their innovative character will receive an annual NAMA best practice award. The winners will receive the award during one of the awareness-raising events.

Cooperation with Public Media

There will be continuous information to public media about the implementation and outcomes of the NAMA.

8.2.2 Stakeholder Targeted Activities

This section refers only to capacity-building activities tailored to the needs of the specific stakeholders (with the exception of the NCA and NIEs, whose capacity-building programme is already covered under Component 1 and under the generic activities of Component 2) and provided by international experts.

The next table summarizes the stakeholders being targeted for specific activities and sets out who is to be responsible for executing the activities.

Table 23. Overview of Stakeholder Oriented NAMA Capacity-Building

Stakeholder	Responsibility
National Climate Change Committee	Capacity-building prepared and carried out by international/national experts.
National NAMA Approver	Capacity-building prepared and carried out by international/national experts
NAMA Executing Entities – Garment Industry	Capacity-building prepared and carried out by international/national experts
Banks	Capacity-building prepared and carried out by international/national experts
Equipment Supplier	Capacity-building prepared and carried out by international/national experts

National Climate Change Committee

The NCCC acts as the high level authority coordinating and monitoring the implementation of the Government's policies, strategies, regulations, plans and programmes in response to climate change issues. Aside from the generic marketing/awareness-raising activities there will not be any specific NAMA related capacity-building at the NCCC level.

National NAMA Approver

The National NAMA Approver (NA) (Ministry of Environment) acts as the interface with the international bodies that are concerned with climate change policies. Its most important NAMA task is to avoid double-counting of emission reductions. Therefore the NA-specific capacity-building will focus on:

- support for exchange of know-how with other countries which are implementing or have implemented industrial energy efficiency NAMAs;
- the MRV system for the NAMA.

NAMA Executing Entities - Garment Industry

NAMA Executing Entities are the companies which will invest in new energy efficient equipment. Lack of information and lack of trust in the benefits of energy efficient equipment have been mentioned as the most relevant barriers to investment in energy efficient equipment. While the generic awareness-raising activities

provide a basic overview of the concepts of energy efficiency, capacity-building activities specifically for this group will focus on:

- 20-30 energy audits conducted by teams consisting of national/international experts, pointing out the most effective and efficient energy saving measures;
- 8-12 training courses in energy efficiency in the garment industry covering;
  - Background of energy management;
  - Barriers to energy efficiency;
  - Implementing energy efficiency programmes;
  - Financial costs and benefits of energy saving measures;
  - Procurement and analysis of energy bills;
  - Energy audits (covering electrical systems, heating, ventilating and air conditioning systems, lighting; motors and drivers, boilers and steam, and compressed air systems).

Banks

National banks provide financing to NEEs for the purchase of energy efficiency equipment. Therefore it is important that banks understand the concepts and benefits of energy efficiency and identify the NAMA as a new business opportunity. Specific capacity-building activities for banks will include:

- presentations at round-table meetings with the most relevant banks, initially at headquarters level and then jointly with bank management at selected branches (if applicable);
- screening of banks´ client portfolios for potential energy efficiency lending opportunities;
- 8-12 training courses introducing energy efficiency;
- joint development of new loan products;
- distribution of guidance information to banks' loan officers to notify them of business opportunities under the NAMA;
- introduction/exploratory visits in co-operation with bank branches to a number of potential clients;
- conducting customer meetings together with loan officers.

Suppliers of Energy Efficient Equipment

Supplying energy efficient equipment is not yet very common in Cambodia. Therefore potential suppliers will receive:

- information and 8-12 training courses about available energy efficient technologies in Cambodia and in the region;
- screening of suppliers´ client portfolios for potential business opportunities;
- joint development of new sales instruments;
- joint customer meetings with sales managers.

9 NAMA Institutional Structure

9.1 Actions to Institutionalize the NAMA

The coordination and management of the NAMA requires an institutional structure, which should meet the following requirements:

- be embedded in national and sectoral policies and strategies;
- undertake effective communication and reporting as required by international agencies, in particular the UNFCCC;
- provide an interface with international bilateral and multilateral NAMA funding entities (such as the Green Climate Fund);
- ensure proper management of financial flows between the NAMA funding entities and the recipients;
- ensure achievement of NAMA targets in terms of
  - energy savings;
  - GHG mitigation; and
  - sustainable development benefits.
- allow transparent monitoring of GHG emissions reduction and the Sustainable Development indicators.

The recommended institutional structure of the NAMA is based on the following principles:

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

The current institutional arrangement for the coordination of climate change response in Cambodia is described as follows:

"The National Climate Change Committee (NCCC) was established in 2006 with the mandate to coordinate and monitor the implementation of the Government's policies, strategies, regulations, plans and programmes in response to climate change issues. Samdech Akka Moha Sena Padei Techo Hun Sen, the Prime Minister of Cambodia, is the Honorary Chair of the NCCC, while the Minister of Environment serves as its Chair. A Climate Change Technical Team (CCTT) was established as an inter-ministerial body to provide technical support to the NCCC in fulfilling its mandate. The Climate Change Department (CCD) within MoE serves as the Secretariat for the NCCC and coordinates the activities of the CCTT. There are climate change focal points and working groups appointed by key line ministries to oversee climate change related activities, such as the development of Sectoral Climate Change Strategic Plans, action plans and projects"(RGC, MOP, 2013).

The relevant institutional entities in Cambodia with responsibility for promoting industrial energy efficiency in the garment industry are as follows.

- The Ministry of Industry and Handicraft (MoIH). The MoIH is responsible for the productivity of the industrial sector in Cambodia. It is also involved in the preparation of the National Energy Efficiency Policy.
- The Ministry of Mines and Energy (MoME) is in charge of energy resources in Cambodia. It is leading the development of the national energy efficiency plan.
- The National Cleaner Production Office - Cambodia (NCPO-C) is an autonomous institution and a focal point of the UNIDO/UNEP international network for Resource Efficient and Cleaner Production (RECP) in Cambodia.
- The Garment Manufacturers Association in Cambodia (GMAC). The GMAC inter alia represents the garment manufacturing companies in the development of garment industry related legislation.

9.2 NAMA Institutions

The institutional structure for the NAMA in Cambodia includes the following institutional bodies at the country level;

- The NAMA National Focal Point or National NAMA Approver (NA);
- The NAMA Coordinating Authority (NCA);
- The NAMA Implementing Entities (NIEs);
- The NAMA Executing Entities (NEEs);
- The National Climate Change Committee (NCCC).[19]

National NAMA Approver and Focal Point

The national NAMA Approver or Focal Point shall inter alia:

- approve NAMAs which will then be registered at the UNFCCC;
- report to the NCCC about international developments and the status of the national NAMA portfolio and follow the guidance of the NCCC in international negotiations;
- provide guidance to the NAMA Coordinating Authority (NCA) on access to climate finance, financial flows, MRV and so on;
- implement measures relating to the accounting of emission reductions to avoid double counting of emission reductions from the various NAMAs being implemented;
- support the preparation of the National Communication, the Biennial Update Reports, the Summary of GHG Reductions and other reports to the UNFCCC.

The Ministry of Environment has already been appointed as NAMA Approver to the UNFCCC and as the National Designated Authority to the Green Climate Fund.

19 In cases where the GCF is engaged in co-funding, an additional entity, the National Designated Authority (NDA), needs to be involved since it is the country focal point in all relations with the GCF and provides the letter of no objections to requests for funding from the GCF.

NAMA Coordinating Authority (NCA)

The NAMA Coordinating Authority (NCA) is the entity which will coordinate the energy efficiency NAMA in the garment industry. Its main tasks are:

- acting as the primary contact for international donor(s);
- approving NAMA targets (penetration rate of efficient equipment up to the target year) and the implementation process with regard to submissions of project applications and disbursement of funds (in close collaboration with the NCCC, the NAMA Focal Point and NIEs);
- approving and updating the eligibility criteria for interventions;
- approving annual monitoring reports prepared by the NIEs (covering inter alia, types and number of items of equipment replaced, the calculation of emission reductions etc.);
- providing national experts to implement the project;
- supervising the financial flows between donors and beneficiaries.

As the relevant sectoral ministry, it is suggested that the Ministry of Industry and Handicraft acts as the NAMA Coordinating Authority.

NAMA Implementing Entities (NIEs)

The NAMA Implementing Entities (NIEs) constitute the main operational body of the NAMA.

Two specialized NIEs will manage their respective areas, the financial NIE will manage the financial flows from the funding entities to the beneficiaries and the technical NIE will manage the technical implementation of the NAMA (inter alia, checking eligibility of interventions, summarizing monitoring data etc.).

The main tasks of the financial NIE are:

- to ensure the proper transfer and disbursement of funds from the donors to the recipients based on an agreed set of criteria;
- to prepare reports to the NCCC/NCA/donors in coordination with the technical NIE on the use of funds, project types and the number of items of equipment installed;
- to cooperate with internal and external financial auditors.

The main tasks of the technical NIE are:

- to check and approve applications for funding under the NAMA;
- to develop technical standards for equipment and installation under the NAMA;
- to provide capacity development for institutions and companies, such as garment producers and equipment suppliers, involved in the implementation of the NAMA;
- to coordinate promotion and awareness-raising campaigns about energy efficiency in the garment industry;
- to coordinate and compile monitoring data; and
- to prepare reports to the NCCC/NCA/donors in coordination with the financial NIE on the use of funds, project types and the number of items of equipment installed.

The Department of Techniques, Science and Technology under the Ministry of Industry and Handicraft will take on the function of the technical NAMA Implementing Entity, while Acleda Bank is to act as financial NAMA Implementing Entity

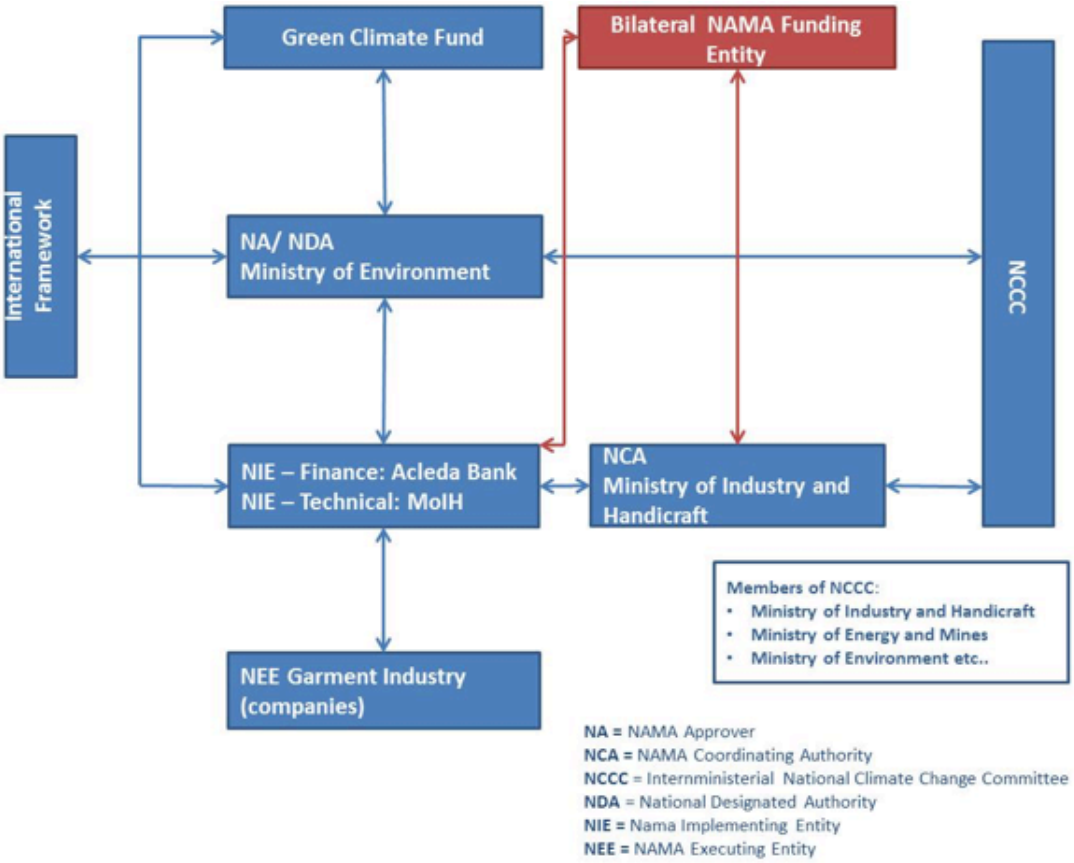
NAMA Executing Entities

The NAMA Executing Entities are the companies which buy new energy efficient equipment either for capacity expansion or to replace old inefficient equipment. NEEs will:

- implement energy saving measures in their companies;
- inform the technical NIE about their technical performance and their estimated energy savings; and
- collect data for monitoring purposes (operating hours, efficiency increases etc.).

The organizational diagram (Figure 9) below illustrates the institutional structure of the NAMA. Bilateral funding entities or donors will be in direct contact with the NCA. The Ministry of Environment will be the contact for the GCF only. The NCCC will act as the national high level political supervisory body of the NAMA.

Figure 10. Institutional Structure of the NAMA



9.3 International/National Experts

A team of international experts will play a supportive role during the first three years of the NAMA, covering the one-year set-up phase and the first two years of operations. The team shall consist of the following personnel.

An international project manager with a) extensive expertise in managing sustainable energy projects and dealing with financial institutions; b) extensive technical experience in energy efficiency and renewable energy projects; c) proven expertise in project implementation planning, including those aspects related to energy management and energy efficiency financing schemes; d) experience in public outreach and marketing; and e) language skills (must be fluent in spoken and written English, while knowledge of the local language would be advantageous); f) minimum seven years' experience.

A local team leader with a) extensive experience in energy efficiency projects and management skills; b) experience in project implementation planning, including those aspects related to energy management and energy efficiency financing schemes; c) excellent communication skills and experience in dealing with financial institutions; d) language skills (must be fluent in spoken and written English and relevant local language); e) minimum five years' experience.

Engineers with a) experience in providing consultancy services on energy efficiency in industrial operations, e.g. process upgrade, heat recovery, modernization/optimization of energy supply systems (power distribution, compressed air, refrigeration, etc.) and improved monitoring and control; b)proven experience in sustainable energy projects, including: (i) conducting energy audits and validation of renewable energy resources; (ii) assessment of project investment plans including risks and mitigation strategy; (iii) commercially based sustainable energy projects financing; and (iv) calculation of greenhouse gas emission reduction for such projects following Kyoto regulations; c) minimum five years' experience.

A Financial/Economic lead Expert with a) significant experience as a corporate finance expert, bank loan officer or economist with a specialization in financial analysis (including capital investment appraisal); b) proven expertise in investing, particularly in the financial structuring of cash-flow based lending projects; and c) language skills (must be fluent in spoken and written English, while knowledge of local language would be advantageous); d) minimum five years' experience.

Experts in communication, marketing/IT, including the ability to devise a web-based facility to inform, report and assist in transactions, with relevant professional experience in marketing successful projects in business to business as well as consumer marketing contexts; proven experience with design, implementation and operation of web-based information, transaction and monitoring systems; and language skills.

9.4 Verification Entity

The Verification Entity shall act as an independent entity to verify the GHG emission reductions and sustainable co-benefits of the NAMA. It shall be accredited by the UNFCCC or by a similar organization to perform verification of carbon reduction programmes or sustainability reports.

10 NAMA Costs and Finance

10.1 Determination of NAMA Costs

The total costs of the NAMA are estimated at approximately US$29.7 million. It should be noted that the financial benefits through energy savings are not taken into account in this approach..

As shown in Table 24, the total costs are split up into three components.

Table 24. Breakdown of Total NAMA Costs

Cost Category	Cost in US$
Investment in energy efficient equipment	26,805,450
Capacity-building	2,112,656
Operation of NIE Programme Office	769,216
Total Costs	**29,687,322**

The calculations and assumptions for the cost categories will be described in detail in the following sections.

10.1.1 Investment Subsidy

It is planned that this NAMA will subsidize 15 per cent of the investment costs of new energy efficient equipment for the garment industry in order to incentivize the replacement of inefficient technologies. The following tables show the assumptions for:

- the theoretical potential of existing equipment;
- the necessary investment per item of equipment; and
- the assumed targets for this NAMA.

Table 25. Cost Assumptions and the Sources Justifying Them: Biomass Boilers[20]

Assumption	Source justifying assumption
Number of garment factories in Cambodia is 661	Ministry of Commerce
2 boilers per factory	NCPO-C
Typical boiler 2 tons steam/hour	Outcome of SAVE[20] initiative

20 The Sustainable Action & Vision for a better Environment (SAVE) is a Public Private Partnership (PPP) project co-financed by public entity Deutsche Investitions- und Entwicklungsgesellschaft (DEG) and the company Puma which started in early 2013 and will finish at the end of 2015. Its primary purpose is to create more environmentally friendly production sites across the footwear, apparel and accessory supply chain in developing countries of Asia. SAVE targets the manufacturing locations of Bangladesh, Cambodia, China and Indonesia (see http://puma-save.org/).

Assumption	Source justifying assumption
Average investment cost/boiler equals approximately US$60,000	Outcome of SAVE initiative
Potential for replacement is 10 per cent of existing boilers. The assumed target for this NAMA is to change 10 per cent of total existing boilers into efficient ones	NCPO-C

Table 26. Cost Assumptions and the Sources Justifying Them: Sewing Machines

Assumption	Source justifying assumption
Number of garment factories in Cambodia is 661	Ministry of Commerce
260 sewing machines per factory	Ministry of Commerce
Average investment cost/ servo motor equals approximately US$200	Outcome of SAVE initiative
Potential for change to Servo motor in sewing machines is 80 per cent (20 per cent of garment manufacturers have already changed to more efficient Servo motors in sewing machines). The assumed target for this NAMA is to change the motors in 10 per cent of existing sewing machines	Consultants' own estimate

Table 27. Cost Assumptions and the Sources Justifying Them: Washing Machines

Assumption	Source justifying assumption
Number of garment factories in Cambodia is 661	Ministry of Commerce
Ten machines per factory	Consultants' own estimate
Average investment cost of a variable speed drive (VSD) equals approximately US$3,500	Local supplier
Potential for implementing VSD for washing machines is 100 per cent The assumed target for this NAMA is the implementation of VSDs in 10 per cent of existing washing machines	Consultants' estimate

Table 28. Cost Assumptions and the Sources Justifying Them: Drying Machines

Assumption	Source justifying assumption
Number of garment factories in Cambodia is 661	Ministry of Commerce
Five machines per factory	Consultants' own estimate
Average investment cost of a VSD equals approximately US$3,500.	Local supplier
Potential for implementing VSD for washing machines is 100 per cent The assumed target for this NAMA is the implementation of VSDs in 10 per cent of existing washing machines	Consultants' own estimate

Table 29. Cost Assumptions and the Sources Justifying Them: Compressors

Assumptions	Source justifying assumptions
Number of garment factories in Cambodia is 661	Ministry of Commerce
Three compressors per factory	Consultants' own estimate
Average investment cost of a compressor equals approximately US$20,000	Local supplier
Potential for implementing efficient compressors is 100 per cent The assumed target for this NAMA is to change 10 per cent of existing compressors to more efficient ones	Consultants' own estimate

Assumptions/Justifications Lighting

The costs/benefits of efficient lighting depend on which technologies will be replaced and on which more efficient technologies will be adopted in the NAMA. Under this NAMA it is expected that US$8 million will be invested in efficient lighting over five years.

UNDP Industry Efficiency NAMA in Cambodia Final Version

Table 30: Indicative Funding Requirements for the Investment Subsidy

							Years					
Intervention	**Investment/ Unit**	**Units/ Factory**	**Total Units**	**% Change**	**No. Units**	**Total Investment**	**1**	**2**	**3**	**4**	**5**	**6**
	US$					**US$**						
								0.2	0.2	0.2	0.2	0.2
Biomass Boilers	60,000	2	1,322	0.10	132	7,932,000		1,586,400	1,586,400	1,586,400	1,586,400	1,586,400
Sewing	200	260	171,860	0.10	17,186	3,437,000		687,400	687,400	687,400	687,400	687,400
Washing	3,500	10	6,610	0.10	661	2,313,500		462,700	462,700	462,700	462,700	462,700
Drying	3,500	5	3,305	0.10	331	1,156,750		231,350	231,350	231,350	231,350	231,350
Compressors	20,000	3	1,983	0.10	198	3,966,000		793,200	793,200	793,200	793,200	793,200
Lighting			0		0	8,000,000		1,600,000	1,600,000	1,600,000	1,600,000	1,600,000
Total Investment						**26,805,450**		5,361,090	5,361,090	5,361,090	5,361,090	5,361,090
Total Investment Incentive	.15					**4,020,818**		804,164	804,164	804,164	804,164	804,164
Funded Internationally												
%								0.95	0.95	0.95	0.95	0.95
Absolute Terms								763,955	763,955	763,955	763,955	763,955
Funded Nationally												
$								0.05	0.05	0.05	0.05	0.05
Absolute terms								40,208	40,208	40,208	40,208	40,208
Total International Funds Required						**3,699,152**						

10.1.2 COSTS of Capacity-Building[21]

Table 31: Indicative Costs of NAMA Capacity-Building

		Year 1-3
	Cost Items	**Costs (US$)**
1	Human Resources	
	Subtotal Human Resources	1,343,000
2	Travel	
	Subtotal Travel	111,000
3	Equipment and Supplies	
	Subtotal Equipment and Supplies	48,500
4	Local Office	
	Subtotal Local Office	55,800
5	Other Cost Services	
	Subtotal Other Cost Services	328,000
6	Contingency (5%)	94,315
7	Project Administration (7%)	132,041
	Total Costs	**2,112,656**

10.1.3 Costs of NAMA Implementing Entity Programme Office

Table 32: Indicative Costs of NAMA Implementing Entity Programme Office

		Year 2-6
	Cost Items	**Costs (US$)**
1	Human Resources	
	Subtotal Human Resources	388,800
2	Equipment and Supplies	
	Subtotal Equipment and Supplied	72,500
3	Local Office	
	Subtotal Local Office	93,000
4	Other Cost Services	

21 Since the services for capacity-building will be tendered by the international donor(s), the NIE or multilateral entity, the figures in this section are only first estimates.

		Year 2-6
	Cost Items	**Costs (US$)**
	Subtotal Other Cost Services	132,500
5	Contingency (5%)	34,340
6	Project Administration (7%)	48,076
	Total Costs	**769,216**

As shown in Table 33, the NAMA costs are distributed over six years.

Table 33: NAMA Total Costs (US$)

	Year						
	1	**2**	**3**	**4**	**5**	**6**	**Total**
Cost Items							
Investments (including 15% investment subsidy)		5,361,090	5,361,090	5,361,090	5,361,090	5,361,090	26,805,450
Capacity-building	704,219	704,219	704,219				2,112,656
NIE Costs		153,843	153,843	153,843	153,843	153,843	769,216
Total Costs	704,219	6,219,152	6,219,152	5,514,933	5,514,933	5,514,933	**29,687,322**

10.2 NAMA Finance

The NAMA costs as determined above shall be funded as follows.

Table 34: NAMA Financing Sources (US$)

	Private Finance	Public Finance	Total Costs
National	22,800,000	300,000	
International		6,600,000	
	22,800,000	6,900,000	29,700,000

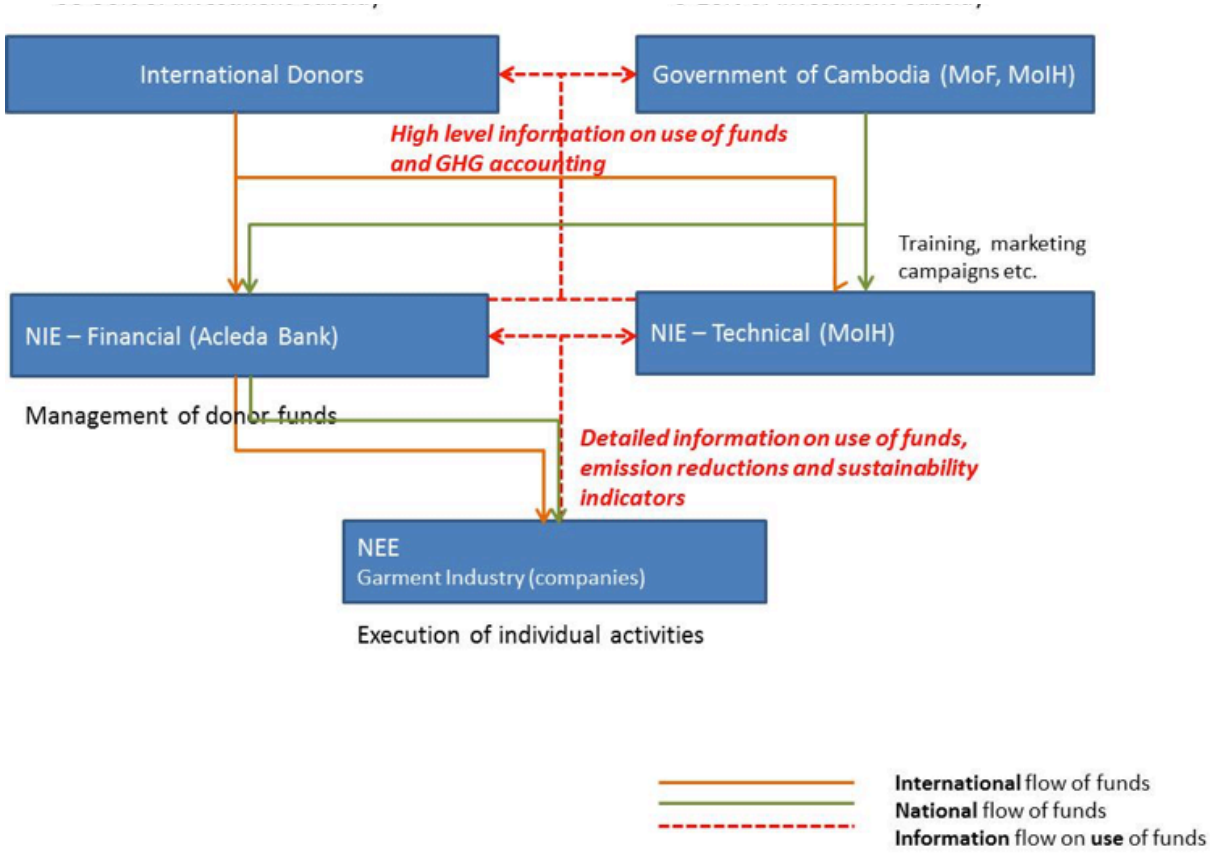
Since the Government and international donor partners will subsidize 15 per cent of the cost of the investments in energy efficiency equipment, only 85 per cent of the investment costs need to be borne by the garment company owners, which equals a **national private finance** component of approximately **US$22,800,000**.

National public finance will fund 5 per cent of the investment subsidy in years 1 and 2 of the NAMA and 10 per cent in years 3 to 5. In total national public finance will therefore cover approximately US$300,000.

International public finance will fund 95 per cent of the investment subsidy in years 1 and 2 of the NAMA and 90 per cent in years 3 to 5. Additionally, it will cover the costs of the capacity-building programme and the NIE programme office. In total international public finance will therefore cover approximately US$6,600,000.

The next figure summarizes the flow of funds and information about their use.

Figure 11. Overview of flow of funds under the NAMA



11 Measurement, Reporting and Verification

A credible and transparent MRV framework is essential if the impact of this NAMA on the nationally appropriate improvements (NAI), greenhouse gas emissions and SD co-benefits is to be assessed effectively. It would provide the country with an accurate and credible information framework that can serve as a basis for understanding the impact of such holistic mitigation actions and for identifying areas needing more targeted effort. On the international level, a strong MRV framework will help the country to receive due recognition for its contributions to GHG emission reduction and the transformation of its industry to low-emission sustainability, while also increasing the likelihood of its accessing international financial support.

11.1 MRV System for GHG Emission Reductions

This chapter describes the measurement, reporting and verification framework for GHG emission reductions associated with the NAMA and the specifics of each technical intervention.

A detailed demonstration how to calculate associated emission reductions is attached as Annex I.

11.1.1 Efficient Biomass Boiler Systems

Efficient biomass boilers using agricultural waste streams as fuel input will decrease GHG emissions by displacing the use of non-renewable biomass. It is assumed that in the absence of the NAMA, the baseline scenario would be the projected use of fossil fuels to meet similar thermal energy needs as those provided by the devices installed through the NAMA. The MRV framework is based on Clean Development Mechanism (CDM) approved "Small-scale Methodology: AMS-I.E.: Switch from non-renewable biomass for thermal applications by the user, Version 06.0" (UNFCCC, 2014).

Measuring/Calculating Emission Reductions

$$ER_y = B_{y,savings} \times N_y \times NCV_{biomass} \times EF_{projected\_fossilfuel} \times LE_y$$

Where:

ER_y	=	Emission reductions durig year ***y*** in t CO_2e
$B_{y,savings}$	=	Quantity of woody biomass in t that is saved in tons per boiler in year ***y*** This is the estimate of average annual consumption of woody biomass per boiler (tons/year)
$f_{NRB,y}$	=	Fraction of woody biomass saved by the NAMA in year ***y***
$NCV_{biomass}$	=	Net calorific value of the non-renewable woody biomass that is substituted (TJ/ton biomass)

$EF_{projected\_fossilfuel}$	=	Emission factor for the fossil fuels projected to be used for substitution of non-renewable woody biomass by similar consumers (tCO_2e/TJ)
N_y	=	Number of NAMA devices operating in year ***y***
LE_y	=	Leakage emissions in the year ***y*** ***(tCO_2e)***

NAMA Default Values for Efficient Biomass Boilers

$f_{NRB,y}$	0.76[22] (fraction)
$NCV_{biomass}$	0.0015[23] (TJ/ton biomass based on the gross weight of the wood that is air dried)
$EF_{projected\_fossilfuel}$	81.6[24] (t CO_2/TJ)
LE_y	0.95[25] (fraction)
$\eta_{old,i}$	0.4[26] (fraction)
$B_{y,savings}$	1,250[27] (tons biomass)

The default values will be used for the first monitoring period of two years after start of the NAMA. The NAMA is defined as starting when the first device (either one of the interventions as defined above) is replaced. After two years the first verification will be carried out and default values will be revised for the next monitoring period as follows.

$f_{NRB,y}$	according to latest value available on UNFCCC CDM website
$NCV_{biomass}$	according to latest version of AMS-I.E
$EF_{projected\_fossilfuel}$	according to latest version of AMS-I.E
LE_y	according to latest version of AMS-I.E
$B_{y,savings}$	derived from historical data or estimated using survey methods

22 Default values approved by the Executive Board are available at http://cdm.unfccc.int.
23 As per AMS-I.E Version 06.0, page 4.
24 As per AMS-I.E Version 06.0, page 5.
25 As per AMS-I.E Version 04.0, page 8.
26 As per outcome of SAVE initiative.
27 Based on the experience of the National Cleaner Production Office - Cambodia.

If surveys are used to determine monitoring parameters, they should be conducted following a random sampling approach and the minimum sample size should be:

- Project target population < 300: minimum sampling size 30 or population size (if the latter is smaller than 30);
- Project target population 300-1,000: minimum sample size 10 per cent of group size;
- Project target population > 1,000: minimum sample size 100.

Since devices will be replaced throughout the year, emission reductions will be calculated on a monthly basis, and it will be assumed that a device has been installed on the last day of the month (e.g. if the new equipment is installed on 3 March, emission reductions will only be calculated from 1 April.)

Emissions reductions shall be considered from the date of commissioning of each device.

Monitoring and Verification

The following information shall be monitored individually by the NIE;

- technical specification of old equipment (efficiency, capacity, technical lifetime, date of installation, annual operating hours, expected remaining lifetime);
- technical specifications of new equipment (efficiency, capacity, estimated annual operating hours, technical lifetime, registration number);
- installation date;
- information on entity receiving the equipment (including company registration, location etc.);
- quantity of thermal energy generated by each new biomass boiler;
- use of agricultural waste stream as fuel input.

Verification shall consist of:

- checking the monitoring and its management system;
- checking a representative sample of all devices, at least once every two years (biennially) to determine if they are still operating; those devices that have been replaced before and independently from the verification survey by an equivalent in-service device can be counted as operating;
- revising default values as explained above;
- determining the woody biomass consumed by taking a representative sample.

11.1.2 Sewing, Washing and Drying Machines, and Compressors

Activities for efficient sewing, washing, drying machines and compressors are improving energy efficiency in motor driven systems and will decrease GHG emissions by reducing the use of electricity. It is assumed that in the absence of the NAMA, the baseline scenario would be the continuation of the current practice and that the volume of electricity consumed (or electricity consumed per unit of production) is what it would have been in the absence of the NAMA for the motor or motor-system that is replaced.

For the first monitoring period the NAMA uses a simplified MRV approach relying mainly on the experience of Cambodian energy efficiency experts (for default values of energy efficiency improvement). However it is proposed that the independent verification entity will assess the default values and will propose changes according to their expert judgement and proper scientific justification.

Measuring/Calculating Emission Reductions

The emission reductions accrue only up to the estimated remaining lifetime of the baseline motor system (i.e. the time when the affected baseline system would have been replaced in the absence of the NAMA). From that point of time onwards, the baseline scenario is assumed to correspond to the NAMA intervention, and baseline emissions are assumed to equal NAMA emissions and no emission reductions are assumed to occur. The average remaining lifetime of the covered equipment is assumed to be five years.

The possible technological interventions are categorized as follows.

Sewing machines:

Replacing existing less efficient motors of washing machines with new more efficient motors;

Washing machines:

Installation of Variable Speed Drive (VSD) for motor;

Drying machines:

Installation of Variable Speed Drive (VSD) for motor;

Compressors:

Replacing existing less efficient compressors with more efficient compressors;

Emission reductions are calculated as follows.

$$ER_y = ES_y \times \frac{EF_{CO2,y}}{(1 - l_y)}$$

Where:

ER_y	=	Emission reductions in year ***y***, (t CO_2)
ES_y	=	Motor systems energy savings associated with NAMA in year ***y*** (MWh)
$EF_{CO2,y}$	=	Baseline emission factor of the electricity displaced in year y.
l_y		Average annual technical grid losses (transmission and distribution) during year y for the grid serving the locations where the devices are installed, expressed as a fraction.

$$ES_y = \sum_y \left(\frac{1}{1{,}000{,}000} \right) [(W / equip_{b,i} \times N_{b,i} \times Hours_{b,i}) - (W / equip_{NAMA,i} \times N_{NAMA,i,y} \times Hours_{NAMA,i,y})]$$

Where:

$W / equip_{b,i}$	=	Baseline motor system load demand per equipment type ***i*** (Watts)
$W / equip_{NAMA,u,i}$	=	NAMA motor system load demand per equipment type ***i*** (Watts)
$N_{b,i}$	=	Quantity of baseline affected equipment type ***i***
$N_{NAMA,,i,y}$	=	Quantity of NAMA affected equipment of type ***i*** in operation in year ***y***
$Hours_{b,i}$	=	Baseline annual operating hours for operative equipment, of type ***i*** hours and adjusted to represent an annual value.
$Hours_{NAMA,i,y}$	=	NAMA annual operating hours for operative equipment, of type ***i*** hours in year ***y*** adjusted to represent an annual value

NAMA default values for Sewing, Washing, Drying Machines and Compressors

$EF_{CO2,y}$	0.66 (tCO_2e/MWh)[28]
$Hours_{b,i}$	3,300
$Hours_{NAMA,i,y}$	3,300
l_y	0.1

$W / equip_{b,i}$ and $W / equip_{NAMA,i}$ will be determined by the NIE based on expert experience in industrial energy efficiency in Cambodia. Ex ante the following improvements are assumed.

$\Delta\eta_j$[29]	Sewing machines (replacement of motor): 50% (fraction)
	Washing machines (VSD): 5% (fraction)
	Drying machines (VSD): 5% (fraction)
	Compressors (replacement of total motor system): 15% (fraction)

28 Based on CDM PDD Kamchay Hydroelectric BOT Project V15. This emission factor will also be used in the case of electricity (partly) generated by a diesel generator. This is conservative (according to CDM methodology AMS.I-F, emission factor default values for diesel generators vary between 0.8 and 2.4 tCO_2e/MWh (UNFCCC, 2014).

29 Based on the experience of the National Cleaner Production Office, Cambodia.

The default values will be used for the first monitoring period of two years after the start of the NAMA. The NAMA is defined as starting when the first device (either one of the interventions as defined above) is replaced. After two years the first verification will be carried out and default values will be revised for the next monitoring period as follows.

$EF_{CO2,y}$	according to latest value available on UNFCCC CDM website
$Hours_{b,i}$	according to survey carried out by independent verifying entity
$Hours_{NAMA,i,y}$	according to survey carried out by independent verifying entity
l_y	according to the latest version methodology ASM.II-N
$\Delta\eta_j$	according to survey carried out by independent verifying entity

If surveys are used to determine monitoring parameters, they should be conducted following a random sampling approach and the minimum sample size should be:

- Project target population < 300: minimum sampling size 30 or population size (if the latter is smaller than 30);
- Project target population 300-1000: minimum sample size 10% of group size;
- Project target population > 1000: minimum sample size 100.

Since devices will be replaced throughout the year, emission reductions will be calculated on a monthly basis assuming that a device has been installed on the latest day of the month (e.g. if the new equipment is installed on 3 March, emission reductions will only be calculated from 1 April).

Monitoring and Verification

The following information shall be monitored individually by the NIE:

- technical specification of old equipment (efficiency, capacity, technical lifetime, date of installation, annual operating hours, expected remaining lifetime);
- technical specifications of new equipment (efficiency, capacity, estimated annual operating hours, technical lifetime, registration number);
- installation date;
- information on entity receiving the equipment (including company registration, location etc.).

Verification shall consist of:

- checking monitoring and its management system;
- checking all devices or a representative sample thereof, at least once every two years (biennially) to determine if they are still operating; those devices that have been replaced before and independently from the verification survey by an equivalent in-service device can be counted as operating;
- revising default values as explained above.

11.1.3 Lighting Applications

Efficient lighting appliances decrease GHG emissions by reducing energy consumed for lighting. It is assumed that in the absence of the NAMA, the baseline scenario would be the continuation of the current practice and that the volume of electricity consumed is what it would have been in the absence of the NAMA for the lighting appliances that are replaced. The MRV framework is based on the CDM methodology "Small-scale Methodology AMS-II.N: Demand-side energy efficiency activities for installation of energy efficient lighting and/or controls in buildings" (UNFCCC, 2013). Since garment production facilities in Cambodia usually do not have space heating systems, interactive effects are not taken into account in this MRV.

Measuring/Calculating Emission Reductions

Emission reductions are calculated as the net energy savings associated with the reduction in the amount of electricity required for lighting, multiplied by an emission factor for the electricity displaced:

Where:

$$ER_y = ES_y \times \frac{EF_{CO2,y}}{(1-l_y)}$$

ER_y	=	Emission reductions in year ***y***, (tCO_2)
ES_y	=	Lighting energy savings associated with NAMA in year ***y*** (MWh)
$EF_{CO2,y}$	=	Baseline emission factor of the electricity displaced in year y.
l_y		Average annual technical grid losses (transmission and distribution) during year y for the grid serving the locations where the devices are installed, expressed as a fraction. A default value of 0.1 shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable

$$ES_y = \sum_i \left(\frac{1}{1{,}000{,}000} \right) \times [(W / fixture_{b,i} \times N_{b,i} \times Hours_{b.i}) - (W / fixture_{NAMA,i,y} \times N_{NAMA,i,y} \times Hours_{NAMA,i,y})]$$

Where:

$W / fixture_{b,i}$	=	Baseline lighting demand per fixture of type ***i*** (Watts)
$W / fixture_{NAMA,u,i}$	=	NAMA lighting demand per fixture of type ***i*** (Watts)
$N_{b,i}$	=	Quantity of baseline affected fixtures type ***i***
$N_{NAMA,,i,y}$	=	Quantity of NAMA affected fixtures of type ***i*** in operation in year ***y***
$Hours_{b,i}$	=	Baseline annual operating hours for operative lighting fixtures, of type ***i*** hours and adjusted to represent an annual value.

$Hours_{NAMA,i,y}$	=	NAMA annual operating hours for operative lighting fixtures, of type ***i*** hours in year ***y*** adjusted to represent an annual value

NAMA Default Values for Lighting Applications

$EF_{CO2,y}$	0.66 (tCO_2e/MWh) [30]
$Hours_{b,i}$	3300
$Hours_{NAMA,i,y}$	3300
l_y	0.1

$W / fixture_{b,i}$ and $W / fixture_{NAMA,i}$ per fixture (as well as the number of fixtures) will be set when lighting fixtures are replaced by the NIE based on expert experience in industrial energy efficiency in Cambodia.

The default values will be used for the first monitoring period of two years after start of the NAMA. The start of the NAMA is defined when the first device (either one of the interventions as defined above) is replaced. After two years the first verification will be carried out and default values will be revised for the next monitoring period as follows:

$EF_{CO2,y}$	according to latest value available on UNFCCC CDM website
$Hours_{b,i}$	according to survey carried out by independent verifying entity
$Hours_{NAMA,i,y}$	according to survey carried out by independent verifying entity
l_y	according to the latest version methodology ASM.II-N

If surveys are used to determine monitoring parameters they should be conducted following a random sampling approach and the minimum sample size should be:

- Project target population < 300: minimum sampling size 30 or population size (if the latter is smaller than 30);
- Project target population 300-1000: minimum sample size 10% of group size;
- Project target population > 1000: minimum sample size 100.

Since devices will be replaced throughout the year, emission reductions will be calculated on a monthly basis assuming that a device has been installed on the latest day of the month (e.g. if the new equipment is installed on 3 f March, emission reductions will only be calculated from 1 April).

30 Based on CDM PDD Kamchay Hydroelectric BOT Project V15. This emission factor will also be used in the case where electricity is (partly) generated by a diesel generator. This is conservative (according to CDM methodology AMS.I-F, emission factor default values for diesel generators vary between 0.8 and 2.4 tCO_2e/MWh (UNFCCC, 2014).

The following parameters shall be documented by the NIE at time of project implementation:

- number, type and wattage of project fixtures/lamps/ballasts/ballast factors installed under the NAMA, identified by the manufacturer and model numbers and the date of supply for each facility;
- the number and specifications of replaced fixtures/lamps/ballasts;
- data to identify unambiguously the location of the equipment distributed under the NAMA.

Verification shall consist of:

- checking monitoring and its management system;
- checking all devices or a representative sample thereof, at least once every two years (biennially) to determine if they are still operating; those devices that have been replaced prior to and independently from the verification survey by an equivalent in-service device can be counted as operating;
- revising default values as explained above.

11.2 MRV System for Sustainable Development Benefits

In addition to GHG emission reductions, the MRV system for this NAMA will monitor the impacts of the NAMA interventions on the selected sustainable development (SD) indicators.

The selection of the SD indicators was made using the Sustainable Development Evaluation Tool (SD Tool) developed by UNDP (UNDP MDG Carbon, 2014). The SD Tool divides the SD indicators into four different domains: environment; social; growth and development; and economic.

For each of the interventions, the tool requires that an indicator (such as air pollution, biodiversity, health, etc.) be selected, the impact be identified, an explanation of the chosen indicator be added, the effect defined and that it be indicated whether monitoring has been done.

The indicators selected for the NAMA interventions in each of the four SD domains are shown in Table 35.

Table 35. SD Indicators for the NAMA Energy Efficient Interventions

Domain	Indicator	Selected (Yes/No)	Identified impacts	Monitored (Yes/ No)
Environment	Air pollution/quality	Yes	Better air quality, less pollutants	No
	Water pollution/quality	No		No
	Soil pollution/quality	No		No
	Others (Noise/visibility)	No	Reduce the adverse per capita environmental impact on cities in relation to air quality	No
	Biodiversity and Ecosystem balance	No		No

Domain	Indicator	Selected (Yes/No)	Identified impacts	Monitored (Yes/ No)
Social	Health	Yes	Improvement of health conditions	Yes
	Livelihood of poor, poverty alleviation, peace	No		No
	Affordability of electricity	No		No
	Access to sanitation and clean drinking water	No		No
	Food security (access to land and sustainable agriculture)	No		No
	Quality of employment	No		No
	Time savings/time availability due to project	No		No
	No child labour	No		No
Growth and Development	Access to clean and sustainable energy	No		No
	Education	No		No
	Empowerment of women	No		No
	Access to sustainable technology	No		No
	Energy security	Yes	Increase efficiency rate Increase share of renewable energy	No
	Capacity-building	No		No
	Equality (quality of jobs given, job condition for men/women)	No		No
Economic	Income generation/expenditure reduction/balance of payments	Yes	Enhance productivity efficiency, Reduce electricity payment	Yes
	Asset accumulation and investments	Yes	Accumulate new investment	Yes
	Job creation (number of men and women employed)	No	No	No

For the sake of simplicity, only a few indicators are to be monitored. The indicators selected are represented by the following parameters.

Table 36. Monitored SD Parameters for Interventions

	Parameters: Biomass boiler
1	Installation of new equipment
2	Investment in new equipment
	Parameters: energy efficiency equipment (sewing, washing, drying and compressor machines)
1	Installation of new equipment
2	Investment in new equipment
	Parameter: lighting
1	Investment in new equipment

Baseline SD scenario

The baseline values are assumed to be zero, because of no implemented NAMA interventions:

Table 37. Overview: Baseline SD Scenario

		Unit	Baseline	Post-Project
	Parameters: Biomass boiler			
1	Installation of new equipment	No.	0	132
2	Investment in new equipment	US$	0	7,932,000
	Parameters: energy efficiency equipment (sewing, washing, drying and compressor machines)			
1	Installation of new equipment	No.	0	18,376
2	Investment to new equipment	US$	0	10,873,450
	Parameter: lighting			
1	Investment to new equipment	US$	0	8,000,000

Measurement and monitoring, reporting:

The SD benefits achieved due to the NAMA interventions should be measured continuously, and reported by the responsible entity/intervention implementer regularly. Hard copies or soft copies of the reports should be kept at a safe centralized point, and be archived.

Table 38. Monitored SD Parameters

Data/parameter	Installation of new equipment - boiler
Unit	Number of boilers
Description	Installation of new energy efficient boilers
Value	132
Source of data	Intervention implementer´s records
Measurement methods	Counting

Data/parameter	Investment in new equipment - boiler
Unit	US$
Description	Investment in new energy efficient boilers
Value	7,932,000
Source of data	Intervention implementer´s records
Measurement methods	Counting

Data/parameter	Installation of new equipment
Unit	Sewing, washing, drying and compressor machines
Description	Installation of new energy efficient sewing, washing, drying and compressor machines
Value	18,376
Source of data	Intervention implementer´s records
Measurement methods	Counting

Data/parameter	Investment in new equipment
Unit	US$
Description	Investment in new energy efficient sewing, washing, drying and compressor machines
Value	10,873,450
Source of data	Intervention implementer´s records
Measurement methods	Counting

Data/parameter	Investment in new equipment - lighting
Unit	US$
Description	Investment in new energy efficient lighting appliances
Value	8,000,000
Source of data	Intervention implementer´s records
Measurement methods	Counting

Further details on the monitoring frequency and responsibilities can be found in the attached Annex II.

Verification

Verification is the periodic independent evaluation and ex-post determination by a third party of monitored SD and emission reduction parameters as a result of a NAMA intervention.

Verification rules for NAMAs are usually based on the requirements of the NAMA funding agencies, as well as host country requirements. The selected body for third party verification should apply appropriate assessment methodologies and be familiar with local conditions and greenhouse gas emission protocols and standards.

Since the data sources for the monitored SD indicators are the entities responsible for implementing intervention activities in the country, the most suitable verification method is the on-site visit. Depending on the total number of implemented projects and the budgetary funding available, verification may take the form of a representative sample or cover all the projects. When samples are taken, the guidance on sampling in the SD Tool should be followed.

For all MRV activities the NIEs will establish a quality assurance and quality control system to ensure good quality of data taking into account the following principles:

- Relevance: collect data and information required for the establishment of baseline and mainly activity data and information;
- 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;
- Correctness: utilize the most recent data available in a sector;
- Accuracy: reduce errors and uncertainties as far as it is practical and cost-effective;
- Objectivity: avoid biased, prejudiced and partial information;
- Conservativeness: 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;
- Traceability: document all data sources.

11.3 MRV System for Financial Support

The support provided as part of the NAMA will also need to be measured. Support will be provided in many forms: capacity-building, technology transfer and financial. As the bulk of support will come in terms of financing, the financial support should be measured.

Data / Parameter:	$FS_{international}$
Data unit:	US$
Description:	International financial support spent per activity
Measurement procedures (if any):	All finances disbursed need to be tracked as per the standard governmental tracking procedures
Monitoring frequency:	Measured continuously and recorded at least monthly

Data / Parameter:	$FS_{national}$
Data unit:	US$
Description:	National financial support (i.e. subsidies) spent per activity
Measurement procedures (if any):	All finances disbursed need to be tracked as per the standard governmental tracking procedures
Monitoring frequency:	Measured continuously and recorded at least monthly

12 NAMA Implementation Plan

The implementation of the NAMA will be carried out in three main steps. As a first step, the institutional structure for the NAMA needs to be established. In parallel, funding both from international and national sources needs to be secured. Once these first two steps are finalized, implementation of the interventions can start

12.1 Establishing The NAMA Institutional Structure

The institutional structure proposed in Chapter 9 of this document needs to be established as a basis for the interventions. The benefit of the proposed structure is that all players are already established and no new body needs to be created. What needs to be confirmed are the roles each of the stakeholders is to play.

It is suggested to start with a first meeting of the NCCC, which should act as a supervising body for the NAMA. In this first meeting, the distribution of roles (NAMA Coordinating Authority – NCA, NAMA Implementing Entities – NIEs) as well as the distribution of tasks should be confirmed. If fine-tuning is necessary, this should be discussed in the NCCC.

12.2 Securing Donor Support and Domestic Funding

Potential donors that already actively fund NAMAs are the German and UK governments through the NAMA support facility[31], the Global Environmental Facility (GEF)[32] through its executing agencies, the Green Climate Fund (GCF)[33], other EU governments, and Japan through the Japan International Cooperation Agency (JICA).[34]

A secured budget for the domestically funded component always provides a strong signal to potential donors of commitment to NAMA implementation. Therefore, it is essential that the domestic contributions to the interventions are secured within the national budget.

12.3 Capacity-building and NAMA Interventions

Once the institutional structure is in place and funding (both national and international) is substantially secured, the capacity-building programme and investments in energy-efficient equipment can start. This part of the NAMA consists of three phases.

Phase 1 is the set-up phase (first component of the capacity-building programme), which should include the following tasks:

- implementing NAMA related laws, by-laws and guidelines, contractual terms;
- implementing NAMA processes (the technical and financial project cycle);

31 http://www.nama-facility.org/start.html.
32 http://www.thegef.org/gef/.
33 http://news.gcfund.org/.
34 http://www.jica.go.jp/english/index.html.

- preparing NAMA project documentation;
- recruiting and training staff for new vacancies under the NAMA.

Phase 1 will start by the middle of year 1 of NAMA implementation and finish within one year after the start of these activities, i.e. by the middle of year 2 of NAMA implementation

Phase 2 refers to the execution of the generic and stakeholder targeted marketing and awareness- raising strategy (i.e. the second component of the capacity-building programme). Phase 2 will start once Phase 1 is finalized, and will last for two years.

Phase 3 refers to the subsidized investments in energy-efficient technologies. It will start at the same time as Phase 2 and will last for five years.

The following table gives a summary of the implementation timeline.

Table 39. NAMA Implementation Time Line

	Year 1				Year 2				Y3	Y4	Y5	Y6	Y7
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8					
Establishment of NAMA institutional structure													
Securing donor support and domestic funding													
Capacity-building and NAMA interventions													
Phase 1 "Set-up"													
Phase 2 - Marketing/"awareness-raising"													
Phase 3 Investments													

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