

**KINGDOM OF CAMBODIA
NATION RELIGION KING**



MINISTRY OF INDUSTRY AND HANDICRAFT

**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, Senior 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

Preface	1
Acknowledgement	2
Abbreviations	4
I. Background	5
A. Policy	7
B. Situation	7
C. Priority issues	9
II. Strategies	11
III. Action Plan	12
A. Summary scope of planning	12
B. Action plan matrix	13
C. Implications for Expenditure in the Ministry	15
D. Expected benefits from the Implementation of the Action Plan	15
IV. Management and Financing Mechanism	16
A. Analysis of existing management and financing mechanisms	16
B. Analysis of potential sources and volume of finance for Climate Change actions	16
C. Entry points for climate change mainstreaming in management and financing mechanisms	17
V. Monitoring and Evaluation	17
VI. Legal requirement	20
VII. Conclusion	21
Annex: Action fiches	22
References	45

Abbreviations

CCAP	Climate Change Action Plan
CCCA	Cambodia Climate Change Alliance
CCCCO	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 (Table 1). 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 competitiveness 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.

Table 1: Enterprises in Cambodia by size

	Micro (1-20 staff)	Small (11 – 50 staff)	Medium (51 – 100 staff)	Large (over 100 staff)
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. 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 global warming — 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 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 (NSDP) 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 skills 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 CO₂ 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 CO₂ seems almost too incredible to achieve. IEA (2009) expects that at current rates, CO₂ 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 CO₂ 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 CO₂ 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 change¹:

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 and the Cambodia Sustainable Energy for All Readiness Plan (UNDP/MIME 2013), and on developing the Energy Efficiency Policy, Strategy and Action Plan. These efforts will continue to play an important role in the development of the industry and handicraft sectors, while at the same time addressing key climate change mitigation issues through green energy production (renewable energy sources), and green industry and energy efficiency in general.

C. Priority issues

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

- 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.
 - Continuing to support industry through inter-ministerial facilitation mechanisms and through eliminating overlapped duties.

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 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 and Energy Sectors (MIME 2012) 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.

The present Climate Change Action Plan (CCAP) for the Industry and Handicraft Sectors identifies priority issues and interventions that will contribute to the achievement of the strategic objectives set out in the sectoral CCSP, aiming to promote the development of the industrial sectors while yielding benefits for addressing climate change more effectively. The CCAP outlines the actions and activities to be implemented during the first four-year period (2015-2018) of the Cambodia Climate Change Strategic Plan (CCCSP) 2014-2023.

II. Strategies

As mentioned, the Royal Government of 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 (CCSP) for Manufacturing Industry and Energy Sectors in 2012, the Cambodia Climate Change Strategic Plan 2014-2023, and the National Strategic Development Plan 2014-2018. This guidance was considered in the identification of the four strategic priorities which guided the formulation of the sector's response to climate change for the next four year period, namely:

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.

The following key actions were identified to address the four strategic priorities:

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

- Development of resource and energy efficiency guidelines for the industry and handicraft sectors
- Training of national experts and industrial personnel on resource and energy efficiency
- Resource and energy efficiency assessment of industries and SMEs
- Development of best resource and energy efficiency practices for industries and SMEs
- Development of a green industry policy and green industry award program

- Development of Nationally Appropriate Mitigation Actions (NAMAs)
- Establishment of an information system to support resilient low carbon industrial development

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

- Assessment of the potential of renewable energy applications in the industrial sector
- Development of a compendium of renewable energy technology for the industrial sector
- Promotion of renewable energy generation on site and co-generation for industrial sector as well as special economic zone

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

- Development of a compendium of low carbon technology for industrial production processes
- Dissemination of information on low carbon technologies relevant to industries and partners
- Development of a policy to promote the use path-breaking technologies for low-carbon production industries

Strategic priority 4: Industrial waste management

- Assessment of waste generation by the industrial sector
- Pilot and document strategies for converting industrial waste into energy
- Promotion of waste management strategies, including hazardous waste management
- Development of a compendium of waste management for the manufacturing and handicraft sector, including waste to energy technology

III. 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, in close collaboration with MME, has proposed actions to address concerns on climate change issues in the manufacturing industry and handicraft sectors, which are summarized in the Planning Matrix, in Table 2 below.

Table 2: Matrix planning

CCCSP Strategy #	MIH Strategic Priority #	Action Number	MIH Actions	Responsible department(s)	Preliminary Estimated budget (USD '000)				
					2015	2016	2017	2018	Total
1									
PROMOTING GREEN INDUSTRY FOR CLIMATE RESILIENT LOW CARBON PRODUCTION IN CAMBODIA									
4, 5	1	1	Development of resource and energy efficiency guidelines for the industry and handicraft sectors	<i>DTST and other Dept.</i>	100	0	0	0	100
4	1	2	Training of national experts and industrial personnel on resource and energy efficiency	<i>DTST and other Dept.</i>	200	200	200	200	800
4, 5	1	3	Resource and energy efficiency assessment of industries and SMEs	<i>DTST and other Dept.</i>	250	250	250	250	1000
4, 5	1	4	Development of best resource and energy efficiency practices for industries and SMEs	<i>DTST and other Dept.</i>	100	100	0	0	200
4	1	5	Development of a green industry policy and green industry award program	<i>DTST and other Dept.</i>	100	100	100	100	400
4	1	6	Development of Nationally Appropriate Mitigation Actions (NAMAs)	<i>GDI, GDSME</i>	100	100	100	100	400
1, 4	1	7	Establishment of an information system to support resilient low carbon industrial development	<i>GDI, GDSME</i>	0	300	200	200	700
Sub Total					850	1050	850	850	3600

2 USE OF RENEWABLE ENERGY AND ENERGY DIVERSIFICATION INCLUDING PROMOTING ON-SITE RENEWABLE ENERGY CAPTIVE GENERATION FOR INDUSTRIAL PRODUCTION PROCESSES									
4, 5	2	8	Assessment of the potential of renewable energy applications in the industrial sector	<i>DTST and other Dept.</i>	100	0	0	0	100
4, 5	2	9	Development of a compendium of renewable energy technology for the industrial sector	<i>DTST and other Dept.</i>	0	100	100	100	300
4	2	10	Promotion of renewable energy generation on site and co-generation for industrial sector as well as special economic zone	<i>DTST and other Dept.</i>	0	500	500	500	1500
			Sub Total		100	600	600	600	1900
3 TO INTRODUCE MORE PATH-BREAKING TECHNOLOGIES FOR LOW-CARBON PRODUCTION INDUSTRIES									
4, 5	3	11	Development of a compendium of low carbon technology for industrial production processes	<i>DTST and other Dept.</i>	100	100	50	50	300
4, 5	3	12	Dissemination of information on low carbon technologies relevant to industries and partners	<i>DTST and other Dept.</i>	100	100	100	100	400
4, 5	3	13	Development of a policy to promote the use path-breaking technologies for low-carbon production industries	<i>DTST and other Dept.</i>	100	100	100	100	400
			Sub Total		300	300	250	250	1100
4 INDUSTRIAL WASTE MANAGEMENT									
4, 5	4	14	Assessment of waste generation by the industrial sector	<i>DTST and other Dept.</i>	500	500	500	500	2000
4	4	15	Pilot and document strategies for converting industrial waste into energy	<i>DTST and other Dept.</i>	300	300	300	300	1200

4	4	16	Promotion of waste management strategies, including hazardous waste management	<i>DTST and other Dept.</i>	200	200	200	200	800
4	4	17	Development of a compendium of waste management for the manufacturing and handicraft sector, including waste to energy technology	<i>DTST and other Dept.</i>	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

These actions are described in the technical Action Fiches in annex, and will be further detailed and adjusted as required during the implementation of the Action Plan.

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 competitiveness 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.

IV. 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 Sectors (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 will be included in the annual revision of the PIP with the assistance of the representatives of the planning department part of 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, as well as those involved in the permitting (authorization) process for the construction and operation of industry and handicrafts activities. The Climate Change Working Group will explore ways in which climate change considerations can be made part of the permitting process.

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.

V. 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 the Climate Change Working Group. They will carry out these tasks with support from and in coordination with the National Council for Sustainable Development (NCSD) and its Secretariat (GSSD) and with 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.

An evaluation of the implementation of MIH's 2015-2018 CCAP will be conducted in mid-2018 so that it can assist in the formulation of MIH climate response for the following period. The monitoring and evaluation program will assess: the progress in implementing the CCAP and CCSP; their relevance and contribution to

addressing climate change impacts on the industry sector; the degree of achievement of the 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 the achievement the objectives set in the CCCSP, and will provide recommendations for future adjustment of 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 are budgeted for M&E activities.

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 to ensure that it is aligned with the National M&E Framework for Climate Change.

Indicators for CCAP for Manufacturing and Handicraft Sectors

1. CCAP delivery and mainstreaming 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.

<ol style="list-style-type: none"> 1. Funds planned and actually disbursed, compared with the CCAP planning matrix⁵ 2. Proportion of CCAP actions funded from national budget, which will indicate the progress in mainstreaming financing into national budgets 	
2. Institutional readiness indicators	
<ol style="list-style-type: none"> 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	
<i>Actions⁶</i>	<i>Indicators</i>
1. Development of resource and energy efficiency guidelines for the industrial and handicraft sector	- Guidelines on resource and energy efficiency for industrial sector developed and in use.
2. Training of national experts and industrial personnel on resource and energy efficiency.	- Number of experts trained.
3. Resource and energy efficiency assessment of industries and SMEs	- Number of onsite resource and energy efficiency assessments conducted (targeting at least 1000 industries by 2018) - Number of industries which have adopted resource and energy efficiency measures identified during the assessment
4. Development of best resource and energy efficiency practices for industries and SMEs	- Number of energy efficiency best practices documented and shared
5. Development of a green industry policy and green industry award program	- Green industry policy for Cambodia established - Number of industries with a green industry award
6. Development of Nationally Appropriate Mitigation Actions (NAMAs)	- Number of NAMA projects developed - Total of GHG emissions reduction expected from developed NAMAs
7. Establishment of an information system to support resilient low carbon industrial development	- Mapping (Inventory of industries in Cambodia) conducted and Geographical Information System developed and in use
8. Assessment of the potential of renewable energy applications in the 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
9. Development of a compendium of renewable energy technology for the industrial sector	- Compendium of technologies for renewable energy application in the industrial sector available both in English and Khmer language

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%.

⁶ Actions as defined in the Action Fiches.

10. Promotion of renewable energy generation on site for industrial sector as well as special economic zone.	<ul style="list-style-type: none"> - 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 processes	<ul style="list-style-type: none"> - Compendium of low carbon technologies for the industrial sector published both in English and Khmer language
12. Dissemination of information on low carbon technologies relevant to industries and partners	<ul style="list-style-type: none"> - Level of utilization of the web page dedicated to low carbon technology for industrial sector in Cambodia - Brochure and leaflet on low carbon technology developed
13. Development of a policy to promote the use path-breaking technologies for low-carbon production industries	<ul style="list-style-type: none"> - Incentive policy for path breaking technologies for low-carbon production industries approved
14. Assessment of waste generation by the industrial sector	<ul style="list-style-type: none"> - Number of industries with waste assessment/waste management reports available - Waste management strategies developed for industrial sector
15. Pilot and document strategies for converting industrial waste into energy	<ul style="list-style-type: none"> - Number of demonstration of pilots for converting waste into energy in industrial sector
16. Promotion of waste management strategies, including hazardous waste management	<ul style="list-style-type: none"> - Policy on industrial waste management developed
17. Development of a compendium of waste management for the manufacturing and handicraft sector, including waste to energy technology	<ul style="list-style-type: none"> - Compendium (handbook) on waste management for the manufacturing and handicraft sectors published
4. Impact	
1. Improved energy efficiency which can help the company to reduce the energy demand, reduced production cost, improve competitiveness	
2. Reduced the GHG emission	
3. Increased 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)	

VI. 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 NCSecretariat). 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.

VII. 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	Development of resource and energy efficiency guidelines for the industry and handicraft sectors
CCCSP Strategic Objective	<i>CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development</i>
Rationale	This action aims to promote the development of green industry for low carbon production in Cambodia. The guidelines offer 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 technology 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	<input checked="" type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input type="checkbox"/> Cat 3 – Dedicated
Type of action	<input checked="" type="checkbox"/> Mitigation <input type="checkbox"/> Adaptation <input type="checkbox"/> Mitigation and adaptation
Short description of the action and expected results and benefits	<p>The development of resource and energy efficiency guidelines for the industry and handicraft sectors will include a review of best practices from the region, as well as an in-depth review the existing Guidelines for the Integration of Cleaner Production and Energy Efficiency from UNEP. The guidelines will consist of a methodology and tools (e.g. worksheet) for resource and energy efficiency assessment, and some real case studies to demonstrate its applicability to the Cambodia context. The guidelines will be published in both Khmer and English.</p> <p>These guidelines 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 (described in Action Fiche 2) who will work as national experts on resource and energy efficiency. They will also be used by industry, academic institutions, and consulting companies as a standard methodology for resource and energy efficiency assessment.</p>
Cost effectiveness of the action	<p>This action can be a good guidance toward resource and energy efficiency in the industrial sector.</p> <p>It is reported that the industrial energy consumption in 2012 was 564.14 GWh. It is estimated that the adoption of energy efficiency measures in the industrial sector could result in energy savings of approximately 28%, when compared with business as usual practices. This would mean that, if energy efficiency measures were in place in 2012, the industry sector could have saved 157.96GWh that year. Assuming an average energy cost for industry of 0.195 USD/kWh, this would have meant that in 2012 industry could have had overall savings of approximately 30 Million USD.</p>

Preconditions needed for successful implementation	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Guidelines on resource and energy efficiency for the industrial sector developed and in use
Implementation arrangements	<i>Responsible department(s):</i> <ul style="list-style-type: none"> - Department of Technique, Science and Technology and other relevant department
Estimated total cost	<ul style="list-style-type: none"> - 100,000 USD
Possible funding sources	<ul style="list-style-type: none"> - Bilateral donors, UNIDO, JICA, ADB, MEF, adaptation funds, green climate funds and CCCA, APO
Timeframe	<ul style="list-style-type: none"> - 2015 – 2016

MIH ACTION FICHE No 2

Action	Training of national experts and industrial personnel on resource and energy efficiency
CCCSP Strategic Objective	<p><i>CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development</i></p> <p><i>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</i></p>
Rationale	<p>To be able to tap into energy savings in industry and reduce GHG emissions in this sector, human and institutional capacities need to be developed. In particular it is key that there is a pool of national experts available to assist both government and industry to make the necessary changes so that the country can progressively move towards a low carbon development.</p> <p>After the guidelines on resource and energy efficiency are produced, the training program will be developed to train the relevant ministry staff, industry personnel and other potential experts on the application of the guidelines.</p>
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input checked="" type="checkbox"/> Cat 2 – Modified <input type="checkbox"/> Cat 3 – Dedicated
Type of action	<input checked="" type="checkbox"/> Mitigation <input type="checkbox"/> Adaptation <input type="checkbox"/> Mitigation and adaptation
Short description of the action and expected results and benefits	<p>Activities include:</p> <ul style="list-style-type: none"> - Identification of the target people to participate in the training program (including staff from MIH and relevant government institutions, personnel from priority industries and academia) - Develop the training modules for the course - Conduct training. <p>In a first round, it is expected that the training will be composed of 4 modules, one week per module, with each module administered every</p>

	<p>two months so that participants can better assimilate the concepts delivered and conduct the different components of the resource and energy efficiency assessment in the selected factories.</p> <p>Modules to be developed are expected to include the following topics:</p> <p><i>The first module: Energy basics; 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.</i></p> <p><i>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</i></p> <p><i>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</i></p> <p><i>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.</i></p> <p>Expected results and benefits from this action include:</p> <ul style="list-style-type: none"> - 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.
<p>Cost effectiveness of the action</p>	<p>This action can be a good guidance toward resource and energy efficiency in the industrial sector.</p> <p>It is reported that the industrial energy consumption in 2012 was 564.14 GWh. It is estimated that the adoption of energy efficiency measures in the industrial sector could result in energy savings of approximately 28%, when compared with business as usual practices. This would mean that, if energy efficiency measures were in place in 2012, the industry sector could have saved 157.96GWh that year. Assuming an average energy cost for industry of 0.195 USD/kWh, this would have meant that in 2012 industry could have had overall savings of approximately 30 Million USD.</p>
<p>Preconditions needed for successful implementation</p>	<ul style="list-style-type: none"> - Collaboration of industries to participate in the training and share data with MIH
<p>Indicator(s) of success</p>	<ul style="list-style-type: none"> - Number of experts trained

	Targets discussed for 2018 include: (1) 100 national experts from provincial departments, NGO, academic institutions get training on resource and energy efficiency and become resource and energy efficiency specialists; (2) 1000 people from industries get training on resource and energy efficiency; (3) 50 expert selected to be energy audit certified to provide support to industries to be energy efficient companies.
Implementation arrangements	<i>Responsible department(s)</i> - Department of Technique, Science and Technology in MIH. <i>Other government and external stakeholders involved in implementation:</i> UNIDO, with other potential partners including UNDP, APO, National Productivity Centre
Estimated total cost	- 800,000 USD
Possible funding sources	- UNIDO; Carbon credit (Nexus); APO; CCCA II; IEA; GEF; Bilateral donors
Timeframe	- 2015 to 2018

MIH ACTION FICHE No 3

Action	Resource and energy efficiency assessment of industries and SMEs
CCCSP Strategic Objective	<i>CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development</i> <i>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</i>
Rationale	Onsite assessment of resource and energy efficiency of industries and SMEs will identify opportunities to save resources and energy in production and business processes. This has the potential to contribute both to business success and to reducing GHG emissions from industries assessed.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input checked="" type="checkbox"/> Cat 2 – Modified <input type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	Experts trained in MIH resource and energy efficiency course, together with staff from selected factories, will conduct onsite resource and energy efficiency assessments of selected industries. This will involve: the selection of factory personnel to be part of the assessment team, together with the expert; the establishment of baseline data and flowchart of production processes; and the identification of opportunities for resources and energy savings (including options regarding technologies and processes), and estimation of the potential for GHG emission reduction. <i>Expected results:</i>

	<ul style="list-style-type: none"> - Greater awareness of industry regarding opportunities for greener production - More quality data on industry's processes (including data on resource and energy input and output) - More experienced pool of experts
Cost effectiveness of the action	<p>This action can be a good guidance toward resource and energy efficiency in the industrial sector.</p> <p>It is reported that the industrial energy consumption in 2012 was 564.14 GWh. It is estimated that the adoption of energy efficiency measures in the industrial sector could result in energy savings of approximately 28%, when compared with business as usual practices. This would mean that, if energy efficiency measures were in place in 2012, the industry sector could have saved 157.96GWh that year. Assuming an average energy cost for industry of 0.195 USD/kWh, this would have meant that in 2012 industry could have had overall savings of approximately 30 Million USD.</p>
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Training conduct and expert with knowledge of the industries selected are available to lead the assessment - Interest and full support secured from industry management to the onsite assessment.
Indicator(s) of success	<ul style="list-style-type: none"> - Number of onsite resource and energy efficiency assessments conducted - Number of industries which have adopted resource and energy efficiency measures identified during the assessment <p>Targets discussed for 2018 include: (1) 1000 industries and SMEs establish resource and energy team; (2) 1000 industries and SMEs conduct resource and energy assessment; (3) 1000 industries and SMEs establish the baseline data of resource and energy consumption.</p>
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH. <p><i>Potential partners include:</i> UNIDO; UNDP; APO; Nation Productivity Centre</p>
Estimated total cost	<ul style="list-style-type: none"> - 1,000,000 USD
Possible funding sources	<ul style="list-style-type: none"> - UNIDO; Carbon credit (Nexus); APO; CCCA II; IEA; GEF; Bilateral donors
Timeframe	<ul style="list-style-type: none"> - 2015 to 2018

MIH ACTION FICHE No 4

Action	Development of best resource and energy efficiency practices for industries and SMEs
---------------	---

CCCSP Strategic Objective	<p><i>CCCSP SO4: Promote low-carbon planning and technologies to support sustainable development</i></p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
Rationale	<p>The work of MIH partnering with industries (through trainings and industries' assessments) to capitalize on potential resource and energy gains, and corresponding GHG emissions reduction, will provide some proven good practices to improve energy and resource efficiency in Cambodia's industry. These good practices need to be captured and disseminated so that the experience and knowledge accumulated can assist similar industries to engage in greener modes of production, helping the country to scale up its efforts to move towards low carbon development.</p>
Category of climate change action	<p><input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated</p>
Type of action	<p>Mitigation</p>
Short description of the action and expected results and benefits	<p>This action consists of the development and dissemination of information on best practices for resource and energy efficiency in industries, applicable in the Cambodia context. One key focus will be to put in place a mechanism to document the experiences from the industries participating in the MIH training and assessment program, and making them available for other industries.</p> <p>This activity will be conducted in parallel with the MIH training and assessment program, and will need to coordinate closely with the assessment teams in the respective industries, collecting information and lessons learnt from those industries throughout the assessment and later throughout the implementation of the recommendations, but also providing information on best practices, from the region and elsewhere, which could be applicable to the particular issues in industries in the country. Best practices will cover a number of issues (including available technologies and operational practices of the equipment or machinery such as motor, compressor, pump, generator, transformer, cooling tower, light, and AC) in a number of industrial sectors, such as garment, rice mill, brick kiln, rubber, beverage and brewery, ice making, and cement sectors.</p> <p>These best practices will be disseminated by MHI through their regular channels, as well as through the Climate Change Knowledge Management and Information Platform of NCSD.</p>
Cost effectiveness of the action	<p>This action can be a good guidance toward resource and energy efficiency in the industrial sector.</p> <p>It is reported that the industrial energy consumption in 2012 was 564.14 GWh. It is estimated that the adoption of energy efficiency measures in the industrial sector could result in energy savings of approximately 28%, when compared with business as usual practices. This would mean that, if energy efficiency measures were in place in 2012, the industry sector could have saved 157.96GWh that year. Assuming an average energy cost for industry of 0.195 USD/kWh, this would have meant that</p>

	in 2012 industry could have had overall savings of approximately 30 Million USD.
Preconditions needed for successful implementation	Successful establishment of partnerships with industries to conduct training of their staff, conduct assessments and to commit to the implementation of recommendations from assessments
Indicator(s) of success	- Number of resource and energy efficiency best practices documented and shared
Implementation arrangements	<i>Responsible department(s)</i> - Department of Technique, Science and Technology in MIH. <i>Potential partners include:</i> UNIDO; UNDP; APO; Nation Productivity Centre
Estimated total cost	- 200,000 USD
Possible funding sources	- UNIDO; Carbon credit (Nexus); APO; CCCA II; IEA; GEF; Bilateral donors
Timeframe	- 2015 to 2017

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 on resource and energy efficiency it is necessary for the country to develop a policy and legal framework that both provides guidance to industries and ensures that the necessary enabling conditions and incentives are in place to support industry to adopt greener practices.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	This action will include a review of international experiences in establishing enabling environments in support of green industrial development, and a review of the current policy and legal framework for industrial development in Cambodia, identifying barriers and opportunities to moving towards greener industrial development, including a specific component on fiscal mechanisms. This study will be led by MIH, with the support of a team of experts (international and national consultants and academia), and will be developed in close consultation with relevant government representatives, the private sector and academia.

	<p>The study will provide concrete recommendations on the establishment of an enabling environment supportive of green industrial development and will also deliver a proposal for a Green Industry Policy and possibly recommendations for specific regulatory requirements (for example, mandatory annual energy or resource efficiency audits for energy intensive industries) or the establishment of fiscal mechanisms that will promote (e.g. through tax reduction or exemption) the adoption of path-breaking technologies for low-carbon production industries.</p> <p>MHI will lead broad based consultations on the draft Green Industry Policy prior its approval, ensuring that private sector is actively involved both in the formulation of the policy and in the evaluation of its implementation once it is approved.</p> <p>The Climate Change Working Group on Manufacturing Industry and Handicrafts will establish and moderate a discussion Forum on Resource and Energy Efficiency, with the participation of government, academia and the private sector, which will advocate for and monitor policy implementation. The result of Forum discussions will be part of the CCAP reporting.</p> <p>Along with these efforts, MIH will design and establish a Green Industry Award Program, together with private sector and media representatives, acknowledging major achievements of Cambodia industries, to further raise awareness on the need for adopting green low carbon industrial practices.</p>
Cost effectiveness of the action	<p>This action can be a good guidance toward resource and energy efficiency in the industrial sector.</p> <p>It is reported that the industrial energy consumption in 2012 was 564.14 GWh. It is estimated that the adoption of energy efficiency measures in the industrial sector could result in energy savings of approximately 28%, when compared with business as usual practices. This would mean that, if energy efficiency measures were in place in 2012, the industry sector could have saved 157.96GWh that year. Assuming an average energy cost for industry of 0.195 USD/kWh, this would have meant that in 2012 industry could have had overall savings of approximately 30 Million USD.</p>
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Government commitment toward green industry - Technical support from UNIDO
Indicator(s) of success	<ul style="list-style-type: none"> - Green industry policy for Cambodia established - Number of industries with a green industry award
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH and other relevant department with support from UNIDO
Estimated total cost	<ul style="list-style-type: none"> - 400,000 USD
Possible funding sources	<ul style="list-style-type: none"> - UNIDO; CCCA
Timeframe	<ul style="list-style-type: none"> - 2015 to 2018

MIH ACTION FICHE No 6

Action	Development of Nationally Appropriate Mitigation Actions (NAMAs)
CCCSP Strategic Objective	CCCSP SO4: Promote low carbon planning and technologies to support sustainable development
Rationale	<p>Nationally Appropriate Mitigation Actions (NAMAs) were first mentioned in the Bali Action Plan of 2007 as “actions [to reduce GHG emissions] 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 are one of the instruments under UNFCCC that promote the active participation of developing countries, such as Cambodia, in the global effort to reduce GHG emissions. At the same time, and as part of UNFCCC agreements, developed countries have committed to support meaningful mitigation actions in developing countries through financing, technology transfer and capacity building.</p> <p>NAMAs, which can take different forms (e.g. policies, programs or projects aiming to reduce GHG emissions) can help developing countries mobilize additional resources to move towards low carbon development.</p> <p>Cambodia, as part a Party to UNFCCC and the Copenhagen Accord, has expressed its commitment to taking action to reduce GHG emissions through the development of NAMAs and is considering the development of NAMAs in different areas including the garment industry, industrial waste, and other areas.</p>
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	<input checked="" type="checkbox"/> Mitigation <input type="checkbox"/> Adaptation <input type="checkbox"/> Mitigation and adaptation
Short description of the action and expected results and benefits	<p>This action aims at developing at least three NAMAs during the CCAP implementation period and will include the following activities:</p> <ol style="list-style-type: none"> 1. The identification and selection of potential actions and NAMA implementers 2. Define baselines 3. Design the MRV (measuring, reporting and verification) plan 4. Detail the NAMA planning (conceptualize and design NAMA, defining the timeline for the set of proposed activities, with clear responsibilities assigned to NAMAs implementers) 5. Identify needed resources (defining a business plan so that resources can be mobilized for NAMA implementation) 6. Submit NAMA to the registry 7. Implement and conduct MRV

	<p>8. Identify and disseminate best practices (establishing a learning process that will start at the earlier stages of NAMA design and implementation, similarly to the process described in Action Fiche 4)</p> <p><i>Expected Results:</i></p> <ul style="list-style-type: none"> - Increased capacity of at least three targeted industry sectors to address green economy and climate change mitigation issues - Increased opportunities to attract both domestic and international financing for the implementation of actions which are important for the country's ability to transition to low carbon development. - Gains in terms of GHG emissions reduction, as well as resource and energy savings - Contribution to the body of knowledge on low carbon development in Cambodia.
Cost effectiveness of the action	<p>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 (business case) development in term of financial, environmental and social benefits.</p> <p>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 tap into international climate funds earmarked for mitigation projects, as well as to mobilize support from developed countries in terms of technical assistance and technology transfer.</p>
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Leadership on low carbon industrial development as the guiding path for successful industrial development - Data of GHG inventory for industrial sector is helpful for NAMA focus
Indicator(s) of success	<ul style="list-style-type: none"> - Number of NAMA projects developed (targeting at least 3 by 2018) - Total of GHG emissions reduction expected from developed NAMAs
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - GDI with collaboration with MOE and NAMA implementers (tbc)
Estimated total cost	<ul style="list-style-type: none"> - 400,000 USD <p>The estimate refers to NAMA development. The full cost of implementing at least three NAMAs will be defined after the business cases for each NAMA are developed.</p>
Possible funding sources	<ul style="list-style-type: none"> - UNDP, UNIDO, ADB, GEF, UNFCCC FM
Timeframe	<ul style="list-style-type: none"> - 2015 - 2018

MIH ACTION FICHE No 7

Action	Establishment of an information system to support resilient low carbon industrial development
---------------	--

CCCSP Strategic Objective	<i>CCCSP SO4</i> : Promote low carbon planning and technologies to support sustainable development
Rationale	<p>Climate resilient and sustainable industrial development requires that policy makers, investors and other relevant stakeholders have sound information (e.g. on climate risks, GHG emissions, gender related information, available low carbon technologies, etc.) when preparing investment plans/projects, allowing them to understand for example the implications of opting for certain technologies (e.g. low carbon) or for different locations (e.g. with lower exposure to climate risks).</p> <p>A mapping of existing industry, as part of an integrated information system linked to a decision support system (DSS), can be a valuable tool for policy makers, investors and others, enabling them to have a better understanding of the impacts and opportunities for industry related with climate change and the environment.</p>
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	<input type="checkbox"/> Mitigation <input type="checkbox"/> Adaptation <input checked="" type="checkbox"/> Mitigation and adaptation
Short description of the action and expected results and benefits	<p>This action consists of the development of a geographical information system that will include an inventory of relevant information on existing manufacturing industry in Cambodia (including activity data, industrial processes, waste management, emissions), as well as other relevant environment and climate change related data. The development of this information system will be structured to respond to key queries designed to assist industry, policy makers, and potential inventors to make crucial decisions, looking for opportunities to change towards more resilient low carbon modes of development.</p> <p>The work will include:</p> <ul style="list-style-type: none"> - Develop the Geographical Information System (GIS) and Decision Support System (DSS), identifying relevant information to be collected and developing queries to be included, with the support of experts and the involvement of key stakeholders; - Train (ToT) provincial departments to collect information needed; - Conduct the inventory, mapping information from existing industries (inventory), as well as environmental and climate change information (e.g. industrial processes, climate risk data, waste treatment processes, GHG emissions, etc.); - Institutionalize the information system (including operationalization of institutional arrangements) so that it can be continuously maintained/updated by MIH, and shared in appropriate platforms, including the NCSD climate change knowledge and information platform. <p>This work needs to be coordinated closely with Ministry of Environment and the General Secretariat for Sustainable Development (GSSD). MIH will also collaborate with MoWA to understand how this tool can help better mainstream gender equality considerations in the industry and handicraft sector.</p>

	This work will enable policy makers and investors make informed choices, facilitating the transition towards more resilient low carbon industrial development, and potentially contributing to reduced GHG emissions, lower exposure to disaster risk and reduced loss and damage of industrial infrastructure due to climate extremes, mitigation of environmental impacts and greater awareness of gender equality issues.
Cost effectiveness of the action	Though the cost of developing this publicly available comprehensive information system will not be directly recovered, the availability of the information has the potential to contribute to a number of gains, including preventing or reducing losses from lower exposure of investments to climate risk, or reducing environmental impacts. Information will also assist the country to better plan for future more resilient low carbon development, and to mobilize domestic and international financing and technological support.
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Technical support from GSSD on GHG inventory system - Good collaboration and involvement of private sector - Availability of climate and environmental data
Indicator(s) of success	<ul style="list-style-type: none"> - Mapping (Inventory of industries in Cambodia) conducted and Geographical Information System developed and in use
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH, in collaboration with MoE, and other relevant department, and with the support from UNIDO, CSIRO
Estimated total cost	<ul style="list-style-type: none"> - 700,000 USD
Possible funding sources	<ul style="list-style-type: none"> - UNIDO, GEF, UNFCC FM
Timeframe	<ul style="list-style-type: none"> - 2016 - 2018

MIH ACTION FICHE No 8

Action	Assessment of the potential of renewable energy applications in the industrial sector
CCCSP Strategic Objective	<p>CCCSP SO4: Promote low carbon planning and technologies to support sustainable development</p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
Rationale	Cambodia has a significant potential for the development of renewable energy which can be used in industrial processes. Renewable energy sources include biomass, wind, and solar. In order to engage policy makers, industrialists, and potential investors in opting for renewables, a comprehensive study on the potential of renewable energy application in the sector is needed.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation

Short description of the action and expected results and benefits	<ul style="list-style-type: none"> - Review the existing studies elsewhere for benchmarking - Conduct an assessment of the potential for renewable energy in Cambodia, with detail cost effectiveness of the each potential source and type of industrial processes - Disseminate the findings to relevant stakeholders and potential investors.
Cost effectiveness of the action	The findings of study will provide useful information for investors on the cost effectiveness of different options to switch to renewable energy sources.
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Support from experienced consultant and institutions to conduct the study
Indicator(s) of success	<ul style="list-style-type: none"> - Assessment of renewable energy potential in Cambodia (including biomass, solar, wind) available to be used by industrial sector - Number of feasibility studies of renewable energy installation in industries
Implementation arrangements	<i>Responsible department(s)</i> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH in coordination with development partners and NGOs
Estimated total cost	<ul style="list-style-type: none"> - 100,000 USD
Possible funding sources	<ul style="list-style-type: none"> - Bilateral donors; UNEP-IETC; UNIDO ; CCCA; Carbon credit (Nexus)
Timeframe	<ul style="list-style-type: none"> - 2015 to 2016

MIH ACTION FICHE No 9

Action	Development of a compendium of renewable energy technology for the industrial sector
CCCSP Strategic Objective	<p>CCCSP SO4: Promote low carbon planning and technologies to support sustainable development</p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
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 of the standard assessment of the technologies so that the user can make a comparison to make a final decision.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<i>Short description</i> <ul style="list-style-type: none"> - Identify all technologies related with renewable energy which are relevant for Cambodia industrial development - Compile all the information about the technologies in a user friendly compendium

	The compendium will assist industries and potential investors in opting for renewable energy options, and can thus contribute to reducing of GHG emissions, as well as to reducing operation costs, making industries more competitive.
Cost effectiveness of the action	- NA
Preconditions needed for successful implementation	- Consult with UNEP IETC to make use of the existing compendium - Make the compendium available in Khmer language
Indicator(s) of success	- Compendium of technologies for renewable energy application in industrial sector available both in English and Khmer language
Implementation arrangements	<i>Responsible department(s)</i> - Department of Technique, Science and Technology in MIH in association with the department of energy in MME
Estimated total cost	- 300,000 USD
Possible funding sources	- UNEP-IETC; CCCA; IEA
Timeframe	- 2016 to 2018

MIH ACTION FICHE No 10

Action	Promotion of renewable energy generation on site for industrial sector as well as special economic zone.
CCCSP and Sector CCSP Strategic Objective	<i>CCCSP SO4:</i> Promote low carbon planning and technologies to support sustainable development
Rationale	After the assessment of renewable energy potential is made available, as well as the suitable technologies that can convert renewable energy into thermal or electrical energy for industrial use, it is necessary to pilot one or two kinds 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	<input type="checkbox"/> Cat 1 – Re-scaled <input checked="" type="checkbox"/> Cat 2 – Modified <input type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<i>Short description</i> Identification, development and implementation of pilots will include: <ul style="list-style-type: none"> - 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. <i>Expected results and benefits:</i> <ul style="list-style-type: none"> - 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 tax exempt.
Cost effectiveness of the action	Captive power generation for industry and SEZ from renewable energy will ensure the security energy supply for the industrial process with minimal impact to the environment in term of GHG emission. Besides, the competitive cost for power generation, the action will contribute to the low carbon and sustainable development of industrial sector. Plus, since energy is one of major cost for industrial operation, the substitution with cheaper and cleaner source will lead to more profit margin as well as more competitiveness, and it improves the image of the industry or cooperation as part cooperate social responsibility.
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Study of renewable energy potential is available - Compendium of renewable energy technologies is available. - List of potential technology suppliers. - Coordinate with relevant government agency for EIA. - Collaborate with CDC for tax exemption list.
Indicator(s) of success	<ul style="list-style-type: none"> - Energy demand assessment available in SEZ with potential of usage of renewable energy for the production processes - Number of demonstration pilots onsite renewable energy production for industrial processes
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH in association with department of energy in MME
Estimated total cost	- 1,500,000 USD
Possible funding sources	- UNIDO; Carbon credit (Nexus); APO; CCCA II; IEA; GEF; ADB; Simplon Cambodia
Timeframe	- 2016 to 2018

MIH ACTION FICHE No 11

Action	Development of a compendium of low carbon technology for industrial production processes
CCCSP Strategic Objective	<p>CCCSP SO4: Promote low carbon planning and technologies to support sustainable development</p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
Rationale	<p>Currently there plenty available low carbon technologies in the market for industrial production processes compared with business as usual. However, those information are scattered which can be a challenge for investor or industries. Collection and compilation of all relevant technologies is a very important step toward the adoption of those technologies in the industrial production processes or new industrial investment.</p> <p>The compendium of such technologies should include cost effectiveness information and comparison with existing technologies.</p>

Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<p><i>Short description</i></p> <ul style="list-style-type: none"> - Collect information on all technologies related with low carbon industrial production - Review the literature on low carbon technology for different sectors, for example rice milling, food process, rubber processing, garment and footwear, ice factory, brick kiln, heavy industry to be developed in Cambodia, etc. - Compile all the information about the technologies in a user friendly compendium <p>The compendium will assist industries and potential investors in opting for renewable energy options, and can thus contribute to reducing of GHG emissions, as well as to reducing operation costs, making industries more competitive.</p>
Cost effectiveness of the action	- NA
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Consult with UNEP IETC and UNIDO to make use of the existing compendium - Make the compendium available in Khmer language
Indicator(s) of success	- Compendium of low carbon technologies for the industrial sector published both in English and Khmer language.
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH in association with the department of energy in MME
Estimated total cost	- 300,000 USD
Possible funding sources	- CCCA; UNEP-IETC; IEA
Timeframe	- 2015 to 2018

MIH ACTION FICHE No 12

Action	<i>Disseminate the technology information to relevant partners and industries</i>
CCCSP Strategic Objective	<p>CCCSP SO4: Promote low carbon planning and technologies to support sustainable development</p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
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	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<p><i>Short description</i></p> <ul style="list-style-type: none"> - 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 <p><i>Expected results and benefits:</i></p> <ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - 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	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH in coordination with development partners
Estimated total cost	- 400,000 USD
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	<p>CCCSP SO4: Promote low carbon planning and technologies to support sustainable development</p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
Rationale	To support the low carbon development for industrial sector as well as to ensure its sustainable development, it is necessary to have a policy in place to support the activities. The policy should promote these

	<p>activities and require investors in energy intensive industries to use low carbon technologies in Cambodia.</p> <p>The policy should promote the path-breaking technologies for low-carbon production industries through tax exemption, or tax holiday etc.</p>
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<p>Develop an integrated policy framework to support the greening of industries. This will include:</p> <ul style="list-style-type: none"> - 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	Over the longer term, more path-breaking technologies for low-carbon production and energy diversification are needed to reduce GHG emissions, as well as other environmental impacts. Path-breaking technologies will not only reduce costs, but it will also improve the living standard.
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Seek expertise from UNIDO on developing green industry policy - Review of existing policies to identify policy gaps
Indicator(s) of success	- Incentive policy for path breaking technologies for low-carbon production industries approved
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH and other relevant department with support from UNIDO.
Estimated total cost	- 400,000 USD
Possible funding sources	- UNIDO; CCCA funds
Timeframe	- 2015 to 2018

MIH ACTION FICHE No 14

Action	Assessment of waste generation by the industrial sector
CCCSP Strategic Objective	<p>CCCSP SO4: Promote low carbon planning and technologies to support sustainable development</p> <p>CCCSP SO5: Improve capacities, knowledge and awareness for climate change responses</p>
Rationale	Waste is a common source of methane generation which is one the potential greenhouse gases. Organic waste from industries should be assessed and properly documented 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	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<ul style="list-style-type: none"> - Develop a methodology for waste assessment (characterization and quantification) from industrial sector - Establish a reporting system for industries to report on waste generated and used - Establish a team to coordinate the assessment and undertake cross checks frequently so data is consistent and accurate - Establish and maintain the industrial waste data based - Set a mobile laboratory and conduct waste analysis (with mobile laboratory or collaborate with national laboratory to analyse the waste) <p><i>Expected results:</i></p> <ul style="list-style-type: none"> - Better understand the waste generation sources and characteristics - Waste minimization and prevention before treatment - When wastes are managed, GHG emissions can be reduced - Maximize the use of waste for energy or other purposes, for example fertiliser or other by product.
Cost effectiveness of the action	Precise information about waste generation from industries will help to have better planning on waste management. The information will support policy makers as well as industry owners to choose cost effective ways to convert waste into useful products or energy, and to minimize environmental impacts in both short and long term. It will also support eco-industrial park design, where waste from one factory is used as input to another.
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - 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	<ul style="list-style-type: none"> - Number of industries with waste assessment/waste management reports available - Waste management strategies developed for industrial sector
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH, MoE, and other relevant department with support from UNIDO
Estimated total cost	- 2,000,000 USD
Possible funding sources	- CCCA funds; UNIDO; GEF; UNEP; bilateral partners
Timeframe	- 2015 to 2018

MIH ACTION FICHE No 15

Action	Pilot and document strategies for converting 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. Currently, the methodology for waste minimization is available to reduce waste generation before treating it. Unavoidable waste can be successfully and cost-effectively converted into energy. For example tapioca starch production processes generate significant amounts of waste water containing enough nutrients to convert into biogas for electricity generation and thermal application drying the starch.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<ul style="list-style-type: none"> - Identification of pilots (based on the activities described in Action Fiche 14) - Pilot industrial waste management strategies and technologies for waste conversion - Document best practices. <p><i>Expected Results:</i></p> <ul style="list-style-type: none"> - GHG emission reduction and potentially greater energy security. - Maximize the use of waste for energy or other purpose for example fertiliser or other by product.
Cost effectiveness of the action	<p>Only cost-effective options are chosen as pilots.</p> <p>Though cost-effectiveness will depend on a number of factors, overall the conversion of waste to energy will improve the efficiency of resource usage. For example the efficiency of the reciprocating engines generator ranges from 20 to 32%, and it can be increased to 74 to 82% if the waste heat is recovered for energy production called combined heat power generation or cogeneration. The efficiency can be increased up to around 90 % if combined cold heat power generation.</p>
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Results from the activities part of action 14 are needed prior to the selection of the pilots - Good collaboration with industries with available and potential waste to convert to energy - Collaborate with MME and MoE to work on this issue.
Indicator(s) of success	<ul style="list-style-type: none"> - Number of demonstration pilots for converting waste into energy in industrial sector
Implementation arrangements	<i>Responsible department(s)</i>

	- Department of Technique, Science and Technology in MIH, with collaboration of MME, MoE, and other relevant departments, with the support from UNIDO
Estimated total cost	- 1,200,000 USD
Possible funding sources	- CCCA funds; UNIDO; GEF; UNEP; other bilateral partners
Timeframe	- 2015 to 2018

MIH ACTION FICHE No 16

Action	Promotion of waste management strategies, including hazardous waste management
CCCSP Strategic Objective	CCCSP SO4: Promote low carbon planning and technologies to support sustainable development
Rationale	Once a clearer picture emerges (from the implementation of actions 14 and 15) regarding the challenges and opportunities in industrial waste management in Cambodia, it will be necessary to develop a national policy for industrial waste management and for the use of waste for energy generation. When industrial waste is well managed, GHG emissions from industrial processes can be reduced, while waste becomes an input for the factory, no longer seen as a problem for industry but a resource or opportunity.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<ul style="list-style-type: none"> - Review of international experiences in developing policy on industrial waste management - Conduct a review of the legal and policy framework for waste management in Cambodia, including hazardous waste and issue recommendation on gaps identified - Draft the industrial waste policy, in consultation with relevant organisations nationally and internationally - Prepare a handbook of waste management for industrial sector - Follow up on other relevant recommendations from the review <p><i>Expected Results:</i></p> <ul style="list-style-type: none"> - Clear road map for waste management from the beginning for industrial sector as well as development partners - Industrial waste is well managed and/or reduced with consequent reduction of environmental impacts - GHG emissions reduced.
Cost effectiveness of the action	Though depending on a number of factors, overall the conversion of waste to energy will improve the efficiency of resource usage. For example the efficiency of the reciprocating engines generator ranges from 20 to 32%, and it can be increased to 74 to 82% if the waste heat

	is recovered for energy production called combined heat power generation or cogeneration. The efficiency can be increased up to around 90 % if combined cold heat power generation.
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - 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	- Policy on industrial waste management developed
Implementation arrangements	<i>Responsible department(s)</i> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH, MoE, and other relevant department with Support from UNIDO
Estimated total cost	- 800,000 USD
Possible funding sources	- CCCA funds; UNIDO; GEF; UNEP; other bilateral partners
Timeframe	- 2015 to 2018

MIH ACTION FICHE No 17

Action	Development of a compendium of waste management for the manufacturing and handicraft sector, including waste to energy technology
CCCSP and Sector CCSP Strategic Objective	CCCSP SO4: Promote low carbon planning and technologies to support sustainable development
Rationale	To facilitate policy implementation, as well as to promote sound waste management in industries, it is necessary to make available a compendium of technologies that can be used to convert waste into energy in situ where the end user or industries, policy makers, academic institutions can refer to when dealing with a given waste/industry. The compendium should have an up-to-date list of technologies with advantage and disadvantage analysis in term of technical, environmental and social impact.
Category of climate change action	<input type="checkbox"/> Cat 1 – Re-scaled <input type="checkbox"/> Cat 2 – Modified <input checked="" type="checkbox"/> Cat 3 – Dedicated
Type of action	Mitigation
Short description of the action and expected results and benefits	<ul style="list-style-type: none"> - Refine the selection of relevant technologies and the best practices documented previously from work undertaken in actions 14 and 15 to include in the compendium. - Produce a compendium/handbook on waste management for the manufacturing and handicraft sector, focusing on technologies for converting industrial waste into energy - Disseminate the compendium <p><i>Expected Results:</i></p> <ul style="list-style-type: none"> - Good reference for those who work in the area of waste management, making critical information available to industry/investors potentiating a better design of industrial waste

	<p>management systems and facilitating selection of appropriate technology.</p> <ul style="list-style-type: none"> - Industrial waste is well managed and/or reduced with consequent reduction of environmental impacts - GHG emissions reduced.
Cost effectiveness of the action	NA
Preconditions needed for successful implementation	<ul style="list-style-type: none"> - Consult with agencies who already work in the field so that it can be spare some support if any for doing the work - Integrate best practices from pilots conducted in action 16 - 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	<ul style="list-style-type: none"> - Compendium (handbook) on waste management for the manufacturing and handicraft sectors published
Implementation arrangements	<p><i>Responsible department(s)</i></p> <ul style="list-style-type: none"> - Department of Technique, Science and Technology in MIH, in collaboration with MME, MoE, and other relevant department, and with support from UNIDO, UNEP, etc.
Estimated total cost	<ul style="list-style-type: none"> - 400,000 USD
Possible funding sources	<ul style="list-style-type: none"> - CCCA funds; UNIDO; GEF; UNEP; other bilateral partners
Timeframe	<ul style="list-style-type: none"> - 2015 to 2018

References

- Council Development Cambodia (CDC). (2014). *National Strategic Development Plan 2014-2018*. Retrieved from http://cdc-crdb.gov.kh/cdc/documents/NSDP_2014-2018.pdf
- Industrial Development Policy. (2014) Retrieved from http://www.sa-asia.com/home/alert_perspective/pdf/industrial_development_policy_2014to2024.pdf
- International Energy Agency (IEA). *World Energy Outlook 2009*; IEA: Paris, France, 2009
- Kamal, U. (2012). *GHG Inventory and Mitigation GHG Inventory Inventory and Mitigation Mitigation in Cambodia* [PowerPoint slides]. Retrieved from http://lcs-net.org/pdf/locarnet_meetings/2012/S1_6%20Uy.pdf
- Ministry of Industry Mines and Energy, 2012: "Climate Change Strategic Plan for Manufacturing Industry and Energy Sectors".
- Ministry of Environment, 2006: "National Adaption Program of Action to Climate Change".
- Overseas Development Institute, 2012: "Cambodia Climate Public Expenditure and Institutional Review Final Report".
- Ministry of Environment, 2010: "Green House Gas Mitigation Analyses for the Energy and Transport sectors".
- Ministry of Industry Mines and Energy, 2013: "Draft of National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia".
- Ministry of Economic and Finance (MEF). (2012) DIC 2012 database on grants and loans managed by MEF, and CDC-CRDB ODA database.
- Ministry of Environment. (2014). Draft Report on Climate Change Financing Framework.
- M. Sarrafa, B. Rismanchi, R. Saidur, H. W. Pin, N. A. Rahi, 2013: "Renewable Energy Policies for Sustainable Development in Cambodia", *Renewable and Sustainable Energy Review*.
- MRC, 2010: "Energy and Power Baseline Assessment Working Paper".
- Naudé, W. (2011). Climate Change and Industrial Policy. *Sustainability* **2011**, 3, 1003-1021; doi:10.3390/su3071003
- National Climate Change Committee, 2013: "Cambodia Climate Change Response Strategic Plan 2014-2023".
- Overseas Development Institute, 2013: "Low Carbon Competitiveness, Cambodia Policy Brief 'Draft' ".
- Prins, G.; Isabel, G.; Christopher, G.; Reiner, G.; Atte, K.; Frank, L.; Ted, N.; Roger, P.J.; Steve, R.; Daniel, S.; et al. *The Hartwell Paper: A New Direction for Climate Policy after the Crash of 2009*. University of Oxford and London School of Economics: London, UK, 2010. Retrieved from <http://www.lse.ac.uk/collections/mackinderProgramme/theHartwellPaper>.
- UNDP, Ministry of Industry Mines and Energy, 2013: "Cambodia Sustainable Energy for All Readiness Plan".
- US, Department of Energy, 2013: "US Energy Sector Vulnerabilities to Climate Change and Extreme Weather".