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Promoting Private Sector Contribution to the Climate Change Response in Cambodia

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Representatives of over 65 companies, development partners and NGOs provided information through individual interviews and participation in consultations on earlier versions of this report. Line ministries involved in the climate change response also provided comments on key findings and recommendations.

The opinions and recommendations expressed in this report are those of the authors and do not necessarily represent the views of NCSD or CCCA donors.

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EXECUTIVE SUMMARY

A small emitter of greenhouse gases (GHG), Cambodia has seen its emissions increase rapidly in recent years and the private sector accounts for the bulk of these. Most GHG emissions come from the agriculture, land use and forestry sectors. Projections shows that population growth, growing demand for agriculture and forestry products, increasing energy needs will contribute to stronger GHG emissions from the private sectors over the next decades. In addition, **Cambodia's high vulnerability to climate change is likely to have major impacts on many sectors of the Cambodian economy.** The climate change response is twofold: first, **adaptation** measures are needed to enhance Cambodia's resilience to adverse impacts of climate change. Second, climate change **mitigation** investments are key to limit Cambodia's contribution to global climate change in keeping with the Paris Agreement and Cambodia's INDC of 2015.

An overview of main policies on climate change suggests despite efforts made to adopt strategies and policies across a wide range of sectors, **the impact of these policies seems to be rather limited**, for many reasons (poor enforcement of existing laws, lack of institutional capacity, lack of targets, etc.).

Against this backdrop, **this study aims to map private sector's contribution to the climate change response, and to identify policy options whereby the Royal Government of Cambodia could enhance this contribution.**

Most data and information was collected through **direct interviews with some 65 public and private actors**. This being the first study of its type, main challenges encountered were the absence of reliable and exhaustive data sources on private climate-related investments, difficulties to identify adaptation measures supported by the private sector, and issues in covering all parts of the economy (mostly due to the size of the informal sector).

Section two provides an **overview of private sector climate related interventions**. Economic growth over the past decade has relied mostly on the agriculture, construction, garment, tourism and services sectors. Small and medium sized enterprises make up the majority of businesses and provide around two-thirds of the country's employment. The share of the **informal sector** is high, both in terms of contribution to GDP and overall employment. Climate relevant programs and activities were identified through the interviews:

- **In the agriculture sector**, farmers are highly vulnerable to climate change, but cultural habits and weak risk profiles are slowing down adoption of resilience techniques. Economic growth led by the agriculture sector can be considered both as a threat for the environment (agriculture land expansion, illegal activities) and as a part of the climate response (green growth). In this context, **Climate Smart Agriculture** (CSA) is an integrative approach to address challenges of food security and climate change, that explicitly aims for three objectives: sustainably increasing agricultural productivity, adapting and building resilience of agricultural and food security systems to climate change at multiple levels and reducing greenhouse gas emissions from agriculture. Noticeable examples include sustainable storage and irrigation system, dissemination of climate resilient seeds, organic fertilizers, drip irrigation systems, etc.

- In the **Forestry sector**, capacity of Cambodian forests to act as a carbon sink is threatened by illegal activities and impacts of economic and human activities. Unclear legal framework on land tenure, absence of long-term visibility (especially on concessions) and lack of dedicated financial instruments limit private firms' investment in sustainable forest management. Initiatives with most potential for scaling up include r**eforestation, agro-forestry** and **sustainable agri-business**. Among other examples, buyers of sensitive commodities (rubber, acacia, rattan, palm oil, mining) are now putting more efforts on ensuring zero deforestation within their supply chain. The study has also identified a few actors active in the reforestation segment, and valuable examples of **payment for economic services** (PES).
- The **Fisheries sector** is one of the first impacted by climate change (rising waters, saline intrusion, droughts and floods). Yet most identified solutions (mangrove rehabilitation, inland conservation, sustainable aquaculture) have not yet reached scale.
- In the **Manufacturing sector**, energy needs are increasing, fuelled by strong economic growth, and translating into higher associated GHG emissions, especially due to the widespread use of illegal and non-sustainable wood. Climate related interventions carried out by private actors are often concentrated in the energy efficiency segment: intelligent motor controllers, compact fluorescent lamps, energy efficient devices in power plants, etc. High electricity costs in Cambodia (in part, due to a share of imports) provide a strong rationale for reducing use of electricity or for generating electricity on-site (e.g. solar generation, electricity and heat produced from waste). Other private sector climate-related interventions in the manufacturing sector focus on ensuring sustainability of supply chain and adopting quality environmental standards. One of the main obstacles to further investments is the absence of a clear policy framework on the use of renewable energy for on-site consumption.
- The **Energy sector** is facing important challenges, as Cambodia's electricity demand is forecast to increase. Biomass energy (mainly in the forms of woodfuel) accounts for 72% of final energy demand of Cambodia, contributing to the high deforestation rate of the country. Cambodia's high potential for large hydro projects is constrained by the adverse ecological consequences of these projects and their vulnerability to climate change. Cambodia has a vast untapped potential for RE, particularly for solar and biomass/biogas. Private sector investments in this field hinge on the adoption of a new regulatory framework or RE law.
- With regards to **Waste and Water waste**, there is currently no infrastructure for waste sorting, re-using and recycling and the 2015 decree on waste management has not brought noticeable changes yet. Private companies consider waste a growing concern for their sustainability plans. Waste can also be seen as an economic opportunity, as value can be created from recycled waste (energy production, construction material, etc.).
- In the **construction sector**, most construction modes are unsustainable (low quality material, low insulation power, no use of natural light), despite sustainable architecture solutions being available in Cambodia. This has a negative ripple effect on energy needs and in turn, GHG emissions. Low enforcement of urban planning laws and of set back provisions contribute to this issue.
- In the **transport sector**, the fleet of vehicles is dominated by old, highly polluting second hand trucks and cars. Factors include the import tax and duty regime which discourages the purchase

of new vehicles, as well as low standards on motor vehicle fuels. This results in high air pollution levels and high GHG emissions. Cambodia's potential for marine, river and railway freight is high, but still unexplored.

- **Tourism** is a key contributor to Cambodia GDP. While international groups are sophisticated in their approach to climate change (environmental policy), the bulk of local players in the hotel industry lag far behind. Many climate-related initiatives (energy management, waste) could be replicated and ecotourism has a strong potential in Cambodia.
- **Households as consumers** are important actors of the private sector's response to climate change in Cambodia:
    - With regards to **cooking and lighting**, widespread use of fuelwood or charcoal for cooking or water boiling puts strong pressure on natural forests. Low carbon initiatives include bio-digesters, improved cookstoves, water purifiers, solar home systems, etc. Role of NGOs in financing and developing these activities is key.
    - **Transport** of individuals is a fast growing sector, contributing to the increase of GHG emissions. This could be addressed through mandatory fuel consumption, fuel economy, and/or GHG standards for light-duty vehicles.
    - **Responsible consumption**: population of Cambodia is generally not aware of the potential to save energy and reduce associated costs (through behavioural changes or better equipment). This issue could be addressed through labels and standards of electric appliances to promote the purchase of EE equipment.

Section 3 is an attempt at estimating current private sector climate-related investments levels, and the potential to scale up. To estimate current climate investment flows, this study used relevant figures extracted from interviews. The CPEIR climate weighting methodology was applied to classify investments (from climate-specific to marginal relevant transactions). The conclusion is that an estimated **US$185 million were invested by private actors in climate related projects over the past 3 years**. This figure should be treated cautiously, as companies in Cambodia do not account for their climate investments and only 65 companies were included in the sample, but is probably conservative.

This study has identified **five generic barriers that hinder investments to scale**:

- Lack of **information/guidance** on innovative and low carbon technologies
- Some climate friendly solutions do not find **access to finance**
- Low availability of **technical solutions**
- Absence of **qualified human resources and skills**.
- **Lack or inappropriate policies**

This study argues there is a **high potential for scaling up some of the climate activities shown in this report**. Based on respondents' answers, the **main drivers for private climate investments** in Cambodia, are summarized as follows:

1. **Monetary savings on energy costs**: the cost of electricity being high in Cambodia, companies are looking to save energy and/or searching for alternative sources of energy.
2. **Supply chain resilience**: supply chain risks (e.g. business continuity of suppliers during extreme weather events) can be mitigated by working with suppliers to strengthen their resilience.

3. **New market opportunities**: rising awareness of customers on responsible consumption could open markets for green products (environmental conscious tourism, energy efficient products, organic food…).
4. **Compliance:** foreign owned companies **–** or Cambodian companies with business links abroad – are expected to comply with more stringent environmental, social and governance regulations that are in force in other countries, and to apply these in the Cambodian context.
5. Providing **access to essential services** as a means to escape the poverty cycle (clean cooking, clean water, mobility, etc.).
6. **Build new skills and a strong workforce**: addressing significant gaps in technical capacity among the Cambodian active population to address demand of new skills in sustainable development is also seen as a driver for investment.

To complement the analysis on potential for new investments, this study assesses the **current sources of financing**:

- One of the main barriers to better mobilisation of finance for climate projects relates to the special weight of **small SMEs** and of the **informal sector**.
- Both commercial and public sources provide financial support for the development of climate-related projects. Microfinance institutions offer examples of climate related financing (e.g. support to solar home system distribution), while a few commercial banks have or are actively developing an environmental policy, strongly supported and influenced by donors in most cases.
- Overall, there is **a rather modest level of bank engagement and activity in the area of climate-related interventions**, mostly because Cambodian banks are generally under-informed and accordingly not highly sensitized to low-carbon and climate-resilient development, but also because loan financing of company activities remains very low in Cambodia even after years of fast credit growth.
- The **climate risk insurance system** is still very much at the early stages in Cambodia.
- With regards to **carbon markets,** in the absence of clear guidelines, voluntary carbon project developers are hesitant in taking further risks, and advocate for a clear, transparent legal framework.

Public climate finance to support private initiatives identified in this study originates for the most part from international sources, which provide investment finance and/or technical assistance. Cambodia received **US$276 million in climate-related ODA in 2014**. These flows target both mitigation (e.g. funds for energy efficiency and renewable energy such as UNCDF CleanStart Energy Access Window) and adaptation (e.g. Adaptation for Smallholder Agriculture Programme).

Section 5 concludes the report and articulates **20 recommendations** to strengthen private sector response to climate change in Cambodia. They are presented by sector and aim to be operational and to focus on high potential areas. Recommendations were organized along four main categories (information policy, capacity building, regulation policy, financing and economic instruments). As these recommendations consist often of a bundle of measures, **short-term actions** that could kick-start the process and be implemented at short notice are also presented (see table below).

Sector	Recommendations
Energy sector	#1 Adopt a Renewable Energy Policy
	#2 Support sustainable consumption and production of solid biomass energy
Energy efficiency, companies and households	#3 Exempt solar panels and equipment from VAT and duty (households and distributed generation)
	#4 Sensitize and advise the household and business sectors about the EE opportunities and technologies
	#5 Encourage energy audits or adoption of energy management systems in business sectors
Low carbon and cleaner transport	#6 Promote the adoption of cleaner vehicles and cleaner fuels through regulations and economic instruments
	#7 Develop and implement a climate-friendly urban transport Policy in the larger cities
Low-carbon more efficient waste management	#8 Promote climate friendly waste management systems
Sustainable Construction	#9 Incentivize sustainable building and construction
Sustainable tourism	#10 Support Green Hotel Certification
Agriculture, forestry, fisheries, livestock	#11 Create a secure framework for private investment in NRM
	#12 Increase appeal for certified and zero deforestation supply chain
	#13 Reinforce resilience of small producers through training and market consolidation
	#14 Build a resilient agriculture/fishery supply chain
	#15 Provide framework for scaling up climate risk insurance

Sector	Recommendations
	#16 Support and consolidate a low carbon livestock sector
	#17 Embed PES in the legal framework
Cross-sector	#18 Create framework for enhanced PS-RGC dialogue on Climate change
	#19 Develop dedicated loan programme for small- and medium sized EE projects
	#20 De-risk green lending to SMEs and households

ACRONYMS

AFD	Agence française de développement
BCA	Biocontrol Agents
BFC	Better Factory Cambodia
CACIC	Cambodian Agriculture Cooperative Insurance Company
CAIF	Cambodian Automotive Industry Federation
CBET	Community Based EcoTourism
CCD	Climate Change Department
CCFF	Climate Change Financing Framework
CDC	Council for the Development of Cambodia
CDM	Clean Development Mechanism
CEDAC	Centre d'Etude et de Développement Agricole Cambodgien
CFAP	Cambodian Farmers Association of Agriculture Producers
CMA	Cambodia Microfinance Association
CRF	Cambodian Rice Federation
CSA	Climate Smart Agriculture
EDC	Electricité du Cambodge
EE	Energy Efficiency
EMS	Energy Management System
ELC	Economic Land Concession
ESG	Environmental Social and Governance
EU	European Union
FA	Forestry Administration
FDI	Foreign Direct Investment
FDP	Fertilizer Deep Placement
GERES	Group for the Environment, Renewable Energy and Solidarity
GGGI	Global Green Growth Institute
GHG	Greenhouse Gases
GMAC	Garment Manufacturers Association in Cambodia
GPCF	Global Partnership Climate Fund
ICOPRODAC	Improved COokstove PROducers and Distributors Association of Cambodia
IPP	Independent Power Producer
LDC	Least Developed Country
LEED	Leadership in Energy & Environmental Design
LULUCF	Land use, land-use change and forestry
MAFF	Ministry of Agriculture, Forestry and Fisheries
MEF	Ministry of Economy and Finance
MoE	Ministry of Environment
MoT	Ministry of Tourism
MSME	Micro, Small and Medium Enterprise
MFIs	Microfinance institutions
MIH	Ministry of Industry and Handicraft

MRV	Monitoring, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Actions
MNCs	Multinational Corporations
PES	Payment for Ecosystemic Services
PPP	Public Private Partnership
PoA	Program of Activities
QIP	Qualified Investment Project
RGC	Royal Government of Cambodia
RE	Renewable Energy
REE	Rural Electrification Enterprise
REDD	Reduced Emissions due to Deforestation of forest Degradation
REEEP	Renewable Energy and Energy Efficiency Partnership
SAVE	Sustainable Action & Vision for a better Environment
SEZ	Special Economic Zone
SHS	Solar Home System
SME	Small and Medium Enterprise
SWE	Small Water Enterprises
UNDP	United Nations Development Programme
VCS	Voluntary Carbon Standard
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

1. INTRODUCTION

1.1. Background

Cambodia is regularly ranked as one of the top ten countries **most vulnerable to climate change** (Kreft, 2014), with major impacts projected on agriculture, infrastructures (transport, irrigation, and urban infrastructures), and health. Initial estimates indicate that annual GDP growth could be reduced by 1.5% by 2030, and a growing percentage in following years, as a result of climate change. Both public and private investment is required to address these threats and minimize climate change impacts on the economy, business environment and well-being of the population of Cambodia.

While Cambodia is not a major emitter of Greenhouse Gases (GHG), Cambodia is at a **critical stage in the expansion and diversification of its economy**. The Royal Government of Cambodia (RGC) is committed to developing and promoting climate-smart and green technologies, as part of its strategy for green growth and Climate Change Strategic Plan.

Globally, private finance is estimated to represent 62% of total climate finance for year 2014 (Climate Policy Initiative, 2015). In Cambodia, the recent climate public expenditure reviews provide up-to-date information on levels of public financing for climate change, as well as guidance on how to improve the mobilization and management of public climate finance. **Much less information is available on investments from private operators** (households or companies). This information is crucial for the Royal Government of Cambodia to understand the full scope of the climate change response in Cambodia, and make informed policy decisions to facilitate private investment in climate-smart solutions.

1.2. Objectives and outline of the Study

This study aims to map private sector's contribution to the climate change response, and to identify policy options whereby the Royal Government of Cambodia could enhance this contribution.
The report is structured as follows: following this introduction, Section 2 provides an overview of private sector climate related interventions; section 3 attempts to estimate current private sector climate-related investments levels, and the potential to scale up; section 4 concludes the report and articulates 20 recommendations to strengthen private sector response to climate change in Cambodia.

The approach and methodology followed for this study are described in Annex 1. Annex 2 provides an overview of the Climate change challenge in Cambodia and of the policy and institutional framework developed in recent years to address this challenge.

2. OVERVIEW OF PRIVATE SECTOR CLIMATE-RELATED INTERVENTIONS

2.1. Overview of private sector in Cambodia

Cambodia's strong economic growth over the past decade (7% on average in the last five years) has been fuelled by strong contribution of the private sector, mostly in the agriculture, garment, tourism and services sectors. Although the pace is slightly slower since 2013, projections suggest that growth is likely to remain strong. Creation of Special Economic Zones (SEZ), along with relatively low salaries and ASEAN economic integration has contributed to establishing Cambodia's as an attractive destination for Foreign Direct Investment (FDI)[1].

Services, industry and agriculture accounted for 41%, 32% and 27% of GDP in 2012 respectively.

Size of firms

Small and medium sized enterprises (SMEs[2]) make up the **majority of businesses in Cambodia** and provide around two-thirds of the country's employment[3]. Table 1 presents a typology of Cambodian firms, based on their numbers of employees.

- Only 0.2 % are companies with at least 100 employees[4];
- 80% of these large firms belong to the garment, footwear and textile manufacturing industries;
- Close to 98% of companies employ 10 people or fewer.

Table 1: Estimated number of establishments (except street businesses), 2014

Establishments[5]	513,759*
1-10 persons engaged:	501,612
11-50 persons engaged	10,648
51-100 persons engaged:	610
101 persons engaged and over:	889

*****The number of establishments that qualify as enterprises is 1,208[6].

Source: Cambodia inter-censal Economic Survey, February 2015

[1] Source: (Word Bank, ADB, 2014): "Cambodia enjoys an abundance of labour at relatively low salaries that has contributed to high and sustained FDI, which at 8.8% of GDP is considerably higher than neighbouring Lao PDR, Thailand or Vietnam."

[2] Based on RGC's classification: Small enterprises employ less than 50 people and their assets are worth less than $250,000; Medium enterprises employ between 51 and 100 people and their assets are worth $250,000 to $500,000; Large enterprises employ over 100 people and their assets are worth over $500,000. Source: SME development framework sub-committee 2005

[3] RGC. (2013). *Investing in Cambodia 2013-2014*

[4] Source: (Word Bank, ADB, 2014)

[5] An establishment refers to a unit of the place where economic activities are performed and fulfil the following conditions in principle: (1) An establishment is a unit of place which occupies a certain space (1 plot) and in which economic activities are performed under a single management. (2) An establishment has (a) person(s) engaged and equipment, and produces and/or sells goods, or provides services on a continuous basis.

[6] An enterprise is a single unit establishment or a group of establishments whose Ownership of Establishment is one of the following categories: 3. General Partnership, 4. Limited Partnership, 5. Private Limited Company, 6. Public Limited Company, 7. Subsidiary of a Foreign Company or 9. Single member private limited company (source: Cambodia inter-censal Economic Survey, February 2015).

High share of the informal sector

The informal sector can be defined as unofficial business activities, which are not regulated by official labor or institutional regulations. Businesses operating in the informal sector are not registered[7].

- Most studies concur that the informal sector accounts for more than half of Cambodia's GDP: some sources mention shares as high as 80%[8], while some others mention shares of 62%[9];
- Employment is largely concentrated in the informal sector: 77% of workers operate in the informal economy and most of these informal jobs are in the Agriculture sector[10];
- Only larger firms tend to be registered: 3.4% of all firms are registered with the MoC, while most firms are family run businesses;

Sectoral analysis

Analysis of employment by industry, based on the 2014 CSES[11], shows that out of an 8.2 m people workforce (including the informal economy) aged 15-64 years:

- 45% work in the agriculture sector, 24% in the industry sector and 31% in the services sector;
- The secondary and tertiary sectors predominate in the Phnom Penh area and urban areas, while in rural regions, about 57% of the employed population works in the agriculture sector;
- Between 2009 and 2014, the share of the agriculture sector in the employed population has decreased, while those of the industrial and service sectors have increased[12]. Out of 3.3 million households in Cambodia, about 2.2 million households depend on agriculture for their livelihoods[13].

2.2. Impacts and contributions of private climate related investments

This section summarizes the climate-related or climate friendly programs and activities per sector that came out of interviews conducted with 65 organizations. This is by no means a comprehensive list and due to restricted time, important sectors were not covered but would be worth surveying at a later stage.

What sectors are relevant?

The study focuses on the following 'climate relevant' sectors, as defined by Whitley (Whitley, 2015), with a depth of focus, which will be a function of the weight of the sector in the Cambodian economy and its impact on emissions/vulnerability to climate change:

Climate relevant sectors, following ISIC14 typology:

- Agriculture, Forestry, Fisheries

[7] Source: World Bank, Concept of Informal Sector
[8] "Around 80 percent of the GDP in Cambodia is produced by the informal sector", (Heinonen "The hidden role of informal economy: is informal economy insignificant for Phnom Penh's development?, 2008)
[9] "In 2003 the informal economy accounted for 62 percent of gross domestic product (GDP) Economic Institute of Cambodia (EIC)".
[10] National Institute of Statistics - Ministry of Planning, 2007
[11] National Institute of Statistics, 2014
[12] CSES, *ibid*
[13] IES, "Comprehensive report outlining alternatives for power generation in the greater Mekong sub-region", 2015
[14] The International Standard Industrial Classification of All Economic Activities is a United Nations industry classification system. http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27

- Extractives (opted out of the study as active operations in cement, mining, oil, coal, include no, or very marginal climate intervention at the time of writing)
- Manufacturing
- Energy
- Water and Waste
- Construction
- Transportation
- Information and communication technology (opted out in the study as active operations are marginal at this date)

Climate relevant sectors, added in the context of Cambodia:

- Accommodation and food service activities
- Households

As the beginning of each sector paragraph, a blue box puts in perspective the climate activities, benchmarking them against macro-economic indicators such as GDP and GHG emissions (when disaggregated data is available).

The study does not carry out a detailed assessment of the climate benefits of these interventions (e.g. tons of CO2-equivalent avoided), as data is not readily available.

Main findings:

The below table summarizes activities and programs per sector (vertical axis) and generic type of climate-related intervention (horizontal axis).

Table 2: climate relevant activities, per sector

Activities (MDB categorization)*	RE (electricity generation, heat production, transmission systems)	EE (in industry, in commercial-public-residential sectors, in public service, vehicle retrofit, energy audit)	Sustainable construction (bioclimatic architecture, AC and refrigeration)	Agriculture, forestry, land use (climate smart agriculture, afforestation and reforestation, biosphere conservation, livestock, biofuels)	Adaptation (drip irrigation, resilient seeds, information systems, insurance…)	Waste and wastewater management
Agriculture/ Forestry/Fishing	Waste to energy (rice husk gasification, biogas, fish waste)	Upgrade of diesel generator, EE in crop transportation		Reforestation, community forestry, sustainable farming, EIA, contract farming, organic animal feed, organic fertilizer, land use management, value chain efficiency, agro-forestry, certification, REDD+, Trust fund, PES, sustainable aquaculture	Crop diversification, climate risk insurance, drip irrigation, resilient seeds, information and training, tourist attraction through biodiversity/conservation, early warning systems, mangrove rehabilitation	PPP on clean water
Manufacturing	Solar heater, solar roofs, heat capture	Energy efficiency in equipment, retrofit	bioclimatic architecture	Environment Profit and Loss		Wastewater treatment
Energy	Solar roofs, solar plants, education and training, solar charging stations, biodigesters for industries, solar water heater, Total Hybrid solar/diesel generator	Energy Management System (EMS), LPG water heater, efficient fuels		Biogas at commercial scale		
Waste and waste water						Wastewater treatment plant, Landfill up to environmental standards, waste sorting, recycling
Construction	Solar roof	Certification, efficient appliances	Certification			Wastewater management
Transportation		Carbon accounting, ISO and ACI norms				Company transportation on biodiesel, solar trucks for delivery
Accommodation and food services (tourism)	Solar heater, solar roofs	AC upgrade, energy audit, changed light bulbs, effiicent appliances		Organic food, eco-tourism and stays, marine reserve	Community forestry, diversion of tourist attraction to encompass biodiversity/conservation	Wastewater treatment, compost, recycling, waste management, rain water, landfill upgrade
Financial and insurance services	Solar for own operations	LED, new AC			Roundtable on sustainable finance, climate policy, green financial products, green micro-finance, clean start find	
Activities of households as consumers	SHS, waste to energy (biomass, biogas), solar tuk tuk, electric cars	ICS, water purifiers, green charcoal, efficient appliances, vehicle retrofit			Clean Energy Revolving Fund	

Note: recorded through interviews with 65 organizations or individuals

Six main points stand out:

1. Heterogeneity: The sample of 65 organizations or business individuals interviewed, exhibits substantial disparities among sectors based on the scale, ownership, and level of sophistication of their climate relevant activities. For instance, the energy sector is fairly dynamic (if still way below its potential as renewable energy and energy efficiency models are still in their infancy), with solar, energy efficiency and waste to energy solutions covering a wide range of actors from households to big players. The transportation climate solutions are quite scarce, however.
2. Additionally, while international groups (hotel, textile, food and beverage) deployed quite sophisticated approaches to deal with climate change, local companies approaches (SMEs or corporates) generally fall short in scale (although local champions examples are illustrating the successive sections), and investment, which in turn limits their influence.
3. The main drivers, all sectors alike, appears to be economic savings, which build a strong business case for climate investment in the sense that it makes economic sense to invest into climate friendly activities. This is also true for multi-nationals whom country directors are first looking at economic performance, although sustainability values are preached by their head office communication colleagues.
4. At this stage, no company in Cambodia is tracking its climate relevant activities and impacts, except companies subject to GRI and CDP reporting[15]. Hence, respondents had difficulties identifying the climate component of their programs, especially when adaptation is concerned. Hence the report findings are the result of the Consultant's own interpretation, based on interviews and literature.
5. A lot of climate activities cut across sectors: wastewater treatment, waste to energy or energy efficiency for instance could be seen in manufacturing, hospitality and agriculture sectors; biodigesters can be used in the industrial, agriculture and household sectors. Although there may seem to be repetitions in the report, examples have been carefully selected to best illustrate main sector trends.
6. Households in Cambodia are a strong contributor to climate related investments, both as consumers (of low carbon products) and producers/employers (mainly climate smart agriculture). For the purpose of the study, households as consumers are captured in the last section, while their contributions as producers/employers are captured in the agricultural section.

The following sections provide an in-depth depiction of how private players contribute to climate mitigation or adaptation in each of the main sectors. For each key sector, a box summarizes key numbers, key issues as regards to emissions (or sequestration), impact of climate change, and climate activities and their challenges.

The examples and illustrations used have emerged from interviews with respondents, as well as literature. They are not an exclusive list of climate activities in Cambodia, but are reflecting a comprehensive approach including parallels and comparison with neighboring countries.

[15] http://about.puma.com/en/sustainability/environment/environmental-profit-and-loss-account

2.3. Agriculture, forestry and fisheries

This section covers the **largest sector** for Cambodia in terms of impacts of climate change, impacts on emissions and sinks, and income generation for the Cambodian population living in rural areas.

80% of the Cambodian population live in rural areas and depend on agriculture, livestock or fisheries (NIS, MoP, MAFF, 2013). Agricultural production is predominantly carried out by household-scale exploitation. As of 2013, 85% of the total number of households were engaged in some form of agricultural-related activities, and 72% of the total number of households in Cambodia managed a so-called agricultural holding[16], covering a total land area size of 3.1 million hectares (there are 1.9 million agricultural holdings (RGC, Census of Agriculture in Cambodia 2013, Preliminary Report, 2015)). The average agricultural land size per farming household is 1.6 ha (National Institute of Statistics 2014). Among households with agricultural holdings, 73% are engaged in agriculture mainly to meet their personal consumption needs. The percentage of agricultural landless households was 29 in 2011 (Phann et al. 2015).

The management of the environment and natural resources is of great importance. Cambodia's environment is also considered a resource for the world. Part of the Burma Indochina Hotspot, Cambodia is a treasure house of biodiversity, home to 2,449 rare and endangered native species of flora and fauna (IUCN, 2015). However, economic development has led to significant environmental changes since the 1990s.

According to FAO data, **47.4% of GHG emissions** in this country came from land-use change and forestry in 2011. Agriculture and LULUCF (Land use, land-use change and forestry) represented more than **90% of GHG emissions in 2000 (SNC 2015)**, with rice cultivation representing more than two thirds of GHG emissions of the agriculture sector.

In Cambodia however, the natural resources management sector is still at the early stages of modernization, and **agriculture development, based on land expansion until now, remains one of the main source of GHG emissions and driver of forest cover loss**.

Agriculture

Table 3: Key facts and figures for Agriculture

% GDP	27% in 2013 (OECD), 36% in 2013 (ODC)
# companies	72% of household engaged in agriculture holding in 2013
GHG emissions	In 2000: 21.1 MtCO2 (44% of total GHG emissions of the country). GHG from intensive and non sustainable farming (chemical inputs, unrecycled manure…), value chain (transport, drying…), Land expansion threatening forests.
Climate impacts	Droughts and floods affecting productivity
Climate solutions	CSA and sustainable farming (intensification-not extension, information and value chain, risk insurance, waste to energy, labels and certification, agro-forestry, carbon finance.
Challenges	Land tenure, unclear regulation, culture (risk profile of farmers, labor shortage because of rural exit, habits to use old techniques).

[16] An economic unit under single management comprising at least two large livestock animals and/or at least three small livestock animals and/or at least 25 poultry of any kind and/or land with a size of at least 300 square meters, used wholly or partly for agricultural production purposes regardless of title, legal form or size.

This section reflects the profile of respondents that are mainly crop growers rather than livestock producers. Also, the dominant farming system in Cambodia is a mixed livestock / rice system, as rice production depends heavily on draught and manure from cattle and buffalo, so most findings on cultivation may be applied to livestock. This however should not hide the fact that livestock accounts for a substantial part of the GHG emissions through enteric fermentation (ruminants, non-dairy cattle and buffalo), methane emission and nitrous oxide emission from Animal Waste Management Systems (AWMS).

A sector heavily impacted by climate change

Agriculture is **dominated by rice-based farming** systems (including livestock) with most rice production reliant on annual wet-season rainfall. Rubber and other crops come next although there is a strong push from the government to switch to more climate resilient crops (horticulture in particular). This new trend is also echoed by regional buyers that are searching to procure from more resilient supply chain (horticulture helps diversifying revenue sources, hence keep continuity in the supply chain).

Climate change projections show Cambodia becoming hotter, with increased rainfall in the wet season and reduced rainfall in the dry season (SNC, 2015). These changes are challenging for farmers, making it difficult for them to select the optimal time to plant rice and other crops. Farmers suffer **recurring losses through drought periods early in the wet season and through damaging floods**, which occur mainly, though not entirely, late in the season.

Poor soil management using outdated techniques together with **deforestation** and erosion (exacerbated by increasing intensity of rainstorms) are leading to loss of soil fertility in some areas. In turn, this drives increased use of **chemical fertilizers**, decrease soil fertility and carbon sequestration and **increase vulnerability to climate change**.

Climate hazards also have **impacts on later stages of agricultural production**, and through the value chain including the transport, storage, processing and market access stages.

A wide range of actors acts for sustainable farming practices, usually supported by development partners. More recently however, private companies have shown a growing interest in investing into bigger scale and highly productive farming:

- To counter-act the effect of climate change, a number of **development partners** are working with MAFF (Ministry of Agriculture, Forestry and Fisheries) and other in line ministries to empower farmers and raise their awareness on climate smart techniques. The **donors** programs are usually hosted by the government, and are dominating the climate friendly farming practices. (See Annex 4 for a non exhaustive list for donors programs).
- Sustainable farming **private investors** however (particularly supported by foreign loans) remain scarce as they operate in a risky investment context (inefficient market systems, unclear land tenure and natural resource management) although their involvement could create more ownership in the long run than donor programs.
- Finally, a few **NGOs**[17] are active in the DRR (Disaster Risk Reduction) scene through the JCCI (Joint Climate Change Initiative) and local partners (among others CEDAC, NTFP, DPA, My Village). They represent private farmers, the most affected by climate disasters. DRR is not covered in this report, as the area is less relevant for private climate investment.

[17] DCA (DanChurch Aid), Action Aid, Oxfam, Save the Children, People in Need

Climate friendly solutions in agriculture may be grouped under the umbrella concept of Climate Smart Agriculture (CSA).

What is Climate Smart Agriculture?

According to CGIAR[18], CSA is an integrative approach to address challenges of food security and climate change, that explicitly aims for three objectives:

1. sustainably increasing agricultural **productivity**, to support equitable increases in farm incomes, food security and development;
2. adapting and building **resilience** of agricultural and food security systems to climate change at multiple levels; and
3. **reducing greenhouse gas emissions** from agriculture (including crops, livestock and fisheries).

CSA is not a set of practices that can be universally applied, but rather an approach that involves different elements embedded in local contexts. CSA relates to actions both on-farm and beyond the farm, and incorporates technologies, policies, institutions and investment.

The following examples of CSA are specifically chosen for their private sector ownership and their climate relevance.

Access to information systems as a key to productivity

According to respondents, limited adaptive capacity and farmers' risk averseness are argued to be the main factors of Cambodia's vulnerability to climate change. So, access to information on new weather patterns, best time for seedling and new cultivation and harvesting techniques is key to productivity and climate resilience.

Sustainable farming techniques look at providing this information to farmers, hence reducing the risks to climate impacts, through timely activities such as **maximizing crop residue** (no burning), **minimizing tillage** to improve water storage capacity, **rotating crops**, **harvesting best practices** (at maturity, not during rain peaks).

These techniques have mainly been pushed by donors so far, as the current farming system does not provide a mature investment climate (supply chain is not strong enough to attract large private investments). Nevertheless, there is a growing number of private actors that are looking at changing the old habits and decreasing the risk profile of farmers.

- UCA[19] (United Cambodia Agri, a private agriculture consultancy company) has worked with HARVEST (USAID program) to disseminate climate smart agriculture practices among farmers. This includes the purchase of a weather station to collect reliable weather data that UCA and the Provincial Department of Water Resources and Meteorology (PDWRAM) office in Battambang would use for more accurate disaster forecasting for farmers.

[18] https://ccafs.cgiar.org/climate-smart-agriculture-0#.Vrv-BhFL6sM
[19] https://www.facebook.com/ucakh/

- Also a partner of UCA, the NGO iDE[20] has worked with private and public partners (Nestle and donors like IFAD, AUSaid, Canada) on an advisory network system that would improve risk profile of farmers (see Box 1 below).

Box 1: The Farm Business Adviser (FBA) model of IDE

IDE's Farm Business Advisor (FBA) network focuses on reducing the risk averseness of farmers by building their capacity on crop productivity, business entrepreneurship, and climate information through:

1. Assured and demonstrated quality inputs
2. Best practices for farming
3. Market information and climate information, looking at highest ROI

For example, use of an IDE Drip Kit can bring a doubling in the crop production from a given volume of water. The FBA model has to date been funded by grants, but is looking at balancing its revenues through private income from sales and farmers trainings.

Climate risk insurance, much needed but only emerging

Because of their vulnerability to climate hazards, farmers pay the high price of climate change through crop and income losses. Climate risk insurance services are available in other countries, but it is an emerging phenomenon in Cambodia (UNDP, 2013).

- Although insuring against flood or drought is a risky business, the **Cambodian Agriculture Cooperative Insurance Company** (CACIC), an initiative established by CEDAC (Cambodia Center for Study and Development in Agriculture), announced in early 2015 the start of an agriculture micro insurance service to help rice farmers better respond to climate change[21]. Farmers, as private investors, have to pay an insurance fee of around US$10 per hectare each season (depending on type of rice variety). In return, they receive consultation on farming techniques, climate change resilience methods and will get an insurance payout when their crop is damaged either by flood or drought. CACIC is funded from the Netherlands' Achmea private Foundation, and by July 2015 about 60 farmers had signed, registering more than 60 hectares of rice plantation.
- Another pilot example is the climate insurance extended by Forte private company to 60 rice farmers, in July 2015[22]. Although the scheme has already offset damages linked to drought in 2015, if they want to scale up, large insurance companies such as Forte will **need a guarantee system** through which farmers are effectively equipped with climate adaptation measures, which would in turn decrease the risk of default. There are currently no professional farmers associations, with a strong information system in place that would insure farmers resilience against climate change. The **Remote sensing-based Information and Insurance for Crops in Emerging economies (RIICE)** project is working in that direction. **RIICE** is a Public-Private Partnership funded by SDC (Swiss Development Cooperation), in partnership with Allianz, Sarmap company, GIZ, IRRI, and has two objectives: 1. Increase the information on rice growth areas through a remote sensing technology, 2. Provide access to insurance solutions for

[20] http://www.ide-cambodia.org
[21] http://www.phnompenhpost.com/business/insurance-option-small-hold-farmers

governments, agricultural intermediaries (such as cooperatives or rural banks) and individual rural farmers. The project is starting his second phase now and will look at developing the insurance chapter in the target countries, including Cambodia.

- An alternative could be to use the Climate Insurance Fund model (CIF)[23] , which overall objective is to improve access to and the use of insurance in developing countries, providing financing to qualified insurance and re-insurance companies. In addition to financing, the Fund provides technical assistance e.g. for product design and development subsidies to reduce the premium payments for the end-clients. The CIF is managed by Blue Orchard in Cambodia (asset manager), but state of development was confidential at the time of writing.

Contract farming as a way to reinforce farming communities

Contract farming links agri-businesses with small producers in a growing trust relationship, beneficial for all parties. Contract farming allows rice millers and crop processors to be **confident in their value chain, increasing resilience** and longevity, which in turn allows them to invest with serenity in the company's growth.

AFD (Agence francaise de développement) in Cambodia has been working with private companies on contract farming for the last 10 years and the scheme can be described as follows:

1. Producers own their land, receive quality inputs (seeds, fertilizers…), training, and **access to market** through advanced purchase agreement, and are responsible to cultivate the crops.
2. Buyers (a rice miller, an hevea producer…) invests in the infrastructure (equipment for industrial exploitation, access roads, irrigation…), commit to purchase on the agreed terms, and secure income to producers, which in turn increase the latter's **supply chain resilience**.
3. A buyers' obligation is also to help farmers organize themselves through an **association** (cooperative-like) to strengthen their negotiating power, and reach economies of scale. The association can also cover the quality control checks on behalf of the buyers (irrigation maintenance, internal control, improve productions, secure land tenure).
    - **Angkor Kasekam** rice miller was one the first to introduce contract farming with a minimum price based on market. The company is now working with 50,000 farmers in 4 provinces (Kandal, Kampong Speu, Takeo, Kampot), 20,000 of working in association.
    - **Golden Rice** miller is working with AFD on contract farming. The scheme is looking at farm mechanization and seed nursery. The company currently supplies high quality paddy to 50,000 farmers that produce around 100,000 tons or rice / year.
    - Others examples include **Amru** rice (largest rice miller and exporter in 2015) and **Baitang**, that both use contract farming and farmers cooperation to secure their supply chain of fair and organic rice.

Initiated by CEDAC[24] and the CFAP (Cambodian Farmers Association of Agriculture Producers)[25], a growing number of **farmers associations** (cooperative types) have emerged in the last few years, with the aim to improve farmers negotiating power and increase the value going back to the producers.

[23] http://www.climateinsurancefund.com
[24] www.cedac.org.kh
[25] http://www.cfap-cambodia.org/index.php?option=com_content&view=category&layout=blog&id=1&Itemid=1&lang=en

Some of them are using CSA techniques, but very few professional associations are streamlining them at the market level.

Food processors are also gathering forces, as illustrated by the **Cambodian Rice Federation**[26] (CRF) mainly representing rice millers and exporters who are wiling to engage their suppliers with sustainable farming techniques. The most recent strategy, presented at the annual rice forum, is on increasing the value chain through a set of activities for sustainable farming: repair the damaged soils, rotate crops to improve soil fertility, maximize storage facilities, consolidate small exploitation into bigger ones to reach economies of scale, reaching energy efficiency through shorter and more efficient transportation, etc. The Federation members are quite diverse in their views though and fierce competition among rice millers may restrict the strategy roll-out, slowing down the route to supply chain resilience.

Waste to energy: biomass gasification and biogas

Food manufacturers face high cost of energy (see manufacturing section) and sometimes do not have access to the grid. Using waste from biomass is a good alternative for energy generation as biomass waste or manure is readily available in close vicinity to the factory. Biomass is usually burned to produced heat or steam that can power a generator and then produce electricity, or simply left to decomposition to produce biogas.

Rice millers or pig farms have opted for this option mainly motivated by energy savings using **rice husk gasification**, or **biogas from animal waste**. A few have already a power plant in place, of small, medium or large scale, using technologies from abroad or mixed with local solutions.

Some companies have expressed **concerns** on the adaptability of the foreign equipment, and the health issues related to the residue left after the husk gasification (although the ashes are used by Chinese companies as an insulation component in construction material). Additionally, the lack of clarity on expansion of the electricity grid undermines the rationale for private investors to go further.

Nevertheless, a few examples of success may be cited:

- **Angkor Kasekam** set up a rice husk gasification system in 2012 of 2MW, selling excess electricity back to REE (Rural Electrification Entrepreneurs). The company is now considering ISO 14001 that would give broader access to export clients.
- **Golden Rice** has recently invested in a rice husk gasification system that will help reach ISO 14001 certification (with technical support from Proparco).
- **Mong Reththy Group** (MRT)[27] is using animal waste from its pig farm to produce biogas for its own factory (1.5 MW) and bio-slurry to partly cover the needs for fertilizer on the plantations. Additionally, the palm oil waste of MRT plantation is used for gasification that produces 3MW of steam for processing palm oil, and provides energy for the 15 neighboring villages, office, and port around the plantations. The savings on the EDC (Electricité du Cambodge) bill are around 30%.
- MRT has recently partnered with **Bambusa** to look at green charcoal production using waste from bamboo planted on MRT plantation areas (Keo Pos, possibility of a contract farming scheme on 200,000 seedlings, 360 ha, for wood palette but also eatable species).

[26] http://www.crf.org.kh
[27] http://www.mongreththy.com

- **Camagra** is currently ready to invest in a power plant and equipment to produce 10 MW of potential energy, for captive use, using acacia wood chips waste from its plantation.
- With support from EEP Mekong, **CEDAC** has developed biomass (rice husk) gasifiers on a pilot basis, working with three community rice millers whereby the energy produced replaces diesel.
- Finally, 20 MW of electricity are produced in Kampong Speu, by private companies, from sugar cane waste, sold to EDC at less than US$0.10 / kWh (comparable to electricity bought from Vietnam).

Growing emissions from livestock

GHG emissions from livestock come from enteric fermentation; methane and nitrous oxide emissions from Animal Waste Management Systems (AWMS), both gases having a strong emission factor than CO2.

These emissions are expected to grow substantially due to increasing demand for livestock products, in particular meat, linked to the growth in population and real GDP per capita.

At the same time, small and medium scale commercial operations are most vulnerable to climate change and have limited capacity to adapt. Threats include temperature change, precipitation change, change in soil water availability, and changes in frequency and intensity of drought, flooding, storms that affect livestock resilience.

Apart from the biogas national program (see above), very limited information was found on how animal feed could both increase resilience of livestock and reduce GHG emissions in Cambodia, although there is a strong correlation found in other countries. Further research on how improved feeding practices (feed, medication) can lower emission in Cambodia is strongly recommended.

A growing organic and certification scene

Under the climate constraint, the use of organic fertilizers has direct positive impacts on the soil. A recent study (Haitao, Jing, Xiao, Yanhai, Sufei, & Gaoming, 2015) shows that organic fertilizers increase soil resilience to lack of water and temperatures increase and they **mitigate climate through adding more carbon stock in the soil** (contrary to chemicals fertilizers that are high emitters of carbon), reversing the agriculture ecosystem from a carbon source to a carbon sink.

Farmers tend to buy cheaper lower quality fertilizers, but this comes at a higher cost in the long run because of impoverishment of the soil and health related issues. They are now turning to organic production but guidance is missing (there is no national standard for organic production in Cambodia, such as USDA organic, although GIZ has submitted one to the national standard institute). Apart from the bio-slurry (a biogas residue widely used by small farmers using a bio-digester), the existing initiatives for organic production are either from research institutes, or private initiatives but remain small scale.

- CEDAC is working with GIZ currently looking in CO2 reduction and climate adaptation programs through integrated organic farming systems. These combine improved seed (stress tolerant varieties), increased usage of organic fertilizer (sequestration of carbon in the soil), green manure and the substitution of chemical pesticides through the promotion of **Biocontrol Agents (BCA)**. Altogether these inputs increase resilience, as they bring diversification and

more self-reliance in terms of water resources. Not only does this approach reduce costs, it also enables farmers to fetch higher prices. A few farmers have already adopted the technique, while the program will need further risk taking from farmers to scale up in the future.

- **BOF**[28] is an organic fertilizer company selling to SMEs and big companies looking at increasing resilience of their soil or rehabilitate a degraded soil (rubber, pepper, cassava…).
- Green Eagle company and the **Khmer Organic** initiative is working with CEDAC and GIZ on a green center approach where government and private sector would work together to promote bio-fertilizer, and seeds. With Khmer private investment, the partners work on creating a production and distribution channel in Cambodia for organic inputs, while they have been mainly imported until now.
- Through the CHAIN Program, SNV is working with farmers on **PEST and disease management in horticulture**, using BCA (one of the main problem in horticulture), as they evolve with climate change.
- Another climate friendly fertilizer technique, but not organic, is the **Fertilizer Deep Placement** (FDP). Compressed fertilizer briquettes are placed beneath the soil surface allowing nutrients to be released gradually to the root zone. By placing the FDP briquettes into the soil, less fertilizer is lost, which results in better yields and less environmental impact. FBA (see above) is promoting this technique through its network of farmers and farmer advisers.

In parallel, commodities exporters in Cambodia are caught in a **race to standard and certification** that open the doors to a fast growing market. End buyers and commodities traders such as Mars, Marks and Spencer, Carrefour, Olam are putting more efforts into their supply chain, to increase its resilience to climate and other hazards. Examples of certification schemes in Cambodia are as follow.

- The **Sustainable Rice Platform**[29] (SRP) has launched the world's first standard for sustainable rice, which sets new and more efficient standards for rice cultivation, which should increase resilience of end-buyers supply chain. The SRP Standard for Sustainable Rice Cultivation uses environmental and socio-economic benchmarks to maintain yields, reduce the environmental footprint of rice cultivation and meet consumer needs for food safety and quality. Progress is measured against quantitative performance indicators.
- **Confirel**[30], known for its palm sugar products, is certified through a variety of schemes (**AB, KH Bio 154, Jas Ecocert, USDA organic**) to cater an export market that is increasingly looking at sustainable farming practices. Confirel is also using the palm tree waste for gasification providing energy in its factories, in a way to reduce GHG emissions linked to deforestation.
- **IBIS rice** is USDA and EU organic certified (see below).

The strong case for agro-forestry

Agroforestry or agro-sylviculture is a land use management system in which trees or shrubs are grown around or among crops or pastureland. It combines shrubs and trees in agricultural and forestry technologies to create more diverse, productive, profitable, healthy, and sustainable land-use systems.

[28] http://www.bofcambodia.com.kh
[29] http://www.sustainablerice.org SRP founding members are Ahold, Kellogg's, Louis Dreyfus, Mars, Nestlé, Olam, and the Asian Institute for Technology (AIT), and is managed by UNEP and IRRI.
[30] http://confirel.com

Agroforestry is a good alternative to land expansion and illegal activities that are threatening both agriculture and forestry sectors. By adopting agroforestry techniques, community of farmers (indigenous or migrants) can **increase value of their farming products, hence increasing and diversifying their revenues, while combating climate change through ecosystems conservation**. Agro-forestry systems provide three potential mitigation benefits:

1. Sequestration and carbon storage in trees and in soils through mulching techniques introduced. Mulching is a protective covering, usually of organic matter such as leaves, straw, or peat, placed around plants to prevent the evaporation of moisture, the freezing of roots, and the growth of weeds;
2. Potential to offset GHG emissions associated with deforestation. Farmers replace logging by cash crops;
3. Production of high quality fodder for ruminant animals, which could reduce emissions from enteric fermentation.

The following examples are set in a protected areas context, in partnership with conservation NGOs and local authorities.

- **IBIS rice** is a typical example of agro-forestry, involving forest communities into organic rice produced near a protected area, as a way to reduce dependence on logging (see box 2 below). The NGO project is scaling up to a social enterprise profile with business plans to scale up through diversification of products and cross-landscapes approach.
- Bambusa[31] (also seen in the agriculture section) is now working on a **bamboo natural forest** in the Eastern Plain Landscapes (Mondulkiri). The forest is about 1,000ha with 4.2 million bamboo poles, that, if cleaned could become 12 million poles that would be used for outdoor furniture, chopsticks, mat, construction poles, organic fertilizer. The company provides an alternative source of income to forest communities in the protected area of Phnom Prich Wildlife Sanctuary (in partnership with WWF) which in turn secure the conservation of the area. The potential for development is exponential as demand for bamboo products is growing.

Box 2: IBIS rice, a wildlife friendly rice

It is an organic type of rice (USDA "NOP" and EU organic standard), grown in the Northern plains of Cambodia, using agro-forestry practices through indigenous communities. Originally an NGO project (initiated by WCS), the activities are now managed through a social enterprise with the view to scale up production to export volume levels, and product diversification (cereals, crackers…). IBIS is positioned as **'wildlife friendly rice'** with direct positive impact on biodiversity and forest conservation through its sustainability model including re-inforcement of protected areas (Preah Vihear, Bantey Meanchey), land tenure and habitat (giant IBIS and other species) at threat from agricultural concessions. http://programs.wcs.org/smpcambodia/About/Ibis-Rice-Project.aspx

The open question of carbon finance

In a way to account, verify and monitor for the GHG emissions reductions, some companies have chosen to use a carbon finance scheme, calling private investors in or using their own funds to change scale of production, and earn carbon credits (verified by UNFCCC accredited entities) that are sold to

[31] http://www.bambusaglobal.com

private companies (usually seeking the co-benefits of carbon credits). From respondents' feedback, one barrier to further investment in the lack of clarity on the regulatory framework in Cambodia for both compliance and voluntary carbon finance. Investors and buyers would feel more confident if rules and share of proceeds between project developers, communities and the public agencies were clarified by the RGC.

In the agriculture sector, carbon finance is mainly used in projects including rice miller using rice husk gasification or cogeneration as an alternative to diesel or wood fuel or charcoal, or biogas at industrial scale reducing methane emissions from pig manure. Most of the projects were developed under the Clean Development Mechanism (CDM) and were started before the CDM crisis (price dropped from EUR 15 /tCO2e in 2011 to EUR 0.5/tCO2e in 2014). The reduced GHG emissions remain substantial, while the generated income and attractiveness for investors remain modest in the case of CDM.

- **Angkor Kasekam** worked in partnership with Japanese firm Mitsubishi and Germany's development bank KfW on a CDM scheme, with an estimate of GHG emission reduction up to 320,000 tCO2e over a period of 7 years (1.5 MW rice husk co-generation plant).
- To address needs of smaller rice milling installations, CEDAC in partnership with Nexus-for Development has developed a **PoA (Program of Activites) on rice husk gasification**, under the CDM scheme. At the time of writing, the project is awaiting the Letter of Approval from the Ministry of Environment. Once approved, the PoA will be open to private and development actors.
- **The Fairtrade Climate Standard**[32] was launched in 2015 to address needs of farmers to account for their GHG emissions. The standard is combining the Gold Standard GHG accounting system for land use projects together with the Fairtrade economic and social label into one standard. The minimum price and the premium enable to feed an extra fund to be used on adaptation activities for farmers that would be hit by climate disasters. The standard is not yet functioning in Cambodia but a few projects developers have expressed their interest.

RECAP: MAIN FINDINGS ON AGRICULTURE

- If managed in a sustainable way, natural resources in Cambodia can increase the carbon sink. If natural resources are harmed, ecosystem services are depleted and food security threatened. So, there is a strong link between sustainable natural resources and poverty alleviation.
- Economic growth led by the private sector is both a threat (agriculture land expansion, illegal activities) and part of the solution (green growth).
- Farmers are the most vulnerable to climate change, but cultural habits and low risk profiles are slowing down their resilience rate and adoption of CSA techniques.
- Whole/big retail commodity buyers (MARS, M&S, Olam) are re-directing their purchase orders on countries with resilient supply chain (which ensure continuity of supply, respect of sustainability measures, build capacity of farmers on CSA). Cambodia lacks competitive advantage in this area: poor storage facilities, limited irrigation systems, low farmers association rate, poor certified seed production => vulnerability is high and resilience is low.
- Diversification of revenues sources is seen as key to climate change resilience.

[32] http://www.fairtrade.net/standards/our-standards/climate-standard.html

- Contract farming is an interesting solution to build resilience as a group and help filling the gap in infrastructure development when tied up with commitment on local development (storage, irrigation systems).
- CSA techniques have a direct effect on water retention and soil carbon sequestration, ensuring revenues because of a higher resilience of soil. Registration of CSA inputs (climate resilient seeds, organic fertilizers, drip irrigation systems) is slow and burdensome though, so it is difficult to market CSA inputs against illegal inputs.
- There is a need for a completely new way of farming (equipment, techniques), not disturbing soil to deliver on CSA.
- GHG emissions from livestock is expected to grow due to substantially increasing demand for livestock products, in particular meat, linked to the growth in population and real GDP per capita.
- Climate risk insurance is an option to cover cost related to natural catastrophes. For climate risk insurance to scale up, risks must be addressed and measures taken to minimize them.

Forestry

The forestry sector is a fairly modest economic sector in Cambodia (3.2% of GDP, about 7,000 people employed)[33].

As seen in the SNC (GSSD-MoE, 2015), the forestry sector acts as a carbon sink of 24,565.50 GgtCO2e. But these figures are based on 2010 forests inventory and the **sink is being eroded by forest cover loss.**

In many countries, the accelerated clearing of forests for agricultural purposes has resulted in the rapid growth of deforestation. Cambodia is no exception with one of the highest deforestation rates in the world (Trends, 2015), mainly due to the following factors:

- **Land conversions**, mainly driven by ELC-based agricultural activities expansion (Economic Land Concession for rubber, sugar cane, biofuels…) which through massive land conversion from primary or secondary forests impoverish the soils and accelerates GHG emissions (Fox, Castella, Ziegler, & Westley, 2014);
- New roads and other **infrastructure** developments have opened up previously inaccessible areas and led to further encroachment;
- Limited forestry **laws enforcement** which in turn does not efficiently prevent illegal logging, forest cover and carbon sink depletion;
- **Wood as the main source for energy** (cheapest and most accessible for brick making, garment manufacturing and household cooking) (R.JOYA, 2014), with no perspective to see a carbon price that would encourage the switch to renewable biomass substitutes.

Table 4: Key facts and figures for Forestry

[33] http://www.globalforestwatch.org/country/KHM

% GDP	US$390.3 million to the economy in 2011, which is approximately 3.2% of the GDP (Global Forest Watch)
# companies	In 2001 concessions were held by only 17 companies (24 concession areas) with a combined forest area of 4 362 729 ha (FAO, National Forests Products Statistics Cambodia, 2003)
GHG sequestration	In 2000: - 24.5 MtCO2e. According to FAO data, 47.4% of GHG emissions in this country came from land-use change and forestry in 2011
Climate impacts	Act as a carbon sink, but reducing because of deforestation (loss of 1.1% annually from 61.15% in 2002 to 57.07% in 2010 (RGC)
Climate solutions	PES (Payment for Ecosystem Services), reforestation, SFM (Sustainable Forest Management), protected Areas, community forests, landscape approach
Challenges	Illegal activities, law enforcement, no clear regulation

Forests and climate change

Forests are an important part of the global carbon cycle because trees and plants **absorb carbon dioxide through photosynthesis**. By removing this greenhouse gas from the air, forests function as terrestrial carbon sinks, meaning they store large amounts of carbon.

Forests have four major roles in climate change: they contribute to global carbon emissions when cleared, overused or degraded; they react sensitively to a changing climate; when managed sustainably, they produce woodfuels as a benign alternative to fossil fuels; and finally, they have the potential to absorb global carbon emissions into their biomass, soils and products and store them - in principle in perpetuity[34].

In Cambodia until now, private actors have had a secondary role in the sustainable management of natural resources (mainly driven by development agencies and conservation NGOs) and through ELCs have contributed heavily to its depletion; but as the following examples illustrate private actors could also be a strong solution provider in a green growth and sustainable supply chain perspective.

Accounting for Natural Capital: Payment for Ecosystem Services (PES)

Natural Capital valuation (including PES) is a growing field of interest for big corporate players active in natural resources management. PES provides an opportunity for corporates to put a price on previously un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for biodiversity, and hence anticipate and manage climate risks pro-actively, rather than repair damage at a higher cost. This is a strong option to make private actors contribute to conservation and support resilience to climate change of the entire country.

Unlike in Vietnam, there is no legal framework in Cambodia that explicitly defines PES, although it is referred in several texts of laws, and a variety of PES examples witness the growing interest and the potential for success.

[34] http://www.fao.org/forestry/climatechange/53459/en/

Very broadly, PES is considered as any scheme that entails a **monetary transfer for the purposes of conservation** from an 'innovative' or non-public source of financing, often sanctioned by a contract of some form (Milne & Chervier, 2014).
Three types of PES schemes are being implemented in Cambodia:

1. **Biodiversity PES** (community based eco-tourism, direct payment for bird nest protection, agri-environment payments). Payees in those cases are tourists, urban consumers, hotels and restaurants that are ready to pay a premium to access quality products that respect the environment (IBIS rice for example, see box above).
2. **Watershed PES** (not yet successful). In 2011-2014, Fauna & Flora International (FFI[35]), with EU funding, explored a watershed PES scheme in the Atay River ("Stung Atay") catchment, to encourage investment in hydrodam catchments in the Cambodian Cardamom Mountains. Despite a clear economic case, the project was not successful (FFI, 2014)
3. **REDD**+ (Oddar Meanchey community forestry REDD+ developed by PACT, Seima Protection Forest REDD+ developed by WCS). REDD+ stands for Reducing Emissions from Deforestation and Forest Degradation, and includes the role of conservation, sustainable management of forests and the enhancement of forest carbon stocks in developing countries. Both projects use a variety of forest management options relying on forest communities' alternative livelihoods and local governance capacity building. In the absence of national and international REDD+ legal framework at the time of start, both have been developed under voluntary carbon market methodologies (VCS + CCBA), and generate carbon credits to be sold to corporate buyers that are private companies (generally EU and US), driven by internal carbon price policies and/or willing to offset their carbon footprint by financing projects that reduce CO2 emissions of an equivalent volume, through preventing deforestation or degradation that would otherwise have taken place.

   These REDD+ projects follow different methodologies and framework than the National REDD scheme, hosted by the FA (Forestry Administration), strongly supported by donors[36]. The national REDD+ scheme follows different methodologies, is embedded into national policies and mainly relies on donors as buyers of the verified REDD+ credits.

Reforestation[37]

Reforestation on degraded land is a **net gain on carbon sequestration**, as it re-creates a carbon capture mechanism that has been lost through agriculture land expansion, depending on the nature of species planted.

There are just a few reforestation companies that are acting with support of foreign investment (although ownership is Cambodian) planting Acacia, Teak, Eucalyptus or other types of trees for furniture or pulp and paper uses for the export or domestic markets. They are **motivated by new market opportunities as they see long term value in wood as a monetized commodity.**

[35] http://www.fauna-flora.org/explore/cambodia/
[36] http://theredddesk.org/countries/cambodia
[37] Afforestation is the establishment of a forest or stand of trees in an area where there was no forest. Reforestation is the reestablishment of forest cover, either naturally (by natural seeding, coppice, or root suckers) or artificially (by direct seeding or planting).

Most of reforestation companies are classified as ELCs, and hence are subject to ELC regulation, unless they are operating on a private land (as in the case of Camagra). Hence, the **recent change in law reducing the duration of (even ongoing) licenses from 70 to 50 years is negatively impacting the forestry companies,** as they see their number of rotation reduced by approximately 30%. This change also requires the production of a new master plan, as contracts need to be renewed and strategies for income are changing (less rotation means less income while the initial investment remains the same).

- **Grandis** is the only FSC (Forest Stewardship Council) certified company in Cambodia, and is working very closely with communities with the view to secure land tenure and the development of master plans. The company is working in partnership with CI and Wildlife Alliance in their fight against illegal logging.
- **Camagra** is a foreign-owned Cambodian company that started planting Eucalyptus and Acacia trees for pulp and paper export. They operate on a highly degraded land but managed to bring soil fertility to acceptable levels through organic agronomic techniques. Export procedures being too complex, the company switched to supplying the domestic market with vinyl, lamber for furniture, and waste to energy from wood chips. The company generates enough wood waste to produce 10 MW of electricity and is ready to invest in a power plant.

The growing influence of a landscape approach

Worldwide, conservation NGOs such as WWF (World Wildlife Fund), WCS (Wildlife Conservation Society), or CI (Conservation International) are now switching from a purely conservation to a landscape approach, including a new driving force in the fight against deforestation that is the private sector. This inclusion aims to position the private sector as a solution provider rather than a threat to forest conservation.

As seen earlier, private companies through their ELCs are one of the main factor of forests losses (including protected areas), but also the main driver for investment for Cambodian economic growth. So, **natural resource management programs are increasingly involving private actors** as a way to embed sustainability in the landscape and maintain the carbon sink at acceptable levels.

- Conservation International has launched a **Trust fund** that is an innovative way to finance conservation activities through a sustainable landscape management approach. The fund is firstly covering programs in the Cardamoms Mountains, but could also be used in the future by other landscapes programs (other Protected Areas in Cambodia under the management of the Forestry Administration). The activities not only involve authorities (through governance, law enforcement programs) and communities (communities forestry management) but also private actors (companies invested in vicinity of the forests, investors using the fund as a green placement). The fund is managed by Blackrock, an investment broker based in Singapore and is actively seeking to raise up to US$8 millions before end of 2016.
- The quickest wins for landscape approach may be found within the supply chain of major international groups such as Michelin[38], Marks and Spencer, Golden-Agri, Nestle, Olam to name a few, looking for **deforestation-free products**. Those groups have made commitment

[38] Michelin is committed to “develop(ing) a responsible supply chain and reduc(ing) its CO2 emissions by 10%” and to “assess(ing) the sustainable development performance of (its) top 400 suppliers and provide encouragement and support so that 70% of them reach the "advanced" level of Michelin standards”. Source: Company website.

to zero deforestation within their supply chain[39], but how to get there is still a central question. In Cambodia, they may do so through the Impact in the Forest (IIF) initiative (a common project by WWF, Impact Hub, Ennovent and Clarmondial) that is **accelerating business solutions against deforestation.** The program consists of four blocs of activities:

1. Community enhancement (start-ups, impact investors, farmers cooperatives, innovators),
2. Innovation development (entrepreneurship and business development support),
3. Access to finance (green bonds, climate finance financing and/or guaranteeing sustainable landscape),
4. Certification (deforestation free products, in partnership with existing labeling initiatives),

IIF is still at the pilot phase (launch scheduled in Q2 2016 in Indonesia, Nepal, and Mekong region), but a few emerging platforms such as the sustainable rubber roundtable or sustainable mining roundtable may build the business case.

RECAP: MAIN FINDINGS ON FORESTRY

- Cambodia has a high carbon sink mainly due to natural forests, but is threatened by a growing and sporadic economic activity.
- Economic growth led by the private sector is both a threat (agriculture land expansion, illegal activities) and part of the solution (green growth). Reforestation, agro-forestry and sustainable agri-business, if managed sustainably, have the potential to substantially increase the carbon sink.
- End buyers of sensitive commodities (rubber, acacia, rattan, palm oil, mining) are now putting more efforts on ensuring zero deforestation within their supply chain.
- Investors need clear and transparent legal framework on land tenure (currently unclear) and long-term visibility (recent change in concession terms) to recoup investment in a long cycle production sector (10-70 years).
- A few reforestation local champions exist (Camagra and FSC certified Grandis planting Teak, Acacia), but face difficulties due to burdensome export policies, illegal logging unfair competition, recent change of concession terms (consequences on master plan, and EIA report).
- Natural Capital valuation (including PES) is a growing field of interest for big corporate players active in NRM (apparel, commodity, brewery, oil palm…). PES provides an opportunity for corporates to put a price on previously un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for biodiversity, and hence anticipate and manage climate risks pro-actively, rather than repair damage at a higher cost. This is a strong option to make private actors contribute to conservation and support resilience to climate change of the entire country.
- PES is mentioned in numerous legal texts, but there is neither clear nor transparent framework that would encourage private investments. Financial instruments to serve as recipients of PES

[39] In this study, the terms “zero deforestation” and “deforestation free” are used interchangeably.

are missing in Cambodia although a few recent initiatives are trying to fill the gap (CI Trust fund).

Fisheries

A strongly impacted sector

Rising ocean temperatures and ocean acidification in the South East Asian region are radically altering aquatic ecosystems. Climate change is **modifying fish distribution and the productivity** of marine and freshwater species. This has impacts on the sustainability of fisheries and aquaculture, on the **livelihoods** of the communities that depend on fisheries (main income generator for 46% of the Cambodian population (ADB, 2014)), and on the ability of the oceans to **capture and store carbon** (biological pump). The effect of sea level rise means that coastal fishing communities are in the front line of climate change, while changing rainfall patterns and water use impact on inland (freshwater) fisheries and aquaculture.

Additionally, there is a strong link between vulnerability of fishermen and large hydropower plants, which could be identified as a **maladaptation** example. More specifically, **large hydropower plants**, the preferred option for domestic power generation, carry significant environmental risks[40]**.** Risks and costs for fisheries, farming and food security in Cambodia are high because of multiple upstream hydropower dams disturbing flood cycles, nutrient flows, sediment transport and migratory fish breeding, hence depleting the main source of protein for the majority of the Cambodian population.

Fishery activities are also closely linked to farming activities (especially around the Tonle Sap lake), as fishermen are also farmers in most cases.

Table 5: Key facts and figures for Fisheries

% GDP	46% of the population relies on fisheries as main income (ADB 2014)
# companies	90% of fishing is accountable to fishery communities
GHG emissions	n/a, included in the agriculture sector
Climate impacts	Droughts and floods affecting productivity and fish stock, with strong impacts of livelihoods. Oceans capacity to capture and store carbon is decreasing because of acidification and increase of temperatures.
Climate solutions	Sustainable aquaculture, inland freshwater conservation, mangrove and coastal rehabilitation, low carbon technologies (improved kilns, bio-energy from fish waste)
Challenges	Limited infrastructure network in place, illegal fishing, acceleration of unsustainable coastal development

Considering 90% of the fishery activity is captured by community fisheries, most adaptation or mitigation programs including private sector are actually public/donor support to community fisheries.

Mangrove and coastal restoration

Mangrove ecosystems and coastal erosion are particularly vulnerable to climate change, and their degradation can intensify vulnerability. Restoration of mangrove forests can protect shorelines from erosion and provide breeding grounds for fish while also sequestering carbon.

[40] https://wle-mekong.cgiar.org/study-on-the-impacts-of-mainstream-hydropower-on-the-mekong-river/

A few mangrove restoration programs are active in Cambodia and include fishermen as private actors that adapt to climate change:

- The '**Coastal Fisheries resources protection and conservation' program in Kampot is managed by FACT** (Fisheries Action Coalition Team)[41] with technical support of GIZ and financing from the Global Nature Fund (GNF). Activities include environmental education, mangrove nursery preparation, mangrove replantation, cash crop plantation, demonstration garden, species inventory. The program ended in December 2015 and reached 60,000 mangrove seedlings on 25 ha of plantation.
- The fishery department is currently considering options for **REDD+ projects** in Koh Kong, Kampong Som and Kampot provinces, that would rehabilitate mangrove forests as a carbon sink. These plans include high commitment of fishing communities. Details on the plans are not available at the time of writing.

Coastal resources are also coming under greater pressure particularly from tourism development, industrialization and urban expansion. Important development projects along the coast are subject to approval of an EIA (Environmental Impact Assessment), ensuring that any development does not have an adverse impact on coastal zone systems (e.g., reclaiming mangrove areas with dirt fill), but some environmental management plans are insufficient or missing, as witnessed in the recent eviction of private hospitality businesses along the coast of Otres in Sihanoukville.

Private coastal conservation plans are very scarce but worth highlighting for their forward thinking.

- **Songsaa resort** (luxury resort in Koh Rong) is very actively engaged with fishing communities from Prek Svay through its Foundation promoting the **Cambodia first dedicated marine reserve**[42]. The conservation plan covers 1 million square meters. The company is investing its own money in activities including marine reserve management, research and monitoring, land conservation initiatives, research and learning incubator (through alliances with universities in Australia and New Zealand) and environmental education.

Inland conservation programs

Southeast Asia's largest lake, Cambodia's Tonle Sap more than quadruples in size during monsoon season, and flushed the region with water and a variety of fishes. Tonle Sap and the inland waters system in Cambodia support some 500,000 tons of fish each year, and the flooded forests purify water and buffer communities from storms — an increasingly important benefit as climate change makes extreme weather more frequent.

But Cambodia's flooded forests are being destroyed by unsustainable human activities.

Since 2008, Conservation International (CI) has been working with local fishermen to ensure that Tonle Sap Lake and its floodplain remain a healthy freshwater ecosystem able to support Cambodia's people, wildlife and economy. The NGO offers alternative means of income that put less strain on natural resources (use of improved cookstoves), improve access to clean drinking water and expand scientific knowledge about the economic value of the Tonle Sap and the importance of protecting it (sustainable fishing)[43]. Today, CI and partners continue to replant and protect flooded forests in key areas in order

[41] http://www.fact.org.kh
[42] http://songsaa.com/#!/sustainability/initiatives/
[43] http://www.conservation.org/projects/Pages/tonle-sap-lake-conserving-cambodia-fish-factory-mekong.aspx

to increase wildlife habitat and improve fishery productivity, while also working with government and community ranger patrols to prevent illegal fishing and install artificial reefs in critically threatened habitats. This is a strong adaptation projects for farmers/fishermen of the Tonle Sap area.

Sustainable aquaculture programs

Aquaculture in Cambodia in mainly seen in small scale farming supplying a domestic market, although a few medium enterprises are exporting raw fish to neighboring countries (Tilapia, Grouper, Snapper exported mainly to Vietnam and Thailand).

Aquaculture is a good alternative to over-fishing, which depletes the ecosystem services of the marine and freshwater environment, as it favors intensification over expansion. But aquaculture needs to be developed in a sustainable manner. In Cambodia, the ASEAN GAP (Good Aquaculture Practice for food fish) is applicable[44].

A good example is WorldFish partnership with the Fisheries Administration. WorldFish center focuses on **increasing aquaculture productivity** for small-scale producers, **while minimizing impacts on the environment** by developing technologies, improving resource management, securing access to essential inputs and improving connections to markets[45].

The main challenge to further aquaculture development is the **limited infrastructure in place**, such as 'flash freezing' storage facilities or large storage areas for processed fish, and the limited contract farming agreements. If existing, the storage facilities could increase competitiveness of Cambodia on the regional export market, and secure higher revenues back to the fishing communities through purchase agreement with cooperative of fishermen.
In the absence of such infrastructures, the export companies of live or frozen products and processing plants are limited in their investments and growth.

Low carbon technologies in fishing

New opportunities for climate smart investments are seen in other countries in low carbon technologies in the fishing industry. The CCAP (Climate Change Action Plan of the Fishery Administration) intends to use incentives to attract such investments. Future investments in mitigation and adaptation to climate change in the fishery sector may be seen in:

- **Improved kilns for smoked fish**, reducing health hazards and limiting GHG Emissions. The improved kilns are energy efficient (use less biomass fuel for cooking) and can introduce use green charcoal instead of wood from the flooded forest (traditional way of cooking). Some models found in other countries are introducing **solar technologies**.
- **Bio-energy** using fish fat and left over from Prahoc production to be transformed in bio-fuel and used as cooking oil. This is already being done in Vietnam.
- **Efficient fuel and maintenance of fishing vessels** to reduce GHG emissions from low performing engines.

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44 http://www.asean.org/storage/images/2015/December/publication/Guidelines%20on%20ASEAN%20Good%20Aquaculture%20Practices%20ASEAN%20GAqP%20for%20Food%20Fish.pdf

45 http://www.worldfishcenter.org/content/sustainable-aquaculture

- Fishermen are the first hit by climate change (rising waters, saline intrusion, droughts and floods), combing by a growing pressure of large hydropower dams with strong externalities cost, including food security (changing fish migration and breeding patterns).
- A few climate friendly solutions exist in Cambodia (or at the R&D stage) but have not yet reached scale: mangrove rehabilitation, inland conservation, sustainable aquaculture, bio-energy.
- Increasing resilience of the entire sector (fishermen and supply chain, infrastructure development) is a key success factor for private investment to flow at low risk.

2.4. Manufacturing

The manufacturing sector in Cambodia is the main contributor to the GDP, growing at a rate of 13% per year. Main manufacturing outputs in Cambodia include garment (textile, wearing apparel, footwear), food and beverage, tobacco, rubber, agricultural products, and others (bricks, furniture…).

Table 6: Key facts and figures for Manufacturing

% GDP	**32% (industry as a whole) (ODC)**
GHG emissions	0.32 MtCO2e, 0.7% in 2000 (SNC, 2015) (including construction)
Climate impacts	Energy consumption through inefficient equipment and carbon intensive technologies for sewing, dying, heating, steaming.
Climate solutions	Equipment upgrade to energy efficiency, sustainable architecture to reduce lighting and ventilation, alternative sources of energy.
Challenges	Lack of awareness, lack of skills and service providers, access to finance.

The garment industry being Cambodia´s most important manufacturing sector, it is a very influential sector in the country, is often cited as a reference and has been largely exposed to international brand pressure in the past. By consequence, this section is widely focused on garment, as it is also the most mature in terms of responsible business solutions, but also ends with a few remarks on the beverage manufacturing.

According to the NAMA on energy efficiency for the garment industry, Cambodia´s garment industry contributes approximately 19% to the national GDP.

Growing impacts on climate change

- Garment industry in Cambodia is represented mainly by **Tier 1 suppliers** (producing the final goods), as opposed to Tier 2 (supplying raw material such as fabric) or Tier 3 (growing material). As a result, the main impacts on climate change come from the energy consumption in factories (steam, electricity, transport), rather than the use and exploitation of the natural capital (water resources, agricultural products such as rubber, cotton, pulp).
- In a country where energy costs are high, across all sectors, **wood burning boilers** are commonly used due to wood being the cheapest source of energy compared to other energy

sources. 800,000[46] tons of wood are used by the industry every year, according to the recent Flowood study by GERES (R.JOYA, 2014). This is likely to change as natural resources become increasingly scarce due to their depletion. Therefore, the supply of wood for industrial production is **not sustainable**.

- By consequence, inefficiencies in the production process and a disproportionate consumption of high cost energy are a **threat to the competitiveness of the Cambodian garment industry**.

The economic case for energy efficiency

In garment, identified solutions exist and are already in place with the most advanced players. The draft Energy Efficiency NAMA encourages new technologies introduction, through a financing incentive scheme, capacity building and awareness campaign.

- As part of the BFC (Better Factory Cambodia) roadmap, selected factories have undergone **energy efficiency audits** conducted by BFC and private sector experts (Better work, 2009). The results of this study show a variety of opportunities for intervention at a factory level and industry level. Some proven energy saving devices are **intelligent motor controllers, compact fluorescent lamps, electronic ballasts, installation of energy efficient devices in power plants, co-generation.**
- There is also a clear opportunity for **on-site solar energy generation** (see Laurelton case study in sustainable architecture section). But due to the upfront cost of solar and the uncertain future of certain commercial activities in Cambodia, factories have been reluctant thus far to move forward with any energy efficiency implementation requiring a medium or long-term return on investment.
- In other sectors, the **National Cleaner Production Office-Cambodia** (NCPO-C)[47], hosted at the Ministry of Industry and Handicraft (MIH), and funded by UNIDO and GEF, has supported factories since 2010 on their path to energy efficiency and cleaner production (see Box 3 below).

[46] The Flowood study looked at 11 economic sectors (including cooking, but also textile, bricks, ice, rubber, salt refinery, tobacco curing, sugar, smoked fishes, noodle…) to better understand the need for wood from production to consumption.
[47] http://www.cambodian-cpc.org/index.php/en/

Box 3: Energy efficiency by NCPO Cambodia

In 2010, the NCPO selected 52 companies from 6 sectors (garments and handicraft textiles, rice processing, rubber processing, food processing, ice processing, furniture) and exposed them to cleaner production abroad, created success through pilot projects, and promoted clean technologies through South South cooperation (technologies were mainly imported from China, India, Vietnam). Results achieved by the 52 companies in 5 years are noticeable:

- Total investment made is US$9,5 millions with a co-financing of the GEF and UNIDO of only US$2,8 millions
- Annual savings are US$6,6 millions
- Pay back period varies but is on average less than 18 months
- GHG emissions reduction achieved are approx. 450,000 tCO_2e in 10 years (280% more than projected).

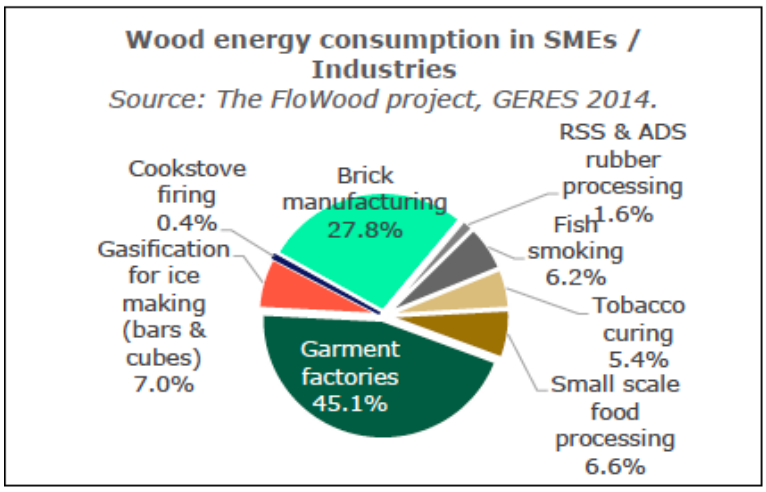
Results are today multiplied through the hundreds of companies following that success story.

Biomass energy

Wood is the main source of biomass in Cambodia, particularly in the forms of wood or charcoal used in the manufacturing sector as heat or steam generation (R.JOYA, 2014).

More recently, a growing interest on waste to energy solutions as an alternative source of energy for the industry is mobilizing investors to the use of sustainable biomass (other than wood or in the form of sustainable charcoal) for the garment and brick industries in particular.

- **GERES** has just won a grant from the CCCA office to finance further study on the use of **renewable biomass for energy, targeting brick and garment factories**.
- **Bambusa and Camagra** (as seen in the agriculture section) are two local companies looking at growing renewable biomass for utility-scale energy production purposes (from bamboo or wood chips waste). These companies have the financial capacity to provide turnkey solution, from the raw material, gasification equipment and converters. Generation capacity could be anything from 2-10 MW.



Source: R.JOYA, 2014

Figure 1: SMEs and industry consume 660,000 tons of wood annually

Sustainable architecture as a way to reduce costs

Three prominent companies are showing that sustainable architecture can decrease electricity bill by up to 30%. They are Laurelton (diamond factory in the SEZ of Phnom Penh), Yellow Pages and Pactics (a textile company in Siem Reap). *(More information and a case study may be found in the sustainable architecture section).*

Sustainable supply chain increasing to meet responsibility and accountability

Ensuring sustainability of supply chain issues for the manufacturing industry is a growing concern. According to a survey led by Ethical Corp (Ethical Corp, 2015), the most pressing risk in the supply chain is **traceability** for 21% of respondents in Europe, while it is **environmental risks** for 20% of respondents in Asia. Hence, there is a direct link between environmental concerns in Asia and the traceability of European and US buyers that have multiplied pledges for more sustainable supply chain.

- For instance, the CanopyStyle initiative gathers 60 signatories (some of them in Cambodia such as Zara, H&M, Levi's) who have committed to **eliminate endangered forests from their fabric supply chains**. Each year, approximately 120 million trees are logged annually for fabrics and about one third of them are sourced from ancient and/or endangered forests [48].
- In Cambodia, major end buyers of manufacturing goods like PUMA[49], Adidas[50], H&M, Levi's, Marks and Spencer, Coles are translating their environmental policy into concrete measures. As most of their carbon emissions come from their supply chain (manufacturing of their products or key components thereof), they work in close cooperation with suppliers in various ways to increase **energy efficiency** (see section above), certify with ISO 140001, have an environmental management system (EMS) in place, and prefer shipping by sea rather than air-cargo (see evidence in the footnotes).
- Additionally, **carbon neutrality** is becoming the norm among global players in this industry with for example Marks and Spencer offsetting 100% of their remaining emissions[51] and PUMA internalizing their externalities in an Environmental Profit and Loss[52].
- Finally, a more recent and accelerating trend in the garment industry is '**coopetition'** where companies who used to fiercely compete would now collaborate and sometimes exchange strategic information to develop climate friendly products (drydrye product line by Adidas), source sustainable cotton, or share information on environmental performance of their shared suppliers (SAVE project by PUMA). A number of industry coalitions are helping those collaborations: Sustainable Apparel Coalition[53], Better Cotton Initiative[54], Climate Neutral Now[55].

As much as reporting and success measurement frameworks are available globally (mainly GRI[56] and CDP [57] reporting frameworks), it is difficult to measure progress in Cambodia as most of the

48 http://www.sustainablebrands.com/news_and_views/collaboration/sustainable_brands/levi's_ms_among_latest_brands_proving_deforestation_

49 http://about.puma.com/en/sustainability/environment/environmental-profit-and-loss-account

50 http://www.adidas-group.com/en/sustainability/planet/climate-change/#/in-kooperation-mit-politischen-entscheidungstragern-und-industrieverbanden/

51 http://corporate.marksandspencer.com/plan-a

52 http://about.puma.com/en/sustainability/environment/environmental-profit-and-loss-account

53 http://apparelcoalition.org

54 http://bettercotton.org

55 http://www.climateneutralnow.org/SitePages/Home.aspx

56 https://www.globalreporting.org

57 https://www.cdp.net

environmental plans are only starting to be rolled-out. However, the PUMA initiative 'SAVE' is a first step towards a sectoral monitoring and evaluation system, with Cambodia acting as a pilot (see Box 4 below).

Box 4: SAVE by PUMA

SAVE is a Public Private Partnership (PPP) project co-financed by DEG and PUMA, which started in early 2013 and finished at the end of 2015. The primary purpose of SAVE is to create more environmentally friendly production sites across the footwear, apparel and accessory supply chain in developing countries of Asia. SAVE targets the manufacturing locations of Bangladesh, Cambodia (where it partnered with H&M), China and Indonesia and has an ultimate goal of reducing their energy, water, waste and greenhouse gas emissions by 25% by ? compared to a 2011 baseline.

Ultimately SAVE will contribute towards achieving a green economy and sustainable industrial development through local capacity building, technical assistance and the establishment of two project support offices, including Cambodia, which will operate beyond the project duration.

Quality assurance for compliance issues

For most of the big brands suppliers, the success factor for energy efficiency and more resilient supply chain starts with the quality assurance system. Consultants and audit companies such as TUV Rheinland in Cambodia can provide technical support to implement norms such as **ISO 14064 (GHG inventory), ISO 14000 (environmental management system), ISO 50001 (energy management system).**
Only selected garment factories (and rice millers, see agriculture section) are applying those norms, usually motivated by compliance requirements of their (global) clients and the perspective to access new markets where quality insurance is the norm.

Beverage, an advanced sector

Beverage accounts for a substantial part of Cambodian manufacturing, with main players such as Coca Cola, Pepsi, Angkor, Cambodia, Kingdom and Kulen among others. The main impacts on climate change are through **energy consumption**, (traditionally through wood, charcoal, or diesel), and **water and waste disposal**. Alternative sources of energy offer a plethora of solutions to decrease GHG emissions as well as the monthly electricity bill (sometimes accounting for 70% of the operations costs). For instance, Coca Cola reduced its energy consumption down to 50% after an energy audit identified solutions such as **LED, heat recovery, routine maintenance, smoke monitoring**. Today, the main factory in Phnom Penh runs at 80% efficiency meanings it saves 20% of energy, hence 20% of labor costs, compared to a baseline of 100% using more energy and labor but for the same output. A new Coca Cola factory is being built which will open its doors in Phnom Penh SEZ (Special Economic Zone) in May 2016 and will cover 20% of its electricity consumption through rooftop solar PV modules; the factory itself will seek the **LEED** silver certification, following the parent company compliance system (see construction section for further information on LEED).

Other solutions in the beverage industry include:

- Transformation of the **cooling system** (solar cooler, eradication of CFC gas through equipment upgrade);

- **Phasing out of fossil fuel** in delivery or on-site transport operations (solar forklift);
- Reduce the raw material consumption: bottles that use **less plastic**, thinner can products;
- **Water management**: reduce volumes of needed water (Coca Cola now uses 1.6l to produce 1l of beverage versus 2.2l three years ago), re-use own water after treatment (for neighboring landscapes or back to the river).

Due to lack of time and sensitivity of the industry, the tobacco industry is not covered in this study. However, it is worth highlighting British American Tobacco's efforts in energy efficient manufacturing in Cambodia.

RECAP: MAIN FINDINGS ON MANUFACTURING

- The manufacturing industry is a growing sector (13% growth per year), with increasing energy needs for steam, heat, electricity, and transport. As a consequence, GHG emissions in this sector are growing fast. Wood burning boilers are commonly used; this is a threat to natural forests.
- Energy efficient solutions exist to reduce energy use and attached costs: intelligent motor controllers, compact fluorescent lamps, electronic ballasts, installation of energy efficient devices in power plant. Competitors are often working together in this area (SAVE project by PUMA including H&M supplier).
- Local champions in rice-milling are using co-generation (electricity and heat produced from waste), while flagship new factories such as Laurelton and Coca-Cola are betting on on-site solar generation to cover up to 25% of their electricity needs and sustainable architecture to use natural ventilation and natural lighting as a way to reduce electricity consumption.
- Ensuring sustainability of supply chain issues for the manufacturing industry is a growing concern. The most pressing risk in the supply chain are traceability and environmental risks that together combined, increase pledges for zero deforestation supply chain.
- Quality environmental standards also gain increasing interest among the regional garment factories, as a way to comply with export market minimum environmental norms.
- A lack of clear guidelines and policy framework on the use of renewable energy for on-site consumption or production are holding off private investors to invest further, although the potential in the manufacturing sector is high. See Energy section hereafter.

2.5. Energy

This section covers the energy production sector including production for captive use by economic agents (energy solutions at the household level are covered in the Household section, below). Generic issues related to EE are also discussed here.

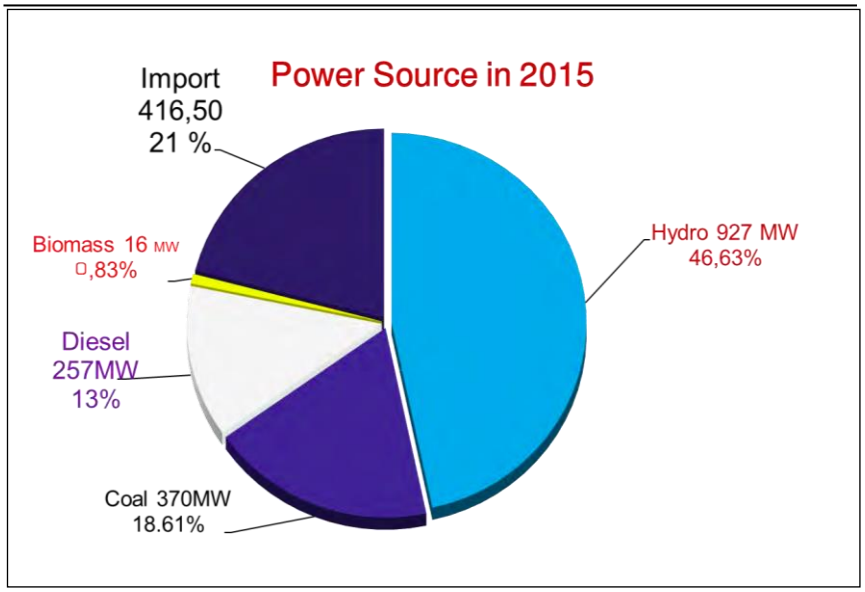
The following paragraphs quickly analyze the power sector situation, and give examples of alternative energy solutions provided by a dynamic and growing number of renewable energy businesses.

Table 7: Key facts and figures for Energy

GHG emissions	2.76 MtCOe (6% of total GHG emissions; 31% residential, 26% transportation, 14% Energy, 12% manufacturing) (SNC 2015)
Climate impacts	Deforestation as main source of energy is wood. Other GHG emissions are from heavy fuel and coal (import), inefficient network systems, diesel generators.
Solution	Renewable energy sources (solar, biomass energy, biogas), or energy efficiency systems (EMS, equipment upgrade)
Challenge	Lack of awareness, lack of skills and service providers, access to finance, unclear grid expansion, lack of RE target, tax on clean energy technologies is still relatively high

Power sector overview

- Electricité du Cambodge (EDC) is the national state-owned utility, producing and supplying electricity to Phnom Penh and other major centers while **rural areas either have no electrification (50% of households, or 35% of villages are connected in 2015)** or are supplied through various rural electricity enterprises (REEs). EDC operates only in areas with the most potential for quick cost recovery, which leaves enormous gaps for the private sector to engage remote areas with innovative solutions.
- Domestic capacity for power generation in Cambodia increased from 308MW in 2009 to 4713 Gwh in 2014 and 5990 Gwh in 2015 while the national grid network has increased to reach 55.37% of households in 2015 (MME 2016). This has contributed to the RGC making steady progress towards its overarching electricity access targets as per the Power Generation Plan 2011-2020 (100% of villages to be electrified by 2020 and 70% of households by 2030).
- The **demand for electricity in Cambodia is outpacing the growth in generation capacity,** however**,** under the impetus of a growing manufacturing sector (Mekong Strategic, 2016); there is a constant need to implement generation facilities in order to keep ahead of demand.
- In 2013, Cambodia consumed a total of 3.552 million kWh of electricity, but about 64% was imported from neighboring countries (EdC, 2014). The government's stated goal is to extend the grid to 100% of village by 2020, and 70% of all household by 2030, according to the MME Energy policy.
- According to government projections, electricity demand in the country will reach almost 8,000 GW by 2020. The Power Development Plan 2008-2020 indicated that hydropower would account for more than half of the total installed capacity by 2020, followed by coal, gas, imports, diesel and HFO (EIC, 2013).



Source: MME 2016

Figure 2: Power Sources in 2015

Energy environmental impacts, only 6% of GHG emissions in 2000 (SNC 2015)

- Worldwide, the energy sector is the first source of GHG emissions, while in Cambodia it comes after agriculture.
- Many options for domestic power generation such as hydropower and coal-fired stations carry significant **environmental risks**[58] (risks and costs for fisheries, farming and food security in Cambodia and Vietnam because multiple upstream hydropower dams disturb flood cycles, nutrient flows, sediment transport and migratory fish breeding.)
- Also, climate change promises greater frequencies and intensities of heat and drought. So more than half of the world's hydropower and thermoelectric generating **plants could find their capacity reduced**[59].
- Due to the number of large hydroelectric stations on the upper Mekong River, the planned projects in Cambodia are **unlikely to produce at nameplate** capacity, as are subject to agreement of neighboring countries also depending on the Mekong river for their power supply.
- Beyond electricity, the demand for energy translates into **pressure on natural forests**, since the first source of energy is fuelwood, generally from unsustainable source.

In light of the strong impacts of fossil fuel-based energy generation on climate change, **renewable energy technologies seem to be well placed to ensure energy security**.

[58] https://wle-mekong.cgiar.org/study-on-the-impacts-of-mainstream-hydropower-on-themekong-river/
[59] http://ecowatch.com/2016/01/07/hydropower-climate-change/

The growing potential of solar

- PV-generated electricity has a number of environmental benefits, primarily through the **displacement of existing generation plants** using carbon intensive fuels such as heavy fuel or diesel. **For each MWh of solar generated electricity in Cambodia,** on average **0.67 tCO2e are displaced,** as the grid emission factor suggests (IGES, 2015).
- Due to increasing economies of scale, more efficient designs, and advances in materials and manufacturing, the price of solar has become very competitive. In Cambodia, solar installations above 1MW can now provide electricity profitably for as low as **12 cents/kWh** (Mekong Strategic, 2016).
- Cambodia has considerable potential for the uptake of distributed renewable generation with **one of the best solar resources amongst ASEAN** countries (ADB, 2015). The highest potential is seen in energy intensive users such as factories and commercial buildings, because of the **attractive dynamics offered through scale, ability to pay, and sensitivity to high electricity tariffs** relative to other customer segments (Deloitte, 2015). SEZs (Special Economic Zone) are a good example of that potential to scale, as they hold energy distribution license (so factories on-site could sell surplus electricity between each other), as well as tax incentives (no import duties for goods in SEZ).

Given the good grounds, a growing number of solar suppliers are now looking at supplying urban and rural energy solar systems. They also act together through the SEAC (Solar Energy Association of Cambodia) that aims to organize the market, set quality standards for solar, and advocate for a stronger regulatory framework that currently hinders the development of this industry..

Examples of a myriad of private projects and initiatives include:

- **Solar Partners Asia** (SPAC) has implemented the first solar power plant in Cambodia (5 MW) for captive use.
- **Kamworks** installed the first grid-connected solar roof at Don Bosco school in Kep in 2012, replicated in Sihanoukville in 2014.
- In February 2016, Phnom Penh Special Economic Zone (PPSEZ) has signed an agreement with **Clean tech Asia**, a Singaporean clean energy firm, to install and operate a solar panel system inside the 357-hectare industrial park. Size and and capacity fo the power unit were not communicated at this stage.[60]
- **TOTAL Cambodia** proposes hybrid solar/diesel generators, particularly suitable for Telecom base station, or hotels that need a constant and reliable power supply. The solar panels are supplied by TOTAL partner Sun Power[61].
- At the time of writing, most solar suppliers are busy answering a tender for 10 MW solar farm Boo project, in Bavet city, Svay Rieng province. Tender is closed on 22 March 2016.
- AFD and the EU are supporting the **rural electrification program** of MME through a concessional loan scheme (credit line of US$15 million to FTB) that enables REEs (Rural Electrification Entrepreneurs) to switch from diesel to solar energy generation. This will provide access to clean energy for farmers currently in off grid villages.
- Most solar companies plan to continue growing their business through the upcoming public tenders on solar plant, solar roofs and solar farms.

[60] http://www.phnompenhpost.com/business/industrial-park-install-solar-energy-system
[61] http://us.sunpower.com

Refer to the household section for household-level solar devices.

Waste to energy, a cheap and accessible renewable energy

Agricultural residues (rice husk-straws, maize, cassava) are a ready source of energy in Cambodia, where some 80% of the population is rural and dependent on agriculture. Cambodia's biomass energy potential is vast and diverse, with large concentrations of **agricultural residues** in the lowland corridor, extensive tracts of land suitable for growing feedstocks for biodiesel and ethanol production, and many farms with sufficient livestock and collectible manure for the operation of biodigesters.

- Most of these applications occur in the manufacturing, agriculture and households sectors (see Manufacturing, agriculture, and household section).
- But it is worth highlighting the UNIDO initiative, partnering with REEs, to provide rural energy to industrial pig farms, through **commercial biogas** (1,500 to 30,000 pigs). The technology would provide enough electricity for on-site use, or sell the extra to EDC or REE or unlicensed companies on mini-grids (1,5 MW saving 1,3 million tCO_2e in 15 years). The program has just started in July 2015, and is now in feasibility study with three components: capacity building of agri-business and REE, insurance and quality control and finance (through FTB loan). This is an interesting example of private companies taking the investment risk of a climate related intervention, although UNIDO would provide a risk guarantee.

Energy efficiency, a quick win that remains unexplored

A growing number of companies are considering energy efficiency measures as a way to input less energy resources for the same or even better energy services such as lighting, cooling, processing and cooking. This includes the generation and distribution of electricity, the manufacturing of industrial products, and the processing of food, air conditioning in buildings and the use of electrical appliances in households, as described in other sections.

A few examples that are cutting across all industries include the following:

- There is an existing draft for the **Energy efficiency policy** in Cambodia (MME, 2013), still under consideration by the MME, although some measures could be a quick win for the economy and the environment. At the same time, a few actors are already offering their services, in a way to push new market opportunities (see examples below).
- Part of the AFD support to the MME on rural electrification (see above the 'Access to finance for electricity and water') is the technical assistance provided by GRET and Artelia, both private companies contracted by a public actor. They are working with SMEs (design companies) in a PPP agreement with Rural Electricity Entreprises (REE) and Small Water Entreprises (SWE) to offer **energy efficient solutions for the distribution network of electricity and water in rural areas** (up to 25% energy efficiency being gained by SWE). Services by SMEs include upgrade of water pumps, streamlined designs of water provision, improved cable installation and procurement quality.
- Schneider electric is the leader on energy efficiency and **Energy Management System (EMS)** in Cambodia. Products are time management, lighting management, motor protection, control command systems… for clients such as commercial building, residential, infrastructure, utilities, datacenter... Since EMS is new in Cambodia, it requires technical skills that are not yet available in the country. To respond to this challenge, Schneider has set up partnership with

training centers (ITC, NTTI, Don Bosco, Centre Kram Ngoy) that are acting like laboratories to supply the market with highly needed skills.

- It is unfortunate that a promising program, **'Meet-Bis'** (Mainstreaming Energy Efficiency Through Business Innovation Support, a SWITCH Asia project), had to end its operations in mid 2015, due to the close of activity of its main implementer (ETC-foundation). The program was meant to support private actors (EE suppliers and developers) through a market support approach (technology development, financing support, marketing and sales training). Remaining partners argue that a similar initiative would still be highly needed in Cambodia. After only 1.5 of operation, Meet-bis managed to get a MoU signed with MME, partnerships signed with 6 EE/RE suppliers, marketing support material for EE/RE suppliers shared to the network. Amount of private money invested is unknown, but a few actors have contracted loans and debt into EE appliances (see Box 5).
- Camcona is the only company in Cambodia providing **hybrid Solar-LPG water heating systems** (see Box 5 below). Clients are mostly hotels, hospitals and commercial buildings (spa, sport club using water intensively).

Box 5: Harmony Phnom Penh

Harmony, a 68-room hotel, has worked with Camcona and Meet-Bis on an energy efficiency plan in 2014. The hotel has opted for a Rinnai centralized gas water heating system that provide the following benefits:

- Over 50% cost saving by replacing electrical heating with gas heating (up to US$10,000 annually on electricity bill)
- Short payback period: < 3 years
- Environmental saving: 73 tCO2e/year through switch from diesel generator to solar/LPG heater

In the future, another sector worth exploring is the cement industry (mining and production). The industry does not appear in the 2000 GHG inventory, but would today represent a substantial proportion of GHG emissions, given the three operating/projected factories. At the time of writing only 2 companies have been identified as 'climate aware' (JV between Siam Cement and K Cement, and JV between Chip Mong and Siam city cement), but only the latter could be reached for interview. The CMIC (Chip Mong Insee Corporation) holds a mining license in the Kampot region. The company has the plan to install a cement factor on the mining site, following the good environmental practices of its shareholders. Energy coproducing and heat recovery, among other climate related investments, are central components of the factory that is due to open in 2017.

RECAP: MAIN FINDINGS ON ENERGY

- Cambodia's electricity demand is forecast to increase and the RGC has indicated investing in sustainable energy is a priority (NSDP, CCCSP, etc.).
- Prices (levelised cost of electricity) of some RE generation technologies such as solar and on-shore wind have fallen in recent years.

- Cambodia has a large potential for large hydro projects but the ecological consequences of these projects (on water availability, deforestation, biodiversity, food security…) and their vulnerability to climate change (droughts) argue for a more diversified electricity mix.
- Cambodia has a vast untapped potential for RE particularly for solar and biomass/biogas.
- Biomass energy accounts for 72% of final energy demand of Cambodia, contributing to the high deforestation rate of the country.
- RE generation capacity expansion can happen in very decentralized ways and close to consumption points, reducing the need for costly grid network expansion investments, and creating lots of new jobs.
- However, this potential could only be unlocked if the policy and regulatory framework is changed, in essence allowing the private sector to invest in RE generation capacity, included distributed generation.
- This framework would also restore a level playing field between grid-supplied electricity which is VAT-exempt and household-level solar products such as SHS that are subject to VAT and taxed on import on material (7% solar PV, LPG…).

2.6. Waste and waste water

This section is cross-sectoral as issues regarding waste and waste water treatment programs and activities are present in most of the industry sectors including manufacturing (beverage section with examples of Coca Cola), agriculture (biomass waste), accommodation and food services (compost). Examples may be found in those sections and they are not repeated here.

Similar to the transport sector though, there is a clear opportunity for PPP (Public Private Partnership) in waste and waste-water treatment. The climate benefits of waste practices result from avoided landfill emissions, reduced raw material extraction and manufacturing, recovered materials and energy replacing virgin materials and fossil-fuel energy sources, carbon bound in soil through compost application, and carbon storage due to recalcitrant materials in landfills.

Due to time restriction, only two examples are briefly described below, but a more thorough investigation would be needed to have a complete picture on the opportunities for private investments.

The **PPP for clean water management in Phnom Penh** brings together the French private companies Safege (on quality control) and Vinci (on pumping station) and the Phnom Penh water Regie (for piping). The project aims to bring clean water to 100% of Phnom Penh households and businesses (including hotels). The project is running until 2017 and is using a GIS (Geographic Information System) technology to detect losses (reduced to 7% only in 2015).

GAEA, the private company managing the landfill in Siem Reap, is considering an upgrade of the current system that would involve the decommissioning of the current landfill, and opening of a new site complying with international environmental norms (geo-membrane, pumping system…). The company is currently working on an EIA, motivated by active participation of its shareholders (Devenco, Dragon Capital funded by IFC-EU among others). Parallel discussions on waste to energy are on-going (conversion of methane to partially cover the electricity needs of the city). This second phase of development is a longer-term scheme, and will require active involvement of the municipality of Siem Reap.

RECAP: MAIN FINDINGS ON WASTE AND WASTE WATER

- Industry (tourism, manufacturing, construction) waste (solid and water waste) is growing and will grow further; potential is high and growing.
- There is currently no infrastructure for waste sorting, re-use, recycle management system.
- Private companies have high expectations, as waste is a growing concern for their sustainability plans.
- Waste can be seen as an economic opportunity, as waste management is a business in itself: value created from recycled waste (energy production, construction material, compost…)
- A sub-decree on waste management exists (July 2015) but does not offer options for sorting, recycling.

2.7. Construction

Given the massive growth in new construction in a country like Cambodia, and the inefficiencies of existing building stock, the construction industry has an important role to play in the fight against climate change.

Table 8: Key facts and figures for Construction

GHG emissions	**In 2000: 0.31 MtCO2 (including manufacturing) (SNC 2015)**
Climate impacts	Increased energy consumption due to inappropriate construction design
Climate solutions	Bioclimatic architecture and construction design.
Challenges	Lack of awareness, anarchy in application of the law, access to finance, taxes on renewables, lack of building code that enforce energy efficiency concept.

Impacts, at the cross roads of mitigation and adaptation:

- Greenhouse gas emissions from buildings primarily arise from their consumption of **fossil-fuel based energy**, both through the direct use of fossil fuels and through the use of electricity which has been generated from fossil fuels (such as heating, ventilation, and air conditioning (HVAC), water heating, lighting, entertainment and telecommunications).
- Significant greenhouse gas emissions are also generated through **construction materials**, in particular insulation materials, and refrigeration and cooling systems as well as **transport** of these materials from production plants to building sites and **demolition** of the building (and recycling of their parts, where this occurs).
- It is not commonly known but climate change is also affecting the construction sector. The higher frequency of storms (Cambodia receives backdrop of strong typhoon passing by the China sea) increases the winds in urban areas, where frenetic rise of tall buildings is narrowing the channels for the wind to evacuate. New buildings lack resilience and are not equipped to **fight strong winds**, so damage of estates accelerate, the risk of collapse increases and the real estate stock value decreases.
- Also, **inappropriate** architecture and **construction** design force energy consumption and GHG emissions increase.

Sustainable construction: the natural choice for bio-climatic buildings

Cities in Cambodia look like a permanent construction site as new buildings and renovations reshape city landscapes. This provides ample business opportunity for both SMEs and large firms. Brick and tile manufacturers constitute the majority of suppliers, and most of new buildings are copies from Chinese style long and narrow housing designs (ptea veng) that are fit for Chinese cold weather but not for Cambodia hot and humid climate. Also, new designs of fancy buildings require material from abroad, hence increasing GHG emissions due to transportation matching the construction industry growth.

This situation is quite unfortunate considering that one of the most influential architect for **bio-climatic construction, Mr. Van Molyvann**, and with him a historical know how, is originally from Cambodia.

Green buildings developers are driven by **new market opportunity**, motivated by **cumulative benefits of bioclimatic construction**:

- Natural ventilation, wall insulation, roof and window shading reduce need for AC
- Right orientation of building on the land reduces needs for lighting
- Wastewater management reduces the need for fresh water sourcing
- Local material sourcing reduces costs of transportation.

While the green architecture and construction sector is still quite small in Cambodia, there are a few foreign-led activities that are worth bringing light on.

- The local firm **Archetype**, recently authored design improvements for a diamond factory in order to achieve LEED[62] certification (Leadership in Energy & Environmental Design). Unilever Phnom Penh has also used Archetype green building services for its newly built office back in 2012. See Box 6 below.
- **Pactics**[63], a textile company in Siem Reap, has completed its green building factory in 2013, using all available solutions such as louvers, natural shades, natural light, good orientation, wastewater management system. The company is now looking at ISO 14001 certification and a way to replicate its success through peer teaching with other factories in the country.
- A number of social entreprises are offering local construction material (**My dream home**[64]with pressed bricks, other companies with bamboo poles) as an alternative to concrete. This serves projects that have a strong environmental focus, combined with a restricted budget, catering a domestic individual needs. Although their market share is small at the moment, demand is growing.
- Numerous opportunities to avoid GHG emissions in buildings may also be found through energy efficiency measures all throughout the building lifecycle (retrofit, AC maintenance, etc.). These are captured in the energy efficiency policy that advocates for energy efficiency standards and labels, but the policy is still under consideration of the RGC.

[62] LEED is a green building certification program originating from the US that recognizes best-in-class building strategies and practices. http://www.usgbc.org/leed
[63] http://pactics.com
[64] https://www.facebook.com/mydreamhomekh/

Archetype and other green designers are also part of the green biz at Eurocham, advocating for a **green building council** that encourages high environmental quality standards for all buildings in Cambodia. This council may not see the light before 4-5 years (time horizon it took for Vietnam Green Building Council to be created), and a new construction code should be in place first, but these are good grounds for improvements.

Box 6: Laurelton, a new LEED certified factory in Cambodia

In 2015, Archetype won the BCI FuturArc Green Leadership Award 2015 in the commercial category for its sustainable design of the Laurelton Diamond Manufacturing Factory in Phnom Penh. This award follows a continuous effort of the company Laurelton to align with LEED (Leadership in Energy & Environmental Design) level 1 certification through its master plan, natural ventilation, material sourcing, a solar shield covering up to 15% of the factory daily electricity needs when at full capacity (currently covering more than 50%). The LEED certification added up 5% to normal cost of construction, but saved the factory 40% costs in water reduction design techniques and 15% in electricity consumption compared to conventional construction.
Total invested budget for this factory was US$517 per sqm, or a total of US$6.5 millions.

RECAP: MAIN FINDINGS ON CONSTRUCTION

- Construction sector is growing in an unsustainable way (low quality material, low insulation power, no natural light), which increases energy needs and in turn, GHG emissions related to energy needs.
- Sustainable architecture solutions are available in Cambodia (quality local material, sustainable design services, home country of bio-climatic construction).
- But the low enforcement of urban planning laws (set-back in particular), and the lack of building code infringe private investment in sustainable construction.
- Local champions have recently proved that sustainable construction is also a business case (reduction of energy costs) and are together working on a Green Building Council (following the example of Vietnam) that should incentivize further investments in that area.

2.8. Transportation

Due to time restriction, this study could only briefly touch on the transportation sector.

This short section covers the freight situation in Cambodia, while individual vehicles are covered in the households' section.

1. Freight by **road** is by far the preferred option. Cambodia's road network consists of 38,870 km of national roads (11%), provincial roads (9%) and rural roads (80%). The national roads connect Phnom Penh to the main provincial capitals and border crossings with main vehicles used being motor vehicles (cars, minibuses, pick-ups, buses, trucks, motorcycles). The network is in constant rehabilitation, as it receives pressure from an increasing an inefficient truck system. Most GHG emissions are coming from energy combustion, particularly damageable as truck engines follow no quality standards,(engines are old, second hand, being fixed multiple times).

2. Both **marine** and **river** transport play significant roles in linking Cambodia's economy to international markets. Sihanoukville Autonomous Port, the country's only deep-sea port, has seen its quantities of cargo, containers and vessels steadily increase since 1996. At the confluence of the Bassac, Mekong and Tonle Sap Rivers, the port of Phnom Penh occupies a central position in river transportation. Same as the trucks, the ships are in bad conditions and not carbon efficient.
3. Cambodia's **rail** network was built between 1929 and 1942 (385 km Northern Line), and in the 1960s (266 km Southern Line). The country is rehabilitating its two main railway lines – the Northern and Southern Lines – and supporting the Trans-Asian Railway which will run from Singapore to China and Russia and from South Korea to Europe. Rail improves air quality as trains consume less fuel and emit less CO2 than the fleets of trucks.

A variety of solutions exist to **reduce emissions in the freight sector** in Cambodia. Typically these solutions are mainly motivated by compliance requirements within international groups.

Solutions at the global level include:

1. Reduce mileage (fleet tracking and performance), like the DHL Go Green program,
2. Reduce fuel consumption for a given mileage (driver behavior and fleet safety, cost reduction and fuel economy, sustainability) or use efficient fuel (as offered by TOTAL in Cambodia)
3. Select sea-leg options that are more energy efficient (depending on weather forecast based on wind, streams, direct or indirect routes),
4. Providing shippers with emissions reporting, and the option to select greener routes, rather than merely the quickest or cheapest route option.

Two illustrations relevant for Cambodia are worth highlighting:

- A promising plan that may have big impacts in the future is the new sustainability plan adopted by the **Airport concession** (part of the French company Vinci). At the global level, the group has adopted in 2015 a revised environmental policy, mainly driven by certification schemes. Vinci Cambodia is now **considering norms such as ACA[65] (Airport Carbon Accreditation) and ISO 14001**[66], which may have big impacts in the future in terms of energy efficiency, more efficient fleet of ground vehicles, waste management and other environmental issues. Vinci Cambodia has also a good base for improvement with a carbon audit, made by GERES back in 2011 and subsequent measures were taken mainly in energy efficiency devices. But the airport is better known for its wastewater treatment plant, one of the first to be operated in Cambodia.
- The country has only two railway lines, with a total length of 650 kilometers. In 2006, a project to rehabilitate the dilapidated railway was launched with the support of ADB, Australian government and OPEC Fund for International Development67. In December 2012, Toll Royal Railway, a company holding a 30-year rail operation license, announced the inauguration of rail services on the southern line. Cost overruns and resettlement problems have significantly

[65] ACA is about reducing carbon and enhancing airport sustainability, http://www.airportcarbonaccredited.org/about/whos-behind-it.html

[66] ISO 14001 environmental certification provides a framework for environmental management best practice to help organisations: minimise their environmental footprint.SNC.

[67] http://www.opendevelopmentcambodia.net/briefing/cambodias-railway-system/

slowed down the operations although an **improved railway system** could bring substantial benefits to Cambodia. From an economic point of view, railway transport, particularly over long distance, is both cost and time saving. From an environmental perspective, rail transport can **improve air quality as trains will consume less fuel and emit less CO2 than the fleets of trucks** currently responsible for transporting goods in Cambodia.

- But railway development often comes with challenges as it involves relocation of communities to accommodate the projects. Railway development could also pose dangers to the environment. Railways often span vast territory, which may comprise agricultural lands, forest, rivers and other sensitive areas. Environmental impacts could be felt if the project is not properly studied, or if there are inadequate plans or mechanisms in place to minimize and mitigate potential impacts.

RECAP: MAIN FINDINGS ON TRANSPORT

- Freight is a fast growing sector as following the economic growth of Cambodia, and fossil fuels remain the prime source to meet the needs of the sector.
- Cambodia's fleet of vehicles is dominated by old, highly polluting second hand trucks, which are imported into the country without regulation. Quality standards for vehicle fuels are low. This results in high air pollution levels and high emissions of GHG (inefficient cars).
- Potential for marine, river and railway freight are high, but still unexplored.

2.9. Tourism

Tourism in Cambodia is growing every year and has more than quadrupled in the last 10 years. In 2014 there were approximately 4.7 million foreign and 8.7 million domestic visitors. The tourism industry is almost completely run by private sector micro enterprises and SMEs. Tourism SMEs are tour companies, restaurants, guesthouses and hotels, and transporters (boat, taxi, bus) that are not necessarily mindful of climate issues. In contrast, big groups such as Sofitel[68], Intercontinental, or private luxury hotels such as Shinta Mani, Aman, Songsaa and 4 Rivers are pushing for more responsibility and accountability within the industry.

Table 9: Key facts and figures for Tourism

% GDP	**16% of GDP in 2014 – 713,000 jobs – 14.7% of total capital investment (Source: World Travel and tourism council, 2014)**
# companies	11% of country employment in 2014.
GHG emissions	5% of GHG emissions in 2013 (Ministry of Tourism, 2016)
Climate impacts	Growing tourism increase GHG from hotel energy consumption, food waste, waste water, visitors transportation
Climate solutions	Energy efficient appliances, compost, no plastic policy, efficient transport
Challenges	Lack of awareness of the industry and visitors, lack of skills

[68] http://www.accorhotels-group.com/en/sustainable-development/the-7-pillars-of-planet-21/carbon.html

Impacts: the pressure of the most dynamic sector

The sector is exposed to numerous direct and indirect impacts from climate change.

- Sea-level rise and more acidic oceans is threatening coastal tourism infrastructure and natural attractions. Climate change is leading to changes in biodiversity, affecting eco-tourism.
- The contribution of tourism to greenhouse gas (GHG) emissions is rising as tourism activity is growing (transport, energy consumption, etc.).
- The sector also faces impacts of a more general nature: more expensive insurance (from more extreme weather), reduced water availability, reduced food security and greater conflict affecting some communities in which it operates.
- Tourism will be affected by policy changes and efforts to reduce GHG emissions causing global warming, especially in the context of the steep growth in its emissions.
- Emissions from transport and the built environment account for 95% of tourism's emissions (according to a recent study by CISL – Cambridge Institute of Sustainability Leadership)[69], meaning that reductions from those two sectors will dictate much of its mitigation potential.

See Annex 8 for an infographic on 'tourism on the move in a changing climate'.

Climate investments in tourism: an exponential and easily replicable potential

Hotel chains mentioned above present a wide range of **activities or integrated programs** in the area of:

- **Energy consumption**: use renewable energy when possible (solar roofs, biogas for staff canteen), replace old devices to energy efficient ones (digital timers, motion sensors, low energy light bulbs, solar heater or mixed with LPG), AC upgrade with regulators;
- **Conservation**: promote biodiversity and conservation (Songsaa Cambodia first dedicated marine reserve), tree planting (Accor Planet 21 program);
- **Waste**: reducing, reusing and recycling, waste water treatment and grey water used for outdoor areas, waste minimization policy, procurement program that favors avoidance of over-packaging and purchase of durable items, paperless policies, solid waste management (compost to up to 100%), promotion of organic agriculture within their supply chain, disposable cups, bamboo straws (Shinta Mani).

These climate-related investments are easily replicable given the rapid growth of the industry and the multiplicity of its actors (majority being SMEs).

Energy saving

- The main motivation from the hotel industry is energy savings, because of the high cost of electricity. Most of the hotels can achieve up to 30% of energy saving after changing their AC and lamps to more efficient devices, or having invested in solar roofs or solar or LPG heater. This is a substantial saving on bills that may reach US$30k or 50k a month, or US$300k-500k a year, according to respondents.

See the Energy section for further details.

Waste

[69] http://europeanclimate.org/climate-change-implications-for-tourism/

- The question of waste is a central concern in the hotel industry of Cambodia. In Siem Reap, some city hotels are joining Shinta Mani Club Hotel to enact eco-friendly practices popular among Western tourists70. New activities include reducing garbage output by 50% by turning it into compost, replacing plastic straws with bamboo ones, and ceasing to use plastic bags for deliveries replacing them by linen or recycled packaging71.
- In 2014, Amansara hotel in Siem Reap announced that they are composting 100% of their compostable waste.
- Various hotels and food places in Siem Reap have followed but it remains a restricted group. Compost is generally used in hotel gardens or given to farmers, and cooking oil to hospitals (to be turned into biodiesels).

Box 7: Accor Planet 21 program

In June 2015, as part of PLANET 21 program, the Accor hotel Sofitel Phnom Penh Phokeethra launched its newly built garbage room, which helps the hotel to support the local community hired to separate the waste into different categories, and reuse some of the material. Some of these materials are sold while the rest is collected by the trash truck. This helps by encouraging reducing, reusing and recycling the waste and supports this new recycling industry in Phnom Penh, creating jobs for local residents. With this new garbage room, waste is collected systematically and in an orderly manner.

The hotel has gradually changed all the light bulbs to energy saving ones, saving between 25% to 80% of energy than traditional incandescent bulbs.

Ecotourism

- Cambodia also offers also vast opportunities for eco-tourism, meeting a growing demand for a responsible tourism supporting biodiversity and conservation. Eco-tourism, as defined by The International Ecotourism Society (TIES), is ”responsible travel to natural areas that conserves the environment and improves the well-being of local people”. It prioritizes conservation, communities and education, allowing tourists to not just gain new experiences but also enhance their worldview through a mindful interaction with their destination.
- In Cambodia, 15-20 Community Based EcoTourism72 (CBET) sites are already in operation around the country, with the most well known being the homestay and adventure tour in Chi-Pat in Kho Kong province73. The CBET works with **forestry communities, diversifying their incomes, which among other benefits divert illegal logging**.

[70] http://www.khmertimeskh.com/news/10673/siem-reap-hotels-go-green/ Georges Rhumerie, Mad Monkey Hostel, Chanrey Tree Restaurant, Khmer Cuisine, and Sokha Boutique Resort, Restaurant and Spa have all committed to making the switch from plastic to bamboo straws, and from plastic to linen bags for all deliveries.
[71] http://www.cleanbodia.com
[72] http://www.tourismcambodia.org/cbet_sites/
[73] http://www.chi-phat.org

Awards

- A few awards for clean hotels are in place such as the Ecoaward by H.E. Prime Minister Hun Sen, in partnership with the MoE and MoT, a Cambodian Clean City Standard every 3 years (Daun Penh won in 2015), and a newly launched ASEAN Clean Tourist City award that plans to enhance the ability of ASEAN tourism to address the climate change issue.

RECAP: MAIN FINDINGS ON TOURISM

- Hotel industry is key to Cambodia GDP. International groups are sophisticated in their approach to climate change (environmental policy), while SMEs (most of the players) are far behind.
- Local champions are found in Siem Reap, Phnom Penh, Koh Rong, and there is a strong potential for replication and domino effect due to the rapid growth of the sector. Ecotourism has a particularly strong potential to raise awareness on sustainable tourism.
- However there is very limited awareness on the benefits of low carbon measures in the sector.
- ASEAN green awards and Cambodian hotel ratings offers framework for improvement (mainly on energy and waste) but are not well known.

2.10. Households as consumers

This section captures the climate relevant activities of households as private consumers (their role in climate adaptation as producer/employer is captured in the agriculture section).

Unlike the corporate actors, the households are contributing to GHG emissions not through production activities[74] but through their domestic consumption and use of emitting devices. Households are also part of the solution when they opt for green products, accelerating new markets for responsible consumption, and investments into the green economy.

However, this study only considers products acquired by households that emit GHG in delivering the services for which they were acquired. The two main such services are cooking and lighting, and mobility (individual transportation).

1. Cooking, lighting

Essential services and their impacts on climate change

Cambodian population is 70% rural and for a large part still deprived of grid electricity. In common with most developed countries, people have to generate or source their own energy. Biomass that people source themselves, often in unsustainable ways, is the main source of energy in the country (R.JOYA, 2014). As such the **household is a main direct contributor to GHG emissions**. Through their needs for cooking, lighting and moving around, households have a tremendous leverage to reduce GHG emission at the individual level.

[74] The line is often blurry for those rural households that produce for their own consumption.

In the last 15 years, NGOs have been the main essential services providers to households with a clear goal to **accelerate access to clean energy for all**. Those pilot projects are now going mainstream and follow a strict market based approach with the view to create new demand, new products, and solidify private entrepreneurship. So, as much as climate benefits are clear and have in some instances been accounted for, the **main driver for the projects today are new market opportunities** and empowerment of the SME sector to provide essential services in a sustainable way. Also worth noting, for the purpose of scaling up, a few of the SME examples below are using carbon finance (a private investment scheme) to scale up their operations.

Efficient cooking

According to the Energy Efficiency policy (MME, 2013), the use of biomass is the preferred option for cooking and other residential purposes. The potential for energy saving however could be up to 30-50% through introduction of improved cook stoves, and char briquettes, substituting fuel wood and charcoal.

- **GERES flagship cookstove 'New Lao Stove' (NLS)**[75] has been introduced to the market in the 1990's, for its energy efficiency attributes (25% energy saving) and was one of the first project at the time (early 2003-3013) to use carbon finance to upscale production and distribution. GERES created the ICOPRODAC (Improved COokstove PROducers and Distributors Association of Cambodia, a private cooperative) to improve industry collaboration on commercialization and price. ICOPRODAC is becoming more and more autonomous in growing the market, while continuing working with GERES on a national standard for clean cookstoves in the country.
- SNV project **'Market Acceleration of Advanced Clean Cookstoves in the Greater Mekong Sub-region'** is a four year project (March 2015-March 2016) to accelerate the market for advanced biomass stoves which are cleaner and safer than other biomass stove alternatives (up to 90% efficient). The project is targeting about 50,000 households and has a central result based finance component to incentivize buyers (stove auction phase to select the most competitive stoves to be launched on the market). SNV will do quality control of the stoves dissemination, technical assistance, and monitoring and verification of the entire program.
- Households may also be using green charcoal as a substitute for charcoal. The social enterprise SGFE (Sustainable Green Fuel Entreprise) is using **waste from biomass to produce energy solutions** (coconut shell briquette, rice husk palette, waste of gasification, charcoal waste), reducing the need for woodfuel. The company is ISO 14064 certified and used carbon credits sale in the past to leverage private investment (SGFE equipment saves 16 tCO2e for each tonne of charcoal produced).
- Hydrologic social enterprise[76] is a producer and distributer of Ceramic Water Purifiers (CWP) that provides **clean water through a filtering system that avoids charcoal/wood use from water boiling**. The GHG emission avoidance are net, and the project is saving up to 80,000 tCO2e per year (certified under the Gold Standard carbon finance scheme). The success story managed to balance revenues from carbon finance, impact investment, crowd funding, MFI and grants and is now on the right track to become sustainable.

Biogas for cooking and lighting

[75] http://gsea.regions.geres.eu/category/stories-of-transformation/
[76] http://www.hydrologichealth.com

Biogas, particularly that from livestock manure, is another renewable energy option for Cambodia. Cambodia's biogas programs promote the use of cattle, buffalo, and pig manure as biogas feedstock, particularly for household cooking and electricity generation.

- The **National Biodigester Programme** of Cambodia, initially launched by SNV and now under MAFF, has reported very favorable conditions for the market uptake (availability of input, local construction materials and technical skills for plant installation, and competitiveness of biogas, given the high price of electricity).
- Since 2015, SNV technical assistance is targeting self-sustainability of the national biogas market (make it work without subsidies) with quality control and maintenance service for customer satisfaction.
- The market potential is estimated at 500,000 households although the technical potential for biogas production in Cambodia is limited by the nature of farming practices and their smallscale.

Interestingly enough, those actors are working in close circle and trust, which witness the needs for NGO projects to transform into sustainable market based approaches. SGFE was originally a GERES project and became a spin off in 2010. SNV and SGFE are now working together to integrate green charcoal into the new cookstoves scheme. GERES, SNV and Hydrologic are all members of Nexus-for Development.

Solar lighting

Only 35% of total population has access to grid electricity – mostly in urban areas, which means that more than 1.6m rural households depend on kerosene & rechargeable car batteries for basic lighting and electricity, with a cost up to US1/kwh. Solar Home Systems (SHS) and solar batteries provide increasingly popular and alternative solutions to households that are in effect purchasing low carbon solutions.

- Kamworks launched the moonlight lantern in 2006 and is now focusing on SHS solutions through an innovative mobile money '**pay as you go'** system serviced by WING.
- Schneider Electric is partnering with Rich Grid to install 10,000 SHS in rural areas.
- Launched in 2015, the SNV program on solar home system (SHS) and solar lighting kits is supported by AFD, and includes private service providers (solar suppliers) and MFIs. The program targets 25,000 rural households over 4 years starting with a strong awareness raising campaign, to create trust in an un-mature market. The program centre piece is a **quality assurance system** that accredits solar companies that commit to promote only high quality products and provide customer care service. A quality label (the good solar initiative[77]) has been developed. Additionally, support by MFIs reduces loan cost,. Through the sale of 25,000 SHS, an estimated turnover of US$10 millions and estimated loan disbursement of US$6 millions have been projected. Partners in the project are MFIs (LOLC, Vision Fund, Kredit, TPC), a growing number of solar suppliers (4 currently accredited: Energy solutions, LES, Kamworks, Ptea Baitong), a training center (Picosol), and business manager expert (EMC), and a marketing/sales agency (17 triggers).
- Other companies providing rural solar solutions include LES, Khmer solar.

[77] http://www.goodsolarinitiative.org

2. Moving around

While the transportation section earlier presented the emissions related to trucks, trains, ships, airplanes, this section focuses on passenger cars and other vehicles meant to move people.

The largest sources of transportation-related greenhouse gas emissions in Cambodia include passenger cars, pickup trucks, and minivans.

Public transportation is still underdeveloped (recent bus system in Phnom Penh). Also, while the private ownership of cars is still quite limited, its fast growing rate threatens to worsen the impacts on climate change.

Table 10: Key facts and figures for Individual transportation

% GDP	(Not likely any data here as most vehicles are imported)
GHG emissions	0.696 MtCO2e in 2000 (SNC 2015)
Climate impacts	Second hand cards are emitting more GHG than new cars
Climate solutions	Promote hybrid energy efficient cars
Challenges	Affordability of cars from grey market (90% of car park)

Dumping ground for old foreign cars

- The majority of greenhouse gas emissions from transportation are CO2 emissions resulting from the combustion of petroleum-based products, like gasoline, in internal combustion engines.
- **Older vehicles are generally less fuel-efficient and release more pollutants into the atmosphere**. Furthermore, within the automotive market, environmentally-conscious recycling and disposal of car batteries makes a large difference to the environmental impact of the industry and requires effective oversight.
- 90% of Cambodian vehicles are being exchanged on the 'grey market' (second hand cars with dubious origins). Cambodia is the last country in ASEAN with no restriction on car imports. This encourages imports of poor quality second hand cars, through a 'grey market' causing problems in safety and environment.

Regulation as a way to promote efficient cars

- 21 international car brands have set up operations in Cambodia, including recently arrived luxury brands BMW, Audi[78] (see Box 9 below) and Porsche. Together with well-established brands Toyota and Mercedes, they advocate for a better regulation of second-hand and 'junker' imports that would improve safety and decrease the GHG emission of the private vehicle sector.
- Through the CAIF (Cambodian Automotive Industry Federation) and the Auto committee of Eurocham, official dealers aim to create an even playing field for car importers by providing

[78] https://www.audi-mediacenter.com/en/press-releases/maximum-transparency-audi-receives-dekra-certificate-for-carbon-footprint-612

guidance to the authorities on making long-term commitments to a **sustainable automotive market**.

An interesting comparison may be made with neighboring Vietnam that recently planned to raise taxes on high engine displacement vehicles[79].

Box 8: Other countries' taxation

Vietnam and Laos have high taxation, or simply ban second hand cars, in order to build a strong automotive industry and protect consumers from unsafe cars. This creates a dynamic automobile industry attracting foreign investments and contributing to the local economy, while limiting the effects on climate change.

A recent tax increase in Vietnam will affect vehicles with bigger engine that have heavy consumption of fuel, while their large sizes are not suitable for the country's traffic infrastructure and strained the people's income. Also, they produce high amounts of exhaust fumes, which pollute the environment. The new tax system plans to apply higher taxes for bigger engine vehicles, while tax incentive may apply to vehicles with more energy efficiency engines.

Box 9: Carbon neutrality by Audi

Audi Cambodia is pursuing the vision of the group to reach CO2 neutral mobility with a wide range of actions. This includes reducing the fuel consumption of its models, launching alternative drive systems on the market and utilizing new energy sources. The focus is on electricity and natural gas as well as fuel cells powered by hydrogen. The company is also researching into synthetic fuels.

More recently, The Audi Group has calculated its corporate carbon footprint and is the first premium automobile manufacturer to be certified according to the international standard ISO 14064. The corporate carbon footprint of the group amounts to 57 million tons of tCO2e each year. The group made a detailed assessment of emissions in all automobile lifecycle phases, including emissions from production plants and from electricity and heating, as well as emissions from the supply and logistics chain, production waste and business trips. This serves to increase energy efficiency, to save energy, and ultimately to reduce our CO2 footprint.

Solar vehicles, starting small but with a strong potential:

Star 8 and Blue mobility are offering alternative ways to move around for households, tourists, or professionals: non polluting solar and electric cars that avoid consumption of fossil fuels. Although those alternatives are used by a very limited number of people, it is worth raising their examples.

- The Star 8 **SolarTuk**[80] is a 100% solar powered vehicle developed for the market. With a top speed of 50 km/h, the Star 8 SolarTuk is able to cover up to 120 kilometres before requiring a recharge, which can be achieved via the sun or a conventional power point. 100 SolarTuk are currently in operation in Phnom Penh, and the business is meant to grow.
- Blue Mobility[81] (part of Bolloré Group) has recently launched a range of cars, **mainly powered by solar energy** (from a solar farm near Angkor Wat). They are 100% recyclable, with a battery

[79] http://vietnamnews.vn/economy/276998/govt-proposes-higher-tax-on-vehicles.html
[80] http://www.star8.com.au/solar-tuk-tuk/
[81] https://www.blue-mobility.com.kh

that contains no toxic component and can be recycled multiple times. As Angkor has now reached a critical threshold in terms of pollution, using electric cars contributes to a sustainable development of tourism.

3. Responsible consumption

Households, if they choose to do so, can be a powerful contributor to GHG emissions reduction, through purchase of energy efficient home appliances such as efficient light bulbs, no HFCs refrigerators, upgrade of ACs, or organic food.

As seen in previous sections, the main challenge is that there are very few quality standards in Cambodia, and when existing, their application is not clear or not widely promoted. There is thus an untapped potential for responsible consumption that could be accelerated by the newly created Center for Responsible Consumption and Responsible Production, under the Green economy department. Growing appeal on responsible consumption will require awareness campaigns targeted at the general public.

RECAP: MAIN FINDINGS ON HOUSEHOLDS AS CONSUMERS

Cooking, lighting

- 80% of the population uses fuelwood or charcoal for cooking or water boiling, threatening natural forests.
- In off-grid rural areas, low carbon technologies are a strong alternative to wood to access clean energy and clean water. Bio-digesters, improved cookstoves, water purifiers, solar home systems are climate friendly solutions driven by NGOs willing to cover risks for creating new markets.
- NGOs projects combine impact investing, carbon finance, MFIs green finance products, and donor money to achieve scale and become economically viable.
- Quality standards and labeling are also essential success factors to consolidate market demand.

Moving around

- Transport is a fast growing sector, as mobility needs increase and fossil fuels remain the prime source to meet the needs of the sector.
- Cambodia's fleet of vehicles is dominated by old, highly polluting second hand cars, which are imported into the country without regulation. Quality standards for vehicle fuels are too low. This results in high air pollution levels and high emissions of GHG (inefficient cars).
- The MoT has commissioned a study on the GHG emissions of vehicles.
- Mandatory fuel consumption, fuel economy, and/or GHG standards for light-duty vehicles are currently in effect for more than 70% of the global new vehicle market, including in Vietnam, Laos and Thailand.

Responsible consumption

- The population of Cambodia is generally not aware of the potential to save energy and reduce associated costs and how this can be done through behavioral changes or better equipment.
- Labels and standards of electric appliances would result in the purchase of higher EE equipment, and life-cycle net gains for consumers (offsetting the possibly higher investment cost), notwithstanding associated carbon emission reductions. This action is included in the draft EE Policy (2013) which states that “efficient use can result in energy savings [could represent] up to 50%.”

3. ANALYSIS OF CURRENT INVESTMENTS, BARRIERS AND POTENTIAL FOR SCALE UP

Building on Section 3, this Section seeks to estimate current private sector climate-related investments levels, and the potential to scale up, particularly in light of the barriers that currently hinder investment

3.1. Estimating current climate investment flows

This is a highly difficult and unprecedented task, for the reasons indicated in the methodology section (see Annex 1).

More importantly, private climate investments in Cambodia are clearly motivated by new business development or business growth, not climate concerns. Hence there is very little awareness of the 'climate' nature of activities, and no framework is in place to monitor climate investments. The data is thus not readily available.

Nevertheless, some relevant figures could be extracted out of the 65 interviews, but should be interpreted with caution.

Qualifying climate investments: not all investments have the same climate relevance

Not all investments are alike when it comes to their climate specificity. Methodologies to track private climate finance usually follow the CPEIR climate weighting (Oxford partners, 2015) that classifies investments as such:

- **Climate-specific transactions** are considered to be 100% relevant and their full value should be counted for the purposes of tracking.
- For **climate-relevant transactions**, we assign a weighting that reflects the relevance of the investment on climate change, based on whether climate change appears to be:
    - High relevant (weighting more than 75%) with a primary objective of delivering specific outcomes that improve climate resilience or contribute to mitigation;
    - Medium relevant (weighting between 50% and 74%) a secondary objective or a co-benefit, related to building climate resilience or contributing to mitigation, or mixed programs with a range of activities that are not easily separated but include at least some that promote climate resilience or mitigation;
    - Low relevant (weighting between 25% and 49%) for activities that display attributes where indirect adaptation and mitigation benefits may arise;
    - Marginal relevant (weighting less than 25%) for activities that have only very indirect and theoretical links to climate resilience.

See Annex 7 for details on weighting per investment type.

All captured transactions (as per respondents) are mostly 100% or 75% climate relevant. For instance, an investment in an EMS system, or a low carbon device (such as improved cookstoves, SHS, or water purifiers) is 100% climate relevant as its primary objective is to deliver specific outcomes that improve climate resilience or contribute to mitigation. On the other hand, a reforestation transaction is 75%

climate relevant as climate mitigation is a secondary objective.

In the table below, percentages have been assigned in line with the CPEIR climate weighing.

Table 11: Estimate of climate-related investments per sector, and sources of financing for the last 3 years

Activities (MDB categorization)*	Equity	Loan	Grant	Guarantee /insurance	Comment	TOTAL per sector	Share of the sector
Agriculture/ Forestry/Fishing	38,090,001	13,750,000	75,217,500	96,000		127,153,501	68.93%
Manufacturing	9,700,000	0	2,800,000	0		12,500,000	6.78%
Energy	3,065,003	15,000,000	200,000	2,000,000		20,265,003	10.98%
Waste and waste water	3,750	0	0	0		3,750	0.00%
Construction	937,500	0	0	0		937,500	0.51%
Transportation	4,044,200	0	0	0		4,044,200	2.19%
Accommodation and food services (tourism)	210,000	0	0	0		210,000	0.11%
Financial and insurance services						0	0.00%
Activities of households as consumers	18,000,000	1,365,000	0	0		19,365,000	10.50%
TOTAL	**74,050,454**	**30,115,000**	**78,217,500**	**2,096,000**		**184,478,954**	**100.00%**

Note: Amounts in US$, per type of investment, for 2012-2015

NB on household's calculations:

For households, figures used are either the actual sales volumes of low carbon technologies, or proxies developed from the multiplication of number of units produced, or the market share, by the unit price at the point of sale. Information was provided by GERES, Hydrologic, SNV, Prasac, SGFE, Nexus for Development, Star 8. Other organization/suppliers included in the mapping did not share figures, so the total sum for households is incomplete (as for other sectors).

- Guarantees (e.g. AFD to FTB and MFIs) are not included. In the fifth column, there is US$96,000 insurance from CACIC and US$2 M from UNIDO on the CPC.
- Figures shared by respondents are **aggregated** by industry sector, for confidentiality reason.
- The **'grant'** column appears disproportionally high as it includes development partners' schemes to support new market development acceleration (SHS, on CSA and sustainable farming).

- The **agricultural sector** accounts for 70.47% of the recorded investments which reflects the importance of a strongly climate change impacted sector. This also may reflect the growing awareness of the private actors on the urgency to act, as they have often been the first hit.
- The figures in the **manufacturing sector are low and likely underestimated**, as they leave out the contributions of the most important investors (international groups in manufacturing) tied by non-disclosure agreements that prevent them to share data. Nevertheless, the low figures also reflect the fact that there is a lot of room for improvement for energy efficiency investments in this sector.

In light of those remarks, figures would be much higher if a **mechanism for tracking private climate investments** were in place.

3.2. Barriers to investments

This section is examining, sector-by-sector, the barriers that hinder investments to scale, and the mitigation measures, as suggested by respondents.

Investments in climate friendly activities could be accelerated if certain barriers were removed. From discussions with private sector actors, this study has identified 7 generic barriers; some of which cut across several sectors. These are (in no oder):

1. **Lack of information/guidance** on innovative and low carbon technologies, **combined with resistance to change**. Cambodian people are deeply attached to certain traditions and habits (use of wood or charcoal for cooking, monoculture farming). This represents a risk for new products entry that needs to address behavior change among other costs. A simple example is the fact that 80% of Cambodian households continue using unsustainable charcoal or wood for domestic cooking, although raising standards of living allow them to cook with electric stove or gas.
2. **Finance**. Some climate friendly solutions do not find access to finance in Cambodia due to the size of the informal sector and lack of suitable financing products from banks or MFIs (e.g. project finance for utility-scale solar PV). For a number of solutions, the only source of finance available is from development partners. Unless specifically designed for guarantee systems, this public finance is usually not appropriate for private activities development. See the finance section for further details on challenges and existing solutions.
3. **Availability of technical solutions.** Whether it is rice husk gasification or hybrid cars, technologies themselves are not always adapted to the Cambodian context, and need to be imported from neighboring countries. For instance, interviewed rice millers acknowledged assembling rice husk gasification equipment with machineries coming from 2-3 countries as not one size fits all. This creates additional costs, time and resources spent in procurement, tests, pilots and maintenance of the different parts.
4. **Human resources and skills**. Engineers and technical experts qualified in energy efficiency or renewable energy, climate agronomists, or green finance analysts are lacking on the Cambodian job market, hence climate friendly activities cannot be conceived, implemented or monitored efficiently. There are very scarce educational and training facilities and the existing ones do not yet meet the human resource needs of a green economy. A few vocational training centers are financed by companies that look to nurture their pool of skilled workers (similar to Schneider training center in partnership with ITC), but these only feed a small portion of the

job market. ITC and RUA have recently opened new education departments, respectively on on renewable energies and climate smart agriculture, but mainstreaming these topics in their education systems will require time.

5. **Policies and regulations (lack or inappropriate**). Cambodia has a number of policies on climate change (CCSSP, Green Growth policy, INDC, etc.). But concrete, time-bound targets and road maps are missing or lack ambition. Some policies exist but have not been formally adopted (e.g. EE policy) or are not implemented (e.g. some building regulations). For example, regulations on Land Use are poorly enforced due to poor institutional capacities, but also because of land tenure issues. Some policies are missing altogether (e.g. RE policy with no clear signals for investors in solar, bio-energy and no possibility for excess of on site energy generation to be valued, ie no feed-in tariffs or net-metering). Some markets are either not regulated (chemical fertilizers versus organic; imported vehicles; standards for electric appliances; building code, among several examples) or with discrepancies due to enforcement issues (e.g. sustainable timber production vs. illegal logging). This in turn creates an unsecure framework for climate friendly investments that are bound by international compliance, and hence have difficulties operating in a weak law enforcement context.

Together, these barriers create **missed opportunities** for pro-climate investments, particularly coming from 'quality investors'. Higher quality investments could be defined as long term investments looking at sustainable development goals in the country their operate in as well as their own profits. These types of investments usually embed sustainability in their operations, account for environmental and social responsibility, which in turn increase the value of the country economy.

The barriers described above create risks and related costs that hinder quality investors to pour money in scalable projects.

The table in Annex 9 depicts the key barriers and challenges holding back pro-climate investments in various sectors (left column), as well as possible solutions, offered by respondents to turn barriers into solutions (right column). This is a summary of respondents' views.
Boxes 10 and 11 below give examples of challenges that long-term projects have faced in their development and analyze enabling factors of success.

Box 10: Review of 10 year experience; NGO projects versus social enterprise, the need for entrepreneurialism

Investors are all looking for bankable projects, with sufficient collateral, future cashflow, clear return on investment and high probability of success, led by a management team capable to deliver.
When comparing three NGO projects that reached scale over the last 10 years with the support of carbon finance, it is clear that a culture of entrepreneurialism is key to ensure bankability and a successful exit strategy.

- After 10 years of carbon finance cycle, the New Lao Stove (improved cookstove led by GERES) relies on the Cooperative of Producers and Distributers ICOPRODAC to continue market expansion. ICOPRODAC has received continuous support on rural marketing and sales approach and is now the sole private entity investing in the brand and ensuring quality control of the reputed New Lao Stove.
- The Ceramic Water Purifier by Hydrologic social enterprise has shown tremendous success, partly due to a strong sense of business, a clear market based approach and efficient rural

marketing campaigns. The social enterprise managed to ally carbon finance, impact investment, grants and loans to make the project bankable and appealing to investors.

The National Biogas Project, initially led by SNV, was the first voluntary Gold Standard carbon project in Cambodia that reached scale through a fast market penetration. After 10 years of crediting period, the project is now subsidized (hosted by the Ministry of Mines and Energy) and faces challenges to reach sustainability in the long run. The 60 biogas companies lack entrepreneurship and a sense of service offer (quality control and after sale service) to cater the needs of the 26,000 installed systems. At the time of writing, GIZ and SNV were working together to induce a stronger business culture into the system.

Box 11: A highly needed sustainable natural resource management framework

According to GERES (Flowood study, 2015), the situation of the biomass energy in Cambodia is putting Cambodian forests in danger. Biomass energy accounts for 70% of final energy demand of Cambodia (2012). Charcoal and firewood consumption for industries are directly responsible for the annual emission of 1.7 million tCO2 e corresponding to the degradation of the forest resources.

On the other hand (as seen in section 2.2) reforestation, agro-forestry and sustainable agri-business, if managed sustainably, have the potential to substantially increase the carbon sink. Two reforestation companies - Camagra and FSC certified Grandis planting Teak, Acacia - have over the last 10 years managed to contract substantial foreign investments into sustainable forest management in Cambodia. But these companies currently face difficulties due to:

1. Export custom officers not familiar with timber export business, so procedures are burdensome and costly,
2. Disruption of the export timber market because of Illegal logging,
3. Changing terms of concessions recently dropped from 90 to 50 years (reducing the plantation rotation of - 30%), forcing companies to re-think their development master plan and adapt their EIA (due to reduced terms, development plan is re-oriented to shorter rotation species),
4. Unclear land tenure reducing the concession size of 20-30%, with direct effect on expected revenues.

As seen in recommendations 2-11-12, these examples demonstrate the need for the establishment of sustainable biomass fuel value chains, as well as a secure framework for private investment in Natural Resources Management, both measures having the potential to substantially attract environmentally responsible investments in the country.

3.3. Potential for additional investments

For reasons indicated before, the rough investment figures presented per sector in section 3.1. under-estimate the full potential for climate investment in the country.

This section provides a cursory analysis of the potential for additional investments, based on drivers for investment.

Based on respondents' answers, the main drivers for private climate investments in Cambodia, all industry alike, may be summarized as follows. They are categorized in order of importance:

1. **Monetary savings on energy costs**: The cost of electricity being high in Cambodia, companies are looking to save energy and/or searching for alternative sources of energy, from waste directly available on site (rice husk, manure), to solar that has seen its production and sale price drop in the last 3 years. This demonstrates a strong business case for climate investment. From a purely economic point of view, it makes sense to invest into climate friendly activities.
2. **Supply chain resilience**: Companies face a variety of business risks as a result of climate change. Some of the most significant — such as regulatory impacts on the cost or availability of materials and energy threatened by climate hazards, or business continuity of suppliers during extreme weather events — are supply chain risks. One solution is to work with suppliers to understand and manage these risks, like the examples shown in **the manufacturing and the agriculture sections**. Solutions to secure constant supply of commodities include strengthening suppliers resilience, compliance, community engagement, sustainable land management practices;
3. **New market opportunities**: Customers are market influencers; brands increasingly rely on customers trends to shape new products. The young, growing and dynamic domestic customers (70% under the age of 30 years old) will soon change their purchasing habits (partly influenced by social media conveying responsible consumption habits), which in turn open markets for green products (environmental conscious tourism, energy efficient products, organic food…). End clients of export products are also increasingly searching for green and responsible products as seen in the growing market share of organic products.
4. **Compliance: Regulations** in other countries impose environmental, social and governance requirements that far exceed those that exist in Cambodia. Foreign owned companies – or Cambodian companies with business links abroad – are expected to comply with those requirements, whether it's a '0-deforestation product line', a '100% renewable energy' claim, or carbon accounting to measure an 'internal carbon price'. This also acts as a driver for more climate investment, and can have spillover effects.
5. **Access to essential services**: This is a slightly different driver, addressing a need rather than an opportunity. Clean cooking, clean water, mobility, are seen by development experts as keys to escape the poverty cycle. Here, this clear link between climate investment and SDGs (Sustainable Development Goals) is an additional motivation for private investors as a way to align and match their social/development targets.
6. **Build new skills and a strong workforce**: There are significant gaps in technical capacity among the Cambodian active population to address demand of new skills in sustainable development. The education system in Cambodia is missing academic curriculums or professional trainings on renewable energy and energy efficiency, sustainable construction, sustainable hospitality businesses, environmental quality standards… These gaps are a strong driver for private companies to invest in their own training centers to ensure supply of a skilled workforce capable of delivering new products on new markets.

Building on these drivers, discussions with respondents have confirmed a set of **untapped potential for investment** that could be readily available if conditions are in place. For the purpose of the present study, they are called 'potential for scaling'. Although the potential may be found in all sectors, the

examples presented below are the most tangible and achievable ones, have been chosen for their replication potential and reflect a common understanding of respondents.

Some figures are shared with an attempt to give a potential benchmark. The figures are estimates only, not accurate numbers, and represent the view of respondents only.

Agriculture and Forestry

- As recently highlighted in a discussion between ADB and provincial agri-businesses[82] there is a plethora of new business opportunities for the private sector to invest into **climate smart agriculture practices**, from ICT service provision (remote sensing yield information through drones) to climate proof input (resilient seeds, organic fertilizer), risk coverage services (crop insurance, micro-credit through cooperatives), or sustainable farming technologies (mechanical tillage, irrigation systems). Recommendations from ADB consultants were that the Cambodian agri-industry will have to endorse the change to remain competitive with neighboring countries. Also, through the discussion, respondents shared that they would invest more (open a new factory for production upscale, develop an new export line) if barriers, such as inefficient value chain, land tenure, adversity to risk, were addressed.
- Cambodia's agro-processing industry results in 1 million tons of rice husk, 25,000 tons of old rubber trees and thousands of tons of other crop waste like coconut shells and corn cobs (TERI, 2012). Traditionally, these outputs have been discarded as waste but in the last 10 years, a waste to energy market has emerged. There is a market for an estimated 2,670 gasifier systems of which only a couple hundred have been installed to date. A few plants over 1 MW are in the planning phase with the aim to **sell excess power to the national grid**. This represents an identified opportunity for private players and the largest green growth opportunity that combines both the agriculture and energy sectors. A good example is Camagra who is considering building power plants for a total of up to 10 MW using Acacia wood chips waste.
- In a sustainable forest management framework, would **timber export** be streamlined (ease at customs, not hidden fees), the limited number of forestry companies could grow, increasing value of the forestry sector. According to respondents, the potential is estimated in tens of millions of dollar a year.

Energy

Energy is cross-sectoral. Energy technologies, whether for power generation, on site captive use, or energy efficiency, are or could be used by all industries (manufacturing, agriculture, construction or hospitality). Hence, one of the main benefits for energy is a strong replication potential.

- If we consider the government were to set an initial target for grid-connected solar PV projects of **100 MW overall** (as recommended by Mekong Strategic Partners), approximately US$100 millions could be invested almost immediately, with a multiplication potential **through foreign investors**.
- This is confirmed by a recent Deloitte study that estimates the total potential market for utility scale solar to be approximately US$100-115 million, growing to US$400-600 million in 2020, and **US$650-750 million by 2025** (Deloitte, 2015).

[82] ADB Workshop on 'Private sector involvement in inclusive agribusiness value chains in a climate constraint environment', 16 Feb 2016, Cambodiana hotel.

- According to another recent study by Mekong Strategic Partners (Mekong Strategic Partners, 2016), Cambodia could add 1,000 GWh to its generating output by constructing 700MW of utility scale solar on 1400 hectares of land. 1,000 GWh would mean the RGC's goal for achieving electricity **self-sufficiency could be achieved in 2017**.
- Another strong potential for additional investments could stem from the adoption of energy efficiency standards and labels for electrical appliances, which would accelerate investments into upgraded appliances imports, equipment installations and quality control, technical skills increase and job creation. An entire new market for energy efficient appliances in hotels, factories, homes and offices could open up. If launched, this will automatically increase the economic value and quality of the building stock in the country.
- **Indirectly**, because of the still untapped potential in the energy sector, more open political framework would further encourage climate friendly investment through multiplication of: job creation, investment into the start-up system, professional business service support, economies of scale in the dynamic tourism and construction sectors (retrofit of all buildings). At this stage, potential investments are difficult to estimate, as an entire sector and sub-sector revamp that is at stake.

Other sectors

All other sectors covered in the study also present strong potential to scale up climate related investments. But figures and projections were not as available as in the two above sectors.
They are:

- Manufacturing: strong scale up potential due to the replication factor of energy-efficiency and waste management measures.
- Construction: new extractive industries are emerging (cement, gold, bauxite) threatening natural resources, but at the same time showing a growing interest for energy efficiency and zero deforestation supply chains. Also, the encouraging discussions on Green Building Council may accelerate appeal for sustainable construction.
- Transport: the growing congestion of urban centers is building the case for an urgent public transportation systems. And the inefficient freight system, particularly in the agricultural sector, is calling for more alternative and low carbon freight solutions.
- Tourism: the strong link between clean cities and climate change is a growing incentive to manage waste responsibly. Additionally, strong case studies are now available to promote energy efficiency as a money saver in this industry.

In conclusion, there is a high potential for scaling up among some of the climate activities shown in this report. Respondents agreed that only a short timeframe is needed to scale their operation, if the right framework is in place. To complement the analysis on potential for new investments, this study assesses the current sources of funding.

3.4. Current financing of climate-related in investments in Cambodia (from respondents)

Complementing section 3.3 on potential for additional investments, this section reviews the main sources of financing for private sector climate-related investments in Cambodia, other than own sources, which remains the main source of financing for many corporate investments. Both commercial and public sources provide financial support for climate-related projects. In addition, carbon markets have provided a dedicated source of revenues for carbon offset projects since the late 1990s, but their rapid growth has been followed by a steep decline since 2011, and their future is in doubt.

3.4.1 Commercial sources

a) General remarks on access to commercial finance

According to the World Banks' Investment Climate Assessment 2014, "The three top constraints to doing business as perceived by firms are associated with electricity, corruption and anti-competitive practices" (World Bank 2014). Finance is not perceived as one the main bottlenecks —see Figure below.

Source: World Bank Enterprise Surveys.

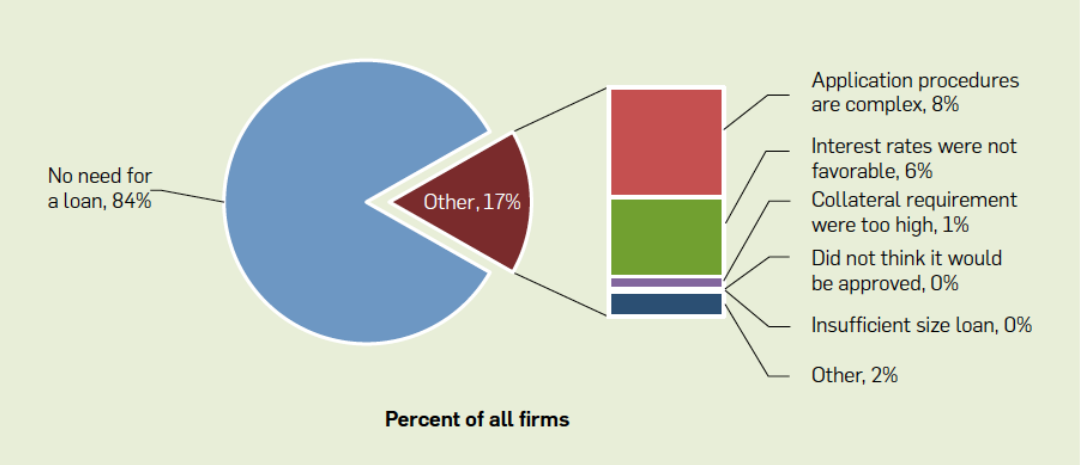
Figure 3: Constraint to doing business in Cambodia

However, the report also noted that:

- Bank lending for financing firm activities is unimportant in Cambodia (see Figure below).
- Yet, when SMEs need a loan, they have limited access to finance and confront credit rationing or risk premiums; banks have difficulty in lending to smaller-size enterprises because the country's weak financial infrastructure makes enforcing loan agreements difficult and liquidating collateral very uncertain.
- For informal-sector enterprises that are not registered, banks face even greater challenges in evaluating their creditworthiness.
- The limited amount of financial information resulting from weak accounting standards and the absence of a credit information sharing system also limits the ability of banks to evaluate the

creditworthiness of borrowers (the recent creation of a credit bureau should address the latter issue).

- For those registered firms that need a loan, the complexity of application procedures and high interest rates are regarded as the main reasons for not applying for a loan, (but bank loan applications by registered firms are nearly always approved); and
- The average value of collateral as a percentage of loans is reported to be over 50 percent of the value of the loan, which is often prohibitive for smaller-size enterprises.



Source: World Bank Enterprise Survey, 2012

Figure 4: most firms do not need a loan

TA recent study by Meet-Bis Cambodia (Meet-Bis, 2013) analysed the **challenges faced by SMEs in accessing finance for energy efficiency and renewable energy technologies**. Its conclusions corroborate those of the World Bank report.

While 70% of SMEs have an interest in EE & RE solutions, most of SME investments are traditionally financed from own funds. However, in terms of future investments, most SMEs were interested in using external funds. Because most SMEs do not operate as registered companies and do not have proper financial records, banks impose onerous collateral requirements. In terms of the loan to value, both banks and MFIs usually finance 50% of the collateral value when the owner of the business holds a soft title and up to 70% in case of a hard title, but many SME owners do not own property or do not have hard titles for their properties. Banks charge high interest rates; in the banking sector, the interest rates range from 10 to 12% per annum and MFI interest rates range from 14 to 30% yearly.

Another key issue also highlighted by the Meet-Bis study, is that "Energy efficiency/ renewable energy investing and financing is a relatively new area for both the SMEs and the financial institutions with some small isolated initiatives started by some financial institutions". The AFD solar programme (see below) includes in its TA package a component targeting the participating MFIs.

While the Consultant had no time to dig into these complex issues, that extend beyond the carbon arena, the above findings suggest that **RGC reforms aimed at reducing/simplifying/facilitating enforcement of bank loan collateral, upgrading accounting standards, encouraging the transition to formal sector status of nonregistered enterprises would have spillover benefits for private sector climate-related investments.**

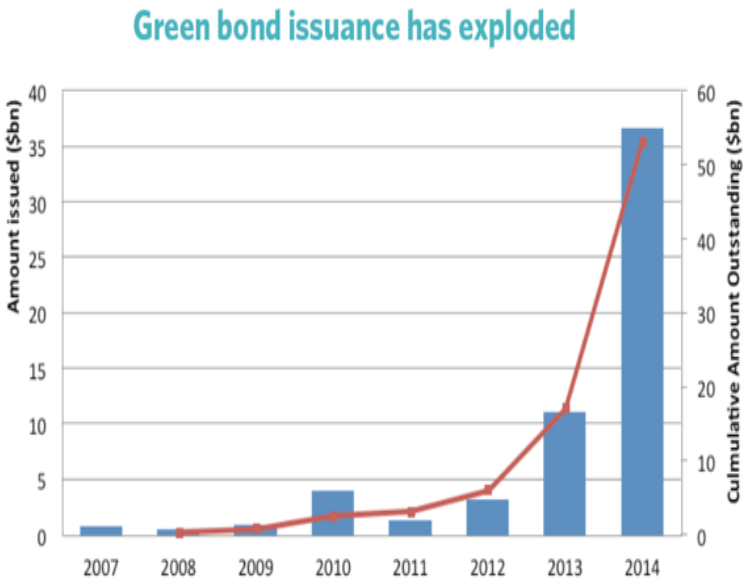
The following sections consider each specific financing source in turn.

b) Debt finance

Three types can be distinguished: bonds; loans from banks and MFIs (intermediated finance); and vendor finance.

Green bonds

One potential and growing source of finance for climate-related projects is the so-called Green Bond or Climate Bond market[83]. This market started in 2007; and has grown very rapidly since (See Figure below), with EDF being the first corporate issuer in 2013. In 2015 US$41.8 bn worth of Green Bonds were issued. The market is gradually becoming mature and organized with the emergence of safeguards: voluntary Green Bond Principles and the Climate Bond Standard, a certification scheme.



Amount issued per year (USD)	
2007	806,940,000
2008	414,284,450
2009	909,372,500
2010	3,904,688,904
2011	1,219,282,424
2012	3,101,960,463
2013	11,042,322,319
2014	36,593,334,453

Figure 5: Green bond issuance 2007-2014

Green Bonds are not suitable for the financing of Cambodian private sector climate projects at this current stage, due to the following reasons:

- Issuers need to have at least an investment grade rating (at least equal to Baa3 for Moody's or BBB- for S&P); however Cambodia's latest Moody's credit rating is only B2, which is five notches below investment grade. As no Cambodian issuer can have a rating higher than that of the State, it means no issuance of a Green Bond could occur unless the bond benefits from a credit enhancement (guarantee) from a DFI or possibly the Green Climate Fund.
- The size of a bond issuance must be large enough to attract institutional investors that are the primary buyers of this asset class (typically pension funds, insurance companies; etc.) and warrant the associated issuance costs. Very few projects in Cambodia would meet the condition, unless some packaging or bundling could be done.

[83] See www.climatebonds.net

Intermediated finance - Banks and MFIs[84]

Commercial banks

A few commercial banks have or are actively developing an environmental policy, strongly supported and influenced by donors in most cases.

- **ANZ**, at the group level, has taken bold steps in 2015, issuing a climate policy statement on the occasion of COP21 in Paris, calling for the decarbonisation of their portfolio, while supporting their clients incorporating climate risks in their strategy for development. Worldwide, ANZ plans to spend US$10 billion in the next 10 years to achieve its targets on forestry, renewables, conservation, etc. (as announced in their climate policy released at COP21). In Cambodia, ANZ Royal plans to embark on this path, but no details are available at the time of writing as the plan is fairly new.
- **FTB** is working on its environmental policy, and is increasing its capacity for green financial products. It is implementing a US$15 million AFD credit line targeting REEs (Rural Electrification Entreprises) and SWEs (Small Water entrepreneurs), under the 'Access to finance for electricity and water' program[85]. Technical assistance is provided by GRET[86] on rural water and electrification and Enclude[87] (to FTB) on environmental performance. In parallel AFD provides a partial credit guarantee (under its ARIZ programme). Loans extended by FTB are in the range US$70,000-1.2 million, have a tenor of up to 10 years and carry an interest rate of 8%. It should be noted that the climate relevance of this credit line is only partial.
- **The Rural Development Bank of Cambodia** is currently building its capacity, with technical assistance of Mekong Strategic Partners and funds from AFD and FMO, to develop strategic orientations. Potentially, the bank could in the future consider issuing green loans for agriculture and rural energy sector.
- **Acleda**, spurred by its shareholders (including IFC) has an environmental policy in place, and keeps lending to SMEs on technologies such as biogas, rice husk gasification, but no special green products have been developed until now, although there was an attempt to do so with Meet-Bis in 2014.

This modest level of bank engagement and activity in the area of climate-related intervention is in stark contrast with the high credit growth rate in Cambodia, at about 30% per annum. This is the reflection of opportunities (few RE projects) and a lack of awareness (for EE and adaptation-related activities), also highlighted by the Meet-Bis study.

[84] Cambodia has 83 authorized FIs: 35 commercial banks (as against 17 in 2003) with total assets of approximately USD 16 bn (2014) of which 56% consisted of loans to the private sector; 9 specialized banks; 39 Microfinance institutions (MFIs) including 7 deposit-takings MFIs (MDIs) with assets of USD 2.4 bn (2014) (NBC, 2014)[84]; In addition, "an estimated 60 NGO micro-finance providers that are unregistered with NBC" (FSDS 2011). The country's banks are all privately owned and most with majority foreign shareholders (FSDS 2011). While the 5 largest banks (Acleda, Canadian Bank, Cambodian Public Bank, ANZ Royal, ICBC) account for 54% of total assets, the 4 largest MFIs (not counting Acleda)(Prasac, Sathapana, Amret, Hattah Kaksekar) represent 70% of total MFI assets (NBC 2014).

[85] http://encludesolutions.com

[86] http://www.gret.org/countries/representation/cambodia/?lang=en

[87] http://encludesolutions.com

As indicated above, unless when the impetus comes from foreign shareholders (particularly DFIs) and even then, Cambodian banks are generally under-informed and accordingly not highly sensitized to challenges and opportunities associated with a low-carbon and climate-resilient development, even less to how they can contribute.

Some **training** could be carried out through the Association of Banks in Cambodia and Cambodia Microfinance Association. For the keenest FIs, a specific capacity building approach would be beneficial. The EE&RE or low-carbon credit lines deployed by MDBs/DFIs generally include a technical assistance component to train banks, and support them with developing a loan product and marketing it, and in appraising projects. This issue is not specific to developing countries as illustrated by EIB's Private Finance for Energy Efficiency (PF4EE) programme, which in addition to concessional loans and a partial credit guarantee provides technical assistance to 10-15 EU28-based banks to help them develop a sustainable EE lending business.

DFI-driven dedicated EE and RE credit lines have played a key role in other countries (e.g. the AFD loan to Bank Mandiri in Indonesia) to address this issue, while providing long-term liquidity at attractive terms (See Recommendation #19). A risk sharing mechanism in a form of guarantee fund could also help unlock bank lending, especially for SMEs and the informal sector which can hardly meet banks' collateral requirements and credit tests (see Recommendation #20).

Project finance remains under-developed in Cambodia. Project finance is particularly suitable for large, revenue-earning low-carbon projects such as utility-scale renewable energy projects and ESCO-type energy efficiency projects, insofar as they both involve the establishment of a special purpose vehicle (SPV) receiving a revenue stream from an off-taker (the company benefiting from the energy saving in the case of ESCO projects), a security package mostly consisting of the pledge of the project assets, and the absence or limited recourse of the banks financing the asset against the balance sheet of the SPV's owners. Project finance is however generally not utilized in Cambodia as local banks lack the expertise and/or the long-term resources to extend loans with the long tenors that are needed to match the economic life of financed assets. This will mostly affect in Cambodia the financing of utility-scale RE projects that are typically financed in this fashion worldwide. It is thus likely that when the market for RE utility-scale projects opens up in Cambodia, DFIs will provide the bulk of the senior debt portion of these deals, before gradually local banks can step in.

Microfinance institutions

Cambodia is well known for the size and growth of its micro-finance industry; in 2013, Cambodia was ranked 6th in the overall microfinance business environment rankings by the Economist Intelligence Unit (EIU) and 5th in the regulatory framework and practices rankings. The regulatory environment is considered to be strong, having been safeguarded by (i) the highly independent nature of the supervisory authority; (ii) well-developed microfinance regulations, and (iii) the government's declaration that microfinance is a priority sector that is key to implementing its financial sector development and poverty alleviation agendas, which are closely supervised by the IMF and ADB. (Blue Orchard)

MFIs are well positioned to support the green SME sector, because they depend on rural lending and are ready to take more risks than commercial banks.

There are currently MFI attempts to support solar home system (SHS) distribution for example, despite several challenges preventing larger scale-up:

- **Prasac** is one example with an Environmental and social policy in place since 2012, which includes a GHG assessment and carbon audit of the MFI operations. Prasac has been a supporter of the National Biogas Program, and is now looking at a more systematic approach on green financial services through the GPCF (see below).
- **Kredit, LOLC and Vision Fund** participate in the 'Green Micro-finance' program funded by AFD and the EU and supported for implementation by SNV (see section on Energy for more details). AFD provides a concessional loan of US$6 million to these three MFIs.
- The most ambitious MFI program encountered to date is a potential new programme developed by the **Global Climate Partnership Fund** (GCPF)88 that could be partnering with Prasac for its Cambodia program.

In 2014 KfW commissioned a study to explore the potential for a low-carbon window within the **Microfinance fund for Asia** (MIFA), a layered fund supported by KfW and IFC, which lends to MFIs in selected countries. Cambodian MFIs are among the largest borrowers, so much so that Blue Orchard, the fund manager, operates an office in Phnom Penh. The MIFA low-carbon window will be deployed in Cambodia in the second half of 2016, after Blue Orchard have engaged a consultant who will assist with programme implementation. Technical assistance will also be deployed to support, when needed, participating MFIs and technology suppliers.

Vendor finance

According to the Meet-Bis, 2013 report, this source is currently non-existent in Cambodia.

b) Equity

External equity finance is mostly relevant when:

a. A new company is set up to finance and operate a revenue-generating project. This is the case for e.g. greenfield utility-scale RE projects where a special purpose vehicle is created to finance, build, own and operate the project assets, which are also pledged to the lenders (project finance). This is a not configuration likely to be relevant for other climate-related investments which in most cases would be implemented 'in-house' by companies, simply because projects have no dedicated revenue stream attached to them stemming from selling the project output to a third party buyer, as is the case with utility-scale (IPP) RE projects.
b. A project in any sector that is so large that the project proponent has no choice but to issue new shares either on a private basis or if the company is listed though a capital increase (secondary offering). Again this would be an unlikely configuration for most of climate-related interventions.

Several private equity funds with strong environmental/climate profile are actively searching for projects in the South East Asian region (e.g. Armstrong and Berkeley that operate from Singapore).

[88] The GCPF is a public private partnership currently in discussion with a few financial institutions in Cambodia, including Prasac. GPCF is managed by a private fund manager, Responsibility. The GPCF finances energy efficiency and renewable energy projects either directly (for up to 30% of its portfolio) or via local financial institutions. Funding comes with an array of trainings and a strong technical assistance package. GPCF is a layered fund (like MIFA) with three classes of investors: Class C Shares that represent the Fund's first-loss equity, Class B Shares that rank senior to the C Share portion, and Class A shares that rank senior to the other two share classes but junior to all other creditors of the Fund. Investors include DECC, Danida, Germany, KfW, IFC, FMO, etc. http://www.gcpf.lu

This study did not attempt to do a comprehensive mapping of these funds, based on the idea that investments will flow to Cambodia if the investment climate and project characteristics and economics are attractive enough.

c) Energy Services Companies (ESCOs)

ESCOs can be a source of finance for EE projects in certain circumstances.

Energy Service Companies provide services to customers such as: Energy supply & management; Energy financing; Technical engineering expertise and consultancy (e.g. audits); Equipment supply / installation / operation / maintenance / upgrade; Monitoring and verification of performance and savings. ESCOs are typically tasked with: i) Developing and designing energy efficiency projects (including provision of energy audits, HVAC and lighting upgrades, metering solutions, boiler or chiller plant improvements, on-site power and co-generation systems, renewable technology applications); ii) Delivering / guaranteeing energy savings; iii) Ensuring cost-effective and optimal performance (minimizing project cycle cost). They can be Public / Private / Utilities.

An ESCO typically enters into an Energy Performance Contract with a client. Among several definitions the landmark EU directive of 2012 on energy efficiency defines Energy Performance Contracting as follows:

> "a contractual arrangement between the beneficiary and the provider of an energy efficiency improvement measure, verified and monitored during the whole term of the contract, where investments (work, supply or service) in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement or other agreed energy performance criterion, such as financial savings".

Under the 'shared savings' model, ESCO can also provide the financing for a project and in addition to performance risks also carry the credit risk of the client defaulting on the loan embedded in the energy service performance contract.

The size of the ESCO industry varies significantly from one country to the other including within the group of developed countries, or from sector to sector (the share of the public sector has been historically very high in the US). In Asia, China and Korea seem to have developed an ESCO industry from scratch thanks to strong government impetus (and initial World Bank support in the case of China).

While ESCOs could emerge in any country where energy prices are high, energy consumption and waste is significant, standards and certification systems exist (of equipment, ESCO providers, etc.), potential private and public clients are creditworthy, and contract enforcement is adequate, the initial or additional spur of government legislation and regulations can be helpful. Examples include the Energy policy act of 1992 in the US, which is credited for creating some of the initial impetus to the ESCO industry in this country, and the aforementioned 2012 EU EE directive.

This step is probably premature for Cambodia, but were the Government willing to boldly pursue this policy avenue a realistic approach could be to structure and launch a **pilot project in the public sector** ((schools, hospitals, etc.) where (initially international) private ESCOs could be invited to offer turnkey solutions and financing ('shared savings' model) for the retrofit of public buildings through some type of public private partnership. A good example of this approach is the Government of Hungary's "Szemunk Fenye" program (from 2006). The program was designed to facilitate lighting and heating

renovations and improvements in state-supported local institutional schools, as well as other municipally supported facilities. Loan financing benefited from a partial credit guarantee from IFC.

d) Insurance

An emerging trend in Cambodia, and still very much at the early stages, is the **climate risk insurance system**. Although insuring against flood or drought is a risky business, there are 2 insurance schemes under development in Cambodia: CACIC with support of CEDAC, and Forte insurance. See agriculture section for more details.

3.4.2. Public sources (including NGOs)

a) International sources

According to OECD-DAC, Cambodia received US$276 million in climate-related ODA in 2014 (see part 2.2.3).

A number of programmes/schemes have been cited in this Study, including the provision of investment finance (AFD, GPCF, FMO loans for biodgesters, etc.) and/or technical assistance.

Other dedicated funds for energy efficiency and renewable energy include: UNCDF CleanStart Energy Access Window[89] that just released calls for proposal for SME projects in the energy sector, or the Clean energy revolving fund, by Nexus-for Development[90], seeking projects in agri-business willing to switch from diesel to waste to energy technologies. US$1,2 million is available for the UNCDF fund (on ASEAN frontier markets), while US$500,000 is available for Nexus fund, through grants and loans.

With regards to financing adaption to climate change, sources include the Strategic Program for Climate Resilience (SPCR) of the Asian Development Bank (ADB), the Adaptation for Smallholder Agriculture Programme of the International Fund for Agricultural Development (IFAD), the Adaptation Fund, etc.

b) Domestic sources

One possible way to boost government revenues as well as encourage the switch to better environmental practices including reduced use of fossil fuels would be to promote environmental taxes —part of the broader family of economic instruments—, such as a **carbon tax.**

Despite the many advantages of environmental taxes, their use rests relatively limited in many countries – but the use is growing. These taxes (energy, motor vehicles, emissions to air and water, wastes, hazardous chemicals, etc.) raised revenues on average in OECD countries in an amount equal to about 1.7% of GDP.

In 2010, 97% of all the revenues from environmentally related taxes were raised on various energy products, especially on motor vehicle fuels, and on motor vehicles and various transport activities.

One reason why environmental taxation is not even more in use is that policy makers fear that they could have a negative impact on income distribution or on the competitiveness of the most affected

[89] http://www.uncdf.org/en/catalyzing-greater-financing-choices-people-who-want-buy-high-quality-affordable-energy
[90] With support of REEEP initiative from the Austrian government (http://www.reeep.org) and the blue moon fund (http://www.bluemoonfund.org)

firms. In general, there are ways to adequately address such concerns, without compromising the environmental benefits that such taxes could entail.
A carbon tax is a form of explicit carbon pricing directly linked to the level of carbon dioxide emissions, often expressed as a value per tonne of CO2 equivalent (tCO2e).

Carbon taxes can be introduced as an independent instrument or they can exist alongside other carbon pricing instrument, such as an energy tax or a cap and trade scheme such as EU's Emission Trading Scheme or China's planned scheme due to come into force in 2017.

Fifteen countries are implementing or have passed legislation for a direct carbon tax, but this total does not include countries such as Cambodia that levy a tax on motor vehicle fuels and motor vehicles (other than VAT). The only Asian country that has established a carbon tax is Japan, in 2012, but the tax is set at a very modest rate, and no country below upper middle-income level [91](as per Word Blank classification) has established a carbon tax.

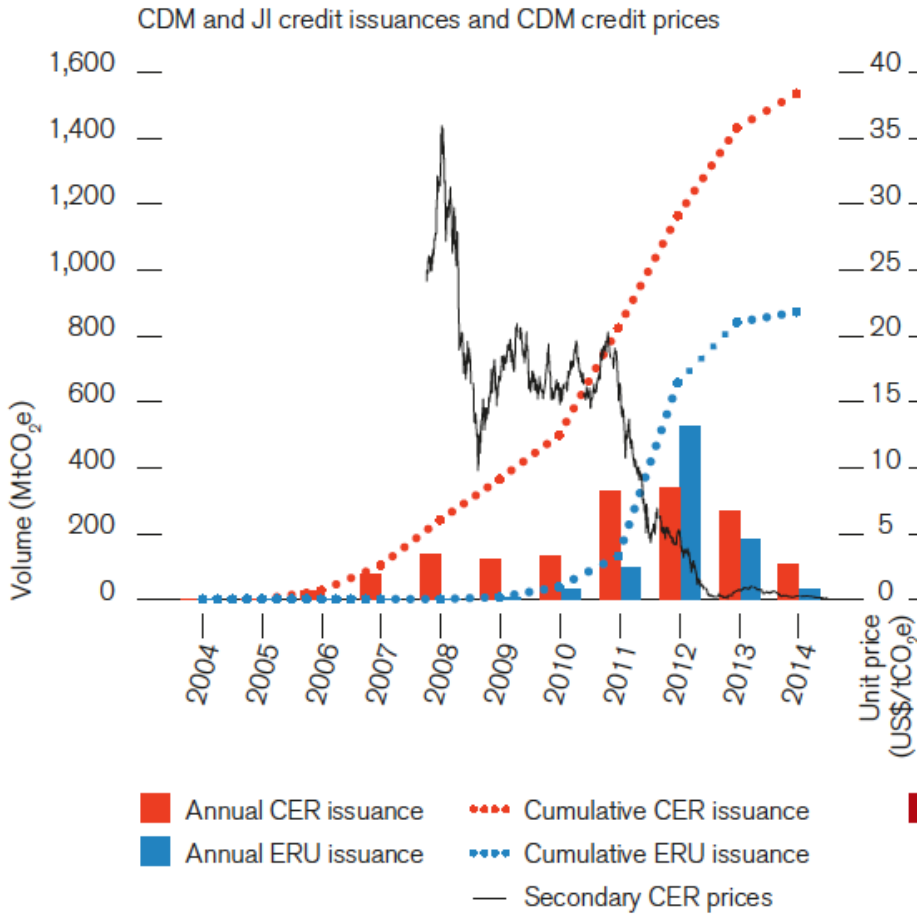
While it would be worth exploring the feasibility of a carbon tax for Cambodia, it is likely not a priority given the low level of energy-related emissions (see above) relative to agriculture and forestry. **A first step would be to rationalize taxes related to motor vehicles and motor vehicle fuels** — see Recommendation #6 in section 5.2 below.

3.4.3 Carbon markets

Another private source[92] is carbon markets, i.e. the trading of carbon allowances or credits. Two types of carbon markets were available to Cambodia until 2013: the Kyoto market (after the Kyoto Protocol of 1997) in the form of the Clean Development Mechanism, and the voluntary markets.

Cambodia was a modest participant in the Kyoto market with 10 projects registered representing potential issuances of 2 million CERs. Since 2013, however, this market is shut for Cambodia as industrialized country governments are not buying any longer (Kyoto ran its course at the end of 2012) and companies wishing to use CDM credits (CERs) for compliance in the EU emission trading scheme (EU ETS) must either use credits generated from a project registered before end of 2012 or from a project based in a Least Developed Country if registered after 2013. Even before CDM prices had started to collapse, as shown in the figure below.

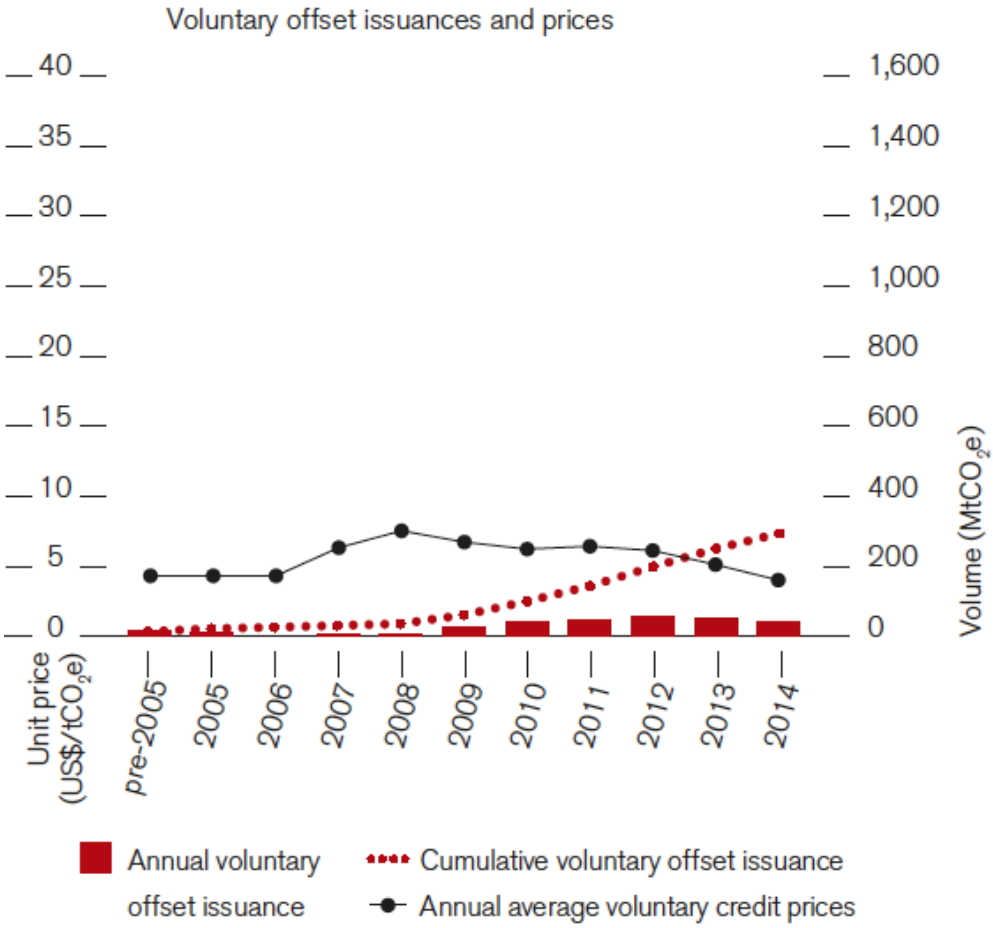
[91] Countries with a gross national income per capita between USD 4,126 to 12,735.
[92] Developed country governments (and their agencies) could be buyers, directly or via their parties such as MDBs, under the Kyoto Protocol, because they had compliance obligations. They could purchase credits from developing countries via the Clean Development Mechanism, whereby verified emission reductions against a baseline achieved by an eligible project (carbon offsets) in a developing country could be sold to the Government of a developed country.



Source: World Bank 2015b

Figure 6: Price and volumes in the Kyoto market

The best hope for Cambodia after the demise of the CDM market is voluntary carbon markets for high quality projects that can fetch premium prices from mostly western-based corporate buyers that have CSR objectives, although average prices have also been declining in recent years —see figure below.



Source: World Bank 2015b

Figure 7: Price and volumes in the voluntary market

The voluntary carbon projects currently under development in the country are facing difficulties to raise finance as the legal framework on voluntary carbon market lacks clarity (see agriculture section). While carbon offsetting is not a widely used practice, it is however very popular with large international corporates, among which companies known for their remarkable sustainability performance (Marks and Spencer, Microsoft, Aviva, Deutsche Post-DHL, Coca Cola…). Additional private carbon offsetting could be significant, if projects are also able to show co-benefits (economic and social impacts) that are increasingly important in buyers' decisions. Projects may be based on an average price on the voluntary market of US$3.3 per tCO2e (Ecosystem Marketplace, 2016)[93], or up to US$10-20 per tCO2e in case of strong co-benefits. In the absence of clear guidelines, however, voluntary carbon project developers are hesitant in taking further risks, and have shared the need for a clear, transparent legal framework on the sharing of proceeds and other obligations to incentivize their investments and those of their carbon partners.

The Paris Agreement adopted in Paris at COP 21 and recently signed by 177 countries, but not yet entered into force, includes some provisions on a **new carbon trading mechanism** in its Article 6 (para 4). However, the rules, modalities and procedures for the mechanism are yet to be established.

[93] Commonly USD 5 for REDD+ projects, and lower for energy efficient projects for instance..

In this context (declining markets, lack of details on the new trading mechanism created by the Paris Agreement, small size of Cambodia not warranting the creation of a domestic emission trading scheme[94]) it is not clear what would the role and added value of a government-sponsored **Carbon Fund/Facility,** which was floated within the Ministry of Environment and on which the Consultant has seen no documentation. **The priority should be to clarify the existing regulations.**

[94] Thailand is working with support from the World Bank's Partnership for Market Readiness towards establishing a domestic emission trading scheme. This process should be carefully monitored by the RGC. The centerpiece of the PMR activities is the Country Programs, i.e. grant funding provided to the Implementing Country Participants to pilot carbon pricing instruments or build readiness components that support the implementation of carbon pricing instruments—including market-based approaches—for GHG mitigation. See

4. CONCLUSIONS AND RECOMMENDATIONS: ENHANCING RGC POLICY TO SCALE UP PRIVATE SECTOR RESPONSE TO CLIMATE CHANGE

4.1. Conclusions

1. **The Climate Change challenge will become more acute in Cambodia:** Private sector emissions will increase fast, driven by demographic and economic growth:
   - In the energy sector, GHG emissions related to electricity generation will increase substantially (see part 2.1.2). Electricity demand from the private sector is likely to rise, driven by growing industry needs and increasing household consumptions. Electricity is likely to remain a major source of GHG emissions (domestic coal and imported heavy fuel).
   - Increasing demand for agriculture products (e.g. meat and rice) will contribute to higher GHG emissions;
   - Capacity of Cambodian forests to act as a GHG sink will be reduced significantly, due to impacts of deforestation;

Climate Change is increasingly affecting Cambodia, through higher drought risks, changes in monsoon and rainfall patterns, sea-level rise, etc. **These changes are likely to have substantial impacts across a wide range of sectors.** For instance, rice production losses due to flooding and drought are likely to occur, as well as lower forest productivity due to longer water deficit, thereby threatening the livelihoods of many Cambodian households. From an economic perspective, GDP growth could be almost entirely offset by 2050 (see part 2.1.3).

2. **The private sector in its diversity is pioneering, experimenting, and implementing CC solutions.** Main drivers of private sector's involvement in the climate change response include:
   - International companies adopt more stringent **Corporate Social Responsibility** (CSR) policies[95], which translate into greater environmental concerns. This is noticeable in the garment industry for instance;
   - **Donor- or NGO- driven initiatives**, mostly related to climate smart agriculture, facilitate private sector involvement on climate change related activities;
   - **High electricity prices and inefficient production techniques** constitute a strong incentive for implementing energy efficiency (EE) and renewable energy (RE) activities;
   - Private sector actors – especially in the agriculture sector- are **increasingly aware of the impacts of climate change** on their livelihood and therefore engage in building adaptation to climate change. Climate resilience of supply chains also needs to be reinforced to reduce exposure to climate change impacts.
3. **There are potential areas where investments could be scaled up.** Table 4 outlines the key drivers of potential opportunties and activities that could lead to reducing GHG emissions and enhancing adaptation across generic climate interventions.

[95] Little data was available on budget allocated by international companies to CSR policies in Cambodia. However, initiatives (e.g. in the garment industry – Puma, etc.) suggest CSR policies are one lever for mainstreaming climate change consideration in firms operations.

Table 12: Key drivers for scaled up climate change interventions

Generic Climate Interventions	Share in GHG emissions and likely trend*	Key drivers of mitigation and climate resilient activities
Sustainable Forestry	49.5% ↘	- Sustainable forestry (including agroforestry) is key to safeguard forests productivity over the long term; - Protected areas are a source of revenues for tourism; - Reforestation contributes to meet the demand for wood products.
Climate Smart Agriculture	44.8% ↗	- Agriculture's high vulnerability to climate change reinforces the case for climate smart agriculture; - Productivity is low and agriculture households are poor: scaling up sustainable farming techniques (maximizing crop residue, improving irrigation and water storage techniques, rotating crops and harvesting best practices) has a strong potential.
Renewable energy and lower carbon energy generation	5.7% ↗	- Electricity is mostly generated through heavy fuel and costs of electricity are high; - Strong solar radiation provides a strong impetus for solar PV. - Waste to energy is underdeveloped, yet has strong potential, especially in the agriculture sector.
Energy Efficiency		- High efficiencies in energy consumption: inefficient equipment and carbon intensive technologies for sewing, dying, heating, steaming; - High energy costs drive down industry profitability.
Clean Transport	n.a. ↗	- Automotive market is dominated by poor quality second hand cars; - Most vehicles have low fuel efficiency; - All countries in the ASEAN have issued restrictions on car imports.
Waste management	0.5% =	- Waste to energy market is still at early stages, with numerous opportunities for investment; - Most potential is in agriculture (e.g. crops waste, rice husk…)

* Authors' assessment based on the 2000 Cambodian GHG inventory (SNC 2015) and review of literature

4. **Barriers to deployment at scale** were identified; main generic barriers include:
    - **Lack of awareness and poor diffusion of information on climate change**:
        - Private sector actors lack information on techniques and best practices to adapt to climate change;
        - Only a few actors are aware that waste can be valorized for electric generation (e.g. through gasification);
        - Poor awareness of high GHG emissions associated with heavy-fuel based electric generation;
        - Lack of information on potential financial savings associated with EE measures;
    - **Policy and legal frameworks related to climate change are sometimes insufficiently enforced or lack clarity:**
        - There is a lack of regulations on renewable energy, green product certification, EE standards and labels;
        - Some laws or programmes were not adopted: for instance the NAMA on Energy Efficiency in the garment industry;
        - Regulations are loosely enforced: e.g. Building Code, regulations on illegal logging and resource extraction, etc.
    - **Lack of skills and training on climate change related issues:**
        - There is a lack of technicians specialized in Energy Efficiency, smart farming and agriculture, sustainable construction;
        - There is no training on management of Renewable energies;
        - Some government officials lack appropriate knowledge, which is one factor of poor institutional capacity to effectively inforce regulations related to Climate Change.
    - **Access to finance:**
        - Most FIs lack awareness on climate change;
        - Structure of the corporate fabric in Cambodia (no registration, no accounts, no collateral) hinders capacity of firms to mobilize climate finance.

4.2. Recommendations

This section presents **20 recommendations** aimed at strengthening the private sector response to climate change in Cambodia. They are organized by sector and aim to be operational and to focus on high potential areas.

As these recommendations consist often of a bundle of measures, **short-term actions** that could be implemented at short notice are also presented. They are listed in Table 5 across the four main types of public policy instruments (adapted from Whitley, 2015):

- **Information policy:** raising awareness on climate change to influence behaviour. This includes awareness campaigns, information centers, etc.
- **Capacity Building**: building technical skills and enhancing operational capacities to improve private operators actions on climate change;

- **Regulation Policy**: influencing behaviours through legality. This includes laws, legally binding targets, import and export restrictions, etc.;
- **Financing and economic instruments** means using prices to influence behaviour (taxes, price supports, etc.).

Energy sector

#1 Adopt a Renewable Energy Policy	
Short-term action	Set a target of 10% of the electricity mix (excluding large hydro) to be supplied from RE sources by 2020
Potential to reduce emissions or strengthen resilience	High as the share of coal in the power supply mix could reach 55% in 2050 according to some estimates ((draft) report by Intelligent Energy Systems and Mekong Economics). Coal is by far the most carbon-intensive fuel.
Government lead	MME, MOE, NCSD
Implementing actors	Private sector developers/investors
Rationale	• "Cambodia's electricity demand is forecast to increase at a rate of 8.6% pa over the 35-year period to 2050" (ibid.) This will require multiplying by a factor of 9 the current power generation capacity (from 2 to 18 GW) in a BAU scenario (ibid.) • The RGC has indicated investing in sustainable energy is a priority (NSDP, CCCSP, etc.). This will (i) enhance security of supply (reduced imports of electricity: in 2014 37% of Cambodia's total electricity demand was met by power transfers from Vietnam, Thailand and Lao PDR; and of coal imports if coal were to increase its share of the electricity mix), (ii) lower energy costs, (iii) help reach access to electricity targets (70% of HHH by 2030), and, not least, (iv) reduce GHG emissions. RE investments will also bring additional FDI to the country, and will avoid potentially stranded costs of coal-fired power plants becoming uncompetitive. • Prices (levelised cost of electricity) of some RE generation technologies such as solar and on-shore wind have fallen so much as to reach cost-parity. • Cambodia has a large potential for large hydro projects but the ecological consequences of these projects (on water availability, deforestation, biodiversity, etc.) and their vulnerability to climate change (droughts) argue for a more diversified electricity mix. • Cambodia has a vast untapped potential for RE particularly for solar and biomass/biogas.

	• According to the above report: "solar, wind and hydro are likely to be good complementary technologies in Cambodia". • RE generation capacity expansion can happen in very decentralized ways (Distributed generation, i.e. through rooftop solar PV installations by commercial buildings, hotels and factories), and close to consumption points, reducing the need for costly grid network expansion investments, and creating lots of new jobs. • However, this potential for scaled up RE investment could only be unlocked if the policy and regulatory framework is changed, in essence allowing the private sector to invest in RE generation capacity, included distributed generation. • This framework would also restore a level playing field between grid-supplied electricity which is VAT-exempt and household-level solar products such as SMS that are subject to VAT and taxed on import on material (7% solar PV, LPG…).
Financing	• Equity: a number of investors and developers are looking for new opportunities (eg RE private equity funds such as Armstrong or Berkeley). • Debt: Utility-scale RE projects will probably still require DFI financing for some time as local banks are generally not able to provide project (limited recourse) finance. • Small scale distributed generation or household-level technologies such as SHS can already be financed by the local financial sector, albeit with some DFI and donor support (FMO biodigester loan programme; AFD-EU programme). • Potential investment for 100 MW: ca US$150m (Around US$1.5 billion was invested in renewable energy in Thailand in 2011).
Approach	• Set an interim RE generation target of at least 10% of peak demand capacity in 2020 (corresponding to an estimated 156 MW of capacity), as proposed by Mekong Strategic Partners in a report for the Mekong Partnership for the Environment (2016). • The target is the first step – it sends a signal to the investor community that Cambodia is open to RE and looking forward to private sector investments in the sector. • However, Cambodia should soon follow up with the adoption of a package of inter-linked reforms that would best be effected through the enactment of a RE law (or amendment of the 2001 (Electricity Law) comprising inter alia the following components (for which several options are sometimes possible):

POLICY ELEMENTS	
Pricing	FIT instruments typically specify price(s) that will be paid to renewable generators on a standard offer basis.
Interconnection	Interconnection regulations can include interconnection guarantees, streamlined or priority interconnection, and rules for how interconnection costs are allocated and recovered.
Purchasing, transmission and distribution	FIT instruments may require that utilities (or other entities) purchase renewable electricity. Related to, but distinct from, interconnection and purchasing requirements are requirements that utilities give priority to renewable electricity on the transmission and distribution systems.
Contracting	FIT instruments may specify details of the contracts that are to be signed with renewable generators. These include the terms of the contract, the extent to which the contract must be simplified and standardized, the contract currency, etc.

Source: (Rickerson *et al*., 2012)

- A Feed-in tariff (FIT) — a premium price usually higher than the wholesale price — is a central component of any RE Policy, but is not the only option.
- The right of onsite generation and to supply excess electricity to the grid (e.g. from rooftop solar PV) should also be recognized, at an agreed price.
- Fine-tuning of all three above points would require a study.
- Moving to a government certification scheme for household-level solar PV and other RE systems (including for biogas, etc.) will help advance the market for these systems, building on the SEAC certification scheme (for SHS).
- Exempt high-performance solar panels and RE equipment from VAT and duty (households and distributed generation). Preparatory work is needed to define the minimum performance standard that equipment eligible for exemption should meet.
- Address skills shortages and capacity gaps all along the value chain.

Precedents in the region	Malaysia (2011), Philippines (2008), Thailand

#2 Support sustainable consumption and production of solid biomass energy	
Short-term action	Enforcement of a strong and systematic fine system on illegal woodfuels
Potential to reduce emissions or strengthen resilience	High on both mitigation (1.7 million tCO_2e emitted annually by charcoal and firewood for industries only) and adaptation (sustainable and community-based management of natural resources, ecosystem restoration, sustaining off-season income generating activities for rural populations living in degraded forest buffer zones and heavily dependent on the forest…)
Government lead	MME
Implementing actors	MoE, MAFF/Forestry Administration, MEF, MoC, MoI, MIH, MEF, coordinated by the NCSD. Private sector actors involved in the production and distribution of sustainable fuels and energy efficient devices. Donors and financial institutions.

Rationale	• Biomass energy accounts for 70% of final energy demand of Cambodia (2012) but a much higher proportion of primary energy given the high losses happening during combustion in kilns and stoves (efficiency of no more than 25%)
	• Annual demand for woodfuels is in the order of 5.5 million tonne; 3.4 million tonne are originated from the forests and overall 1.2 million tonne of woodfuels consumed annually are not sustainable.
	• Cambodia consumes 360,000 tonne of unsustainable charcoal per year which requires the harvesting of 2.94 million tonne of firewood annually. Industries (garment, brick, ice factories, small-scale food processing) consume 780,000 tonne of firewood annually.
	• Charcoal and firewood consumption for industries are directly responsible for the annual emission of 1.7 million tCO_2e corresponding to the degradation of the forest resources.
	• Recently a producer of sustainable charcoal (from inter alai coconut shells) was granted a VAT exemption to ensure a level playing field, but much more needs to be done as its market share remains negligible.
	• The objective would be
	  ○ To support the establishment of sustainable biomass fuel value chains as alternative to illegal charcoal fuelling domestic cooking in urban areas and illegal firewood fuelling industries, mostly around main urban centers
	  ○ To reduce consumption of woodfuels (5.5 million tonne in 2014) by residential and industrial sectors

Financing	• Development of a NAMA to access climate finane in order to support private sector investment through the form of a result-based financial incentive per tonne of sustainable biomass sold in the market. • Part of the NAMA action plan could be financed through enforcement of a stronger system of fines on illegal woodfuels to reflect the environmental

	cost of unsustainable extraction practices. Considering a carbon cost of 20USD/tCO2e, the fine should be in the order of 400 Riels per kg of charcoal and would generate an annual income of USD36 Million. • Credit lines from DFIs such as AFD to local FIs to support uptake of energy efficient solutions (see rec. #21).
Approach	1. <u>Increase the sustainable supply of biomass energy</u> *Sustainable sourcing from Community Forestry* • Disseminate silviculture models valorizing thinning and pruning residues into sustainable woodfuels to be sold in the markets; • Support enrichment planting with coppicing species to allow short rotation woodfuels harvesting; • Strengthen the actors into a business association and support linkages with private sector distributors and retailers; *Valorization of agro-industries residues into biomass fuels* • Support agro-industries in the Research & Development of processes to valorize their agricultural residues into energy fuels. *Development of a framework to support private sector investment in the sector* • Adapt Community Forestry regulations to allow enough productivity in the harvesting of silviculture residues (chainsaw) and the processing • (center close from forest areas); • Royalties exemption for Community Forestry sourcing to be replaced by a fee to be paid to the community. • VAT exemption for formal distributors for domestic market retailing, fully compensated by the revenues generated from fines on illegal products. • Result-based financial incentives to support private sector investment. 2. <u>Decrease the consumption of biomass energy</u> *For industrial users* • Creation of a National Standard on energy efficiency for equipment • purchased in Cambodia (boilers, dryers, gasifiers…); • Enforcement of a strong taxation on procurement of non-compliant • equipment; • Progressive upgrading of formal actors through tax breaks (to be • defined) for those who decide to replace old equipment with compliant ones; • Support private sector investment through concessional loans. *For domestic users* • Creation of a National Standard on domestic cooking appliances • Enforcement of a strong taxation on import of non-compliant equipment; • Support private investment in manufacturing of locally produced advanced cooking devices;

	• Support a market-based adoption of alternative cleaner cooking solutions in some specific contexts where woodfuels are too scarce (such as LPG around the Tonle Sap lake to protect remaining flooded forests).
Precedents in the region	None

Energy efficiency, companies and households

#3 Adopt labelling and standards for electric appliances and energy-consuming products	
Short-term action	Launch preparatory work on products to be included and minimum performance standards to be attained.
Potential to reduce emissions or strengthen resilience	Medium. The switch to higher performance appliances and equipment will result in significant energy savings, and thus GHG emission reductions. The associated carbon abatement will be all the more significant as the share of coal in the power mix increases (as the emissions factor would increase).
Government lead	MME, MOE and MIH
Implementing actors	RGC (enforcement), Suppliers, Households
Rationale	• Electricity consumption is growing fast, driven by growth. • As shown by the EU example, energy labels help consumers choose energy efficient products, while ecodesign regulations (standards) require manufacturers to decrease the energy consumption of their products by establishing minimum energy efficiency standards. • Electric appliances and energy-consuming products such as air-conditioners are sold in the Cambodian market without labelling and standards. Labels and standards would result in the purchase of higher EE equipment, and life-cycle net gains for consumers (offsetting the possibly higher investment cost), notwithstanding associated carbon emission reductions. • This action is included in the draft EE Policy (2013) which states that "according to international experiences implementing and enforcing energy labels for end user products and their efficient use can result in energy savings of up to 50%."
Financing	Standards and labels may, in an initial phase, result in higher prices as the policy will induce customers to purchase higher-performance equipment. However, as international experience shows, this will be mitigated by (i) the lower life-cycle cost of the energy service thus procured as the high-performance consumes less energy over its lifetime; and (ii) Higher-performance will soon undergo a fall in relative prices as they will become mainstream.

Approach	• This change may require new legislation, in the form of a framework law like in the EU, allowing consecutive regulations (for new products) to be taken under this umbrella. • Preparatory work is needed on products to be included and minimum performance standards to be attained • There is a strong rationale for harmonization within ASEAN.
Precedents in the region	tbd

#4 Sensitize and advise the household and business sectors about the EE opportunities and technologies	
Short-term action	Formally approve the National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia
Potential to reduce emissions or strengthen resilience	Energy efficiency is generally regarded as the cheapest carbon mitigation option. However, unlike for RE, EE calls for virtually everyone (that consumes energy in one form or another) to make its contribution. The (yet to be approved) draft national Policy on EE (2013) sets the objective to reduce the energy consumption by 20% or 1,190 ktoe in 2035, compared to the business as usual projections, thus reducing the projected annual energy demand in 2035 further down to 4,757 ktoe, which will reduce GHG emissions by 3 MtCO2.
Government lead	MME, MIH, MOE, NCSD
Implementing actors	Households and private sector businesses that consume significant amounts of energy
Rationale	*Households* • The population of Cambodia is generally not aware of the potential to save energy and reduce associated costs and how this can be done through behavioral changes or better equipment. • As indicated, the (yet to be approved) draft national Policy on EE (2013) sets the objective to reduce the energy consumption by 20% in 2035, compared to the BAU projections. • This action is included in the EE Policy (2013) : “Organize public awareness campaigns in urban and rural centers with appropriate media coverage“. *Businesses* • Electricity costs are high in Cambodia. • Energy costs represent a high proportion of total production costs for a number of sectors that are energy intensive, eg garments, cement, etc.

	• Reducing these costs improves competitiveness, boosts profits but also may result in overall performance improvements. • Most companies particularly the smaller ones are poorly informed about the opportunities and available technologies to save energy. •
Financing	Public budget with donor support
Approach	• Approval of the National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia will send a signal to the market that energy efficient products will be promoted. This in itself may stimulate the market. via suppliers 'push'. • An awareness campaign plan and budget should be prepared by the (Relevant ministry) in consultation with donors and key target sectors (buildings, energy-consuming equipment, etc.) • These campaigns should be sustained in the initial years. • Related to this, but for the longer haul, is to "Integrate the principles of energy efficiency in the curriculum of schools and universities" (EE Policy). • For businesses, the proposal in the short term is to scale up the CPC model to create an industry information centre, focal point for all questions on RE-EE (workshops, info booklet, quality standards guidelines, case studies to show business case, annual meetings, field visits, booklet share at registration at MOC-MIH-CDC…). • In the longer run, Cambodia should move towards the establishment of a dedicated EE Agency within the government or as quasi autonomous body. This agency would not formulate policy but implement programmes and run information campaigns. There are several models across the world.

Precedents in the region	• Thailand developed the new national long-term Energy Efficiency Development Plan (EEDP) in 2011, with two main objective:
	  ○ To set the short-term (2011-2015) and long-term (2011-2030) energy conservation targets both at the national level and for the specific energy consuming sectors, including industry, transportation, commercial and residential sectors.
	  ○ To lay down strategies and guidelines for energy conservation, to establish the planning framework and the work plan and to allocate the tasks to related government agencies.
	• Targets:
	  ○ For all economic sectors, to reduce energy intensity (energy use per unit of GDP) by 25% in 2030, compared to 2005 levels;
	  ○ To reduce overall energy consumption by 20% (about a 30 million toe equivalent reduction) in comparison to projected BAU levels in 2030; overall CO2 emissions by 49 million tons and industrial sector energy consumption by about 11 million toe.

	• The Vietnam Energy Efficiency Program (VNEEP) is a ten year program, which was approved in April 2006 by the Prime Minister. It is a targeted national program and the first-ever comprehensive plan to institute measures for improving energy efficiency and conservation across all sectors of the Vietnamese economy. The overall aim of the program is to make initial savings of 3 – 5 % during the period 2006 – 2010 and a further 5 – 8 % during the period 2011 – 2015.

#5 Encourage energy audits or adoption of energy management systems in business sectors	
Short term action	Adopt RGC regulation on energy audits
Potential to reduce emissions or strengthen resilience	Same as above
Government lead	MME, MOE
Implementing actors	Energy-intensive sectors
Rationale	• Same rationale as above. • The main areas of priority for developing energy efficiency in the private sector are: Steam systems, mainly in industry. Cooling systems. Pumps and fans, which exist in both industry and large buildings. The development of Variable Speed Drives (VSD) motors is a main area of potential. Compressed air systems exist in almost all industrial facilities and are often a field with high potential. Hot water production in hotels, restaurants, hospitals, but also in industry. Solar systems should be developed. Lighting in tertiary but also in industry: fluorescent lamps, electronic ballasts, Light Emitting Diodes (LEDs), control systems. • 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 office for refrigeration. • It is assumed that the industrial energy consumption totals to about 3.04 TWh/year22 and with its present growth rate of 5.7%23 in terms of production, it can be expected that the energy consumption will grow steadily at an annual growth rate of 14.7%24 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%. (Source; draft EE Policy). • EE can reduce costs and boosts competitiveness of companies. • Conducting an energy audit is essential in that it provides the data and information required for informed decision making.
Financing	Budget – donor-supported programme for EAs
Approach	• To better understand the opportunities that exist in their facilities companies can either conduct energy audits or (for the larger ones) set up energy management systems (EMS). There are ISO standards for EMS (50001) and energy audits (BS EN 16247-1:2012 - Energy audits - Part 1: General requirements – work in progress). • The proposal is that the RGC - incentivize (though a partial subsidy) the implementation of EA at companies that consume up to (value to be set) MW/h (electricity or heat); - make EA compulsory for companies that consume in excess of (value to be set) MW/h (electricity or heat); - support the adoption of EMS in the larger companies. • Initially the RGC should draft specific regulations, as well as guidance notes or manual on EAs and EMS (see good example from Mauritius).
Precedents in the region	

Low carbon and cleaner transport

#6 Promote the adoption of cleaner vehicles and cleaner fuels through regulations and economic instruments	
Short term action	RCG to commission a review of regulations and standards governing fuel quality and the pollution and efficiency of vehicles
Potential to reduce emissions or strengthen resilience	Transport-related emissions are rising fast and fossil fuels are the predominant fuel. Switching to more efficient, higher-performance vehicles and enhancing fuel quality will substantially reduce GHG emissions.
Government lead	MOE, MPWT and MoE
Implementing actors	Households, companies for freight vehicles
Rationale	• Transport is a fast growing sector as mobility needs increase and fossil fuels remain the prime source to meet the needs of the sector. • Cambodia's fleet of vehicles is dominated by old, highly polluting second hand cars which are imported into the country without regulation. Quality

	standards for vehicle fuels are too low and highly emitting cars (eg 4x4) are treated like low-emitting vehicles. • Standards for vehicle fuels are too low. • This results in high air pollution levels and high emissions of GHG (inefficient cars). • The MPWT has commissioned a study on the GHG emissions of vehicles. • Mandatory fuel consumption, fuel economy, and/or GHG standards for light-duty vehicles are currently in effect for more than 70% of the global new vehicle market, driving development and introduction of new energy-efficient technologies, smaller engines, and lighter vehicles. Many governments around the world - including Japan, the European Union, United States, Canada, China, Australia, South Korea, Mexico, Brazil, and India - have proposed, established, or are in the process of revising light-duty vehicle fuel economy or GHG emission standards.
Financing	Adjusting import duties and taxation will have implications for the Cambodian treasury. A study should be conducted to evaluate these impacts and recommend the solutions that best reconcile public revenue generation and environmental considerations.
Approach	• Review import duties and VAT on imported vehicles to remove the advantage procured to old cars, and facilitate of new, hybrid, electric and low-emission cars • Set pollution standard for the purchase (and thus also import) of light-duty (eg E5 in EU) and heavy-duty vehicles (including second hand vehicles) • Set lower (higher) VAT rate (or a 'bonus-malus' system as exists in France) for vehicles with lower (higher) emissions per km • Reduce taxation on more efficient fuels • Incentive and promote all "fuel economy" products for fuel and lubricants • Set minimum standards for vehicle fuels (bring down sulphur level to 500ppm for diesel) In the longer run, Cambodia could adopt CO2 emission standard for vehicles and a labelling system for new cars for fuel consumption and CO2 emissions; and move to a carbon tax that would tax all fossil-based liquid and solid fuels based on their carbon content. Several precedents exist internationally.
Precedents in the region	• Neighboring countries (Vietnam, Laos) have recently amended their tax system to penalize older and more polluting cars, and encourage renewal of their car park. • Smaller and more efficient cars (very few large 4x4 or SUV) are seen in Vietnam and Thailand.

#7 Develop and implement a climate-friendly urban transport policy in the larger cities	
Short term action	Elaborate sustainable urban transport master plan for Phnom Penh
Potential to reduce emissions or strengthen resilience	Transport-related emissions are rising fast and fossil fuels are the predominant fuel. Switching to more efficient, higher-performance vehicles and enhancing fuel quality will substantially reduce GHG emissions. Public urban transport holds significant potential for carbon abatement (and reduction of the high economic cost of congestion and air pollution) in the larger cities.
Government lead	MPWTMME, MOE
Implementing actors	Larger city administrations, private sector transport companies
Rationale	• Cambodian cities are growing fast and its urban population is rapidly expanding. • Increased urban traffic (Tuk-tuk, cars, motorcycles) has resulted in higher GHG emissions, air pollution and congestion. • Public urban transport would address all these issues but remains underdeveloped in large Cambodian cities. • The MPWT is planning to launch a study on congestion in the city of Siem Reap.
Financing	Donors for a transport master plan in the (5) larger cities. Private operators through PPP to invest and operate the services.
Approach	• Conduct study to elaborate public urban transport master plans • Organize tender for PPP in Phnom Penh • Clean bus services in an initial stage
Precedents in the region	• The transport ministries in Indonesia, the Philippines, Viet Nam and Thailand are working to improve their sustainable transport action plans • At the ASEAN level, fuel efficiency policies and green freight and logistics are taken up as issues in a regional strategy on sustainable transport. • The Indonesian Ministry of Transportation aims to incorporate environmental concerns into its five-year plan and is drafting a white paper – a collection of proposals and options – on environmentally sound freight transport. In order to realise green transport projects, the Department of Transportation and Communication of the Philippines is improving the basic rules and management of the Special Vehicle Pollution Control Fund. • Indonesia has improved its methods of monitoring and reporting greenhouse gas emissions from transport and is drawing up an action plan to make further improvements to the system; Thailand is developing an MRV system for transport as well.(Source: GIZ)

Low-carbon more efficient waste management

#8 Promote climate friendly waste management systems	
Short term action	Create a framework (infrastructure, rules and regulations) for waste reducing, reusing and recycling
Potential to reduce emissions or strengthen resilience	High in short term
Government lead	MoE, Municipalities/khan, Ministry of Interior
Implementing actors	Industry players, HH (to a minor extent)
Rationale	• Industry (tourism, manufacturing, construction) waste (solid and water waste) is growing and will grow further => potential is high and growing. • Currently no infrastructure for waste sorting, re-use, recycle management system. • Private companies have high expectations, as waste is a growing concern for their sustainability plans. • Economic opportunity: waste management is a business in itself: value created from recycled waste (energy production, construction material, compost…) • The most prominent collecting services are done by private companies (CINTRI in Phnom Penh and GAEA in Siem Reap), under a PPP framework. • Sub-decree on waste management exist (July 2015) but does not offer options for sorting, recycling
Financing	Public budget (public service in most countries); private capital if PPPs
Approach	• Continue reinforcing application of sub-decree, with regular (bi-annual) assessment of performance, with penalty system (fines and concessional license renewal) to reinforce quality service of private collecting companies. • Impose minimum environmental standards on private landfills • Create a framework (infrastructure, rules and regulations) for reduce, reuse, recycle with clear tariffs as way to incentivize private investment in that domain. • HH: Information campaign, tax on plastic bags • Promote PPPs for municipal waste management schemes
Precedents in the region	tbd

Sustainable Construction

#9 Incentivize sustainable building and construction sector	
Short term action	Strictly enforce building set-back provisions
Potential to reduce emissions or strengthen resilience	High: direct effect on energy consumption, with strong replication power due to fast growth of the sector
Government lead	MLUPC, MoE, Municipalities
Implementing actors	Construction players, IBC, Korean, Eurocham
Rationale	• Construction sector is growing in an unsustainable way (low quality material, low insulation power, no natural light => increase energy needs => increase GHG emissions). • Sustainable architecture available in Cambodia (quality local material, home country of bio-climatic construction). • Low enforcement of urban planning laws (set-back in particular), lack of transparency on construction permits • Case for good quality construction = energy but also monetary saving.
Financing	National budget, donors
Approach	• Precedent measures on energy and waste management are applicable to the construction sector • Approve building code as planned (end 2016) • Strengthen existing urban planning regulations (set-back law) to encourage professionals to consider natural light and natural ventilation • Include climate proof measures (voluntary base) in the upcoming construction standards • Support and endorse green building council roadmap
Precedents in the region	Vietnam Green Building Council[96]

[96] http://vgbc.org.vn/index.php/en

Sustainable tourism

#10 Support Green Hotel Certification	
Short-term action	Industry campaign to raise awareness on economic benefits of RE-EE-waste and boost adoption of low carbon technologies
Potential to reduce emissions or strengthen resilience	High
Government lead	Ministry of Tourism
Implementing actors	Hotel industry players
Rationale	• Hotel industry is key in Cambodia GDP. International groups are sophisticated in their approach to climate change (environmental policy), while SMEs (most of the players) are far behind. • Local champions are found in Siem Reap, Phnom Penh, Koh Rong, and there is a strong potential for replication and domino effect due to the rapid growth of the sector. Ecotourism has a particularly strong potential to raise awareness on sustainable tourism. • However there is very limited awareness on the benefits of low carbon measures in the sector. • ASEAN green awards and Cambodian hotel ratings offers framework for improvement (mainly on energy and waste) but are not well known.
Financing	National budget
Approach	• Precedent measures on energy and waste management are applicable to the tourism sector • Long-term industry campaign to boost information and promote ASEAN green hotel standard and Cambodia green hotel ratings • Training and capacity building (see earlier in Energy) • Publish an ecotourism guide to be circulated in visitors center
Precedents in the region	ASEAN green hotel standard[97]

[97] http://www.asean.org/storage/2012/05/ASEAN-Green-Hotel-Standard.pdf

Agriculture, forestry, fisheries, livestock

#11 Create a secure framework for private investment in Natural Resources Management	
Short term action	• Reinforce law on illegal logging and illegal fishing • Accelerate adoption of zoning plans to ensure no encroachment of lands takes place • Re-allocate a recently cancelled concession for sustainable production/integrated farming system • Create toolkit for EIA
Potential to reduce emissions or strengthen resilience	High (direct positive effect on carbon sink)
Government lead	MAFF, MoE, MLUPC
Implementing actors	Farmers, agri-businesses
Rationale	• Natural resources = high carbon value in forest, mangroves, agricultural land => carbon sink of Cambodia. • Strong link between sustainable natural resources and poverty alleviation. If natural resources are harmed, Ecosystem services are depleted (watershed, carbon sequestration) and food security threatened (fishery stock are main source of proteins for 70% of population, no water for agriculture). • Economic growth led by PS is both a threat (agriculture land expansion, illegal activities) and part of the solution (green growth). • Current land use situation is improving but still unclear, illegal settlement on ELCS is a major disincentive and risk for investors. • Investors need clear and transparent legal framework on land tenure and long term visibility to recoup investment in a long cycle production sector (10-70 years).
Financing	
Approach	• Reinforce law on illegal logging and illegal fishing to maintain high level of forests and mangroves, including penalties (continue recent improvements), working with conservation NGOs that have a presence on the ground • Accelerate adoption of zoning plans to ensure no encroachment of lands takes place • Set up a provincial multi-stakeholder roundtable to re -allocate a recently cancelled concession for sustainable production/integrated farming system to

	serve as model for CSA where biodiversity is conserved and income is generated. • Create toolkit for EIA (guidelines on best practices and minimum requirements per sector), to clarify expectations until new EIA law is approved. • Set an example for Sustainable Forestry Management (see next recommendations) • Facilitate permitting and other requirements across Ministries so that it is clear and simple for investors to move ahead with sustainable production plans. • Work on a sustainable land use master plan showing production potential, land tenure, soil conservation, ELC classification (incl. agri, livestock, forestry, fisheries) to promote deforestation free supply chain • Engage in FLEGT and develop master plan for sustainable production forest management
Precedents in the region	• Indonesia land use planning at provincial level to ensure palm oil supply chain resilience • Sustainable landscape projects with CI, WWF, WCS in the Mekong • Sustainable forest management policy in Vietnam

#12 Increase appeal for certified and zero deforestation supply chain	
Short term action	• Pilot champions' case to regain trust of reforestation companies • Promote FSC forest and planted forest
Potential to reduce emissions or strengthen resilience	High (direct increase of carbon sink)
Government lead	MoE, FA /MAFF
Implementing actors	Reforestation companies, agri-businesses
Rationale	• Degraded forests have the potential to reduce pressure on deforestation as part of a sustainable landscape plan • Reforestation, agro-forestry and sustainable agri-business, if managed sustainably, have the potential to substantially increase the carbon sink • FSC [98] certification guarantees sustainable environmental and social management of forests • End buyers of sensitive commodities (rubber, acacia, rattan, palm oil) are now putting more efforts on ensuring zero deforestation within their supply chain

[98] Forest Stewardship Council, https://ic.fsc.org/en

	• A few reforestation pilot cases exist (Camagra and FSC certified Grandis planting Teak, Acacia), but face difficulties due to: 1. Export custom officers not familiar with timber export business, so procedures are burdensome and costly 2. Disruption of the export timber market because of Illegal logging 3. Changing terms of concessions recently dropped from 90 to 50 years (reducing the plantation rotation of - 30%), forcing companies to re-work their development master plan and adapt their EIA (due to reduced terms, development plan is re-oriented to shorter rotation species) 4. Unclear land tenure reducing the concession size of 20-30%, with direct effect on expected revenues
Financing	Companies
Approach	In addition to the previous recommendation, select interested companies to: • Initial commitment from government to facilitate permitting of sustainable reforestation process and provide protection from illegal settlement/squatting on secured ELC licenses • Fast track export custom procedures • Exempt tax on sustainable timber export • Reconsider concession term (keep at 90 years), or fast track new master plan approval and EIA application • Facilitate FSC process and discussion with FSC representatives • Embed zero deforestation in land use planning
Precedents in the region	

#13 Reinforce resilience of small producers through training and market consolidation	
Short term action	User friendly toolkit on 'how to build a cooperative' and engage in contract farming with TA on rural entrepreneurship
Potential to reduce emissions or strengthen resilience	High replication potential and domino effect due to 80% population depend on agriculture income. Agriculture is by far the 1st GHG emitter sector.
Government lead	MAFF, MoE, MOC
Implementing actors	Farmers, fishermen, Private sector cross-cutting service partners (contract harvesters, food processers…)

Rationale	• CSA techniques have a direct effect on water retention and soil carbon sequestration, ensuring revenues because of a higher resilience of soil • Diversification of revenues sources seen as key to CC resilience. • Water management is critical in CSA, with moisture storage and retention, not just in dams, dykes, ponds, lakes, aquifers & vessels, but also in the soil, plants and vegetation biomass, humus and groundwater itself • Contract farming can help filling the gap in infrastructure development when tied up with commitment on local development (storage, irrigation systems) • Cultural habits: Low risk profile of farmers slowing down adoption on CSA. Farmers have a short-term vision, do not invest in long term. No natural appeal to cooperative of association. Their first concern is income security. • Below activities are necessary to ensure a stronger and resilient supply chain
Financing	Private (commodity buyers), donors
Approach	• National roadshow on CSA to create momentum (info booths, field practice, trials…), in support to existing programs (IFAD, ADB, AFC, CAVAC, HARVEST), 1. Special focus on women (studies have shown that impacts are stronger and longer when programs are targeting women, the most vulnerable to climate change). 2. Combined with an award scheme (star rating) to reward farmers that pass all CSA best practices trainings (comes in support to next reco). 3. User friendly toolkit on 'how to build a cooperative' showing the benefits and best practices of contract farming to push adoption of small producers associations (and facilitate irrigation systems like communal water basins) 4. Call for Technical Assistance on entrepreneurship, serviced by a private company specialized in rural entrepreneurship, to build capacity of small producers to endorse change in their business operations • Sustained engagement at farm community level: farmer field schools, 24 hr on-line support. • Support switch to higher value crops such as horticulture that increase revenue diversification by connecting farmers to markets through contract farming purchase agreement and price control (see next recommendation on supply chain resilience). • Call for proposal open to private companies to 'mainstream access to strategic information' through technologies that allow all users to share real time information on weather forecast, planting and harvesting times • Embed CSA at school and in agriculture training program (RUA) (long term),
Precedents in the region	• FBA (Farmers Business Association) in Cambodia, supported by iDE: farmer to farmer advisory service and CSA technology distribution

	• Khmer organic cooperative[99] • Pur Projet[100] in Thailand in partnership with corporates (Accor, Ben and Jerry's) • RIICE[101] using remote sensing images in Cambodia to inform about rice growth • Thales technology on DRR strategic management • Myanmar CSA strategy (2015)

#14 Build a resilient agriculture/fishery supply chain	
Short term action	Fast track adoption of quality standards of CSA inputs (resilient seeds, organic fertilizers, drip irrigation)
Potential to reduce emissions or strengthen resilience	High: a resilient supply chain will foster purchase agreement with big commodity buyers, which in turn will secure revenues for small producers and increase their resilience
Government lead	MAFF, MoE, MOC
Implemeting actors	Farmers, agri-business, government (for infrastructure)
Rationale	• Whole/big retail commodity buyers (MARS, M&S, Olam) are re-directing their purchase orders on countries with resilient supply chain (which ensure continuity of supply, respect of sustainability measures, build capacity of farmers on CSA). • Cambodia lacks competitive advantage in this area: poor storage facilities, limited irrigation systems, low farmers association rate, poor certified seed production => vulnerability is high and resilience is low. • Registration of CSA inputs (climate resilient seeds, organic fertilizers, drip irrigation systems) is slow and burdensome, so it's difficulty to market CSA inputs against illegal inputs. • Need for a completely new way of farming (equipment, techniques), not disturbing soil to deliver on CSA.
Financing	National budget
Approach	• Ensure farmers understanding of CSA techniques (see precedent recommendation).

[99] http://khmerorganiccooperative.com
[100] www.purprojet.com/en
[101] http://www.riice.org

	• Fast track quality standards registration of CSA inputs (resilient seeds, organic fertilizers, drip irrigation) to boost domestic and export sales, while reinforcing penalties for illegal/counterfeited inputs. New frameworks and protocols may be needed to assess new technologies. • Adopt standards (under development SNR-I, SRP, TUV Rheinland on sust. Rice), while building in-house capacity of implementers and auditors. • Facilitate entry (administration procedures) of international technology providers for CSA techniques (new machinery, new seeds, new equipment). Need to have more global players to invest in resources and register technologies to deliver the innovation and efficiencies Cambodia farming requires for climate adaptation. • Call for proposal open to private companies, to replicate model farms examples on integrated farming system in each province/district (show ROI)[102]. The call shall also be open to fishermen cooperatives (including women's groups) for fishing/fish processing, to replicate and scale up existing models of sustainable aquaculture on the Tonle Sap lake[103] • Accelerate infrastructure development: build collective dryer/storage [104] facility (for rice, cash crops and 'flash freezing' fillets or processed fish), improve freight efficiency (low emission freight solutions, see transport section), that will accelerate competitiveness for export market. • Reinforce Rural Development Bank capacity to allocate credit scheme for CSA practices, with seasonal loan products in banks and MFIs.
Precedents in the region	Thailand small producers associations Cooperatives in Latin America are quite a good model

#15 Provide framework for scaling up Climate Risk Insurance	
Short term action	Engage with Insurance companies to show a climate resilient framework is being reinforced.
Potential to reduce emissions or strengthen resilience	Medium: Resilience of small producers and supply chain must be built before to serve as a solid base for scaling up private climate risk insurance schemes. So, need to address previous 2 recommendations first.
Government lead	MAFF, Ministry of Water Resources and Meteorology, MoE, MEF

[102] http://www.cfap-cambodia.org/index.php?option=com_content&view=article&id=483%3Athe-specific-training-program-called-on-site-training-model-&catid=28%3Anews&Itemid=25&lang=en

[103] http://www.conservation.org/projects/Pages/tonle-sap-lake-conserving-cambodia-fish-factory-mekong.aspx

[104] Need to dry products as soon as harvested to minimize moisture content and avoid wasting resources hauling water around the country.

Implemeting actors	Farmers, insurance companies
Rationale	• Farmers are the first hit by CC, and their understanding of the solutions is still low (see cultural habits above). • Climate risk insurance is an option to cover cost related to natural catastrophes. Only 2-3 pilots (Forte, CEDAC). • For climate risk insurance to scale up, risks must be addressed and measures taken to minimize them. • Resilience of small producers and supply chain is key to minimize the risk .So, this recommendation is intrinsically linked to 2 precedent ones.
Financing	Insurance companies, Ministry of Water resources and meteorology, MoE
Approach	• Implement 2 previous recommendations; • Strengthen information system (Ex: RIIC[105] E[106]) to have access to strategic information in real time, and reinforce efficiency of the decision making process; • Engage with Insurance companies to show a climate resilient framework is being reinforced and risks are minimized. • Link contract farming association and insurance companies to accelerate scheme development.
Precedents in the region	• RIICE in Bangladesh, Cambodia, India, Indonesia, Philippines, Thailand and Vietnam. • Climate Insurance Fund by Blue orchard and Swiss-Re in Cambodia • Crop insurance system in the Philippines.

#16 Support and consolidate a low carbon livestock sector	
Short term action	• Adopt quality standards for the NBP to revive adoption rate • Research further on animal inputs (feed, medication) as a way to lower emission from improved feeding practices
Potential to reduce emissions or strengthen resilience	High: because of the emission factor of methane and Nitrous Oxide as opposed to CO2 (emissions of GHG come from enteric fermentation; methane and nitrous oxide emissions from Animal Waste Management Systems (AWMS))
Government lead	MAFF, MoE
Implementing actors	Farmers, agri-business

[105] http://www.climateinsurancefund.com

[106] Remote-sensing based information and insurance for crops in emerging economies.

Rationale	• Traditional farming system in Cambodia combines rice and livestock production. So, previous recommendations are applicable to livestock producers. • GHG emissions from livestock is expected to grow due to substantially increasing demand for livestock products, in particular meat, linked to the growth in population and real GDP per capita.
Financing	National budget
Approach	• Ensure farmers' understanding of CSA techniques (see previous recommendations). • Adopt quality standards for the NBP to revive adoption rate. • Research further on animal inputs (feed, medication) as a way to lower emission from improved feeding practices
Precedents in the region	• Thailand: private companies offering climate friendly animal feed • Vietnam National Biodigesters program

#17 Embed PES in the legal framework	
Short term action	Create a user-friendly toolkit to show benefits of PES within the framework of the Environmental Code and EIA law.
Potential to reduce emissions or strengthen resilience	High: because of the direct attribute of ecosystem services to regulate climate (forests regulating fresh water sources, increasing carbon stock, mangrove regulating soil erosion…)
Government lead	MAFF, MME, MOE, CDC
Implementing actors	Private sector developers/investors, HH
Rationale	• Natural Capital valuation (including PES) is a growing field of interest for big corporate players active in NRM (apparel, commodity, brewery, oil palm…). A standard protocol is under development. • PES provides an opportunity to put a price on previously un-priced ecosystem services like climate regulation, water quality regulation and the provision of habitat for biodiversity. • Cambodia has a high carbon sink mainly due to natural forests, but is threatened by a growing and sporadic economic activity. • PES is an option to make private actors contribute to conservation that would increase resilience to CC and/or reduce GHG emissions. It has the benefit to anticipate and manage climate risks pro-actively, rather than repair damage at a higher cost.

	• PES is mentioned in numerous legal texts, but there is neither clear nor transparent framework that would encourage private investments. • Financial instruments to serve as recipients of PES are missing in Cambodia (CI Trust fund is hosted by Blackrock in Singapore). • This recommendation is intrinsically linked to NRM master plan.
Financing	Companies
Approach	• PES policy to clarify rules and procedures applying to PES for watershed, eco-tourism, Fishery, Forestry (REDD+)… Policy should address among other points: 1. Create polluter pay principle, tax incentives, and other means of attracting both those providing the services and those investing in them, *2.* Remove barriers to work with hydropower developers, ELC owners, and others interested companies in engaging in PES schemes before permits are issued and projects are developed *3.* Create a clear and fair share of proceeds framework • Work with conservation NGOs to scale current pilots such as Ibis Rice, voluntary REDD+, bundling of services across large landscapes like the Cardamom mountains • Potentially impose PES on certain industries like hydropower to maintain watersheds in good condition, or tourism in coastal zones to re-create mangroves • Create user-friendly toolkit to show benefits of PES within the framework of the Environmental Code and EIA law. • Allow registration of Trust funds in Cambodia as a sustainable finance tool for conservation (Trust fund featured by the TWG on sustainable PA financing as an easy vehicle to collect conservation finance)
Precedents in the region	• Vietnam: PES on water provision • Cambodian: NTFP association[107], unsuccessful attempt of FFI on water provision the Cardamoms, bird watching by WCS, IBIS rice by WCS, private REDD+ projects (Seima, Oddar Meanchey) • Conservation International Trust Fund in Singapore, currently raising private funding for conservation activities in the Cardamoms. • Costa Rica: Nation wide PES plan including tourism, water fund, and payments to small-scale farmers to keep forested areas and prevent soil erosion.

[107] http://www.ntfp-cambodia.org

Cross-sector

#18 Create framework for enhanced PS-RGC dialogue on climate change	
Short term action	Add climate friendly solutions to the existing CDC Qualified Investment Projects (QIP) list 1st year PS workshop to keep momentum running.
Potential to reduce emissions or strengthen resilience	High
Government lead	NCSD, MoE
Implemeting actors	Companies, CCCA (in partnership with Oxfam CSR national platform, Eurocham green biz committee, Chambers of commerce, TWGs, industry association (CRF, CAIA, GMAC, CAMFEBA, MFI association, Banking association, Hotel association…)
Rationale	• Very little engagement with PS on CC • No coordination of PS climate related interventions, although they could benefit from information sharing, technology solutions transfer (climate solutions are cross-sectorial) • No CSR consulting firms in Cambodia as legal environment not yet mature for this type of business • Climate change is just one component of a larger scope => recommendation to widen the scope to include all CSR aspects (economic, social sustainable practices that intrinsically linked to climate change issues)
Financing	National budget/CCCA
Approach	Create focal point within NCSD for all PS related CSR/climate interventions to: • Add climate friendly solutions to the existing QIP list[108] • Engage with CDC to include these solutions in the future investment law • Coordinate and manage the newly created network and sustain momentum gained during the public consultation week (attendees on 15 March workshop expressed their wish to meet again in the short term to continue learning and exchange best practices on sustainability) • Organize bi-annual workshops (for the 1st year, then annual) to share info and updates on low carbon technologies, network and see progress within the RGC CCAPs. Content for the 2 first workshop could be: • Show case best practices in each key industry (Coca Cola-H&M for manufacturing, Amru-IBIS for agriculture, Sofitel-Songsaa-Shinta Mani-Cabaret bleu for hospitality),

[108] http://www.cambodiainvestment.gov.kh/investment-scheme/investment-incentives.html

	• Training on ISO norms (26000 on CSR, ISO 14001 on Environment). • Benefits of climate disclosure showing the business case: companies reporting on carbon are economically more performant than the ones not reporting (introduction to CDP, carbon reporting, carbon price concept *This should build on existing initiatives such as Green biz CSR committee and Oxfam national CSR platform, already doing some work in those areas.* • Actively engage CDC, MOC, MEF to install a tracking system for private climate investments at company registration level (simple tick box in registration forms sending information to a centralized information system within Department of CC). This should be compulsory for all IQP projects. • Propose a framework for mandatory/voluntary carbon disclosure at the company level: guidelines on which companies to target, what tool to be used, what technical support to provide. The main incentive for companies is that companies with sustainability programs outperform their peers (strategic thinking based on lessons learnt is showing longer benefits)[109]. • Reinforce understanding and skills of NCSD and Department of CC on Private sustainability development plan per industry (garment, food and beverage, rubber, agriculture, construction, transport, cities).
Precedents in the region	• Malaysia, Vietnam, Singapore offer pieces of legislation to report on energy usage, or encourage disclosure on governance and sustainability. • The Philippines have a CSR Act. • Indonesia has laws for CSR and no financial disclosure • National offices of WBCSD (World Business Council on Sustainable Development) as seen in Vietnam, Singapore, offer technical support to companies • Private consulting firms (Corporate Citizenship, CSR Asia) offer reporting services in Thailand, Hong Kong, Malaysia, Singapore

Expand supply of green finance

#19 Develop dedicated loan programme for small- and medium sized EE projects	
Short term action	Request DFIs and donors active in Cambodia to explore interest in and feasibility of dedicated EE credit line for Cambodian SMEs supported by a technical assistance package
Potential to reduce	Carefully designed cost-effective investments could reduce by at least 20% the energy consumption and energy costs of SMEs operating in the commercial,

109 http://www.sustainablebrands.com/news_and_views/new_metrics/mark_mcelroy/new_evidence_bolters_claims_connectivity_between_csr_market_?utm_source=newsletter&utm_medium=businessweekly&utm_campaign=mar7&mkt_tok=3RkMMJWWfF9wsRoluK%2FLZKXonjHpfsX66esuUaa3lMI%2F0ER3fOvrPUfGjI4ETcZqI%2BSLDwEYGJlv6SgFTrTBMbVxyLgOXxk%3D

emissions or strengthen resilience	tourism and manufacturing sectors, reducing pressure on the electricity grid, and GHG emissions of the 'energy' sector (as defined by UNFCCC and reported in Cambodia's SNC)).
Government lead	MOE, MIH
Implementing actors	DFIs, Commercial banks, donors (for Technical Assistance support package)
Rationale	• Although hard data are missing, there is anecdotal evidence that SMEs in the commercial, tourism and manufacturing sectors could save energy by implementing carefully designed cost-effective investments plans, as might be recommended by energy audits. Dedicated loans with attractive terms (interest rates, tenors, collateral requirements) would contribute to unlocking these investments. • While 70% of SMEs have an interest in EE & RE solutions, most of SME investments are traditionally financed from own funds. However, in terms of future investments, most SMEs are interested in using external funds (Meet-Bis, 2013). • However, SMEs face challenges in accessing finance, for a range of reasons including the high share weight in Cambodia of small SMEs and the informal sector (see Section 4). • Because most SMEs do not operate as registered companies and do not have proper financial records, banks impose onerous collateral requirements and charge high interest rates (in the banking sector, the interest rates range from 10 to 12% per annum. MFI interest rates range from 14 to 30% yearly)(Meet-Bis report). • As a result, "Energy efficiency/ renewable energy investing and financing is a relatively new area for both the SMEs and the financial institutions with some small isolated initiatives started by some financial" institutions" (Meet-Bis report). • Current donor-financed schemes do not target the SME EE segment (FMO loans to Prasac and Amret for biodigesters; AFD loan to three MFIs for household-level SHS) • Given the lack of long-term resources of local commercial banks, and as commercial banks are generally unfamiliar with EE projects (A USAID project implemented by Mekong Strategic Partners is looking to remedy this) and what EE lending entails, the solution could be initially to develop a DFI credit line backed by technical assistance funded by donors.
Financing	DFI credit line – Donor funds for a TA package
Approach	• The recommendation is to implement a dedicated EE credit line (including RE measures integrated into the buildings such as rooftop solar PV panels; note that the programme would not finance utility-scale RE projects). • A DFI (ADB, AFD, GCPF, etc.) would extend concessional loan to a group of qualifying banks having appetite for the sector.

	• The loan programme would target SMEs or small projects by larger companies. • The programme would be supported by a TA package to assist both the banks (in marketing, identifying, selecting, appraising and monitoring projects) and project owners (in developing bankable projects). Training could also raise awareness of FIs on financial characteristics of EE and RE projects (including need for longer loan tenors). The TA could also include a component to train banks and FIs that do not receive a refinancing loan from a DFI but are interested in the 'soft' added value (learning and building skills) of the programme. • The programme could also be complemented by a risk sharing mechanism to reduce the perceived risk to local FIs. • The first step would be to seek donor funding for and launch a study on on the market potential and feasibility of a credit line. The study would identify which FIs would have appetite and be qualified to implement this credit line and determine the scope of a technical assistance support package. • A prerequisite would be to enact/clarify regulations on energy audits (the aforementioned study could make recommendations in this regard.)(see above) *Other possible actions:* • To encourage green lending in the longer-run Cambodia could consider providing incentives to local FIs, such as eg reducing the level of bank mandatory reserves at the as in Lebanon NBC (to be further studied). • A set of reforms aimed at reducing/simplifying/facilitating enforcement of bank loan collateral, upgrading accounting standards, encouraging the transition to formal sector status of nonregistered enterprises would have spillover benefits for private sector climate-related investments. • The RGC or NBC could make the tracking and reporting of low-carbon and climate resilience loans mandatory, based on e.g. the 2015 MDB criteria for mitigation and adaptation projects. • A Cambodian entity (such as an FI) could be prepared for accreditation by GCF, enabling it to extend loans and guarantees (neither NCSD nor NCDD which are understood to be seeking accreditation would be able to fulfill this role).
Precedents in the region	Thailand (AFD credit line to Kasikorn Bank), Indonesia (AFD credit line to Bank Mandiri. The Thailand's Energy Conservation Promotion Act (ENCON) of 1992 set up energy conservation and renewable energy policies, including the ENCON Fund financed from a tax on all petroleum products sold in Thailand. Under the Energy Efficiency Revolving Fund (EERF) zero interest loans were made from the ENCON fund to 11 local banks for on-lending to EE projects.

#20 De-risk green lending to SMEs and households

Short term action	Explore feasibility of a national guarantee fund (or facility)
Potential to reduce emissions or strengthen resilience	A guarantee scheme would help unlock green lending and thus facilitate investments in projects reducing GHG emissions, particularly in sectors in sectors such as commercial buildings, tourism, manufacturing, etc.
Government lead	MOF, MOE, MIH
Implemeting actors	Local FIs, Existing or new body to host and operate the guarantee scheme
Rationale	• While recommendation #21 would expand liquidity (through a DFI credit line) for green loans, a guarantee scheme would reduce perceived risk to local FIs. • The collateral requirements are particularly daunting for the smaller borrowers (see above). • This results in a higher cost of borrowing, and discourages many small companies from borrowing. • A dedicated low-carbon guarantee fund could facilitate lending by reducing or eliminating those barriers for the smaller companies. • Such guarantee funds typically achieve a higher ratio of mobilization of additional resources compared to grants and loans. • A national credit guarantee scheme came close to being implemented in Cambodia in 2011 by the Ministry of Finance (which was also to host and operate the scheme). The blueprint for this initiative which would have seen local banks and the RGC contribute to the capitalization of the fund is still worthwhile and could serve as a basis for the proposed fund.
Financing	RCG and donor funds for core (first loss) capital leveraging DFI and private capital
Approach	• The Guarantee Fund's core capital would consist of (either domestic and/or donor) public funds providing the 'first loss' tranche. A layered structured could be designed to leverage additional (DFI) or private capital, along the lines of the GCPF (see above) or the European Energy Efficiency Fund (http://www.eeef.eu). • The Guarantee Fund would charge banks a fee based on their portfolio, and sufficiently attractive to trigger lending at reasonable rates. The Fund's management would be entrusted to a professional manager recruited through competitive tendering or a DFI. The host could be an existing (non-FI to avoid conflicts of interest) entity, including possibly the MOF. In Lebanon, the national guarantee fund targeting SMEs, —Kafalat—, is owned by the National Institute for the Guarantee of Deposits and fifty Lebanese banks (http://kafalat.com.lb).

	• The Guarantee Fund would guarantee up to 80% of the net losses incurred by local banks on their green loans to SMEs (and other eligible projects) up to a ceiling. • A study would be needed to explore the feasibility, structuring and initial capitalization of the scheme.
Precedents in the region	Malaysia, the Philippines, and Thailand - but not specifically for green lending

Table 13: Short-term recommendations per type of public policy instruments

Recommendations	Information policy	Capacity Building	Regulation Policy	Financing and economic instruments
Energy sector				
#1 Adopt a Renewable Energy Policy			RE target of 10% of electricity mix	
#2 Support sustainable consumption and production of solid biomass energy			Fine system on illegal woodfuels	
Energy efficiency, companies and households				
#3 Exempt solar panels and equipment from VAT and duty (households and distributed generation)			Preparatory work on standards	
#4 Sensitize and advise the household and business sectors about the EE opportunities and technologies			Approval of EE National Policy, Strategy and Action Plan	

#5 Encourage energy audits or adoption of energy management systems in business sectors			Adopt RGC regulation on energy audits	
Low carbon and cleaner transport				
#6 Promote the adoption of cleaner vehicles and cleaner fuels through regulations and economic instruments			Commission a review of regulations and standards governing fuel quality and the pollution and efficiency of vehicles	
#7 Develop and implement a climate-friendly urban transport Policy in the larger cities			Elaborate sustainable urban transport master plan for Phnom Penh	
Low-carbon more efficient waste management				
#8 Promote climate friendly waste management systems			Waste reducing, reusing and recycling framework	
Sustainable Construction				
#9 Incentivize sustainable building and construction			Strictly enforce building set-back provisions	
Sustainable tourism				

#10 Support Green Hotel Certification	Campaign on economic benefits of EE-RE-Waste			
Agriculture, forestry, fisheries, livestock				
#11 Create a secure framework for private investment in NRM	Create toolkit for EIA		-Reinforce law on illegal logging and illegal fishing - Accelerate adoption of zoning plans	Concession for sustainable production/integrated farming system
#12 Increase appeal for certified and zero deforestation supply chain	-Promote FSC forest and planted forest - Pilot champions' case to regain trust of reforestation companies			
#13 Reinforce resilience of small producers through training and market consolidation	Toolkit on 'how to build a cooperative'	TA on rural entrepreneurs hip		
#14 Build a resilient agriculture/fishery supply chain			Adoption of quality standards of CSA inputs	
#15 Provide framework for scaling up climate risk insurance	Engage with Insurance companies			
#16 Support and consolidate a low carbon livestock sector			Adopt quality standards for the NBP	Research further on animal feeding and medication

#17 Embed PES in the legal framework	Toolkit to show benefits of PES			
Cross-sector				
#18 Create framework for enhanced PS-RGC dialogue on Climate change			Add climate friendly solutions to the existing CDC QIP list	
Expand supply of green finance				
#19 Develop dedicated loan programme for small- and medium sized EE projects				Mobilize DFIs and donors for creating a EE credit line
#20 De-risk green lending to SMEs and households				Explore feasibility of a national guarantee fund

5. BIBLIOGRAPHY

ADB. (2014). *Country Povert analysis: Cambodia.*

ADB. (2015). *Renewable Energy Developments and Potential in the Greater Mekong Subregion.*

Almack. (2012). *Assessing vulnerability to climate change and building adaptive capacity in Cambodia's fisheries sector.*

Better work. (2009). *ENERGY PERFORMANCE IN THE CAMBODIA GARMENT SECTOR.* BFC, IFC.

Climate Policy Initiative. (2015). *The Global Landscape of Climate Finance.*

Deloitte. (2015). *The Business Case For: Solar PV in Cambodia.*

Ecosystem Marketplace (2016), *Raising Ambition, State of the Voluntary Carbon Markets 2016.*

EdC. (2014). *Annual report.*

EIC. (2013). *Renewable Energy Development in Cambodia: Status, Prospects and Policies.*

Ethical Corp. (2015). *Sustainable Supply Chain Trends 2015* .

FFI. (2014). *SPES: lessons learnd and next steps.*

Fox, J., Castella, J., Ziegler, A., & Westley, S. (2014). Rubber plantations expand in Mountainous Southeast Asia: what are the consequences for the enviornment? *Asia Pacific Issues* (114).

GSSD-MoE. (2015). *Cambodia's Second National Communication under the United Nations Framework Convention on Climate Change.* Kingdom of Cambodia.

Haitao, L., Jing, L., Xiao, L., Yanhai, Z., Sufei, F., & Gaoming, J. (2015). *Mitigating greenhouse gas emissions through replacement of chemical fertilizer with organic manure in a temperate farmland.*

IFC. (2012). *Financing to Micro, Small, and Medium Enterprises Globally.* Washington: World Bank Group.

IGES. (2015). *List of grid emission factors.*

IUCN. (2015). *The IUCN red list of threatened species.*

Johnston. (2009). *"Scoping Study on Natural Resources and Climate Change in Southeast Asia with a Focus on Agriculture.*

Kreft, Eckstein, Junghans, Kerestan and Hagen, (2014) *Global Climate Risk Index 2015*, German Watch,

MDB-IDFC. (2015). *Common Principles for adaptation tracking.* MDB-IDFC Joint Statement.

MDB-IDFC. (2015). *Common Principles for Mitigation tracking.* MDB-IDFC Joint Statement

Meet-Bis. (2013). *MSME Access to Finance for Energy Efficiency and Renewable Energy Investments in Cambodia* .

Mekong Strategic. (2016). *Switching On: Cambodia's Path to Sustainable Energy Security.*

Milne, S., & Chervier, C. (2014). A review of payments for environmental services (PES) experiences in Cambodia. (154).

MME. (2013). *National Policy, Strategy and Action Plan on Energy Efficiency in Cambodia (draft).*

National Institute of Statistics - Ministry of Planning. (2007). *Cambodia Socio-economic Survey.*

National Institute of Statistics. (2014). *Cambodia Socio-economic Survey.*

NIS, MoP, MAFF. (2013). *Census of Agriculture in Cambodia.*

ODI. (2012). *Cambodia Climate Public Expenditure and Institutional Review.*

OECD-DAC. (2011). *Climate Markers.*

OECD DAC (2015). External Development Finance Statistics

Olsen-Rong, T., House, K., Sonerud, B., & Kidney, S. (2015). *Bonds and climate change: the state of the market.* Climate Bonds initiative for HSBC.

Oxford Partners. (2015). *Tracking Private Climate Finance Flows at the National Level.*

Phann et al. (2015). Landlessness and child labour in Cambodia. Phnom Penh: Cambodia Development Resource Institute.

R.JOYA, S. K. (2014). *An assessment of biomassenergy consumption patterns in Cambodia .* GERES.

RGC. (2013). *Investing in Cambodia 2013-2014.*

Trends, F. (2015). *Conversion Timber, Forest Monitoring, and Land-Use Governance in Cambodia.*

UN Secretary General. (2015). *Trends in private sector climate finance.*

UNDP. (2009). Methodology Guidebook for the Assessment of Investment and Financial Flows to Address Climate Change, Version 1.0

UNDP. (2013). *Microinsurance: The Understanding and Needs of Low-Income Populations regarding Microinsurance.*

UNDP. (2015) *Energy Efficiency NAMA in the garment industry Cambodia*.

UNFCCC. (2006). *Climate Change, impacts, vulnerabilities and adapation in developing countries.* United Nations Framework Convention on Climate Change.

UNFCCC SFC. (2014). *Summary and recommendations by the Standing Committee on Finance on the 2014 biennial assessment and overview of climate finance flows.* -: UNFCCC.

Whitley. (2015). *Mapping climate-relevant incentives and investment at country level .* ODI.

Word Bank, ADB. (2014). *The Investment Climate Climate Assessment.* World Bank, ADB.

World Bank. (2015). *Cambodia Economic Update.*

World Bank. (2015b). *State and Trends of Carbon Pricing.*

Yusuf, F. (2009). *Climate Change Vulnerability Mapping for Southeast Asia.*

6. ANNEXES

Annex 1: Approach adopted for this report

Why is it important to understand private sector's climate-related investments?

Developed countries have committed to mobilize US$100 billion annually in long-term climate finance (UNFCCC, 2011). But much more is needed to act efficiently, with a growing awareness of the private actors that they have to contribute even more.

It is important to track private sector climate-related activities and associated climate finance flows to:

1. Measure its effectiveness, learn lessons and replicate good practices, without which scale will not be reached;
2. Support the allocation of public funds to private sector incentives and fiscal mechanisms;
3. Inform discussions on the share between public and private finance in meeting GHGs climate mitigation and climate resilience policy objectives;
4. Support the development of longer term private sector mobilization strategies, targets and policy instruments;
5. Assess the growth and development of 'green' industries and sectors, and their contribution to investment and economic development;
6. Establish credibility and build baseline data to support access under the Green Climate Fund Private Sector Facility and other relevant instruments;
7. Monitor private finance mobilized by international public funds towards the fulfillment of commitments made under the UNFCCC process;
8. Develop material for Monitoring, Reporting and Verification (MRV) processes under the UNFCCC (from Whitley 2015)

Scope and boundaries

The key *research questions* are as follows and have been organized by section in the present report:

What are the Cambodian private sector' climate-related interventions/activities in response to climate change? (Section 2)

This section:

- Identifies climate-related interventions per relevant sector;
- Analyzes the motivation and drivers of private sector climate-related interventions.

What are the level of current climate-related investments, the barriers they face the potential for scaling up, and the nature and sources of climate finance? (Section 3)

This section:

- Attempts (with limited success due to the paucity of data) to estimate the levels of financing of these interventions;
- Reviews *barriers* to investment and financing and attempts *to gaug*e the *appetite* of private sector players for *a*dditional investments;
- Analyses the sources of financing of these interventions (instruments; and type of financiers; domestic vs international).

How could the RGC mobilize additional private sector investments in support of its climate policies? (Section 4)

This section brings together the aforementioned analyses on barriers to investments and recommendations for policy measures that could facilitate or stimulate additional private sector investments.

The following definitions are used:

What is the private sector?

The private sector comprises a range of actors, including:

- **Households***:* Households contribute to the climate response and climate finance flows mostly as end-users of GHG mitigation and climate change adaptation technologies (e.g. purchases of solar home systems, or more efficient vehicles and electric appliances).
- **Commercial companies and project developers**: These groups are the major private investors in climate-relevant activities. They may borrow or use their own equity to invest in climate-relevant projects (e.g. renewable energy facilities). We can distinguish:

  MSME (Micro-Small-Medium Enterprises): sole proprietor, small holders and family, enterprises with fewer than 50 employees (IFC, 2012). Many operate in the informal economy.

  Medium and large enterprises: 50 or more employees.

  MNCs (Multinational corporations): direct or indirect investments in developing countries where their supply chain is located.
- **Finance providers:** Commercial banks and other financial institutions (including insurance companies and private foundations as part of their CSR activities). As financial providers, most lack technical capacity, and tend to see climate change investments as just one of a wide range of asset classes, with a specific risk/reward profile.
- For legal entities, this study relies on the ownership-based OECD DAC definition of private sector ("private investments are those made by companies without a majority public shareholding, or those where the risk of the investment does not lie with the public sector." (UNDP 2015).

What type of interventions?

The emphasis is on capital expenditure (capex) (i.e. 'Investment Flows' as per UNDP's Methodology Guidebook for the Assessment of Investment and Financial Flows to Address Climate Change), but sometimes the border is blurry between capex and non-capex, especially at the household level; hence this report includes some 'durable goods' in the definition of capex.

The study seeks to estimate the **value** of private sector investments using transaction-level data if available or proxies; time horizon captured is the last 3 years depending on data availability. When data is unavailable, which is likely for most sectors, the study relies on qualitative assessments.

The estimate of private sector climate-related investments was only made for the sample of companies interviewed in the framework of this report (see below).

What are climate-related interventions?

An activity will be classified as **climate change mitigation** if it promotes efforts to reduce or limit greenhouse gas (GHG) emissions or enhance GHG sequestration (OECD-DAC, 2011), and as **climate change adaptation** if it helps communities and ecosystems cope with changing climate conditions (UNFCCC, 2006).

For GHGs mitigation, the study relies on the list of activities as included in the Common Principles (MDB-IDFC, 2015)[110].

As for adaptation, unlike for mitigation, there is no defined list for adaptation activities, only indicative types of investments or projects within given sectors.

Methodology

The study combines desk research and data collection in the field, based on semi-structured interviews with 65 stakeholders from public and private sectors, NGOs and development partners/DFIs.

The purpose of interviews is to:

- Map out the private sector climate interventions, financial flows and sources of data (what, from whom, for which period);
- Gauge the potential for and barriers to additional climate-related investments;
- Identify how and through which instruments and measures the government could address these barriers and stimulate additional investments.

Limitations and barriers

A reasonable approximation (if not quite a definition) of 'Climate finance' has been provided by the UNFCCC' Standing Committee on Finance: "Climate finance aims at reducing emissions, and enhancing sinks of greenhouse gases and aims at reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts." (UNFCCC SFC, 2014)

Some issues are still outstanding, including the following that also impacted this study:

110

http://www.worldbank.org/content/dam/Worldbank/document/Climate/MDB%20IDFC%20Mitigation%20Finance%20Tracking%20Common%20Principles%20-%20V2%2015062015.pdf

- The difficulty to pin down adaptation, a concept that the private sector does not use when considering making investments that promote climate compatible development.
- Data on private climate investment flow is **generally not tracked at all,** except in connection with utility-scale (Independent Power Producer - IPP) renewable energy projects (see annual CPI and BNF-UNEP reports), of which there is no example as of yet in Cambodia. The information collected is hence significantly anecdotal and accordingly difficult to extrapolate.

Additionally, **issues of commercial confidentiality** and regulatory restrictions make the tracking of private finance even more challenging than tracking public flows (Whitley, 2015), especially when considering MNCs that are tied by non disclosure agreement.

This lack of data is one of the most significant barriers to understanding the effectiveness of existing initiatives by the public sector to mobilize private climate finance.

“Improved tracking at the national level can help strengthen climate change policy-making processes and ensure effective management of public resources to deliver on national climate change policy goals”. (Climate Policy Initiative, 2015)

Annex 2: Overview of the climate change challenge and overall policy response in Cambodia

1) Cambodia and the challenge of Climate Change

1.1. Current GHG emissions

As a least developed country (LDC), Cambodia is **a small emitter of greenhouse gases** (GHG): it is estimated that 47,709 GgCO2-eq were emitted in 2000[111] but these estimates are out-dated in light of the fast GDP growth registered by Cambodia since then. Sinks of CO2, associated with Land use change and forestry (LUCF) were estimated at 48,383 GgCO2-eq. In the 2015 *Second National Communication under the United Nations Framework Convention on Climate Change* (UNFCCC), Cambodia is presented as **a net sink country in terms of GHG emissions** (see Table 6). Main characteristics of Cambodia's emissions are:

- Agriculture and Land use, change and forestry (LUCF) represent more than 90% of GHG emissions;
- Energy sector emissions account for 6% of gross emissions (before removals;)
- Within the agriculture sector, rice cultivation accounts for more than two thirds of GHG emissions;
- The waste sector is a low contributor to Cambodian GHG emissions.

Table 6: Main sources of GHG emissions

Year 2000	Energy	Agriculture	Land use change and forestry[112]	Waste	Total
Carbon Dioxide (CO2)	2,052.59		22,858.73		24,911.32
Methane (CH4)	28.19	875.52	32.06	10.18	945.95
Nitrous Dioxide (N2O)	0.40	8.79	0.22	0.05	9.46
CO2 removals			-48,165.86		-48,166
Total (GgCO2-eq)	**2,767.30**	**21,112.16**	**-24,565.50**	**229.24**	**-456.81**

[111] (GSSD-MoE, 2015)

[112] Estimates on LUCF should be handled with care: "the estimates of carbon emissions and removals through LUCF are very complicated and large uncertainties remain, because of complexity of biological factors and lack of reliable data.", in Ministry of Environment, "National Greenhouse Gas Inventory for the year 2000", *Technical Report*, 2009

Sectoral breakdown of GHG emissions (main sources)	- Residential sub-sector (31%) - Transportation (26%) - Energy industries (14%) - Manufacturing industries (12%).	- Rice cultivation (68%) - Enteric fermentation (16%) - Agricultural soils (11%)	Sources of sinks of CO2: - Changes in forest and other woody biomass stocks, - Forest and grassland conversion - Abandonment of managed lands		

Adapted from: GSSD (2015)

The bulk of emissions are attributable to the private sector, especially as the AFOLU (Agriculture, Forest and Other Land Use) sector (AFOLU) is predominantly composed of private sector entities. In the energy sector, most GHG emissions are also attributable to private entities: almost two thirds of electricity are produced by Independent Power producers (IPP) while the state-owned electric utility Electricité du Cambodge (EDC) accounts for the remainder[113].

1.2. Projected GHG emissions

Cambodia's GHG emissions are expected to rise significantly over the next decades[114]. The Second National Communication to the UNFCCC (SNC) includes GHG projections to 2050. Under the business as usual scenario (BAU)[115], it is forecast that:

- LUCF will remain a net sink, yet the total sink capacity will be divided by 6, mostly due to high human pressure on forests, high demand for forest products and impacts of resource extraction;
- GHG emissions of the agriculture sector could double over the period, driven by increased demand for agriculture products, notably meat and rice. This demand is fuelled by growth of Cambodian population (forecast to be 1.9 times higher in 2050 compared to 2000) and growth in GDP per capita (which has already tripled between 2000 and 2013);
- In the energy sector, total emissions might increase from 2,643 GgCO2-eq in 2000 to 25,549 GgCO2-eq in 2050, mostly due to increases in the transport sector and in energy industries[116].

1.3. Main impacts of climate change in Cambodia

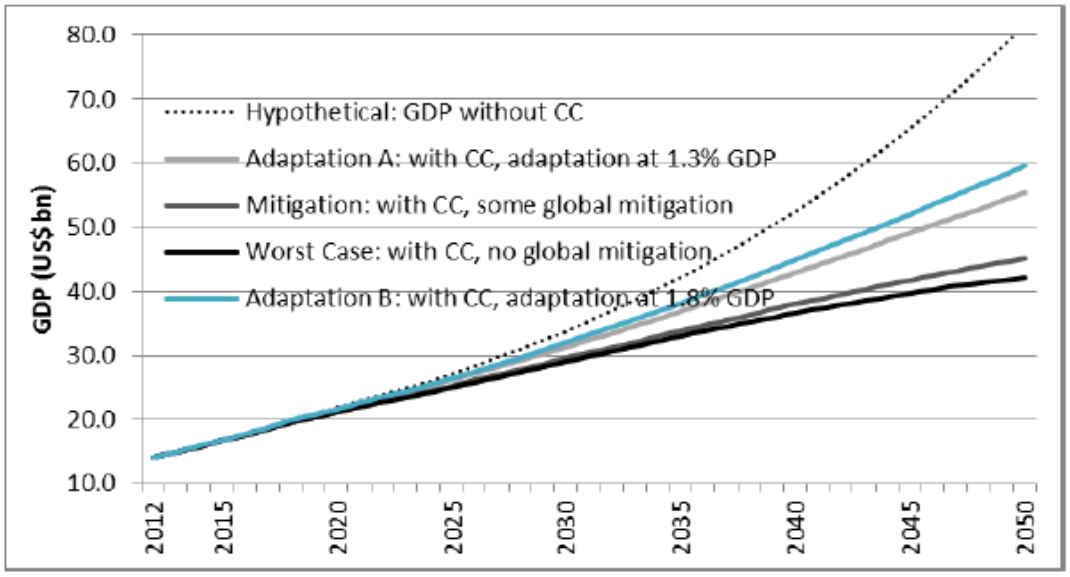
Impacts from climate change are numerous and would have adverse effects on infrastructure, human health, agriculture, economic development, etc. Most significant manifestations of climate change in

[113] Source: GSSD 2015, *ibid*
[114] GSSD 2015, *ibid*
[115] Key assumptions underpinning the business as usual scenario were mostly developed for the agricultural sector and the LUCF sector. Modelling of GHG emissions was based on projected macroeconomic conditions, policy conditions and market conditions. For instance, Cambodia's high population growth will probably boost the demand for products and services, which is likely to stimulate agricultural productivity, land encroachment and the demand for wood (products) with a consequent increased pressure on forests.
[116] *Energy industries* encompass all emissions related to electricity generation

Cambodia are floods, droughts, windstorms and seawater intrusion.

Cambodia's high vulnerability to climate change is likely to have substantial impacts on several levels:

- From an **economic perspective**, analysis based on the scenario of a 2°C temperature rise by 2050 estimates that the **full damage of climate change on Cambodia's GDP will be at least 1.5% per year by 2030, and 3.5% by 2050**. By 2050, GDP growth could be almost entirely offset (reduced to 1% only) by the impacts of climate change[117]. Figure 8 shows the impacts of climate change on GDP growth in Cambodia.
- In the **agriculture sector**, rice-growing areas in the Mekong River and Tonle Sap Lake regions are exposed to extreme flooding and extended periods of flooding, which entails significant losses in production. Most agriculture areas will also be exposed to higher drought risks, which could result in lower productivity. Over the past 20 years, 62% of rice production losses were due to floods, while 36% of rice production losses were caused by drought (SNC);
- In the **forestry sector**, lowland forests (altitude <500m) represent 89% of total forests in Cambodia. They are expected to experience longer water deficit periods, which is likely to cause lower forest productivity;
- As far as **infrastructure** is concerned, floods are expected to have strong impacts on roads, irrigation and urban infrastructure. Coastal zones are likely to be inundated due to sea level rise. The Koh Kong Province would be the most exposed region in the case of a permanent 1 m sea level rise.



Source: CCFF 2014

Figure 8: impacts of Climate Change on GDP

[117] The main sources of this damage are from:
- Drought and floods in agriculture (1.42% of GDP);
- Increased burden of diarrhea and other climate sensitive diseases (0.85% of GDP);
- More rapid degradation of infrastructure, including roads, irrigation and rural water supply (0.71% of GDP);
- Flood damage to urban infrastructure (0.25% of GDP).

1.4. Assessing Cambodia's vulnerability to climate change

Most studies concur with the diagnosis that **Cambodia's vulnerability to climate change is high to very high**[118]**.** Based on the assessment used in the SNC[119], "most communities in Cambodia are categorized as vulnerable to extremely vulnerable". Table 7 shows the main determinants of vulnerability to climate change and their magnitude in the Cambodian context.

Table 14: Assessing Cambodia's vulnerability to climate change

Determinants of Climate Change vulnerability	Assessment of Cambodia's vulnerability
1. Climate hazards: cyclones, droughts, floods, landslides, sea level rise, etc.	- Regions most highly exposed to climate hazards are those sharing borders with the **Mekong river delta** and those close to the Tonle Sap Lake
2. Population density and protected areas	- Cambodia has relatively **more protected areas** compared to other countries in the region
3. Adaptive capacity, determined by: - **Socio-economics factors (e.g. human development, poverty incidence, income inequality…);** - **Technology factors (e.g. electricity coverage);** - **- Infrastructure (e.g. road density).**	- Overall, Cambodia has very **low adaptive capacity:** - **GDP per capita is low** (US$1,036 in 2013[120]) - For large parts of the population, the only source of income is **drawn from natural resources**; - **Agricultural production** is highly dependent on rainfall and monsoon regimes; - **Fishing practices and aquaculture** are highly dependent on the country's natural hydrology; - **Existing infrastructure** is exposed to harm from floods or other climate hazards.

Source: adapted from (Yusuf, 2009)

2) Cambodia's climate change strategy and policy and the role of the private sector

2.1. Overview of Cambodia's strategy on climate change

Cambodia's overarching development strategy is set out in its **Rectangular Strategy** first introduced in 2004 whose Phase III coincides with the 5th Legislature of the National Assembly (2013-2018). It asserts Cambodia's ambition to become an upper-middle income country by 2030 includes some references

[118] Studies on vulnerability of Cambodia to climate change used in this report are:
- (Yusuf, 2009)
- (GSSD-MoE, 2015)
- (Johnston, 2009)
- (Almack, 2012)

[119] Vulnerability Index used in the SNC is based on three main indicators - socio-economic status, infrastructure and population (GSSD, *ibid*).

[120] GSSD 2015, ibid

to climate change, not least the RGC's commitment to "*intensifying efforts to reduce the impacts of climate change by strengthening adaptation capacity and resiliency to climate change, particularly by implementing the "National Policy on Green Development" and the "National Strategic Plan on Green Development 2013-2030",* and "*continuing to strengthen technical and institutional capacity to promote the mainstreaming of climate change responses into the policies, laws and plans at national and sub-national levels*".

This goal is mirrored in the **National Strategic Development Plan** (2014-2018) roadmap for the implementation of the Rectangular Strategy. In it the RGC pledges to "reduce the impact of climate change by strengthening the adaptation capacity and resiliency to climate change, particularly by implementing the "Cambodia Climate Change Strategic Plan 2014-2023", "National Policy on Green Development" and the "National Strategic Plan on Green Development 2013-2030"".

These three documents encapsulate the RGC's climate strategy.

The **Cambodia Climate Change Strategic Plan** (CCCSP) of 2014 sets forth 8 strategic objectives:

1. Promote climate resilience through improving food, water and energy security: sub-objectives f. (Promote renewable energy and energy efficiency to reduce GHG emissions) and g. (Develop decentralized energy production systems integrating the application of renewable energy, especially solar energy) are especially relevant;
2. Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts;
3. Ensure climate resilience of critical ecosystems (Tonle Sap Lake, Mekong River, coastal ecosystems, highlands, etc.), biodiversity, protected areas and cultural heritage sites;
4. Promote low-carbon planning and technologies to support sustainable development;
5. Improve capacities, knowledge and awareness for climate change responses;
6. Promote adaptive social protection and participatory approaches in reducing loss and damage due to climate change;
7. Strengthen institutions and coordination frameworks for national climate change responses; and
8. Strengthen collaboration and active participation in regional and global climate change processes.

The CCCSP 2014-2023 identifies a number of actions to be implemented in three consecutive phases:

> 2013–2014: putting in place institutional and financial arrangements for the implementation of the CCCSP, development of national monitoring and evaluation (M&E) frameworks and indicators, and development of climate change action plans (2014 – 2018) by line ministries.
>
> 2014–2018: continue to support the implementation Phase 1 actions, with expansion to cover other activities such as accreditation of the Adaptation Fund and GCF, research and knowledge management, capacity development, mainstreaming of climate change across sectors at different levels, operation of M&E and data management systems, and launching some high priority projects/programmes in key sectors identified in the Climate Change Action Plans

(CCAPs). Initial priority would be given to adaptation activities but gradually GHG mitigation activities will be included.

2019–2023: focus will be on research and learning, but its main objective will be to scale up success cases and to continue mainstreaming climate change into national and sub-national programmes. This will involve an increased use of budget support for national programmes.

The **National Policy on Green Growth** and **National Strategic Plan on Green Growth (2013-2020)** were both adopted in March 2013. The latter aims at developing a green economy by the effective use of natural resources, environmental sustainability, green jobs, green technologies, green finance, green credit, and green investment. The scope is broader than but overlaps climate change and other environmental policies.

In 2006 Cambodia adopted a **NAPA**, which is now out of date and is of limited relevance.

In 2015, Cambodia submitted its **Intended Nationally Determined Contribution (INDC)** to the UNFCCC as a contribution to the COP21. For the first time, it sets a goal of reducing energy sector-emissions by 27% (3.1 MtCO2) by 2030 relative to a BAU scenario and of increasing forest cover to 60% of national land area by 2030.

Overall, mitigation is a lesser objective for Cambodia than adaptation[121]. A **Climate Change Financing Framework** (CCFF) was developed to structure budgeting and climate finance mobilization. It aims to facilitate identification, prioritization and financing of adaptation and mitigation activities. Climate financial resources identified in the CCFF are drawn from the government's regular budget or sourced from global facilities and from bilateral and multilateral donors.

At the sectoral level, **Climate Change Actions Plans** (CCAP) have been adopted by key line ministries and agencies[122] to identify activities in relation with strategic objectives. The sectoral CCAPs include 68 actions associated with policy, planning, capacity building, institutional strengthening, 39 actions to deliver services to beneficiaries and 10 actions involving investment in infrastructure[123]. For example, one of the actions identified in the CCAP for the Transport Sector that could have a direct impact on the private sector, consists in enhancing maintenance and inspection of vehicles, as an effort to promote GHG reductions[124].

MIME endorsed the **Sustainable Energy for All** (SE4All) **Readiness Plan** in 2013, which set a vision by 2030, Cambodia will have sufficient and efficiently produced and consumed sustainable energy that will contribute to making Cambodia healthy, prosperous and more equitable nation. The SE4All recognizes the role of private sector in power sector development including informing polies for attracting investment, service delivery, and developing innovating finance and business models.

A **National Policy, Strategy and Action Plan on Energy Efficiency** in Cambodia (MIME 2013) has been developed over the past years with strong support from the EU. The overall objectives of the National Energy Efficiency Policy are (i) to reduce the future national energy demand by 20% by 2035 compared

[121] This assessment is confirmed in *Cambodia Climate Change Financing Framework*, p. viii

[122] The line ministries included in 2013 were: the Ministry of Environment (MoE); Ministry of Agriculture, Forestry and Fisheries (MAFF); Ministry of Industry, Mines and Energy (MIME); Ministry of Education, Youth and Sport (MoEYS); Ministry of Health (MoH); Ministry of Women's Affairs (MoWA); Ministry of Water Resources and Meteorology (MoWRAM); Ministry of Public Works and Transport (MPWT); Ministry of Rural Development (MRD); and the National Committee for Disaster Management (NCDM). Source: RGC, CCCSP 2014-23, 2013

[123] Source: Cambodia Climate Change Financing Framework

[124] Ministry of Public Work and Transports, "Climate Change Action Plan for Transport Sector 2014-2018", april 2014

to BAU projections; and to reduce national CO2 emissions in 2035 by 3 millions tCO2" (MIME 2013, p.7). However this document has yet to be approved by the RGC.

Cambodia does not have a renewable energy policy framework. According to the power development plan, however, the government plans to supply 50% of electricity from hydropower. The Rural Electrification Master Plan intends to increase access to electricity in the rural areas through renewable energy, among other options.

RGC has also developed a **REDD+ Roadmap**.

2.2. Institutional framework on Climate Change

Between 2006 and 2015, the **main public body in charge of climate change** (not including REDD + which has its own dedicated set of bodies) was the **National Climate Change Committee** (NCCC), whose role was to coordinate the response to climate change in Cambodia (e.g. preparing, coordinating and monitoring implementation of policies, strategies, legal instruments, plans and programmes related to climate change).

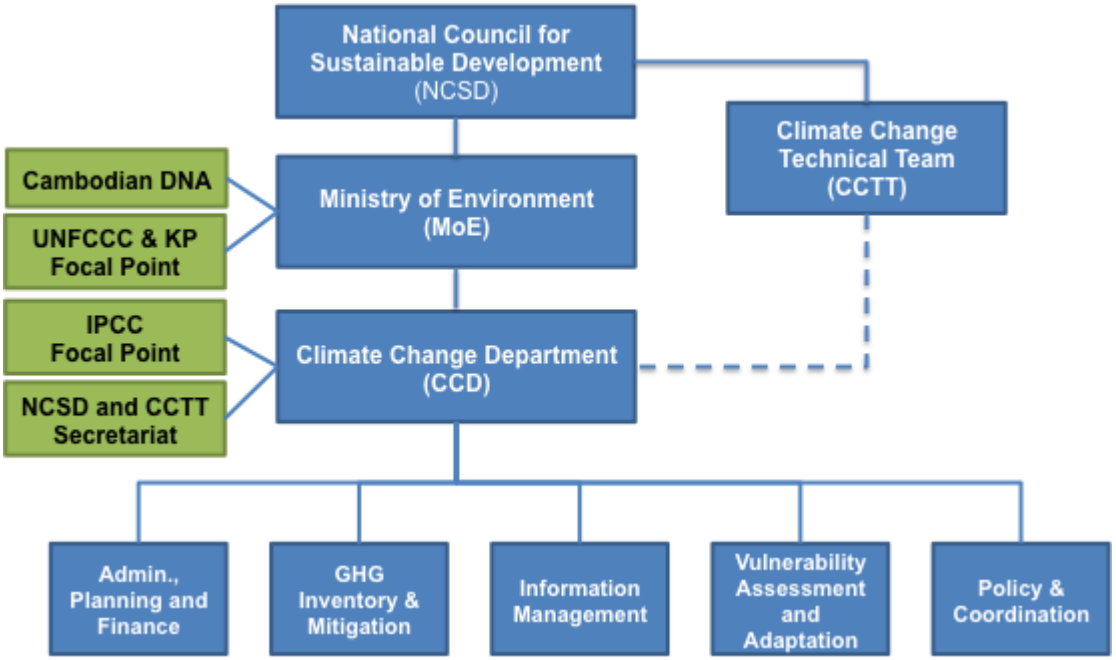
In May 2015, the **National Council for Sustainable Development** (NCSD) took over the functions of the NCCC. The NCSD is composed of Secretaries and Under-secretaries of State and is chaired by the Minister of Environment. Compared to the NCCC, membership of the NCSD has increased (more ministries are included, as well as provincial governors) [125]. The NCSD has played a major role in the preparation of the Cambodian Climate Change Strategic Plan 2014-2023, the sectoral Climate Change Action Plans and the Climate Change Financing Framework (see part 2.2.1).

The **Ministry of Environment** (MoE) plays a leading role in Cambodia's response to climate change:

- Within the MoE, the Climate Change **Department** (CCD) was established in 2009 [126]. It is responsible for a wide range of activities related to climate change [127] and serves as **Cambodia's focal point for** the UNFCCC, the Intergovernmental Panel on Climate Change (IPCC), and the Kyoto Protocol. It also coordinates working groups on climate related sectors or issues, such as energy, forestry, GHG inventories, vulnerability and adaptation, etc.
- In July 2002, the MoE was appointed as the **Designated National Authority** (DNA) for the Clean Development Mechanism (CDM). The CCD acts as a secretariat of the DNA.

The Climate Change Technical Team (CCTT), established in May 2011, acts as a technical advisory body to the NCSD. For instance, it provided support to the line ministries for the development of sectoral CCAPs.

[125] Source : SNC
[126] It replaced the Cambodia Climate Change Office (CCCO), which was established in 2003
[127] Activities include: formulation of draft climate change plans and policies, implementation of the UNFCCC, assessment of new technologies to adapt to the adverse effects of climate change or to mitigate GHG emissions, and capacity building and awareness raising.



Source: adapted from: MOE (Ma Chan Sethea), "Climate Vulnerable Forum Asia Regional Workshop", 2015[128]

Figure 9: Cambodia institutional Climate Change Institutional Framework

2.3. Public sector climate finance flows

Cambodia is one of 11 countries in the Asia-Pacific region, where a Climate Public Expenditure and Institutional Review (CPEIR) was undertaken (in 2012). A CPEIR is a systematic qualitative and quantitative analysis of a country's public expenditures and how they relate to climate change. As clearly acknowledged in the CPEIR Cambodia 2012, however, "there is no easily available source of information about expenditure by the private sector on mitigation and adaptation" (p.x).

Climate public expenditure has substantially increased between 2009 (US$92M) and 2012 (US$179M), increasing from **14% to 17% of total public expenditure** (including off-budget programmes such as donor-funded programmes), equivalent to about 3.5% of GDP[129]. Donor-based funding represents three quarters of total public climate expenditure[130], and adaptation actions account for the predominant share of expenditures. Key figures for the years 2009-2012 on public sector climate finance are presented in table 8.

[128] Abbreviations used in this figure:
- DNA: Designated National Authority (DNA), which is the operating entity for the Clean Development Mechanism (CDM)
- KP: Kyoto Protocol
- IPCC: Intergovernmental Panel on Climate Change

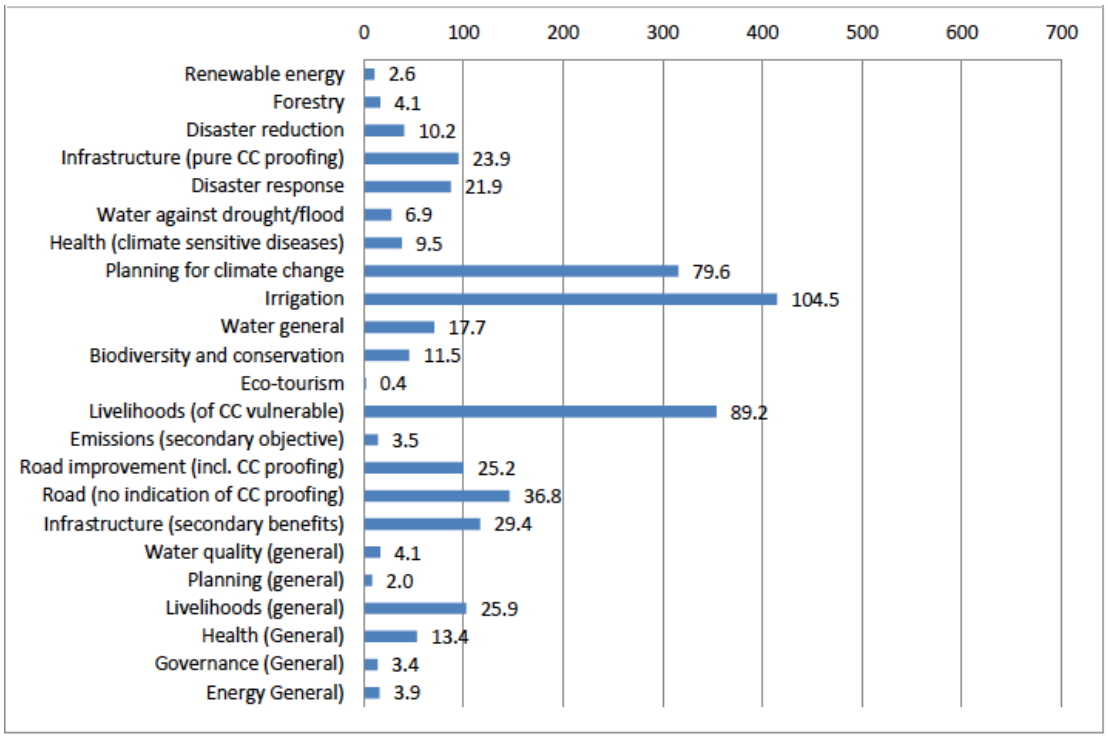
[129] Source: http://climatefinance-developmenteffectiveness.org/CPEIR-Database
The database provides climate public expenditure data at the national level, Climate based on Public Expenditure and Institutional Reviews

[130] CPEIR 2012 notes that "In the last two years, Cambodia has received between CR 388bn and CR 492bn of external high relevance climate funding. This is equivalent to about USD$ 100m to USD$ 125m" (p.46).

Table 15: Cambodia's Public Climate Expenditure (2009-2012)

Year	Total Climate Expenditure (USD)	Sources of Funding		Climate Change Program	
		Government	Donor	Mitigation	Adaptation
2009	91,895,351	23%	77%	1%	99%
2010	111,327,497	24%	76%	3%	97%
2011	140,510,894	32%	68%	3%	97%
2012	178,514,450	23%	77%	3%	97%

Source: adapted from CPEIR Country Database



Source: CCFF 2014

Figure 10: Climate expenditure 2009-2012 (US$ millions)

In 2014, total climate-related Official Development Aid (ODA) committed to Cambodia amounted US$276 million, including:

- Climate mitigation: US$78 million;
- Climate adaptation: US$155 million;
- Both mitigation and adaptation: US$43 million.

Source: OECD DAC External Development Finance Statistics, 2015

2.4. Climate change policy implications for the private sector

Most policy documents put a strong emphasis on **harnessing the potential of private sector participation** in the Cambodia's climate change response:

- CCCSP 2014-2023: as part of an effort to improve "capacities, knowledge and awareness for climate change responses", the private sector should be sensitized on "threats and opportunities of climate change". CCCSP identifies the need to **establish public-private partnerships for communication**.
- SNC 2016: **win-win measures could be implemented by the private sector in the short term**: this includes mitigation activities such as energy efficiency projects, where investments are profitable even without valuing carbon. In the medium term, the private sector is deemed instrumental to meet Green Growth objectives.
- CPEIR: there are "many examples of private investment in renewable energy" and notable efforts to engage the private sector in clean development have been conducted through the CDM. Building on the Green Growth Roadmap, implementation and funding for adaptation and mitigation activities is likely to "come through private sector sources".
- CCFF: not only should the private sector play a central role in climate-related investments, but it could also raise public awareness and lobby for corporate social responsibility. Opportunities in the medium term are mainly on **mitigation activities, mostly in energy and transport.** The CCFF acknowledges that the role of private sector on carbon markets is still very limited and that low price of carbon credits represents a major issue. The CCFF sees greater potential in Renewable Energy (RE) and Energy Efficiency (EE). With regards to EE, a few enterprises in the manufacturing industry already achieved substantial savings as a result of EE projects and there is therefore potential for similar projects. Renewable Energy potential presented in the CCFF is mostly on solar panels and biomass gasification.

Annex 3: List of organizations interviewed and/or considered for the study

Agriculture/Forestry/Fishing	Energy	Activities of households as consumers
Camagra	Total	GERES
Grandis	FTB	Hydrologic
Golden Rice	Mekong Strategic partners	SNV
Mong Reththy	Schneider	SGFE
Bambusa	Camcona	SHS (Kamworks, LES, Solar Partners…)
Angkor Kasekam	Kamworks	Nexus for Development
Amru	Khmer Solar	Prasac
SOMA	Solar Partners	Audi
BOF	Picosol	Star 8
CEDAC	UNIDO	Blue Mobility (Bolloré Group)
CACIC	GRET	
GIZ	**Waste and waste water**	
IFAD	GAEA	
SNV	Vince PNH water treatment plant	
IBIS	Cleanbodia	
AFD	**Construction**	
Confirel	TUV Rheinland	
FAO	Archetype	
WWF	**Transportation**	
CI	Vinci airport	
WCS	**Tourism**	
FFI	Sofitel	
iDE	Shinta Mani	
HARVEST	Intercontinental	
DCA (Action aid)	Chi-Pat	
Ecoland, grow asia, EU	4 rivers	
Manufacturing	Songsaa	
H&M	**Financial and insurance services**	
PUMA	Mekong Strategic Partners	
Marks and Spencer	Acleda	
Adidas	MFI association	
Laurelton	ANZ Royal	
Pactics	KfW	
Center for Cleaner Production (UNIDO)	AFD	
Coca Cola	UNDP	
Pepsi / Angkor		

Annex 4: Selected donor program for Climate Smart Agriculture.

There are numerous donor programs, hosted by ministries, and technically supported by NGOs and/or research institutes, sometimes showing limited coordination while going in the same direction.

- The USAID funded HARVEST[131] integrated food security and climate change program is working more than 100,000 farmers in approximately 1,500 villages around the Tonle Sap Lake to empower them through associations (rice, horticulture, fisheries) that receive training on productivity, resilience to climate change and natural resources management. The program has reached significant results including almost 1 million ha under improved natural resource management, increased yield and increased income (US$12.6 million in sales of agricultural inputs, US$22 million sales across value chains). Also, see Annex 4 for full figures.
- The ADB '**Climate friendly agribusiness value chain sec**tor' project is supported by Japan and Canada funds for private sector in Asia. The project is starting in Q1 2016 and will enhance rural households incomes and agricultural competitiveness by providing improved critical production and post-harvest infrastructure, reducing energy costs by promoting bio-energy use and sustainable biomass management, offering policy and capacity supported services. Another ADB project named SPCR (Strategic Program for Climate Resilience) involved private sector but achievements and impacts of the private contributors were limited at the time of writing.
- Cambodia Agricultural Value Chain program (**CAVAC**) is an Australian government program in partnership with MAFF. CAVAC's objective is to increase the productivity and incomes of small farmers and trade in milled rice and other crops by strengthening market systems and investing in irrigation infrastructure. So, the focus here is on productivity.
- Program for Agricultural Development and Economic Empowerment (**PADEE**), funded by IFAD, is specifically looking at the value chain development and market consolidation in a climate constraint environment, including all stakedholders (government, farmers, NGOs, agri-business). Using drip irrigation, information system, resilient seeds, working on transport efficiency and storage capacity. Nested in PADEE is the S-RET program co-funded by GEF (Scaling up of RE technologies), looking at solar oven/dryer, portable biogas, ICS, small scale rice millers/gasifiers, solar water pump
- Adaptation for Smallholder Agriculture Program **(ASAP)** is using climate finance to make rural development program more climate-resilient through managing competing land-use systems at the landscape level while at the same time enhancing biodiversity, increasing yields, and reducing greenhouse gas (GHG) emissions.
- ASEAN Sustainable Agrifood Systems (**ASEAN SAS**) is a GIZ led program which develops regionally coordinated policies and strategies addressing sustainable agriculture and food production/security and strengthen sustainable agrifood systems. In Cambodia, GIZ ASEAN-SAS is working closely with the Council for Agricultural and Rural Development (CARD) on the ASEAN Integrated Food Security Framework (AIFS) and the Ministry of Agriculture, Forestry and Fishery (MAFF) to install a regulation scheme for BCA and an organic agricultural standard.
- Stress Tolerant Rice Varieties (STRV), varieties with greater tolerance of biotic and abiotic stresses, are an entry point technology to increase resilience to climate change and are considered of high priority. Cambodia, through the participation of the Cambodian Agricultural Research and Development Institute (CARDI), has expressed their interest in further promoting

[131] http://www.cambodiaharvest.org

STRV to strenghten the competitiveness of the rice sector and to increase the resilience of rice farming communities. The Forestry and Climate Change Project (FOR-CC) of the ASEAN-German program, through the GIZ, is testing integration of STRV on a few pilot projects, including IBIS rice.

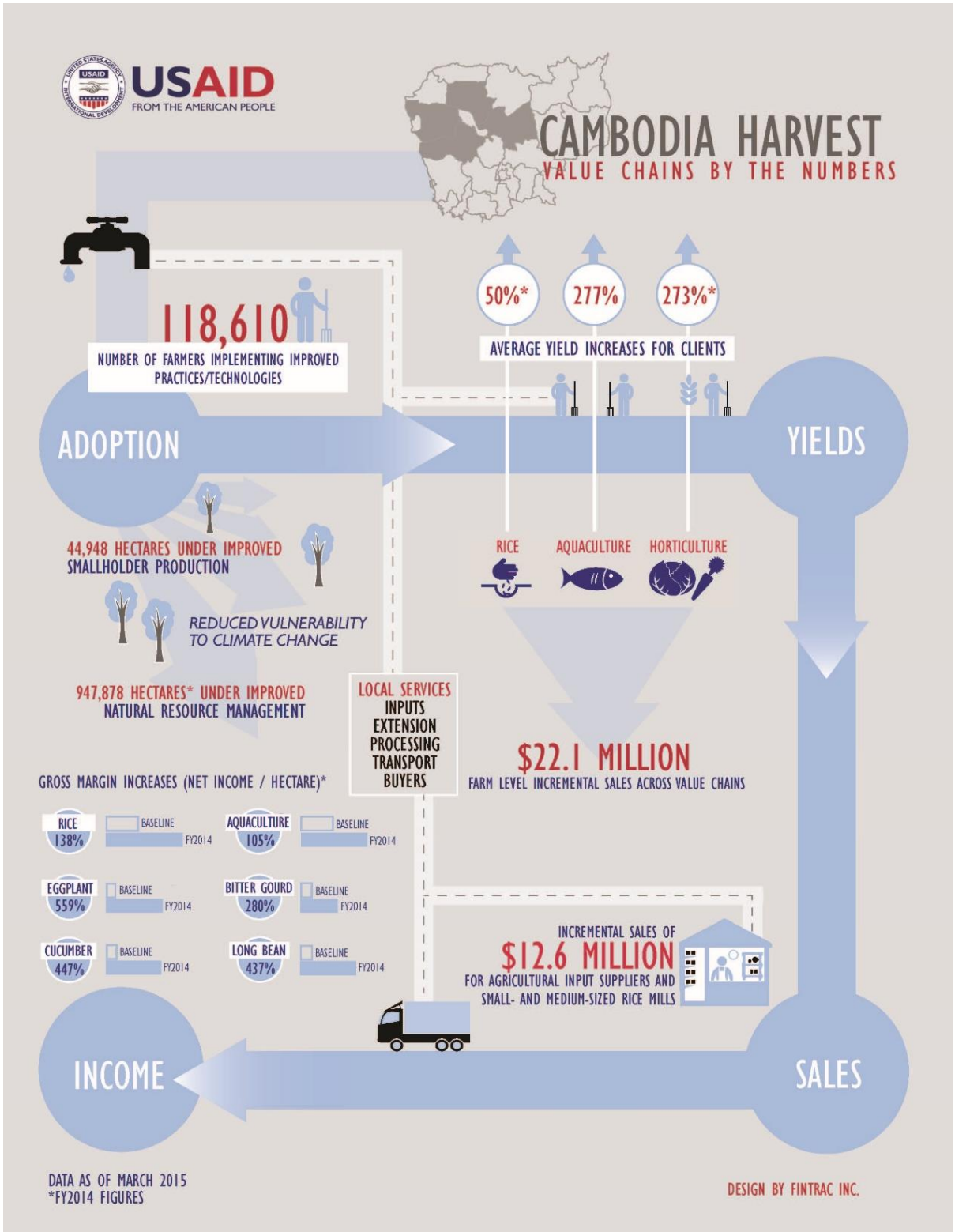
- AFD is supporting MAFF on infrastructure (transport, irrigation), contract farming, hevea clones gardens, and commercialization of quality rice (through certification).
- CGIAR Climate Change, Agriculture, and Food Security program, in partnership with Oxford University and Environmental Change Institute is working with MoC and MAFF on food security and climate scenario to increase resilience of the food systems in Cambodia.

Annex 5: Sectors, impacts of climate change, and adaptation activities

Potential sectors	Potential impact of climate change	Potential adaptation activity
Financial services	Increased strain on banking sectors as clients experience climate impacts	Creation of dedicated financing mechanisms to promote the uptake of climate resilient technologies
ICT (Hardware)	Damage to key national data centres from storms or floods	Identification of sites at greatest risk and enhancement of resilience of those sites
Manufacturing	Historic specifications for equipment inappropriate under new climate	Design of climate resilient equipment, e.g. stable cranes for harbours in cyclone zones
Trade	Disruption of national trade due to climate disasters	Local government support for business continuity planning amongst local employers
Professional services	Increase in the demand for professional services for climate risk assessment	Provision of finance to SMEs providing relevant services, e.g. engineering or insurance
Education	Climate change results in technical syllabus is outdated for high risk sectors	Technical capacity building for training the trainers in water and agri-sectors
Construction	Shift in zones affected by typhoons/ hurricanes/storm surges	More robust building regulations and improved enforcement practices
Oil, gas, mining	Shift in zones affected by typhoons/ hurricanes	Increased intensity of seismic survey and offshore drilling outside hurricane seasons
Health	Changing patterns of diseases as a result of changing climatic conditions	Monitoring of changes in disease outbreaks and development of a national response plan
Disaster risk management	Increased frequency and/or intensity of climate related disasters	Financial assistance for improved planning of government bodies/NGOs integrating climate change scenarios in their planning activities.
Water resources	Reduction in river water levels due to reduced rainfall	Improved catchment management planning and regulation of abstraction
(Waste) water infrastructure	Increased groundwater salinity due to sea level rise and/or coastal flooding	Provision of microfinance for domestic rainwater harvesting equipment and storage
Waste management	Increased risk of pollution of areas below landfill sites due to risk of flood	Completion of a climate risk assessment prior to location of landfill sites
Fossil fuel energy generation	Increased seasonality of rainfall, creating periods of low river flows	Investment in coal fired generators with minimal cooling water requirements
Renewable energy	Reduction in river flows lead to loss of generation from hydroelectric plant	Hydro-infrastructure subject to due diligence against climate and hydrological models
Transmission and distribution	Higher temperatures reduce distribution efficiency	Investment in embedded renewable generation to reduce distribution requirements
Tourism	Drought disrupts mammal migrations and causes large scale starvation	Diversification of tourist attractions to encompass biodiversity/conservation
Transport	More extreme river flows cause erosion of embankments and loss of bridges	Use of revised recurrence intervals for extreme events in infrastructure design
Ecosystems	Drought causes loss of forest cover with impacts on livelihoods/biodiversity	Identification of protected areas and establishment of migration corridors for at-risk ecosystems' wild life (animals)
Forestry	Increased frequency of forest fires	Engagement with local communities to limit the source, and improved forest fire management
Agriculture	Increased variability in crop productivity	Provision of information on crop diversification options, with assessment of costs
Livestock production	Loss of forage quantity or quality	Increased production of fodder crops to supplement rangeland diet
Fishing	Loss of river fish stocks due to changes in water flows and/or temperature	Adoption of sustainable aquaculture techniques to supplement local fish supplies
Urban development	Increased urban flooding from extreme rainfall events	Asset review to identify assets vulnerable to increased flooding, then prioritise protection works

Source: Oxford Partners, 2015

Annex 6: Harvest program, value chain by the numbers



Annex 7: Weighting of private climate investment

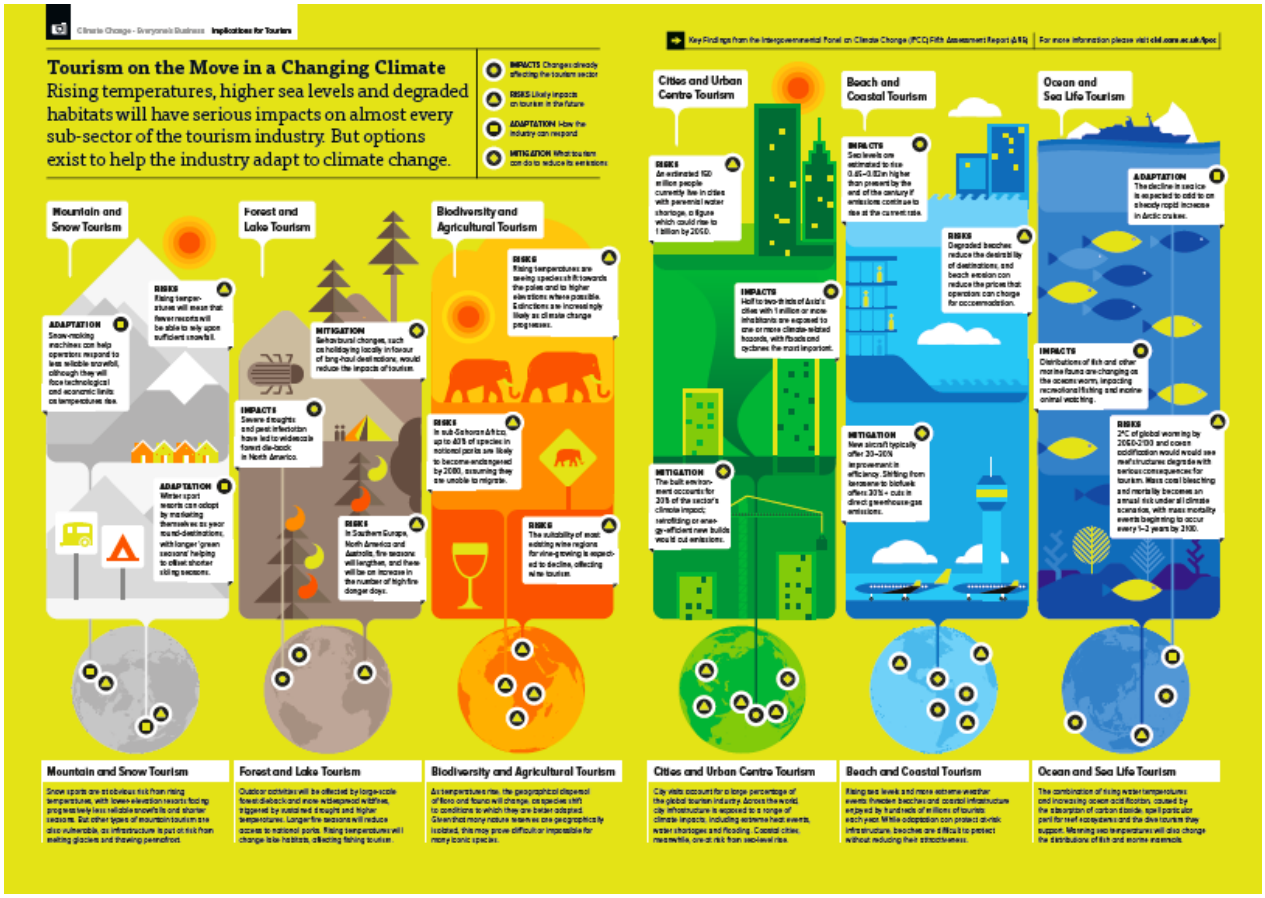
High	Rationale	Clear primary objective of delivering specific outcomes that improve
Weighting more than 75%	Examples	▯▯ Energy mitigation (e.g. renewables, energy efficiency) ▯▯ Disaster risk reduction and disaster management capacity ▯▯ The additional costs of changing the design of a programme to improve climate resilience (e.g. extra costs of climate proofing infrastructure, beyond routine maintenance or rehabilitation) ▯▯ Anything that responds to recent drought, cyclone or flooding, because it will have added benefits for future extreme events ▯▯ Relocating villages to give protection against cyclones/sea-level ▯▯ Healthcare for climate sensitive diseases ▯▯ Building institutional capacity to plan and manage climate change, including early warning and monitoring
Medium relevance	Rationale	Either (i) secondary objectives related to building climate resilience or contributing to mitigation, or (ii) mixed programmes with a range of

Source: Oxford Partners, 2015

Weighting between 50% to 74%	Examples	▯▯ Forestry and agroforestry that is motivated primarily by economic or conservation objectives, because this will have some mitigation effect ▯▯ Water storage, water efficiency and irrigation that is motivated primarily by improved livelihoods because this will also provide protection against drought ▯▯ Bio-diversity and conservation, unless explicitly aimed at increasing resilience of ecosystems to climate change (or mitigation) ▯▯ Eco-tourism, because it encourages communities to put a value of ecosystems and raises awareness of the impact of climate
Low relevance	Rationale	Activities that display attributes where indirect adaptation and mitigation benefits may arise

Weighting between 25% - 49%	Examples	▯▯ Water quality, unless the improvements in water quality aim to reduce problems from extreme rainfall events, in which case the relevance would be high ▯▯ General livelihoods, motivated by poverty reduction, but building household reserves and assets and reducing vulnerability in areas of low climate change vulnerability ▯▯ General planning capacity, either at national or local level, unless it is explicitly linked to climate change, in which case it would be high ▯▯ Livelihood and social protection programmes, motivated
Marginal	Rationale	Activities that have only very indirect and theoretical links to climate
Weighting less than	Examples	▯▯ Short term programmes (including humanitarian relief) ▯▯ The replacement element of any reconstruction investment (splitting off the additional climate element as high relevance)

Annex 8: Tourism and climate change impacts



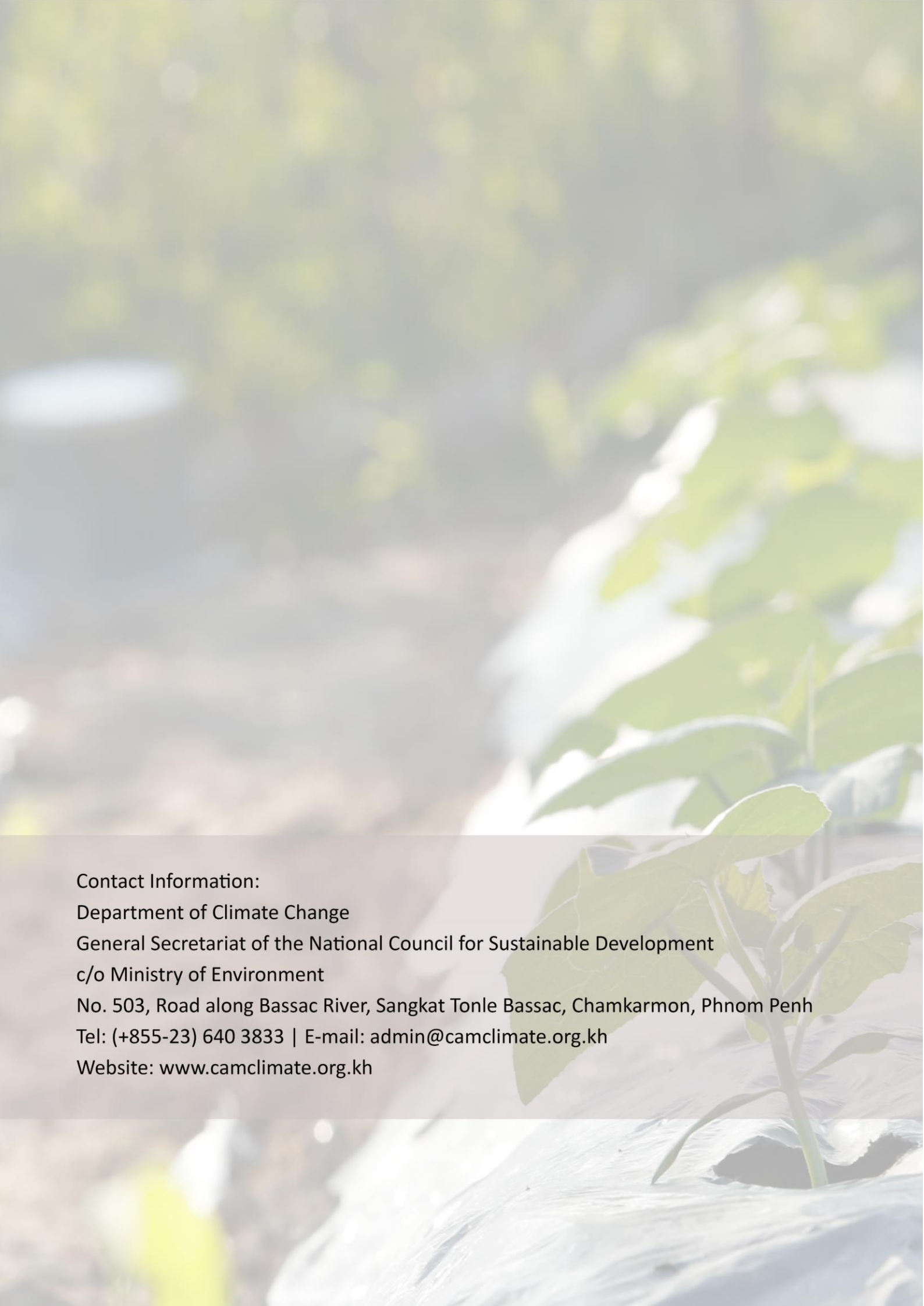
Source: European Climate, CISL, 2014

Annex 9: Barriers and solutions per sector (as expressed by respondents)

Sector	Challenges	Solutions
Agriculture	Cultural: old habits are keeping productivity low and blocking switch to innovative solutions (CSA, waste to energy, sustainable farming)	- Information, communication, training on CSA, (maximizing crop residue rotating crops and harvesting best practices) - Encourage economies of scale through farmers association (irrigation, purchase agreement, supply chain) - Promote a climate risk insurance
	Land tenure: ownership still unclear in some cases slowing down green investment and access to finance	- Speed up the process for land tenure registration, particularly in case of strong environmental impacts of project - Promote a landscape management approach
	Legal framework: unclear legal framework for PES and EIA	- Develop toolkits for PES and EIA to clarify procedure, timeframe, costs.
	Law enforcement: weak enforcement on illegal input (fertilizers) impoverishing the soil, and on illegal logging	- Ban and penalize illegal input, accelerate registration for organic input and climate resilient seeds.
Forestry	Legal framework: unclear legal framework for PES and EIA, change of concession length (70-50 years) reducing production cycle by 1/3	- Develop toolkits for PES and EIA to clarify procedure, timeframe, costs. - Negotiate one on one for projects with strong environmental impacts
	Law enforcement: weak enforcement on illegal logging	- Penalize illegal logging, through involvement at the highest level (PM)
Manufacture	Lack of awareness, technical skills, human resources	- Training and capacity building through university programs, peer to peer learning on EMS, carbon audit, EERE
	Lack of finance and credit constraints	- Subsidize green financial products
	No incentive to promote RE. Inefficient equipment and carbon intensive technologies for sewing, dying, heating, steaming	- Tax import exemption on RE for captive use - Subsidy for switch to EE equipment

	Market discrepancies with unfair competition between responsible and less responsible companies	- Oblige to disclose GHG emissions following best practices (CDP) with support of end-buyers.
Energy	Lack of technical skills on EE and RE	- Enhanced secondary and tertiary vocational training on RE, EE, equipment, installations and maintenance - Build capacity of MME, EAC, EDC on managing RE as part of the electricity supply - Set a quality standard for solar, relying on existing initiatives
	Lack of information and guidance on EMS, RE, low clarity on on-grid RE regulatory framework	- Set a clear and ambitious target for RE and EE - Law to recognize and arbitrate of on-site electricity generation - Upgrade existing grid management system`w2xsa to include smart grid management technologies - Clarify rules for RE tenders Clarify grid expansion
	Limited awareness on benefits of EE as a cost saver	- Adopt EE policy, - set minimum international standards for electric appliances
	No appropriate financial mechanism (no tailor made green products, no interest from banks) and taxation issues (import tax on RE equipment + VAT = 17% higher than EDC bill)	- Send clear signals (RE law, RE policy, RE strategy) to grow confidence of foreign investors - Export duty and VAT exemption on RE (solar, waste to energy, sustainable biomass)
Waste management	No legal framework, no infrastructure in place for waste management	- Provide infrastructure for waste disposal and recycling - Penalize illegal waste disposal - Subsidize, co-finance, waste to energy landfill
	Unclear legislation for waste water management	- Produce toolkit with all legal references for waste water management systems and options
Hospitality	Energy: lack of information, awareness on benefits of RE and EE as cost savers	- 6 month campaign to promote EE and RE - Financial incentive (subsidies?) to promote the switch to upgraded energy systems

	Waste: inefficiency of waste collector company in PNH affecting the hospitality industry (city unclean), limited recycling options slow down investment into waste management systems	- Improve garbage collection system. - Penalize illegal waste disposal
Construction	No respect of law on set-back increasing the use for lighting and AC	- New building code to reinforce law on set back enforcement
	Access to finance is difficult and procurement of EE and RE is costly	- Import tax exemption on RE and EE - Subsidize green financial products for RE and EE
	Bad reputation of solar discouraging investment	- Set a quality standard for solar, reyling on existing initiatives
	No clear legal framework for on-site use of RE	- Encourage net metering and feed-in tariff for on-site use.
Households: cooking, lighting	High expansion cost for rural electricity	- Support RE in rural areas with agreement when grid reaches location.
	Solar: Bad reputation of solar discouraging procurement, no skills for installation and maintenance	- Set a quality standard for solar, reyling on existing initiatives - Enhanced secondary and tertiary vocational training on RE, EE, equipment, installations and maintenance
	Low consideration for HH devices in national policies, while 80% of them use biomass for cooking	- Acknowledge the importance of the informal sector in biomass consumption, in a RE law. - Tax exemption on all sustainable biomass production.
Households: mobility	Lack of awareness on the effects of vehicle pollution	- Campaign on benefits of recent vehicle models
	Lack of regulation of the grey market accelerating GHG emissions as private transport is increasing	- Limit importations of cars to 5 years old cars - Ban import of damaged cars that harm the environment (quality fuel used)
	New vehicles and electric cars are expensive	- Import tax exemption on solar equipment - Subsidize the purchase of new and efficient cars - Increase tax on second hand cars imports



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