

Kingdom of Cambodia

Nation Religion King

Ministry of Industry, Mines and Energy



Climate Change Strategic Plan for Manufacturing Industry and Energy Sectors

Year 2012

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2. Acronyms and Abbreviations

3Rs	:	Reuse, Recycling and Repair
ADB	:	Asian Development Bank
ASEAN	:	Association of South East Asian Nations
BAT	:	Best Available Techniques
BEP	:	Best Environmental Practice
CCSP	:	Climate Change Strategic Plan
CDM	:	Cleaner Development Mechanism
CO ₂	:	Carbon Dioxide
CP	:	Cleaner Production
CRS	:	Corporate Social Responsibility
D.O	:	Diesel Oil
EDC	:	Electricité du Cambodge
EMA	:	Environmental Management Accounting
EMS	:	Environmental Management System
FBT	:	Food, Beverage and Tobacco
FDI	:	Foreign Direct Investment
GDP	:	Gross Domestic Product
GEF	:	Global Environment Fund
GHG	:	Green House Gas
GNP	:	Gross National Product
HFO	:	Heavy Fuel Oil
IEE	:	Industrial Energy Efficiency
IFC	:	International Finance Cooperation
ISIC	:	International Standards Industrial Classification
KOICA	:	Korea International Cooperation Agency
LED	:	Light-Emitting Diode
MIME	:	Ministry of Industry, Mines and Energy
MJ	:	Megajoule
MW	:	Megawatt

NGOs	:	Non-Government Organizations
NIP	:	National Implementation Plan
NIS	:	National Institute of Statistics
NSDP	:	National Strategy Development Plan
POPs	:	Persistent Organic Pollution
R&D	:	Research and Development
SMEs	:	Small and Medium-sized Enterprises
SPIN	:	Sustainable Product Innovation
TEST	:	Transfer Environmentally Sound Technology
UNDP	:	United Nation Development Programme
UNEP	:	United Nation Environment Programme
UNIDO	:	United Nations Industrial Development Organization
VAM	:	Vapor Absorption Machine
VFD	:	Variable Frequency Drive
VOCs	:	Volatile Organic Chemicals/Compounds
VSBK	:	Vertical Shaft Brick Kiln
WB	:	World Bank

Preface

MIME has a vital role for the improving in development of Industry, Mines and Energy. These three sectors actively participate in the national economy development and poverty reduction in the consistent with National Strategic Development Plan and the Royal's Government Rectangular Strategies-Phase 2 as the Cambodian Millennium Development Goal well. these sectors development have also cohered with more thoroughly consideration on the three dimension benefits social, economic and environmental sustainability.

The Industry and Energy Sectors also contribute into production process developments for factories, enterprises and handicraft for job creation growth, income generation for the nations and increase national budget named particularly gross national products, for the support in social economy as a whole.

For the Energy sector is necessarily requirement for daily live of each individual and also for the development of other daily business such as commerce, agriculture and other sector's needs.

The main goal in development of Industry and Energy sectors are to harmonize mutual benefit match each other and balance such social, economic and environmental aspects through technology adoption, technology transfer in both sectors becoming gradually green in the near future. Bases on technical manner, we have to strengthen existing activities such as cleaner technology development through transferring an environmental sound technology, management of chemical sound safety, energy efficiency and renewable energy development including solar energy, wind energy, hydro energy, biomass and biogases energy as well; whose the subjects mainly necessitate to be implemented.

The Climate Change Strategic Plan for Manufacturing Industry and Energy is a roadmap that will serve the instructional needs of helping private sectors in order to plan in advance pre-act in planning for implementation and dealing with the occurred problems related to climate change of the sectors. Theses could be done through-energy efficiency and resources efficiency consumption, reduction the pollution and waste emission, changing the hazardous chemicals to less hazard or none hazardous substances in the factories, enterprises and handicrafts.

The results of these actions will increase the productivity, quality and competitiveness of those factories, enterprises and handicrafts for further improvement. Furthermore, the Climate Change Strategic Plan for the two sectors will also serve as the roadmap for relevant government institutions, development partners particularly those are under the supervision of Ministry of Industry, Mines and Energy, contributing and implementing for the national climate change of the sectors.

Ministry of Industry, Mines and Energy will continue in collaboration and participation for the implementation on strategic plan with Ministry of Environment and other relevant Ministries in collaboration and supporting from European Union, United Nation Development Program and other development partners for Cambodian Climate Change Alliance Program.

Signed by Suy Sem
Minister
Ministry of Industry, Mines and Energy

3. Executive Summary:

Even Cambodia is at the beginning stage of industrialization, but the problems in terms of industrial pollution and environmental degradation remarkably affected. For the reasons of typical specific industries, fuel use for energy production, unused best available environmental practices and available technology not environmental sound, inefficient housekeeping, inefficient resources consumption and inefficient energy consumption in which lead those local industries facing industrial pollution.

Thus, the sustainable environmental management will become a necessarily mean for preventing and dealing with the scarcity of natural resources and environment issues. The management on those problems should consider the preventing strategy rather than responding or solving the current problem exists.

This Climate Change Strategic Plan for Manufacturing Industry and Energy sectors divided into eight main parts in which the articles are described interaction detail with the annex. Part I describes the information Climate Change Strategic Plan related to Manufacturing Industry and Energy Sectors. Part II describes on background and procedure on preparing this strategic plan including the explanation on how to implement the plan based on flexibility and applicability approaches, stakeholder collaboration, impact assessment on private business and the benefits of strategic plan implementation. Part III describes on the general situation related to manufacturing industry, small medium enterprises in which the statistic of any classifications of those SMEs. It described and permitted by MIME since 2008 to 2011, also the chapter is described the production and supplying of energy sector throughout the country which included the specific indicators in 10 years forward, 2010 to 2020 and 2020 to 2030. Part IV analysis the impact on the manufacturing industry, SMEs and energy sectors including the climate change issues, green house gases emission and other emissions by these sectors. Part V defines the priority strategic for dealing with the priority strategies and action plans included energy efficiency, green industry, transfer environmentally sounds technology, management sound safety of chemicals, for the energy sector included solar energy for households, small and medium hydro station, biomass and biogases energy as well. Part VI raises on measure response to existing climate change sub-sectors and plans implementation by setting up the vision for adoption, mitigation, prevention and reduction the climate change for the sectors and missions, goals and objectives are defined. In the chapter, also analysis the weakness, strength, threat and opportunity in the sectors, the programs are set for dealing with the challenges and strengthen the weakness. Part VII defines the mandate of the strategic plan in according with the Royal Government of Cambodia for 5 years forward. In addition, Part VIII expands about the detail of stages this strategic plan into two parts: first, adoption and mitigation, second for prevention and elimination on climate change of the sectors.

4. Introduction:

The Climate Change Strategic Plan in Industrial and Energy sectors is prepared for the purpose to collaborate in the implementation for the climate change adaptation, mitigation, prevention and reduction with other relevant sectors in which the Ministry of Environment is a key player for coordination the National Climate Change Strategic Plan.

The Climate Change Strategic Plan in Industrial and Energy sectors will be implemented not only by the General Department of Industry and General Department of Energy, with the direction, orientation and management of MIME, but also it could be implemented by the provincial departments of Industry, Mines and Energy, for their extending implementation with relevant private sectors and development partners.

For the implementation of the Strategic Plan, we have to assess and evaluate comprehensively on the causes and benefits for the two sectors in order to adopt for implementation and reflect to real requirements of social economy and environment status. And it also is considered that the implementation plan could not additionally burden on the private businesses entity.

Small and Medium-sized Enterprises (SMEs), the target groups will be particularly focused for the implementation of the Climate Change Strategic Plan for Industrial and Energy Sectors. So that the main purpose of the Climate Change Strategic Plan for Industrial and Energy Sectors, will assist those enterprises in term of preventing approaches for reducing green house gases, also make them more efficiency of energy and raw materials consumption. Then they will reduce the pollution discharge and waste output, achieve monetary savings, and increase access to more modern technologies, such as cleaner technologies. In addition, they will be able to access to international markets more effectively, of their using cleaner production methods, reducing production cost to respond to the requirements of international clients' demands, and they will improve environmental and social performance, while at the same time remaining or even becoming more competitive.

The energy sector development plays an important role for national economic growth, because energy is not only demands for daily life, but it is also a major part for the development of other fields including industry, handcraft, business, agriculture, service and economic. The Ministry of Industry, Mines and Energy will not consider only one aspect of benefits, but we balance the benefits for other aspects strategies i.e. economics, social, cultural and environment. For MIME's energy development plan, we have to develop based on multi-benefits strategic approaches in order to implement energy development plan for gradually green by focused on:

- Energy Diversification:
 - Solar energy
 - Wind energy
 - Hydro energy
 - Bio-mass energy
 - Bio-gases energy

The result of implementation of Climate Change Strategic Plan for Industrial and Energy Sectors will benefit through acquiring the new knowledge on resource efficiency, 3R, green energy and industry. So that it can increase the productivity and quality, effectiveness of production while at the same time, the waste, emission, all kinds of pollution or greenhouse gases will be reduced from those industrial enterprises.

Finally, the Cambodia people and the country's eco-system will gain the benefits from the reduced load of environment pollutants as the consequence of implementation the Climate Change Strategic Plan. Furthermore, those factories, enterprises and SMEs will extensively penetrate their market

for better productive and competitive to international level; so that the Cambodia people gradually improve their living standards for the near future.

5. Describe Sector-related Profile:

5.1. Situation of Manufacturing Industry, Small and Medium Enterprises and Handcraft:

Industrial and energy sectors is main factors in development country, by increasing of numbers of manufacturing industries also increase jobs, products and productivities that can increase GDP which is backbone of social and economic development, especially, reduction the poverty for the whole country. In order to get the products and services, manufacturing industry needs to have crucial inputs in production line such as capacity of human resource, equipment and machinery, raw materials, substituted materials, and technology. Those crucial inputs contributed to produce into main products, by-products and wastes. Strengthening the quality, productivity and competitiveness will succeed base on efficiency and effectiveness of the production management through good housekeeping, raw materials and substituted materials use efficiency, water and energy efficiency, and best available technique. Mean while the main products produced, other unintended wastes or by-products also occurred. For the reasons that are never noted and paid attention causes by the solid, liquid discharges and gases emission into environment as a part contributed to climate change. These issues are the most concerns of the whole society that impact for the present and the nearest future.

Industrial and energy development are main contribution and responsibility for the benefits of social, economical and environmental which are our duty, functioning and our privilege all of us, as other sectors related for the whole nations to consider and prevent measures on the balancing the benefits of economic, society, culture and environment as the climate change issues well. These action measures demonstrated through energy efficiency, resource efficiency, job creation, saving, cleaner production/technology, good housekeeping, water consumption, pollution management, 3Rs, job safety, transportation, food safety and other requirements. For taking part of our responsibility on economic, social and environmental issues and our duties as well as sectors relevant ministries and our nation, we will consider and establish preventing approaches for the future in terms of social-economic, culture and environment as well the climate change challenges.

Based on the economical analysis and research, noted that the industrial growth in 2007, mainly contributed by the textile and garment, rice processing sectors in which are major share a half of the whole industrial sectors for the economic development. Since 2007, the numbers of factories and SMEs gradually have increased from 33,183 establishments with created 502,164 jobs and 38,357 establishments with created 591,187 jobs in 2011. Even though, the growth numbers are not constant by the years. The industry value growth contributed between 20% to 30% in comparing with GDP; but this sector growth reached the peak at 56% in 1993. Share from the industry sectors, mainly contributed 70% by the textile and garments and also generated roughly 70% income of the national export.

These figures and statistics of manufacturing industry and SMEs, in duration from 2007 to 2011, classified by International Standard of Industrial Classification are shown in the following tables:

Table 1: Manufacturing Industry in Cambodia

ISIC	Industry	2008	2009	2010	2011
31	Food, Beverage & Tobacco (FBT)	42	46	53	57
32	Textile, Wearing Apparel & Leather Industries	418	422	451	537
33	Manufacture of Wood Products, including Furniture	6	9	9	9
34	Manufacture of Paper Product, Printing and Publishing	11	11	12	15
35	Manufacture of Chemicals & Chemical Petroleum, Coal, Rubber and Plastic Products	32	34	38	47
36	Manufacture of Non Metallic Mineral Product, except Products of Petroleum and Coal	9	9	11	12
37	Fabricated and Metal Products	21	22	24	31
38	Other manufacturing Industries	3	3	3	3
	Total	542	556	599	711

Table 2: SMEs Sector

ISIC	SMEs	2008	2009	2010	2011
31	Food, Beverage & Tobacco (FBT)	26,208	29,987	31,479	30,513
32	Textile, Wearing Apparel & Leather Industries	1,478	1,443	1,485	1,817
33	Manufacture of Wood Products, including Furniture	-	-	-	3
34	Paper Product, Printing and Publishing	43	48	59	62
35	Chemicals & Chemical Petroleum, Coal, Rubber and Plastic Products	192	203	24	241
36	Non-Metallic Mineral Product, except Products of Petroleum and Coal	875	987	1,037	1,084
37	Fabricated and Metal Products	-	-	-	4
38	Metal	3,039	1,902	2,052	2,392
39	Other	965	990	1,086	1,530
	Total	32,800	35,560	37,422	37,646

(Source MIME Annual Report 2011, 2012)

5.2. Situation of Energy production and supply in Cambodia:

The Royal Government of Cambodia rehabilitates and continues to develop the energy sector strategic plan for short, medium and long terms in order to extent the sufficient energy supply for all households, throughout the country. Currently, the Royal Government of Cambodia strongly focuses on the increasing of energy productions to 80% in 2020 and in 2030 at least 70% of households, throughout the country will consume with qualified energy as transmitted connection lines.

To respond to the national progress and development that the demands of country energy growth, from 2002 to 2011, in annual average 16.3% and in Phnom Penh 17% were higher in comparing to neighboring countries and in the region. Since 2000, Cambodia mostly has depended on the energy productions from fuel and diesel generators, roughly 80%, in which Phnom Penh and other provinces the electricity had produced by individual or small private sectors. In this regard, since 2002, the Ministry of Industry, Mines and Energy initially has established the following hydropower plants such as Komchai, TaTai, Artai and coal-energy production plant as well in Kampong Soam province that connect to Phnom Penh and Kampong Speu province.

6. Define sector and sub-sector climate change impacts and climate risk profile

Nowadays, the climate change is a significant global issue. The scientists try in efforts to understand the cause and effect of the climate change and the current and future situation of impact to human life. Understanding of the climate change is very important among the policy makers, who can decide the issues of climate change to be integrated into the challenge and agenda of the national and international development programs. But, until now the problems of climate change are being the complexity and still controversially discuss as the complicated global and environmental issues such as global warming and environmental degradation etc.

Based on study, research and development, experience learnt in the past noted that the climate change i.e. global warming has been changed from day to day and caused mainly by humans' activities. In this regard, the carbon dioxide (CO₂) and green house gas (GHG) have been emitted increasingly from burning sources of fossil fuel and particulate matters released from manufacturing industry activities including: cement production, food processing, rice milling, garment and textile, paper and pulp making, brick and kiln sectors... etc. into environment. Other sector-factors related to the changing of climate, such as using of fertilizers, pesticides and livestock farming in agricultural sector, chemicals use in production and manufacturing sector, decreasing of forestry caused by natural depletion and deforestations are involved direct and indirectly which influent to the Ozone layer depletion i.e. climate change.

Cambodian industry is highly energy inefficient, with energy consumption per unit of output being higher and more than two times, comparing to many countries in the region other developed countries. On the basis of studies and survey are currently carrying out on the rubber refining sector, the energy consumption based on the output basis, equivalent to almost doubly more than the international consumption norms, while the energy consumption levels of rice processing compared to international norms, is 30 % higher. So did in the garment, textile and brick kiln sectors. We also observed that in the manufacturing industries such as in the garment, textile, food processing consumed mostly the energy sources from the diesel oil and other fossil fuels

generators, but in brick and kiln sector consumed wood firing as the source of energy generation from the activities of deforestation and environment degradation.

As we stated in the above problems, there will be many options or alternatives for measures to reduce the pollutants emission from deferment sources by the application of technology changing sound environmental and energy efficiency.

7. Policies and Strategies respond to Climate Change in Industrial and Energy sectors

Ministry of Industry, Mines and Energy has focused on preparing an energy policy and energy development plan as a key role for the support other sectors development in the country through transferring of technology on renewable energy and energy efficiency. This institution will play more important role for the future in this implementation plan for reduction the green house gases in terms of preparing the national policy on energy efficiency, other legal aspect and technical guidelines, strengthening as well the capacity of human resources on transferring energy management, green energy and industry, renewable energy and establishment institutional arrangement as well.

Bases on the strategy and policy on the improving knowledge, education and training need assessment and observation on climate change for Cambodia resulted/shown that knowledge based gaps in this regard convey an impressing for the review of across-sectors related on knowledge gaps in the government institutions, universities, other promotional and educational systems in order to support future vision. So that these systems will be adopted and restructured by including knowledge management system and improving knowledge on climate change.

7.1. Industry Sector

A. Energy Efficiency in Industrial Sector

Energy efficiency is what some call the “fifth fuel” — after oil, coal, gas and renewable — and one that addresses the issues of climate change and energy security. Many energy analysts have recognized that energy efficiency as the tool with the greatest potential to concurrently address the basic goals of a country’s energy policy: economic competitiveness, energy security and environmental sustainability. Being an “alternative-energy disadvantaged” country, energy efficiency appears to offer the best solution for Cambodia to meet its climate change targets. In developing country, such a Cambodia is not fully adopted or changed for alternative uses of fossil oil. The alternative approaches such as energy efficiency including energy savings and efficient energy consumption are the best solution for Cambodia enhanced and considered in order to reduce green house gas emission and climate change reduction.

In Industry Sector, the three higher operating expenses are often found to be energy (both electrical and thermal), labor and materials. Among these three components, energy is the most potential in cost reduction especially in Cambodia. Thus, implementing of energy efficiency means one can save a lot of money as well as reduction of environmental impact.

- Food sector
- Rice milling
- Garment and textile manufacturing sector
- Brick and tile production (Brick kiln)
- Paper and pulping paper production

B. Green Industry

Green Industry is industrial production and development that does not come at the expense of health of natural system, or lead to adverse human health outcomes and mainstreaming environmental, climate and social considerations into the operations of enterprises. It provides a platform for addressing global, inter-related challenges through a set of immediately actionable crosscutting approaches and strategies that take advantage of emerging industry and market forces. Green Industry stimulates technological advances and innovation, as well as the development of new industries. It not only reduces environmental impacts but also spurs innovation, thereby creating business opportunities and new jobs, thus contributing to poverty alleviation.

Green industry involves a two-pronged strategy to create an industrial system that does not require the ever-growing use of natural resources and pollution for growth and expansion. These two components are:

- The greening of existing industry
- And; the creation of “Green Industries”.

▪ **The greening of existing industry**

The greening of existing industries is focused on continuously improving resource productivity and environmental performance of all industries, regardless of their sector, size and location. It entails commitment to and action on reducing the environmental impact of processes and products by:

- Improving production efficiency: by using resource more efficiency and optimizing the productive use of natural resources:
 1. Increase the productive use of materials, water and energy in industrial production, through approaches as: dematerialization of products and value chains; use of materials with longer service lifetime; replacement of virgin materials with recycle materials
 2. Using 3Rs concept and measure for industrial manufacturing and SMEs: recycling, reuse and recovery of materials, energy and water and use of materials, water and energy from sustainable managed and/or low impact source;
- Enhancing environmental performance by:
 1. Minimizing environmental impact by reducing the generation of wastes and emissions: minimize and where possible eliminate the creation of waste and emissions within factories, through such approach as: improvements in process operation, monitoring and maintenance; waste minimization;
 2. Application of advanced process technologies with higher efficiencies with high proficiency and specificity, and recycling, reuse and recovery of process streams
 3. Waste management sound environmental by enhancing liquid waste management; proper management on chemicals waste and hazards, highly efficient and effective kiln of waste burning.
- Minimize risks associated with chemicals and (hazardous) wastes: minimize risks associated with production, use and disposal of chemicals through such approaches as:
 1. Sound management of chemicals (aiming to achieve the WSSD 2020 goals); phasing

- out of toxic and other environmentally harmful substances (including those contributing to ozone layer depletion and/or climate change);
2. Application of Best Environmental Practice (BEP) and Best Available Techniques (BAT) to prevent unintended formation and emissions of POPs and other hazardous pollutants;
 3. Replacement of chemical processes by non-chemical processes (biological, physical, ect.); and replacement with safer, more specific and/or more effective alternative chemicals.

▪ **Creating Green Industries**

Green industry is systematically enhancing mechanisms in creation and extension scale the major green industry, which produce goods and services sound safety and environmental focusing on: manufacturing production, renewable energy system adoption/installation, cleaner production development as well as other services such as 3Rs applications, waste management and waste treatment. Furthermore, for dealing with these challenges, green industry will also consider on the consultancy on environment and energy consumption.

By the experiences learnt: new industry the development, increasing an effectiveness of existing industry and impact of green industry application, provided an opportunity and economical benefits, particularly for the developing countries in which the green industry development will gain three benefits in Economical, Environmental and Social. In the mean time, it will also overcome the environmental issues that included climate change and chemical pollution.

Cambodian green industry is adhering to the context of National Green Development and also play an important role for contribution to the manufacturing industry development, small and medium enterprises for the increasing as the national gross domestic products well as.

C. Identification, Assessment and prioritization of pollution and transfer of environmentally sound technologies (TEST and Hot-Spot):

This project's aim is help enterprises to overcome those challenges and obstacles for substantial business process especially, reduce pollution from its operation, which against climate change and increase the green growth in country.

- Hot-Spot Methodology:
 1. Preliminary evaluation
 2. Detailed evaluation based on Biodiversity, Pollution control, Socio-economic and Water quality
 3. Prioritization of pollution Hot-Spots

- TEST methodology:

Transfer Environmental Sound Technology Methodology (TEST) is one methodology, which involves each level of the management and combines the following essential elements such as: Cleaner Production (CP); Environmental Management Accounting (EMA); Environment Management System (EMS); and Corporate Social Responsibility (CSR).

❖ Assessment and Implementation of Cleaner Production (CP):

Cleaner Production and Resource Efficiency is a large objective that not only focuses on technical factors such as social, economic and environment but also deeply analysis on implementation, environment protection and total productivity management. This procedure is used in both manufacturing and service enterprises for resource efficiency as materials, water and energy; reduces green house gas (GHG) other air emissions and wastes; and protect and reduce risk of health and safety for human.

❖ Environmental Management Accounting (EMA):

EMA focus on materials and related cost: the use of energy, water and materials, as well as the generation of waste and emissions, are directly related the environmental impacts of organizations and their products, material purchase costs and materials lost in waste and emissions are the most prominent cost drivers in many organizations. Especially in countries with low enforcement of legal compliance, relatively low labor costs, materials usage, energy consumption, and related losses are a significant cost driver.

❖ Environmental Management System (EMS):

EMS is a systematic approach for incorporating energy and environment goals and priorities (such as energy use and regulatory compliance) into routine operations. EMS is a system of interconnected parts: Environmental policy; Planning; Implementation and operation; Check and corrective action; Management review; with the goal to managing, the activities have or can have environment impacts. In addition, EMS provides a mechanism ensuring that company: Think of environment; decide what company wants to do; works out how to do it; implements as planned; corrects deviations from plan; review its directions for the future for better performance.

❖ Corporate Social Responsibility (CSR):

Responsibility of an organization for the impacts of its decisions and activities on society and the environment, through transparent and ethical behavior that:

- is consistent with sustainable development and the welfare of society;
- takes into account the expectations of stakeholders;
- is in compliance with applicable law and consistent with international norms of behavior;
- is integrated throughout the organization and in its relationships

There are 3 basic criteria: economic; environment; society. Fundamental subjects of CSR are organizational governance; Human rights; labor practices; environment; fair operating practices; consumer issues; social development (community involvement and development)

D. Chemical Management in Industrial Sector:

Although Cambodia is not an industrial country, the industrial sector seems to be developing. Cambodia has more than 700 operating factories relying solely on imported raw industrial chemical materials. The information and available data related to importation of industrial chemical raw materials has been provided by the Department of Industrial techniques, Ministry of Industry, Mines and Energy. This includes proposals for importation of industrial chemicals raw materials proposed by manufacturers and factories. These chemicals are divided into four groups:

industrial organic chemicals, inorganic chemicals, dyeing chemicals, and other chemical substances.

Chemicals provided high advantages for many businesses but at the same time caused negative impacts on both human health and the environment, which in turn cost a lot of money to mitigate the impact and eliminate the problems. So chemical raw materials are the global problem related to climate change. Therefore, the chemical raw materials have the global challenges related to the climate change.

7.2. Energy Development Sector

A. Policies Development in Energy Sector

Energy is a priority sector that we have pay more attention for its development In order to develop the nation economics, because the energy not only require daily needs all of us , but it plays an important role for support other sectors development such industry, SME, trade, agriculture and other services in order to support economic development and growth. The main objectives for country energy development are necessarily, firstly, to supply and produce with sufficient consumption in the whole country, with appropriate price, and sound quality, effectiveness, transparency and sustainability so that this will facilitate and support for the investment and social economic development as a whole.

And secondly, for its development we also would consider furthermore what kinds of energy are least impact on the social environment and for its sustainability. In this regards, the ministry has provided incentives to those energy produced locally such as: hydro, natural gases, coals, biomass, biogases and solar energy production and other sources of energy supply for long-term sustainability and energy import from neighboring countries to ensure that the country will sufficiently supply.

- In the past few years, energy development in Cambodia remarkably progress and achieve the followings:

- ① Rehabilitate and expand the supply of electricity throughout the country
- ② Import Energy in small scale from neighboring countries to supply in urban and boarder provinces
- ③ Established small scale energy supply connection by using diesel machines, renewable energy in to supply to rural and remote areas, put in processing and construct the main hydropower plants and direct high voltage connection from Thailand and Vietnam and as well as coal energy power plant in Preah Sihanouk and other provinces.

- The energy development sector will contribute for socially and economically acceptable development, the said energy policy, particularly directed by the Royal Government of Cambodia as the followings:

1. To supply sufficient electrical energy at reasonable and affordable price throughout the country
2. To ensure a reliable and secured energy supply in order to facilitate the investment and national economic development
3. To encourage for the research and development of non-impact or least impact energy to

social and environment

4. To encourage the effective energy consumption and environmental impact reduction which the energy consumed and supplied
- **To support these said policies, the Royal Government of Cambodia sets the strategies that improve the energy security for the nation as follows:**
1. To foster the energy development in which the country existed, especially for hydro power energy and use this source for high efficiency uses
 2. To foster the diversified electrical energy
 3. To foster and encourage the private investment for electrical supply
 4. To foster the energy business in the region by bilateral and multi-lateral co-operations
 5. To ensure the energy security by the development of local reserved energy.

In this sector development, the RoC defined the National Policy, Master Plan and strategies for long term vision in order to improve the energy security for Cambodia. Especially the national policy for rural electrification in which aims at development of rural areas, poverty reduction and improving peoples 'living harmony at rural. Furthermore, the ROC also will continue to improve additional development of rural electrification and electrical connecting extension from national transmission connection lines, from other sources with cheapest price, as well solar-renewable electrical energy development in which the people in rural areas access to energy consumption. The rural electrification with its following targets:

- In 2020, all villages in the country will access to different source of energy supply
- In 2030, at least 70% of all families will consume and connect with qualified electricity as the connected electricity transmission lines.

B. Energy Development Sound Environmental

Even though the RoC has set the main policy so that the energy supply will cover throughout the country, but the RoC highly consider those energy sound environmental or less impact on environment such as:

Rural Energy-Electrification

The RoC has established an institutional arrangement called Rural Energy-Electrification:

- To foster fair energy supply for all people living in rural areas are able to buy energy at affordable price as a part for contribution in poverty reduction.
- To foster and encourage the private investors in sustain electrical supply in rural areas by introducing the development of new technology and renewable energy.

Solar Energy for Households

The main purpose the application of solar energy system is to support the local investors for insuring the solar energy supply to the household level with reduction cost of their purchasing per unit of solar system. Moreover, for facilitating the people in rural areas, where are not transmitted lines connected to, are able to buy the solar panel for their household uses.

In the transaction stage, the ROC with its effort has replacing gradually of using fuel engines to use other source electrical energy such as buying from neighboring countries and other hydro-power plants in which the prices are cheaper. The electrical energy impost is a temporally strategy or the

means deal with sufficient electrical supply source and in order to extend local electrical market through development the sole national connecting system with highest effectiveness and make the electrical supply more effective stable, safer, and appropriate price. Other efforts, ROC's will deal assigned the following strategic master plan:

– **Small/Medium Hydropower and Renewable Energy Stations**

The main purpose of small and medium Hydropower and Renewable energy Stations is to foster electrical energy plants used the renewable energy technology and supply the electricity for the households' consumption. Meanwhile, the RoC has been continuing to install the biomass, solar biogases in the many rural provinces/areas for the ensuring the remote areas accessed to energy consumption in order to prevent the coal-wood fired and the RoC has prepared the feasibility study and guidance on efficient electrical charging places. As mentioned above strategies, MIME contributes partly for climate change implementation.

8. Propose possible/ existing Specific Sectoral response to Climate Change

8.1. Vision

“Sustainable adaptation, mitigation, prevention and reduction on Climate Change for the manufacturing industry and energy sectors, MIME strongly participate and take responsibility/ functioning with its mandate reflected to global climate change context”.

Nowadays, there is interaction correlation between climate change and daily human activities to our environment i.e. *to be clean and safe environment, a right but not privilege*. Even Cambodia is still at the beginning stage of industrialization, but Cambodia is also considered as country easily faces with impact of climate change. This vision of CCSP on Manufacturing Industry and Energy sectors are to respond substantially of adaptation, mitigation, prevention and reduction on Climate Change for long term in the two sectors. MIME determines necessarily on triple benefits or win-win-win strategies i.e. Environmental, Economic and Social as a whole. This vision of CCSP is up on substantially responsive requirements for short, medium and long terms strategic plan of climate change.

8.2. Mission

Requirements to respond the short, medium and long terms for sustainable climate change vision of MIME, is a required mission in which it will set particularly or specifically agenda in order to ensure for long terms of its achievements and success. The particular agenda will focus on:

- Preparing and supporting in aspect of legal system and policy framework
- Preparing and supporting in aspect of technical standards and guidelines
- Structuring and institutional development and human resource capacity building
- Developing the mechanism for communication, public awareness and information sharing
- Transferring of technology adoption and new technology in terms of knowledge, experience regarding green industry and energy
- Fostering and encouraging for the local research and development on technology sound green

- Mobilization the capital resources and foundation mechanism from relevant stakeholders such as private sectors, partners development and government agencies
- Encourage to private sectors participation for the implementing strategic plan of climate change
- Gender mainstreaming into CCSP for equality of participation and benefits

8.3. Goals and Objectives:

MIME has goals and main objectives with its mandate to contribute, collaborate, facilitate, and share all relevant data, information, knowledge and experience related to its sector for adoption, mitigation, prevention and reduction of climate change. The goals and objectives will address more specifically in short, medium and long term strategic plan, specific plan of action, programs, indicators definition, resources input, expectation results and impacts evaluation. It also will do SWOT analyses, problems solving and forecast for the future success of implementation. MIME will use all existing resources and its capability in terms of soft and hard, definitely collaborated and supported by the development partners, private sectors inside and outside of the country.

Ministerial Technical Team for the development of CCSP for manufacturing and energy sectors has set the goals and objectives as follows:

- Strengthen the capacity of related institutional and human resource development both government and private sectors
- To foster and support equipment facilities and materials in order to facilitate for the implementation of strategic plan
- Establish and strengthen communication and sharing system to stakeholders and vulnerable target groups
- Identify Hot-Spot and gas house emission in manufacturing industry and energy which caused the climate change
- Develop climate change foundation for ensuring long-term substantiality implementation
- Transfer the knowledge, experience and technology in green industry and energy by corporation projects and programs from national and international partners for development
- Create information and data system of source and level of impact related to climate change
- To foster and encourage the researcher and technology creator who will participate support in preventing and reduction the climate change
- To foster and encourage the private sectors participation and vulnerable groups and gender main streaming into climate change
- To motivate and encourage the establishment of R & D institutions in place which support the two sector sound green
- To evaluate and gap analysis the existing legal(s) aspect and guidelines in order that the climate change of two sectors will be integrated consolidated into the new regulation and technical guidelines establishment
- To make the request for new preparing and establishment law, sub-decree ministerial notices, technical norm and guidelines related to climate change of the two sectors and long term legal support for the implementation
- Establish and implement the legislation and regulation included technical standard in green industry and energy

To achieve these goals and objectives as above mentioned , the working group has selected the

existing topics and activities such as: Green industry and energy, energy efficiency, TEST (CP, EMA, EMS and CSR), SPIN, solar energy, wind energy, biomass energy and hydro stations in order to extent from the pilot to scale up for the future implementation throughout the country.

8.4. Strategy Framework

❖ Strategy Analysis:

A. Challenges:

- Inadequate and high cost of electricity supply: the critical problems for the new establishment enterprises are inadequate electricity supply and electricity price a half higher in comparing with imported from neighboring countries
 - Lack of finance and credit: financing through credit and grant are major factor in which industry and energy sectors will enhance and increase their productivity and competitiveness in local and international.
 - Equipment and products supply sound energy efficiency, public awareness, technical capability, skill and budget support are limited, and also inadequate energy efficiency policies, institutional and regulatory frameworks are not in place for effective and sustain promotion throughout the country.
 - Lack of understanding among industry decision-makers and enterprises, of their potential for energy efficiency improvements, in which are concerned with the costs, management, audit and savings of energy and their understanding base on their own intuition of the concepts, with limitation of the data and economical benefits.
 - Insufficient and limited technical capacity within enterprises and in the market to identify, develop and implement industrial energy efficiency projects and measures. Industrial enterprises have shown limited understanding of energy benchmarking, energy system efficiency and impact of operating conditions.
 - Limited to technical capacity of government officials, human resources, and expertise to implement substantive and effective policies and programs for extending perfectly of the promotion and support on energy efficiency to the private sectors.
 - Limited to technical capacity and expertise i private sectors. It is necessarily for private sectors and factory owners need to acquire the particular understanding on situation analysis of energy consumption, energy efficiency and the impact of cause and effect of implementation. A few of export factories had less recorded energy consumption and report system as a base for assessment and develop planning which
 - Insufficiency budget and credit of government institution and private sectors is also the unrests which the private sectors need to develop and install the new technology for ensuring the sustainable of financing or budget.
 - It is still poor for the implementation of energy efficiency in the manufacturing industry sector such as textile and garment, brick kiln, rice processing and paper production as well. It is higher consumed the energy consumption for one unit production.
 - It is still consumed fuel oil and other fuel. It is obvious that the consumption of fuel oil and other in manufacturing is higher in textile and garment, brick kiln, rice and food processing and paper making industries and also are used of firewood that caused to deforestation and environment pollution. These problems could be solved by many selective options in order to reduce the pollution discharged by the demonstration on the energy saving and transfer of environmental sound technology implementation.
 - There are insufficient and limited the data collection on green house gas emission: data of

gases emission, CO₂ from the sources of production. Even there is a scenario or future forecasting on the data of CO₂ in industry sector based on a small scale and pilot implementation and suppose that the CO₂ emission will be increased ten times in 2050.

B. Strengths:

▪ Trade and political globalization

The Kingdom of Cambodia currently has better political stability preferred by local and international investors. It is obviously noticed that the capital investment grows gradually. And recently, the Kingdom of Cambodia has been empowered to be the ASEAN chairmanship, preside over of all the ASEAN meetings, forums and ASEAN plus which illustrate potentially and realistically in ASEAN region and global for coordinating and facilitating all of the historical events that are attracted by many investors in world and the region.

Moreover, the Kingdom of Cambodia has joint as a member of Global Climate Change Committee and other conventions such as Stockholm convention (the Stockholm convention on persistent organic pollutant (POPs) are used in industrial sector and electrical sector and other chemicals and intentionally produced POPs or POPs by-products).

- The Rectangular Strategies for second phase of the Royal Government as a vision**
- National Strategic Development Plan Update, for 2009-2013 and Cambodian Millennium Development Goals as the roadmap and direction for the implementation.**
- Manufacturing industry and energy sectors are core responsible of Ministry of Industry, Mines and Energy**

Royal Government of Cambodia assigned the core role and responsibility to the Ministry of Industry, Mines and Energy to establish and develop the manufacturing industry and energy sectors in the country as an important engine to push national economic growth because the energy is a necessarily input into manufacturing industry and other services. Therefore the energy is the most important factor to participate in many kinds of manufacturing activities in order that it would be diversifiable generated and supplied and ensuring the its sufficient consumption with available cost and least environmental impact to the society .

▪ Appropriate existing laws, policy and capable human resources

Currently the Ministry of Industry, Mines and Energy has annexed fewer relevant laws and policies and many technical guidelines , standards supported for energy and manufacturing industry's implementation and also in process of preparing more in order that ensuring the implementing of sectors will be advantage and competitive .

The ministerial officials mostly are equipped with the qualified decrees and skills from abroad and local guarded in specific fields such as from higher Doctor, Master, and bachelor to technicians. They have also gained more experiences and skills development from time to time through additional training, seminars regarding to 3Rs, green Industry and Energy in abroad and in the country. Likewise, the experiences learnt from the participation in particular projects in term of bilateral or multilateral cooperation such as Cleaner Production, Energy Efficiency, Hot Spot, TEST, Rural Energy Production, Solar Energy, Bio- Energy... ect.

▪ **Natural Resources Opportunities and potential:**

Cambodia has many natural places and water sources, which are suitable for building up hydro station to produce and supply electricity to remote areas and provincial towns. Moreover, Cambodia has many natural resources and tourist places that is why Cambodia government and Cambodia people have to protect and prevent any impacts on its natural resource, especially environment impact. Furthermore, Cambodia is still at the beginning stage of industrialization and the tiny problem faced as industrial pollution. Most manufacturing industries are labor-intensive based rather than machinery and automation technology which feasibility prevents the environment. Base on the experiences noted that only a few particular kinds of manufacturing industries that caused for environmental pollutions.

C. Sector Responsive Strategies to Climate Change:

Ministry of Industry, Mines and Energy has tried to overcome all the challenges and issues as stated above in order to strength effectiveness of its implementation. It implemented the functioning in according with the Government rectangular strategy and national strategic development plan and adapted to the international and global issues and requirements.

The following points will describe more detail of objectives and action plan to adapt, mitigate and prevent all aspect regarding to climate change in the manufacturing industry and energy sectors. These objectives and action plan primarily inputted by the consultants, experts and industrial and energy climate change working group.

Connecting to the context of the National Green Growth; the Green Industry and Energy in Cambodia will play the important role in contribution to industrial and SMEs development, manufacturing industry and energy sectors into the growth of the national GDP and GNP.

The strategic framework and activities for the Climate Change Strategic Plan for Manufacturing Industry and Energy (CCSPMIE) in Cambodia will be included in the medium and long-term strategy as follows:

- Budget support for preparing and implementation of plan of actions
- Preparing strong and transparent laws and regulations
- Gender mainstreaming for intersector plan development
- Coordination, collaboration and cooperation
- Monitoring, evaluation and inspection
- Communication, information sharing and public awareness
- Joint research and development for the whole green society.

8.5. Continuous Implementation Program

The Ministry of Industry, Mines and Energy strongly overcomes all existing challenges in the past implementation plan as above mentioned in order to effectively strengthen of its performance. For following implementation of action plan will comply with policy programs of the ROC, updated National Strategic Development Plan and will be flexible to the occurring current challenges in national and international contexts.

The following sections, in the annexes, will describe the goals, objectives and specific plans of action to adopt, prevent and deal with the problems related to Climate Change of the two sectors, which evaluated and concluded by the Working Group on Climate Change Strategic Plan on Industry and Energy.

9. Validity of Climate Change Strategic Plan

The Ministry of Industry, Mines and Energy has implemented its role and responsibility in conformity to /under the supervision, the management and direction from highest level officers and the Royal Government of Cambodia within its five year mandates. The MIME also prepares the implementation plan in order to develop strategic plan for its sector in according with the agenda and political programs defined by the ROC. So that the validity of prepared strategic plan and its implementation for these sectors on the Climate Change, once five years, but maintains its right and role for reviewing, evaluation and adoption of the plan after five years reflected and flexible to the directed policy programs of the followings ROC.

10. Conclusion

The Climate Change Strategic Plan for Manufacturing Industry and Energy Sectors is a basic and guidance document to assist the MIME, not only for integration of climate change subject into short, medium and long terms of Ministerial Strategic Development Plan, but also for the integration into Cambodian Climate Change Alliance, at MOE. In addition, it will be integrated into the National Strategic Development Plan for next mandate of the Royal Government of Cambodia.

The main purposes of CCSPMIE are to adopt, mitigate, reduce and prevent the climate change of the sectors reflecting to the country priority and global contexts. The changing of behavior for the Climate Change adoption and mitigation are the short and medium terms strategic plan that for all of us cannot refuse and oppose to existing challenges in the global situation that, for all nations and individual have been facing and recognize those problems. We necessarily adopt and recognize it for proceeding implementation and peoples' participation for the harmonization, prosperity and progress in the future. The adoption and mitigation for climate change of the sectors are the changing of our behavior, practice and attitudes in according to the changing of social-economic and environment contexts through urgent measures to acquire the new knowledge, information, experience and all levels of impact to our social, economy, environment and human being at all.

The vision of prevention and reduction for climate change of these sectors, will illustrate and foresee the future implementation of the strategic plan, as the long term, that it will be translated our vision, goal, adjectives and specific plan of actions in which refer to necessary measures in global, regional, national, all level of public and vulnerable target groups. They all directly will implement and take measures as well as the legal, technical regulations, additional participation in the research and development, adoption and acquiring the transfer of technology, creativity, information and data system sharing, capital and resources mobilization, public participation and stakeholders participation such as making decision makers, implementer, promoter, vulnerable target groups. All these relevant partners will develop the measures for preventing, reducing the expected occurrence and respond immediately while the disaster happening. In order to achieve successfully of Climate Change Strategic Plan for Manufacturing Industry and Energy sectors in short, medium and long terms, it is the necessary participation from relevant agencies such as government sectors, universities, privates sector, development partners, equity gender and technical and financial support as well.

Even though Cambodia, the country received impact of climate change from other sources or global challenges, but we, all commit, have a good will to participate in the implementation, sharing our experiences and dealing with the existing problems. It means that our global issues for all of us, the

whole nations so that our living, society, economy and environment, the whole one is harmonized, developed and sustained.

MIME is under direct supervision of the Royal Government of Cambodia, has to function in according to its role and responsibility assigned, will implement the strategic plan for the climate change of the sectors for success in its mandate.

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