Royal Government of Cambodia

Nation Religion King

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Climate Change Action Plan for Industry and Handicraft Sectors 2015-2018

Climate Change Working Group for Manufacturing Industry and Handicraft Sectors, 2015

Preface

The Cambodian industrial sector has achieved remarkable growth over the past decades. Its share to GDP was 12.6% in 1993 and reached the peak to 26.2% in 2006 before it dropped and maintained at 22% in subsequent year. In 2013, its share to GDP started to rise again to an estimated level of 24%. The industrial sector has grown on average at 12.4% per annum over the period of 1998 – 2013 compared to 4.7 % and 8.5% for agriculture and service sectors respectively, making it the fastest growing sector which has been contributing significantly to poverty reduction and job creation.

There are, however, challenges that Cambodia and specifically its industrial sector have to cope with due to impact of climate change. While there is a consensus that the country is ranked the most vulnerable to climate change, its industrial sector has also been contributing greenhouse gases at a growing rate. Indeed if action is properly done, industrialization itself could mitigate greenhouse gases and facilitate adaptation and build country resilience. The challenge is to ensure that industrial development is not adversely affected by climate change and that industrial development takes place without worsening the climate i.e., moving to a low-carbon green economy. This implies that active, and selective industrial policies and actions are needed to ensure that manufacturing industry remains an engine of growth for poverty reduction, equity and employment.

Responding to this formidable challenges, the Climate Change Working Group for Manufacturing Industry and Handicraft Sectors was tasked to develop Climate Change Action Plan (CCAP) as the milestone to support the developments of industrial and handicraft sectors in Cambodia. The Working Group has studied and identified existing national development plan and policies, strategies, intervention measures, financing mechanisms and key stakeholders. The Working Group suggests short-term intervention on improving energy efficiency in large industries and small and medium enterprises. Over the medium term, an emphasis is on greater use of renewable energy and energy diversification, and over the longer term, an emphasis is on more path-breaking technologies for low-carbon production.

The mobilization of funding resources for the implementation of all the actions is critical to successful implementing the Climate Change Action Plan for Ministry of Industry and Handicraft. Thus, I would like to call upon all stakeholders – relevant ministries, UN agencies, development banks, private sector, and civil society – to join hands together to mobilize technical and financial resources for effective intervention in this sector.

I would like to take this opportunity to thank National Committee on Climate Change (NCCC) and the Ministry of Environment for taking the lead in climate change work through technical and financial support from Cambodia Climate Change Alliance program.

Senior Minister

Minister of Ministry of Industry and Handicraft

Cham Prasidh

Acknowledgement

The development of **Climate Change Action Plan (CCAP 2015-2018) for Ministry of Industry and Handicraft** is the result of commitment and political support from the Royal Government of Cambodia. The ministry has established the Climate Change Technical Team of (CCTT) which consists of all key technical departments representative as well as department of planning, finance, and administrative for the preparation of the Climate Change Action Plan for Ministry of Industry and Handicraft. The participation from all key departments enhances the coherence and alignment of the climate change action plan with the existing plans of the ministry and with national priorities.

The Climate Change Technical Team of ministry would like to express deep appreciation for the continuous support from the **H.E. Cham Prasidh, Minister of Ministry of Industry and Handicraft** and from other government ministries, technical departments, development partners and non-governmental organizations for invaluable inputs in preparation of this action plan. The team also wishes to thank to the National Climate Change Committee, chaired by Ministry of Environment for overall coordination and facilitation in this sector in order to address climate change in Cambodia.

Finally, the development of Climate Change Action Plan for the Ministry of Industry and Handicraft was made possible through technical and financial supports from Climate Change Department of Ministry of Environment through Cambodia Climate Change Alliance (CCCA) funded by the European Union (EU), the Swedish International Development Cooperation Agency (Sida) and the United Nations Development Programme (UNDP).

Contents

Abbreviations

CCAP	Climate Change Action Plan
CCCA	Cambodia Climate Change Alliance
CCCO	Cambodian Climate Change Office
CCCSP	Cambodia Climate Change Strategic Plan
CCD	Climate Change Department
CCSP	Climate Change Strategic Plan
CO_2	Carbon Dioxide
EAC	Electricity Authority of Cambodia
EDC	Electricité du Cambodge
EU	European Union
GHG	Greenhouse Gas
MEF	Ministry of Economy and Finance
MoE	Ministry of Environment
MoP	Ministry of Planning
MIH	Ministry of Industry and Handicrafts
MIME	Ministry of Industry Mines and Energy
MME	Ministry of Mines and Energy
M&E	Monitoring and Evaluation
NAPA	National Adaptation Program of Action to Climate Change
NIP	National Implementation Plan on the Environment in the Transport Sector
PIP	Public Investment Plan
PPCR	Preparation of a Strategic Pilot Program for Climate Resilience
SCCSP	Sectoral Climate Change Strategic Plan
SNC	Second National Communication
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

I. Background

The Cambodian industrial sector has been growing dramatically as its share to GDP has increased from 12.6% in 1993 and reached the peak at 26.2% in 2006. Since then it has declined and maintained 22% due to changes in international trade regime and later global economic crisis. In 2013, its share to GDP started to rise again to an estimated level of 24%. In average the industrial sector grew at 12.4% per annum during the last 15 year (1998 – 2013) compared to 4.7 % and 8.5% for agriculture and service sector respectively, thus making it the fastest growing sector (Industrial Development Policy, 2014).

The industrial sector plays a key role in job creation. In 1993, there were only about 5% of people employed in industrial sector compared to around 72% in agriculture sector. According to 2008 National Census, the number of jobs created in the sector has increased to almost 600,000 positions equivalent to 8.6% of total employment, while in 2012, it has increased to 1.4 million positions or 18.6% of the total employment. Cambodia industry is weak as reflected in its narrow base and low level of sophistication that is concentrated in few sectors such as garment, footwear and food processing. Most industries are family-based with lack of entrepreneurship and limited use of technology. Thus they could not compete in international markets. Their key characteristics could be summarized as follows: the share of manufacturing in industry remains small; the pace of modernization is slow; it is an export-oriented sector; it is mostly foreign direct investments in special economic zone; FDI leads industrialization process in the country, and a dual industrial structure exists between local industries and export industries during its early stage of development.

In general, most of Cambodia's enterprises are retails and restaurants. Among 510,000 enterprises, only 70,000 or 14% are manufacturing type. The sector dominated by the food processing and textiles, which are accounted for 45% and 35% respectively. Among large enterprises in the manufacturing sector, around 80% reside in textile, wearing apparel and footwear (TWF). This manufacturing structure is still under development, wearing apparel and textile productions are still low value added and less complex. The production of construction materials, electronics, machineries, engines, and chemical products are still small and import substitution products such as motorcycles, vehicles, plastics, construction materials, and many other products are still at early set up stage.

Export structure 2000-2008 shows that 75.6% are textiles and footwear and 22% are woods/wooden products out of total export. However, between 2009 and 2013 exports of woods and wooden products have increased tremendously by around 30% per annum, while textile and footwear declines to around 58%. Three major products including agriculture products, rubber and transportation vehicles have also largely contributed to export.

In industrial sector, the share of micro enterprises is 97.3%, small and medium enterprises is 2.2% and large enterprises is 0.6%. Amid those, the amount of enterprises absorb around 63.3% of the labour force, 29.3% for micro enterprises and 7.4% for small and medium enterprises. However, in term of production, the share of large enterprises production is up to 76%, while it is 12% for micro and small and medium enterprises respectively. There are weaknesses in this form of structure due to significant reliance on large enterprises. Therefore, the employment condition and economic growth would be negatively affected and it would be challenging for the economy to recover if there is shutdown of one or two of those large enterprises. This type of structure can also easily lose its competiveness in the case of the loss of favourable trade condition or a change in input cost structure as there is no support from small and medium enterprises.

Enterprises in Cambodia by size

	Micro (1-20 staffs)	Small (11 – 50 staffs)	Medium (51 – 100 staffs)	Large (more than 100)
Total amount of enterprises	69851	5861	530	609
Total share	97.3%	1.9%	0.2%	0.6%
Total labor force	162335	28,706	11,949	350,260
Total share	29.3%	5.2%	2.2%	63.3%
Total production (millions dollars)	396	300	94.4	2,500
Total share	12%	9.1%	2.9%	76.0%

Source: (Industrial Development Policy, 2014)

In the fifth legislature, RGC continue promoting further diversification of the industrial base through encouraging investments in new high value added and competitive industries, including assembly of electronics, spare parts manufacture, metrological industry, agro-processing and other manufacturing industries, while also promoting further development of SMEs and handicrafts and expanding industrial development into rural areas. RGC will also focus on the development of extractive industries (CDC, 2014). As per new challenge on industrial development due to climate change, promoting low-carbon industrialization and climate resilient industrial development is obviously a win-win strategy for Cambodia in the long term basis. The strategy will itself improve the ability industry sector to adapt to climate change as well as to mitigate anthropogenic global warming through low carbon industrial development.

Climate change is predicted to have particular economic and social impacts through various channels. As a developing country, Cambodia is expected to be worst affected. These impacts and consequences will require adaptation to climate change as well as actions to mitigate anthropogenic global warming (AGW). It means that active, and selective industrial policy will have to be used to achieve the balancing act of reducing GHG emissions and ensuring that industry (manufacturing in particular) remain an engine of growth and employment. Adaptation and mitigation will have costs and opportunities for industrial development. Generally, the challenge is to ensure that industrial development and the prospects for industrial development are not adversely affected by climate change and that industrial development takes place without worsening AGW — ideally contributing towards moving global production, distribution and consumption towards a low-carbon and eventually de-carbonized economy. Moreover industrialization itself could mitigate climate change and facilitate adaptation through providing the means to accelerate the transfer of employment from agriculture to industry — this could potentially reduce pressures on deforestation and clearing of land for agriculture, two important sources of GHG emissions. According to the national GHG inventory in 2000, land use change and forestry and agriculture contributes to 49% and 44% of GHG emission respectively (Kamal, 2012). Moving to a low-carbon economy will require industrial policy measures towards innovation and technological change that have different outcomes over the short, medium and long-term. Over the short-term the emphasis needs to be on improving energy efficiency, over the medium term to phase in the greater use of renewable energy and energy diversification for

industrial processes, and over the longer term to introduce more path-breaking technologies for low-carbon production (Naudé, 2011).

A. Policy

According to the National Strategic Development Plan 2014-2018, RGC will focus on the following priorities for industrial development policy:

- Formulating industrial development policy based on two key approaches: (1) expansion of industrial base supported by increased attractiveness of Cambodia to investors and investment promotion including modernization of SMEs; and (2) improved connectivity with regional production networks to integrate with and move up the global value chains.
- Preparing science, technology and metrology industry policy with the objective to increase research and development capability of Cambodia in responding to the projected needs of national development in the next higher phase, in particular ensuring consistency with the industrial development policy and agricultural development policy as they evolve.
- Updating the SMEs Development Framework to be consistent with the industrial development policy aimed at enhancing SME's capacity to link with large enterprises and form a cluster while promoting entrepreneurship, productivity, creativity, innovation and specialization through introduction and implementation of a comprehensive package of supporting measures including clustering, enhanced technology transfer, increased access to finance, strengthened technical standards, establishment of business development counselling centres, promotion of "one village one product" movement and improvement of regulatory framework as well as strengthened institutional coordination.
- Aligning private sector development and investment policies with SME and industrial development policy especially by encouraging investment in industrial clusters and industrial parks through promoting the adoption of Law on **Special Economic Zones**, in order to upgrade management, infrastructure and operations in the industrial sector to international standards.
- Promoting industrial corridor development along the main national roads, linking key economic poles in Cambodia and connecting the Cambodian economy with the neighbouring countries in particular through the economic corridor development framework in GMS and ASEAN.
- Further strengthening the development process in extractive industry, especially technical regulation and supervision including risk management, and social and environmental impact management from inception of operations to post operations; and the management of fiscal revenue from this activity through development of policy, strengthening regulatory framework, capacity building, institutional coordination and human resource development.
- Human resource development especially the skill training for industrial sector through enhanced quality of education in all areas and at all levels, especially the reform of tertiary education, technical and vocational training, giving priority to training of engineers, technicians and workers to acquire appropriate skills as demanded by the markets with a pro-active approach using public-private sector partnerships.

B. Situation

Country-by-country approach is likely to be sub-optimal (Naudé, 2011). In the past industrial policy was very much nationally oriented with little cooperation and coordination between countries. Now, however, a transition to a low-carbon economy will require global cooperation and coordination. It has been estimated that in order to limit average global warming to 2 degrees Celsius by 2100, with a 50 per cent probability, that concentrations of CO_2 should be stabilized at 450 ppm (parts per million) by 2030 (IEA, 2009). In 2010, it

was around 389 ppm and rising by 2 ppm per year—growing at around 1.5 per cent annually (IEA, 2009, Prins *et al.,* 2010). The challenge in achieving this reduction in CO_2 seems almost too incredible to achieve. IEA (2009) expects that at current rates, CO_2 emissions would continue to rise from 28.8 Gt (Gigatonnes) in 2007 to 40.2 Gt in 2030. This is estimated to push average global temperatures up by 6 degrees Celsius and result in CO_2 levels of more than 1000 ppm. Currently, and to date since the first industrial revolution, most developing countries are not major GHG emitters. However as far as the future is concerned, the IEA (2009) expects that all of the projected increase in CO_2 emissions between now and 2030 will come from developing countries—mainly China, India and the Middle East. And most of the current industrially-generated stock of carbon in the atmosphere has been caused by advanced economies, where most of the technological capability, know-how, human skills and financial resources reside to mitigate climate change and adapt to its impacts.

The industry sector in the Kingdom of Cambodia has shown a strong growth in the past decade. Among the energy consuming industries, the garment sector can be considered as the driving force, followed by the fabrication of clay bricks for building construction, the rice mills for processing paddy into polished rice, the rubber production and the food sector with a particular emphasis on the fabrication of ice for refrigeration. It is assumed that the industrial energy consumption totals to about 3.04 TWh/year (MIME, 2013) and with its present growth rate of 5.7% in terms of production, it can be expected that the energy consumption will grow steadily at an annual growth rate of 14.7% until 2030. All relevant sectors (garment, rubber production, brick kilns, food processing, ice making and rice mills) have at least 20% energy saving potentials and particularly brick kilns can potentially save up to 70% by changing the technology.

Climate change vulnerability:

Climate change could cost Cambodia, Laos, Thailand and Vietnam $16 billion per year in lost worker productivity, crop production and natural resource assets, plus $18 billion in infrastructure damage because of flooding, storms and extreme heat. The report by the Washington-based World Resources Institute think tank for the USAID Mekong Adaptation and Resilience to Climate Change drew findings from a 2013 USAID analysis that forecasts higher temperatures, more rainfall and sea level rise for the region by 2050. Worker productivity is projected to suffer heavily, costing $8 billion per year in lost work days due to illnesses such as heat rash, fatigue and stroke, particularly among farmers and construction workers. "There are tens of millions of open-air workers likely to experience greater levels of heat stress and heat-related illnesses when temperatures start rising above 40 degrees Celsius," report author John Talberth said in a statement. "So much of the Lower Mekong Basin's economy is based on outdoor labour, worker productivity should be front and centre for any adaptation plans, and fast-tracked." The report suggests preventive actions such as changes to working hours and redirecting spending on urban growth towards greener cities "to make life more hospitable as temperatures rise". The cost of falling crop yields due to storms, rising sea levels, flooding and higher temperatures was projected at $2.5 billion, and $430 million for hydroelectric power production. Most Mekong River tributaries have dams in place or planned, with 71 projects expected to be operational by 2030, the report said, identifying 11 hydropower facilities in locations of projected increases in temperature and potential drought.

The sector is vulnerable to climate change and extreme weather. Current climate trends indicate that the impacts already experienced by the sector from extreme weather events or other climate induced phenomena will increase both in magnitude and frequency, making it an imperative for the sector to adapt. Examples of these impacts on the industry sector include:

- Floods, which can impact the industrial infrastructure as well as operation.

- Typhoons, which can cause damages to the infrastructure, closure of industries and loss of production
- Droughts, which can impact the availability of water for industrial processes (particularly significant to industries such as textile and food processing)
- Saltwater intrusion, which can destroy the supply chain of food or agro industries.

Increasing temperatures, increasing frequency and intensity of droughts, storms and floods, saline intrusion or sea level rise, will each independently, and in some cases in combination, affect Cambodia industrial activities.

Contribution to climate change[1]:

Environmental pollution caused by unmanaged industrial waste and GHG emissions from diverse industries all contribute to climate change. Paper, brick and tile factories, rubber/plastic processing and bio-fuel production all contribute significantly to climate change. According to the CCSP for Manufacturing and Energy, GHG emissions for Cambodia are currently extremely low compared to regional and global averages. According to the Statistical Year Book for Asia and the Pacific 2012, the 2009 total carbon dioxide emissions for Cambodia was about four million tons. Over the same period, energy consumption by sector was highest in residential areas, followed by the transport sector and then the industry sector. Under rapid urbanization (around 4 percent annually), unless addressed through mitigation measures, energy consumption is likely to increase as a result of increased energy intensity arising from expanded residential, industrial and commercial use. Therefore, increasing energy production to boost industrial activities while simultaneously addressing local emission levels by improving energy efficiency in residential, commercial and industrial energy use and improvements in industrial waste management, are essential for sustainable development.

Existing Initiatives:

The former Ministry of Industry Mines and Energy (MIME) focused on preparing a range of policies to respond to climate change, including the sectoral Green Growth Strategic Plan, the Cambodia Sustainable Energy for All Readiness Plan (UNDP/MIME 2013) and the Energy Efficiency Policy, Strategy and Action Plan (MIME/EU). These policies, strategies and action plans will continue to play an important role in developing the industrial sectors while at the same time addressing the mitigation aspect of climate change response through green energy production (renewable energy sources), green industry and energy efficiency generally.

C. Priority issues

Planned Actions to implement the prioritized policies (CDC, 2014):

- Improving the investment environment for both large industries and SMEs, and establishes links and chains between large industries and SMEs.
- Strengthening good governance for SMEs through transparent law enforcement:
    - Continuing to implement programs promoting good governance and law enforcement, strengthening professional ethics, social responsibility, and monitoring mechanisms.
    - Continuing to review regulations and assess the impact on business by the new regulations, to ensure that regulation promotes business within the domain of desirability.

[1] This section addresses the contribution to climate change of the industrial sector only. Climate change caused by conventional fossil-based energy production will need to be the subject of a separate exercise.

    - Continuing to support industry through inter-ministerial facilitation mechanisms and through eliminating overlapped duties.
    - Continuing to promote the Public-Private Forum Mechanism for enhancing the reforms programs and promoting the private sector.
    - Continuing to build the capacity of sub-national institutions and delegate authority to them for a closer access to the clients.
- Promoting competitiveness in the SMEs:
    - Offer business development and supporting services through institutions like Cambodia Industrial Laboratory Centre, National Productivity Centre, Hatching Technology Centre, Industrial Training Centre, Cambodia Standard Centre, National Metrological Centre, etc.
    - Supporting SMEs through imparting technical and business skills to them.
    - Disseminating knowledge through the National Production Movement, Entrepreneurship Movement, Business Potential Movement and the like.
    - Continuing to build institutional capacities in enforcing property rights, promoting research and creativity, and establishing support mechanisms.
- Setting up a financial service system for SMEs:
    - Promote financing options for the SMEs as a part of total finance package aligned with the Industrial Development Strategy, to encourage SMEs becoming a part of the value chain with larger companies.
    - Continuing to implement the national settlement system and promoting financial product development.
    - Continuing to improve the financial environment for attracting private investment and establishing a domestic capital market.
    - Providing technical assistance to build SME's capacities in formulating business plans, developing accounting systems, and generating information necessary to raise finances.
- Enhancing Cambodia's productivity aligned with national, regions, and international standards:
    - Developing Cambodian Standards for products and systems based on the demand in the national, regions, and international markets.
    - Formulating legal documents to enforce Law on Cambodia Standards, enhancing inspections and take up other tasks.
    - Increasing promotional campaigns to raise awareness on standardization, compliance assessment, and technical barriers on trade.
    - Promoting the issuance of Product and System Certificate.
    - Seeking concurrence from international institutions for Cambodia to issue Product and System Certification Unit and building the capacity of the National Recognition Assessment Unit of the Cambodia Standard Institute.
    - Becoming a full member in the International Standard Organization (ISO) and in International Electronic Committee (IEC).
- Creating enterprise clusters for SMEs.
- Improving the effectiveness of metrological development, which is the main basis to support the operation of production chains of industries and handicrafts to obtain finished products complied with the set standards and to ensure the quantity, quality, security and environment through National Center of Metrology:
    - Supporting and promoting the activities of the metrological legalization and metrological science through strengthening the management of the metrological standards, verification of metrological devices, produced items and packed items, calibration, type approval,

testing, analysis to protect the benefits of the suppliers and consumers and ensure the fairness in commercial activities.

- Promoting the activities of metrological registration, issuance of metrological trademark use license, issuance of license for producing and repairing metrological devices to contribute to market expansion and make the Cambodian products more credible.
- Supporting and increasing the promotion of the metrology and its benefits to contribute to promoting the development of all sectors as well as poverty alleviation of Cambodian people.

The Climate Change Strategic Plan (CCSP) for the Manufacturing Industry Sectors provides a strategic framework and sets specific strategic objectives for addressing both adaptation and mitigation aspects of climate change response in the industry and energy sectors. This sectoral Climate Change Action Plan (CCAP) identifies measures that will achieve the strategic objectives set out in the CCSP. It will promote the development of the industrial sectors while yielding benefits for addressing climate change effectively. The CCAP outlines the actions and activities to be implemented during a four-year period (2015-2018).

II. Strategies

Cambodia has developed a number of strategic documents providing guidance to the Industry and Handicraft sectors development in alignment with the sustainable development imperative for the country, including the Climate Change Strategic Plan for Manufacturing Industry and Energy in 2012, the Cambodia Climate Change Strategic Plan (CCCSP) and the National Strategic Development Plan 2014-2018. This guidance was considered in the identification of the four key strategic priorities which will guide the sector's response to climate change intervention strategies which constitute to address the adaptation and mitigation aspects of the sector in the present are:

1. Promoting green industry for climate resilient low carbon production in Cambodia
2. Use of renewable energy and energy diversification including promoting on-site renewable energy captive generation for industrial production processes
3. To introduce more path-breaking technologies for low-carbon production industries
4. Industrial waste management.

Strategic Priority 1: **Promoting green industry for climate resilient low carbon production in Cambodia**

- Develop resource and energy efficiency guidelines for the industry and handicraft sectors
- Training of national expert and industrial personnel on resource and energy efficiency
- Onsite assessment of industries and of SMEs
- Development of best energy efficiency practices for industries and SMEs
- Development green industry supporting policy and green industry award program
- Develop nationally appropriate mitigation actions (NAMAs) in at least three areas
- Establish mapping system for industries with sensitive information including climate risks zone, GHG emission taking into account gender sensitive issue

Strategic priority 2: **Use of renewable energy and energy diversification including promoting on-site renewable energy captive generation for industrial production processes**

- Assess the potential of renewable energy application in industrial sector
- Development compendium of renewable energy technology for the industrial sector
- Promote the renewable energy generation on site and co-generation for industrial sector as well as eco industrial park

Strategic priority 3: **To introduce more path-breaking technologies for low-carbon production industries**

- To develop compendium of low carbon technology for industrial production process
- Disseminate the technology information to relevant partners and industries
- Develop a policy to promote the use path-breaking technologies for low-carbon production industries
- Promote climate change research and technology for industry.

Strategic priority 4: **Industrial waste management**

- Assessment the waste generation from industrial sector
- Promoting the conversion of industrial waste into energy
- Development of strategies for waste management including hazardous waste management
- Develop compendium of technology for waste to energy technology as well as waste management technologies.

Action Plan

A. Summary scope of planning

The Climate Change Action Plan on industry sectors focuses on enhancing the mitigation and adaptation capacity of MIH to cope with issues arising from climate variability and change, such those posed by floods, storms, droughts, rising temperatures and sea level rise. Four key strategic interventions have been identified to the support the move toward a low-carbon economy by improving the existing condition of industrial and planning for the future industrial development. Over the short-term the emphasis needs to be on improving energy efficiency and waste management and on reducing exposure to climate risk, over the medium term to phase in the greater use of renewable energy and energy diversification, and over the longer term to introduce more path-breaking technologies for low-carbon production.

B. Action plan matrix

The MIH and MME have proposed actions to address concerns on climate change issues in the energy and industry sectors, as below:

Table 1: Matrix planning

CCCSP Strategy #	Ministry CCSP Strategy #	Action Number	MIH Actions	Category of action	Responsible department(s)	Preliminary Estimated budget (USD '000)				
						2015	*2016*	*2017*	*2018*	*Total*
1	***1***		**Promoting green industry for climate resilient low carbon production in Cambodia**							
4,5	***1***	*1*	Develop resource and energy efficiency guidelines for the industry and handicraft sectors	*Dedicated*	*DTST and other Dept.*	100	0	0	0	100
4	***1***	*2*	Training of national experts and industrial personnel on resource and energy efficiency	*Dedicated*	*DTST and other Dept.*	200	200	200	200	800
4,5	***1***	*3*	Onsite assessment of industries and of SMEs	*Re-scaling*	*DTST and other Dept.*	250	250	250	250	1000
4,5	***1***	*4*	Development of best energy efficiency practices for industries and SMEs	Dedicated	*DTST and other Dept.*	100	100	0	0	200
4	***1***	*5*	Development green industry policy and green industry award program	*Re-scaling*	*DTST and other Dept.*	100	100	100	100	400
4	***1***	*6*	Develop nationally appropriate mitigation actions (NAMAs) in at least three areas	Dedicated	*GDI, GDSME*	100	100	100	100	400
1,4	***1***	*7*	Establish mapping system for industries to support resilient low carbon industrial development	Dedicated	*GDI, GDSME*	0	300	200	200	700
			Sub Total			850	1050	850	850	3600
4	***2***		**Use of renewable energy and energy diversification including promoting on-site renewable energy captive generation for**							

			industrial production processes							
4,5	***2***	*8*	Assess the potential for renewable energy applications in the industrial sector	*Dedicated*	*DTST and other Dept.*	100	0	0	0	100
4,5	***2***	*9*	Development of a compendium of renewable energy technology for the industrial sector	*Dedicated*	*DTST and other Dept.*	0	100	100	100	300
4	***2***	*10*	Promote the renewable energy generation on site for industrial sector as well as eco industrial park	Modified	*DTST and other Dept.*	0	500	500	500	1500
			Sub Total			100	600	600	600	1900
4	***3***		**To introduce more path-breaking technologies for low-carbon production industries**							
4,5	***3***	*11*	To develop compendium of low carbon technology for industrial production process	*Dedicated*	*DTST and other Dept.*	100	100	50	50	300
4,5	***3***	*12*	Disseminate the technology information to relevant partners and industries	*Dedicated*	*DTST and other Dept.*	100	100	100	100	400
4,5	***3***	*13*	Develop a policy to promote the use path-breaking technologies for low-carbon production industries	*Dedicated*	*DTST and other Dept.*	100	100	100	100	400
			Sub Total			300	300	250	250	1100
4	***4***		**Industrial waste management**							
4,5	***4***	*14*	Assessment the waste generation from industrial sector	Dedicated	*DTST and other Dept.*	500	500	500	500	2000

4	***4***	*15*	Promoting the conversion of industrial waste into energy	Dedicated	*DTST and other Dept.*	300	300	300	300	1200
4	***4***	*16*	Development of strategies for waste management including hazardous waste management	Dedicated	*DTST and other Dept.*	200	200	200	200	800
4	***4***	*17*	Develop compendium of technology for waste to energy technology as well as waste management technologies	Dedicated	*DTST and other Dept.*	100	100	100	100	400
Sub Total						1,100	1,100	1,100	1,00	4,400
Grand Total						2,350	3,050	2,800	2,800	11,000
Ceiling						6,000	7,000	8,000	9,000	30,000

C. Implications for Expenditure in the Ministry

MIME's total domestic budget for 2012 included 20.5 billion riels (approx. US $5.1 million) in recurrent budget and 21.75 billion riels (approx. US $5.5 million) in capital budget (mostly counterpart funding). In addition, US $89 million were disbursed by development partners in support of investment projects under MIME's supervision, with various implementation modalities (MEF, 2012). Of the US $99.6 million public expenditure in 2012, US $13.4 million were identified as directly contributing to the climate change response (MOE, 2014).

The proposed CCAP, if fully funded, would represent approximately 2.7 percent of the total annual public funding for the industry and energy sectors, and a 33 percent increase on the existing level of climate change expenditure in these sectors (based on 2012 figures).

D. Expected benefits from the Implementation of the Action Plan

The expected results of this implementation action plan will have both short to medium term and long-term benefits.

Short to medium term benefits could include:

- Experts in industrial energy efficiency and clean technology available
- Guideline on industrial resource and energy efficiency will be developed plus compendium of best practice on resource and energy efficiency, and clean technology
- In-flow of soft and hard technology transfer from developed countries to Cambodia;
- Improve the energy efficiency in industrial sector which leads to the reduction of energy demand;
- Better competiveness of the industrial sector

- Low carbon development in industrial sector
- GHG emission from industrial sector is reduced around 20% compared to business as usual

Long-term benefits will focus on:

- Economically sound environment, with poverty gradually reducing;
- Productivity and quality of life will be improved, as will standard of living for all;
- Natural resources are preserved for sustainable development;
- Long-term investment will move toward low carbon technology.

III. Management and Financing Mechanism

A. Analysis of existing management and financing mechanisms

There are currently no government-partner technical working groups in the industry sector and MIH is not a pilot ministry for program budgeting. Investment/capital budgets are therefore managed through a project modality. Projects must be aligned with relevant sector strategies, in particular the Climate Change Strategic Plan for the Manufacturing Industry and Energy Sector (MIME, 2012).

The Planning Department is in charge of updating the three-year rolling Public Investment Plan (PIP) annually, for submission to the Ministry of Planning (MoP). The PIP is mostly externally funded through projects, with some counterpart funding from domestic sources. Resource mobilization is done through direct bilateral discussions with development partners. MIME's main financing partners include Japan, China, ADB, World Bank, Germany and the Republic of Korea.

B. Analysis of potential sources and volume of finance for Climate Change actions

The proposed budget of the CCAP for the four-year period is US $11 million, based on a low-growth scenario of climate finance. However, with economic growth, industrialization and increased opportunities for funding of climate mitigation activities, a higher target may be envisaged.

Given the project nature of most of the investments in the industry sectors, the most efficient way to mobilize additional resources would be through engagement of existing donors to the sectors, through advocacy for (i) climate-proofing their investments in line with CCAP priorities (screening for climate relevance, development and adoption of climate-smart technical standards, capacity development including climate considerations, etc.) and (ii) topping-up existing projects with additional funding (climate finance) corresponding to the climate change element of the project. Several of the key donors in these sectors deliver both official development assistance (ODA) and climate finance, and may be able to combine these two sources of financing to climate-proof their own projects.

Alternatively, co-funding may be sought from specialized climate funds (Adaptation Fund, Green Climate Fund, GEF/LDCF, Nordic Development Fund), to cover the climate-proofing of traditional projects, or dedicated climate change projects. UN agencies, such as UNIDO, may be in a position to support resource mobilization for some of the 'soft' activities, and provide technical and capacity development services. Several NGOs are also very active in the renewable and energy efficiency area. Policy and capacity development support, as well as funding for innovative activities, maybe be mobilized through the Cambodia Climate Change Alliance, or the Global Green Growth Institute.

The potential for carbon-credit financing of mitigation initiatives should also be explored, with technical support from the Department of Climate Change, Secretariat for the National Council for Sustainable Development.

C. Entry points for climate change mainstreaming in management and financing mechanisms

Dedicated CCAP actions be included in the annual revision of the PIP with the assistance of the representatives of the planning department in the Climate Change Working Group for Manufacturing Industry and Handicraft Sectors.

At project level, a key action will be to ensure that the screening criteria for any new project development in MIH include an assessment of climate relevance, and if the project is climate relevant, that specific measures are included in the project design to contribute to mitigation or adaptation objectives. Advocacy on this issue will target both technical and planning departments involved in the review and formulation of new projects.

There is currently no significant domestic capital budget (except for counterpart funds) allocated to the industry sector. In the future, when MIH operates with a program-based budget, the financing of CCAP actions will be facilitated.

IV. Monitoring and Evaluation

Monitoring and evaluation (M&E) of the CCAP will be conducted consistently with the national framework for M&E of climate change response established by the CCCSP.

The department of planning in MIH will be responsible for the monitoring, reporting and evaluation process, with technical support from climate change working groups. They will carry out these tasks with support from and in coordination with the National Council for Sustainable Development (NCSD) and MoP.

Progress on the implementation of the CCAP will be reviewed on an annual basis through the framework of the Annual Progress Review established by MIH; a specific chapter reviewing CCAP progress will be included. The CCAP indicator framework will be integrated within the indicator framework of the ministry; relevant indicators for climate change will be also included in the NSDP submission.

A mid-term evaluation will be organized in 2016 and a final evaluation in 2018. The monitoring program and the two evaluations scheduled will assess: the progress in implementing the CCAP and CCSP; their relevance and contribution to addressing climate change impacts on the industry sector; achieving positive impacts foreseen in sectoral plans and the NSDP; effectiveness in terms of mainstreaming climate change within MIH; and integration in planning and monitoring systems of the ministries. The evaluation will also assess the alignment with and contribution to achieving the objectives set in the CCCSP, and will provide recommendations for future adjustment of the policy response. It will be important that evaluations identify lessons learned and, if needed, entry points for improving policies and actions. A precondition for organizing quality evaluations at program (CCAP) and action levels will be that sufficient resources for M&E are budgeted.

Monitoring of the CCAP will be based on the following indicator framework:

Indicator Type	Purpose	Frequency
1. CCAP delivery and mainstreaming	Tracking the progress of fundamental aspects of CCAP implementation, such as fund mobilization	Annual
2. Institutional readiness[2]	Tracking the progress of improving capacities and integration of climate change into sectoral policies and planning	Annual
3. Results	Assessing the results of actions	Annual, or depending on the nature of the action[3].
4. Impact	Assessing the progress towards ultimate climate policy and development objectives	Annual, ad-hoc for indicators that require specific studies (e.g. GHG reduction achieved)

To minimize costs and improve mainstreaming, whenever possible indicators will be based on relevant indicators already being monitored4. Baseline and targets for indicators for CCAP delivery and mainstreaming, and for impact indicators, will be established by the end of 2015 and will be included in the first CCAP progress report. Result indicators will be finalized and respective baselines and targets established as the actions are financed. The indicator framework will be reviewed in 2016 during the mid-term evaluation.

Indicator for CCAP on Industrial sectors

1. CCAP delivery and mainstreaming indicators
1. Funds planned and actually disbursed, compared with the CCAP planning matrix[5] 2. Proportion of CCAP actions funded from national budget, which will indicate the progress in mainstreaming financing into national budgets
2. Institutional readiness indicators
1. Integration of Climate Change into sectoral policy and budgeting of MIH 2. Capacities for climate change mainstreaming 3. Availability and use of data and information
3. Results indicators

[2] These indicators will be using a qualitative assessment based on scorecards.

[3] Given that most actions will require formulation of project proposals to access the funds required for implementation, the indicators identified are preliminary and will be updated to reflect the actual scope of the action. Only indicators related to actions that have been funded for implementation will be monitored.

[4] Additional processing and analysis of existing indicators will often be required to address the climate change aspects; this might include classifying the data according to the vulnerability analysis included in the Draft SNC to the UNFCCC and subsequent vulnerability assessments.

[5] This indicator will be calculated as the ratio of actual funds allocated and the budget foreseen in the planning matrix. For example if by 2016 the total funds actually allocated are 28 M (10 M in 2014, 8 M in 2015, 10 M in 2016) and the total budget is of 35.7 M (11.9 for each year), the indicator will be 78%.

Actions[6]	*Indicators*
1. Develop resource and energy efficiency guideline for the industrial and handicraft sector	- Guidelines on resource and energy efficiency for industrial sector developed and in use.
2. Training of national expert and industrial personnel on resource and energy efficiency.	- Number of experts trained. - Targets for 2018 include: - 100 national experts from provincial departments, NGO, academic institutions get training on resource and energy efficiency and become resource and energy efficiency specialists - 1000 people from industries get training on resource and energy efficiency - 50 expert selected to be energy audit certified to provide support to industries to be energy efficient companies.
3. Onsite assessment of industries and of SMEs	- - Number of industries and SMEs with developed capacity on resource and energy efficiency (ie those with a dedicated resource and energy team, a resource and energy assessment available and with baseline data for resource and energy consumption). - The following targets have been established for 2018: - 1000 industries and SMEs establish resource and energy team - 1000 industries and SMEs conduct resource and energy assessment - 1000 industries and SMEs establish the baseline data of resource and energy consumption
4. Development of best energy efficiency practices for industries and SMEs	Number of energy efficiency best practices developed
5. Development green industry policy and green industry award program	- Green industry for low carbon industrial development policy for Cambodia established - Number of industries with the green industry award
6. Develop nationally appropriate mitigation actions (NAMAs) in at least three areas	- Number of NAMA projects developed - Amount of GHG avoided
7. Establish mapping system for industries to support resilient low carbon industrial development	- Mapping (Inventory of industries in Cambodia) and Geographical Information System developed
8. Assess the potential of renewable energy application in industrial sector	- Assessment of renewable energy potential in Cambodia, including biomass, solar, wind available to be used by industrial sector. - Number of feasibility study of renewable energy installation in industries.

[6] Actions as defined in the Action Fiches.

9. Development compendium of renewable energy technology for the industrial sector	- Compendium of technologies for renewable energy application in industrial sector published.
10. Promote the renewable energy generation on site for industrial sector as well as special economic zone.	- Energy demand assessment available in SEZ with potential of usage of renewable energy for the production processes. - Number of demonstration pilots of onsite renewable energy production for industrial processes
11. To develop compendium of low carbon technology for industrial production process	- Compendium of low carbon technology for different kind of industries published.
12. Disseminate the technology information to relevant partners and industries	- Level of utilization of the web page dedicated to low carbon technology for industrial sector in Cambodia - Brochure and leaflet of low carbon technology developed.
13. Develop a policy to promote the use path-breaking technologies for low-carbon production industries	- Incentive policy for path breaking technologies for low-carbon production industries approved.
14. Assessment the waste generation from industrial sector	- Waste from industries assessment report available - Waste management strategies developed for industrial sector
15. Promoting the conversion of industrial waste into energy	- Feasibility study of conversion waste from industries into energy available. - Number of demonstration of pilots for converting waste into energy in industrial sector.
16. Development of strategies for waste management including hazardous waste management	- Handbook of waste management for industrial sector published - Hazardous waste assessment conducted
17. Develop compendium of technology for waste to energy technology as well as waste management technologies	- Compendium of technologies for converting industrial waste into energy published.
4. Impact	
1. Improve the energy efficiency which can help the company to reduce the energy demand, reduced production cost, improve competiveness.	
2. Reduce the GHG emission	
3. Better energy security for industrial production process	
4. Improved enabling conditions for a resilient and low carbon industrial development (including favourable legal framework, institutional arrangements, human capacity and information available on climate risks, response measures and appropriate technology).	

V. Legal requirement

The establishment of the Climate Change Working Group for Manufacturing Industry and Handicraft Sectors will be formalized, ensuring that its membership is strengthened to include staff from key departments and units (e.g. planning and finance) and that detailed terms of reference for the working group are developed

and approved, including specific references to the coordination function (detailing in particular how the group will coordinate with its counterparts at MME and with the NCSD secretariat). Given the synergies to be had with the work that MME will be undertaking on climate change, the MIH working group will aim to meet regularly (at least twice a year) with their counterparts at MME for efficient coordination, cooperation and implementation of the proposed actions.

VI. Conclusion

The Ministry of Industry and Handicraft has put forth the present Climate Change Action Plan 2015-2018 as a basis for national policy development and implementation on climate change for the manufacturing industry and handicraft sectors. Based on the priority strategies defined above, there are specific strategies which will support the achievement of the national strategic plan's vision, mission and goals for the sector's climate change response. This action plan will help the Cambodia industrial sector to move towards a low-carbon economy through the improvement of energy efficiency, the use of renewable energy and energy diversification, and the use of path-breaking technologies for low-carbon production. The manufacturing industry will increase productivity, effectiveness and competitiveness for competing with other foreign firms and enterprises and will progressively move towards a greener industry and society. These strategies also indicate the importance of triple-dimension approaches to benefit to society, the economy and the environment as a whole.

Annex: Action fiches

MIH ACTION FICHE No 1

Action	Develop resource and energy efficiency guidelines for the industry and handicraft sectors
CCCSP Strategic Objective	*CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development*
Rationale	This action aims to promote the development of green industry for low carbon production in Cambodia. The guideline offers the private sector concrete guidance on the steps to be taken to tap into resource and energy efficiency gains, including which methodologies to use to assess resource and energy efficiency in different types of industries and how to introduce process and technological changes into ongoing operations. The guidelines will also be used as a reference document for the training of trainers on energy efficiency and resource conservation assessment.
Category of climate change action	☑Cat 1 – Re-scaled ☐Cat 2 – Modified ☐Cat 3 – Dedicated
Type of action	☑Mitigation ☐Adaptation ☐Mitigation and adaptation
Short description of the action and expected results and benefits	The development of resource and energy efficiency guidelines for the industry and handicraft sectors will include a review of best practices from the region, and will in particular review the existing Guidelines for the Integration of Cleaner Production and Energy Efficiency from UNEP. The guidelines will consist of a methodology for resource and energy efficiency assessment, tools (worksheet) and some real case studies to demonstrate its applicability to the Cambodia context. They will be published in both Khmer and English. These Guildelines will provide national guidance for energy and resource efficiency assessments in Cambodia and will be used as training material for the training of local experts who will work as national experts on resource and energy efficiency. They will also be used by both industry, academic institutions, consulting companies as a standard methodology for resource and energy efficiency assessment.
Cost effectiveness of the action	This action can be a good guidance toward resource and energy efficiency in the industrial sector. It is reported that the industrial energy consumption totals to about 249.2 GWh in 2009 and with its present growth rate of 5.7% in terms of production. Based on this growth rate, in 2015 the energy consumption by industrial sector is 249.2 GWh x (249.2 GWh x 34.2%) = 334.4264 GWh. It is estimated that industrial energy efficiency can have a potential of energy reduction by 28 % compared with business as usual. With this project projection, the energy saving is projected to be 334.4264 GWh x 28% = 93.639392 GWh/year. With the current energy cost of 0.20 USD/kWh. This action will lead to a saving of 93.639392 GWh/year x 0.2 USD/kWh x 1000000 kWh/GWh = 18,727,878 USD per year.

Preconditions needed for successful implementation	- Commitment of the ministry - Review the existing guidelines or manuals available elsewhere for example India Bureau of Energy Efficiency, National Energy Use Database of Canada, UNIDO, UNEP and APO
Indicator(s) of success	Guideline on resource and energy efficiency for industrial sector established and in use.
Implementation arrangements	*Responsible department(s):* - Department of Technique, Science and Technology and other relevant department
Estimated total cost	$100,000
Possible funding sources	Bilateral donors, UNIDO, JICA, ADB, MEF, adaptation funds, green climate funds and CCCA, APO
Timeframe	*Indicate the start and end year* 2015 – 2016

MIH ACTION FICHE No 2

Action	Training of national expert and industrial personnel on resource and energy efficiency
CCCSP Strategic Objective	*CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development* *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	To be able to tap into energy savings in industry and reduce GHG emissions in this sector, human and institutional capacity needs to be developed. In particular it is key that national experts are available to assist government and industry to make the necessary changes so that the country can progressively move towards a low carbon development. After the guidelines on resource and energy efficiency are established, the training program will be developed to train the relevant ministry staff and industrial personnel to become energy and resource efficiency specialists.
Category of climate change action	☐ Cat 1 – Re-scaled ☑Cat 2 – Modified ☐Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - *Identify the target people to participate in the training program (including staff from MIH and relevant institutions, personnel from priority industries and academia)* - *Develop the training modules for the course* - *Conduct training.*

	The training should be divided into 3 modules with one week for each module. From one module to another should be around 2 months so that the training expert will be allowed to go to the factory to do resource and energy efficiency assessment for the selected factory. Modules to be developed are expected to include the following topics: *The first module:* - *Energy basic* - *Energy Management and Audit* - *Energy and Material Balance* - *Baseline data collection and compilation* - *Energy and resource consumption benchmarking* - *Energy and Resource Assessment instruments* - *Introduction to each sector of industry participating in the training program.* *The second module:* - *Fuel and combustion* - *Boiler and steam system* - *Waste heat recovery* - *Electrical system* - *Motor* - *Compressor* - *Pump* - *Cooling tower* - *HVAC* - *Refrigeration system* - *Lighting system* - *Financial Engineering* - *Reporting* *The third module:* - *Waste management* - *Best practice of resource and energy efficiency* - *Converting waste into energy* - *Case study presentation* - *Energy management system ISO 50001* - *Safety and energy management system ISO 14001, OSHA 18001* *The fourth module: On the job training for industrial energy managers which will include* - *Data collection and analysis to establish the baseline for energy efficiency in industry;* - *Identify options or opportunities to improve resource efficient and cleaner production as well as energy efficiency;* - *Technology identification and evaluation;* - *GHG inventory from their specific industries.* *Expected results and benefits, including number of beneficiaries and type of impact on beneficiaries:*

	- 20% to 30% of energy saved in selected factories (the reduction of GHG emission can be calculated proportionally to the volume of energy saved based on baseline survey) - Different models of energy efficiency for different industries will be developed for further application - 1000 industries and SME are involved in assessments until 2018 - 50 experts will be certified for energy audits of industries.
Cost effectiveness of the action	It is reported that the industrial energy consumption totals to about 249.2 GWh in 2009 and with its present growth rate of 5.7% in terms of production. Based on this growth rate, in 2015 the energy consumption by industrial sector is 249.2 GWh x (249.2 GWh x 34.2%) = 334.4264 GWh. It is estimated that industrial energy efficiency can have a potential of energy reduction by 28 % compared with business as usual. With this project projection, the energy saving is projected to be 334.4264 GWh x 28% = 93.639392 GWh/year. With the current energy cost of 0.20 USD/kWh. This action will lead to a saving of 93.639392 GWh/year x 0.2 USD/kWh x 1000000 kWh/GWh = 18,727,878 USD per year.
Preconditions needed for successful implementation	- The executing agent would be the Department of Technique, Science and Technology in MIH in coordination with UNIDO and/or other development partners - Selected industries need to communicate their data to MIH every year - The action would be implementable with the existing capacities of state institutions, with additional consultancy inputs
Indicator(s) of success	- Technologies and measures for energy saving in selected industries are available and being used - Number of experts trained Targets for 2018 include: - 100 national experts from provincial departments, NGO, academic institutions get training on resource and energy efficiency and become resource and energy efficiency specialists. - 1000 people from industries get training on resource and energy efficiency. - 50 expert selected to be energy audit certified to provide support to industries to be energy efficient companies.
Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH. *Other government and external stakeholders involved in implementation:* - UNIDO - UNDP - APO - Nation Productivity Centre
Estimated total cost	- 800,000 USD
Possible funding sources	*Bilateral donors*: - UNIDO

	- Carbon credit (Nexus). - APO - CCCA II - IEA - GEF
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 3

Action	Onsite assessment of industries and of SMEs
CCCSP Strategic Objective	*CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development*
Rationale	After finishing the module I training, the expert from ministry and those from the factory will have to work together to conduct the onsite assessment of resource and energy efficiency. First of all, they have to establish a team of the factory to collect the baseline data, of energy and resource consumption as per the given methodology. Consultation with supporting expert should be provided to the team to verify if the established data is correct. After the baseline data is established, the team should continue the work on process flowchart development with detail material and energy input and output.
Category of climate change action	☐ Cat 1 – Re-scaled ☑Cat 2 – Modified ☐Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - *Resource and energy efficiency team formation* - *Baseline data establishment* - *Flowchart of the production processes* Expected results: - Resource and Energy Team in each factory established with detail of responsibility and task assignment - Baseline data - Flow chart of the production process with detail of material and energy input and output.
Cost effectiveness of the action	It is reported that the industrial energy consumption totals to about 249.2 GWh in 2009 and with its present growth rate of 5.7% in terms of production. Based on this growth rate, in 2015 the energy consumption by industrial sector is 249.2 GWh x (249.2 GWh x 34.2%) = 334.4264 GWh. It is estimated that industrial energy efficiency can have a potential of energy reduction by 28 % compared with business as usual. With this project projection, the energy saving is projected to be 334.4264 GWh x 28% = 93.639392 GWh/year. With the current energy

	cost of 0.20 USD/kWh. This action will lead to a saving of 93.639392 GWh/year x 0.2 USD/kWh x 1000000 kWh/GWh = 18,727,878 USD per year.
Preconditions needed for successful implementation	- Make sure the training or energy and resource management audit is fully understood. - Methodology is clearly given and understood. - Assignment is clear. - Make sure the training program is clearly organized. - Supporting document are available in both language English and Khmer - Support provide during the on site assessment should be allocated.
Indicator(s) of success	- Number of industries and SMEs that developed capacity on resource and energy efficiency, namely which have a resource and energy team, a resource and energy assessment with baseline data for resource and energy consumption. The following targets have been established for 2018: - 1000 industries and SMEs establish resource and energy team - 1000 industries and SMEs conduct resource and energy assessment - 1000 industries and SMEs establish the baseline data of resource and energy consumption
Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH. With support arrangement from: - UNIDO - UNDP - APO - Nation Productivity Centre
Estimated total cost	- 1,000,000 USD
Possible funding sources	- UNIDO - Carbon credit (Nexus). - APO - CCCA II - IEA - GEF - *Bilateral donor*s
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 4

Action	Development of best energy efficiency practices for industries and SMEs
CCCSP Strategic Objective	*CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development* *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	At the same of resource and energy efficiency training program is going on, the best practice of resource and energy efficiency for industrial sector should be developed to assist the project implementation in the respective industries.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - Development of best practices in three categories: (1) best operational practice of the equipment or machines (2) best available technologies (3) Operational practice for significant equipment such as motor, compressor, pump, generator, transformer, cooling tower, light, AC etc.
Cost effectiveness of the action	It is reported that the industrial energy consumption totals to about 249.2 GWh in 2009 and with its present growth rate of 5.7% in terms of production. Based on this growth rate, in 2015 the energy consumption by industrial sector is 249.2 GWh x (249.2 GWh x 34.2%) = 334.4264 GWh. It is estimated that industrial energy efficiency can have a potential of energy reduction by 28 % compared with business as usual. With this project projection, the energy saving is projected to be 334.4264 GWh x 28% = 93.639392 GWh/year. With the current energy cost of 0.20 USD/kWh. This action will lead to a saving of 93.639392 GWh/year x 0.2 USD/kWh x 1000000 kWh/GWh = 18,727,878 USD per year.
Preconditions needed for successful implementation	- Commitment of the ministry - Review the existing guide line or manual available elsewhere for example India Bureau of Energy Efficiency, National Energy Use Database of Cananda, UNIDO, UNEP and APO
Indicator(s) of success	Number of energy efficiency best practices developed Targeted sectors: - Energy efficiency best practice for garment sector - Energy efficiency best practice for rice mill sector - Energy efficiency best practice for Brick kiln sector - Energy efficiency best practice for rubber sector - Energy efficiency best practice for beverage and brewery sector - Energy efficiency best practice for cement sector - Energy efficiency best practice for ice making sector

Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH. With support arrangement from: - UNIDO - UNDP - APO - Nation Productivity Centre
Estimated total cost	USD 200,000
Possible funding sources	- UNIDO - Carbon credit (Nexus). - APO - CCCA II - IEA - GEF - *Bilateral donor*s
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 5

Action	Development of a green industry policy and green industry award program
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	To support the work of resource and energy efficiency it is necessary to have policy in place as well as incentives to support the activities. The policy will promote resource and energy efficiency activities or to feature it in the law requiring the energy intensive industries to conduct yearly energy or resource efficiency audits. The policy will also promote the path-breaking technologies for low-carbon production industries through tax exemption, or tax holiday.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- Establish a working group for green industry policy establishment with clear scope - Policy and existing incentive scheme gap analysis - With support from experts, the policy is drafted - Internal and external consultation and input - Launch and implement the policy
Cost effectiveness of the action	It is reported that the industrial energy consumption totals to about 249.2 GWh in 2009 and with its present growth rate of 5.7% in terms of

	production. Based on this growth rate, in 2015 the energy consumption by industrial sector is 249.2 GWh x (249.2 GWh x 34.2%) = 334.4264 GWh. It is estimated that industrial energy efficiency can have a potential of energy reduction by 28 % compared with business as usual. With this project projection, the energy saving is projected to be 334.4264 GWh x 28% = 93.639392 GWh/year. With the current energy cost of 0.20 USD/kWh. This action will lead to a saving of 93.639392 GWh/year x 0.2 USD/kWh x 1000000 kWh/GWh = 18,727,878 USD per year.
Preconditions needed for successful implementation	- Technical support from UNIDO who has good experience in green industry policy - Government commitment toward green industry - Timely available budget
Indicator(s) of success	- Green industry for low carbon industrial development policy for Cambodia established - Number of industries with the green industry award
Implementation arrangements	- Department of Technique, Science and Technology in MIH and other relevant department with Support from UNIDO
Estimated total cost	*US*$ 400,000
Possible funding sources	- CCCA funds - UNIDO
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 6

Action	Develop nationally appropriate mitigation actions (NAMAs) in at least three areas
CCCSP Strategic Objective	CCCSP SO4: Promote low carbon planning and technologies to support sustainable development
Rationale	NAMAs emerged from the international climate negotiations under the framework of the UNFCCC. They were first mentioned in the Bali Action Plan of 2007 when they were referred to as "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". NAMAs have inherited central formulations from the founding UNFCCC; these elements (sustainable development, technology transfer, financing and capacity building) help define the obligations of developed and developing countries. It is mandatory for Cambodia as a Party to UNFCCC.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	☑Mitigation ☐Adaptation ☐Mitigation and adaptation

Short description of the action and expected results and benefits	The development of a Nationally Appropriate Mitigation Action is composed of a number of stages. These stages include: 1. Assessment of the technical and political context in a country, 2. The identification and selection of mitigation options 3. Detailed NAMA development, 4. Implementation and monitoring, 5. Reporting and verification (MRV). Benefit and Results: - Capacity building for the development of Nationally Appropriate Mitigation Actions (NAMAs) and their development by Non-Annex I parties to the Convention is one of the key requirements from the negotiation process under the Convention. - Reflect in the country's willingness to emission limitation and economy development in line with its own capabilities and possibilities and in accordance with sustainable development principles - Increase opportunities for financing at the international level and implementation of specific actions important for the country. The - GHG emission reduction related activities - Continuous monitoring and reporting of emission reductions in concrete activities. - Enhance policy making toward sustainable development. Expected results of NAMA development: At least three key and potential areas are selected for NAMA development.
Cost effectiveness of the action	NAMA is always cost effective option because not only it reduces the emission of GHG but it also increases profit margin as well as competitiveness for a business itself. The cost effectiveness will vary from case to case and it will be analysed during the NAMA project development in term of financial, environmental and social benefits. Furthermore, the NAMA will help Cambodia to manage GHG emissions effectively, providing useful information to policy makers on potential areas for low carbon development planning in Cambodia. It will also help Cambodia to attract for climate funding earmarked for mitigation projects, as well as to mobilize support from developed countries in terms of technical assistance and technology transfer.
Preconditions needed for successful implementation	- NAMA development requirement both financial and technical support from development partners and developed countries - Low carbon industrial development policy is necessary for successful NAMA implementation - Data of GHG inventory for industrial sector is helpful for NAMA focus
Indicator(s) of success	- Number of NAMA projects developed - Amount of GHG reduced
Implementation arrangements	GDI with collaboration with MOE and development partners
Estimated total cost	400,000

Possible funding sources	UNDP, UNIDO, ADB, GEF, UNFCCC FM
Timeframe	2016 - 2018

MIH ACTION FICHE No 7

Action	Strengthening information system for industries to support resilient low carbon industrial development
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development
Rationale	To be climate resilient and sustainable industrial development, data on climate risks, GHG emissions and gender related information must be available to policy makers, investors and other relevant stakeholders so they have sound information when preparing investment plans/projects, allowing them to understand for example the implications of opting for certain technologies (e.g. low carbon) or different industrial zone or park locations (e.g. low exposure to climate risks) in the long term. This mapping system is one of the cost effective way to present multiple data layers for the policy maker, investors and other relevant people and to understand the impacts and opportunities related with climate change and environment, combining it with a Decision Support System.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	☐Mitigation ☐Adaptation ☑Mitigation and adaptation
Short description of the action and expected results and benefits	The work need to be coordinated closely with Ministry of Environment and General Secretariat of National council for sustainable development (GSSD) where the climate information is available. Based the available data, the follow actions need to be executed: - Map existing (and projected) industries, including other industry, environmental and climate information (e.g. industrial processes, climate risk data, waste treatment processes, GHG emissions, etc.); - Maintain the information system up-to-date (including operationalization of institutional arrangements) - Collaborate with MoWA to understand how this tool can help mainstream gender equality into the sector. Benefit and Results: - GHG emission reduction - Better planning for new industrial zone - Gender equality awareness - Minimized effect on ecosystem from the industrial development - It is to ensure the climate risk is well informed to the new industrial development plan - Reduce loss and damage due to climate change impacts - Climate change resilient industrial development

Cost effectiveness of the action	The action will ensure the equal sharing of benefit for everyone from industrial development. It will prevent or minimize loss and damage due to climate change impact. The GHG information of existing industries are necessary information to low carbon and long term planning of industrial development. It will also attract support financially and technically from developed country on sustainable industrial development.
Preconditions needed for successful implementation	- Technical support from GSSD on GHG inventory system as well as registry system for data input - Good collaboration and involvement of private sectors - Timely financial support and technical support - Availability of climate data - Involvement of private sector
Indicator(s) of success	- Mapping (Inventory of industries in Cambodia) and Geographical Information System developed
Implementation arrangements	Department of Technique, Science and Technology in MIH, MoE, and other relevant department with Support from UNIDO, CSIRO
Estimated total cost	700,000 USD
Possible funding sources	UNIDO, GEF, UNFCC FM
Timeframe	2016 - 2018

MIH ACTION FICHE No 8

Action	Assess the potential of renewable energy application in industrial sector
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	In Cambodia, there are good potential of renewable energy which can used to produce energy for industrial processes. These renewable energy include biomass, wind, solar. To prove this potential to policy makers and investors as well as industrial owner, it is necessary to have concrete and comprehensive study of available sources of renewable energy with potential usage in the industry for the energy demand mix.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- Get support from experience consultant and institutions to conduct a study of available and potential renewable energy which can be used as captive power generation for the energy demand mix. - Conduct study on potential renewable energy with detail cost effectiveness of the each potential source - Disseminate the findings to relevant peoples and investors

Cost effectiveness of the action	The findings will a good source of reference for investor to have renewable energy for their energy demand mix. It will also a significant study to help policy makers to better plan the low carbon society.
Preconditions needed for successful implementation	- Use a standard methodology for renewable energy assessment - Review the existing study elsewhere for benchmarking - Technical support from experts.
Indicator(s) of success	- Assessment of renewable energy potential in Cambodia, (including biomass, solar, wind) available to be used by industrial sector. - Number of feasibility study of renewable energy installation in industries.
Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH in coordination with development partners and NGOs
Estimated total cost	USD 100,000
Possible funding sources	*If identified, name the proposed source(s) of funding.* *Bilateral donors*: - CCCA funds - Carbon credit (Nexus) - UNEP-IETC - UNIDO
Timeframe	*Indicate the start and end year* 2015 to 2018

MIH ACTION FICHE No 9

Action	Development compendium of renewable energy technology for the industrial sector
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	After the assessment of renewable energy potential for industrial use is done, it is necessary to develop a compendium of technologies that can be used with existing renewable energy potential. The compendium should consist also the standard assessment of the technologies so that the user can make comparison to make final decision.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - Collect all technologies related with renewable energy - Searching for the literature about the technology - Compile all the information about the technologies *Benefits*:

	- Industrial people can make decision on what technology best to them then make investment decision - Save GHG - Operation cost reduction - More competitive
Cost effectiveness of the action	- NA
Preconditions needed for successful implementation	- Consult with UNEP IETC to make use of the existing compendium - Consider for hiring an expert in the field to do the assessment of the technologies - Make the compendium available in Khmer language
Indicator(s) of success	- Compendium of technologies for renewable energy application in industrial sector established both in English and Khmer language published.
Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH in association with the department of energy in MME
Estimated total cost	USD 300,000
Possible funding sources	- CCCA funds - UNEP-IETC - *IEA*
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 10

Action	Promote the renewable energy generation on site for industrial sector as well as special economic zone.
CCCSP and Sector CCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development
Rationale	After the assessment of renewable energy potential is made available for use, as well as the suitable technologies that can convert these renewable energy to thermal or electrical energy for industrial use. It is necessary to pilot one or two kind of renewable energy for thermal and electrical generation onsite for industrial processes to prove the applicability of the technology. The pilot will also work as demonstration for those who wish to see the technology working.
Category of climate change action	☐ Cat 1 – Re-scaled ☑Cat 2 – Modified ☐Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - Energy demand assessment for a give factory or special economic zone to define the size of the technology or energy generation - Financial feasibility analysis of the project - Request for EIA if needed

	- Request for any incentive for example tax exemption for importing components or technology. *Expected results and benefits:* - Report of energy demand for a given site - Feasibility report in term of technic, finance and environment. - EIA report - List of component of the technology to be ta exemption.
Cost effectiveness of the action	**Power Plant Type** / **Cost (US$/kWh)** Coal: $0.10-0.14 Natural Gas: $0.07-0.13 Nuclear: $0.10 Wind: $0.08-0.20 Solar PV: $0.13 Solar Thermal: $0.24 Geothermal: $0.05 Biomass: $0.10 Hydro: $0.08 *Adapted from US DOE*[2]
Preconditions needed for successful implementation	- Make sure the study of renewable energy potential is available - Compendium of renewable energy technologies are available. - List of potential technology suppliers. - Coordinate with relevant government agency for EIA. - Collaborate with CDC for tax exemption list.
Indicator(s) of success	- Energy demand assessment available in SEZ with potential of usage of renewable energy for the production processes. - Demonstrated Number of demonstration pilots onsite renewable energy production for industrial processes
Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH in association with department of energy in MME
Estimated total cost	*USD 1,500,000*
Possible funding sources	- UNIDO - Carbon credit (Nexus). - APO - CCCA II - IEA - GEF - ADB - Simplon Cambodia
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 11

Action	*To develop compendium of low carbon technology for industrial production process*
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	Currently there plenty available low carbon technologies in the market for industrial production processes compared with business as usual. However, those information are scattered around which can be a challenge for investor or industries to look when needed. Collection and compilation of all those technologies is very important step toward the adoption of those technologies in the industrial production processes or new industries investment. The compendium of such technologies should be include the cost effectiveness or comparison with the existing technologies of business as usual ones.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - Collect all technologies related with low carbon - Searching for the literature about the technology for different sector for example rice milling, food process, rubber processing, garment and footwear, ice factory, brick kiln, heavy industrial to be developed in Cambodia etc. - Compile all the information about the technologies *Benefits*: - Industrial people can make decision on what technology best to them then make investment decision - Save GHG - Operation cost reduction - More competitive
Cost effectiveness of the action	- NA
Preconditions needed for successful implementation	- Consult with UNEP IETC to make use of the existing compendium - Consider for hiring an expert in the field to do the assessment of the technologies - Make the compendium available in Khmer language - Consult also with UNIDO about the existing compendium
Indicator(s) of success	- Compendium of technologies for renewable energy application in industrial sector published both in English and Khmer language.
Implementation arrangements	*Responsible department(s)* - Department of Technique, Science and Technology in MIH in association with the department of energy in MME

Estimated total cost	USD 300,000
Possible funding sources	- CCCA funds - UNEP-IETC - *IEA*
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 12

Action	*Disseminate the technology information to relevant partners and industries*
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	After compendium of path-breaking technologies for low-carbon production in the industrial sector is established, it is necessary to disseminate the technologies to relevant partners and investors. The dissemination can be done through a workshop, direct sending to potential investors, Cambodia embassy abroad to attract more investors, TV program or website.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	*Short description* - List of technologies - Feasibility analysis - Material preparation for different way of dissemination for example workshops, investor meeting etc. - Develop a strategy for outreach - Implement the dissemination program *Expected results and benefits:* - Investors informed and making the right choices as to adoption of low carbon technologies - Making Cambodia industry a low carbon based one. - Guide the investor or industrial people to the right place toward sustainable development.
Cost effectiveness of the action	NA
Preconditions needed for successful implementation	- Review the existing document and make it available in local context - Assess the need of technology locally - Provide the right technology at the right time and places
Indicator(s) of success	- Level of utilization of the web page dedicated to low carbon technology for industrial sector in Cambodia - Brochure and leaflet of low carbon technology developed.
Implementation arrangements	*Responsible department(s)*

	- Department of Technique, Science and Technology in MIH in coordination with development partners
Estimated total cost	- USD 400,000
Possible funding sources	- UNIDO - Carbon credit (Nexus). - APO - CCCA II - IEA - GEF - ADB
Timeframe	2015 - 2018

MIH ACTION FICHE No 13

Action	Develop a policy to promote the use path-breaking technologies for low-carbon production industries
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	To support the low carbon development for industrial sector as well as to ensure its sustainable moving, it is necessary to have policy in place to support the activities. The policy should promote the activities or to feature it in the law requiring the energy intensive industries to use low carbon technology from the beginning when coming to invest in Cambodia. The policy should promote the path-breaking technologies for low-carbon production industries through tax exemption, or tax holiday etc.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- An integrated framework to support the greening of industries - Creating an enabling environment - Supporting industry-led initiatives - Harnessing environmental technologies - Instrument mixes to promote the greening of industries - Committee to evaluate low carbon technology - Involve the bank to finance the low carbon technologies
Cost effectiveness of the action	*NA*
Preconditions needed for successful implementation	- Since UNIDO is very specialized in establish green industry policy, it is recommended to approach this organization to development one for Cambodia. - Review the existing policy - To define policy gap

Indicator(s) of success	- Incentive policy for path breaking technologies for low-carbon production industries approved.
Implementation arrangements	- Department of Technique, Science and Technology in MIH and other relevant department with Support from UNIDO.
Estimated total cost	*US*$ 400,000
Possible funding sources	- CCCA funds - UNIDO
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 14

Action	Assessment the waste generation from industrial sector
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development *CCCSP SO5*: Improve capacities, knowledge and awareness for climate change responses
Rationale	Waste is a common source of methane generation which is one the potential greenhouse gases. Organic waste from industries should assessed and properly document so that we can understand how to avoid and at the end treat it properly with possibility of harnessing energy from it at the same time. The potential waste generator includes starch processing, rubber processing, food manufacturing, soft drink and brewery industry, vegetable and fruit markets, animal feed processing etc.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- Establish a methodology for waste assessment from industrial sector - Establish a team to conduct the assessment - Establish the data based for waste generation and characterisation - Mobile laboratory or collaborate with national laboratory to analyse the waste. Benefit and Results: - Well understand the waste generation source and characteristic - Waste minimization and avoiding before treatment - When wastes are managed, GHG can be avoided - Maximize the use of waste for energy or other purpose for example fertiliser or other by product.
Cost effectiveness of the action	*NA*

Preconditions needed for successful implementation	- Consulting with other agencies about the available waste assessment methodology to be benchmark for developing one for use in Cambodia. - Good collaboration with industries. - Establish Prakash for industrial waste assessment and reporting - Collaborate with Ministry of Environment to work on this issue.
Indicator(s) of success	- Waste from industries assessment report available. - Waste management strategies developed for industrial sector
Implementation arrangements	- Department of Technique, Science and Technology in MIH, MoE, and other relevant department with Support from UNIDO
Estimated total cost	*US*$ 2,000,000
Possible funding sources	- CCCA funds - UNIDO - GEF - UNEP - Other bilateral partners
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 15

Action	Promoting the conversion of industrial waste into energy
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development
Rationale	After the waste generation is quantified and characterised, it is important to propose the action to management it. It always is a win win strategy to manage waste by converting it into useful energy such as electrical energy and thermal one. Currently, the methodology for waste minimization is available in place to reduce the waste generation before treating it. Unavoidable waste should be converted into energy for use. For example in the tapioca starch production processes generate plenty amount of waste water containing enough nutrient to convert into biogas for electricity generation and thermal application drying the starch.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- Establish a methodology for waste quantification and characterization. - Establishing a reporting system for industrial to do so - Do the cross check frequently so that the report data is consistent and usable. - Laboratory for waste characterisation - Establish a team to conduct the assessment

	- Establish the data based for waste generation and characterisation - Mobile laboratory or collaborate with national laboratory to analyse the waste. Benefit and Results: - GHG emission avoidance - When wastes are managed, GHG can be avoided - Maximize the use of waste for energy or other purpose for example fertiliser or other by product. - Energy independent or security
Cost effectiveness of the action	*NA (only possible after the waste assessment is done)*
Preconditions needed for successful implementation	- Consulting with other agencies about the available waste assessment methodology to be benchmark for developing one for use in Cambodia. - Good collaboration with industries. - Establish Prakash for industrial waste assessment and reporting - Collaborate with Ministry of Environment to work on this issue.
Indicator(s) of success	- Feasibility study of conversion waste from industries into energy available. - Number of demonstration pilots for converting waste into energy in industrial sector.
Implementation arrangements	- Department of Technique, Science and Technology in MIH, MoE, and other relevant department with Support from UNIDO
Estimated total cost	*US*$ 1,200,000
Possible funding sources	- CCCA funds - UNIDO - GEF - UNEP - Other bilateral partners
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 16

Action	Development of strategies for waste management including hazardous waste management
CCCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development
Rationale	At the same of waste assessment and characterisation, it can be used as a based information for managing the waste. It is very crucial if it can be developed into national policy for industrial waste management and use of waste for energy generation for onsite. When waste is managed, GHG can be avoided, waste turns into resource for the

	factory, at the same time. Waste is no longer a problem for industry but an opportunity.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- Study on related policy on industrial waste management in Cambodia as well elsewhere. - Policy gap analysis - Draft the policy and consult the policy with relevant organisations nationally and internationally. Benefit and Results: - Clear road map for waste management from the beginning for industrial sector as well as development partners - Industrial waste is well managed - Industrial waste is avoided to pollute the environment as well as GHG generation - GHG emission is avoided.
Cost effectiveness of the action	*NA*
Preconditions needed for successful implementation	- Learn the experience from developed country on industrial waste management - Request for technical support from developed countries that are specialized in industrial waste management.
Indicator(s) of success	- Handbook of waste management for industrial sector published - Hazardous waste assessment conducted.
Implementation arrangements	- Department of Technique, Science and Technology in MIH, MoE, and other relevant department with Support from UNIDO
Estimated total cost	*US*$ 800,000
Possible funding sources	- CCCA funds - UNIDO - GEF - UNEP - Other bilateral partners
Timeframe	*Indicate the start and end year* - 2015 to 2018

MIH ACTION FICHE No 17

Action	Develop compendium of technology for waste to energy technology as well as waste management technologies
CCCSP and Sector CCSP Strategic Objective	*CCCSP SO4*: Promote low carbon planning and technologies to support sustainable development
Rationale	To facilitate the policy implementation as well as to promote the waste management in the industries, it is necessary to establish the

	compendium of technologies that can be used to convert waste into energy in place where the end user, policy maker, academic institutions can refer to with dealing with a defined waste. The compendium should have upto date list of technologies with advantage and disadvantage analysis in term of technical, environmental and social impact.
Category of climate change action	☐ Cat 1 – Re-scaled ☐Cat 2 – Modified ☑Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	- Collect and compile all relevant technologies - Apply standard technology assessment method to assess the technologies - Establish a compendium with detail information of supplier and condition of supply etc. Benefit and Results: - Good reference for those who work in the area of waste management - Industries people can use the compendium for decision making to manage their waste properly with latest technologies.
Cost effectiveness of the action	*NA*
Preconditions needed for successful implementation	- Consult with agencies who already work in the field so that it can be spare some support if any for doing the work. - Review the existing in other developed country as part of technology transfer - Involve international expert who can support the development of the compendium
Indicator(s) of success	- Compendium of technologies for converting industrial waste into energy published
Implementation arrangements	- Department of Technique, Science and Technology in MIH, MoE, and other relevant department with Support from UNIDO, UNEP etc.
Estimated total cost	*US*$ 400,000
Possible funding sources	- CCCA funds - UNIDO - GEF - UNEP - Other bilateral partners
Timeframe	*Indicate the start and end year* - 2015 to 2018

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