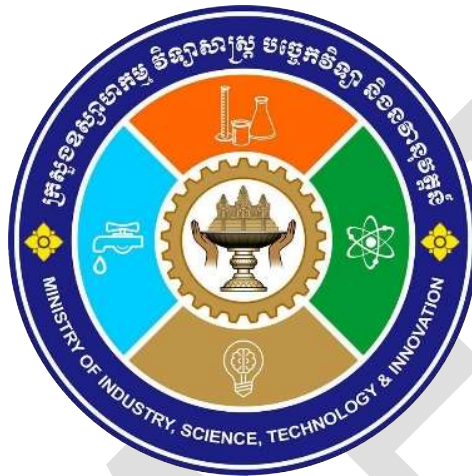


Royal Government of Cambodia
Nation Religion King



**Resource Efficiency and Cleaner
Production Strategy and Action Plan
for
Industry and SME Sector
2021-2030**

Final Draft - August 2021

Resource Efficiency Working Group for Industry and SME Sectors, 2021

[This document is only for discussion purpose.]

Preface

The Royal Government of Cambodia (RGC), since the past few decades, has effectively implemented the Rectangular Strategy for Growth, Employment, Equity, and Efficiency, transforming Cambodia's economy from an economically underdeveloped country to one of the fastest-growing economies in the world and a champion in terms of poverty reduction and improvement in social indicators. The Government's ambitious efforts have led Cambodia and its people from a low-income country to a lower-middle-income country in one of the leading transformation efforts in the world. The Government has now set a new vision for Cambodia's socio-economic development to experience a **"New Transformation"**, that is the transition to an upper-middle-income country. Towards this vision, the Royal Government of Cambodia seeks to maximise the benefits of technological advancement and digitalization, particularly in the context of the fourth industrial revolution and, to improve the effectiveness of environmental protection and conservation, natural resources, ecosystems, biodiversity, forest and wildlife sanctuaries, and climate change adaptation.

The industrial sector of Cambodia has been the backbone of this inspirational economic growth. Over the past two decades, Cambodia has pursued transformation from a post-conflict state into a market economy. The industrial sector has consistently grown at a rate of more than 10%, emerging as the fastest-growing and now the second-largest economic component of Cambodia's GDP. The industrial sector has grown from almost 23% in 2010 to 36.5% of the GDP in 2019, and at this rate will soon become the largest component of Cambodia's GDP replacing the services sector. Cambodia has positioned its industries globally, becoming a destination for global manufacturing and exports, between 2010-2019, Cambodia's exports between the period grew at an average year-on-year rate of 17% reaching USD 15 Billion of exports in 2019.

Cambodia understands that the future economic growth of the industrial sector has to be built on the foundations of sustainability. Currently, Cambodia ranks 139th globally on the Global Environmental Performance Index (EPI) and has higher than average regional resource efficiency parameters in the ASEAN. Cambodia's industries face the challenges of outdated technology, inefficient equipment, lack of knowledge leading to ecological destruction and environmental pollution. Consequently, excessive GHGs are emitted into the environment and harmful wastewater is discharged into water bodies and land, contaminating agricultural land, groundwater bodies, as well as irrigation networks [1].

Resource Efficiency and Cleaner Production (RECP) can provide a new growth paradigm addressing such challenges. RECP is a preventive strategy, targeting industries at different levels of sustainability readiness and aimed at decoupling consumption of ecosystem resources from production. This includes strategies of dematerialization - savings, reduction of material and energy use; and re-materialization - reuse, remanufacturing and recycling in a systems-wide approach to a circular economy [2]. RECP interventions will help Cambodia in not only improving the sustainability of our industries but also in increasing human well-being and economic growth while lowering the amount of resources required and negative environmental impacts associated with resource use.

Cambodia must incorporate sustainable resource use to sustain its long-term growth and achieve the targets to become an upper-middle-income country by 2030. After successful implementation of the Third, Fourth and Fifth Legislature of the National Assembly, for the Sixth Legislature, the RGC through the formulation of the National Strategic Development Plan 2019-2023, has set the objective of **"Promoting resource efficiency and sustainability by implementing the principle of sustainable consumption and production"**.

¹ UNIDO - <https://open.unido.org/projects/KH/projects/150275>

² UNEP - <https://www.unenvironment.org/resources/report/resource-efficiency-and-climate-change-material-efficiency-strategies-low-carbon>

Resource Efficiency and Cleaner Production (RECP) is also key to achieving sustainable development goals (SDGs). This is reflected in Goal 4 - Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all; Goal 6 - Ensure availability and sustainable management of water and sanitation for all; Goal 7 - Ensure access to affordable, reliable, sustainable, and modern energy for all; Goal 8 - Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all; Goal 9 - Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation; Goal 12 - Ensure sustainable consumption and production patterns and Goal 13 - Take urgent action to combat climate change and its impacts.

With the vision 'to accelerate the green transition of the industry sector The Ministry of Industry, Science, Technology and Innovation (MISTI) as the nodal ministry for industrial development in Cambodia has prepared the **"Resource Efficiency and Cleaner Production Strategy and Action Plan for Industry and SME Sector 2021-2030"**. The strategic action plan aims to provide the framework for and ensure the implementation of, sound and sustainable industrial practices, including a realistic, coherent, and implementable policy ecosystem on enabling RECP.

On behalf of the Royal Government of Cambodia, I announce the official launch of the **"Resource Efficiency and Cleaner Production Strategy and Action Plan for Industry and SME Sector 2021-2030"**, which is a roadmap for helping our industries to transition towards a resource-efficient, green, and sustainable future.

On behalf of the Royal Government of Cambodia, I would like to express my gratitude to excellencies, ladies and gentlemen from ministries and institutions, the private sector, educational institutions, non-governmental organisations, development partners, local communities, and concerned stakeholders who have made significant contributions to the development of this important strategic document.

Finally, I would state that to promote Cambodia's industrial development towards a green, climate-resilient, equitable, sustainable, and knowledge-based ecosystem; various stakeholders including development partners, financial institutions, educational institutions, non-governmental organisations, local communities, and all stakeholders must continue to work closely together to effectively implement the RECPSAP.

Phnom Penh, xx July 2021

Kitti Settha Pandita CHAM Prasidh

Senior Minister and Minister of Industry, Science, Technology, and Innovation (MISTI)

Table of Contents

| | |
|--|-----------|
| List of Figures | 4 |
| List of Tables..... | 5 |
| Abbreviations..... | 6 |
| 1. Background..... | 8 |
| 1.1. Policy..... | 9 |
| 1.1.1. Articles of the Constitution..... | 9 |
| 1.1.2. International Conventions..... | 9 |
| 1.1.3. Laws | 11 |
| 1.1.4. Policies | 11 |
| 1.2. Situation | 13 |
| 1.2.1. National Resources | 13 |
| 1.2.2. Overview of Industry sector..... | 19 |
| 1.2.3. Challenges for RECP adoption in Cambodia | 45 |
| 1.3. Priority matters..... | 46 |
| 2. Strategies | 48 |
| 2.1. Strategic Analysis | 48 |
| 2.1.2. Guiding Principles..... | 49 |
| 2.2. Mainstreaming Gender | 50 |
| 3. Vision, Mission and Strategic Goals | 54 |
| 3.1. Vision | 54 |
| 3.2. Mission | 54 |
| 3.3. Strategic Goals and Objectives..... | 54 |
| 4. Action Plan for Strategic Objectives | 55 |
| 4.1. Summary scope of planning | 55 |
| 4.2. Action plan matrix | 56 |
| 4.3. Institutional and collaboration structure for implementing the action plan | 66 |
| 4.4. Expected benefits from the implementation of the Action Plan | 67 |
| 5. Expenditure or Management and Financing Mechanism | 68 |
| 5.1. Analysis of existing management and financing mechanisms | 68 |
| 5.2. Analysis of potential sources and volume of finance for RECP actions | 70 |
| 5.3. Entry points for RECP mainstreaming in management and financing mechanisms | 71 |
| 6. Monitoring and Evaluation | 72 |
| 6.1. Indicators for RECP Action Plan | 72 |
| 7. Conclusion | 84 |
| 8. Annexure I: Stakeholder consultations conducted as part of the RECP SAP 2021-2030. | 85 |
| 9. Annexure II: Note on sub-sectors selection | 95 |

List of Figures

| | |
|---|----|
| Figure 1: Material Intensity - kg per GDP (constant 2010 US\$) – (Source: UNEP The International Resource Panel) | 14 |
| Figure 2: Total Primary Energy Supply (2010-2017) and Energy Intensity (toe/million USD) - (Source: World Bank Official MME, Energy Balance Table, EBT) | 15 |
| Figure 3: Trend of emissions by sector (total GHGs, Gg. CO ₂ -eq) and BAU GHG emissions in 2030 – (Source: First Biennial Update Report of The Kingdom of Cambodia, 2020; Cambodia's Updated Nationally Determined Contribution, 2020) | 16 |
| Figure 4: Emission Intensity kg CO ₂ -eq/GDP – (Source: First Biennial Update Report of The Kingdom of Cambodia, 2020) | 16 |
| Figure 5: Trend of emissions 1994 – 2016 (GHG, Gg. CO ₂ -eq) and Quantity of recycled solid waste from 2010 to 2017 (kg) – (Source: First Biennial Update Report of The Kingdom of Cambodia, 2020) | 18 |
| Figure 6: Cambodia Gross domestic product by economic activity – (Source: NIS, 2020) | 19 |
| Figure 7: Categorisation of industries in Cambodia (Source: MISTI) | 20 |
| Figure 8: Methodology for sub-sector analysis | 21 |
| Figure 9: High level sector prioritisation – (Source: MISTI; PwC Analysis) [] | 21 |
| Figure 10: Textile and wearing apparel - SEC - Baseline and 2030 sub-sector target | 23 |
| Figure 11: Textile and wearing apparel - Capital Efficiency of selected technologies | 24 |
| Figure 12: Textile and wearing apparel - Payback period of selected technologies | 24 |
| Figure 13: Textile and wearing apparel - Energy Saving Potential (TWh) | 25 |
| Figure 14: Footwear - SEC - Baseline and 2030 sub-sector target | 25 |
| Figure 15: Footwear - Capital Efficiency of selected technologies | 26 |
| Figure 16: Footwear - Payback period of selected technologies | 26 |
| Figure 17: Footwear - Energy Saving Potential (TWh) | 27 |
| Figure 18: Rice Mill - SEC - Baseline and 2030 sub-sector target | 28 |
| Figure 19: Rice Mill - Capital Efficiency of selected technologies | 28 |
| Figure 20: Rice Mill - Payback period of selected technologies | 29 |
| Figure 21: Rice Mill - Energy Saving Potential (TWh) | 29 |
| Figure 22: Beverages - SEC - Baseline and 2030 sub-sector target | 30 |
| Figure 23: Beverages - Capital Efficiency of selected technologies | 30 |
| Figure 24: Beverages - Payback period of selected technologies | 31 |
| Figure 25: Beverages - Energy Saving Potential (TWh) | 31 |
| Figure 26: Cement - SEC - Baseline and 2030 sub-sector target | 32 |
| Figure 27: Cement - Capital Efficiency of selected technologies | 33 |
| Figure 28: Cement - Payback period of selected technologies | 33 |
| Figure 29: Cement - Energy Saving Potential (TWh) | 34 |
| Figure 30: Bricks - SEC - Baseline and 2030 sub-sector target | 34 |
| Figure 31: Bricks - Capital Efficiency of selected technologies | 35 |
| Figure 32: Bricks - Payback period of selected technologies | 35 |
| Figure 33: Bricks - Energy Saving Potential (TWh) | 36 |
| Figure 34: Paper and paper products - SEC - Baseline and 2030 sub-sector target | 37 |
| Figure 35: Paper and paper products - Capital Efficiency of selected technologies | 37 |
| Figure 36: Paper and paper products - Payback period of selected technologies | 38 |
| Figure 37: Paper and paper products - Energy Saving Potential (TWh) | 38 |
| Figure 38: Rubber - SEC - Baseline and 2030 sub-sector target | 39 |
| Figure 39: Rubber - Capital Efficiency of selected technologies | 40 |
| Figure 40: Rubber - Payback period of selected technologies | 40 |
| Figure 41: Rubber - Energy Saving Potential (TWh) | 41 |
| Figure 42: Cassava - SEC - Baseline and 2030 sub-sector target | 42 |
| Figure 43: Cassava - Capital Efficiency of selected technologies [] | 42 |
| Figure 44: Cassava - Payback period of selected technologies | 43 |
| Figure 45: Cassava - Energy Saving Potential (TWh) | 43 |
| Figure 46: RECP's measures and approach to low carbon growth ^[46] | 49 |
| Figure 47: RECP SAP implementation timelines | 55 |
| Figure 48: Institutional and collaboration structure | 66 |
| Figure 49: MISTI institutional structure relevant to RECP Strategy and Action Plan | 69 |
| Figure 50: RECP SAP Monitoring and Evaluation Structure | 72 |
| Figure 51: Methodology for sub-sector selection | 95 |

List of Tables

| | |
|---|-----|
| Table 1: Emission from different sectors and reduction from the BAU scenario – (Source: Cambodia's Updated Nationally Determined Contribution (NDC) – 2020) | 10 |
| Table 2: Annual rubber product estimates ('000 tonnes)- (Source : NSDP 2019-2023) | 39 |
| Table 3: Key challenges and gaps for RECP in Cambodia | 45 |
| Table 4: Applications and outcome elements of cleaner production [] | 48 |
| Table 5: Barriers to advancements and transformation for women's economic empowerment (Source: UNIDO) | 51 |
| Table 6: Adopted recommendations for enabling gender-responsiveness in green industry (Source: UNIDO) .. | 51 |
| Table 7: Coverage of Gender and social considerations in the Policy and regulatory framework of Cambodia .. | 52 |
| Table 8: Action Plan matrix | 56 |
| Table 9: Potential funding sources | 70 |
| Table 10: RECP SAP indicator matrix | 73 |
| Table 11: Actions indicator matrix | 77 |
| Table 12: Sub-sector wise data gathered | 95 |
| Table 13: Analysis of sub-sector's coverage in national policies | 96 |
| Table 14: Sub-sector categorisation based on Energy, Waste and Resource intensity performance | 97 |
| Table 15: Scoring matrix | 98 |
| Table 16: Sub-sector rankings based on the conducted analysis | 99 |
| Table 17: Sub-sectors selected for detailed analysis | 100 |

Abbreviations

| Abbreviation | Definition |
|--------------|---|
| ASEAN | Association of Southeast Asian Nations |
| BAU | Business as Usual |
| CAGR | Compound Annual Growth Rate |
| CCAP | Climate Change Action plan |
| CCCSP | Cambodia Climate Change Strategic Plan |
| CDC | Council for the Development of Cambodia |
| CP | Cleaner Production |
| CSDG | Cambodia Sustainable Development Goals |
| CSO | Civil service organisations |
| DE | Domestic extraction |
| DMC | Domestic Material Consumption |
| DTIS | Department of Techniques & Industrial Safety |
| EBRD | European Bank for Reconstruction and Development |
| EBT | Energy Balance Table |
| EE | Energy Efficiency |
| EIP | Eco Industrial Park |
| ELC | Economic Land Concessions |
| EMS | Environmental Management System |
| EPI | Environmental Performance Index |
| EPR | Extended producers Responsibility |
| ESCO | Energy service company |
| EU | European Union |
| FDI | Foreign direct investment |
| FMCG | Fast-moving consumer goods |
| FOLU | Forestry and Other Land Use |
| GCF | Green Climate Fund |
| GCPF | Global Climate Partnership Fund |
| GEF | Global Environment Facility |
| GHG | Greenhouse Gas |
| GMP | Good Manufacturing Practice |
| GSSD | General Secretariat of National Council for Sustainable Development |
| HACCP | Hazard Analysis and Critical Control Point |
| HCFC | Hydrochlorofluorocarbons |
| IDP | Industrial development policy |
| IPPU | Industrial Processes and Product Use |
| ISIC | International Standard Industrial Classification |
| LBNL | Lawrence Berkeley National Laboratory |
| LPG | Liquefied petroleum gas |

| Abbreviation | Definition |
|--------------|---|
| MISTI | Ministry of Industry, Science, Technology, and Innovation |
| MME | Ministry of Mines and Energy |
| MSME | Micro, Small & Medium Enterprises |
| MSW | Municipal solid waste |
| MT | Metric Tonne |
| NA | Not Applicable |
| NCPO | National Cleaner Production Office |
| NDC | Nationally Determined Contributions |
| NESAP | National Environment Strategy and Action Plan |
| NIS | National Institute of Statistics |
| NPCC | National Productivity Centre of Cambodia |
| NPGG | National Policy on Green Growth |
| NSDP | National Strategic Development Plan |
| ODS | Ozone Depletion substances |
| OECD | Organisation for Economic Co-operation and Development |
| PCB | Printed circuit Board |
| PIP | Public Investment Plan |
| POP | Persistent Organic Pollutants |
| RECP | Resource Efficiency and Cleaner Production |
| RECPSAP | Resource Efficiency and Cleaner Production Strategy and Action Plan |
| REDD | Reducing emissions from deforestation and forest degradation |
| RGC | Royal Government of Cambodia |
| SDG | Sustainable Development Goals |
| SEC | Specific Energy Consumption |
| SEZ | Special Economic Zone |
| SME | Small & Medium Enterprises |
| SO | Strategic Objectives |
| TFC | Total final consumption |
| TPES | Total Primary Energy Supply |
| TWh | Tera-Watt hour |
| TWG | Technical Working Group |
| UASB | Up flow anaerobic sludge blanket |
| WHRS | Waste Heat Recovery Systems |

1. Background

Over the past two decades, Cambodia has pursued transformation from a post-conflict state into a market driven economy. Between 2011-2019, with an average GDP growth rate of ~7.9%, Cambodia became one of the fastest growing economies in the ASEAN. The GDP growth recently dropped to -3.1% [3] in 2020 due to the impact of the COVID-19 pandemic. However, the World Bank has projected that Cambodia's GDP growth rate will revive back to 4% and 5.2% in 2021 and 2022, respectively [4].

In 2020, Cambodia's GDP was estimated to be 25.40 Billion USD (at current USD) with an average per capita GDP of USD 1,519 (at current USD) [4]. As per the classification of the World Bank, this level of GDP per capita positions Cambodia as a lower-middle income country (USD 1,026 - 4,035). Cambodia has set a target to become an upper-middle income country (USD 4,046 - 12,535) by 2030 and a high-income country (> USD 12,535) by 2050.

Cambodia's economic growth has been led by the industrial sector, which has consistently grown at an average rate of ~ 14% between 2010-2018 [6]. Considering the structure of output, the share of industrial sector in GDP is growing at a fast pace, replacing the contribution of agriculture sector in the GDP. The industrial sector has grown from almost 23% in 2010 to 36.5% share of the GDP in 2019, whereas the share of agriculture has dropped from almost 36% to 22% of the GDP between the same period [5]. The manufacturing sector between grew at an average rate of 11% between 2010-2018 [6]. From 2010-2019, Cambodia's exports and imports grew at an average annual rate of 17% each to USD 15 Billion and USD 22 Billion respectively [5]. In terms of the economic value, the textile, wearing apparel and footwear products (with products such as knit and non-knit suits, sweaters, and T-shirts) accounted for over 85% of the exports [7]. Food, beverages, and Tobacco products (with products such as cereals, vegetables, beverages, spirits, tobacco, and manufactured tobacco substitutes) accounted for around ~4% of the exports [7].

Rapid industrialization, in conjunction with the growing population, and lack of access to and awareness of clean technologies present a growing threat to the environment in Cambodia. Rapid and unsustainable industrialization has contributed to the following concerns [8]:

- **Ecological:** As most of the industries are located in proximity to river basins of the Mekong River, its two main tributaries (the Tonle Sap and Tonle Bassac) as well as the coast of the Gulf of Thailand, the basins' ecosystems are at a constant risk.
- **Waste Management:** Inefficient industrial operations increase the amount of wastes both in terms of quantity and toxicity.
- **Water Pollution:** The industrial sector's excessive freshwater usage and discharging of untreated wastewater containing toxic dyes and harmful chemicals by factories have negative impacts on the local water streams, rivers, and the coastal area.
- **Air Pollution:** Releases of harmful substances, such as NOx and SOx into the air could potentially lead to the formation of acid rain.
- **Community Concerns:** Local communities who depend on the surface water for their social, cultural, and economic well-being are highly impacted by these detrimental developments.

³ Message of Prime Minister to Cambodian on the occasion of the National New Year on April 5, 2021.

⁴ <https://pubdocs.worldbank.org/en/112311563917601421/mpo-khm.pdf>

⁵ ADB – <https://data.adb.org/dataset/cambodia-key-indicators>

⁶ NIS - https://www.nis.gov.kh/nis/NA/NA2018_Tab_files/TAB1-2.htm

⁷ The Observatory of Economic Complexity - <https://oec.world/en/profile/country/khm/>

⁸ UNIDO - Low-carbon development for productivity and climate change mitigation through the Transfer of Environmentally Sound Technology (TEST) methodology

Most factories in Cambodia use outdated technology and inefficient equipment, often imported second hand. The lack of knowledge regarding the inefficiency of production processes, especially in the dominant small and medium scale and family owned enterprises, further contributes to release of GHGs and other gases causing environmental pollution. In addition, toxic wastewater is often discharged without treatment into water bodies and land, contaminating agricultural land, groundwater bodies, as well as irrigation networks [9].

The aforementioned factors have impacted Cambodia's resource consumption and efficiency metrics which have underperformed as compared to its regional counterparts in ASEAN by a significant margin on the Global Environmental Performance Index (EPI). As of 2017, Cambodia's Domestic Extraction intensity was 4.10 kg per USD of GDP (constant at 2010 USD) compared to the regional average of 3.10 kg per USD of GDP (constant at 2010 USD) and the Domestic Material Consumption (DMC) intensity was 4.70 kg per GDP (constant at 2010 USD) compared to the regional average of 3.20 kg per USD of GDP (constant at 2010 USD) [10] [11].

The Ministry of Industry, Science, Technology, and Innovation (MISTI), as the nodal ministry for industrial development in Cambodia, targets the development of Cambodian industries by promoting environmental sustainability and increasing overall productivity. The 'Resource Efficiency and Cleaner Production Strategy and Action Plan for Industry and SME Sector 2021-2030' is a first of its kind endeavour to chart the strategic direction and lay out the roadmap of actions for the introduction of RECP in the industrial sector of Cambodia. It presents the blueprint to develop and mainstream RECP measures in Cambodian industries and promote sustainable growth and competitiveness.

1.1. Policy

The RECP Strategy and Action Plan has a wide scope spanning across energy, water, material use, waste, and safety aspects in the industrial sector. It, therefore, derives its legal basis from multiple sources, including the articles of the Constitution, international conventions, domestic laws, and policies, which are briefly presented below:

1.1.1. Articles of the Constitution

The following two articles of the Constitution provide legal basis for RECP Strategy and Action Plan:

A. Article 59

The Article states that "The state shall protect the environment and the balance of natural resources and establish a precise plan for the management of land, water, airspace, wind, geology, ecological systems, oil and gas, rocks and sand, gems, forests and forestry products, wildlife, fish and aquatic resources."

B. Article 61

The Article states that "The state shall promote economic development in all sectors and particularly in remote areas, especially in agriculture, handicrafts and industry, with attention to policies on water, electricity, roads and means of transportation, modern technology and credit systems."

1.1.2. International Conventions

The following international conventions provide a legal basis for RECP Strategy and Action Plan:

A. United Nations Framework Convention on Climate Change (UNFCCC)

⁹ UNIDO - <https://open.unido.org/projects/KH/projects/150275>

¹⁰ DMC - Domestic material consumption (DMC) reports the overall amount of materials (in metric tonnes) used in an economy including diverse materials as biomass, fossil fuels, metal ores and non-metallic minerals. DMC intensity refers to the DMC per unit GDP

DE - Domestic extraction is the input from the natural environment to be used in the economy. DE is the annual amount of raw material (except for water and air) extracted from the natural environment. DE intensity refers to the DE per unit GDP

¹¹ International Resource Panel (IRP) - Global Material Flows Database and SCP Hotspot Analysis Tool

Since its ratification in December 1995, Cambodia has been a party to the United Nations Framework Convention on Climate Change (UNFCCC). Its membership was formalised on 17 March 1996. In 2002, Cambodia ratified the Kyoto Protocol, which became effective in February 2005. The most significant goal of both treaties (UNFCCC and Kyoto Protocol) is to keep greenhouse gas levels in the atmosphere stable at a level that prevents harmful human interference with the climate system. The commitment of the Parties to take action to ensure a comprehensive response to climate change, considering their 'common but differentiated responsibilities' in accordance with their respective capabilities, is an important pillar of the Climate Convention.

B. Paris Agreement: Cambodia's Nationally Determined Contribution

In response to the Paris Climate Agreement, 2015, the Royal Kingdom of Cambodia submitted its updated NDC to the UNFCCC in 2020. The updated NDC sets national and sector wise emission mitigation targets for the next decade. In the updated NDC, various scenarios have been developed, which includes a BAU (Business as Usual) scenario, one NDC scenario for all sectors except FOLU (Forestry and other Land Use), and three FOLU sector NDC scenarios.

Table 1: Emission from different sectors and reduction from the BAU scenario – (Source: Cambodia's Updated Nationally Determined Contribution (NDC) – 2020)

| Sectors | BAU 2030 (MtCO ₂ e) | NDC 2030 GHG emission reduction (MtCO ₂ e) | Reduction from BAU |
|-----------------|-----------------------------------|---|--------------------|
| Energy | 34.4 | 13.7 | 60% |
| Agriculture | 27.1 | 6.2 | 77% |
| Industry (IPPU) | 13.9 | 5.9 | 58% |
| Waste | 3.3 | 0.6 | 82% |

C. Vienna Convention and Montreal Protocol

The objective of the Vienna Convention is to preserve human health, and to protect the environment from any harmful effects of the depletion of the ozone layer. The Convention encourages research activities, cooperation, and the exchange of information between states, and national legislative measures, without however prescribing any concrete measures. Cambodia is a Party to the Montreal Protocol having acceded to the Vienna Convention and the Montreal Protocol in June 2001. Montreal Protocol is a multilateral environmental agreement, which regulates nearly 100 man-made chemicals referred as Ozone Depletion substances (ODS). The Montreal Protocol targets the phase out of the consumption and production of various Ozone Depletion Substances, in a structured manner in the signatory countries. The Royal Kingdom of Cambodia has set up a phasing out plan for ODS's such as HCFC 22 and HCFC 123. The new control schedule of Montreal Protocol targets to phase out the 2008 baseline of 165 MT - 10% by 2015, 35% by 2020, 67.5% by 2025, and finally the 100% by 2030. The phasing out efforts mandate to limit the production and consumption of the two ODSs to 0.38 tonnes by 2030.

D. Cambodian Sustainable Development Goals Framework (CSDG)

Following the UN's Sustainable Development Goals (SDG), the Royal Government of Cambodia has drafted a country focused framework: the Cambodian SDGs (CSDG). From the adopted CSDGs and indicators the following are of relevance to RECP:

- i) CSDG 6: Clean Water and Sanitation
- ii) CSDG 7: Affordable and Clean Energy
- iii) CSDG 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
- iv) CSDG 12: Ensure Sustainable Consumption and Production patterns

v) CSDG 13: Climate Action

E. Rotterdam Convention

The Rotterdam Convention is a multilateral protocol aimed at fostering mutual commitments with respect to imports of hazardous chemicals. The Convention supports the open sharing of information and calls on exporters of hazardous chemicals to use proper marking, to include safe handling guidance and to warn consumers of any identified limitations or prohibitions. Signatory countries may determine whether to allow or prohibit the import of the chemicals referred to in the Treaty, and exporting countries are obliged to ensure that they comply with the conditions of the producers under their jurisdiction. The convention covers various chemicals that have been banned, which includes pesticides and industrial chemicals having adverse impact on environment and/or Human health. Cambodia has acceded to the Rotterdam Convention and become the 151st Party in May 2013.

F. Stockholm Convention on Persistent Organic Pollutants (POPs)

The Stockholm Convention on Persistent Organic Pollutants, is a global treaty to protect human health and the environment from chemicals that remain intact in the environment for long periods. It was adopted by the Conference of Plenipotentiaries on 22 May 2001 in Stockholm, Sweden. The Convention entered into force on 17 May 2004 and Cambodia became the party to the convention in 2001. According to the Convention, all parties undertake to prepare an updating of implementation plan five years after submission of the original plan. The national Implementation Plan focuses mainly on the skill development of the relevant stakeholders, capacity building knowledge sharing. With this, unintentional production of POPs can be minimized. Proper Monitoring and Evaluation framework is to be designed and enforced as per the plan. Several projects have been identified to limit, minimize, and eliminate POPs pesticides in the Royal Kingdom of Cambodia with their estimated budgets, summing up to a total of USD 7.245 Million.

1.1.3. Laws

The following laws provide a legal basis for RECP Strategy and Action Plan:

A. Law on Environmental Protection and Management of Natural Resources (1996)

The law enacts Royal Government's plans for environmental and natural resource conservation and protection. In accordance with Article 59 of the Constitution, the law has broadly protected human health, the environment, and natural resources, including biodiversity. In general, the law addresses the environmental fields, such as environmental and natural resource management and protection and public participation.

B. Law on Water Resources Management (2007)

The law sets provisions for fostering effective and sustainable management of water resources to attain socio-economic development and the welfare of the people. This Law determines:

- i) The rights and obligations of water users.
- ii) The fundamental principles of water resources management.
- iii) The participation of users and their associations in the sustainable development of water resources.

1.1.4. Policies

The following policies provide a legal basis for RECP Strategy and Action Plan:

A. The Rectangular Strategy-Phase 4, 2018 and National Strategic Development Plan (NSDP 2019-2023)

"Rectangular Strategy-Phase 4" is the "Socio-Economic Policy Agenda" of the "Political Platform of the Royal Government of the Sixth Legislature of the National Assembly". The policy is a blueprint to guide the activities of

all development stakeholders to remain within the “Dynamics of Stakeholder System” to step up development in the medium and longer terms in a sustainable manner by ensuring efficiency and effectiveness of the public institutions and management of all the resources.

National Strategic Development Plan (“NSDP 2019-2023”) provides the roadmap for the implementation of the Political interventions of the Royal Government including the Rectangular Strategy. The NSDP provides identification of the priorities, indicators, and timeframe for the implementation and with the identification of mechanism for monitoring and evaluation of the Result Framework, especially setting the responsibility of the line ministries and agencies within each angle in order to achieve the Cambodia Visions 2030 and 2050. The NSDP attempts to transform Cambodia to become a higher-middle income country by 2030. NSDP discusses economic diversification covering reduction of electricity tariff, preparedness for industry 4.0, Private sector development and employment, and Inclusive and sustainable development.

The Rectangular Strategy-Phase 4 and National Strategic Development both addresses all the three dimensions of RECP - production efficiency, environmental conservation, and human development. The objective of the policy focuses on economic efficiency and productivity, inclusive and sustainable development, sustainable management of natural resources, and environment sustainability and readiness for climate change.

Under the key policy priorities and actions 2019-2023, NSDP highlights a strategic goal to minimize environmental impacts, enhance the capacity to adapt to climate change, and contribute to reducing the global climate change to ensure sustainable development. Key challenges include increase in natural resource utilization, deterioration in environmental quality, including water, land and air, limited capacity in mainstreaming technology that is resilient to the climate change, as well as the limited cooperation and participation from stakeholders, and the need to ensure water and energy security in the long term. In the Sixth Legislature of the National Assembly, the RGC of Cambodia will give priorities to:

- i) **Promoting resource efficiency and sustainability by implementing the principle of sustainable consumption and production.**
- ii) Continuing to implement the “National Strategic Plan on Green Growth 2013-2030”, “Cambodia Climate Change Strategic Plan 2014-2023”, “National Environment Strategy and Action Plan 2016-2023”, “National REDD+ Strategy”; and use social and environmental fund effectively to ensure economic development with low-carbon emission and resilience to climate change.
- iii) Reinforcing the management of solid waste, wastewater, gas, and lethal substance by implementing principles of reduction, reuse, recycling, and non-use as well as strengthening pollution monitoring and control mechanism.
- iv) Increasing the usage of environmental-friendly and climate-friendly technologies in physical infrastructure and socio-economic development.
- v) Continuing to promote the implementation of carbon trading mechanisms and related regulatory frameworks, strengthen the capabilities to develop and implement climate change adaptation and resiliency measures as well as explore the possibility of studying financial resiliency to respond to disasters caused by climate change.
- vi) Continuing to encourage and increase investment in clean energy and renewable energy, especially solar power while reducing the production of energy from unclean sources to ensure long-term energy security.
- vii) Strengthening regulatory framework, research, as well as development of skill and capacity for national and sub-national officials in terms of environment, green development, climate change, integrated water resource management, and the usage of natural resources in a sustainable manner.

B. Industrial development policy (2015 – 2025)

Industrial development policy (IDP) forms a guide for the industrial development in Cambodia aimed at maintaining sustainable and inclusive high economic growth through economic diversification, strengthening competitiveness, and promoting productivity.

The IDP addresses the environmental conservation and human development component of the RECP dimensions by highlighting priority strategy to set clear standards and guiding principles on environmental protection and production safety for investment projects located in SEZs and other industrial zones.

C. National Policy on green growth, 2013

National Policy on Green Growth (NPGG), covers all the three dimensions of RECP - Production efficiency, Environmental conservation, and Human development as it focuses to balance economic growth with the needs of the community, environment, and culture, while ensuring the sustainable utilisation of national resources to improve people's well-being and living conditions. This policy sets the course for stimulating the economy by low-carbon strategies, generating jobs, protecting vulnerable groups, and enhancing the protection of the environment.

D. Climate Change Strategic Plan (2014-2023)

The Cambodia Climate Change Strategic Plan (CCCSP) forms linkages with the RECP dimensions of environmental conservation and human development. The CCCSP outlines its vision to develop Cambodia towards a green, low-carbon, climate-resilient, equitable, sustainable, and knowledge-based society; and highlights a mission for creating a national framework for engaging the public, the private sector, civil society organizations and development partners in a participatory process for responding to climate change to support sustainable development.

E. National Environment Strategy and Action Plan (2016-2023)

The National Environment Strategy and Action Plan (NESAP) 2016-2023 forms linkages with the RECP dimensions of environmental conservation and human development and is developed pursuant to Article 59 of the Constitution of the Kingdom of Cambodia and in accordance with the 1996 Law on Environmental Protection and Natural Resource Management. NESAP 2016-2023 focuses on the introduction and implementation of environmental sustainability and inclusive growth measures which are at the centre of the Rectangular Plan, NSDP, and other sectoral policies. The main goal of NESAP 2016-2023 is to recognize the needs and prospects for the protection of the ecosystem and of natural resources as one of the core elements of the national development framework.

1.2. Situation

1.2.1. National Resources

Cambodia is known for its abundance of natural resources such as forests, wildlife, arable land, lakes, freshwater, coastal fisheries, mineral resources, and renewable energy opportunities. Natural resources per capita are high, but with population growth and poor environmental and natural resource management, the supply of per capita natural assets stands the risk of falling short of the demand in the future.

A. Material Intensity

The Domestic Material Consumption (DMC) which reports the actual amount of material in an economy, between 2000-2019, grew at an average year on year rate of 7%. The years 2008-2010 witnessed large domestic extractions (DE) in construction resources, due to the strong demand in the previous years for construction materials in the neighbouring regions. However, this was followed a ban ^[12] by the government on the exports of

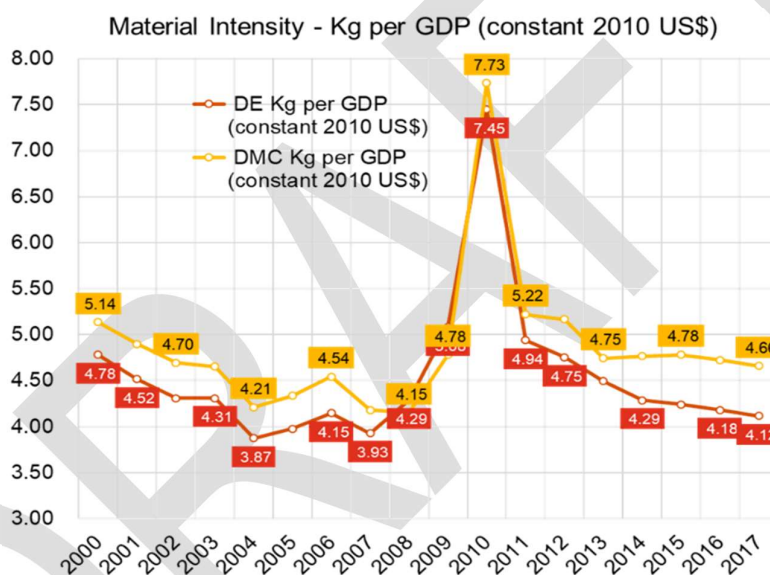
¹² Global Witness - https://www.globalwitness.org/documents/17819/shifting_sand_final.pdf

construction materials, resulting in an excess capacity for the following years. This time period witnessed a growth of more than 140% in the construction based domestic extractions with almost -96% decline in construction exports, which together resulted in an almost 70% spike in the total DMC.

As represented in Figure 1, the material intensity indicators of Cambodia peaked in the year 2010 and are declining at an annual average rate of (-)6-8%. However, these trends do not represent improving productivity conditions and are rather due to the ban [12] on the construction exports. The trends normalize post a significant spike in domestic extractions in the 2008-2010 period. Although a disaggregation of the material intensity across various sectors is not available, expert opinion suggests that the industry sector is next only to the construction sector in contributing to a high material intensity.

As per the 2017 data, Cambodia's DE intensity (4.1 kg per GDP) and DMC intensity (4.7 kg per GDP) both are above the ASEAN regional average of 3.1 kg per GDP and 3.2 kg per GDP, respectively. Cambodia is one of the three nations in ASEAN with the highest material intensity, which points to the need for improving material use efficiency.

Figure 1: Material Intensity - kg per GDP (constant 2010 US\$) – (Source: UNEP The International Resource Panel) [13]



B. Energy intensity

Between 2010 and 2017, Cambodia's energy sector has seen consistent growth, with Total Primary Energy Supply (TPES) rising from 5,349 ktoe in 2010 to 7,266 ktoe in 2017 at a CAGR of 4.47%. Cambodia's fuel composition has been dominated by biomass since the early 1990s. However, its share in the TPES has steadily decreased from 67.67 per cent in 2010 to 53.78 per cent in 2017 due to fuel substitution by the end use sectors. From 2010 to 2017, demand for petroleum products rose by 5.08 per cent per year due to the rise in road vehicles.

Coal imports have seen a significant rise since 2013, when their share of TPES rose from 0.008 per cent in 2013 to 10.4 per cent in 2017. Coal imports rose by 78.8% between 2010 and 2017 due to a rise in the share of coal-fired thermal power production. [14]

¹³ UNEP The International Resource Panel - <https://www.resourcepanel.org/global-material-flows-database>

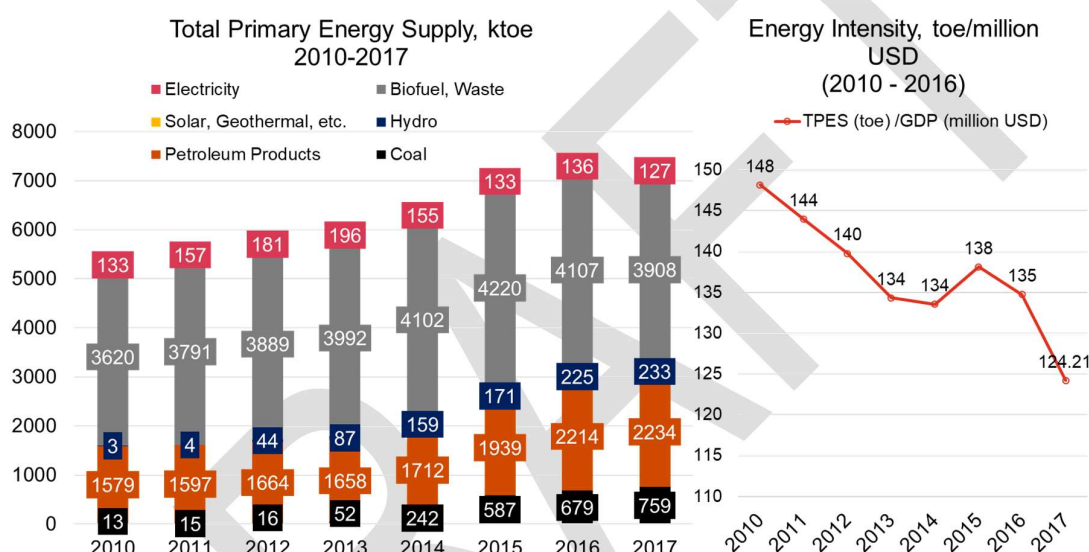
¹⁴ Analysis of Official Energy Balance Table, MME. The figures do not coincide with some of the other sources such as IEA, Basic Energy Plan by EERIA & MME. However, a decision was made to use national sources.

The Industry sector is the third largest energy consumer with the total final consumption (TFC) recorded at 1,128 ktoe in 2017 which approximates to 18% share in the overall TFC. Majority of the industrial demand is met by Biomass/ Waste 3,349 ktoe (55%), followed by oil products 2,146 ktoe (35%) and electricity 583 ktoe (10%) [14].

As presented in Figure 2, Cambodia's Energy Intensity has witnessed a decreasing trend during the years (2010 – 2014) and an increase between the years 2014 to 2017. The increase between the years 2013 to 2015 is attributable to an increase in coal imports where imports spiked from 52 ktoe to 242 ktoe [15]. The energy intensity has majorly reduced due to substitution of biomass with other fuels and higher rate of growth of GDP in comparison to TPES (due to growth of services sector).

It is important that the present energy mix should see a transition to cleaner energy sources while also pursuing energy conservation/efficiency interventions to sustain energy intensity improvements.

Figure 2: Total Primary Energy Supply (2010-2017) and Energy Intensity (toe/million USD) - (Source: World Bank Official MME, Energy Balance Table, EBT)



C. Emissions Intensity

The total greenhouse gas (GHG) emissions in Cambodia were estimated to be 1,63,592 Gg.CO₂-eq in 2016, 285 per cent more than in 1994. Deforestation expressed in the emissions of the FOLU sector is estimated to be the key cause of this rise in GHG emissions. Agriculture represents the second largest emitter influenced primarily by rice cultivation, whose activity level and emissions have increased at a CAGR of ~2.3% in the period between 1994-2016.

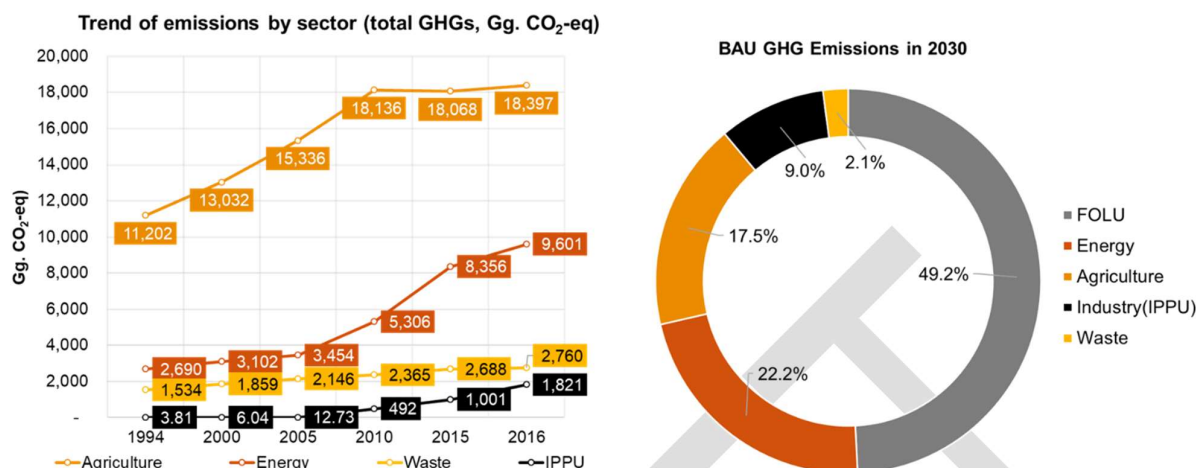
Cambodian GDP, along with its population, significantly increased during the timeframe covered by the GHG inventory. This is mirrored in the rising trend in pollution from the country's third and fourth largest emitting sectors, i.e. the energy and waste sectors, respectively. The IPPU represents the fifth largest source of GHG emissions owing to carbon-intensive nature of the industrial processes. The IPPU statistics represent a sharply rising trend, due to cement production and consumption of fluorinated gases.

As represented in Figure 3, it is estimated that by 2030, energy will replace agriculture as second highest emissions contributor estimating about 22.2 per cent of the total emissions [16].

¹⁵ Official MME, EBT

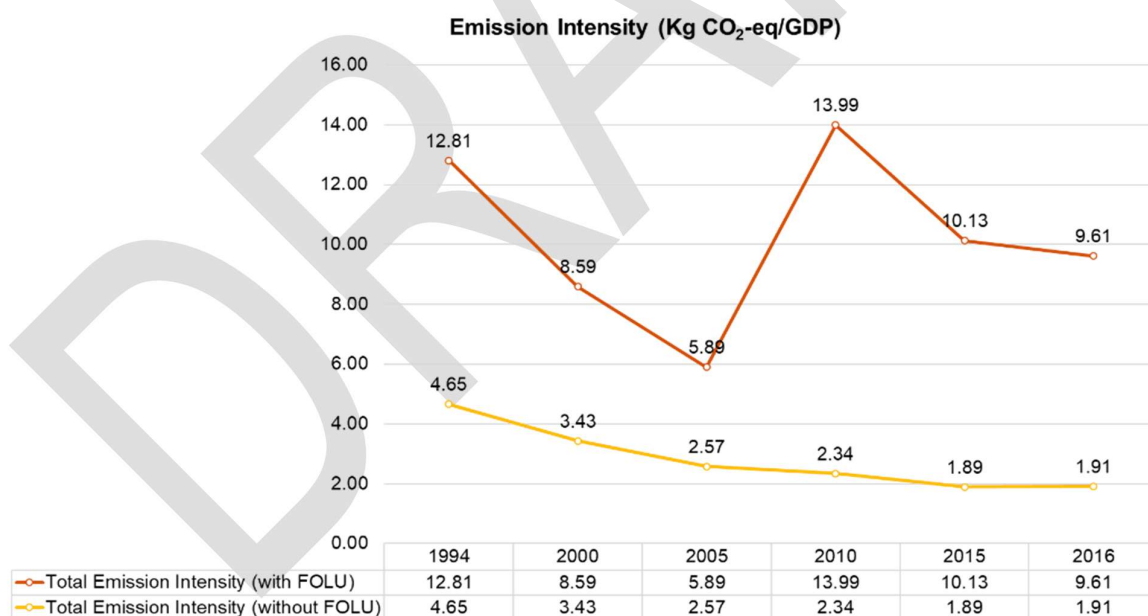
¹⁶ Cambodia's Updated Nationally Determined Contribution, 2020

Figure 3: Trend of emissions by sector (total GHGs, Gg. CO₂-eq) and BAU GHG emissions in 2030 – (Source: First Biennial Update Report of The Kingdom of Cambodia, 2020; Cambodia's Updated Nationally Determined Contribution, 2020)



As represented in Figure 4, the emissions intensity (kg CO₂-eq/GDP) of the Cambodian economy has declined from 4.65 to 1.91 without FOLU and 12.81 to 9.61 with FOLU. The declining trend is due to the reduction in economic activities in the FOLU and agriculture sector. However, the boom in the construction sector has led to an increase in the IPPU related emissions, which has grown at a CAGR of 32% between 1994-2016.

Figure 4: Emission Intensity kg CO₂-eq/GDP – (Source: First Biennial Update Report of The Kingdom of Cambodia, 2020)



D. Water Intensity

Cambodia has several freshwater bodies, including rivers, streams, and lakes, which contribute to ample water supplies. The Mekong River and the Tonle Sap Lake are the primary reservoirs of freshwater for Cambodia. About 500 km from Laos' boundary to the Mekong Delta in South Vietnam, the Mekong River runs through Cambodia, carrying a significant amount of water streaming through its territories. The Tonle Sap Lake, the

biggest freshwater lake in South East Asia, flows millions of cubic meters of water from and to the Mekong River [17] [18].

In general, there is limited data pertaining to water use by end-use sectors and the sector wise disaggregated data dates as far back as the year 2006. In 2006, total water withdrawal was about 2.184 cubic km, of which 2.053 cubic km (94 percent) was used in agriculture, 0.98 cubic km (4.5 percent) in municipalities and 0.33 cubic km (1.5 percent) in industries. Expert opinion indicates that the share of water withdrawal from industries has increased significantly since then. Most manufacturing and warehouses in Phnom Penh are located along the embankment of the Tonle Sap river north or the Bassac river south of the city, with mixed commercial and residential areas. Such locations allow direct access to river transport and high consumption of water. The industrial sector's water requirements are based upon the size of the factory. An estimate of water use volume for different sizes and types of factories are as follows [19][20]:

- Major industry: 1,000 – 20,000 cubic meter/day (paper making, chemical manufacture, iron and steel production, oil refining, etc.);
- Large-scale industry: 100 – 500 cubic meter /day (food processing, vegetable washing, drinks bottling, ice making, chemical products, etc.);
- Medium- and small-scale industry: 50 cubic meter /day;
- Garment factory without wet processing: 65 cubic meter /day; and
- Garment factory with wet processing (around 50 ton/month): 1,917 cubic meter /day.

To meet this water demand, industries access water from municipality, river, ground water and rainwater. Groundwater is being exploited at ever-increasing rates, particularly by shallow tube wells for factories far away from municipality supply network and river. Normally, ground water is extracted without any charge. Expert opinion, however, suggests that if the agricultural and industrial sectors continue to extract groundwater to meet water demands without being charged, and responsible institutions do not exert regular control over this sector, there may be adverse effects from over-extractions [19]. Therefore, it is important for Cambodia to track and report water use by end use sectors as a part of its CSDG reporting and establish incentives/disincentives to promote efficient use of water by industries.

E. Waste Intensity

Between 2010 and 2019, Cambodia's final consumption expenditure more than doubled from USD 9.852 Billion to USD 20.106 Billion [21]. Industrial production, construction, and consumption have contributed to an increase in both the use of materials and waste over the same time. The total waste generated in Cambodia is estimated to be ~35 million tonnes per annum (tpa) in 2017, which is further estimated to reach 99 million tpa in 2050 [22]. As of 2020, waste recycling in Cambodia is dominated by the informal sector. It is estimated that about 7.3% of municipal waste in Phnom Penh, about 75,000 tonnes per year, is recycled informally [22].

Two firms have received permits for collection, transportation, storage, and disposal of industrial solid waste. One of them collects and transports various industrial wastes (including sludge from wastewater treatment plants) from factories (i.e., garment, leather, plastic, and paper) to their own final disposal sites where the waste is deposited generally without any treatment [39]. The other firm, which is a cement factory, uses the collected waste for 'co-processing' wherein waste is used as a fuel in cement manufacturing with no adverse environmental impact. As of 2020, the cement factory had an existing capacity to co-process 75,000 t/year of waste. However,

¹⁷ Mekong River Commission (MRC). State of the Basin Report; Mekong River Commission Secretariat (MRCs): Phnom Penh, Cambodia, 2010

¹⁸ Water Governance in Cambodia, 2017 - <https://www.mdpi.com/2079-9276/6/3/44/pdf>

¹⁹ WEPA. (2010). State of water environmental issues: Cambodia. Water Environment Partnership in Asia.

²⁰ FAO. (2016, August 13). Food and Agriculture Organization of the United Nations. Retrieved from AQUASTAT website: http://www.fao.org/nr/water/aquastat/countries_regions/khm/

²¹ World Bank – Cambodia - <https://data.worldbank.org/indicator/NE.CON.TOTL.CD?locations=KH>

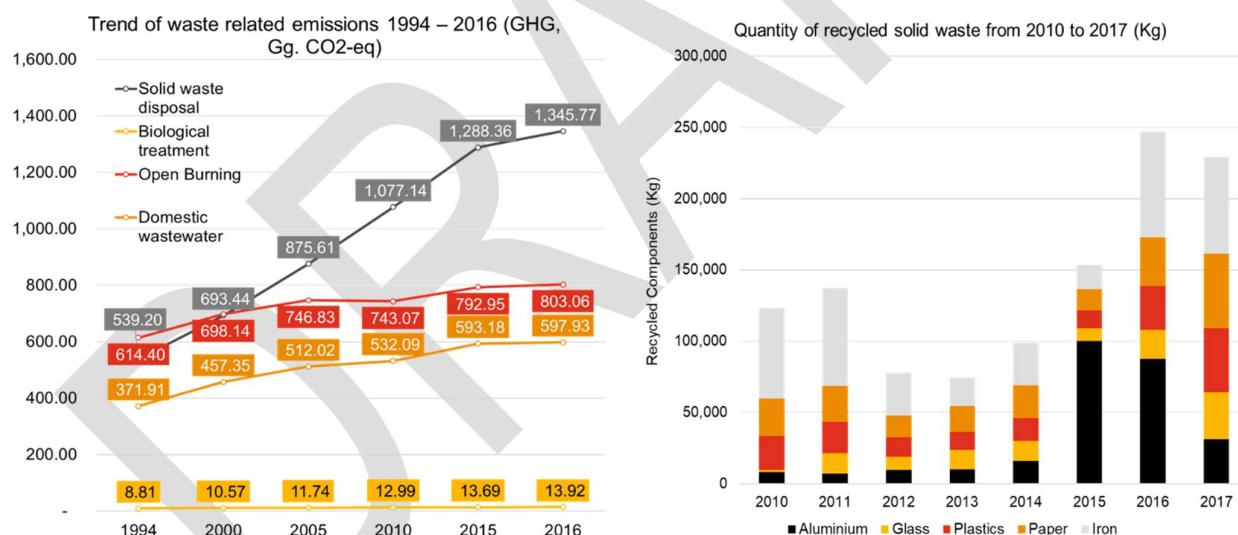
²² Ricardo (2018) for UNDP Solid Waste Management in Cambodia – National Context.

the business case for the co-processing of different types of wastes varies significantly. While the co-processing of Garment and footwear, plastic, expired FMCG, paper, fly ash, branded products, rubber, and oil wastes presents a sound business case, mineral oil, agro-chemical, solvent waste, contaminated oil, industrial sludge, paint, expired pharmaceutical, pesticide, PCB waste, lacquers varnish don't have a sound techno-commercial case due to reasons such as low calorific value, high transport costs of wastes, high moisture content, etc. [23]. For such types of wastes, there is a need to find strategies to create a sound business case for co-processing or disposal through industrial symbiosis while also minimizing their generation at the source.

Solid waste disposal is the primary emission contributor in the waste category, whose share has increased from 35.1% in 1994 to 48.7% in 2016. This trend is partly attributable to the rise in population and an increasing share of such wastes going to landfills. A primary reason for the unchecked increase in landfill waste is the lack of any landfill gateway fees for dumping wastes in the landfills. Imposition of such a fee, as is being envisaged in the Draft Circular Economy Strategy and Action plan can significantly improve the business case of waste minimization and environmentally sound disposal.

The total quantity of recycled solid waste covers paper, plastics, aluminium, iron, and glass. It is estimated that the total quantity of recycled waste increased from 122,997 kg in 2010 to 229,210 kg in 2017. The largest component being recycled were iron products, estimating 30% of the total recycled solid waste quantity; followed by paper and plastics at ~20% each; and aluminium and glass at 14% each in 2017 [24]. Cambodia has a waste intensity of 1.92 kg/GDP (constant 2010 USD). The commercial and industrial waste forms the highest share with an intensity of 0.88 kg /GDP (constant 2010 USD), followed by 0.82 kg /GDP (constant 2010 USD) of the construction and demolition waste.

Figure 5: Trend of emissions 1994 – 2016 (GHG, Gg. CO₂-eq) and Quantity of recycled solid waste from 2010 to 2017 (kg) – (Source: First Biennial Update Report of The Kingdom of Cambodia, 2020)



Cambodia is ahead of its targets on the CSDG 12.5 (Cambodia Sustainable Development Goals) tracking the national recycling of materials. However, its performance is below the set targets for the CSDG 12.4 which targets environmentally sound management of chemicals and all wastes throughout their life cycle. Sound chemical management can therefore, go a long way in reducing the waste intensity of the industry sector.

²³ As per the information obtained during Chip Mong stakeholder consultation on 16-December-2020

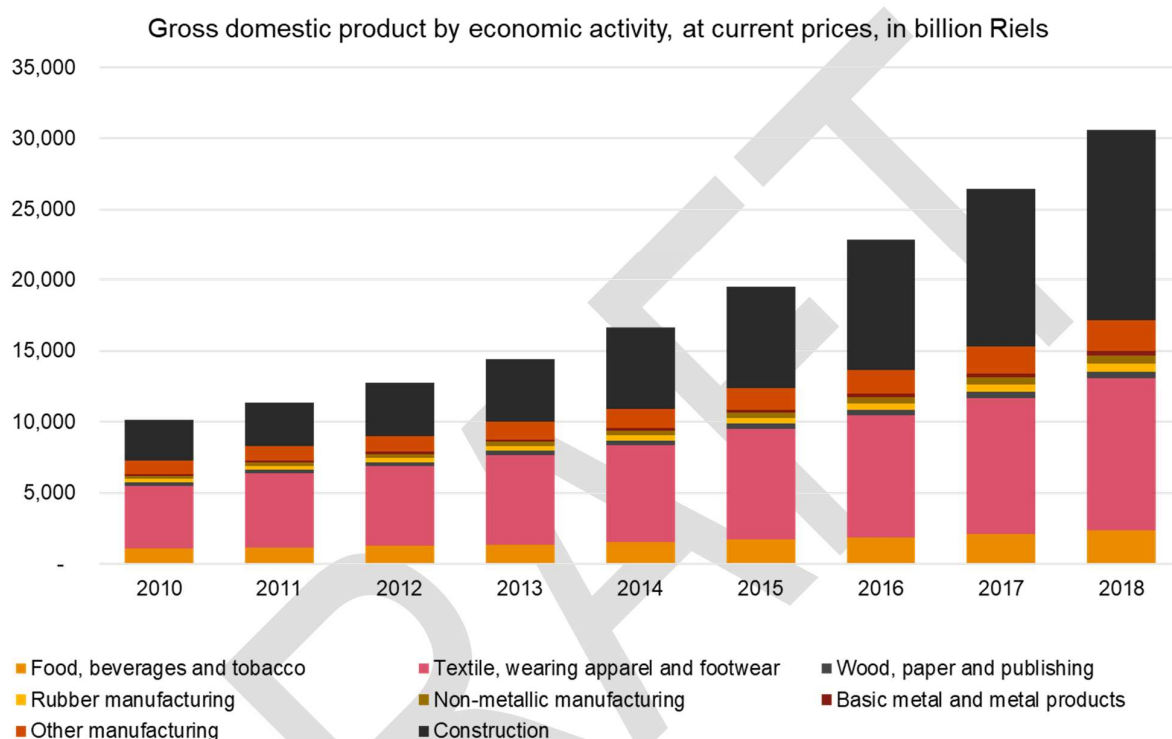
²⁴ First Biennial Update Report of The Kingdom of Cambodia, 2020

1.2.2. Overview of Industry sector

Cambodia's industrial sector has been growing at a fast pace over the past decade. The industrial sector's share to GDP rose from the economic slowdown lows of 23% in 2009 to the record highs of 36.5% in 2019, surpassing traditional sectors such as agriculture, fisheries, and forestry [5].

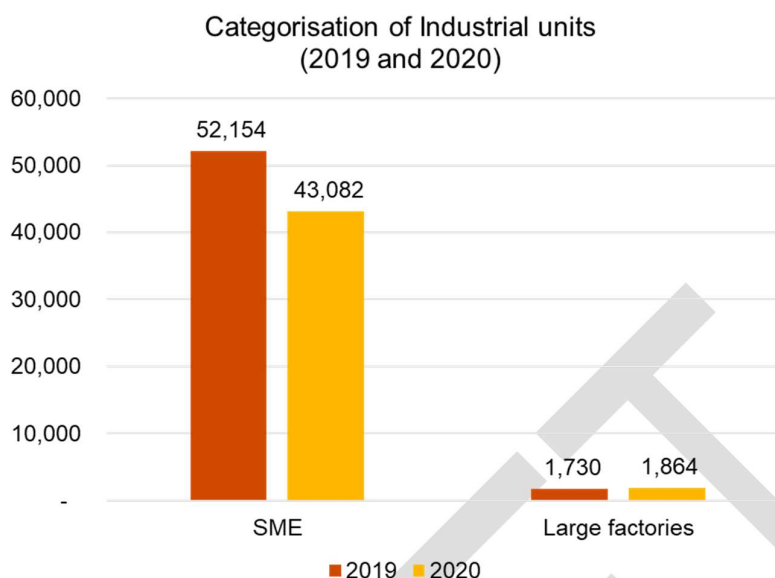
The Figure 6, represents the industrial GDP by economic activity for the Cambodian industries. The construction; 'textiles, wearing apparel and footwear' and 'food, beverage and tobacco;' can be seen to dominate the GDP.

Figure 6: Cambodia Gross domestic product by economic activity – (Source: NIS, 2020)



The Cambodian industries are predominantly small and medium scale enterprises. As per the Ministry of Industry, Science, Technology, and Innovation (MISTI) data, by 2020, there were a total of 44,946 registered manufacturing enterprises. Around 96% of these were small and medium enterprises.

Figure 7: Categorisation of industries in Cambodia (Source: MISTI)



The industrial sector employs around 1.4 million people. The large industries in Cambodia employ around 1 million workers, with a reported output of USD 9,622.11 million in 2020, 35% lower than those in 2019 due to COVID-19 impact. The number of factories in Cambodia are dominated by the manufacturing of wearing apparel (garments) accounting for around 39% of total number of 1,864 factories, followed by the manufacturing of leather and related products (14%), manufacturing of food and beverage products (7%), manufacturing of rubber and plastics products (6%) and manufacturing of textiles (5%) [25].

The SMEs employed around 428,563 people in 2020, which is a 48% decline from the 824,245 people in 2019 due to COVID-19 pandemic. Among the SMEs, Food, beverage, and tobacco account for 66% share of total (43,082 nos.) enterprises in 2020, followed by manufacturing of basic metals (12%), manufacturing of textiles, wearing apparel, and leather and related products (8%) and other subsectors (14%) [25]. Despite being highly diverse in terms of the International Standard Industrial Classification (ISIC) classification of sub-sectors (based on products manufactured), only a few sub-sectors of Cambodia contribute a major share to the country's overall resource consumption (energy, wastewater, materials). The strategic action plan is therefore focused on these sub-sectors, for which a detailed analysis has been provided in the following sections.

²⁵ MISTI Summary report

1.2.2.1. Approach followed for Sub-sector analysis

The sub-sector analysis studied the key industrial sub-sectors to analyse their resource saving potential and overall investment requirement. Figure 8 presents the methodology for sub-sector analysis.

Figure 8: Methodology for sub-sector analysis



A. Sub-sector Selection

A selection framework (as detailed in *Annexure II: Note on sub-sectors selection*) was used for identifying the sub-sectors to be included in the scope of this Strategy and Action Plan. For the following selected sub-sectors, detailed analysis of resource efficiency potential has been conducted.

Figure 9: High level sector prioritisation – (Source: MISTI; PwC Analysis) [26]

| Sr. No. | Sub-sectors | No. of industries (2019) | Average GDP Contribution (2018-19) | Export sales Mn USD (2019) | Cumulative Sales - Exports + Local (2019) | Strategic Context | Energy Intensity [27] | Resource intensity [27] | Waste intensity [27] |
|---------|--|--------------------------|------------------------------------|----------------------------|---|-------------------|-----------------------|-------------------------|----------------------|
| 1. | Textile, wearing apparel and footwear (covering Garments and Footwear) | 000 | 000 | 000 | 000 | 000 | 000 | 000 | 000 |
| 2. | Food and Beverages (covering Rice Milling and Beverages) | 000 | 00 | 00 | 000 | 000 | 000 | 000 | 000 |
| 3. | Construction materials (covering Cement and Clay Brick) | 00 | 000 | 0 | 00 | 000 | 000 | 00 | 00 |
| 4. | Agro Processing (covering Cassava and Rubber) | 000 | 000 | 000 | 00 | 000 | 00 | 0 | 0 |
| 5. | Paper and paper products | 0 | 0 | 0 | 0 | 0 | 00 | 000 | 000 |

| Legends | 000 | 00 | 0 |
|---------|------|--------|-----|
| | High | Medium | Low |

²⁶ Strategic importance - extent to which the sub-sector contributes to NSDP agenda of producing value added products and diversification of export basket.

²⁷ Prioritization of various sectors based on Energy, Resource and Waste intensity was determined through expert consultations.

B. Sub-sector specific data gathering

To gather relevant data for the selected sub-sectors, the energy audit reports, and cleaner production assessment reports of Cambodia were studied. Specifically, the parameters such as product type, annual operating hours, specific energy/resource consumption (thermal/electrical), quantum of waste generated/ recycled, recommended technical interventions and their investments were compiled for the analysis.

C. Development of resource use baseline for selected sub-sectors

A baseline energy and resource consumption profile (baseline specific consumption of energy, water, and materials as applicable) for the Large and SME units of each selected sub-sector was developed. Following that, the unit level baselines were extrapolated to the sub-sectoral level using production data.

D. Sub-sector wise target setting for the year 2030

For the large and SME units in a sub-sector, the value of targeted specific resource consumption was set based on global and regional benchmarks. Based on the baseline and targeted specific resource consumption, the reduction in specific energy/resource consumption was determined for each year of the time horizon (2021-2030).

E. Identification and assessment of RECP Technologies for selected sub-sectors

To identify the materially important technologies, significant energy/resource users in the industrial process were identified and the potential of energy/resource saving through these technologies was estimated. The identified technology interventions were classified into the following categories:

- **Energy Efficiency:** Interventions targeted at decreasing the energy intensity
- **Fuel Switching:** Interventions targeted at reducing dependence on fossil fuels and transitioning to clear fuel sources.
- **Resource efficiency:** Interventions targeted towards reducing resource waste while enhancing resource productivity.
- **Water use efficiency:** Interventions targeted at improving water management.

The capital efficiency i.e. investment required per unit energy/resource saving and payback period of the selected technologies were estimated.

F. Sub-sector level assessment

The year-wise energy and water savings were estimated based on the baseline and targeted specific resource consumption and assuming an adoption rate of 50% for the identified RECP measures [28]. The savings were multiplied by the capital efficiency to calculate the annual investment requirement.

G. Extrapolation of outcomes to national level

The sub-sector level outcomes of the analysis, in terms of the energy/ resource savings, emissions reduction and investment requirement were aggregated to the national level.

The following section presents a brief profile of the selected sub-sectors and the key outcomes of the analysis.

1.2.2.2. Outcomes of the sub-sectoral analysis

A. Textile, wearing apparel and footwear

Textile, wearing apparel and footwear is one of the key industrial sub-sectors in Cambodia, which has grown at an average rate of 12% between 2010-2018. The sub-sector accounted for 11% of the GDP in 2018 [6]. As of 2020, approximately, 54% of the large enterprises and 5% of the SMEs in Cambodia were engaged in

²⁸ 50% of the total industry units in any given sub-sector adopt the identified RECP measures

manufacturing textile, wearing apparel and footwear. The sub-sector employed more than 73% of the large industry's workforce and ~44% of the SME workforce in 2020. [29]

The sub-sector is a key area of focus in the Cambodia's Updated Nationally Determined Contribution (NDC), with the following mitigation projects –

- Promote sustainable energy practices in manufacturing - Garments: Reduce 2,291 GgCO₂e, 55% by 2030.
- Centralized recycling facility for industrial waste from the garment sector - Reduce 108,472 tCO₂e/at an average of 10,847 tCO₂e/year.

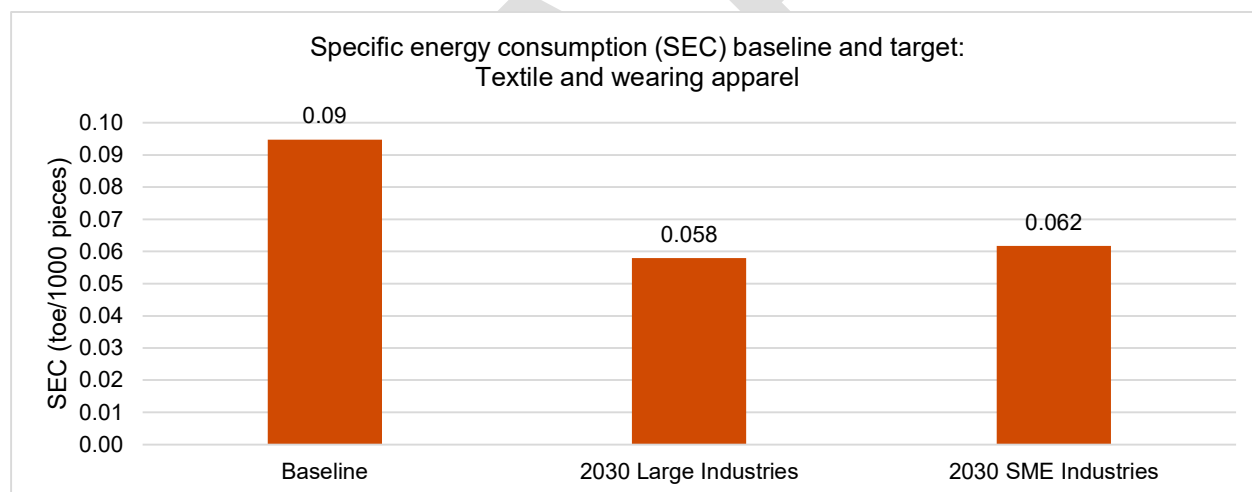
Textile and wearing apparel

The following section provides a brief overview of the RECP potential in the Textile and wearing apparel sub-sector:

i. SEC: Baseline and 2030 sub-sector target

Based on the review of the country-specific energy audit and cleaner production reports, the baseline specific energy consumption for the textile and wearing apparel manufacturing units was set at 0.09 toe/1000 pieces. The targeted specific energy consumption for the large and SME units was set at 0.058 toe/1000 pieces and 0.062 toe/1000 pieces, respectively [30].

Figure 10: Textile and wearing apparel - SEC - Baseline and 2030 sub-sector target



ii. Capital Efficiency of selected technologies (Million USD/TWh energy saving)

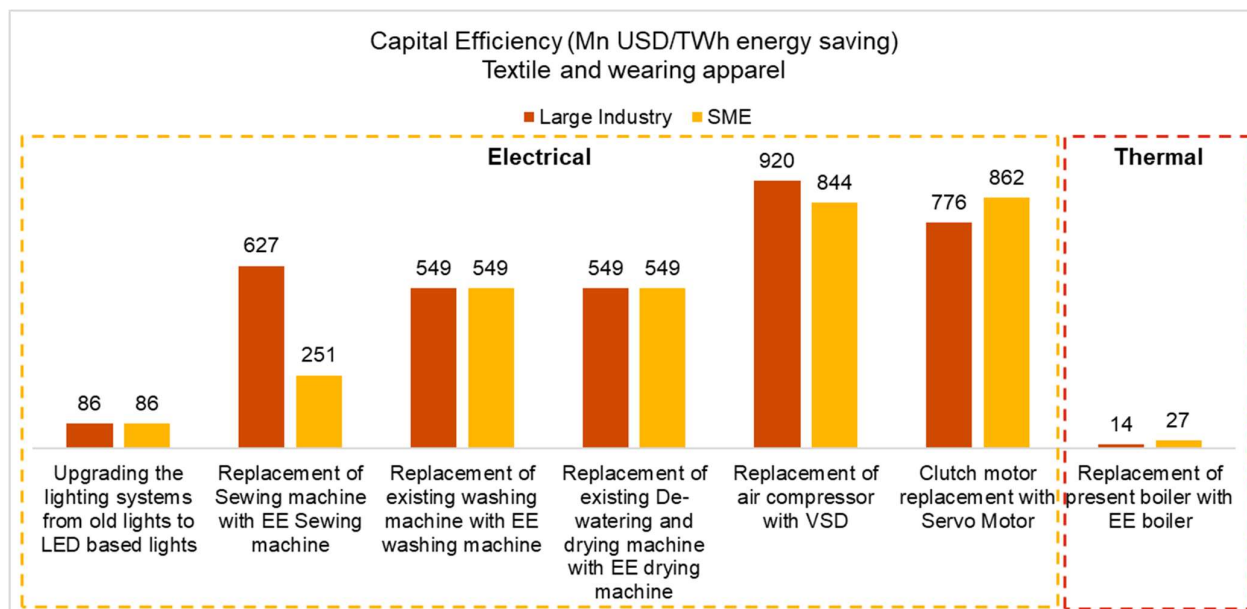
For the shortlisted technologies, the capital efficiency was calculated by dividing the total investment by the annual energy saving. Replacement of present boiler with EE boiler and upgrading the lighting system to LED lights were evaluated as the two most capital efficient interventions. The variation in capital efficiency between large industries and SMEs was due to the quantum of investment, operating hours, etc.

²⁹ MISTI Summary Report, 2019

³⁰ Ahmet Çay, Energy consumption and energy-saving potential in the clothing industry, Energy, Volume 159, 2018, <https://doi.org/10.1016/j.energy.2018.06.128>.

The benchmark SEC value for the Textile and wearing apparel sub-sector is in the range of 0.019 toe/1000 pieces to 0.129 toe/1000 pieces

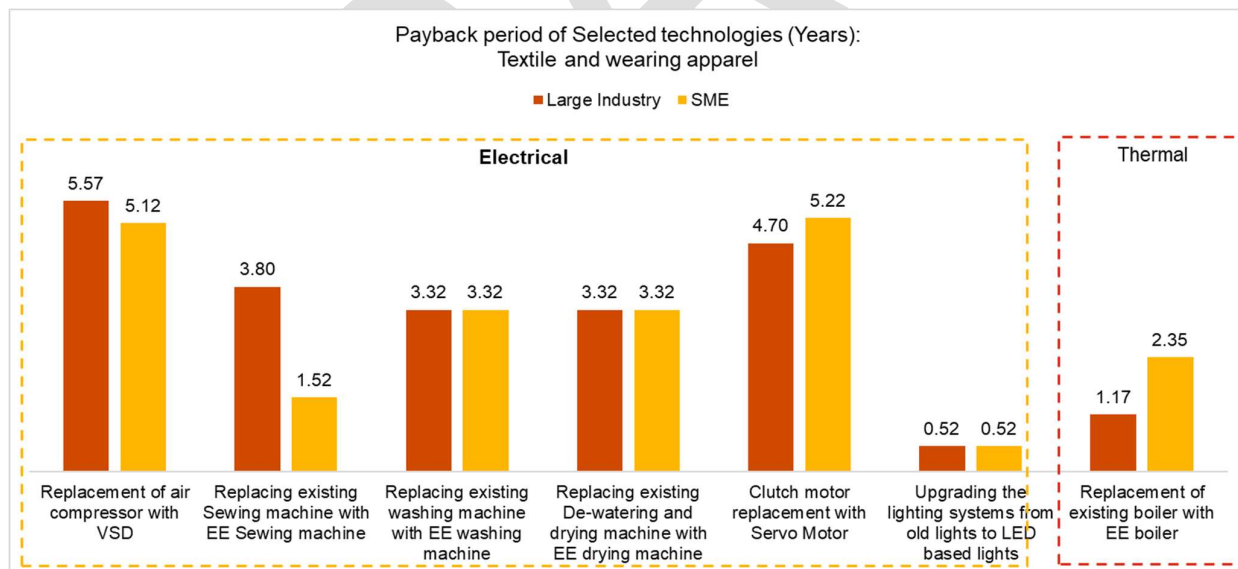
Figure 11: Textile and wearing apparel - Capital Efficiency of selected technologies



iii. Payback period of Selected technologies (Years):

The payback period defines the time to recover the cost of the investment through energy savings. The RECP technologies with a relatively lower payback periods are LED lights, Energy-efficient sewing machine, and energy efficient boiler.

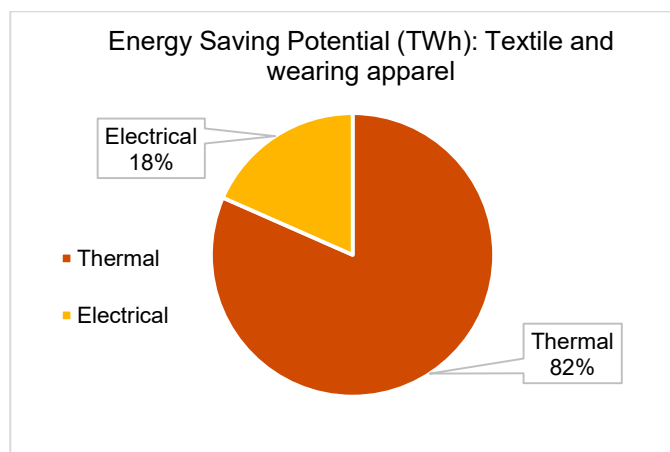
Figure 12: Textile and wearing apparel - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential of the sub-sector from 2020 to 2030 was estimated to be 2.23 TWh (1.82 TWh of thermal energy saving and 0.41 TWh of electrical energy saving). The total investment required to achieve the energy savings was calculated to be USD 55.8 Million.

Figure 13: Textile and wearing apparel - Energy Saving Potential (TWh)



v. Water Savings (Million Cubic meter)

The textile and wearing apparel sub-sector consume a significant amount of water in the production process and washing. The water saving potential of the sub-sector was estimated as 115.127 Million Cubic meters, which has been calculated for reusing water through counter-current washing technology. The required investment was estimated to be USD 8.6 Million.

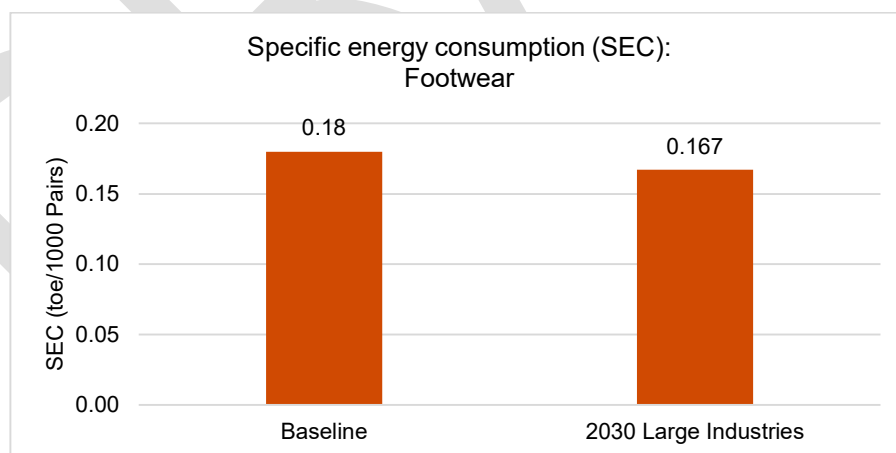
Footwear

The following section provides a brief overview of the RECP potential in the footwear sub-sector:

i. SEC: Baseline and 2030 sub-sector target

Based on the country-specific energy audit and cleaner production reports, baseline energy consumption for the footwear manufacturing units was set at 0.18 toe/1000 pairs. The targeted specific energy consumption for the large industries in the sub-sector was set at 0.167 toe/1000 pairs ^[31].

Figure 14: Footwear - SEC - Baseline and 2030 sub-sector target



ii. Capital Efficiency of selected technologies (Million USD/TWh):

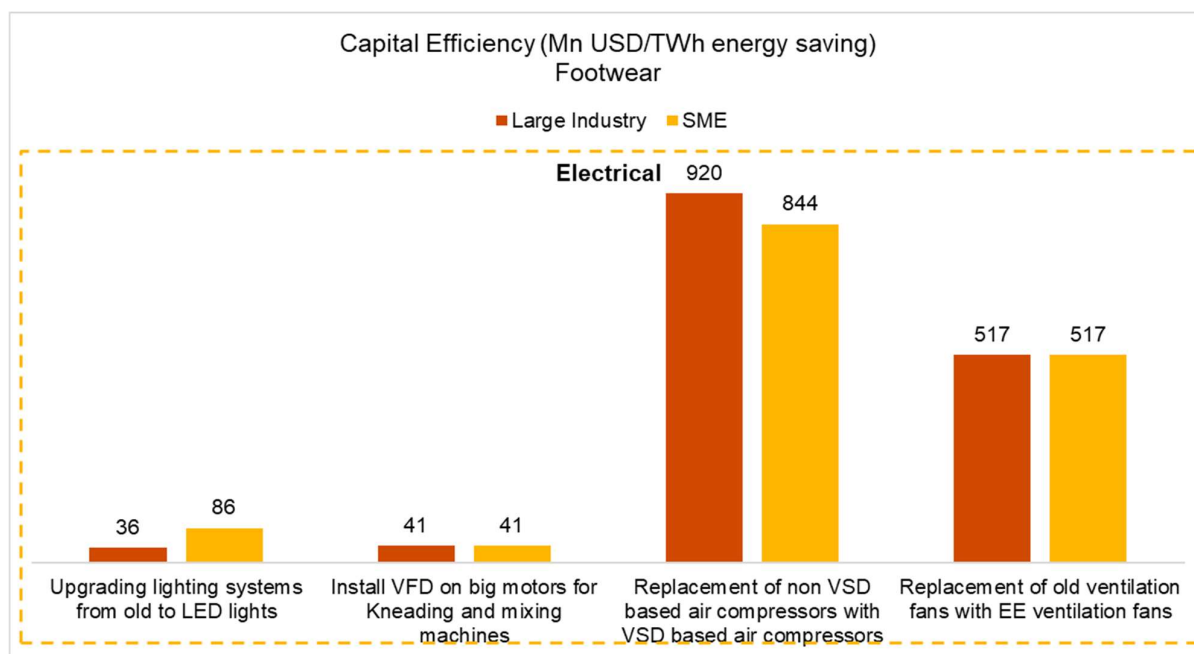
³¹ Environmental impact of shoe consumption, MARIE GOTTFRIDSSON, YUQING ZHANG, Department of Energy and Environment, CHALMERS UNIVERSITY OF TECHNOLOGY, 2015

<https://publications.lib.chalmers.se/records/fulltext/218968/218968.pdf>

The benchmark SEC value for the Footwear sub-sector has been evaluated to be between 0.073 toe/1000 pairs to 0.279 toe/1000 pairs

Based on the techno-economic analysis of all the identified technologies, LED lighting, variable frequency drive (VFD) on large motors and energy-efficient ventilation fan were identified as the most capital efficient technologies.

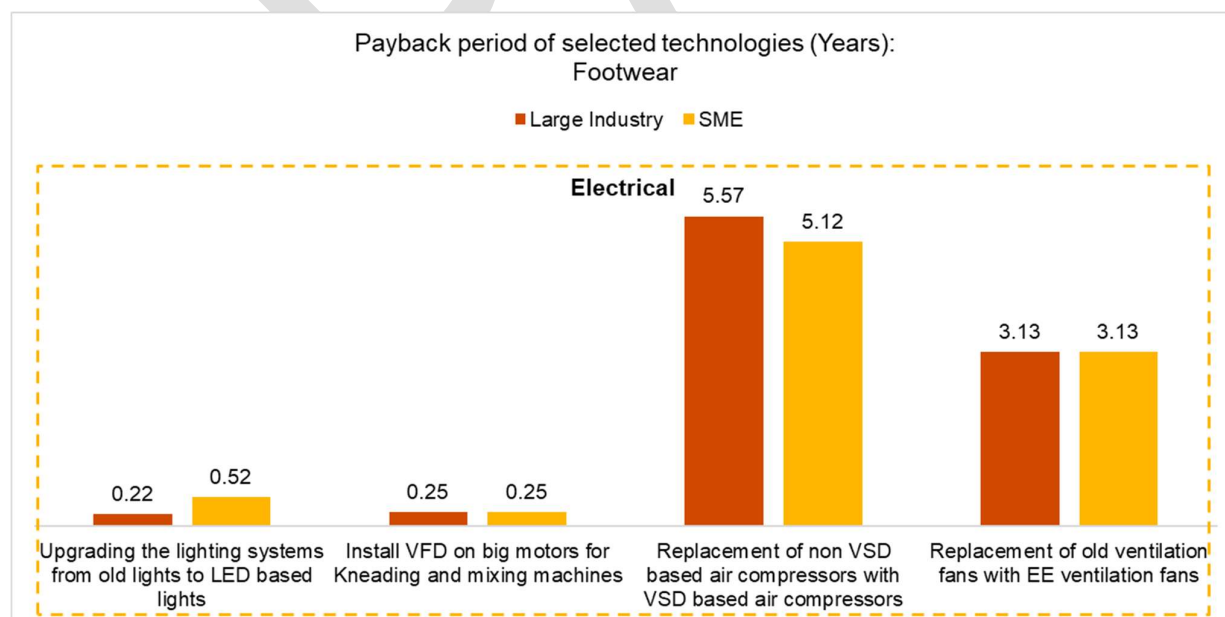
Figure 15: Footwear - Capital Efficiency of selected technologies



iii. Payback period of selected technologies (Years):

For the footwear sub-sector, LED lights, variable frequency drive (VFD) on large motors and energy-efficient ventilation fan were identified as the technologies with a relatively lower payback period

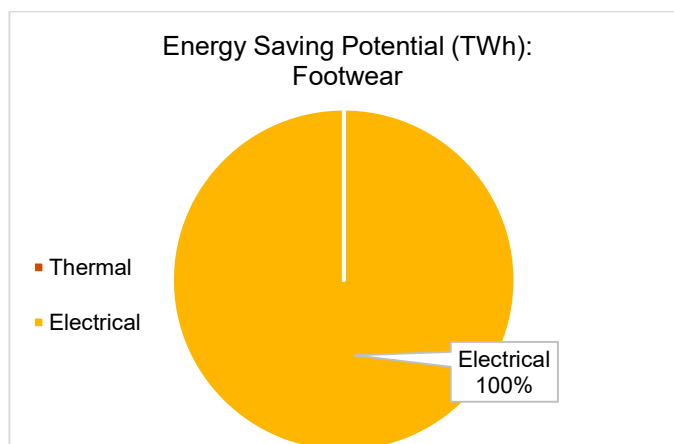
Figure 16: Footwear - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential between 2020 - 2030 was estimated to be 0.06 TWh of electrical energy. The total investment required for the same was estimated to be USD 1.8 Million.

Figure 17: Footwear - Energy Saving Potential (TWh)



v. Water Savings

The footwear sub-sector is not a major water consumer and hence the water-saving analysis is not applicable for the sub-sector.

B. Food and Beverages (F&B)

The F&B sub-sector is a key industrial sub-sector as per the IDP (2015-2025) and contributes to 2% of the national GDP and 15% of the manufacturing GDP. The sector has grown at a CAGR of 11% between 2010-2018. The F&B sub-sector accounts for 7% of the large factories employing 2% of the workforce and 66% of the SME enterprises employing 39% of the SME workforce. [29]

The F&B sub-sector is a key area of focus in the Cambodia's Updated Nationally Determined Contribution (NDC), with the following mitigation projects –

- Promote sustainable energy practices in manufacturing - Food and Beverage: 1,043 GgCO₂e, 25% by 2030.
- Better management of industrial wastewater in the food & beverage sector - 5-10% of total CH₄ emissions.

Within the F&B sub-sector, Rice milling, and Beverage manufacturing sub-sectors were chosen for a detailed analysis.

Rice Milling

Cambodia is a major producer of rice, with 9-10 million tonnes (t) [32] of annual production. Annual paddy output surpasses domestic consumption by about five million tonnes, with the surplus being exported as paddy or milled rice via formal and informal marketing routes. In Cambodia, there are ~ 800 rice mills, with 200 of them being medium or large-scale mills and around 40 of which function as exporters. The top 25 rice mills have a monthly capacity of over 2,000 t, with several having a monthly capacity of 10,000 to 20,000 t.

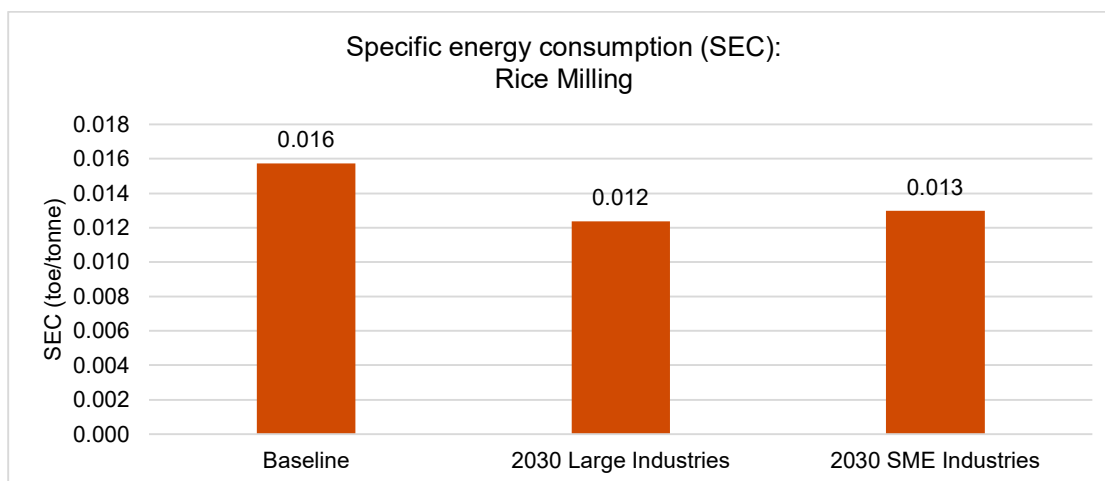
The following section provides a brief overview of the RECP potential in the rice mill sub-sector:

i. SEC: Baseline and 2030 sub-sector target

³² Centre for the Promotion of Imports from Developing Countries, Netherlands - Value Chain Analysis Cambodia Rice, 2019

Based on the country-specific energy audit and cleaner production reports, the baseline energy consumption for the rice mills was set at 0.016 toe/MT. The targeted specific energy consumption of the large industries in the sub-sector was set at 0.012 toe/MT, and that of SME was set at 0.013 toe/MT ^[33].

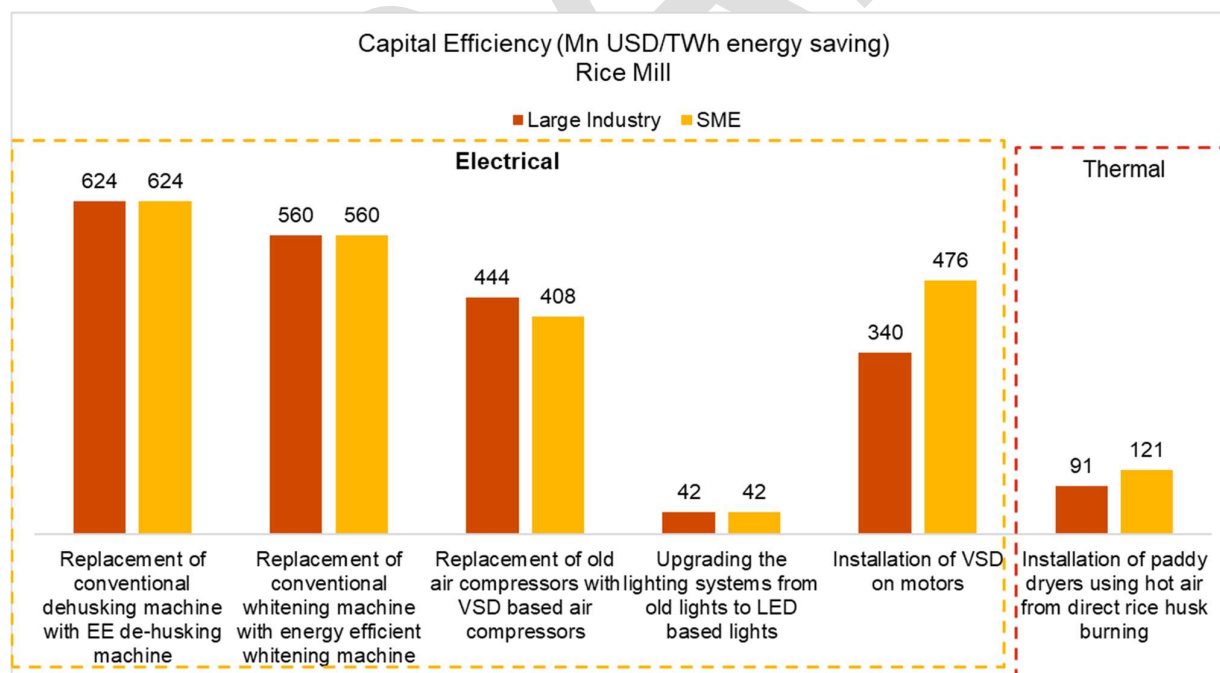
Figure 18: Rice Mill - SEC - Baseline and 2030 sub-sector target



ii. Capital Efficiency of selected technologies (Million USD/TWh):

Based on the techno-economic analysis of all the identified technologies, LED lighting, rice husk-based paddy drier, VSD on large motors and VSD based air compressors were identified as the most capital efficient technologies.

Figure 19: Rice Mill - Capital Efficiency of selected technologies

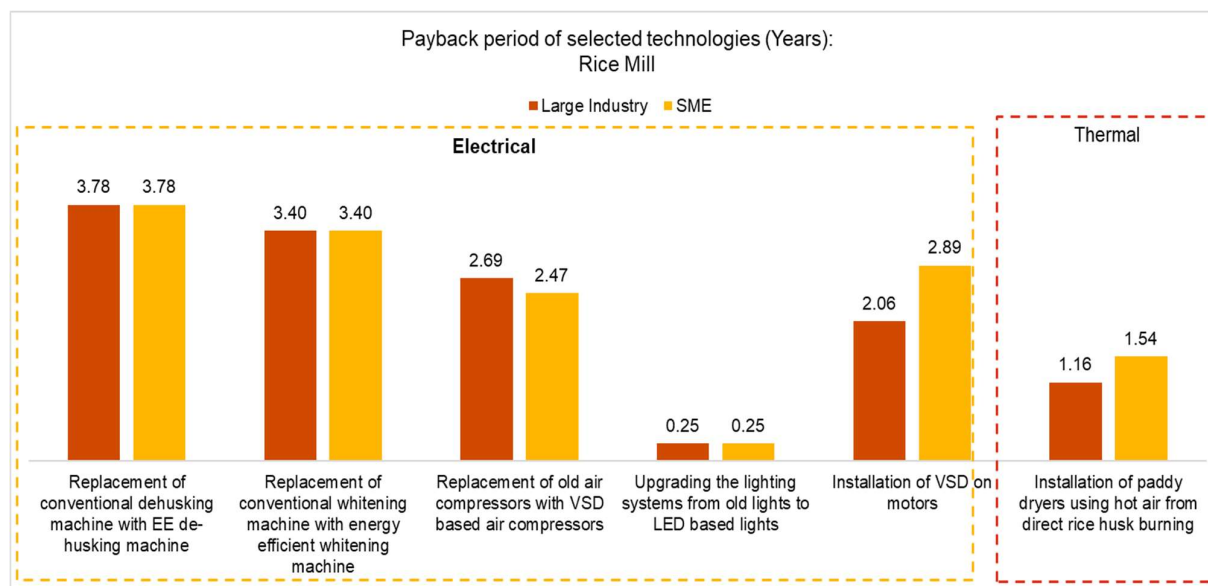


iii. Payback period of selected technologies (Years):

³³ The benchmark SEC value for the Rice mill sub-sector has been evaluated to be between 0.0034 toe/MT to 0.0228 toe/MT, largely influenced by the level of automation in the production unit.

LED lights, rice husk-based paddy drier, VSD on large motors and EE air compressor were identified as the technologies with a relatively lower payback period.

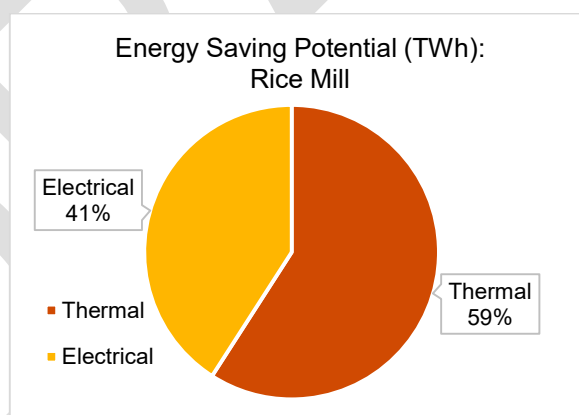
Figure 20: Rice Mill - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential between 2020 to 2030 was estimated to be 0.66 TWh, (0.39 TWh of thermal energy saving and 0.27 TWh of electrical energy saving). The total investment required to achieve the energy savings was estimated to be USD 46.9 Million.

Figure 21: Rice Mill - Energy Saving Potential (TWh)



v. Water Savings

The sub-sector is not a major water consumer; hence the water-saving analysis is not applicable for rice mills.

Beverages (non-alcoholic)

Cambodia is an emerging beverage market in the ASEAN region and is witnessing several global investments from leading brands. In 2019, the beverages (non-alcoholic) sales were USD 965 million and crossed USD 1 billion sales market size in 2020 [34].

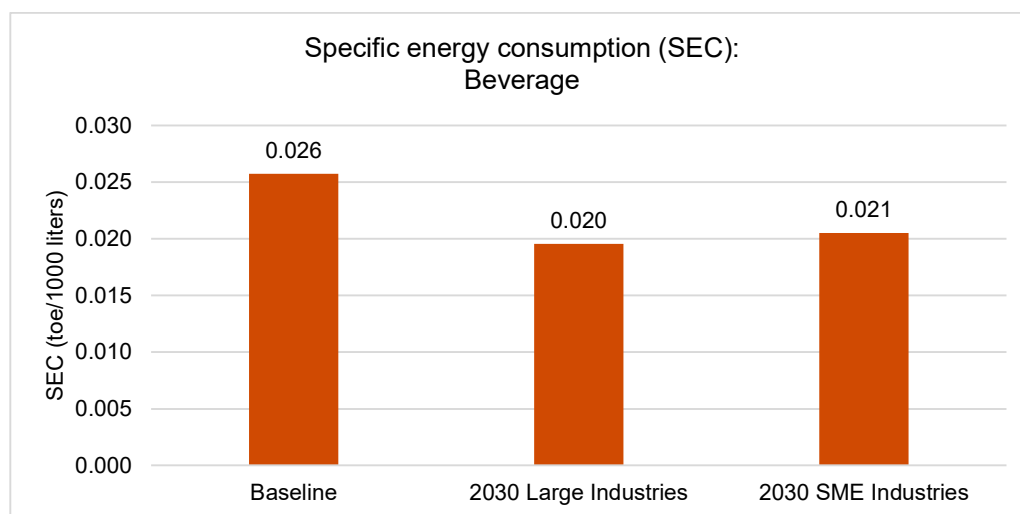
The following section provides a brief overview of the RECP potential in the beverages (non-alcoholic) sub-sector:

³⁴ National Statistics, Fitch Solutions

i. SEC: Baseline and 2030 sub-sector target

Based on the country-specific energy audit and cleaner production reports, the baseline energy consumption for the carbonated beverage production units was set at 0.026 toe/1000 litres. The targeted specific energy consumption for the large industries in the sub-sector was set at 0.020 toe/1000 litres, and that of SMEs was set at 0.021 toe/1000 litres ^[35].

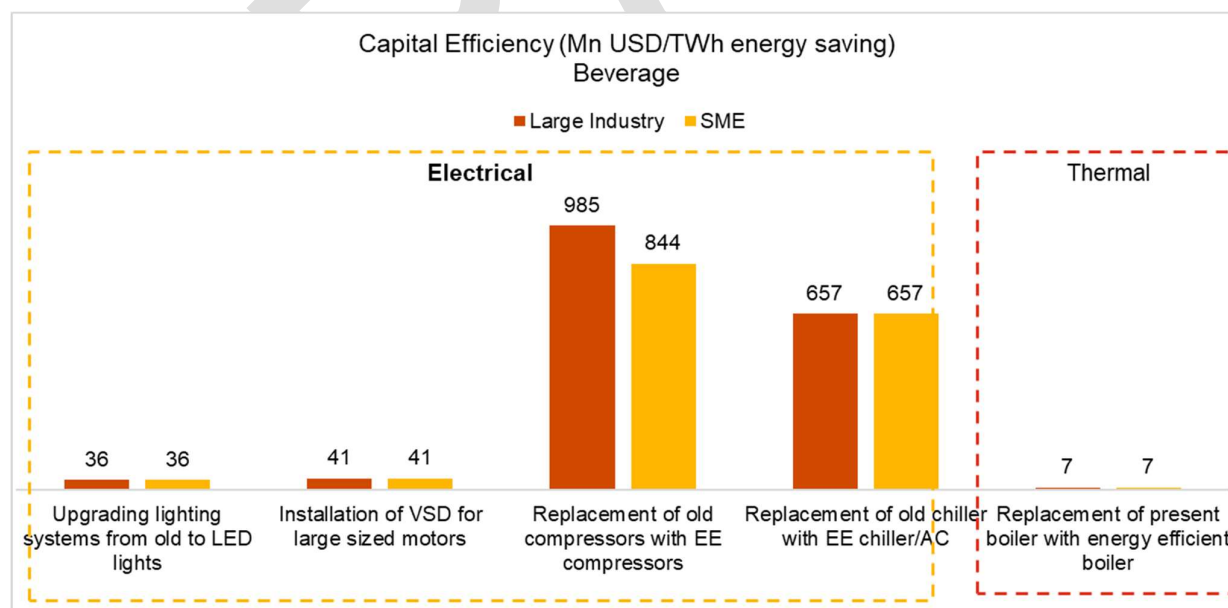
Figure 22: Beverages - SEC - Baseline and 2030 sub-sector target



ii. Capital Efficiency of selected technologies (Million USD/TWh):

Based on the techno-economic analysis of all the identified technologies, upgrading to energy-efficient boilers, implementation of LED lights, and installation of VSD on large motors are identified as primary low-cost energy and resource-saving measures.

Figure 23: Beverages - Capital Efficiency of selected technologies

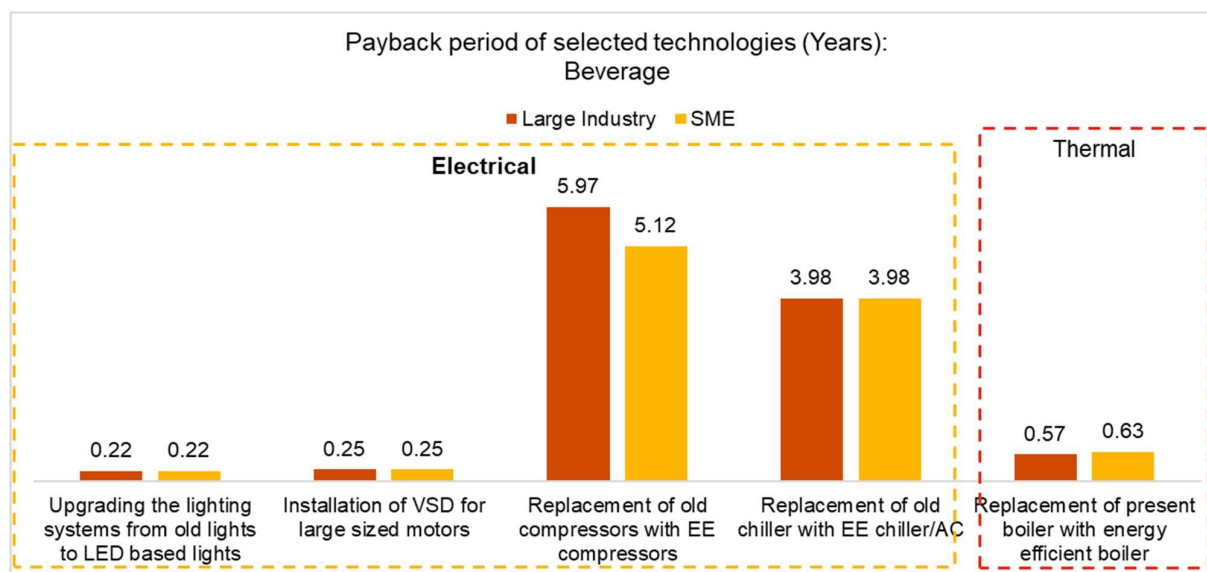


³⁵Beverage industry round table, 2019, <http://bierstaging.wpengine.com/wp-content/uploads/2018-Water-and-Energy-Use-Benchmarking-Study.pdf>
The benchmark SEC value for the beverages sub-sector has been evaluated to be between 0.0045 toe/1000 litres to 0.0201 toe/1000 litres

iii. Payback period of selected technologies (Years):

LED lighting, VSD on large motors, and energy-efficient boilers are the technologies with a relatively lower payback period for beverages sub-sector.

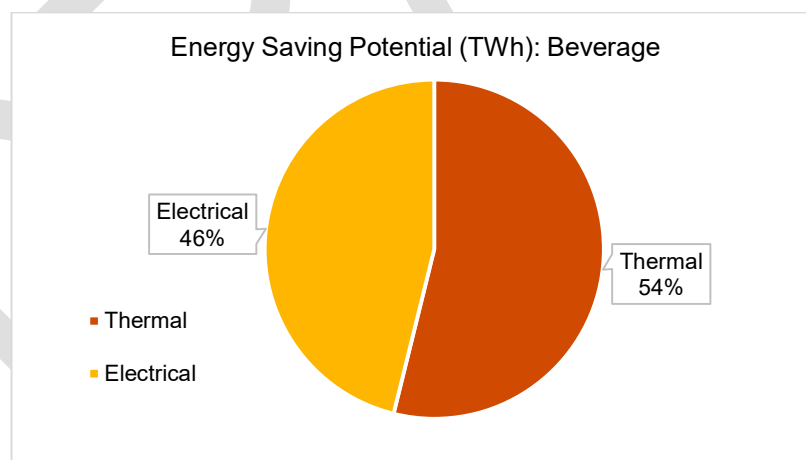
Figure 24: Beverages - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential from the sub-sector between 2020 - 2030 was estimated to be 0.13 TWh, (0.07 TWh of thermal energy saving and 0.06 TWh of electrical energy saving). The total investment required for the same was calculated to be USD 7.3 Million.

Figure 25: Beverages - Energy Saving Potential (TWh)



v. Water Savings

The beverage sub-sector is a major consumer of water in its production and other processes such as bottling and equipment cleaning. The water saving potential by incorporating good housekeeping practices was estimated to be 769 Million Cubic meters. The required investment was estimated to be USD 62 Million over the span of 10 years.

C. Brick and Cement manufacturing

Brick and Cement production are the primary sub-sectors of the construction industry which is one of the fastest growing industries with a CAGR of 21%. The construction industry had 14% share in the total GDP in 2018. The following sections provide a detailed analysis of the RECP potential in the Cement and Brick manufacturing sub-sectors.

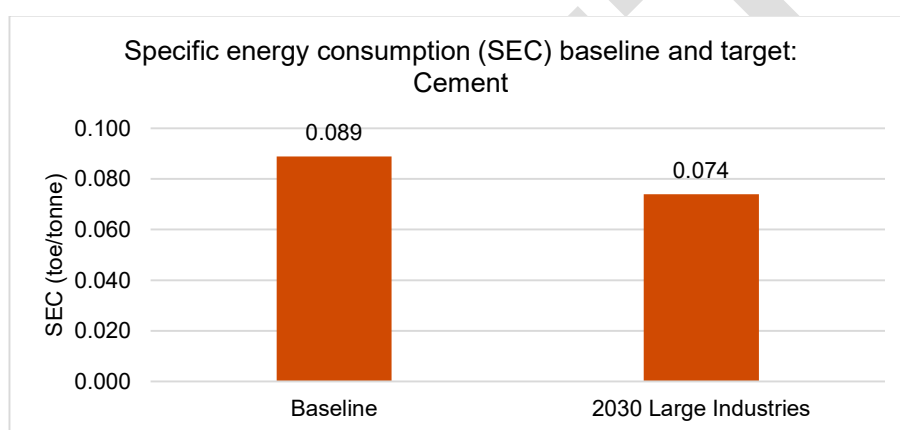
Cement manufacturing

As per the National policy on mineral resources for 2018-2028, five cement factories were operating in Cambodia by the end of 2017, with a supply capacity of about 7 MT of cement annually. The following section provides a brief overview of the RECP potential in the cement sub-sector:

i. SEC: Baseline and 2030 sub-sector target

The baseline energy consumption for the cement sub-sectors was set at 0.089 toe/MT. The targeted specific energy consumption of the large industries in the sub-sector was set at 0.074 toe/MT ^[36].

Figure 26: Cement - SEC - Baseline and 2030 sub-sector target

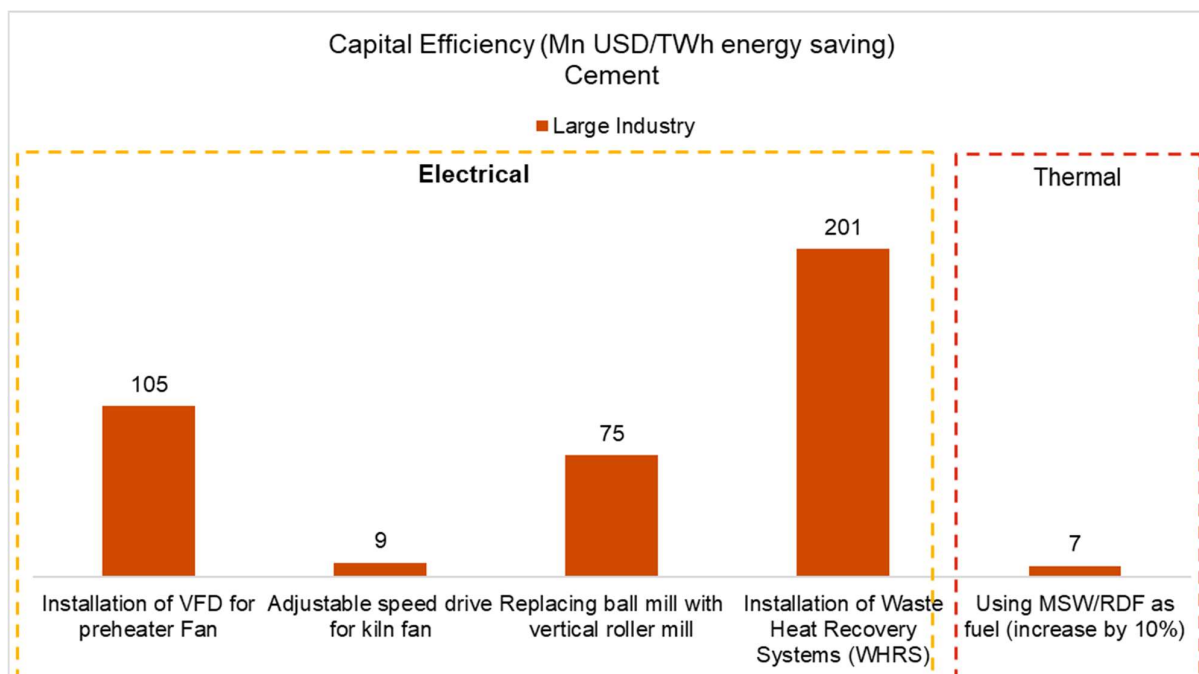


ii. Capital Efficiency of selected technologies (Million USD/TWh):

Cambodia's cement industries are all large units. Based on the techno-economic analysis of all the identified interventions, increasing the share of MSW/RDF as fuel, adjustable speed drive for kiln fan and replacing ball mill with vertical roller mill are identified as the most capital efficient measures.

³⁶ IEA, Global Energy Assessment, Chapter 8: Energy End-Use: Industry
The benchmark SEC value for the Cement sub-sector has been evaluated to be between 0.069 toe/MT to 0.096 toe/MT

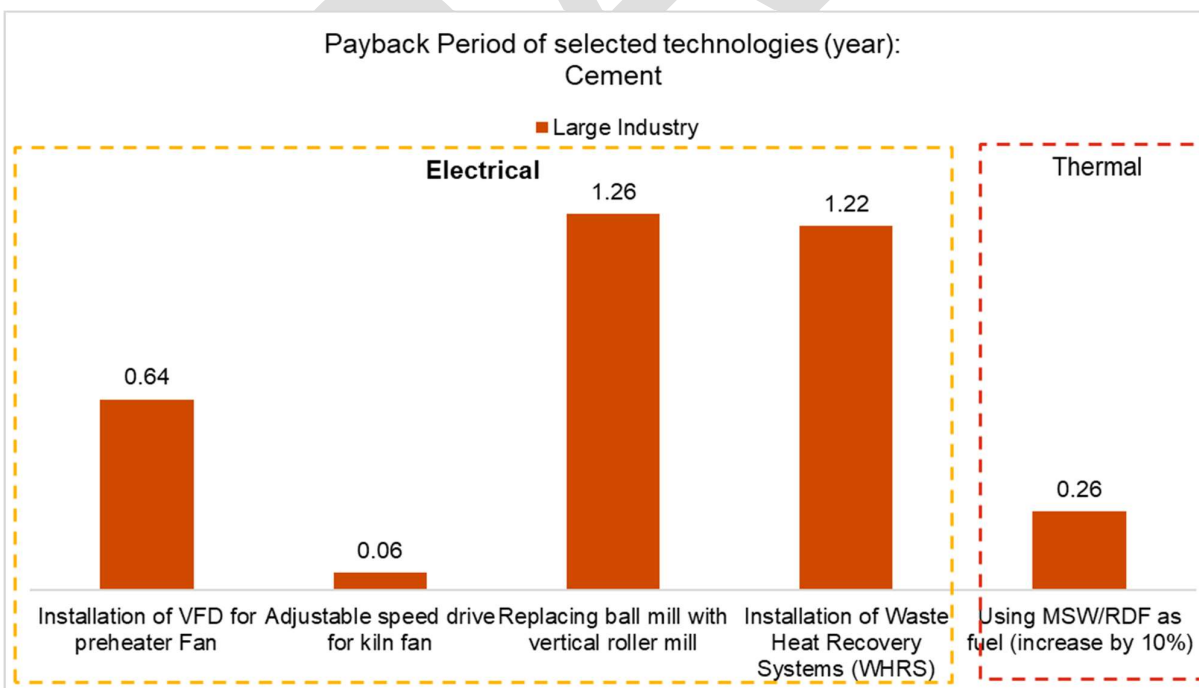
Figure 27: Cement - Capital Efficiency of selected technologies



iii. Payback period of selected technologies (Years):

The technologies with relatively lower payback periods were adjustable speed drive for kiln fan, increasing the share of MSW/RDF as fuel and replacing ball mill with vertical roller mill.

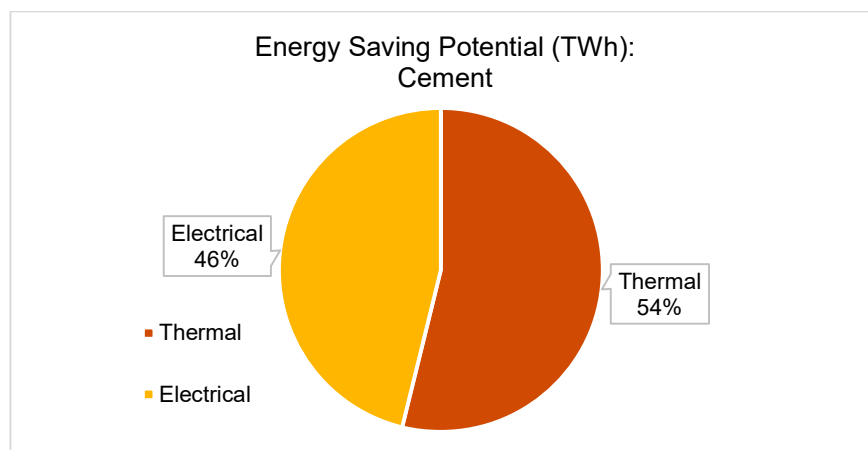
Figure 28: Cement - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential of the sub-sector between 2020 - 2030 was estimated to be 5.2 TWh, (2.8 TWh of thermal energy saving and 2.4 TWh of electrical energy saving). The total investment required for the same was estimated to be USD 70 Million.

Figure 29: Cement - Energy Saving Potential (TWh)



v. Water Savings (Million Cubic meter)

The cement sub-sector does not involve extensive water use. Therefore, the analysis of water saving potential was not conducted.

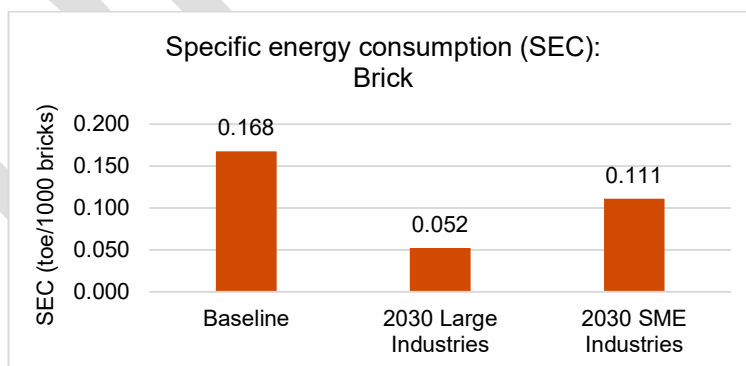
Brick manufacturing

The annual production of bricks in Cambodia exceeds 500 million units [37]. The IDP 2010-2015, highlights that brick manufacturing employs poor technology and hence is unable to produce a variety of products. The policy highlights that the construction sector's low productivity is the main reason for most of the manufacturing sector serving only domestic demand with low value-added products. Limited awareness of the economic and environmental benefits of energy efficiency, lack of enabling regulations and limited availability of finance are the key challenges plaguing the brick manufacturing sub-sector. The following section provides a brief overview of the RECP potential in the brick sub-sector:

i. SEC: Baseline and 2030 sub-sector target

Based on the country-specific energy audit reports, the baseline specific energy consumption for the Brick sub-sector was set at 0.17 toe/ 1000 bricks. The targeted specific energy consumption of the large industries in the sub-sector was set at 0.052 toe/1000 bricks, and that of SMEs was set at 0.111 toe/1000 bricks [38].

Figure 30: Bricks - SEC - Baseline and 2030 sub-sector target



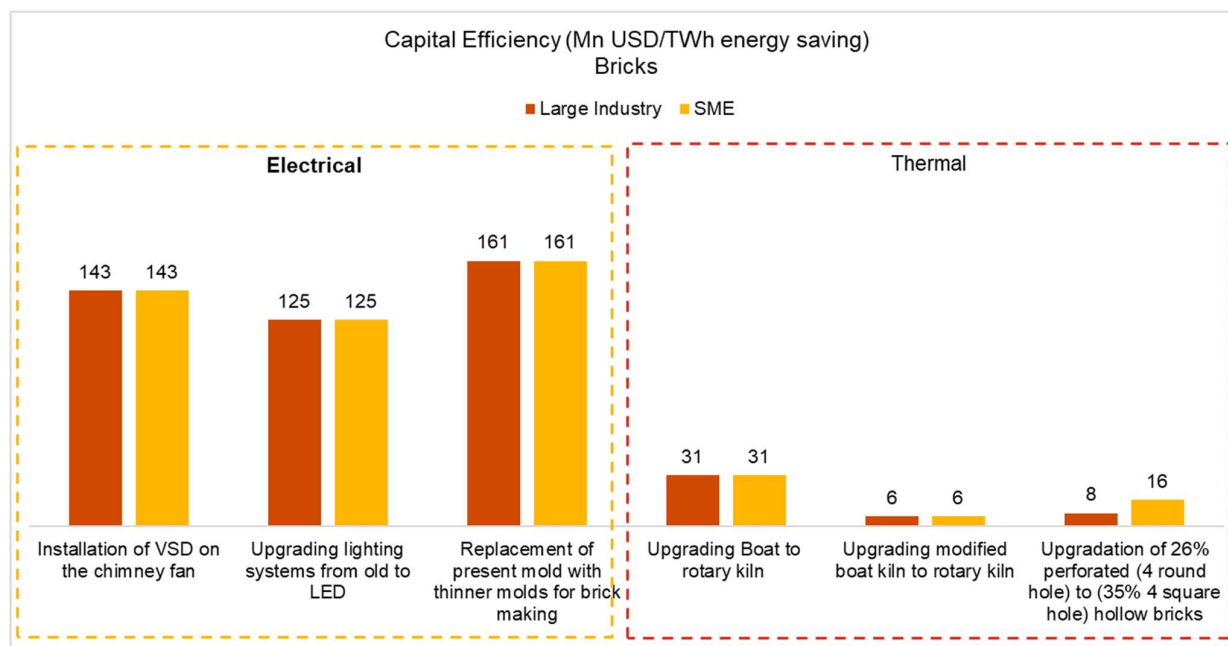
ii. Capital Efficiency of selected technologies (Million USD/TWh):

³⁷ GGGI - The Economic, Social and Environmental Impacts of Greening the Industrial Sector in Cambodia - http://gggi.org/site/assets/uploads/2018/10/GGGI_Greening-the-Industrial-Sector-in-Cambodia_FULL-REPORT.pdf

³⁸ The benchmark SEC value for the Brick sub-sector is evaluated to be between 0.026 toe/1000 bricks to 0.143 toe/1000 bricks

Based on the techno-economic analysis of all the identified interventions, kiln up-gradation from modified boat or boat to rotary kiln and making highly perforated bricks were identified as the most capital efficient technologies.

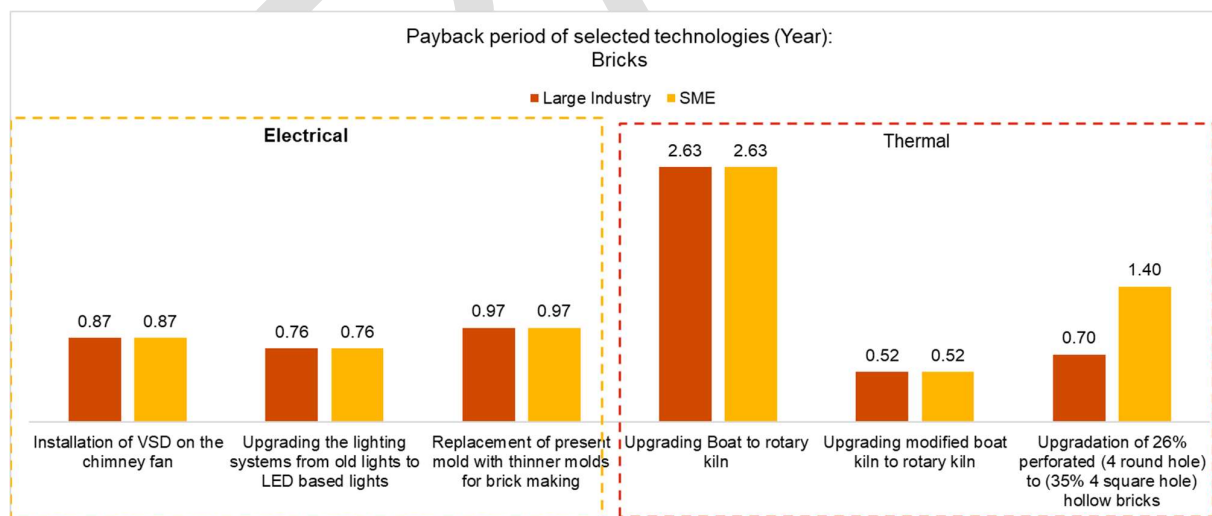
Figure 31: Bricks - Capital Efficiency of selected technologies



iii. Payback period of selected technologies (Years):

Kiln up-gradation from modified boat to rotary kiln, making highly perforated bricks and LED lighting were identified as the technologies with a relatively lower payback period.

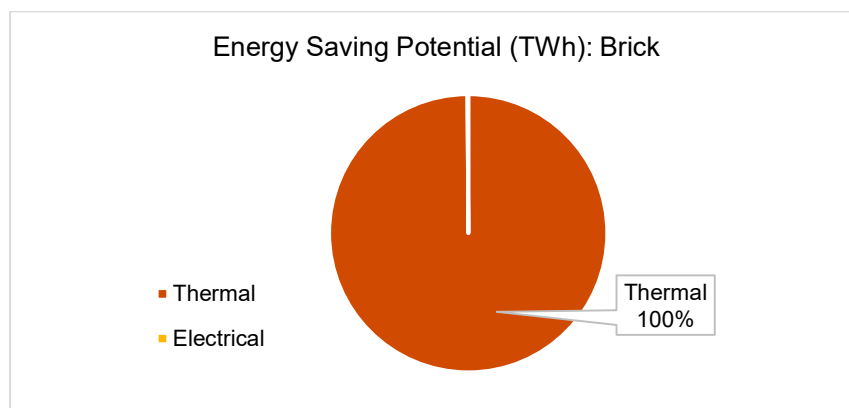
Figure 32: Bricks - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential from the sub-sector between 2020 – 2030 was estimated to be 6.04 TWh, (6.04 TWh of thermal energy saving and 0.005 TWh of electrical energy saving). The total investment required for the same was estimated to be USD 15.8 Million.

Figure 33: Bricks - Energy Saving Potential (TWh)



v. Water Savings (Million Cubic meter)

The brick sub-sector has very negligible water use during the moulding process and hence analysis of water savings has not been conducted.

D. Paper and paper products

Paper and paper products are a part of the wood, paper, and publishing sector, which grew at CAGR of 8% between 2010-2018. Paper manufacturing is highly energy and resource intensive. The sector accounts for 4% of the large scale factories, employing 0.6% of the large workforce and 0.4% of the SME enterprises employing 1% of the SME workforce [29].

Paper manufacturing accounts for almost 10% of the MSW sampled at generation points in Phnom Penh, 20-25% of the exported recyclables between 2013-2014 and 5% of the industrial waste in 2016 (as sampled at landfill site of Sarom industry) [39].

The following section provides a brief overview of the RECP potential in the Paper and paper products sub-sector:

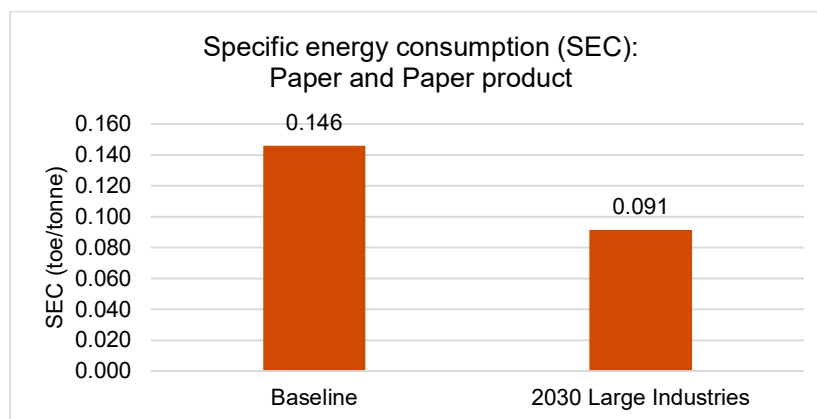
i. SEC: Baseline and 2030 sub-sector target

The baseline energy consumption for the Paper and Paper product manufacturing was set at 0.146 toe/MT. The targeted specific energy consumption of the large industries in the sub-sector was set at 0.091 toe/MT by 2030 [40].

³⁹ Phnom Penh Waste Management Strategy and Action Plan 2018-2035 - <https://www.iges.or.jp/en/pub/phnom-penh-waste-management-strategy-and/en>

⁴⁰ The benchmark SEC value for the Paper sub-sector has evaluated to be between 0.092 toe/MT to 0.101 toe/MT

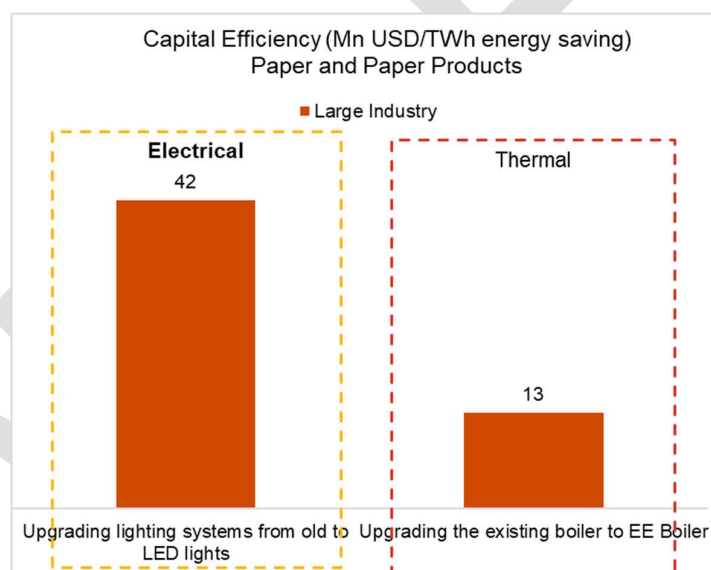
Figure 34: Paper and paper products - SEC - Baseline and 2030 sub-sector target



ii. Capital Efficiency of selected technologies (Million USD/TWh):

Based on the techno-economic analysis of all the identified interventions, use of de-watered sludge as fuel in the burner, energy-efficient boiler and LED lighting are identified as the most capital efficient technologies. The use of dewatered sludge does not require any additional investment.

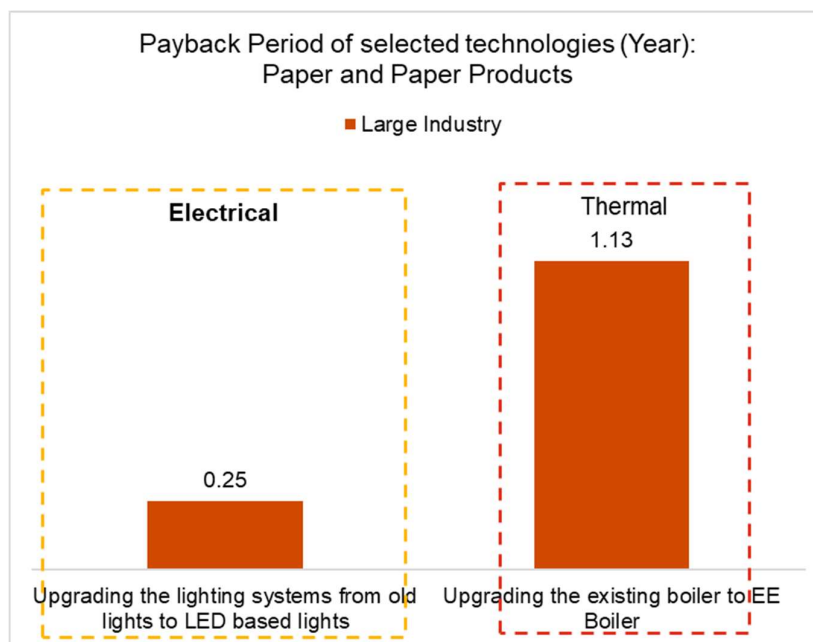
Figure 35: Paper and paper products - Capital Efficiency of selected technologies



iii. Payback period of selected technologies (Years):

The use of de-watered sludge as fuel in the burners, Energy-efficient boiler and LED lighting were the technologies/interventions with a relatively lower payback period.

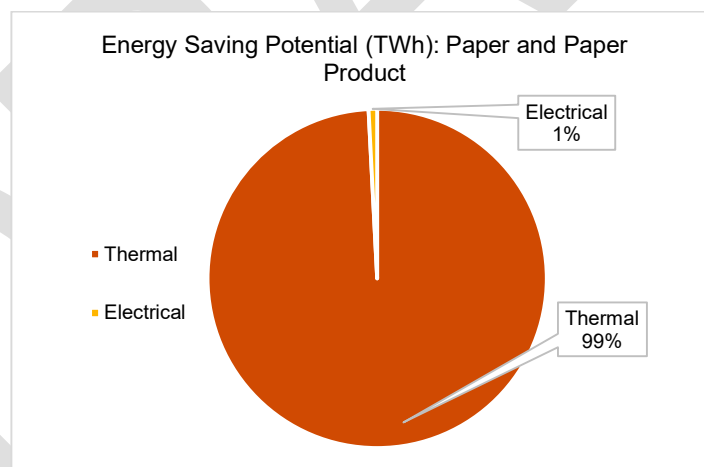
Figure 36: Paper and paper products - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential from the sub-sector between 2020 - 2030 was estimated to be 0.36 TWh, (0.36 TWh of thermal energy savings and 0.003 TWh of electrical energy saving). The total investment required for the same was estimated to be USD 450,000.

Figure 37: Paper and paper products - Energy Saving Potential (TWh)



v. Water Savings (Million Cubic meter)

The paper industry consumes a significant amount of water in its production processes. The water saving potential of the sub-sector was estimated to be 3.3 Million cubic meters for re-using wastewater and good upkeeping of pipe system of collected water condensate. The investment requirement was estimated to be USD 200,000.

E. Agro-Processing including Rubber and Cassava processing

Agro processing is the future of Cambodia's agricultural industry. Increasing Cambodia's agro processing capacity has the potential to enhance agricultural and socio-economic development significantly. Agro processing, which links the agricultural and manufacturing sectors, takes raw and intermediate materials –

including crops, livestock, fish, and forest materials – and turns them into finished, marketable products. Under the Industrial Development Policy, which is set to guide decision-making from 2015-2025, Cambodia plans to increase the export of processed agricultural products to 12 per cent by 2025. To achieve this, the government has set meaningful goals, including identifying growth opportunities for Cambodian agro-processing businesses, and identifying priority products for processing and export. The following sections present a detailed analysis of the RECP potential in Rubber manufacturing and Cassava processing.

Rubber

MoAFF's 'Agricultural Sector Strategic Development Plan' highlights rubber as a long-term agro-industrial crop that has played a vital role in helping farmers and fostering economic growth. In addition, it effectively seeks to safeguard the ecosystem by providing green forest cover, maintaining ecological balance, and avoiding soil erosion.

In 2016, rubber production reached 145,200 tons, increasing by 18,339 tons compared to 2015. The average rubber yield has increased from 1,141 kg/ha in 2015 to 1,143 kg/ha in 2016. Based on the most current data, rubber smallholdings own 36% of total rubber crop plantations, while the remaining 64% is owned by former state farms and Economic Land Concessions (ELC). Table 2, represents the NSDP estimates for the annual rubber production, which are observed to reach 417 kt by 2023.

Table 2: Annual rubber product estimates ('000 tonnes)- (Source : NSDP 2019-2023)

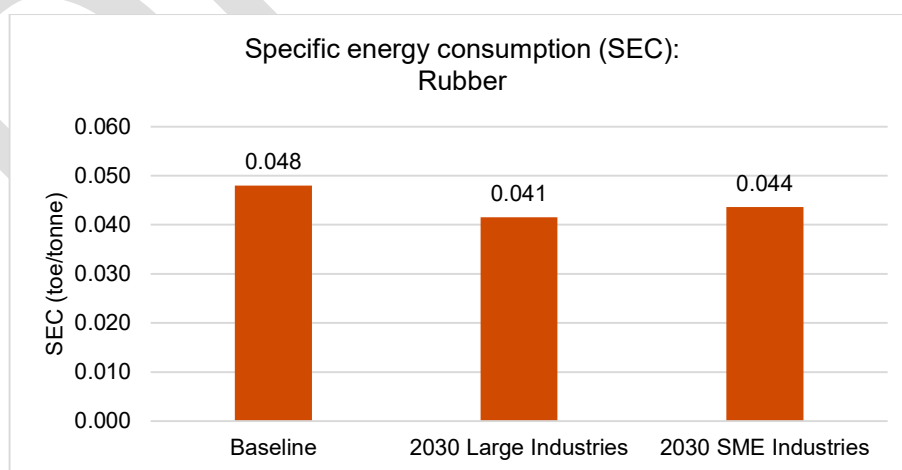
| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|------|------|------|------|------|------|
| Annual rubber product estimates ('000 tonnes) | 207 | 292 | 353 | 395 | 412 | 417 |
| Growth (%) | | 41% | 21% | 12% | 4% | 1% |

The following section provides a brief overview of the RECP potential in the Rubber sub-sector:

i. SEC: Baseline and 2030 sub-sector target

The baseline energy consumption for rubber manufacturing was set at 0.048 toe/MT. The targeted specific energy consumption of the large industries in the sub-sector was set at 0.041 toe/MT, and that of SMEs was set at 0.044 toe/MT [41].

Figure 38: Rubber - SEC - Baseline and 2030 sub-sector target

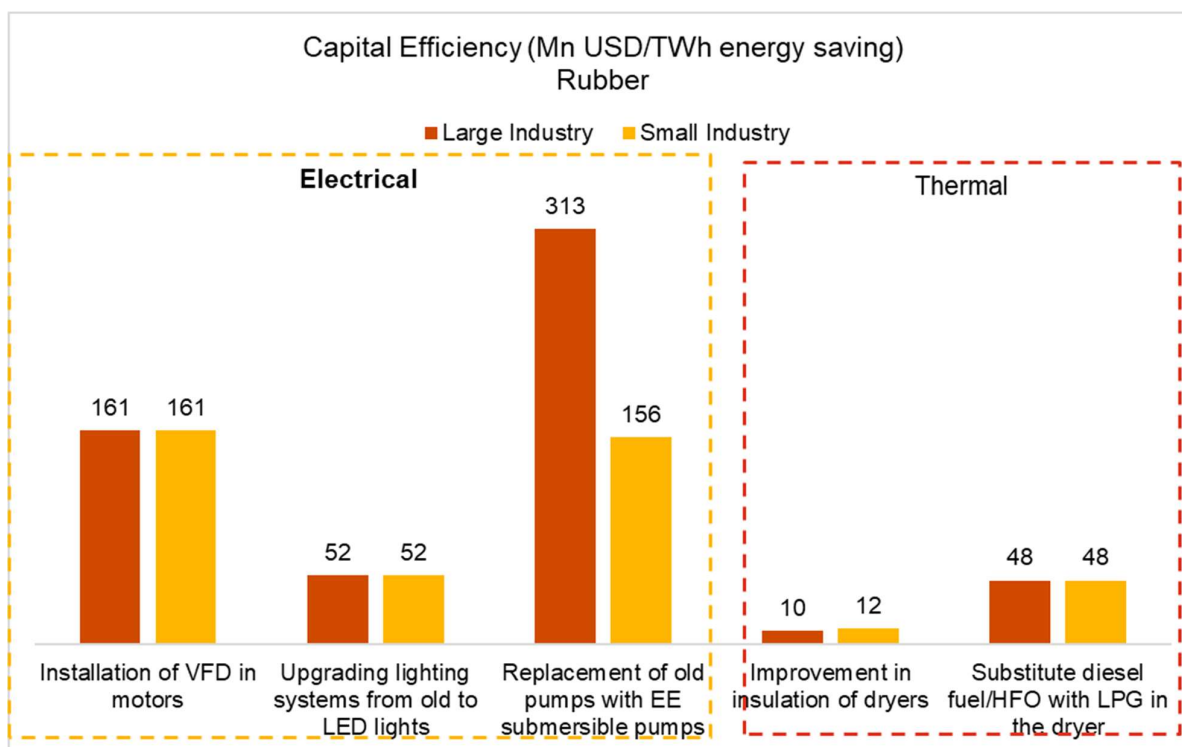


ii. Capital Efficiency of selected technologies (Million USD/TWh):

⁴¹ Project on studying of Energy Efficiency index in the rubber industry, Ministry of Energy, Thailand
The benchmark SEC value for the Rubber sub-sector has been evaluated to be between 0.035 toe/MT to 0.052 toe/MT

Based on the techno-economic analysis of all the identified interventions, improvement of insulation of dryer, substitution of diesel fuel/HFO with LPG in the dryer, LED lighting were identified as the most capital efficient technologies.

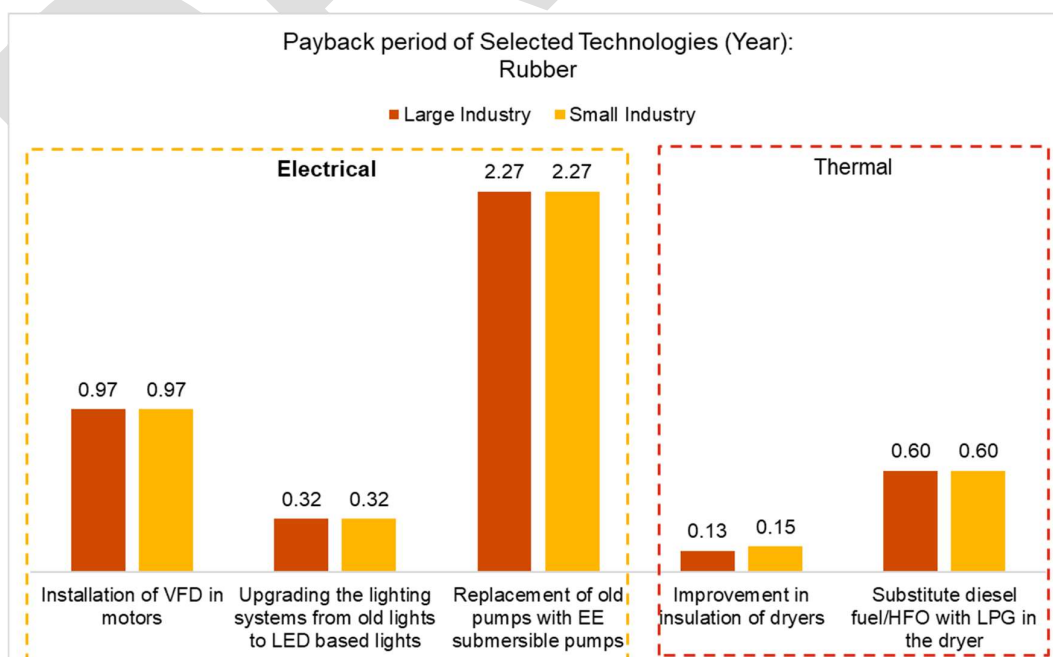
Figure 39: Rubber - Capital Efficiency of selected technologies



iii. Payback period of selected technologies (Years):

Improvement of Insulation of dryer, substitution of diesel fuel/HFO with LPG in the dryer and LED lighting were identified as the technologies with a relatively lower payback period.

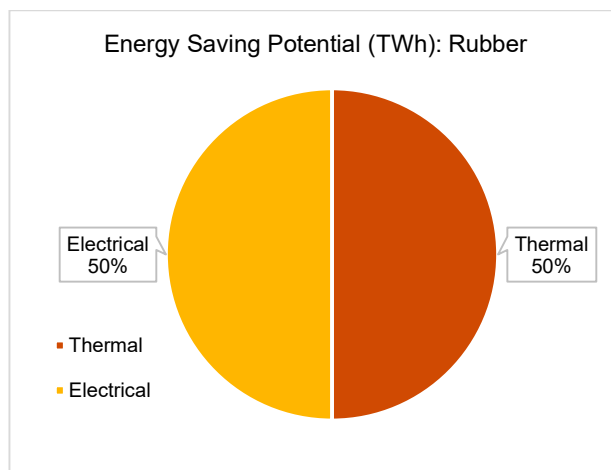
Figure 40: Rubber - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential of the sub-sector between 2020 - 2030 was estimated to be 0.08 TWh (0.04 TWh of thermal energy saving and 0.04 TWh of electrical energy saving). The total investment required for the same was estimated to be USD 1 Million.

Figure 41: Rubber - Energy Saving Potential (TWh)



v. Water Savings (Million Cubic meter)

The rubber subsector does not involve extensive water use in the processes. Therefore, the analysis of water savings has not been conducted.

Cassava processing

There has been a massive growth over the last decade in cassava plantation areas and it is expected to contribute between 3% and 4% of GDP [42]. In the recent past, nearly US\$300 million has been invested annually in the cultivation of cassava over a plantation area of 600,000 ha. Exports, primarily in the form of fresh roots and dry chips, are worth approximately US\$728 million [43]. In 13 provinces, the sector has engaged more than 90,000 rural households in the production of cassava and produced many seasonal jobs for local workers. There are 14 out of 17 starch processors in operation, while one new processing plant is being operationalized.

The following section provides a brief overview of the RECP potential in the Cassava processing sub-sector:

i. SEC: Baseline and 2030 sub-sector target

The baseline energy consumption for the Cassava starch production has been estimated at 0.046 toe/MT. The targeted specific energy consumption of the large industries was set at 0.013 toe/MT [44].

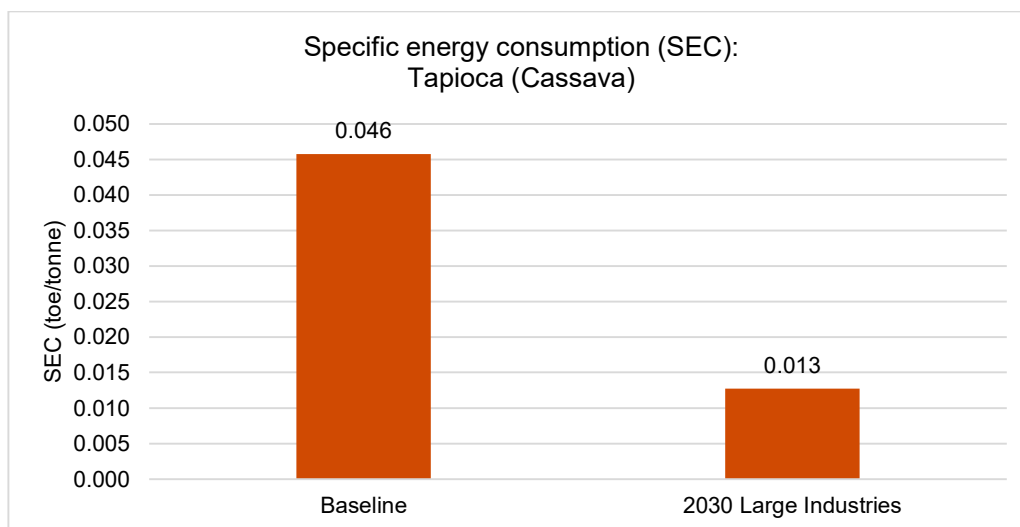
⁴² UNDP 2016, Cassava Value Chain In Cambodia

⁴³ Cassava Industry Analysis Report (2017) ASCS-Radius for its client, Green Leader Co. Ltd. 5

⁴⁴ Kriengkrai Assawamartbunlue, Wanwiwa Luknongbu, Specific energy consumption of native starch industry in Thailand, 2020, <https://doi.org/10.1016/j.egy.2019.11.078>

The benchmark SEC value for the Cassava sub-sector has been evaluated to be between 0.014 toe/MT to 0.036 toe/MT.

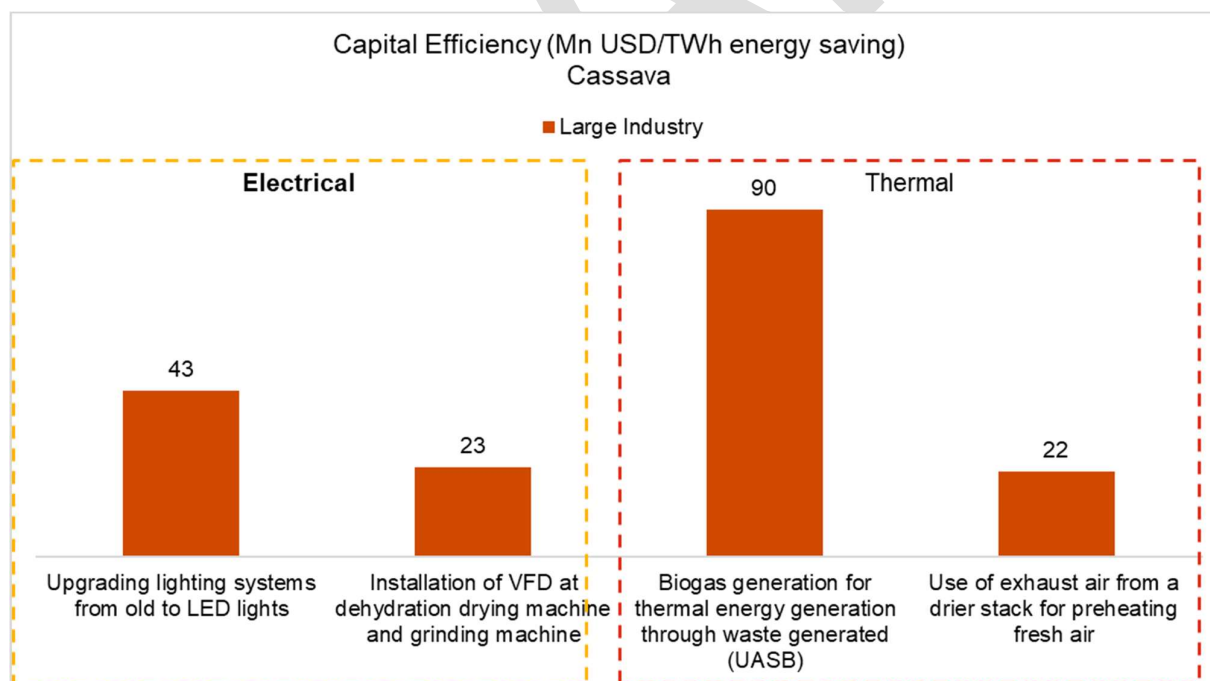
Figure 42: Cassava - SEC - Baseline and 2030 sub-sector target



ii. Capital Efficiency of selected technologies (Million USD/TWh)

Based on the techno-economic analysis of all the identified interventions, use of exhaust air from a drier stack for preheating fresh air, installation of VFD at dehydration drying machine and grinding machine, and LED lighting are identified as the most capital efficient technologies.

Figure 43: Cassava - Capital Efficiency of selected technologies ^[45]

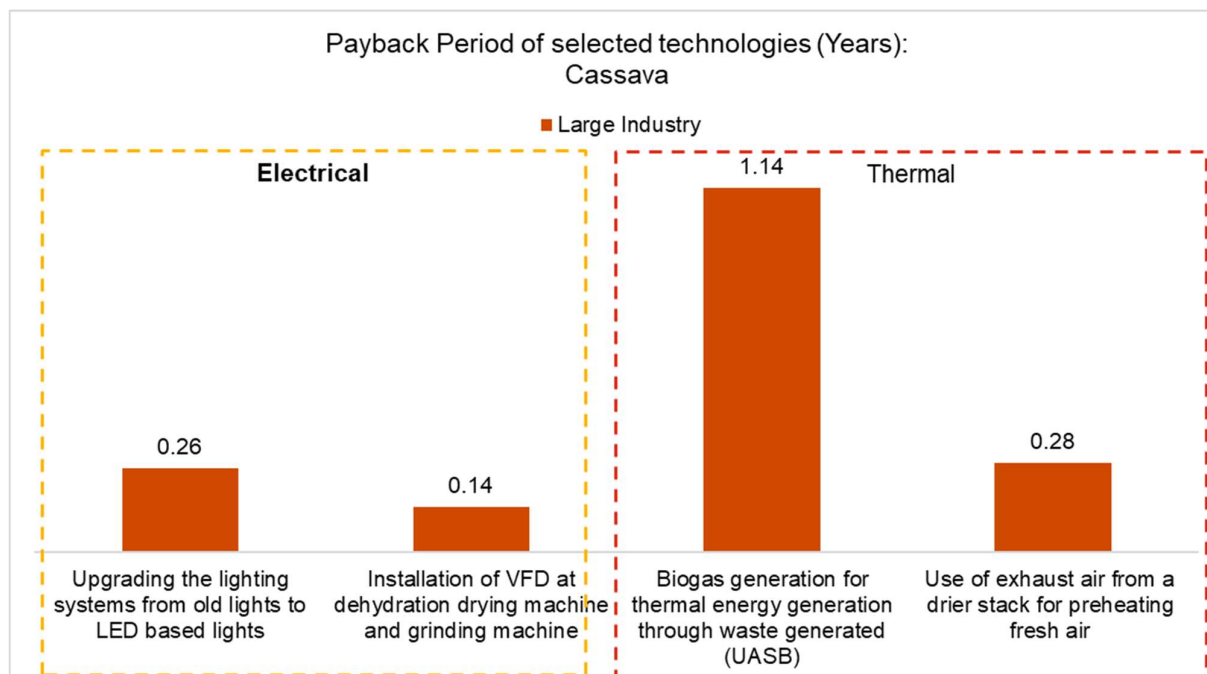


iii. Payback period of selected technologies

The technologies with a relatively lower payback period are VFD at dehydration drying machine and grinding machine, use of exhaust air from a drier stack for preheating fresh air and LED lighting.

⁴⁵ Up flow anaerobic sludge blanket

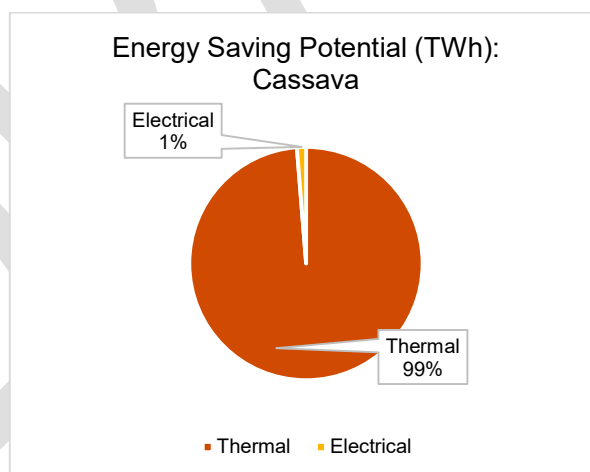
Figure 44: Cassava - Payback period of selected technologies



iv. Energy Saving Potential (TWh):

The overall energy saving potential of the sub-sector between 2020 - 2030 is estimated to be 0.16 TWh (0.16 TWh of thermal energy saving and 0.002 TWh of electrical energy saving). The total investment required for the same is USD 1.40 Million.

Figure 45: Cassava - Energy Saving Potential (TWh)



v. Water Savings (Million Cubic meter)

Water saving potential of the industry sub-sector is estimated to be 0.77 Million Cubic meters, which is to be achieved by re-using water in the cleaning of the cassava process. The required investment is estimated to be USD 0.06 Million.

F. Summary

The sub-sector analysis presented an overview of the Cambodia's industrial sector by evaluating various metrics such as energy consumption (baseline and targets for the year 2030), energy saving potential of the sector,

capital efficiency of selected technologies and their respective payback periods. The total investment requirement for the identified technological interventions is estimated to be USD 271 Million, which will result in total energy savings of ~15 TWh, total water savings of 888 Million Cubic meters and emission reductions of 6.34 Million Tonnes of CO₂-eq by 2030.

DRAFT

1.2.3. Challenges for RECP adoption in Cambodia

RECP implementation in Cambodia has traditionally relied on project based interventions thus far and need a long term program based support, for which the mainstreaming of the RECP into government programs is necessary. The key challenges for the adoption of RECP in Cambodia are presented below:

Table 3: Key challenges and gaps for RECP in Cambodia

| Theme | RECP Challenges and Gaps | |
|---|--|---|
| | Policy framework | Implementation |
| Material Efficiency | <ul style="list-style-type: none"> ▪ Lack of regulations on: <ul style="list-style-type: none"> ○ Consumption based pricing of water use by industries ○ Extended producer responsibility (EPR) ○ Industrial symbiosis ○ Chemical Management ▪ Lack of specific standards for reused/recycled/remanufactured products | <ul style="list-style-type: none"> ▪ Second-hand imported industrial equipment leaves little scope for optimizing design ▪ No monitoring and reporting of resource use/recovery/recycling ▪ Limited economic incentive for material efficiency ▪ Limited capacity of industries to use recycled inputs |
| Circular economy and waste management | <ul style="list-style-type: none"> ▪ Draft of National Circular Economy Strategy and Action plan is under preparation ▪ E&NR code is under development ▪ No regulation to minimize Single Use Plastic for packaging | <ul style="list-style-type: none"> ▪ Constrained waste management budgets of industries; Infeasibility of cost-plus model of waste processing for certain types of wastes ▪ Low economic incentive for industries to expand markets for alternative products ▪ Limited presence of Eco-Industrial Parks/clusters ▪ Limited progress on green procurement and ecolabelling |
| Energy Efficiency and Emission reduction | <ul style="list-style-type: none"> ▪ Draft of National Energy Efficiency Policy is being revised ▪ Resource efficiency and cleaner production are not accorded adequate focus in CCAPs | <ul style="list-style-type: none"> ▪ Lack of financing program for industrial EE technologies ▪ Lack of model energy service performance contracts for the operations of ESCOs |
| Industrial Safety | <ul style="list-style-type: none"> ▪ No databases on the certification of industrial equipment such as boilers and motors ▪ No formal mechanisms of reporting of workplace accidents/incidents to MISTI | <ul style="list-style-type: none"> ▪ Limited compliance of second hand imported industrial equipment/locally fabricated equipment with equipment safety standards ▪ Low awareness among the industry units about industrial safety best practices ▪ Limited budgetary resources for Good Manufacturing Practice (GMP) and Hazard Analysis and Critical Control |

| Theme | RECP Challenges and Gaps | |
|---|---|---|
| | Policy framework | Implementation |
| | | Point (HACCP) assessments in industries |
| Electrification of industrial processes and fuel switching | <ul style="list-style-type: none"> ▪ Draft of key policies such as National Energy Efficiency Policy and E&NR code are being revised ▪ Lack of regulatory clarity on sustainable use of forest wood by industries | <ul style="list-style-type: none"> ▪ Unrestrained and free access to firewood for thermal energy weakens the business case for fuel switch in industries ▪ Lack of regulatory support for the adoption of Captive Renewable Energy projects in Industries |

The RECP Strategy and Action plan augmented by necessary regulations and institutional arrangements to support the RECP interventions, can support a holistic development of the industrial sector. Several focus areas can be targeted such as financial mobilization to support the project implementation and demonstration: promoting private sector initiative through green and social entrepreneurship and capacity building and knowledge transfer through training and formal education programs for industries.

1.3. Priority matters

Promoting low-carbon industrialization and climate resilient industrial development will be crucial for Cambodia's economic development. IDP 2015-2025 has set directives for the promotion of the following industries:

- New industries with the capacity of breaking into new markets**, with high value-added products, creative and highly competitive such as machinery assembly, mechanic/electronic/electric equipment assembly, means of transport assembly and natural resource processing.
- SMEs in all sectors** especially those involved in drugs and medical equipment production, construction materials, packaging equipment for export, furniture manufacturing and industrial equipment, etc.
- Agro-industrial production** for export and domestic markets.
- Various types of supporting industries for the agriculture, tourism, and textile sectors** as well as for **industries serving regional production chains with either global markets or global value chains**.
- Industries serving regional production lines** and those of future strategic importance such in ICT, energy, heavy industries, cultural/historical/traditional handicraft, and green technology.

For the Sixth Legislature of the National Assembly, the RGC of Cambodia (RGC) will focus on the following priorities that are related with industry and SME sector:

- Diversifying the industry and expanding the industrial production capacity, increasing productivity**, with emphasis on the implementation of the IDP 2015-2025.
- Encouraging investment to create industrial clusters, industrial parks and the establishment of Special Economic Zones** as well as investment in infrastructure development and linking both software and hardware supporting all industrial production activities.
- Strengthening scientific, technological, and innovative cooperation and promoting research activities and encouraging new innovations** in the business, services and products that are appropriate in national and digital contexts or industry revolutions 4.0.
- Continuing to promote the management of SMEs statistics across the country in the formulation of a strategic plan to promote and support the SME development** and handicrafts.

- v) ***Promoting, supporting, and enhancing the movement of One Village One Product***, creating training courses on financial control and handicraft, enterprise management in collaboration with development partners.

The priority areas of IDP and Sixth Legislature of the National Assembly, forms the foundation for the RECP Strategy and Action Plan. The priority areas highlighted above have been used as the basis to develop strategic objectives and actions aligned with the national policy framework of the Royal Government of Cambodia.

DRAFT

2. Strategies

2.1. Strategic Analysis

2.1.1. RECP and its significance

Resource Efficiency and Cleaner Production (RECP) is a **preventive strategy** (targeting industries at various levels of sustainability readiness), aimed at decoupling consumption of ecosystem resources from production. RECP's premise is to prevent/minimize the waste and pollution generated in industry instead of trying to recycle, recover and treat waste and pollutants once created or already discharged into the environment.

RECP builds on the cleaner production methodology to enhance the adoption of preventive environmental policies at business levels for processes, products, and services. The term Cleaner Production (CP) was defined by UNEP in 1990 as: '*The continuous application of an integrated environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment*'. The strategy for CP is to target unsustainable production challenges at the source, using a product lifecycle approach that considers techniques, process, and service dimensions. [46]

Table 4: Applications and outcome elements of cleaner production [47]

| Application Dimensions | Outcome elements |
|------------------------|---|
| Production processes | <ul style="list-style-type: none"> a) To reduce the consumption of raw materials and energy used in the production of one unit of product. b) To eliminate (at the maximum possible extent) the use of toxic and dangerous materials. c) To reduce at source the quantity and toxicity of all emissions and wastes generated and released. |
| Products | <p>Cleaner Production aims to reduce the environmental, health and safety impacts of products:</p> <ul style="list-style-type: none"> a) Over their entire life cycles. b) From raw materials extraction, through manufacturing and use, to the ultimate disposal of the product. |
| Services | Cleaner Production implies incorporating environmental concerns into the design and delivery of services. Developing the design of a service by giving emphasis to the right implementable solutions and methodologies is crucial. |

⁴⁶ UNEP - Sustainable Consumption and Production (SCP) - A Handbook for Policymakers - <https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1951&menu=35>

⁴⁷ UNIDO - Manual on the Development of Cleaner Production Policies - https://www.unido.org/sites/default/files/2007-11/9750_0256406e_0.pdf

2.1.2. Guiding Principles

The RECP Strategy and Action plan 2021-2030 is governed by the following principles, which have been used to develop the strategies and actions:

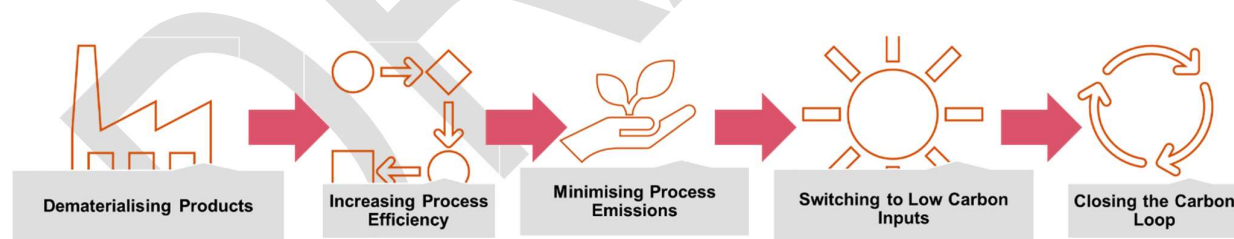
- **Production efficiency:** Increase productivity by ensuring a more efficient use of raw materials, energy, and water. This principle is aimed at improving business functions by decreasing the use of unnecessary materials and reducing the energy use in producing goods and services.
- **Environmental conservation:** Promote better environmental performance through reduction at source of waste and emissions. This principle is aimed at reducing the environmental impact of industrial products throughout their life cycle by supporting the design of environmentally friendly but cost-effective products.
- **Human development:** Support reduction of risks to people and communities from enterprises and supporting their development. This principle is aimed at helping communities through efficient and cleaner processes by promoting judicious use and conservation of resources.

2.1.3. RECP approach and its benefits for Cambodia

RECP's preventive measures for environmental management focus on pollution prevention rather than end-of-pipe treatments. Such measures include adoption of environmentally sound technologies, introduction of process modification and substitution of raw materials ^[46] :

- **Dematerialising Products:** developing new products with less resource footprint over their lifecycle.
- **Increasing Process Efficiency:** reducing resources intensity of water, energy, chemicals, and materials.
- **Minimising Process Emissions:** integrating clean technologies to minimise the generation of greenhouse gases (GHG).
- **Switching to Low Carbon Inputs:** using renewables and low carbon sources of energy and materials.
- **Closing the Carbon Loop:** recovering organic wastes for reuse as feedstock for energy and materials.

Figure 46: RECP's measures and approach to low carbon growth ^[46]



A realistic, coherent, and implementable policy ecosystem on enabling RECP will support Cambodia's national and international agenda on sustainability. Along with supporting Cambodia's national industrial development and environmental conservation efforts, the RECPSAP 2021-2030, could be an effective instrument to meet obligations from multilateral environmental conventions.

2.1.4. MISTI's Role in RECP

MISTI has a mandate to promote resource use in the industry sector through various departments such as the National Productivity Centre of Cambodia (NPCC), Department of Techniques & Industrial Safety (DTIS) and Department of Industrial Affairs.

The main function and responsibilities of MISTI and its departments revolve around Green productivity, 5S and Environmental Management System (EMS), Industrial Safety, Sound Management of Chemicals, the Green

Industry Award and Green technologies. MISTI's main responsibilities for the promotion of resource efficiency in the industrial & SMEs sectors are provided below:

- a) Improving the investment environment, establish links and chains between large industries and MSMEs and set up a financial service system for MSMEs.
- b) Strengthening good governance for MSMEs through transparent law enforcement and registration and promoting competitiveness in the MSMEs and manufacturing industry.
- c) Enhancing Cambodia's productivity aligned with national, local regions, and international standards, Metrology and Conformity Assessment.
- d) Establishing clusters and parks for MSMEs and Manufacturing Industry, Technology and Innovation Centre, Academic of Science, and technology/Institute.
- e) Creating favourable environment for producing portable water and cleaning drinking water for Cambodian population in city and urban areas with safety, quality, and appropriate price.

Note on cross-ministerial responsibility for the adoption of captive renewable energy projects in industries:

Note: Adoption of Captive Renewable Energy Projects in Industries

MISTI has received requests from various industry stakeholders to: ***“Enable industries to adopt non-grid interactive captive Renewable energy projects based on solar PV and Waste to Energy (WtE) technologies for Industry Units (with corporate sustainability vision) using ‘Energy as a Service’ model.”***

Further, various regulatory hurdles in the adoption of solar PV systems have been brought to the notice of MISTI, including:

- i) Lack of feed-in tariffs or a net metering system, to incentivise solar producers contributing electricity to the National Grid.
- ii) Mandating only Medium and High voltage Consumers to install on-grid solar PV limits the adoption of solar technologies by low voltage consumers.
- iii) Additional costs burden of a two-part tariff system comprising charges for both capacity and energy applicable to solar PV consumers.

MISTI duly notes that the aspects related to Energy regulations are governed by The Ministry of Mines and Energy (MME). MISTI requests MME to kindly note the voices of industry on the adoption of Solar PV and take remedial actions to ease the regulations. During implementation of various actions, MISTI will ensure steady dialogue and consultations with MME to ensure robust implementation of RECPSAP 2021-2030 and a successful transition of Cambodian industries towards a green and sustainable ecosystem.

2.2. Mainstreaming Gender



The issue of gender and social equality has come to the fore in both policy and research arenas in the last decade, due to the widespread recognition that neither the impact pathways for climate change, nor the policy responses are gender neutral. Climate change can worsen existing conflicts and gender inequalities, and some strategies to address climate risks can exacerbate this if not applied with gender-sensitive principles. ***Gender-sensitivity and integration of backward communities will therefore be considered as a key priority during the implementation of the RECPSAP 2021-2030.***

- **Gender mainstreaming:** In addition to empowering women through the strategy and action plan, gender mainstreaming will enable women and men to access, participate and benefit equally from development projects. Gender inequalities will be considered throughout the implementation project cycle - from design and implementation to monitoring and evaluation. Throughout the course the implementation of various

activities the RECP Technical Working Group and respective implementation departments would suggest recommendations on mainstreaming of gender and backward communities.

- **Gender-specific interventions:** Targeted actions as specified in the action matrix will be special measures, focused to bridge the gaps and address the needs of a particular group, enabling them to participate in industrial development and benefit from the results and finally, to ensure equality. To this end, the RECPSAP 2021-2030 will motivate its implementation agencies to develop provisions to boost and create awareness about women empowerment. RECPSAP 2021-2030 will also develop provisions, which increase access to skills and tools that help to economically empower women and improve their participation in industrial development.

Key factors undermining women's economic empowerment in green industry [⁴⁸]:

Table 5: Barriers to advancements and transformation for women's economic empowerment (Source: UNIDO)

| Barriers to advancement | Barriers to transformation |
|--|--|
| Lack of awareness about policies and programmes designed to benefit women and/or encourage participation in green industry | Harmful social norms that discourage women from starting their own business |
| Lack of access to the technology necessary to start green businesses or upscale existing businesses | Inequitable caretaking responsibilities |
| Women entrepreneurs have difficulty in finding and hiring skilled workers | Intersectional inequalities and internalized sexism |
| Women's lack access to mentoring impacts networks for investment funding and job opportunities | Low self-confidence |
| Women lack access to necessary capital, collateral, and credit resources | Financial barriers prevent businesses from accessing means to invest in greener technologies |
| Women lack access to markets to sell their products | Lack of clarity on "green industry" definition |
| Women face value chain challenges and "hidden costs" of doing business | Right to information |
| Language inefficiency | |

The RECP SAP 2021-2030, has adopted the following recommendations for enabling gender-responsiveness in green industry [48]:

Table 6: Adopted recommendations for enabling gender-responsiveness in green industry (Source: UNIDO)

| Contents/topics to be covered |
|--|
| Inclusion of specific gender targets and indicators and collect sex-disaggregated data and gender statistics for monitoring and evaluation |
| Elimination of gendered language (e.g. Chairman to Chair) |
| Generation of S.M.A.R.T. indicators (specific, measurable, achievable, relevant, and timely) using robust sex-disaggregated data |
| Process |
| Integrating women's agency, meaningful and equal participation, and decision-making at all levels |
| Addressing the needs of women using an intersectional perspective that takes into consideration the multiple and intersecting forms of discrimination based on gender, rurality, race, migration status, poverty, and other socio-economic factors |
| Supporting education and awareness (e.g. knowledge and skills transfer, mentorship programme, partnerships, and networking platforms) |
| Ensure the engagement of women at every stage of the planning and policy process including consultation, monitoring, and evaluation |

⁴⁸ UNIDO - Policy Assessment for the Economic Empowerment of Women in Green Industry - https://www.unido.org/sites/default/files/files/2021-06/Cambodia_Country%20Report_Final_ENG_0.pdf

| |
|---|
| Conducting gender impact assessments and ensure consultation and dialogue with local women's groups and organized civil society |
| Diversifying women's access to, and source of start-up capital |
| Promoting women's equal access to education and vocational studies to provide technical knowledge in green industry |
| Identifying strategies to root out institutionalized sexism and discrimination, especially in the private sector |

RECPSAP 2021-2030 has further taken cognizance of the gender promotion aspects prescribed in various policy instruments which forms a basis for the strategic action plan. The strategic action plan throughout the implementation of its activities will abide by the following policy and regulatory provisions around mainstreaming gender:

Table 7: Coverage of Gender and social considerations in the Policy and regulatory framework of Cambodia

| Coverage of Gender and social considerations in the Policy and regulatory framework of Cambodia | | |
|---|--|--|
| Law | Draft Environment and natural resources code of Cambodia | Article 14: Gender equity and the participation of women in all aspects of decision-making concerning the environment and natural resources shall be promoted and encouraged. |
| Policy | Rectangular strategy 4, 2018 | Rectangle 1 – Human resource development: Strengthen gender equality and social protection. |
| | National policy on mineral resources for 2018-2028 | Objective 3: Developing Mineral Resources and Community Encourage the use of women's labour in all mining activities except in high risk areas, as well as providing special healthcare for women. |
| Action Plan | National strategic development plan (2019-2023) | Strengthening Gender Mainstreaming Mechanism at Sectoral and National Programs, including Climate Change <ul style="list-style-type: none"> Strengthening the capacity and mechanism capacity in mainstreaming gender including the Gender Mainstreaming Working Group and the Strategic Plan for Sector Gender Mainstreaming. |
| | National strategic plan on Green Growth (2013-2030) | <ul style="list-style-type: none"> Development and implementation of gender roles in green growth. Strengthen green governance capacity to green youths, gender equity, sub-national administration, and the private sector. |
| | Cambodia Climate Change Strategic Plan (2014-2023) | <ul style="list-style-type: none"> Reduce sectoral, regional, gender vulnerability and health risks to climate change impacts. Prioritize women's needs in climate change adaptation and mitigation actions. |

Coverage of Gender and social considerations in the Policy and regulatory framework of Cambodia

| | | |
|--|--|---|
| | Cambodia Climate Change Action Plan for Industry and Handicraft Sector (2015-2018) | Establish mapping system for industries with sensitive information including climate risks zone, GHG emission taking into account gender sensitive issue. |
|--|--|---|

3. Vision, Mission and Strategic Goals

MISTI has developed the RECPSAP 2021-2030 following guidance from the Council of Ministers, to provide strategic direction and a plan of action to address the challenges for industry and SMEs sector development. The following sections present the vision, mission, and strategic objectives of the RECPSAP.

3.1. Vision

“To accelerate the green transition of the industry sector of Cambodia”

3.2. Mission

“To enable sustainable management of resources and minimization of the environmental impact of the industry sector of Cambodia.”

3.3. Strategic Goals and Objectives

The RECPSAP 2021-2030's strategic goal is:

“To mainstream RECP concepts and practices into the day-to-day operations of industries as well as design and delivery of programs for the industry sector of Cambodia.”

In order to achieve the vision, mission, and goals of RECPSAP 2021-2030, the following three strategic objectives have been identified:

Strategic Objective 1: Strengthen regulations, standards, and data reporting

Strategic Objective 2: Support scalable RECP program delivery models

Strategic Objective 3: Promote innovation, entrepreneurship, and enhanced capacity to undertake RECP implementation

4. Action Plan for Strategic Objectives

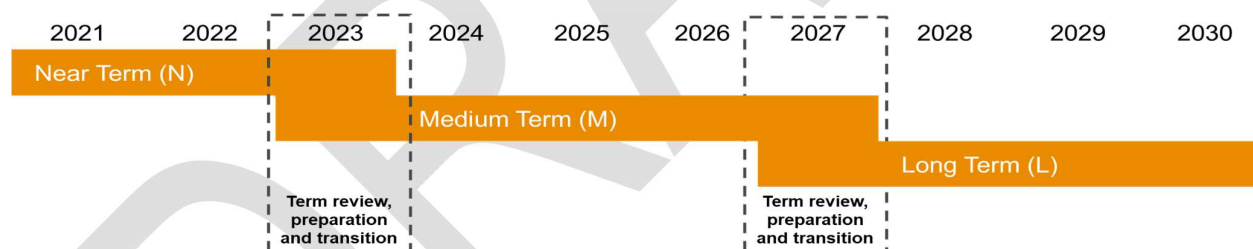
4.1. Summary scope of planning

The RECPSAP is focused on enhancing resource efficiency in the manufacturing sector of Cambodia. The resource efficiency of an industry is a relationship between product output and resource input. It characterizes how efficiently resources are used to add economic value. The term “resource” includes raw materials, energy, water, and all operating supplies required for value generation. Thus, improving resource efficiency involves an integrated reduction of materials, energy, supplies, and waste minimization as these factors are usually interlinked.

Besides profitability, resource efficiency can also unlock the potential for innovation and growth in the industry sector, encouraging the emergence of new technologies and driving job creation. This optimizes value generation across the full life cycle, including manufacturing processes, design of eco-efficient products, recycling, and reuse of waste. However, the scope of the RECPSAP will be limited only to efficiency improvements in the manufacturing process that minimize resource use and the generation of wastes at the point source. Raw materials extraction/mining and disposal of wastes in an environmentally friendly manner are not included in the scope of the RECPSAP as they are not part of MISTI’s mandate.

The time frame for this RECPSAP is 10 years from 2021 to 2030. The ten-year plan is divided into three phases - Near term (2021 – 2023), Medium Term (2023 – 2027) and Long term (2027 – 2030).

Figure 47: RECP SAP implementation timelines



The following section presents the recommended actions and sub activities for each of the strategic objectives, their implementation timelines, responsible department, and budget allocation.

4.2. Action plan matrix

The action plan lays out concrete measures and timelines for putting the strategy into action. The following matrix highlights the MISTI's proposed actions to promote RECP:

Table 8: Action Plan matrix

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|---------|---|--|-----------|-----------|-----------|---|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| SO1 | Strengthening of regulations, standards, and data reporting | | | | | | |
| 1. | Develop regulations for voluntary self-reporting of industrial data | <p>Develop guidelines for voluntary self-reporting of industrial data through online portal (mandatory reporting to be explored in due course)</p> <ul style="list-style-type: none">- Data to be reported may include data related to occupational health and safety, resource use- Develop incentives to enhance self-reporting of data on resource use, chemicals management and workplace safety | | | | <p>General Department of Science, Technology, and Innovation</p> <p>General Department of General Affairs</p> <p>General Department of Industry</p> <p>General Department of Small and Medium Enterprises and Handicrafts</p> <p>Institute of Standards of Cambodia</p> | 1,000,000 |

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|---------|---|---|-----------|-----------|-----------|--|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| 2. | Develop guidelines to establish consumption-based pricing of ground water for Industry and SME Sector | Develop guidelines for establishing consumption-based pricing of industrial ground water abstraction <ul style="list-style-type: none"> - The objective of these guidelines is to deter excessive use - The price will be set based on costs of infrastructure development and O&M for groundwater recharge, cost of water treatment, etc. | | | | <i>Department of Water Regulation</i> | 250,000 |
| 3. | Develop standards for the use of remanufactured or recycled materials in the industrial process as raw material/ feedstock | Establish minimum standards for the use of remanufactured or recycled materials in the industrial process as raw material/ feedstock | | | | <i>Institute of Standards of Cambodia/ Department of Technical and Industrial Safety</i> | 750,000 |

| | | | | | | |
|----|---|---|--|--|--|-----------|
| 4. | <p>Establish S&L guidelines and MEPS for industrial equipment, followed by regulations to support the planning, development, and implementation of Eco-labelling</p> | <p>Establish S&L guidelines and MEPS for industrial equipment.</p> <ul style="list-style-type: none"> - Identification of industrial equipment for preparing S&L guidelines - Market assessment, review of performance test standards and review of S&L guidelines in countries from which equipment is imported - Establishment of energy performance levels based on performance characteristics of all variants of the industrial equipment in the Cambodian market - Statistical analysis to create 3 to 5 performance levels between the minimum and maximum performance range - Establish Technical Working Group and plan for approval of S&L guidelines - Drafting of S&L guidelines and stakeholder consultation - Verification and approval of S&L guidelines - Notification to importers and manufacturers regarding future announcement of MEPS to upgrade the performance levels of equipment - Setting Minimum Energy Performance Standards at a level that is above 10-15% of the low performing variants of the equipment in the market <p>Create regulations to support planning, development, and implementation of Eco-labelling</p> <p>(The Eco-labelling program would motivate industries to adopt profit-driven strategies such as sustainable product design and Design for Sustainability (D4S) helping them in improving the efficiency of current production and the design of new products and services through supply chain management, corporate reporting, benchmarking, and adopting related international standards.)</p> <ul style="list-style-type: none"> - Identify industrial sub-sectors and products for implementing Eco-labelling strategy - Develop incentives and penalties on enhancing the program | | | <p><i>General Department of Science, Technology, and Innovation</i></p> <p><i>General Department of General Affairs</i></p> <p><i>General Department of Industry</i></p> <p><i>General Department of Small and Medium Enterprises and Handicrafts</i></p> <p><i>Institute of Standards of Cambodia</i></p> | 1,500,000 |
|----|---|---|--|--|--|-----------|

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|---------|---|---|-----------|-----------|-----------|--|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| | | <ul style="list-style-type: none"> - Develop a voluntary program for ecolabelling products and services with information on environmental burden, including but not limited to information on multiple environmental and health issues (include toxicity, air quality, energy and water use, recyclability, use of natural resources, and other areas of concern). | | | | | |
| 5. | Develop Standards for industrial machinery safety | Promulgate Standards which will cover the following aspects <ul style="list-style-type: none"> - General aspects - Safety management, safety audit, plant layout, mechanical guards on machines, etc. - Equipment - Hand operated tools, machine tools, abrasive grinding wheels, Cranes, etc. - Operations - Welding and thermal cutting, pressure vessels, gas cylinders, LPG storage, Pipelines colour codes, chemical laboratories, Rubber and Plastic fire safety, Wood working machine - Electrical safety - Earthing, Rotating electrical machinery, Equipment for hazardous areas, hazardous area classification, Safety equipment, Encapsulated equipment, Dust proof equipment, electrical measuring equipment for explosive areas, etc. - Other aspects to be covered may include Transportation, Material handling, Noise, Vibration, Illumination, Civil Construction, Fire safety, Personal protection | | | | <i>Institute of Standards of Cambodia/ Department of Technical and Industrial Safety</i> | 360,000 |
| 6. | Develop Regulations for implementation of Globally Harmonized System | Develop and update the list of banned or severely restricted Industrial chemicals under the Rotterdam Convention | | | | <i>General Department of Industry</i> | 350,000 |

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|---------|---|---|-----------|-----------|-----------|--------------------------------|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| | for Industrial Chemical management | Create regulations to guide the chemical use and management in industries <ul style="list-style-type: none"> The regulations will govern chemical management systems (including any certifications from internationally recognized management system), chemical purchasing and selection, hazard communication, chemical storage and transfer, chemical exposure and controls and chemical disposal | | | | General Department of Industry | |
| 7. | Regulation on the phasing out of Single Use Plastic in Industries | Regulation on phasing out of single-use plastic products in industries <ul style="list-style-type: none"> Conduct Market analysis to define major SUPs, MUPs and sustainable alternatives in the country and region Engage the private sector manufacturers in understanding challenges in promoting production of MUP and alternatives Develop targets for phase out of SUPs from Industries as a part of the Regulation | | | | General Department of Industry | 350,000 |
| SO2 | Supporting scalable RECP program delivery models | | | | | | |

| | | | | | | |
|----|---|--|--|--|--|-----------|
| 8. | Program based support for transformation of Industrial Zones (located in SEZ's) into eco-industrial parks | <p>Program based support for transformation of Industrial Zones into EIPs with the following stages</p> <ul style="list-style-type: none"> - Identification of SEZs, companies and technologies for EIP pilot projects (Note: In addition to achieving cost reductions, Industries in EIP will be favourably placed to attract FDI investments and in terms of public procurement when Regulations on Green Public Procurement materialize in Cambodia. This will be an incentive for the industries to participate in the EIP pilots) - Capacity building of MISTI, CDC, SEZ Boards and Industry owners about EIP - RECP audits, identification of opportunities for unit level RECP interventions, zone level industrial symbiosis projects and preparation of feasibility studies - Implement Unit level RECP interventions, industrial symbiosis interventions and projects to improve occupational health and safety of workers as a part of pilot - Development of Policies and guidelines to transform industrial zones into EIP. The policy/guidelines will cover the following <ul style="list-style-type: none"> o Process to be recognized as an EIP, roles and responsibilities of different stakeholders in the transformation of existing SEZs to EIPs o Legal basis for directly re-using process waste (solid waste, gaseous waste, liquid waste or other by products) from one factory as a raw material in another factory - Development of metrics for monitoring and evaluation of the performance of EIPs on GHG, POP, water efficiency and pollution, waste production, reuse and recycling rates and occupational health and safety | | | <p><i>General Department of General Affairs</i></p> <p><i>General Department of Industry</i></p> <p><i>General Department of Science, Technology, and Innovation</i></p> <p><i>in collaboration with</i></p> <p><i>CDC and the Boards of selected Special Economic Zones</i></p> | 3,000,000 |
|----|---|--|--|--|--|-----------|

| | | | | | | | |
|----|--|---|--|--|--|--|-----------|
| 9. | Design and operationalization of an industrial RECP program | <p>Development of an industrial RECP program with the following activities:</p> <ul style="list-style-type: none"> ○ Identification of industry units in key sub-sectors as per the RECPSAP and getting their Expression of Interest for participating in the RECP program ○ Undertake RECP audits to estimate the baseline level of resource efficiency, the improvement potential and investment need for Resource Efficient technologies ○ Set unit level targets for resource efficiency in discussion with Company management, which are to be achieved as a part of the program on an annual basis ○ Set up a concessional loan scheme (of size USD 190 million) and a risk sharing scheme for industries/ESCOs in partnership with commercial banks for a defined list of Resource Efficient technologies ○ The key activities for the development of the scheme would be as follows^[49]: <ul style="list-style-type: none"> ○ Defining a list of eligible technologies and their estimating their market potential in Cambodia ○ Assess the interest of Banks and formalize partnerships for operationalizing the Concessional loan/Risk sharing scheme ○ Conduct Capacity Building of Loan officers of Banks on the appraisal of loans for resource efficient technologies ○ Technical due diligence to create an empanelled list of technology suppliers for Banks, with a preference for suppliers interested in EPR/take back schemes ○ Matchmaking between Banks and companies for financing RECP interventions ○ Develop an online portal for reporting industry unit level data such as: <ul style="list-style-type: none"> ○ resource consumption (electricity, fuels, chemicals, water) by industry units | | | | <p><i>General Department of Industry</i> <i>General Department of Small and Medium Enterprise and Handicraft</i> <i>National Productivity Center</i></p> | 1,000,000 |
|----|--|---|--|--|--|--|-----------|

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|---------|--|---|-----------|-----------|-----------|---------------------------|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| | | <ul style="list-style-type: none"> incidents related to workplace safety and chemical management The portal will also host RECP related policies, regulations, and international case studies to act as a knowledge repository for the participating industries <p>Note: Based on the success of data reporting, benchmarking of resource efficiency parameters for various sub-sectors may be explored in due course</p> <ul style="list-style-type: none"> Conduct RECP audits annually in the participating industries (using program TA support) to monitor progress against the targets and build capacity of industries to mandatorily report their data on MISTI's online portal and undertake RECP interventions as specified in the action plan Develop training program for RECP certified auditor and other certificate courses on the concepts of Reuse-Reduce-Recycle, 5S, KAIZEN, Lean manufacturing, and Energy Management Systems Disseminate the outcomes achieved to the relevant stakeholders (government agencies, industries, etc.) on RECP <p>Note: Based on the success of this approach, the program could be scaled up to newer industrial sub-sectors as well.</p> | | | | | |
| SO3 | Promoting innovation, entrepreneurship, and enhanced capacity to undertake RECP implementation | | | | | | |

⁴⁹ Size of the loan package is set at ~70% of the calculated investment for adopting RECP measures i.e. USD 190 million. The remaining 30% is expected to come from equity contribution of the industries.

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|---------|--|--|-----------|-----------|-----------|---|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| 10. | Strengthen the National Cleaner Production Offices at the National level and Subnational to undertake training and awareness raising programs on RECP | <p>The NCPO will take the following additional responsibilities:</p> <ul style="list-style-type: none"> - Conduct 'Training of trainers' on RECP and expand mandate beyond productivity to include resource efficiency, chemical management, industrial safety and industrial automation as well - Develop training material and a plan for organizing RECP related training programs at all the provincial offices of NCPO (Industries participating in self-reporting of Resource Use data get free access to training programs) - Create a dedicated Open Access IT portal to act as a repository of RECP related policies and regulations at the national level and international case studies and best practices - Conduct awareness campaigns for: a) O&M Staff of Industrial units, b) Industrial Associations, c) SEZ boards d) other key stakeholders | | | | <p>General Department of Industry</p> <p>General Department of Small and Medium Enterprise and Handicraft</p> <p>National Productivity Centre</p> | 300,000 |

| Sr. No. | RECP Actions | Activities | Timeline | | | Responsible department(s) | Budget (USD) |
|--------------|---|---|-----------|-----------|-----------|--|--------------|
| | | | 2021-2023 | 2023-2027 | 2027-2030 | | |
| 11. | Develop an ESCO incubation facility | <ul style="list-style-type: none">· The ESCO incubation facility will be involved in the following activities- Invite innovative project ideas from ESCOs on an annual basis; The best submissions get access to technical advice and seed funding- Create and disseminate model energy service performance contracts for ESCOs as well as the industry units- Depute technical experts in the incubation facility to provide technical advice to selected ESCOs/start-ups in the Cleantech/Sustainability business on the design of solutions, developing business models and go to market plans | | | | General Department of Industry General Department of Small and Medium Enterprise and Handicraft General Department of Science, Technology, and Innovation National Institute of Science, Technology, and Innovation | 500,000 |
| 12. | Develop Green Industry Awards for Industry and SME in Cambodia. | <ul style="list-style-type: none">- Include RECP performance metrics as a criterion in the Green Industry Award | | | | General Department of Industry | 200,000 |
| | | <ul style="list-style-type: none">- Annually reward industries for achieving their targets in the RECP program by recognition as a part of the Green Industry Award program | | | | General Department of Small and Medium Enterprise and Handicraft | |
| | | <ul style="list-style-type: none">- National recognition for sustainability-oriented corporates/brands as a part of the Green Industry Awards | | | | National Productivity Centre | |
| Total Budget | | | | | | | 9,560,000/- |

4.3. Institutional and collaboration structure for implementing the action plan

The implementation of the RECPSAP 2021-2030 will be governed by the Technical Working Group (TWG) on RECP in close coordination with the internal departments of MISTI, other ministries, development partners, civil service organisations (CSO) and private sector organisations.

The TWG so established, has representation from all the departments of MISTI and the Ministry of Environment (MoE)/General Secretariat of National Council for Sustainable Development (GSSD). The TWG will have the responsibility to conduct the Monitoring and Evaluation (M&E) of RECPSAP. The implementation of the RECPSAP will be overseen by the relevant MISTI departments as per the responsibility allocation under the guidance of the TWG. The concerned departments will oversee the design and operationalization of relevant initiatives and projects, working closely with related targeted participant groups, communities, agencies, development partners, and concerned CSOs.

The RECP TWG with the support of its constituent departments and ministries will perform the key functions -

A. RECPSAP implementation:

TWG would oversee the implementation of RECPSAP by facilitating institutional collaboration, strategic direction, and resources for streamlined implementation and conducting the M&E of RECPSAP.

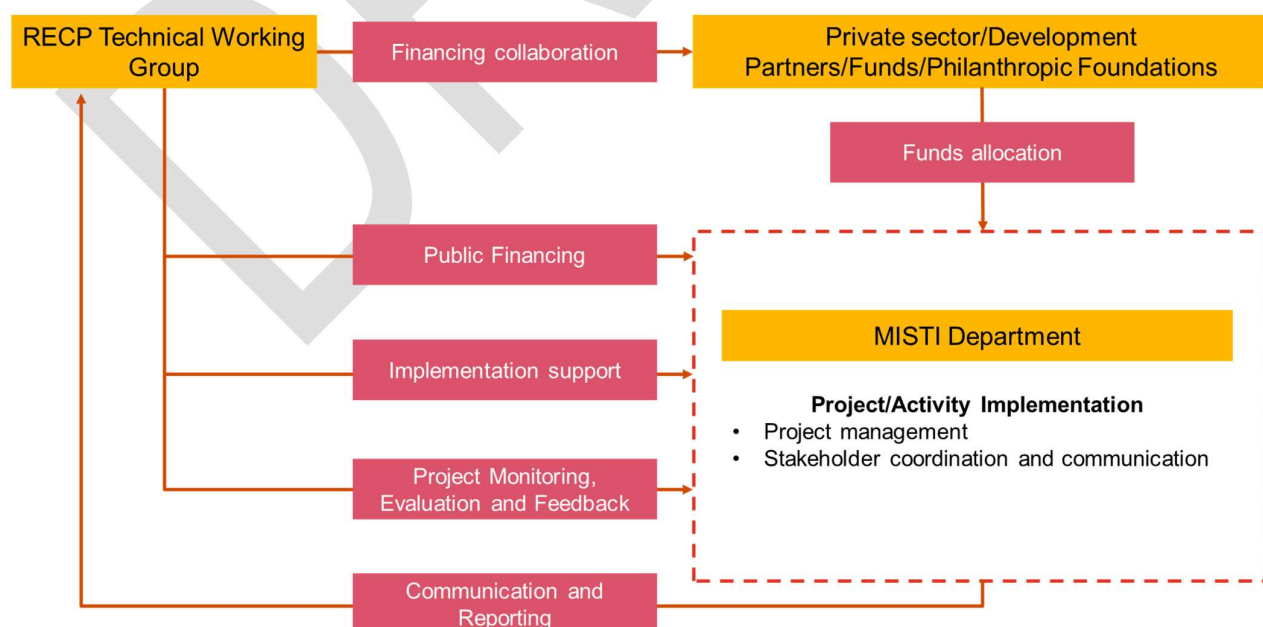
B. Mobilising financing support:

TWG would actively participate in organising and mobilising funds for the implementation of various activities from appropriate funding streams such as public expenditure, official development assistance, global funds, and private sector finance.

C. Project Monitoring and Feedback:

TWG would be responsible for enforcing monitoring frameworks, quality assurance checks and utilising the learnings from the implementation to enhance or develop the program.

Figure 48: Institutional and collaboration structure



4.4. Expected benefits from the implementation of the Action Plan

The following are the targeted short-term, medium-term, and long-term benefits envisaged:

A. Short Term

In the short term, RECPSAP 2021-2030 will focus on enhancing the existing regulatory framework and data reporting mechanisms through enactment of regulations and standards, formalizing the structure of the proposed programs (for RECP and EIPs) and facilitating a strong engagement between the government and the private sector (including women, SMEs, and other marginalized groups) to cultivate buy-in for the proposed interventions. Capacity development will be conscious strategy to be adopted from this phase itself, so that the responsible departments and entities have the requisite knowledge and skills for the fulfilling their roles and responsibilities in the subsequent phases of the plan. The short-term actions will build the momentum that would be required to launch the proposed programs and send positive market signals for attracting the International Development Agencies for supporting MISTI's plans through TA and funding support.

B. Medium Term

In the medium term, RECPSAP 2021-2030 will initially focus on piloting solutions at a small scale to test them for a large-scale rollout. Based on the outcomes of the piloting the program-based initiatives would be launched, which would lead to the adoption of RECP in the industrial value chain, product diversification, innovation promotion and development of Special Economic Zones. The medium-term actions will also support new and innovative paradigms including industrial automation, digital integration, and industrial symbiosis.

C. Long term

In the long term, the proposed programs are expected to lead to significant resource savings, enhanced workplace safety, increased competitiveness, development of new markets, improved flow of FDI, entrepreneurship and skill development. The impacts will help Cambodia achieve the targets set as per the national policy framework and its key commitments in International Conventions.

5. Expenditure or Management and Financing Mechanism

5.1. Analysis of existing management and financing mechanisms

The Ministry of Industry, Science, Technology, and Innovation fulfils its mandate as Royal Government Marshal on the leadership and management in the field of industry, science, technology, and innovation, including the handicraft and potable water sectors of the Kingdom of Cambodia.

5.1.1. Management Mechanisms

The Ministry of Industry, Science, Technology, and Innovation's management structure is primarily segregated into three categories:

A. National level units

National level units comprise of the primary ministerial units and departments including:

1. Cabinet of the Ministers
2. General Department of General Affairs
3. General Department of Industry
4. General Department of Small and Medium Enterprise and Handicraft
5. General Department of Clean Water
6. General Department of Science, Technology, and Innovation
7. Institute of Standard of Cambodia
8. Institute of Science, Technology, and Innovation
9. National Metrology Center
10. Inspectorate
11. Department of Internal Audit
12. Provincial and City Technical Authority

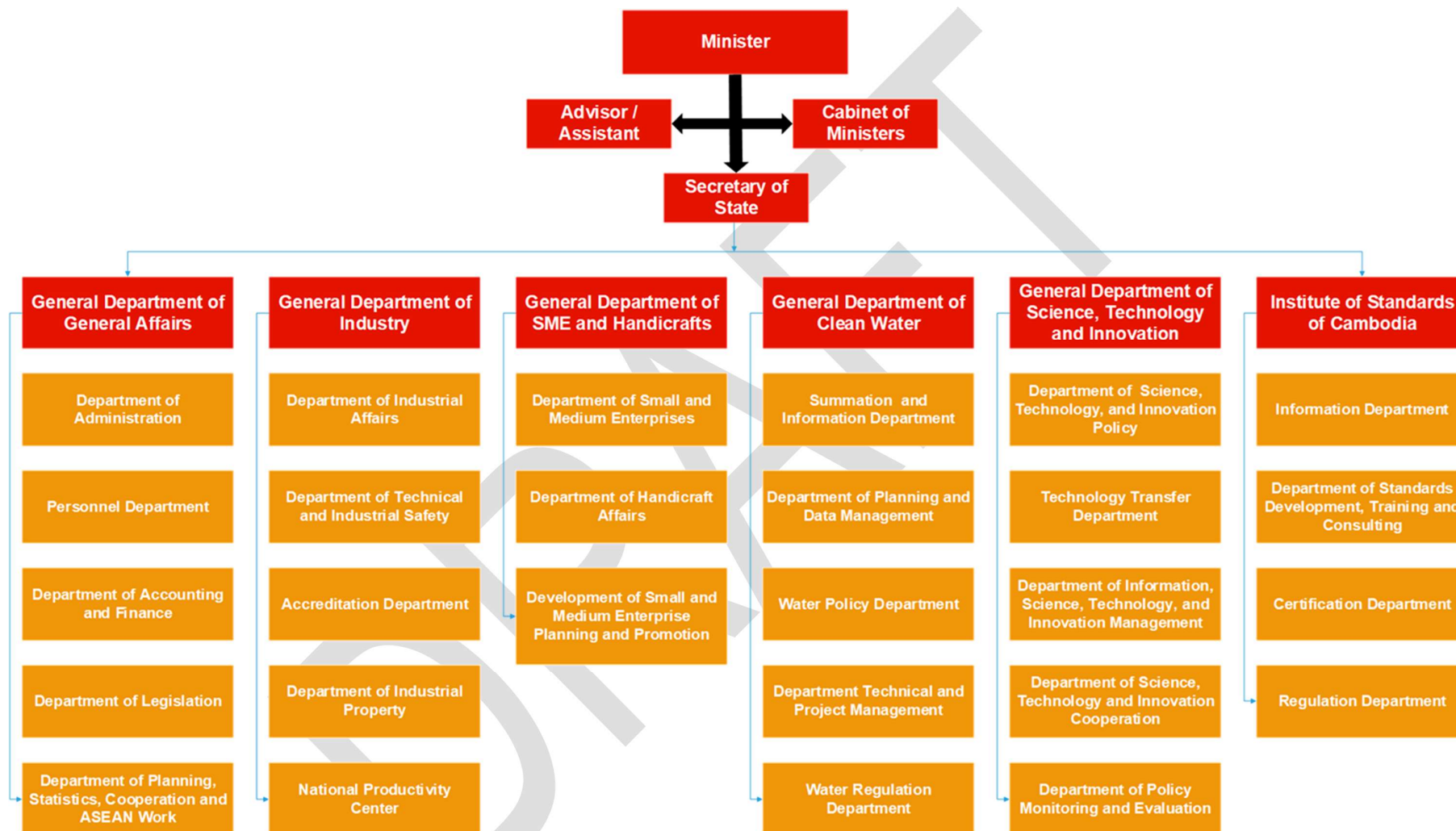
B. Public enterprise or public administrative institution

This category includes Public enterprises or administrative institutions under the technical guardianship of the Ministry of Industry, Science, Technology, and Innovation.

C. Sub-national level units

This category includes Department of Industry, Science, Technology and Innovation's units in cities and provinces. Amongst the general departments the 'General Department of Science, Technology and Innovation' and the 'General Department of Industry' will be the key departments for the implementation of the RECPSAP 2021-2030. Specific aspects related to standards, water and educational capacity building will be governed by the 'Institute of Standard of Cambodia,' 'Department of Water Regulation' and 'National Productivity Centre' respectively. MISTI has formed a technical working group on RECP comprising of representations from all the departments and the Ministry of Environment (MoE)/General Secretariat of National Council for Sustainable Development (GSSD). The TWG will be the central coordinating unit and responsible for overseeing the implementation of RECPSAP 2021-2030. The Figure 49 below illustrates the institutional structure of MISTI.

Figure 49: MISTI institutional structure relevant to RECP Strategy and Action Plan



5.1.2. MISTI Institutional Mechanism on Budgeting

The General Department of General Affairs is responsible for the budgeting aspects including the following functions:

1. Raise the budget of the Ministry and monitor the implementation of the budget
2. Concentrate, managing and coordinating all expenditures of the Ministry according to the budget, including public procurement work
3. Gather needs, develop expenditure programs, manage the preparation and repair of materials and equipment of the Ministry

The program budgeting aspects are not governed by MISTI and hence investment/capital budgets are managed through a project modality. A 3-Year Rolling Public Investment Plan (PIP) is prepared by the General Department of General Affairs annually for submission to the Ministry of Planning (MoP). The PIP is primarily externally funded through projects, with some funding accessed from domestic sources. Resource mobilisation is accomplished through direct bilateral discussions with development partners such as UNIDO, UNDP, ADB and The World Bank.

Further for financial supervision and coordination, the Financial Supervision Unit under the Inspectorate was established by the Minister of Economy and Finance in accordance with the provisions of the regulation set in Sub-Decree No. 81 OrNKr.BK dated 16 November 1995 on the Establishment of Financial Supervision Institutions on Budget Expenditures in Ministries.

5.2. Analysis of potential sources and volume of finance for RECP actions

Majority of the RECP SAP strategic objectives and subsequent activities are designed to either internalise efforts by developing existing ministerial capacity or to externally coordinate with development partners for support. Despite the strategic design and considering the economic impact of the COVID-19 pandemic, the financial demand is expected to remain high.

Future resource mobilisation will focus on a balanced mix of national and international funds along with innovative market mechanisms. It will also be crucial for the implementation of RECP SAP that its actions and investment commitments are integrated in the next three-year rolling Public Investment Program (PIP) and derives adequate adjacent investment support from the existing PIP 2020-2022.

Since RECP interventions are associated with improved productivity, reduction in costs and improved profits, industries will be motivated through techno-feasibility assessments and awareness creation programs to mobilise private sector financing. Ministry will apprise industries of the benefits of investing in RECP interventions and handhold them for implementation through various technical and incubation support. Further, the ministry through active coordination with regional and international financial institutions will develop financial support schemes to assist industries and service providers in accessing credit lines for adopting RECP technical interventions.

The ministry will actively explore the following potential funding sources to enhance its annual budgets:

Table 9: Potential funding sources

| Sr. No. | Source | Potential modes |
|---------|-------------------------|---|
| 1. | National public sources | <ul style="list-style-type: none"> • National budget allocations to MISTI • Cambodia Joint SDG Fund |

| Sr. No. | Source | Potential modes |
|---------|-------------------------------|---|
| 2. | National private sources | <ul style="list-style-type: none"> Private sector investments based on improved productivity and increased profit margins Commercial Banks as intermediaries for administering Concessional Credit lines supported by Multilateral Agencies |
| 3. | International sources | <ul style="list-style-type: none"> Green Climate Fund (GCF) The Global Environment Facility (GEF) fund allocations Donors (multilateral and bilateral donors) including ADB, AFD, EBRD, EU, GGGI, IFC, JICA, KOICA, OECD, Sida, USAID, World Bank Insurance and sovereign wealth funds Climate investment funds (CIF) The Global Climate Partnership Fund (GCPF) Corporate Social Responsibility Funds |
| 4. | International private sources | <ul style="list-style-type: none"> Brands with sustainability mandates such as global garment brands and FMCG firms procuring from Cambodia. |

5.3. Entry points for RECP mainstreaming in management and financing mechanisms

Defined actions and indicators for the RECP SAP 2021-2030, shall be included in the annual revision of the PIP, starting in 2022 for the 2023-2026 period. The technical working group with the support from the General Department of General Affairs will be responsible for the integration.

At the ministerial project level, it will be critical to mainstream RECP agenda and criteria in various budgeting and departmental functions. Post the completion of the timeline of the RECP SAP, various RECP functions shall be distributed amongst departments for future work and project management. It will be ensured that post the working duration of the technical working group, a department is transferred the overall management of the RECP and Sustainable industry related portfolio.

There is currently no significant domestic capital budget (except for counterpart funds) allocated to the ministry, hence when MISTI adopts a program-based budget, RECP actions shall be included in the program budgets for co-funding through the national budget.

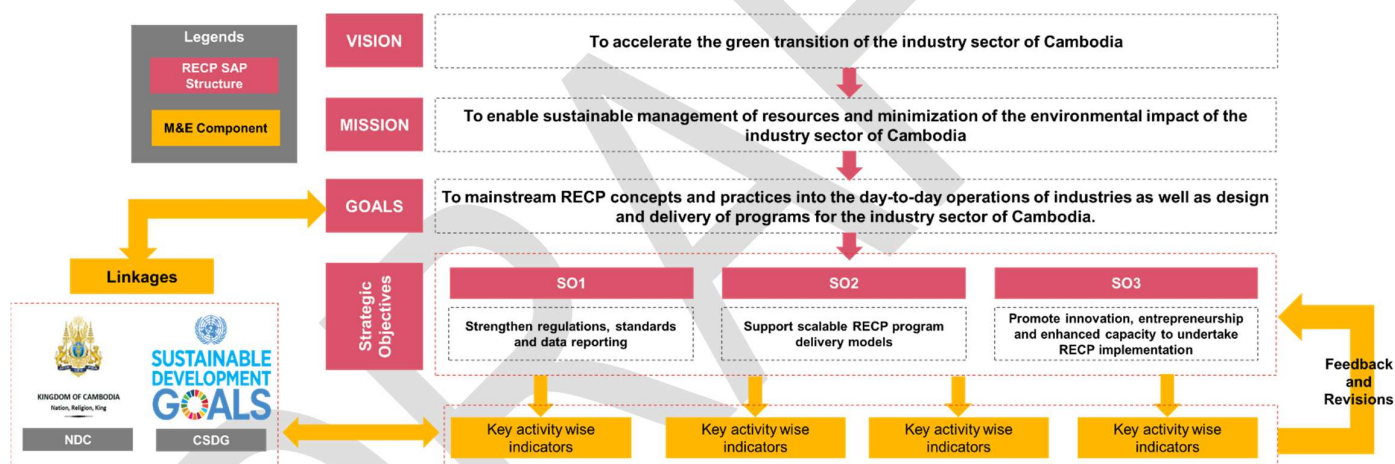
6. Monitoring and Evaluation

This chapter presents the Monitoring and Evaluation (M&E) framework of the **Resource Efficiency and Cleaner Production Strategy and Action Plan for Industry and SME Sector 2021-2030**. The M&E framework of RECPSAP follows the guidelines of Ministry of Planning in its working paper - 'Monitoring And Evaluation: An Approach To Strengthen Planning In Cambodia'. The M&E framework has been designed using a 'logical framework' approach, with quantifiable indicators for inputs, outputs, outcomes, and impact. It gives due emphasis to the linkages of the actions with Cambodia's sustainable development goals (CSDGs) and NDC commitments and could potentially be used by MISTI for NDC and CSDG reporting as well.

6.1. Indicators for RECP Action Plan

Figure 50, presents the monitoring and evaluation framework of the RECPSAP. The RECPSAP has adopted M&E indicators from Cambodia's national policies and international commitments relevant to MISTI's mandate. The progress against the indicators in the M&E framework will be reviewed annually to analyse the implementation status and challenges and be used to make course corrections, as required.

Figure 50: RECP SAP Monitoring and Evaluation Structure



For each action, the responsible department will report progress as per the frequency defined by the technical working group. The implementing departments are expected to refine and mainstream the indicators and targets into their departmental plans.

The M&E will be based on the following indicator framework:

Table 10: RECP SAP indicator matrix

| Sr. No. | Indicator Type | Purpose | Activity Outputs | Output Indicators | Frequency |
|---------|--|--|---|--|---|
| 1. | RECP delivery and mainstreaming | Tracking the progress of fundamental and structural aspects of RECPSAP implementation. | i) Vision, mission, goals, and strategic objectives ratified | Completion Timeline (Days/Months) | Inception and Bi-annual |
| | | | ii) Actions and implementation timelines ratified | Completion Timeline (Days/Months) | |
| | | | iii) Institutional and collaboration framework mobilised | <ul style="list-style-type: none"> All stakeholders apprised of responsibilities (Yes/No) Collaboration channel/platform formed (Yes/No) | |
| | | | iv) Gender considerations mainstreamed | <ul style="list-style-type: none"> Number of gender related actions prioritised Gender disaggregated (Female/Male/Others) data maintained for capacity building and awareness creation actions | |
| | | | v) Funds mobilised | <ul style="list-style-type: none"> Financing modalities identified and mobilised Activity wise funds disbursed (% of total requirement) | |
| 2. | Institutional readiness | Tracking progress in improving institutional capacities including the ability to mainstream RECP | i) Capacity needs of departments analysed and upgraded as per the institutional framework | <ul style="list-style-type: none"> Internal discussions conducted to analyse departmental capacity Requested resources mobilised to improve capacity for RECP actions | Inception and Bi-annual; As per PIP cycle |

| Sr. No. | Indicator Type | Purpose | Activity Outputs | Output Indicators | Frequency |
|---------|------------------------|---|--|---|---|
| | | into ministerial and budget and departmental plans. | ii) Integration of RECP in ministerial and departmental budgets | <ul style="list-style-type: none"> Number of RECP actions adopted and integrated with financial commitments Number of RECPSAP actions adopted in PIPs | |
| 3. | Action outcomes | Assessing the results of actions | Framework is detailed in Table 11 | | Annual or as required by the nature of action |
| 4. | Impact | Assessing the progress towards the implementation of goals and strategic objectives | To mainstream RECP concepts and practices into the day-to-day operations of industries as well as design and delivery of programmatic interventions for the industry sector of Cambodia. | <ul style="list-style-type: none"> Percent of large industries and SME with RECP actions implemented with sub sectoral segregations such as garments, beverages, rubber processing, etc. (%) SDGs Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all <p>Target 8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead</p> <p>Indicator 8.4.1: Material footprint, material footprint per capita, and material footprint per GDP</p> | Annual |

| Sr. No. | Indicator Type | Purpose | Activity Outputs | Output Indicators | Frequency |
|---------|----------------|---------|------------------|---|-----------|
| | | | | <p>Indicator 8.4.2: Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP</p> <ul style="list-style-type: none"> • SDGs Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation <p>Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities</p> <p>Indicator 9.4.1: CO₂ emission per unit of value added</p> <ul style="list-style-type: none"> • SDGs Goal 12. Ensure sustainable consumption and production patterns <p>Target 12.1: Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries</p> <p>Indicator 12.2.1: Material footprint, material footprint per capita, and material footprint per GDP</p> | |

| Sr. No. | Indicator Type | Purpose | Activity Outputs | Output Indicators | Frequency |
|---------|----------------|---------|------------------|--|-----------|
| | | | | <p>Indicator 12.2.2: Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP</p> <ul style="list-style-type: none"> • NDC: Reduce 58% (in contribution) of the IPPU emissions from 13.9 MtCO₂e (BAU 2030) to 5.9 MtCO₂e (NDC 2030) • NDC: Promote sustainable energy practices in manufacturing - Garments: 2,291 GgCO₂e, 55% by 2030 • NDC: Centralized recycling facility for industrial waste from the garment sector - Reduce 108,472 tCO₂e/at an average of 10,847 tCO₂e/year • NDC: Promote sustainable energy practices in manufacturing - Food and Beverage: 1,043 GgCO₂e, 25% by 2030 • NDC: Better management of industrial wastewater in the food & beverage sector - 5-10% of total CH₄ emissions | |

The Table 11 below details the action indicator matrix:

Table 11: Actions indicator matrix

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|---------|---|---|---|---|--|
| SO1 | Strengthen regulations, standards, and data reporting | | | | |
| 1. | Develop regulations for voluntary self-reporting of industrial data | Guidelines for voluntary self-reporting of industrial data through online portal developed | i.Functioning of Global reporting platforms such as HIGG index, IPE analysed. (Yes/No) ii.Number of consultations conducted with global brands to determine their reporting requirements iii.Number of Consultations conducted with local industries iv.Developed regulatory and economical provisions to support self-reporting. (Yes/No) | i.Number of platforms analysed – 2 ii.Number of international brands consulted – 5 iii.Number of local industries consulted – Atleast 3 each in the nine subsectors (Across small, medium and large industrial units) iv.Yes | Goal 12. Ensure sustainable consumption and production patterns Target 12.6 Indicator 12.6.1 |
| 2. | Develop guidelines to establish consumption-based pricing of ground water for Industry and SME Sector | Guidelines established for consumption-based pricing of industrial ground water abstraction. | Guidelines established (Yes/No) | Yes | Goal 6. Ensure availability and sustainable management of water and sanitation for all Target 6.4 Indicator 6.4.1 Indicator 6.4.2 |
| 3. | Develop standards for the use of remanufactured or recycled materials in the industrial process as raw material/ feedstock | Minimum standards for the use of remanufactured or recycled materials in the industrial process as raw material/ feedstock established | i.Sub-sectors analysed (Yes/No) ii.Minimum standards established (Yes/No) | i.Yes ii.Yes | Goal 12. Ensure sustainable consumption and production patterns Target 12.5 Indicator 12.5.1 |

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|---------|--|---|---|----------------------------|--|
| 4. | Establish S&L guidelines and MEPS for industrial equipment, followed by regulations to support the planning, development, and implementation of Eco-labelling | i. S&L guidelines and MEPS for industrial equipment established. ii. Regulations to support planning, development and implementation of Eco-labelling created. | i.Guidelines established for S&L for industrial equipment (Yes/No) ii.MEPS for industrial equipment established and enforced (Yes/No) iii.Regulations to support planning, development and implementation of Eco-labelling established (Yes/No) | i.Yes ii.Yes iii.Yes | Goal 12. Ensure sustainable consumption and production patterns Target 12.7 Indicator 12.7.1 |
| 5. | Develop Standards for industrial machinery safety | Industrial machinery safety standards developed | Standards industrial equipment safety (Yes/No) | Yes | Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all Target 8.8 Indicator 8.8.1 Indicator 8.8.2 |
| 6. | Develop Regulations on implementation of Globally Harmonized System for Industrial Chemical management | List of banned or severely restricted industrial chemicals developed and updated under the Rotterdam Convention. | List of industrial chemicals compiled and submitted under the Rotterdam Convention (Yes/No) | Yes | Goal 12. Ensure sustainable consumption and production patterns Target 12.4 Indicator 12.4.2 |
| | | Regulations to guide the chemical use and management in industries developed. | i.Consumer use of chemicals assessed in industries (Yes/No): ii.Regulations established (Yes/No) | i.Yes ii.Yes | |

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|------------|--|---|--|---|--|
| 7. | Regulation on the phasing out of Single Use Plastic in Industries | Regulations established on phasing out of single-use plastic products in industries | i. Identified the most problematic single-use plastics and their current causes (Yes/No) ii. Assessed the extent of impact and concerned geographical and ecological ecosystems (Yes/No) iii. Evaluated consumers' willingness to pay for SUPs, MUPs and any relevant alternatives (Yes/No) iv. Consultations and workshops conducted with industries to determine their transition gaps and requirements | i. Yes ii. Yes iii. Yes iv. At least 2 consultation workshops covering the nine subsectors (Across small, medium and large industrial units) – | Goal 12. Ensure sustainable consumption and production patterns Target 12.4 Target 12.5 Indicator 12.5.1 |
| SO2 | Support scalable RECP program delivery models | | | | |
| 8. | Program based support for transformation of Industrial Zones (located in SEZ's) into eco-industrial parks | Program based support for transformation of Industrial Zones into EIPs developed | i. Capacity building of MISTI, CDC, SEZ Boards and Industry owners with regard to EIP conducted. (Yes/No) ii. RECP audits, identification of opportunities for unit level RECP interventions, zone level industrial symbiosis projects and preparation of feasibility studies conducted. (Yes/No) iii. Number of sub-decree and guidelines to transform | i. Yes ii. Yes iii. 1 sub-decree/guidelines iv. Yes | Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation Target 9.4 Indicator 9.4.1 |

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|---------|--|--|---|---|--|
| | | | industrial zones into EIP developed. iv. Metrics for monitoring and evaluation established (Yes/No) | | |
| 9. | Design and operationalization of an industrial RECP program | Industrial RECP program developed and operationalised. | i. Targeted overall participation of industries ii. Number of RECP audits conducted to estimate the baseline level of resource efficiency, the improvement potential and investment need for Resource Efficient technologies iii. Unit level targets for resource efficiency set (Yes/No) iv. Concessional loan scheme and a risk sharing scheme for industries/ESCOs launched. (Yes/No) v. Online portal for reporting industry unit level data launched. (Yes/No) vi. Number of workshops conducted to disseminate the outcomes achieved to the relevant stakeholders vii. Number of awareness creation databases created for RECP viii. | i. 100 industrial units (Across small, medium and large industrial units) ii. At least 80 baseline audits conducted in the nine subsectors (Across small, medium and large industrial units) iii. Yes iv. Yes v. Yes vi. 1 workshop annually vii. 1 RECP knowledge database | Goal 6. Ensure availability and sustainable management of water and sanitation for all Target 6.4 Indicator 6.4.1 Indicator 6.4.2 Indicator 6.b Indicator 6.b.1 Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all Target 7.1 Indicator 7.1.2 Target 7.2 Indicator 7.2.1 Target 7.3 Indicator 7.3.1 Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all Target 8.4 |

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|---------|--|---------|-------------------|---------|--|
| | | | | | <p>Indicator 8.4.1 Indicator 8.4.2</p> <p>Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation</p> <p>Target 9.2 Indicator 9.2.1 Indicator 9.2.2</p> <p>Target 9.3 Indicator 9.3.1 Indicator 9.3.2 Target 9.4 Indicator 9.4.1</p> <p>Goal 12. Ensure sustainable consumption and production patterns</p> <p>Target 12.2 Indicator 12.2.1 Indicator 12.2.2 Target 12.4 Indicator 12.4.2 Target 12.6 Indicator 12.6.1</p> |
| SO3 | Promote innovation, entrepreneurship, and enhanced capacity to undertake RECP implementation | | | | |

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|---------|--|---|---|--|--|
| 10. | Strengthen the National Cleaner Production Offices at the National level and Subnational to undertake training and awareness raising programs on RECP | RECP interventions mainstreamed in NCPO's sectoral plans and specific RECP programs launched. | i. Number of trainings conducted on RECP. ii. Open Access IT portal created to act as a repository of RECP related policies and regulations at the national level and international case studies and best practices. (Yes/No) iii. Number of awareness creation programs created. | i. At least 2 training programs annually and At least 10% female participants completing training sessions. ii. Yes iii. At least 2 awareness raising programs launched. | Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all Target 4.3 Indicator 4.3.1 Target 4.5 Indicator 4.5.1 Target 4.7 Indicator 4.7.1 Goal 12. Ensure sustainable consumption and production patterns Target 12.8 Indicator 12.8.1 Goal 13. Take urgent action to combat climate change and its impacts Target 13.3 Indicator 13.3.1 |
| 11. | Develop an ESCO incubation facility | The ESCO incubation facility launched and operationalised. | i. Model energy service performance contracts for ESCOs developed. (Yes/No) ii. Technical experts deputed (Yes/No) | i. Yes ii. At least 1 expert deputed. | - |
| 12. | | RECP performance metrics integrated as | RECP Metrics mainstreamed (Yes/No) | Yes | - |

| Sr. No. | RECP Actions | Outputs | Output Indicators | Targets | SDG Indicators |
|---------|---|---|--|--------------------------------------|----------------|
| | Develop Green Industry Awards for Industry and SME in Cambodia | a criterion in the Green Industry Award | | | |
| | | Annually reward mechanism for industries launched | Reward program launched (Yes/No) | Yes | - |
| | | National recognition for sustainability-oriented corporates/brands as a part of the Green Industry Awards | % of industries participating in the award program | Large Industries - 50% SMEs – 50% | - |

7. Conclusion

The Ministry of Industry, Science, Technology, and Innovation (MISTI) as the nodal ministry for industrial development in Cambodia, has put forth this **Resource Efficiency and Cleaner Production Strategy and Action Plan for Industry and SME Sector 2021-2030** to guide the Cambodian industries towards enhancing their productivity, achieve sustainability and gain international competitiveness.

The rapid industrialisation of the Cambodian economy underscores the need for necessary RECP interventions to incorporate sustainable resource use for Cambodia to achieve its economic growth targets without causing harm to the environment. The implementation of the RECP interventions will help the industrial ecosystem to reduce 6.34 Million Tonnes CO₂eq of emissions and save 15 TWh of energy (thermal + electrical) and 888 Million cubic meters of water by 2030.

The aim of the strategic action plan will be to provide the framework for, and ensure the implementation of, sound and sustainable industrial practices, including a realistic, coherent, and implementable policy ecosystem on enabling RECP. The RECP implementation in Cambodia's industries will maximise the RGC's objectives to enhance industrial production efficiency, improve environmental conservation and support human development. Along with the national agenda on sustainability, the strategic action plan will support RGC in fulfilling its agenda on the UN Sustainable Development Goals (SDGs). The relevant SDGs include:

| | |
|------|---|
| SDGs | Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all |
| | Goal 6. Ensure availability and sustainable management of water and sanitation for all |
| | Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all |
| | Goal 8. Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all |
| | Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation |
| | Goal 12. Ensure sustainable consumption and production patterns |
| | Goal 13. Take urgent action to combat climate change and its impacts |

The strategic action plan envisages a leading role for the private sector industries to adopt and promote RECP interventions. Private sector including the large industries and SMEs will be motivated through various capacity building and incentives programs for scaling up RECP interventions and solutions. RECPSAP 2021-2030 will ensure mainstreaming of gender-sensitivity and integration of backward communities throughout the implementation and will abide by the gender promotion aspects prescribed in various policy guidelines of the RGC.

8. Annexure I: Stakeholder consultations conducted as part of the RECP SAP 2021-2030

The RECP SAP 2021-2030's analysis and development has emphasised on developing close interactions with relevant industry and sustainability stakeholders. The summary of stakeholder consultations including key objectives and outcomes are presented below:

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|--------------------------|--------------|--|---|
| 1. | 10.12.2020 | Stakeholder Consultation | MoE and NCSD | Discuss existing and planned policies and regulations on sustainable use of resources and progress on international commitments. | <ul style="list-style-type: none"> a) Industrial data reporting need to be strengthened across multiple sectors with a wider coverage of resource efficiency metrics. b) MoE is developing a 'Sub-decree on self-reporting'. As per the sub-decree, the industries will have to set-up self-reporting systems, which will regularly send the required environmental data to the concerned ministries. c) In 2021, MoE will revise sub-decree on air pollution control. While there is no specific standard so far on the emissions from Industrial boilers, the new sub-decree will try to incorporate this aspect by setting appropriate emission standard for industries. d) Sub-decree related to water quality and management is undergoing amendments. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|--------------------------|---|--|---|
| 2. | 16.12.2020 | Stakeholder Consultation | Ministry of Mines and Energy (MME) | Discuss initiatives around monitoring energy use in industries, reporting gaps, training, and capacity building needs | <ul style="list-style-type: none"> a) Industrial capacity (Technical and Human) for energy and resource audits needs to be strengthened. b) Cambodia's national policies need to be streamlined and harmonised with the global best practices. c) Incentive structure and policy support around the adoption of RECP need to be developed and strengthened. d) EAC is preparing a Time of the Day tariff and has conducted consultation workshops regarding the adoption of this tariff. This may apply to those companies that use both solar energy and electricity sold by EDC. e) MME together with EDC, EAC and provincial authority are preparing a subsidy program for consumers using less than 10 kWh/month - 380 KHR/kWh, 11 to 50 kWh/month - 480 KHR/kWh, 51 to 200 kWh/month - 610 KHR/kWh from 201 to 2000 kWh/month - 740 KHR/kWh. f) MME is in the process of preparing 'National Energy Efficiency policy' and 'Draft Climate Change Action Plan for Energy Sector' g) Plan for MEPs of industrial equipment may be led by the Department of Industrial Techniques, MISTI |
| 3. | 16.12.2020 | Stakeholder Consultation | United Nations Development Programme (UNDP) | Discuss challenges and opportunities in introducing resource efficiency in the Cambodian industries and industrial sectors with high potential; and gaps around SDGs reporting and | <ul style="list-style-type: none"> a) Data reporting around CSDGs need to be strengthened. b) UNDP has plans to implement project on energy management systems in industries as a part of CCCA-III. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|--------------------------|--------------------------------------|--|--|
| | | | | potential ways to strengthen the data reporting | <ul style="list-style-type: none"> c) UNDP is assisting MoE in preparing national policies for circular economy. d) UNDP has, in the past, conducted a small pilot exploring the linkage between behavioural change and Energy efficiency. They are now looking at developing standards and labelling for appliances. |
| 4. | 16.12.2020 | Stakeholder Consultation | Chip Mong Group | Regulatory support required for formalizing waste collection, processing, and disposal | <ul style="list-style-type: none"> a) Only two firms in Cambodia have the permits for collection, transportation, storage, and disposal of industrial waste including Sarom Trading and Chipmong Ecocycle. b) Only one SEZ in Cambodia provides facility for waste management and collection to industries. c) Waste mining from dump site and on-site collection of certain wastes such as plastics can be economically not feasible. d) For solar energy operations, there are regulatory challenges in Cambodia, such as high capacity charge which reduce the commercial attractiveness of solar for industries. |
| 5. | 17.12.2020 | Stakeholder Consultation | Global Green Growth Institute (GGGI) | Discuss business models and potential mechanisms for financing resource efficiency (including carbon market, climate finance etc.) | <ul style="list-style-type: none"> a) Basic performance standards for the industries should be developed. b) Government should support the development of reporting of sustainability metrics for industries. c) Government policies need to be streamlined to promote sustainability interventions such as solar energy or energy efficient equipment. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|--------------------------|--|--|--|
| 6. | 18.12.2020 | Stakeholder Consultation | Garment Manufacturing Association in Cambodia (GMAC) | Challenges associated with implementing RECP interventions, training, and capacity building in the industrial sector. | <ul style="list-style-type: none"> a) Financial support from the Government for capacity building and training program for industries is required. b) Most of the technical and soft skill trainings for industries are conducted by foreign trainers. National human resource capacity needs to be strengthened to act as trainers for industries. c) Post COVID-19, industries might find it prohibitive to invest in RECP without external financial support. d) Sustainability data monitoring and reporting needs to be strengthened. |
| 7. | 21.12.2020 | Stakeholder Consultation | Nexus for Development | Discuss financing challenges associated with Resource efficiency and innovative financing mechanisms. | <ul style="list-style-type: none"> a) Lack of incentives (subsidies and penalties) to motivate industries to transition and adopt RECP. b) Lack of Cambodia based feasibility studies to showcase success stories of investing in renewable energy or resource efficiency. c) Government could streamline policies to develop and strengthen investors' commitment in Cambodia for renewable energy and resource efficiency. |
| 8. | 21.12.2020 | Stakeholder Consultation | SME Bank | Discussion on credit enhancement mechanisms for SMEs in Cambodia and on any special dispensation for disbursing loans to women entrepreneurs in the industrial sector. | <ul style="list-style-type: none"> a) There is a need to demonstrate the feasibility of setting up dedicated financing schemes for resource efficiency, post which commercial banks can start considering such initiatives. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|--------------------------------|---|--|---|
| 9. | 24.12.2020 | MISTI Departments consultation | Departments of MISTI: Department of Industrial Techniques and Safety (DITS); National Productivity Centre of Cambodia (NPCC); Department of SMEs | Discuss departmental initiatives, needs and support from RECP SAP. | <ul style="list-style-type: none"> a) Setting up and managing a database for the certification of industrial equipment such as boilers and motors is a challenge. Also, the systems and methodology for the calculation of GHG emissions from industries need to be developed. b) There is a need to organise more trainings on industrial safety. c) Chemical management is yet to be integrated in MISTI's Prakas or guidelines. d) Existing surveys on resources are insufficient and data reporting need to be strengthened. Specific and detailed data on all kinds of resources is largely missing and such an activity needs setting up of relevant systems in collaboration with other departments. e) Private sector has to be motivated to proactively coordinate with MISTI on the aspects of improving productivity. f) Data around SME operations, workforce and resources consumption is largely missing. |
| 10. | 22.01.2021 | Stakeholder Consultation | EuroCham and Brands (H&M, VFC) | Gather inputs on the support required by the garment and footwears sector on resource efficiency (Energy, Water and Materials Saving). | <ul style="list-style-type: none"> a) Disincentives or penalties for excessive resource consumption such as water could be considered. b) Government support to strengthen interventions around energy efficiency, minimum performance standards, solar rooftops, chemical standards is required. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|---|--|---|--|
| | | | | | <ul style="list-style-type: none"> c) A robust policy framework for implementing sustainability in industries is required. Government could consider streamlining the policies and incentives to promote the adoption of renewable energy in industries. d) Most sustainability initiatives in Cambodia are driven by brands, public sector's capacity could be built to undertake sustainability initiatives. e) Implementation focused policy interventions are required for resource efficiency. f) Public sector financial support is required for sustainability programs. |
| 11. | 17.02.2021 | First Stakeholder Consultation Workshop | 104 participants across various stakeholder groups | Disseminate preliminary results and gather views, needs and support from the RECP SAP | <ul style="list-style-type: none"> a) Develop legal framework for resource efficiency promotion (institutional arrangements, statutory compliance requirements, incentives/rewards, penalties etc.). b) Establish resource consumption reporting system by large factories and SMEs (templates for data reporting). c) Enhance enforcement mechanisms for environmental data reporting by industries and pollution monitoring. d) Promote the adoption of ISO 14001 and other standards and certifications on environmental management. e) Enhance capacity of MISTI departments and industrial and SMEs personnel. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------|---------|-------------|----------------|--|
| | | | | | <ul style="list-style-type: none"> f) Develop awareness of industry associations and units on resource efficiency. g) Conduct regular and accurate testing of boiler emissions by government officials to help drive greater attention on efficiency/ fuel quality and alternatives to biomass. h) Shared Sustainability/ Green incentive for Clusters: Operators must be motivated to reinvest savings/benefits in the Cluster as the upfront financing costs are high & prohibitive. i) Consider SME 4.0 transition funding or subsidy funding loan as a form of “Leapfrog subsidy” to boost next generation of industrial development. j) SME Cluster Committee: Form an inter-ministerial body which can assess and decide Cluster development plans, SME’s incentives eligibility and enforce investors commitment. k) Develop a policy to link all SME Clusters (regardless of developer) as a network to share Cluster resources or outputs. l) Develop a Made in SME Cluster Seal of Quality Assurance. m) Develop regulations for SME Cluster licensing (similar to SEZs) as Manufacturing & R&D investment development vehicles. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------|---------|-------------|----------------|--|
| | | | | | <ul style="list-style-type: none"> n) Establish Law regulating import of industrial chemicals, which would help push importers to pick better chemicals as identified under ZDHC Gateway. o) Establish regulations governing waste disposal options. p) Provide national level recognition for CO₂ emission reduction which enable to drive the climate change action plan. q) Establish a water use pricing through regulation. r) Support shared Environmental Management Planning (EMP) and Environmental Management Contract (EMC) with Cluster Operator as overall responsible party. s) Water: Need supply & discharge standards/ High & inverted rates for industries. Need improved testing facilities. t) Regulatory requirement for installation of continuous monitoring equipment with real time data feed to Environment Ministry. u) Approval for water extraction needs licenses from multiple ministries such as license for extracting from a certain point, license to transport water, license for wastewater treatment and license or certification to distribute and sell clean water either publicly or to industrial use. Licensing process may have single window approval. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------------|--|---|---|---|
| | | | | | v) Improve support for cluster based solar microgrids through FiT, waiver of capacity charge and lower off-peak tariffs for industrial clusters using solar. |
| 12. | 06.07.2021 | Second Stakeholder Consultation Workshop | 72 participants across various stakeholder groups | Sensitize the stakeholders on the key recommendations, receive stakeholder feedback and inputs, build consensus between the Government, Non-government, and Private sector stakeholders | <ul style="list-style-type: none"> a) Industries need assistance to leverage finance from financing institutions for green industrial initiatives. b) The rising fossil fuel (coal) based energy in the energy mix of Cambodia will have a direct impact on the sustainability considerations of the industries. c) The data reporting in industries need comprehensive, government driven technical extension programs and can focus on leveraging existing reporting mechanisms such as the HIGG index and ZDHC portal. d) More initiatives should be taken to promote solar, sustainable energy sources and waste to energy initiatives. |
| 13. | 09.08.2021 | Third Stakeholder Consultation Workshop | 67 participants across various stakeholder groups | Sensitize the stakeholders on the key recommendations, receive stakeholder feedback and inputs, build consensus between the Government, Non-government, and Private sector stakeholders | <ul style="list-style-type: none"> a) The program should see if the concept of Sustainable Product Innovation (SPIN) can be integrated in the RECP SAP 2021-2030. b) The program should highlight any synergies that can be developed with Ministry of Environment's "Single use plastic ban". MOE has recently launched the circular economy and drafting the single use plastic sub-decree to prevent plastic pollution. c) Industry associations expressed their support and readiness to take part in implementing the RECP SAP. |

| Sr. No. | Date | Meeting | Stakeholder | Key Objectives | Outcomes |
|---------|------|--|-------------|----------------|----------|
| 14. | TBD | Fourth Stakeholder Consultation Workshop | - | - | - |

9. Annexure II: Note on sub-sectors selection

The identification of sub-sectors under the sub-sectoral analysis followed a multi-step process based on quantitative and qualitative benchmarking. The methodology selected for identifying sub-sectors is represented below:

Figure 51: Methodology for sub-sector selection



A. Data gathering for sub-sector characterisation

A broad list of initial sub-sectors was compiled based on official statistics of National Institute of Statistics' [50]. Additionally, based on expert consultations – 'Manufacturing of electrical equipment' and 'Manufacturing of transport equipment' were included as emerging economic sectors of the Cambodian economy. To gather data for identified relevant sub-sectors, NIS statistics, MISTI's annual data reports and stakeholder consultations were utilised. Identified parameters are presented below:

Table 12: Sub-sector wise data gathered

| Sr. No. | Sub-sectors | Number of industries (2019) [51] | Average GDP Contribution (2018-19) | Export sales Mn USD (2019) [52] | Cumulative Sales - Exports + Local (2019) |
|---------|--|----------------------------------|------------------------------------|---------------------------------|---|
| 1. | Agro Processing (covering Cassava and Rubber) | 1,188 | 4.5% | 899.00 | 964.56 |
| 2. | Construction materials (covering Cement and Clay Brick) | 500 | 9.0% | 75.98 | 445.47 |
| 3. | Food and Beverages (covering Rice Milling and Beverages) | 38,775 | 2.3% | 243.39 | 1,475.60 |

⁵⁰ NIS - <https://www.nis.gov.kh/index.php/en/21-na>

⁵¹ Number of industries include both large and SMEs

⁵² Export sale values are based on available data from large industries

| Sr. No. | Sub-sectors | Number of industries (2019) [⁵¹] | Average GDP Contribution (2018-19) | Export sales Mn USD (2019) [⁵²] | Cumulative Sales - Exports + Local (2019) |
|---------|---|---|------------------------------------|--|---|
| 4. | Manufacture of fabricated metal products, except machinery and equipment | 119 | 0.3% | 33.71 | 456.94 |
| 5. | Manufacturing of electrical equipment | 537 | <0.2% | 482.53 | 537.70 |
| 6. | Manufacturing of transport equipment | 149 | <0.2% | 373.52 | 1,102.94 |
| 7. | Manufacturing of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | 317 | 0.5% | 107.65 | 107.92 |
| 8. | Paper and paper products | 259 | 0.5% | 56.66 | 150.17 |
| 9. | Textile, wearing apparel and footwear (covering Garments and Footwear) | 4,331 | 10.2% | 4,519.86 | 4,745.16 |

B. Strategic analysis of sub-sector's coverage in national policies

Various national policies were analysed with a special focus on NDCs and Industrial Development Policy to ascertain coverage of those sub-sectors. Sub-sectors with clear actions and coverage were rated "high" and sub-sectors without specific policy focus were assigned "low":

Table 13: Analysis of sub-sector's coverage in national policies

| Sr. No. | Sub-sectors | Linkages with national policies |
|---------|--|---------------------------------|
| 1. | Agro Processing (covering Cassava and Rubber) | High |
| 2. | Construction materials (covering Cement and Clay Brick) | High |
| 3. | Food and Beverages (covering Rice Milling and Beverages) | High |
| 4. | Manufacture of fabricated metal products, except machinery and equipment | Low |
| 5. | Manufacturing of electrical equipment | High |

| Sr. No. | Sub-sectors | Linkages with national policies |
|---------|---|---------------------------------|
| 6. | Manufacturing of transport equipment | Low |
| 7. | Manufacturing of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | High |
| 8. | Paper and paper products | Low |
| 9. | Textile, wearing apparel and footwear (covering Garments and Footwear) | High |

C. Qualitative rating of sub-sectors on Energy, waste, and resource indicators

Based on expert interviews, qualitative assessments were conducted for categorising sub-sectors on their Energy, Waste and Resource intensity performance:

Table 14: Sub-sector categorisation based on Energy, Waste and Resource intensity performance

| Sr. No. | Sub-sectors | Energy Intensity | Resource intensity | Waste intensity |
|---------|--|------------------|--------------------|-----------------|
| 1. | Agro Processing (covering Cassava and Rubber) | Medium | Low | Low |
| 2. | Construction materials (covering Cement and Clay Brick) | High | Medium | Medium |
| 3. | Food and Beverages (covering Rice Milling and Beverages) | High | High | High |
| 4. | Manufacture of fabricated metal products, except machinery and equipment | High | Medium | Medium |
| 5. | Manufacturing of electrical equipment | High | Medium | Medium |
| 6. | Manufacturing of transport equipment | Medium | Medium | Medium |

| Sr. No. | Sub-sectors | Energy Intensity | Resource intensity | Waste intensity |
|---------|---|------------------|--------------------|-----------------|
| 7. | Manufacturing of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | Medium | Medium | Medium |
| 8. | Paper and paper products | Medium | High | High |
| 9. | Textile, wearing apparel and footwear (covering Garments and Footwear) | High | High | High |

D. Developing a scoring matrix

Each of the sub-sectors were scored based on a numerical indicator as represented below:

Table 15: Scoring matrix

| Sr. No. | Parameters | Ratings and Scoring indicators | | |
|---------|---|--------------------------------|-----------------------|-------------------|
| | | High (15 Points) | Medium (10 Points) | Low (5 Points) |
| 1. | Number of Industries (2019) | Above 1000 | 500 to 1000 | Below 500 |
| 2. | Average GDP Contribution (2018-19) | Above 4% | 1% - 4% | Below 1% |
| 3. | Export sales Mn USD (2019) | Above 500 | 100 to 500 | Below 100 |
| 4. | Cumulative Sales - Exports + Local (2019) | Above 1000 | 400 to 1000 | Below 400 |
| 5. | Strategic Context | As per specified rating | | |
| 6. | Energy Intensity | As per specified rating | | |
| 7. | Resource intensity | As per specified rating | | |
| 8. | Waste intensity | As per specified rating | | |

The sub-sectoral rankings were analysed as per the numerical indicators and are represented below:

Table 16: Sub-sector rankings based on the conducted analysis

| Ranking | Sub-sectors | Number of industries (2019) | Average GDP Contribution (2018-19) | Export sales Mn USD (2019) | Cumulative Sales - Exports + Local (2019) | Strategic Context | Energy Intensity | Resource intensity | Waste intensity | Total Score |
|---------|---|-----------------------------|------------------------------------|----------------------------|---|-------------------|------------------|--------------------|-----------------|-------------|
| 1. | Textile, wearing apparel and footwear (covering Garments and Footwear) | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 120 |
| 2. | Food and Beverages (covering Rice Milling and Beverages) | 15 | 10 | 10 | 15 | 15 | 15 | 15 | 15 | 110 |
| 3. | Construction materials (covering Cement and Clay Brick) ^[53] | 10 | 15 | 5 | 10 | 15 | 15 | 10 | 10 | 90 |
| 4. | Agro Processing (covering Cassava and Rubber) ^[53] | 15 | 15 | 15 | 10 | 15 | 10 | 5 | 5 | 90 |
| 5. | Manufacture of fabricated metal products, except machinery and equipment | 10 | 5 | 10 | 10 | 15 | 15 | 10 | 10 | 85 |
| 6. | Manufacturing of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials | 10 | 5 | 10 | 5 | 15 | 10 | 10 | 10 | 75 |
| 7. | Manufacturing of transport equipment | 5 | 5 | 10 | 15 | 5 | 10 | 10 | 10 | 70 |
| 8. | Paper and paper products ^[53] | 5 | 5 | 5 | 5 | 5 | 10 | 15 | 15 | 65 |
| 9. | Manufacturing of electrical equipment ^[53] | 5 | 5 | 5 | 10 | 5 | 15 | 10 | 10 | 65 |

E. Identification of audit reports for detailed sub-sector analysis

⁵³ In the case of sub-sectors which have received similar final score, the sub-sector which has the higher score for energy, waste and resource intensity is given higher priority.

Availability of energy audits reports/cleaner production assessment reports was a key factor in the selection of final sub-sectors for detailed analysis. Due to their nascency, the audit reports for the 'Manufacture of fabricated metal products, except machinery and equipment'; 'Manufacturing of transport equipment'; 'Manufacturing of wood and of products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials'; and 'Manufacturing of electrical equipment' were found to be not available. The four sectors were excluded, and the following table represents the list of sub-sectors selected for detailed analysis [54]:

Table 17: Sub-sectors selected for detailed analysis

| Ranking | Sub-sectors | Number of industries (2019) | Average GDP Contribution (2018-19) | Export sales Mn USD (2019) | Cumulative Sales - Exports + Local (2019) | Strategic Context | Energy Intensity | Resource intensity | Waste intensity | Total Score |
|---------|--|-----------------------------|------------------------------------|----------------------------|---|-------------------|------------------|--------------------|-----------------|-------------|
| 1. | Textile, wearing apparel and footwear (covering Garments and Footwear) | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 120 |
| 2. | Food and Beverages (covering Rice Milling and Beverages) | 15 | 10 | 10 | 15 | 15 | 15 | 15 | 15 | 110 |
| 3. | Construction materials (covering Cement and Clay Brick) | 10 | 15 | 5 | 10 | 15 | 15 | 10 | 10 | 90 |
| 4. | Agro Processing (covering Cassava and Rubber) | 15 | 15 | 15 | 10 | 15 | 10 | 5 | 5 | 90 |
| 5. | Paper and paper products | 5 | 5 | 5 | 5 | 5 | 10 | 15 | 15 | 65 |

⁵⁴ **NOTE:** It should be noted that the RECP SAP 2021-2030 through various actions gives special emphasis on expanding the RECP based audits and industrial data reporting for various sub-sectors and further identifies the need to expand the list of sub-sectors in the medium term.

