October
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PHNOM PENH WASTE MANAGEMENT STRATEGY AND ACTION PLAN 2018-2035

Editorial Team

Waste Management Strategy and Action Plan for Phnom Penh 2018-2035 is the result of the collaboration between the Waste Management Division of Phnom Penh Capital Administration (PPCA) and a team of experts from the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET) at the Institute for Global Environmental Strategies (IGES), Japan and Nexus for Development (Nexus), and Cambodian Education and Waste Management Organization (COMPED).

The contents of the Waste Management Strategy were drafted based on consultations with a broad range of stakeholders, including representatives of the PPCA, Phnom Penh Khan and Sangkat authorities, relevant line departments of ministries of the Royal Government of Cambodia (RGC), development partners, NGOs, academia, etc. The strategy development project is a joint-project by United Nations Environment Programme (UN Environment) and Cambodia Climate Change Alliance (CCCA) trust facility managed by the General Secretariat of the National Council for Sustainable Development (NCSD).

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Waste Management Strategy and Action Plan of Phnom Penh 2018-2035

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ADB	Asian Development Bank
AFD	Agence Française de Développement (French Development Agency)
CCET	IGES Centre Collaborating with UNEP on Environmental Technologies
C&D	Construction and Demolition
CCCSP	Cambodian Climate Change Strategic Plan
CEA	Cambodia Environmental Association
CER	Certified Emission Reductions
COMPED	Cambodian Education & Waste Management Organization
CRC	Cambodian Red Cross
DANIDA	Danish International Development Agency
DoE	Department of Environment
DoEYS	Department of Education, Youth and Sports
DEF	Department of Economy and Finance
DLMUPC	Department of Land Management, Urban Planning and Construction
DoH	Department of Health
DoIH	Department of Industry and Handicraft
DPWT	Department of Public Works and Transport
EEE	Electrical and Electronic Equipment
E-Waste	Waste Electrical and Electronic Equipment
GCF	Global Climate Fund
GDP	Gross Domestic Product
GHG	Green-house Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German Corporation for International Cooperation GmbH)
GWP	Global Warming Potential
HCW	Healthcare Waste
IGES	Institute for Global Environmental Strategies
IFAD	International Fund for Agricultural Development
IFC	International Finance Cooperation
JCM	Joint Crediting Mechanism
JICA	Japan International Cooperation Agency
Kg	Kilogram
KOICA	Korea International Cooperation Agency

L	Litre
LGCC	Local Governments and Climate Change
MAFF	Ministry of Agriculture, Forestry and Fisheries
M/D	Municipality and Districts
MEF	Ministry of Economy and Finance
MFAT	Ministry of Foreign Affairs and Trade (New Zealand)
MLMUPC	Ministry of Land Management Urban Planning and Construction
MME	Ministry of Mines and Energy
MoC	Ministry of Commerce
MoE	Ministry of Environment
MoEYS	Ministry of Education, Youth and Sports
MoEF	Ministry of Economic and Finance
MoH	Ministry of Health
MoI	Ministry of Interior
MoIH	Ministry of Industry and Handicraft
MPP	Municipality of Phnom Penh
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MWMU	Medical Waste Management Unit
NCCC	National Climate Change Committee
NCGG	National Council on Green Growth
NCDD	National Committee for Sub-national Democratic Development
NCSD	National Council for Sustainable Development
NGO	Non-government Organisation
NORAD	Norwegian Agency for Development Cooperation
NSDP	National Strategic Development Plan
PA	Provincial Administration
PFI	Private Finance Initiative
PET	Polyethylene Terephthalate
PDCA	Plan-Do-Check-Action
POPs	Persistent Organic Pollutants
PPCA	Phnom Penh Capital Administration
PPCC	Phnom Penh Capital City
PPCH	Phnom Penh Capital Hall

PPUTMP	Phnom Penh Urban Transport Master Plan
PPP	Public-Private Partnership
PPSEZ	Phnom Penh Special Economic Zone
PSP	Private Sector Participation
RGC	Royal Government of Cambodia
SDG	Sustainable Development Goals
SIDA	Swedish International Development Cooperation Agency
SNAs	Sub-national Authorities
STT	Sahmakum Teang Tnaut (NGO)
t	tonne / metric ton (10^3kg)
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNEP	United Nations for Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UPWD	Urban Poor Women Development
USAID	United States Agency for International Development
USD	United States Dollar
WEEE	Waste Electrical and Electronic Equipment
Yr	Year

FOREWORD

Forward Message for Phnom Penh Waste Management Strategy

In Phnom Penh's Master Plan on Land Use 2035 – the guiding policy document for its mid-to-long term development, the PPCA has envisioned the city to become a competitive political, economic, business and cultural center of Cambodia with sustainable and equitable development. While the realisation of this vision largely depends on how we can organize ourselves as individuals and as society in many front, the waste sector undoubtedly plays an important role towards establishment of sustainable society.

Just like in any city, the waste management has always been a major societal issue for Phnom Penh. As explained in the strategy, the monthly amount of disposed waste at the landfill more than doubled in the past decade, owing to factors such as population growth, economic growth, change in industrial structure, and our own lifestyle. While PPCA has been exerting much effort to organised waste management system, coping with such a dramatic increase has been a challenging task. The collection, transportation, and disposal need to be strengthened, but 3R (reduce, reuse, and recycle of waste) and appropriate disposal also need to be promoted through the cooperation of those who produce the waste.

The Phnom Penh Waste Management Strategy and Action Plan 2018-2035 has been designed to respond to these demands through the programs and actions that are developed under the common vision, mission and goal. The document is a result of the collective effort by all the stakeholders engaged in waste management on a daily basis, from waste management division, relevant departments, Khan and Sangkat administrations, private sector, NGOs, and academia. Also, it is intended to clarify the roles and responsibilities among stakeholders so that each one of us can take tangible actions, and fulfill our own responsibility we owe to the future generations. It is important that each one of us initiate what we can do.

PPCA will continue to place higher priorities to making improvements to the waste management service, through implementation of the actions enshrined under the five major areas of the strategy, and through coordination of, and close collaboration with, the relevant stakeholders. Particularly, PPCA will closely work with Khan Administrations that have assumed a renewed responsibility in the implementation of waste management service in their own jurisdiction, in the context of proceeding decentralisation in this sector.

Finally, on behalf of Phnom Penh Capital Council and Governing Board of Phnom Penh Capital I would like to thank UN Environment, the IGES-Centre Collaborating with UNEP on Environmental Technologies, Cambodia Climate Change Alliance, Nexus for Development and all those who participated in the strategy development process for their kind support and dedication which came to fruition today, and would like to call for the cooperation of all stakeholders towards the implementation of the strategy toward make city clean and clean with sustainable environment.

Phnom Penh, Date 01 August, 2018

Khuong Sreng

Good waste management practices avoid adverse effects on human health and the environment while contributing to recycling of secondary resources. Our UN Environment report, "Towards a Pollution-Free Planet", determined that the economic impact of improper treatment of general waste is over two hundred billion US dollars annually. In low and lower middle-income countries, waste management generally relies on some 15 million informal waste pickers around the world. While they collect secondary resources on landfill sites, often also living in the immediate environs, these informal workers are exposed to numerous hazards. The United Nations Environment Assembly at its third session in 2017, resolved to make efforts to ensure environmentally sound management of waste for the protection of human health and the environment. As one municipal level response to this resolution, the Phnom Penh Waste Management Strategy and Action Plan 2018-2035 lays out an inclusive path for all relevant stakeholders in Phnom Penh to together overcome the challenges associated with current waste management practices. UN Environment very much hopes that this plan will enable Phnom Penh City to achieve success in environmentally sound management of waste and enjoy associated economic, health and environmental benefits.

Keith Alverson
Director of International Environmental Technology Centre, UN Environment

Forward Message for Phnom Penh Waste Management Strategy

Like many other fast-growing cities in Asia, Phnom Penh Capital City faces a tremendous challenge in managing its waste. In this regard, IGES Centre Collaborating with UNEP on Environmental Technologies (CCET) has selected Phnom Penh Capital City as one of the first target cities to cooperate for the development of a waste management strategy and action plan based on a holistic waste management approach. Thanks to the strong commitment and leadership of officials of Phnom Penh City Hall, the Phnom Penh Waste Management Strategy and Action Plan 2018 - 2035 was successfully developed with close coordination and supervision of the concerned Departments and representatives from Khan Administrations, private sector entities, NGOs and academia. This Strategy and Action Plan, which was developed through 2 years of inclusive consultative process, highlights the main waste management challenges and presents vision, mission, goal and targets for improved waste management system, and by so doing lays out a roadmap for the collective actions by the stakeholders geared towards achieving a resource efficient and sustainable society in Phnom Penh. The programmes and approaches identified in the strategy stands on holistic approach, covering all the steps of waste management chain - from waste collection, diversion, final treatment and disposal, and various waste streams including, MSW, industrial, medical, construction and other E-Waste. Broader governance dimensions are also highlighted beyond technical solutions for ensuring waste services are made sustainable over the long term through supportive financial mechanisms, sound policies, and robust institutional and monitoring frameworks. CCET hope that this strategy and action plan would serve as a critical first step for the people of Phnom Penh towards establishing a sustainable society.

Kazunobu Onogawa
Director, IGES Centre Collaborating with UNEP on Environmental Technologies

Nexus for Development is a non-profit network and finance partner making local solutions count towards the Sustainable Development Goals. For the past 8 years, Nexus has provided expertise and resources to support and scale-up low-carbon development projects in South East Asia. Nexus first started in the Kingdom of Cambodia, with the goal to create equitable access to carbon finance and promote awareness about climate change.

The Phnom Penh Waste Management Strategy 2018-2035 is a result of collaboration made possible with the support of the Cambodia Climate Change Alliance (CCCA) and is delivered in partnership with PPCA and UNEP-IETC/IGES. Nexus contributed to bring together the relevant stakeholders and facilitated discussions necessary for the preparation of this strategy. Our goal has first been to revive the issue of municipal waste management in the urban development agenda and to encourage collaboration between the various stakeholders. The Strategy aims to provide actionable activities within short, medium and long timeframes and to promote efficient use of resources for sustainable waste management practices in Phnom Penh.

We hope that the agreed-upon action areas will effectively tackle the negative environmental externalities of waste management and result in achieving some of the goals of the Cambodia Climate Change Strategic Plan 2014-2023 and of the 2016-2020 Green Growth Strategy for Cambodia.

Together, these actions reflect Phnom Penh's vision towards becoming an inclusive, green and sustainably managed city.

Claire Dufour
Executive Director, Nexus for Development

Chapter I

Introduction to the Strategy

Chapter I Introduction to the Strategy

1. Needs for Waste Management Strategy

Phnom Penh, the capital of Cambodia, has achieved remarkable economic growth in the last several decades, generating prosperity and improving the livelihoods of its people. However, the rapid economic development coupled with urban and industrial development as well as lifestyle change have given rise to an equally rapid increase in waste generated in the city, posing significant public health, environmental and resource challenges.

As detailed in this strategy document, the annual total generation of MSW in Phnom Penh is estimated at close to 1 million tonnes a year, of which only a little over 700,000 tonnes is deposited in the landfill. Phnom Penh's landfill in Dangkor district receives close to 2,000 tonnes of MSW a day from 12 districts. With the previous efforts exerted by the city towards improving waste collection, the amount of waste brought into the final disposal site has gradually increased in the last decade (MoE Cambodia, 2015). However, the collection service coverage is only limited to the central areas of the city, while waste discharging and collection are conducted in a haphazard fashion where services are available, resulting in accumulation of uncollected waste in the city and illegal or environmentally unsound waste treatment and disposal.

With limited actions been undertaken for 3R (Reduce, Reuse, and Recycle), Dangkor Final Disposal Site, where most of the generated and collected wastes within the city are brought in, is faced with an ever increasing inflow of MSW and rapidly decreasing capacity. As a result, measures to prevent the negative human and environmental impacts are treated secondarily to sustained operation of the disposal site. Simple pits or large open space areas are used for dumpsites without appropriate practices and facilities such as soil cover, fire control systems, methane gas collection facilities, or leachate treatment systems.

Unsound waste management has already begun to cause serious impacts on public health, the eco-system and contributed to air pollution, water pollution and soil pollution, threatening the sustainability of natural resources and economic development.

From a global perspective, now that the international community has agreed upon two key international agreements – the Paris Agreement and Sustainable Development Goals (SDGs), which provide a framework for local, national, and global policy making – building a low-carbon, resource-efficient sustainable society is an imperative for all cities and countries, including Phnom Penh, in order to attain sustainable prosperity for its residents. In this context, the role the waste management sector can play is substantial.

Whether our decedents can enjoy and benefit from the natural environment is therefore dependent upon our ability, as individuals and through organisations and society, to transform our lifestyle, behavior and social system in order to minimise the environmental burden. To this end, we need to review not only the current mode of waste management but also the entire resource value chain. The pressing question is how an effective and sustainable waste management system can be established and different stakeholders organised to induce actions in the face of the various constraints.

In this regard, PPCA has been working with the relevant stakeholders to develop a Waste Management Strategy and Action Plan, aiming to set the direction for the city's waste management and promote the development of a conducive policy framework. Accordingly, the development of this waste management strategy is based on a holistic waste management approach, which seeks to address waste in all its forms (solid waste, liquid waste/ wastewater and gaseous emissions), primarily focusing on solid waste but also covering other forms within PPCA's mandate.

The Waste Management Strategy and Action Plans of Phnom Penh 2018-2035 is the first outcome of the initiative and offers a visionary document and strategic guide to address key issues, needs and challenges associated with the management of waste whilst raising awareness amongst key stakeholders towards achieving a resource efficient and sustainable society.

The programmes and approaches contained in this Strategy are intended not only to improve the current waste management service, from waste collection and diversion to final treatment and disposal, but also to ensure that waste management services are made sustainable over the long term, by ensuring secure financing, innovation and continuous improvements through a regular and inclusive management cycle including periodical reviews and monitoring.

2. Positioning of Waste Management Strategy and Action Plan

2.1. Alignment with National and Subnational Policies

This strategy is developed based on the needs and priorities of the current waste management administration of Phnom Penh, and constitutes an integral part of the city's development policies, which have been made public in the form of plans and strategies on both sector-specific and cross-cutting issues. Efforts were exerted to integrate the previous political agreements – on visions, goals, and actions – enshrined in such preceding policies both at the national and city level, in order to assure policy consistency and to guide the relevant stakeholders in a cohesive manner. The positioning of the Waste Management Strategy and Action Plan of Phnom Penh in relation to such key policy documents as well as the key documents themselves are overviewed below.

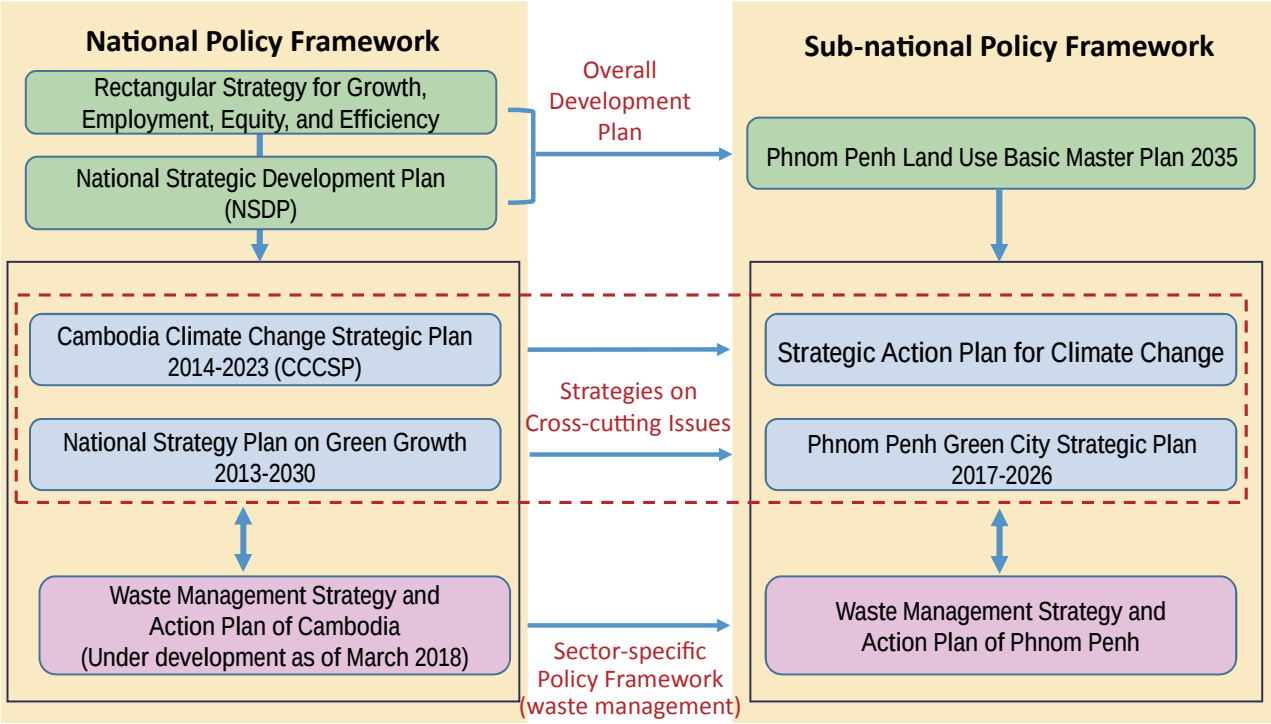


Figure 1: Positioning of the Waste Management Strategy and Action Plan of Phnom Penh

Subnational Policy Framework

Phnom Penh Master Plan on Land Use 2035

The Urban Development Master Plan of Phnom Penh Capital City was approved by Council Ministers in December 2015 for managing urban development in Phnom Penh over a period of 20 years. The Master Plan 2035 aims to address the rapidly growing population of the city, which is expected to exceed three million by 2020, while providing a vision for the city to become "a competitive political, economic, business and cultural centre of Cambodia with sustainable and equitable development" by 2035.

The Master Plan on Land Use 2035 sets out three goals to realise the vision:

1. To set the land use direction to ensure its potential for efficiency, sustainability and equity that will contribute to Cambodia' socioeconomic development, food security and clean environment.
2. To set the development direction for Phnom Penh, in balance with the development of other smaller cities and provincial towns.
3. To empower the city's identity and develop its competitiveness with other cities in the region, which will provide Phnom Penh with more technical and financial access.

The Master Plan also proposes five main strategies for the development, improvement, and expansion of Phnom Penh in order that the city can respond to the need of growing urban population and challenges:

- Phnom Penh to become a core centre for development
- Phnom Penh to become an international standard city
- Development of a reserve for the development of the necessary physical infrastructure
- Urban planning aimed at Phnom Penh becoming a metropolitan city
- Development of a special area for cultural heritage and view of the city

Phnom Penh Capital City Strategic Action Plan for Climate Change

The Strategic Action Plan was developed and published in July 2017 as a result of technical cooperation between Phnom Penh Capital City and its sister city Kitakyushu City (Japan) on various environmental issues, and is expected to operationalise "Cambodia climate Change Strategic Plan 2014-2023" established in November 2013 by the RGC. While setting its general policy direction in six fields – waste, energy, transportation, waterworks/sewerage/rainwater drainage, environmental conservation, and green production, it also proposed specific measures taken in each field to address climate-induced environmental challenges of PPCC.

In relation to the waste sector, the document proposed a number of key actions towards establishing a circular society/economy, calling for strengthening waste collection and treatment, advancing waste prevention, and developing a master plan on waste management, and provided a basis for the development of this Strategy and Action Plan.

Phnom Penh Green City Strategic Action Plan 2017-2026

The Green City Strategic Action Plan for Phnom Penh is the result of collaborative efforts by PPCA, NCSD and Global Growth Institute (GGGI), and provides key policy directions for eight components of Green Growth city planning – urban planning, urban vulnerability, energy, transport, built environment, manufacturing, solid waste management, and public spaces and cultural heritage. The strategy complements Phnom Penh's Master Plan on Land Use 2035 which envisions the city to transform itself as a "*competitive political, economic, business and cultural center of Cambodia with sustainable and equitable development*".

In the waste sector, the strategy proposed priority actions under the four objectives below:

1. Expand quality solid waste management collection services
2. Reduce organic waste going to the landfill or incinerator
3. Waste separation to enable recycling by households, markets and commercial enterprises
4. Implementation of the 4R principle (reduce, reuse, repair, recycle)

National Policy Framework

Waste Management Strategy and Action Plan of Cambodia

In 2016, the MoE, with support from UN Environment and the IGES Centre Collaborating with UNEP on Environmental Technologies (CCET), initiated a project to develop a national waste management strategy and action plan which would provide a national policy framework for accelerating waste management implementation across the country. The framework document, currently being drafted by MoE at the time of writing (May 2018) and expected to be launched within 2018, provides guidance for the direction sub-national governments are to follow. The core principles of the strategy are explained in Figure 2.

Vision	**The Kingdom of Cambodia becomes clean and beautiful city and towns with improved public health, social security, and environmental quality by 2030**
Mission	☐ To optimize the exploitation of useful resources from solid waste through waste separation according to its type and promote the use of recycled products resulting from waste. ☐ To improve and optimize the waste collection service based on the type of waste separation. ☐ To create infrastructure for waste disposal facility and improve the current existing dumping sites in compliance with environmentally sound management of waste disposal.
National Goal	Development of environmentally sound management of solid waste, ensuring a balance between economic development and environmental protection
Objective A:	To improve waste collection coverage at urban area and minimize the amount of waste, disposed at landfill by promoting segregation of organic and plastic waste at source for recycle.
Objective B:	To nurture recycling business sector by promoting recycling of recyclable waste for sustainable resource management and economy development.
Objective C:	To promote multi-benefits on the improvement of water and air pollution through establishing sound management of solid waste.
Objective D:	To improve data collection and estimation methods on waste management situation for monitoring and evaluation of waste management.

Figure 2: Overview of the National Waste Management Strategy and Action Plan 2018-2030

Source: Modified by drafting taskforce based on MoE (2018)

Cambodian Climate Change Strategic Plan (CCCSP) 2014-2023

On the national level, the Waste Management Strategy aligns with the vision for achieving climate-smart development as promoted by the CCCSP 2014-2023.

The Strategy will highlight key challenges and promote low carbon planning and technologies to support sustainable development, which will help meet Strategic Objective 1, "Promote climate resilience through improving food, water and energy security" of the CCCSP 2014-2023. The emission reduction analysis and mitigation potential of proposed interventions in the Strategy will meet Strategic Objective 4, "Promote low-carbon planning and technologies to support sustainable development", by delivering a sectoral analysis on low emission options and sources of emissions in waste management; contributing to low carbon development policies, legal frameworks and action plans in conformity with national development priorities; promoting appropriate technology transfer for low-carbon development that facilitates diffusion through carbon market mechanisms; and promoting low carbon city development planning and developing city level coordination mechanisms.

2.2. Alignment with Sustainable Development Goals

As an indispensable public service deeply connected with our lives, improvements in waste management envisioned within this strategy and action plan will result in multiple co-benefits extending to various goals and targets set out by the Sustainable Development Goals (SDGs) and Global Waste Management Goals. The below table elucidates the strategic importance of waste management in achieving such global goals, and how PPCA intends to take sound actions towards sustainable development through the waste sector.

Table 1: Sustainable Development Goals and the Relevant Action Areas under the Strategy

SDGs		Relevant Action Components
	Goal 1. End poverty in all its forms everywhere	Integrating waste pickers into formal waste management systems (AA3)
	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Managing food waste loss through promotion of waste reduction at source (AA1, AA5)
	Goal 3. Ensure healthy lives and promote well-being for all at all ages	Achieving complete collection, transportation, and proper treatment and disposal of all waste (AA1, AA2, AA3, AA4)
	Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	Advancing environmental education in schools and beyond (AA5)
	Goal 6. Ensure availability and sustainable management of water and sanitation for all	Introducing leachate treatment system to the final disposal site (AA3) Preventing MSW from entering into water bodies (AA1, AA4, AA5)
	Goal 7. Ensure access to affordable, reliable, sustainable, and modern energy for all	Promoting affordable Waste-to-Energy solutions as clean/renewable energy source (AA1, AA2, AA3)

SDGs		Relevant Action Components
	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Advancing waste/recycling industry as a focus area for Green Growth (AA2) Realising decent work environment for waste sector workers (AA3)
	Goal 10. Reduce inequality within and among countries	
	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	Establishing a sound waste management system and advancing circular economy (AA1, AA2, A3, AA4, AA5)
	Goal 12. Ensure sustainable consumption and production patterns	Promoting 3Rs (AA1, AA2, AA4, AA5)
	Goal 13. Take urgent action to combat climate change and its impacts Waste and GHG emissions, and Co-benefits	Promoting 3Rs (AA1, AA2, AA4, AA5) Diverting organic waste from landfill and controlling GHG/SLCP emission at landfill. (AA1, AA2, AA3) Combating waste dumping and burning (AA1, AA3, AA4, AA5)
	Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	Preventing marine litter by strengthening waste management system on land (AA1, AA2, AA3, AA4, AA5)
	Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Preventing land pollution from improper waste disposal (AA1, AA3, AA4)
	Goal 17. Strengthen the means of implementation and revitalize the global partnership for sustainable	Sharing strategy towards collective action, and ensuring implementation and service quality (AA5, Chapter V)

2.3. Strategy Development Process

The Waste Management Strategy and Action Plan 2018-2035 is a product of collaboration between PPCA, UN Environment, CCCA, CCET, and Nexus and was developed through two years of participatory development process. The consultative process was structured to include both large-scale Strategy Formulation Workshops (SFWs) aimed at building broad consensus on the direction the strategy may take, enhancing inclusiveness of the process; and small-scale expert/stakeholder-led Technical Working Group (TWG) meetings to allow for in-depth, focused discussion, both complementing each other to improve legitimacy and effectiveness of the resulting product.

In 2016, an Inception Workshop was co-organised by PPCA, IGES and Nexus to initiate the strategy development project, followed by conclusion of an MoU among three parties to officialise the cooperation.

At the Inception Workshop, baseline data both on waste (physical aspect) and prevailing waste management practices (governance aspect) compiled by stakeholders were reported to develop a common understanding on the current status of the city's waste management challenges. This was immediately followed by two TWG to gather more information on waste management challenges faced by stakeholders.

The first Strategy Formulation Workshop was organised in March 2017 to discuss and agree upon the vision, mission, goals and five action areas through which the vision, mission and goals are operationalised. Further, four TWGs and some individual consultative interviews were organised between May and November 2017 to discuss specific areas of the waste management chain (transportation, disposal) and to shed light on implementation barriers.

Table 2: Consultative Process for Developing the Strategy and Action Plan

Inception WS	October 2016	Reporting baseline study, identification of gaps and agreement on general direction
TWG 1	December 2016	Discharge, collection and general issues (PPCA)
TWG 2	February 2017	Solutions and targets for discharge, collection, general issues (PPCA)
SFW 1	April 2017	Agreement on the outline, action areas and discussion of the first draft strategy
TWG 3	May 2017	Collection and transport (MoE)
TWG 4	May 2017	Landfill management
TWG 5	October 2017	Collection and transport (CINTRI)
TWG 6	November 2017	Discussion of 1st Draft (PPCA, Khan Administrations)
Final SFW	January 2018	Review, discussion and endorsement of Draft Strategy and Action Plan

The draft Strategy and Action Plan was further improved by the Drafting Team by incorporating the inputs at the Final SFW and further consultation with PPCA, and was finalised in June 2018.

Figure 3: Signing of Trilateral MoU (top) and Strategy Formulation Workshop (middle and bottom)

II

Chapter II

Waste Management Challenges Where We are Now

Chapter II
Waste Management Challenges –Where We are Now

1. City Overview

Phnom Penh is the capital and largest city of Cambodia has a permanent population of 1,445,902 as of 2014, annual population growth of 3.97%, and population density of 2,213 inhabitants per square kilometer (Phnom Penh Department of Planning, 2015).

Geographically, it is located in the south-central region of the country at the confluence of three rivers – Tonle Sap, Mekong and Bassac. The city has an area of 692.64 square kilometres, equivalent to 0.37% of the country's total land area (PPCA, n.d.).

The city has gradually expanded its geographical boundaries over the years, in four stages (PPCA, n.d.), which contributed to growth of its population. The population of the city's 12 Khans (districts) in 2014 subsequent to administrative integration is elaborated in the table below.

- 1st Stage: Incorporation of Dangkor District
- 2nd Stage: Creation of Khan Russey Keo
- 3rd Stage: Integration of 4 villages from Kanthork Commune
- 4th Stage: Integration of 20 communes from 5 Districts (Ponnhear Leu, Mok Kampoul, Khien Svay, Kandal Steung, Angsnoul) of Kandal Province to Phnom Penh.

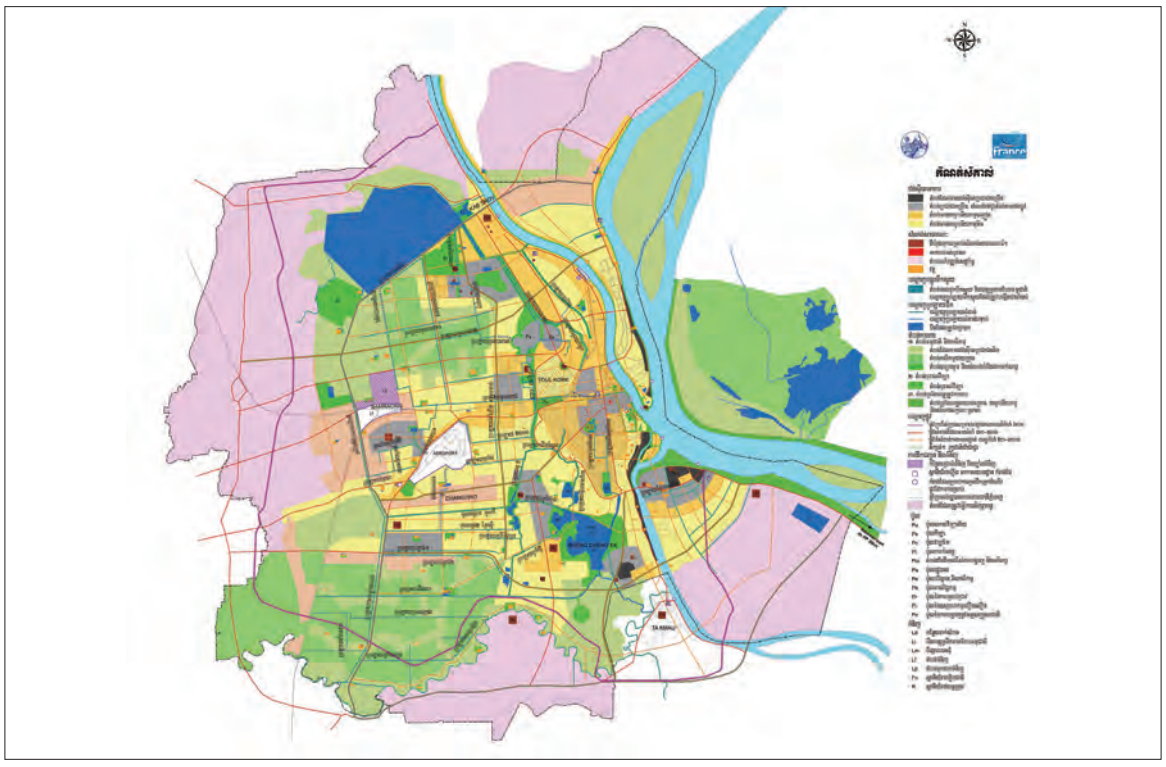


Figure 4: Map of Phnom Penh City

Source: MLMUPC, 2015

The socio-economic development of Phnom Penh has resulted in drastic changes in the city's landscape over past decades, with considerable loss of water bodies such as lakes, canals and rivers, as well as green landscapes across the whole city area. This resulted in increased flooding due to the loss of drainage function of the city (Save Cambodia's Wildlife, 2014).

Population Growth

PPCA's official website[1] shows a population of 1,501,725. However, with the addition of three new districts in 2013 and integration of a large number of communes into city boundaries, an up-to-date estimate puts the figure at over 2 million since 2015. Recent population projections using the last census data of 2008 and taking into account new areas show that in 2016 the Phnom Penh population stood at 2,147,000, rising to 2,406,000 in 2020 and 2,868,000 in 2035 (Phnom Penh Capital City Strategic Action Plan for Climate Change, 2017).

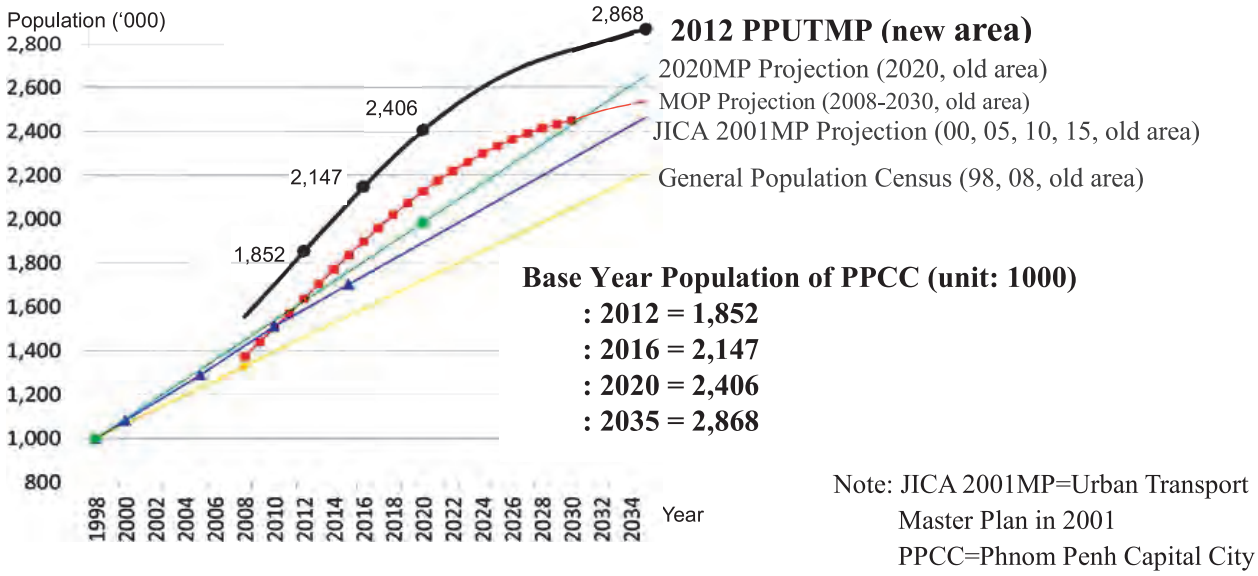


Figure 5: Population Projections from Previous Studies

Source: PPCA, 2017

Economic Growth

Cambodia's economy has exhibited strong and sustained growth over the past decade, with a GDP growth rate of approximately 7%, the major drivers of which were the service sector, manufacturing sector including garments, and tourism sector.

However, more recently there are signs of diversification in the industrial landscape, particularly in manufacturing. The Cambodia Economic Update (October 2017, ADB) reports that there has been visible entry of high-value-added manufacturers, including electrical appliances and components as well as auto parts, and concludes that the country may be "*on the verge of climbing up the manufacturing value chains – from garments to electronics and auto parts*".

[1] http://phnompenh.gov.kh/en/phnom-penh-city/facts/

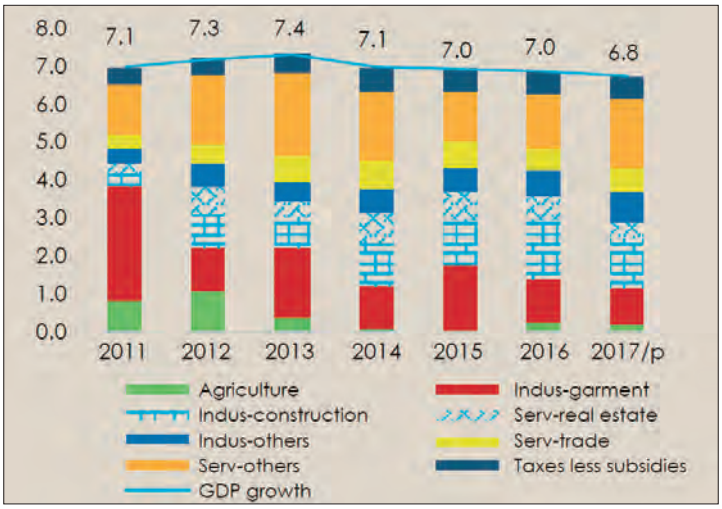


Figure 6: GDP Growth and Major Sectors of Growth from 2011 to 2017

Source: ADB, 2017

2. Waste Inventory

2.1. Municipal Solid Waste (MSW)

Legal and Policy Framework

Various laws, regulations, declarations, sub-decrees and instructions have been issued by both national agencies as well as PPCA over the years relating to the management of MSW.

National Regulations

- Sub-Decree On Solid Waste Management, No. 36 (1999)
- Inter-Ministerial Declaration of Ministry of Interior - Ministry of Environment on Waste and Solid Waste Management in Province / Municipalities of Cambodia, No. 80 (2003)
- Sub - Decree on Urban Solid Waste Management, No. 113 (2015)
- Waste Management Strategy and Action Plan of Cambodia (planned)

Sub-national Regulations

- Draft Strategy and Methodology for Improving Waste Management and Cleansing, Collection and Transport of Solid Waste in Phnom Penh Capital
- Sechkdey Chun Damnoeng (Notification) On Waste Storage, Cleansing, Waste Discharge and Penalties on Improper Waste Disposal in Phnom Penh Municipality, No. 13 (2013)
- Instruction Plan on the Application of Penalties to Promote Environmental Sanitation Raising In Phnom Penh Municipality, No. 09 (2010)
- Sechkdey Nainoam (Instruction) on Penalties on Waste Disposal in Public Areas, No. 16 (2010)
- Instruction Plan on Waste Separation Promotion in Phnom Penh Municipality, No. 08 (2010)
- Waste Storage, Cleansing, Waste Discharge and Penalties on Improper Waste Disposal in Phnom Penh Municipality (2013)

Prevailing Waste Management Practice

Waste Generation

The annual total generation of MSW in Phnom Penh cannot be precisely estimated due to variation in the city's population, as explained in the previous section. However, the prospective trend of waste generation amount estimated by Institute of Technology of Cambodia (Figure 7) presents continuous growth of waste generation in Phnom Penh towards until 2030. MSW collected for landfill has increased exponentially over the past two decades due to an increase in population in Phnom Penh as well as increase in waste generation by source. However, thanks to the enormous efforts of the PPCA, the collection service provider and residents, a rising trend in collection amount has been seen over the years (see Figure 8). In 2017, the average daily amount of MSW taken to the Dangkor final landfill was 2,215 tonnes/day (Dangkor Landfill Authority, PPCA, 2018).

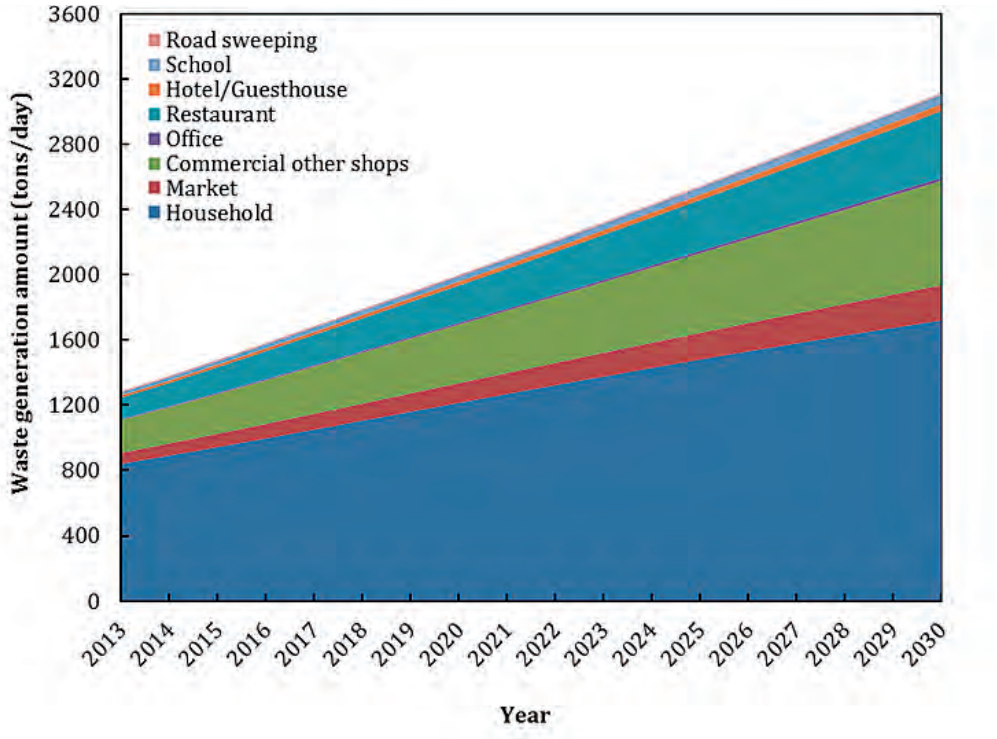


Figure 7: Prospect of Waste Generation Growth in Phnom Penh until 2030

Source: Institute of Technology of Cambodia, 2015

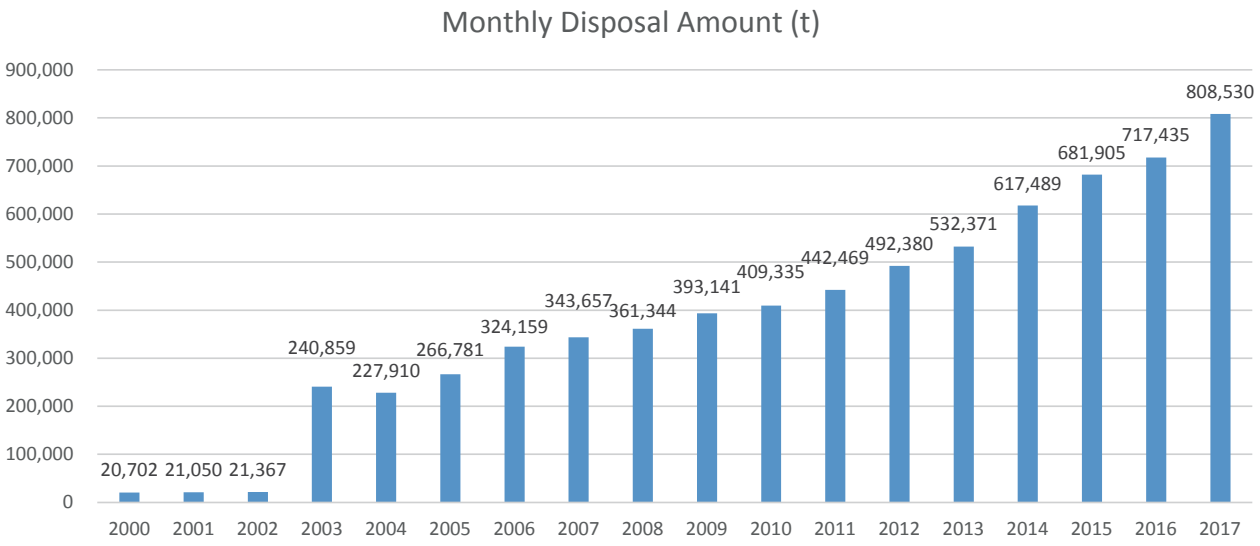


Figure 8: Trend of MSW Disposal at Landfill, Phnom Penh

Source: PPCA, 2017

With regards to waste generation per capita, it is important to distinguish between "per capita household waste generation" and "gross waste generation per capita". The most recent per capita household waste generation measurement was carried out by the Asia Foundation (2013) and equates to 0.498 kg/capita/day, slightly higher than the JICA (2003) figure of 0.487 kg/capita/day.

Gross waste generation rate per capita is calculated by dividing the total waste collected by the population, thus varies in line with changes in population or waste collection ratio in the city. Based on information from various sources, the gross generation rate was found to increase from 0.74 kg/capita/day in 2003 (Seng et al., 2010) to approximately 1.32 kg/capita/day in 2016 (calculated by drafting team based on 2016 data).

Table 3: Gross Waste Generation per Capita based on 2016 Data

Indicators		Value
a	**Waste transported to landfill in 2016 (tonnes/year)**	717,435
b	**Average city-wide reported collection rate* (%)**	75%
c	**Total waste generated excluding recycling (tonnes/year)[Calculated by a/b/100]**	956,580
d	**Recycling rate – at household level (%)****	5
e	**Recycling rate – during collection time (%)**	2.3
f	**Total waste generation in 2016 (tonnes/year) [Calculated by c/(100-d-e)/100]**	1,031,909.5
g	**Population as of 2016**	2,147,000
h	**Gross waste generated per capita in 2016 (kg/cap/day)[Calculated by "f x 1,000/g/365"]**	1,32

*Based on estimations from discussions with PPCA, 2017.
**Recycling rates based on JICA reports (2005), more recent data unavailable

Reportedly, in central khans, the collection rate is close to 100% while in outer khans it is around 60%. A UN Habitat study (2014) focused on outer khans estimated that nearly 40% of urban poor communities in Phnom

Penh had no access to solid waste collection.

According to JICA reports (2005), around 7.3% of all waste generated, estimated at over 75,000 tonnes a year (based on 2016 data) was recycled through the informal recycling sector in Phnom Penh.

MSW collected and brought into the final disposal sites from 12 Khans across the city are largely mixed in nature. Figure 9 gives a breakdown of MSW by source. Of all sources, household waste occupies the largest portion (55.3%), followed by hotels/guesthouses (16.7%), restaurants (13.8%) and markets (7.5%).

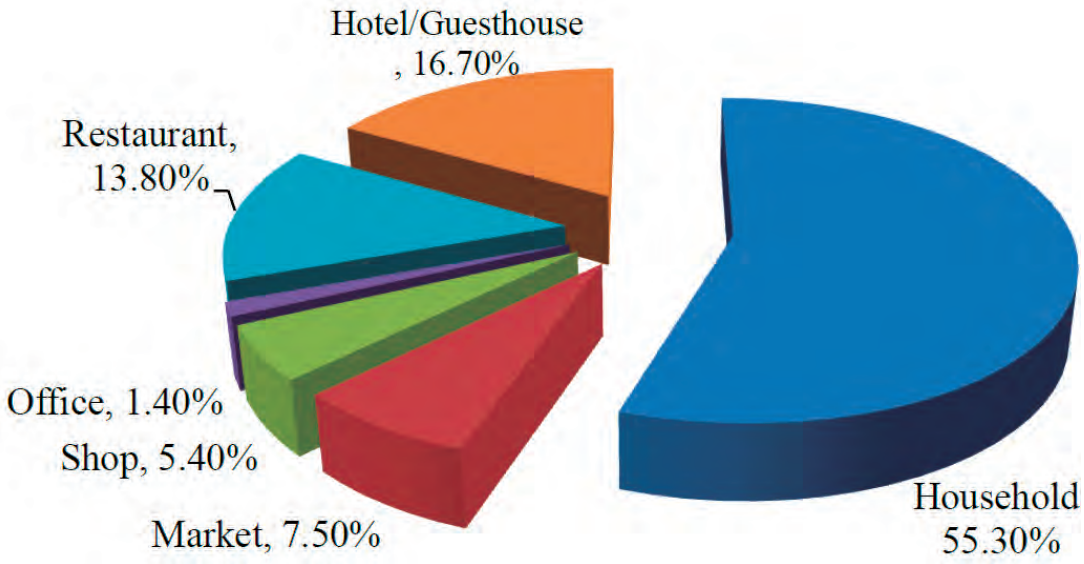


Figure 9: Sources of MSW Generated in Phnom Penh

Source: The Asia Foundation, 2013

Waste Composition

Figure 10 illustrates the composition of MSW sampled at generation points in Phnom Penh. As is typical for the average Cambodian city, over 50% of waste at the discharge point is organic waste, followed by plastics (20.9% - including plastic bags, other plastics and PET bottles), papers (9.9%), grass and wood (2.3%). It is generally considered that the percentage of organic waste tends to be higher and recyclable waste lower at the final disposal site compared to at the generation stage as some recyclable wastes such as hard plastics, PET bottles, cans and metals are extracted at source by waste producers, removed by street scavengers before collection, or removed during collection by collection crews.

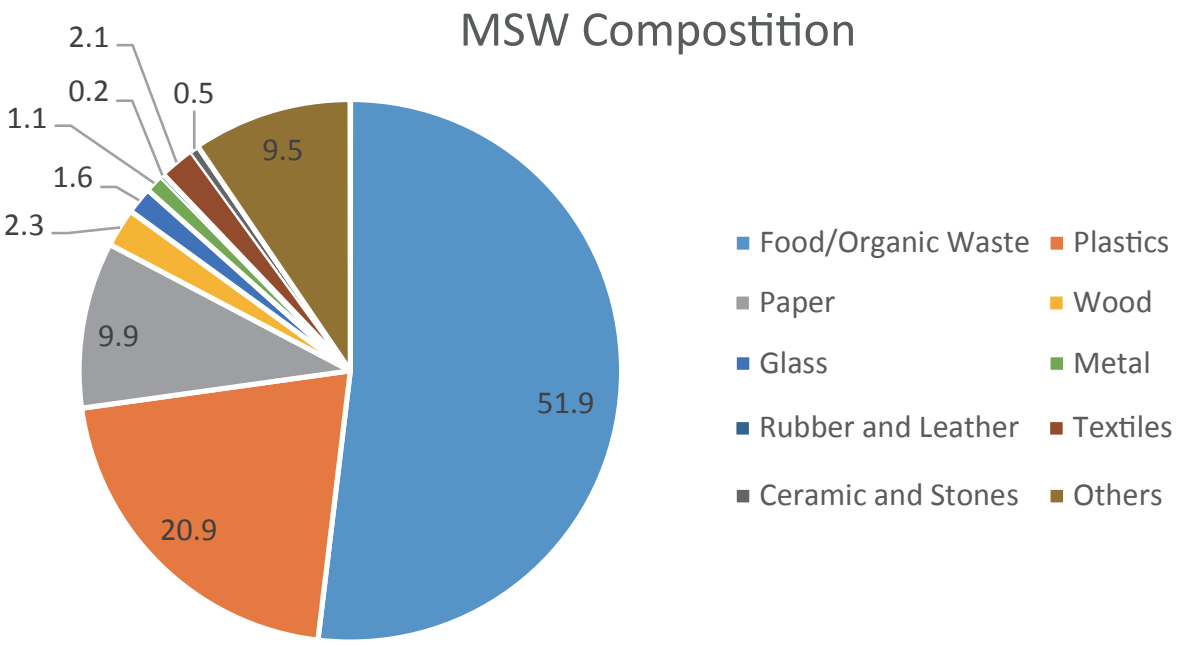


Figure 10: Waste Composition at Generation Point in Phnom Penh

Source: Asia Foundation, 2013

Collection and Transportation

A private operator company, CINTRI Cambodia Co. Ltd is currently responsible for collection and transportation of the waste generated in the city, and has gradually expanded its geographical coverage over the years. However, the service in peripheral areas of the city is still limited in capacity and often does not satisfy the technical standard. Complaints are frequency received related to delayed collection and unsanitary collection practices (leakage of organic waste in public areas and overspill of leachate from collection trucks), among others (PPCA, 2017).

On the other hand, awareness among citizens of waste management and public hygiene tends to be low. As a result, due to the manner in which wastes are discharged at the designated areas (improperly packed or not following designated timetables), much uncollected litter remains on roads, vacant land, canals and riversides, causing degradation of urban sanitation and the living environment.

Management of Final Disposal Site

Phnom Penh relies almost entirely on Dangkor landfill site for the final treatment and disposal of MSW generated within the jurisdiction. The landfill, developed with the assistance of JICA, started operating in July 2009 following the closure of its predecessor, Stoeng Mean Chey landfill site, which had reached capacity.

In 2017, the amount of MSW collected and brought in to Dangkor landfill site in Phnom Penh is estimated to be about 2,215 tonnes/day on average. Table 4 shows the aggregate incoming waste from different sources.

Table 4: Amounts of MSW Disposed by Source in 2014 and 2017

Source	2014		2017	
	T/day	%	T/day	%
CINTRI	1,653	97.0%	2,172.74	98.0%
Doeum Kor Market	28	1.6%	27.7128	1.3%
Prek Phnov Market	n.a.	n.a.	3.27	0.1%
New Mean Chey Market	n.a.	n.a.	0.09	0.1%
Slaughter houses	8	0.5%	9.37	0.4%
Public Work Dept.	10	0.6%	2.85	0.1%
Others	6	0.4%	0.12	0.1%
Total	1,705		2,215.15	

Source: Phnom Penh Landfill Authority, 2018

Prior to 2010, the recommended management practice forwarded by JICA, such as applying cover soil was followed. However, this was discontinued due to grave damage to the site caused by serious flooding, which also affected most regions of Cambodia and resulted in the collapse of landfill pile both in Area A and Area B. Without landfill compaction, the remaining life of the landfill site rapidly shortened, while hygiene also deteriorated resulting in offensive odors and breeding of disease vectors and noxious insects, which especially intensifies during rainy seasons.

The leachate from the landfill site is now collected to an evaporation pond for concentration, but no treatment process is currently employed. Due to the geological features of the site, collected leachate can infiltrate the ground, contaminating the soil of adjacent areas as well as the groundwater system (see Chapter VI).

Illegal disposal and private treatment of municipal waste are still commonplace. This is partially a result of the inadequate waste collection and transportation service within the city, as well as dumping of wastes in open and private land and open burning in private areas.

In 2015, approximately 117,530 tonnes/year of MSW was illegally disposed of in such manner, equivalent to 11.7% of the waste generated in the Phnom Penh (Inventory Data Collected from Departments of Environment in Cambodia, MoE, 2015).

Recycling and Export of Solid Waste

While there is a general lack of data on the actual amount of recycled waste in Cambodia, recycling activities of limited scale are observed in Phnom Penh. In addition to local NGOs such as CSARO and COMPED[2] which accept organic waste from Daeum Kor Market for composting, several private companies are exploring the business potential targeting both organic and inorganic wastes. In response to increasing stream of incoming waste to final disposal site, PPCA is also exploring potential measures for engaging recycling companies.

Limits to recycling capacity are posing a major challenge to both Phnom Penh and Cambodia in the transition

[2] COMPED closed its operation in Phnom Penh City in 2009 when SMC Final disposal site was closed in the same year.

from a society based on linear approach to waste/resource management (in which resources are extracted, processed, consumed and disposed of) to the one based on circular approach, resulting in wastage of economic assets and environmental degradation. Whilst a certain amount of recyclable waste is generated and collected nationwide, domestic recycling activities within Cambodia are limited due to the lack of recycling industry, recycling infrastructures and market for recyclable materials and recycled products. Therefore, some of the recyclable wastes and materials are exported to neighboring countries for recycling purpose.

Figure 10 presents the amount of recyclable wastes purchased by junkshops across Cambodia for recycling including paper, plastic (bags and plastic bottles), aluminum (broken items and cans), iron, and glass bottles/ broken bottle glass, while Figure 11 presents the trend of such recyclable waste exported under the permission scheme of the MoE (MoE Cambodia, 2018), both graphs illustrate expanding trend of material recovery in Cambodia in the past a few years. Another MoE data from 2013 and 2014 (Table 5) indicates that the recovered materials were exported to other countries such as Thailand, South Korea, Vietnam, China, Singapore, Malaysia and Taiwan, causing an outflow of potential resources which could otherwise alternate virgin resource imports. In addition, while the increase of material recovery is a welcoming development, efforts are also required to ensure such recovery activities are managed to minimise the health and environmental risks.

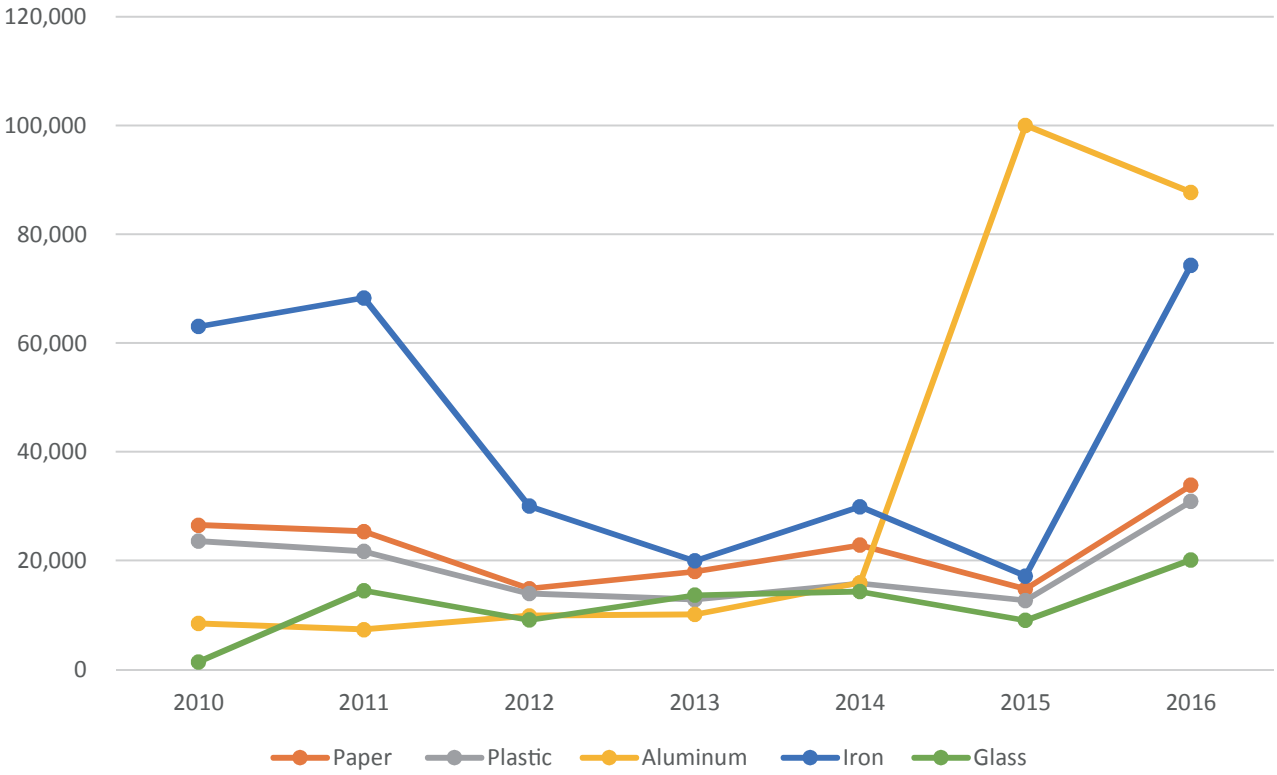


Figure 11: Amount of Recyclable Waste Purchased by Junkshops for Recycling (Tonnes/year)

Source: MoE, 2018

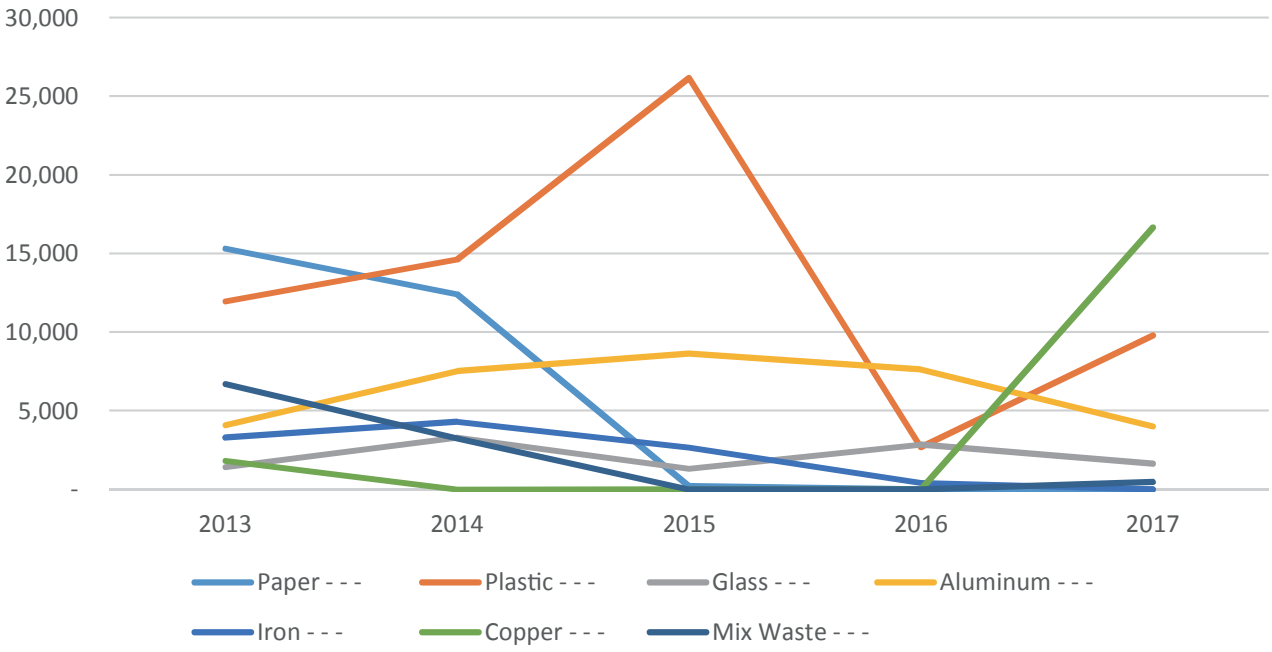


Figure 12: Amount of Recyclable Waste Exported under the Due Process of MoE (Tonnes/year)

Source: MoE, 2018

Table 5: Amounts of Exported Recyclables and Destination Countries in 2013 and 2014

Type of raw material	Amount (tonnes/year)		Exported to
	2013	2014	
Iron Scraps	3,300	4,300	Thailand
Aluminum Scraps	4,075	7,523	South Korea, Singapore, China, Taiwan
Copper Scraps	18,000	0	South Korea
Mixed Recycle Waste	6,700	3,250	Thailand, Vietnam
Paper Scraps	15,300	12,400	Thailand, Vietnam
Broken Bottle	1,417	3,277	Malaysia
Plastic Scraps	11,966	14,634	Vietnam, China

Source: MoE Cambodia, 2015

2.2. Construction and Demolition (C&D) Waste

Legal and Policy Framework

Currently, no laws or policies have been issue targeting specifically C&D waste.

Prevailing Waste Management Practice

Management of C&D waste in Phnom Penh is currently under development; some generated wastes are collected, treated and disposed of by the private sector on a contract-basis, some are sold to buyers for reuse (soil,

rubble and rock), while others are dumped on open land or in remote public areas.

A rapid environmental assessment on the waste composition involving sampling at several C&D sites in Phnom Penh revealed the following rough estimates: 60% broken bricks, rocks, leaf-over cement and soil; 20% wood; 10% metal; 5% plastic; 5% paper and other waste.

Sub-decree 113 (Urban Solid Waste Management) stipulates the responsibilities of the generators and contractors of C&D waste for proper storage, collection, transportation and final disposal; and allows the generator to dispose of the generated C&D waste at the final landfill site either by itself or via contractor services.

However, in practice, some C&D waste is not brought into the final disposal site. As a result, while some C&D waste is reused or recycled (only pure bricks, soil, rocks and stones) on demand, mixed C&D wastes with no market value are partly mixed with general waste and partly illegally dumped along water bodies or on arable lands or fields. The combustible components are often openly burnt at the time of illegal disposal, although a slight decreasing trend in this practice has been noted.

The lack of availability of basic data poses another challenge for the city's C&D waste management system, and no official national inventories or surveys on the exact generation amount of C&D waste exist. However, waste generation can generally be estimated based on the type of property and area, although such data are not disclosed to the public or used in waste management planning in the city currently.


Figure 13: Illegal Disposal and Burning of C&D Waste in Phnom Penh

Source: IGES and COMPED, 2015

Currently, no national legislation has been enacted to address C&D Waste, while Sub-decree 113 provides a clause clarifying the responsibility of generators for appropriate transportation and disposal of such waste either by utilising private service contractors or by themselves. While development of a national regime tailored to promoting 3R and disposal of C&D waste is hoped for in the coming years, PPCA can also take interventions to regulate the waste types.

2.3. Medical Waste

Legal and Policy Framework

The management of medical waste is primarily governed by the MoH and its sub-national representatives based on the three national regulations below:

- Prakas on Health Care Waste Management (2008)
- Decision on creation of MWMU, No. 96 of Red Cross Cambodia (2009)
- National Guideline on Health Care Waste Management (2012)

Prevailing Waste Management Practice

Management of medical waste generated in Phnom Penh City is currently handled by the MWMU of Red Cross Cambodia, which was created in 2009 to provide collection, transportation, treatment and final disposal services to the medical facilities in the city.

The total amount of medical waste generated in the city was approximately 40T/month consisting of infectious waste, pathological waste, sharps waste (i.e., knives and syringes) and pharmaceutical waste (Choeu, 2016). The quantity of medical waste is increasing with the expansion of the medical sector and improved accessibility to medical services (see Figure 14).

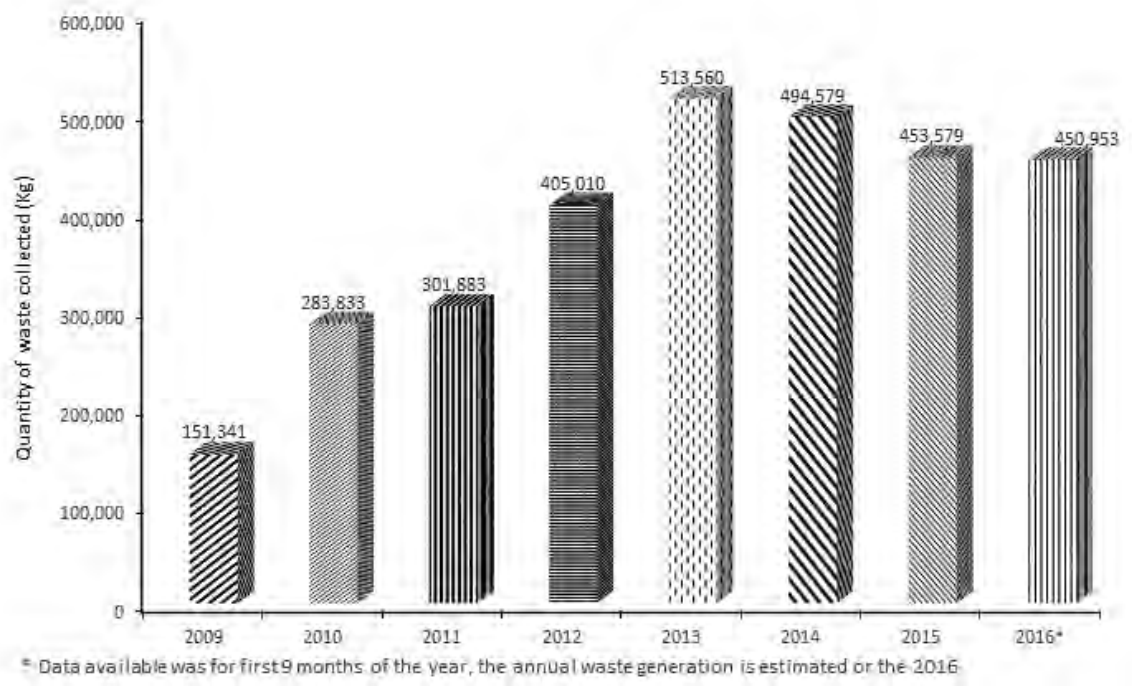


Figure 14: Quantity of Medical Waste Collected for Incineration

Source: Choeu, 2016

According to MWMU, 1.9 tonnes/day of medical waste are generated in Phnom Penh where composition is detailed in Table 6 below.

Table 6: Composition of Medical Waste Generated in Phnom Penh

Composition	Infectious Waste	Pathological Waste	Sharp Waste and Others
Percentage	Approx. 70%	Approx. 20%	Approx. 10%

Source: Interview with MWMU, conducted on 4 September 2017

Medical waste is separated at respective healthcare centres and categorised into three types of wastes utilising safety equipment (safety plastic bags, paper boxes for used needles, and PVC safety bins). However, this waste separation practice is still limited or absent in some healthcare facilities. As a result, medical wastes are mixed with kitchen waste and/or ordinary waste and slip into the MSW stream.

The stored medical wastes are collected and transported by the MWMU utilising GPS-equipped trucks to the incineration plant in a Red Cross facility adjacent the city's Dangkor landfill site, approximately 15 kilometers from Phnom Penh City Centre (Choeu, 2016). At the MWMU treatment facility, medical wastes are incinerated at up to 1,200 °C (Choeu, 2016).

As of 2016, Red Cross Cambodia's service coverage is 100% of the 2,214 medical facilities (both public and private) in Phnom Penh (see Table 7) (Choeu, 2016), although some of the service contracts are yet to be finalised. Despite such comprehensive service coverage, the actual collection rate is still unknown, with reports of uncollected medical waste within Phnom Penh.

Table 7: Number of Medical Facilities under MWMU's Service Coverage in Phnom Penh

District	No. of customers		
	Contracted	Not yet contracted	Total
Tuol Kok	226	61	287
7 Makara	132	31	163
Chamkamon	239	89	328
Doun Penh	164	17	181
Por Sen Chey	224	81	305
Dangkor	38	43	81
Prek Phnov	28	1	29
Sen Sok	145	12	157
Roeusey Keo	122	66	188
Chroy Chang Wa	20	11	31
Chbar Ampov	65	32	97
Mean Chey	149	109	258
Total	1552	553	2105

Source: Choeu, 2016

2.4. Industrial Waste

Legal and Policy Framework

The annex of Sub-decree No. 113 classifies and regulates the following hazardous solid waste generated from various sources, such as from households, public institutions, commercial facilities and tourism facilities:

National Regulations

- Guideline on Solid Waste Management at factories, enterprises and companies, No. 11 (2003)
- Guideline on Sludge Waste Management at Factories – Enterprises (2000)
- Guideline on Manufacturing Hazardous Waste Management, No. 87 (2000)

Municipal Regulations adopted by Phnom Penh City

- Declaration on Industrial Solid Waste Collection and Transport in Phnom Penh and Kandal, No. 148 (2002)
- Declaration on the permitting Sarom Trading to collect and transport industrial wastes from Phnom Penh and Kankal province, No. 156 (2001)

Prevailing Waste Management Practice

In Phnom Penh, the industrial solid waste management is conducted by Sarom Trading Company, a private sector entity that 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 located in the Por Sen Chey district (formerly known as Phum Chambok, Khan Kombol, Srok Angsnuol, Kandal Province), based on a permit from the MoE. The collected industrial waste is brought into the final disposal site without any treatment, and the site itself is an open dump site with minimum controls such as basic scaling and entry registration. The amount of waste collected by Sarom Trading landfill is presented in Figure 15.

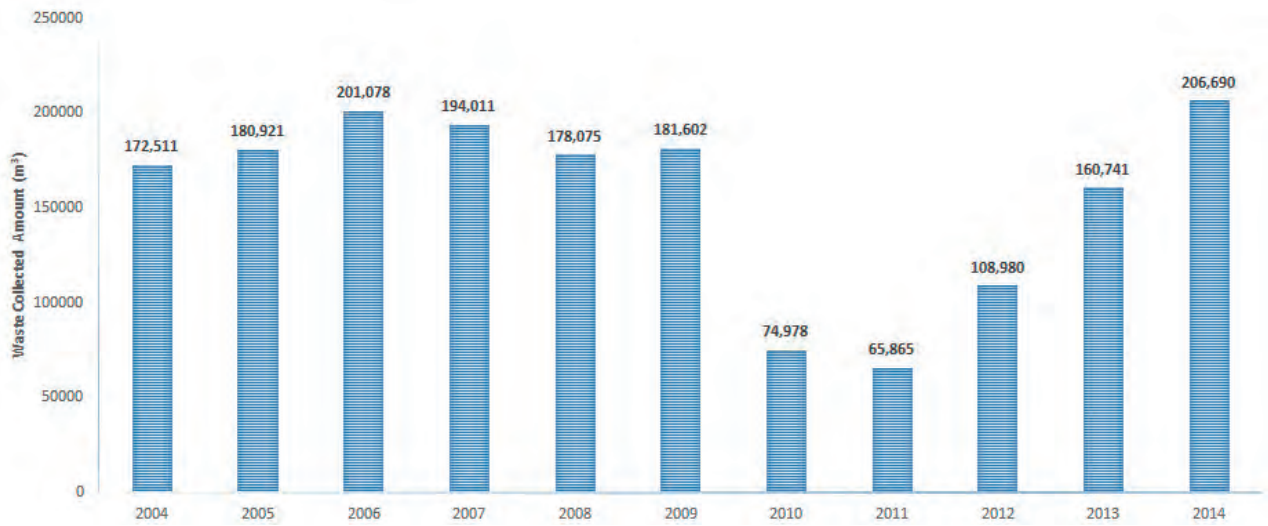


Figure 15: Amount of Industrial Waste Collected by Sarom Trading

Source: Sarom Trading, 2016

The figure below illustrates the composition of industrial waste brought to the final disposal site managed by Sarom Trading. Waste textiles from the garment sector occupies the major portion, reflecting on the high concentration of garment factories in the city.

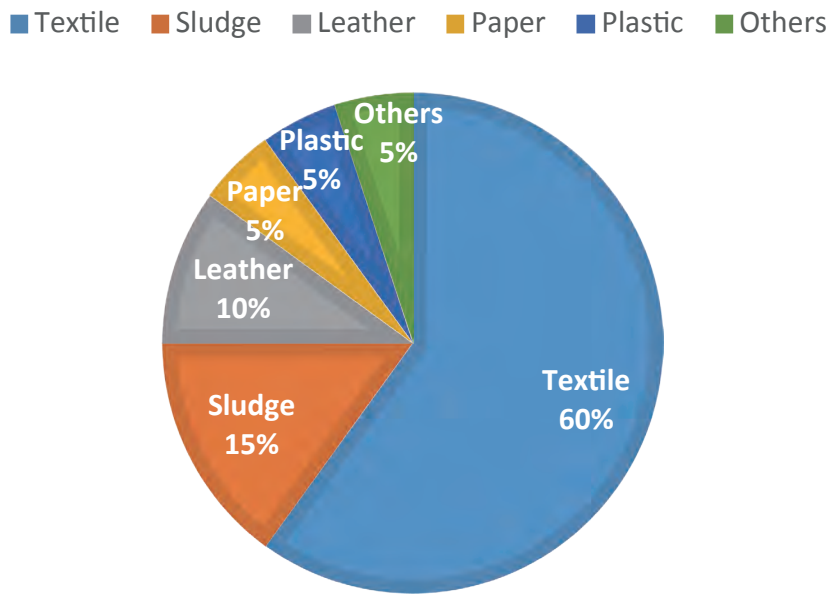


Figure 16: Composition of Industrial Waste Sampled at Landfill Site of Sarom Industry

Source: MoE, 2016

Other types of industrial wastes brought into the final disposal site are also listed below (MoE Cambodia, 2002):

- Semi-dry muddy waste removed from effluent treatment pool
- Coloured fibers and pieces of fabrics
- Plastic waste containing Polyvinyl Chloride
- Rubber waste and vulcanised rubber containing Polymer-Butylene
- Batteries and battery waste
- Ashes left over after the burning of medical waste
- Lighting waste and electrical devices
- Paint waste lacquer and packaged materials
- Insecticide waste used in agriculture and in packaged materials (must be placed in a rubber tub before being dumped)
- Waste resulting from production and utilisation of printing ink
- Expired or sub-standard goods
- Negatives
- Expired medicine and waste resulted from production of medicine
- Waste containing asbestos substance

As with CINTRI, which also provides MSW collection service, Sarom Trading is faced with the major challenge of collecting user fees as some factory owners evade payment, resulting in income uncertainty.

2.5. Hazardous Waste

Legal and Policy Framework

Cambodia has issued two regulations for the management of hazardous waste in general, while specific regulations were enacted for medical waste and E-Waste.

- Sub-Decree No 446 on the organisation and function of the Department of Hazardous Substance Management (2015)
- Declaration No 387 on the enforcement of standard levels of amounts of toxic or hazardous substance that can be abandoned (2015)

The annex of Sub-decree No. 113 classifies and regulates the following hazardous solid waste generated from various sources, such as from households, public institutions, commercial facilities and tourism facilities:

- Battery waste
- WEEE/E-Waste
- Bottle glass waste or canes spoiled with chemical or agricultural pesticides
- Old vehicle tires
- Used oil
- Waste of paint, dye and its containers
- Waste of printing ink
- Asbestos waste

In addition, MoE also regulates the management of hazardous waste from other sources such as factories, handicrafts, agriculture and mining. However, this strategy only highlights E-Waste and medical waste due to the availability of national data and legislation in those areas – the foundations of interventions at subnational level.

2.6. E-Waste

Legal and Policy Framework

A new decree was issued by the MoE in 2016 to regulate companies that purchase, dismantle and dispose of E-Waste. As well as the need for prior application for initiating business operations, it also imposes a non-compliance penalty of 40,000 Riel for individuals and 2,000,000 Riel for businesses.

- Sub-decree on E-Waste and Electronic Equipment (2016)

Prevailing Waste Management Practice

Along with the growing middle class and changing lifestyles, demand for ICT products and electronic appliances is also growing in Phnom Penh. A variety of second-hand EEE such as monitors, printers, keyboards, CPUs, typewriters, projectors, mobile phones and PVC wires are imported to Cambodia from various countries. These goods come in all models and sizes, with both junk materials (also known as E-Waste / WEEE) mixed in with functional items, which will be sold, consumed or refurbished or turned into E-Waste.

The E-Waste inventory in terms of figures (Figure 17) and weight (metric tonnes) (Figure 18) for the six major EEE items, from the year 2009 till 2019 are estimated as below. E-Waste generation in Phnom Penh is expected to grow exponentially during the coming years. In terms of weight, TVs is expected to grow most, followed by PCs, refrigerators, air conditioners, washing machines, and mobile phones; while in terms of numbers of units, mobile phones have the largest share, which is expanding rapidly (MoE Cambodia, 2009a).

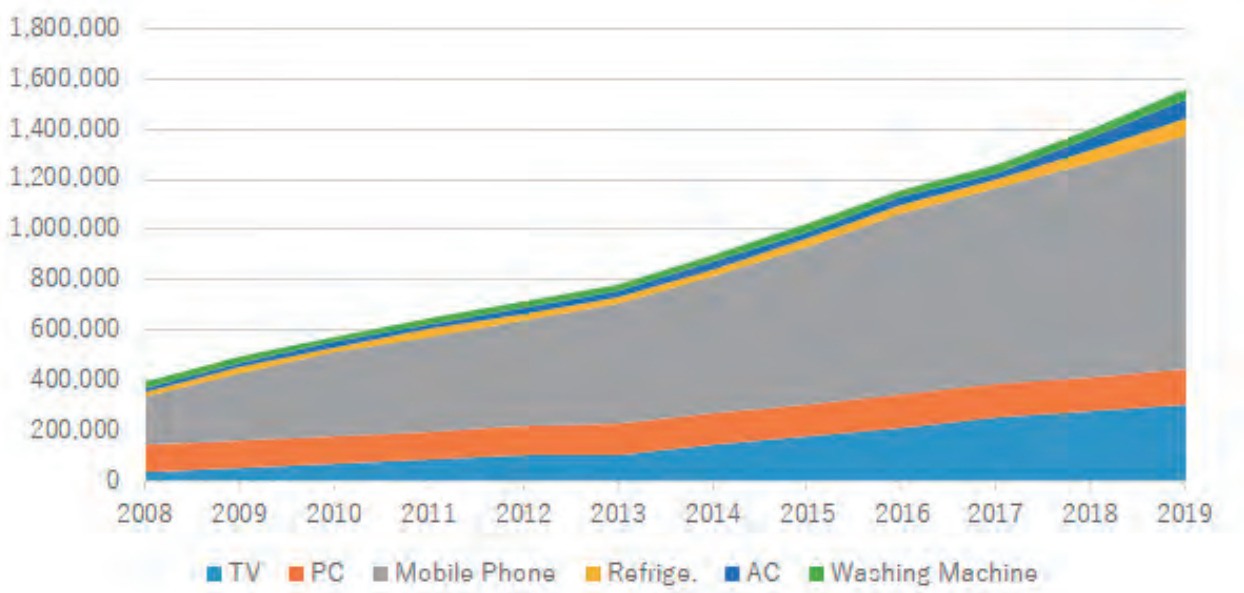


Figure 17: Estimated E-Waste Generation in Phnom Penh in Units

Source: MoE Cambodia, 2009(a)

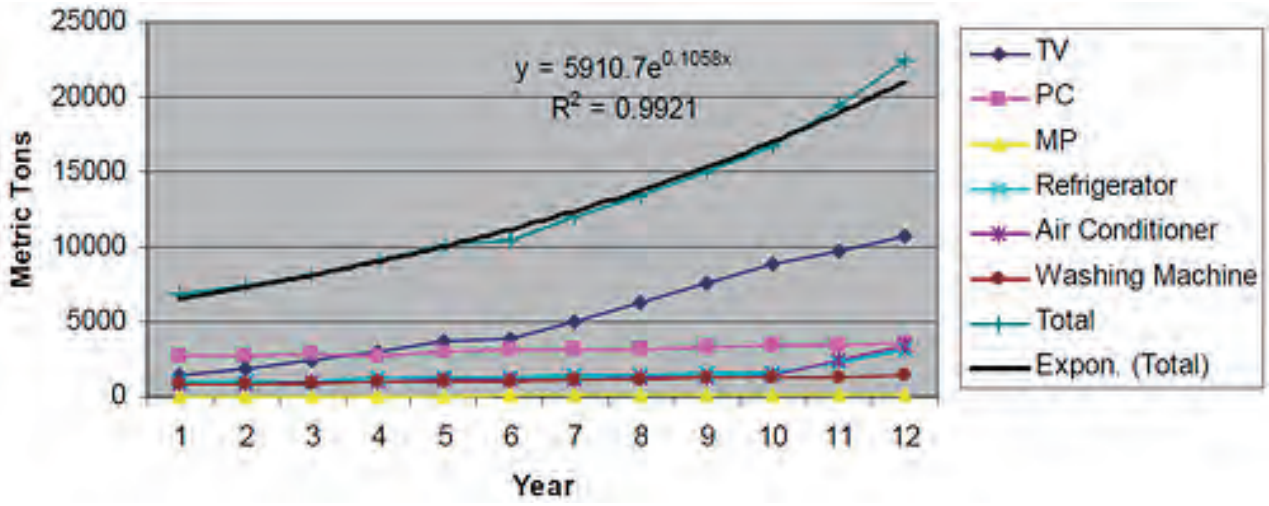


Figure 18: Projected E-Waste Generation in Phnom Penh by Weight

Source: MoE Cambodia, 2009b

In Phnom Penh, E-Waste has been and still is largely circulated within the market-based product-waste value chain in which generators, traders, retailers, scrap dealers and dissemblers (dismantlers) together form a semi-formal/informal sector (MoE Cambodia, 2009a) (see Figure 19 for details).

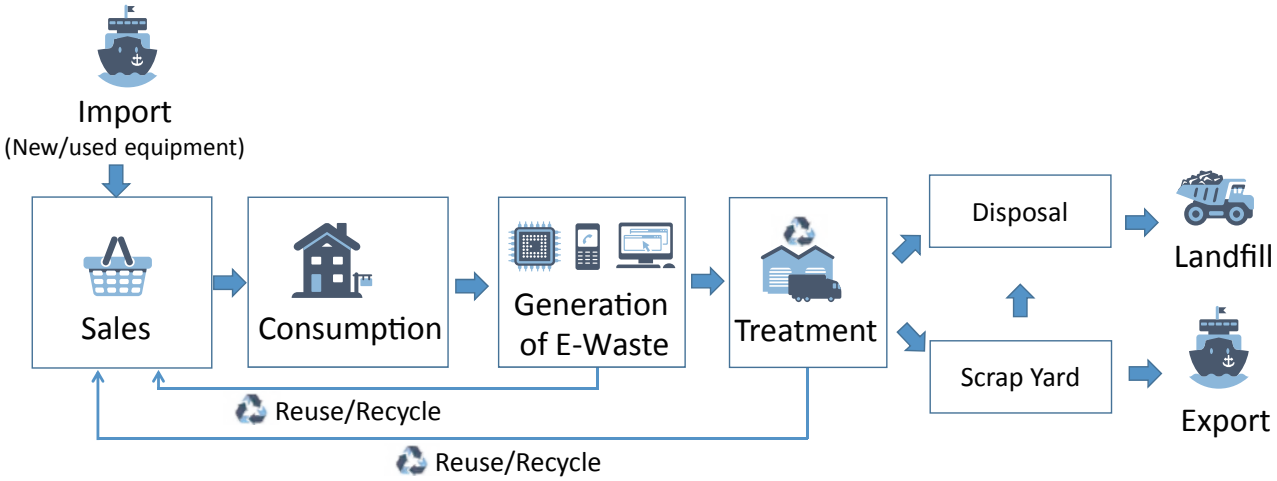


Figure 19: Sectoral Organisation of E-Waste Trade Value Chain in Phnom Penh

Source: MoE and UNEP-DTIE, 2009

Waste pickers and dismantlers play a pivotal role in collection of E-Waste. Wastes are generally purchased from generators for reusable components or material recycling, where valuable components are sold to scrap yards for export, and non-valuable components are removed and disposed of as domestic waste. According to the MoE Cambodia report for 2015, the amount of E-Waste exported from Cambodia to Singapore, one of the major destination countries, amounted to approximately 3,514 tonnes in 2013 and 1,588 tonnes in 2014.

Since there is no E-Waste collection service, E-Wastes are brought in, disposed of and incinerated improperly at sites close to or behind repair or dismantling shops, during which process hazardous substances are often emitted causing degradation of human health and the environment (MoE Cambodia's Technical Working Group, 2013).

Approximately 3% of residues generated from dismantling, separating and/or sorting processes is disposed, while the remaining 97% is sold to local recycling shops or transported to other recyclers according to demand. However, a CEA survey in 2007 found that 80% of E-Waste is sold for recycling (MoE Cambodia's Technical Working Group, 2013).

Lack of understanding among operators and junk shop owners on the negative environmental as well as health impacts of improper treatment and disposal is responsible for the ongoing release of hazardous substances from E-Waste. While on the one hand such operating practice needs to be improved, collection system established, resource recovery promoted, and residuals detoxified locally, strengthening of monitoring and management of imported EEE, as well as development of a take-back scheme based on EPR also need to be considered at national and local levels in the long run.

3. Institutional Setup

3.1. Legal Framework and Waste Classification

Figure 20 below illustrates waste classification based on the waste legislations of Cambodia and Phnom Penh.

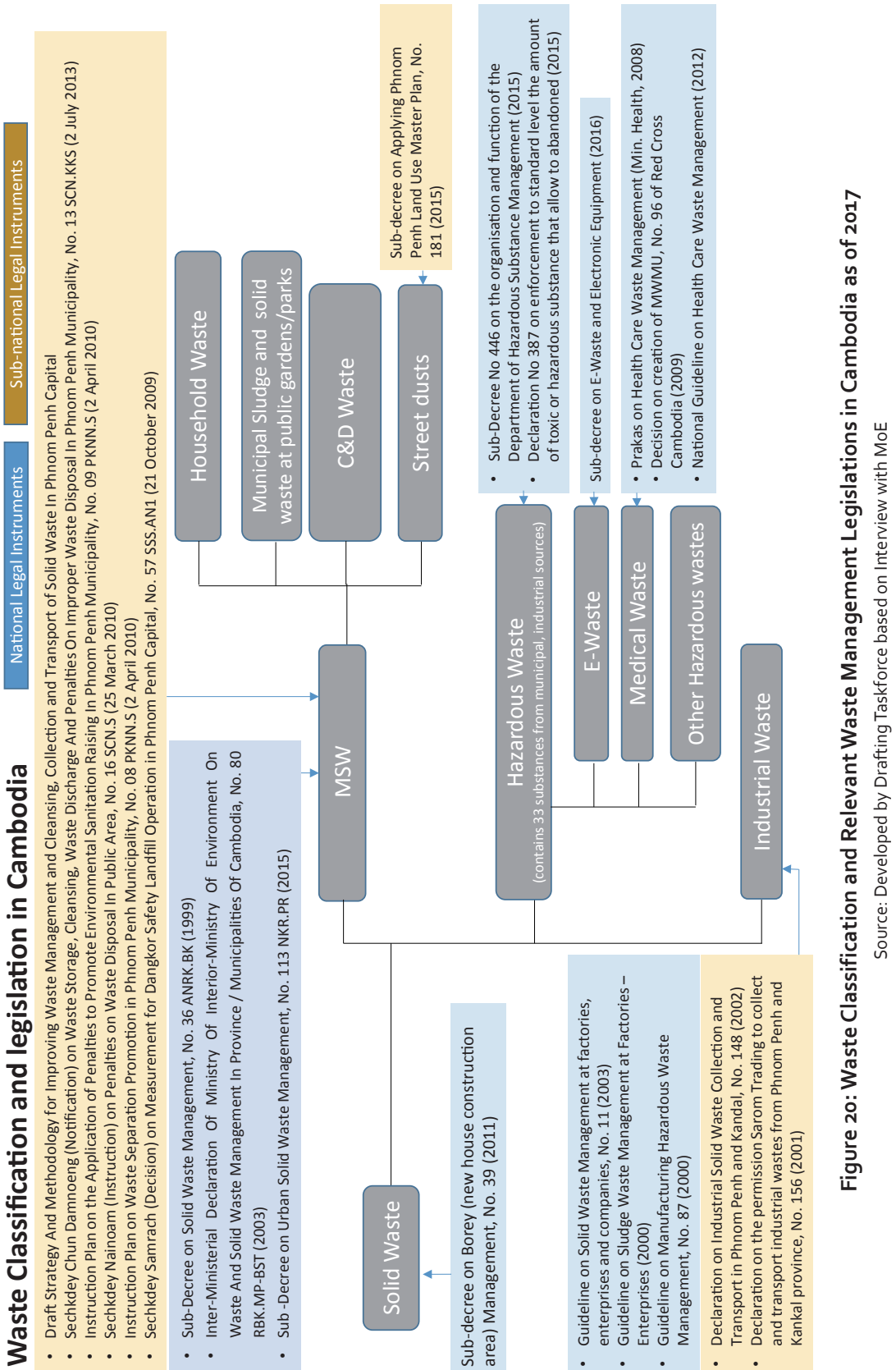


Figure 20: Waste Classification and Relevant Waste Management Legislations in Cambodia as of 2017

Source: Developed by Drafting Taskforce based on Interview with MoE

3.2. Roles and Responsibilities of Relevant Stakeholders

National Institutional Setting

Relevant Ministries

Table 8 summarises the demarcation of responsibilities among national agencies for the waste management governance in Cambodia.

Table 8: Mandate of Ministries Related to Waste Management Governance in Cambodia

Ministry	Responsibility
Ministry of Environment (MoE)	MSW, industrial waste and hazardous waste including demolition and construction waste under the General Directorate of Environmental Protection
Ministry of Health (MoH)	Medical waste through the Department of Hospital and Provincial Departments of Health.
Ministry of Industry and Handicraft (MoIH)	Administration of private industrial sector entities including management of industrial waste and promotion of cleaner production processes.
Ministry of Agriculture, Forestry and Fisheries (MAFF)	Registration of agricultural pesticides and fertilizers under the General Directorate of Agriculture and the management of its waste diposal in cooperation with MoE.
Ministry of Interior (MoI)	General Department of Administration, in cooperation with NCDD, is responsible for supporting local (capital, provincial and city) administrations to promote decentralisation and deconcentration of administration including waste management.

Source: Developed by Drafting Taskforce based on Interviews with Relevant Ministries

Inter-ministerial coordination

The inter-ministerial coordination mechanism for the environment has evolved over the last decade, as a result of strong political commitment. One such mechanism is the NCCC, which was established in 2006 by Sub-decree 35. Its aim is to coordinate and monitor relevant ministries and institutions for cohesive development of policies, strategies, regulations plans and programmes for climate change. Another is the NCGG, established in 2012, which is mandated to develop laws, policies, strategies, action plans and programmes for green growth.

Apart from the above, the National Council on Sustainable Development was newly established in May 2015, which "consolidated competencies previously held by four bodies now extinct…" (MoE, 2014) , i.e., the NCCC, NCGG, National Biosafety Secretariat and the National Biodiversity Steering Committee. Comprising high-level representatives of ministries, agencies and governors and chaired by the Prime Minister and Minister of Environment, the structure of the Council demonstrates high political commitment and makes it highly influential in setting the overall national policy framework under which Cambodia's waste management programmes operate.

The national-subnational institutional setting is illustrated in Figure 21, in which provincial departments play the main role as representatives of respective line ministries at the provincial level. It should be noted that while

Phnom Penh Capital City and Battambang Municipality have their own waste management division/office, other cities have representative offices of provincial technical departments (upper administrative layer) to which they report.

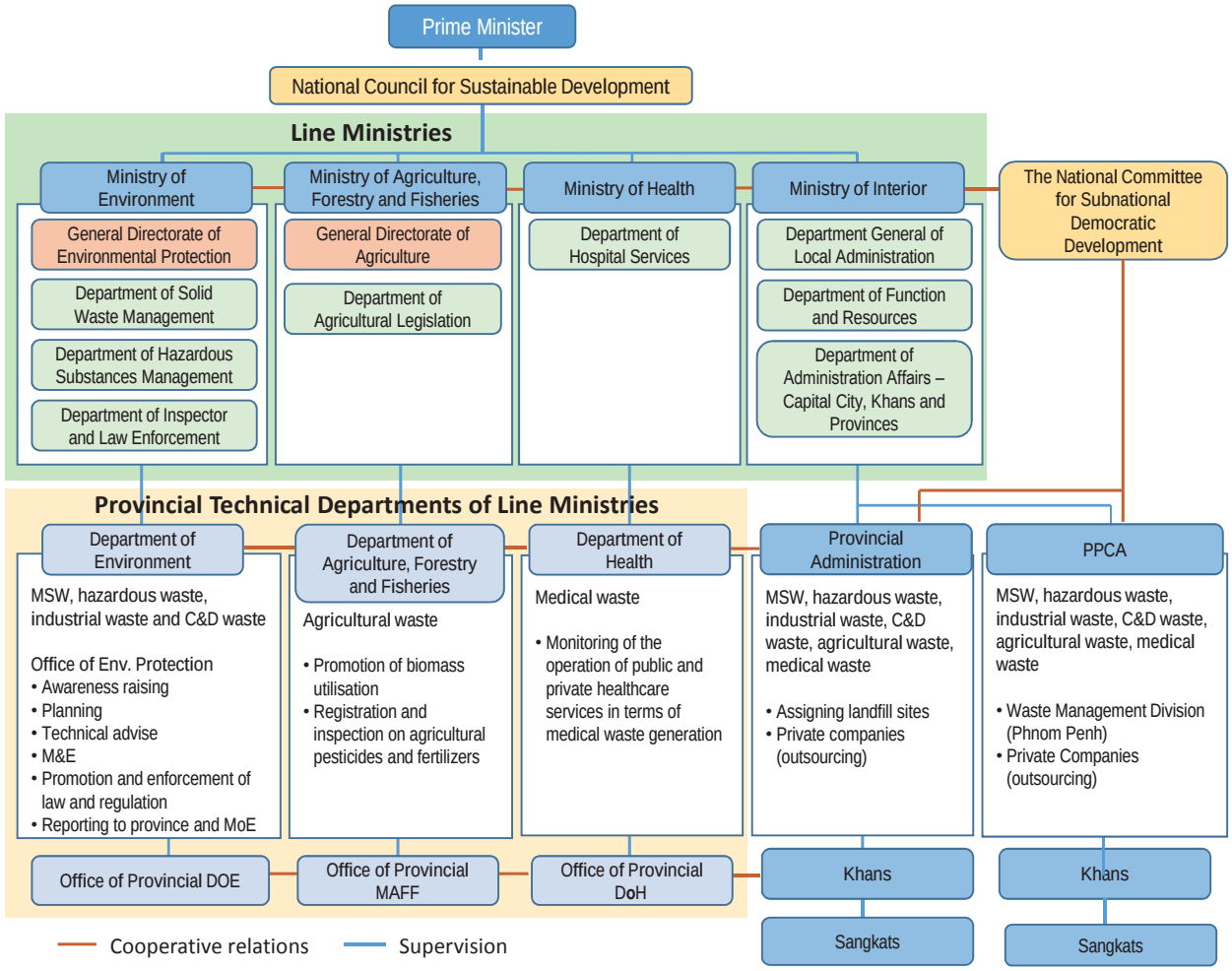


Figure 21: National-Subnational Institutional Setting for Waste Management

Source: Developed by Drafting Taskforce based on Interview with Relevant Stakeholders

Against this backdrop, decentralisation also proceeded in the waste sector, while cooperative relations between sub-national governments and line ministries via provincial technical departments were preserved. As indicated by Min (2016), waste management has been attracting increased attention in M/D across Cambodia as a priority issue. However, the level of implementation of waste management varies among jurisdictions and many SNAs struggle to fulfill their expected roles. In this context, the Sub-decree on Urban Solid Waste Management No. 113 issued in November 2015 clarified M/D's mandate on solid waste management at the municipal level, with the support and coordination by PAs.

In the waste sector, the provincial DoE works on behalf of the MoE without further delegation of its work to offices at M/D level due to the limited capacity of its M/D line office. At the M/D level, there are two types of line office: those under direct control of M/D administrations (often understaffed and under-resourced) such as the Office of Finance and Administration, Office of Commune/Sangkat Support and Planning and Inter-sectoral Office; and those under control of provincial departments such as Office of Environment (Min, 2016). The above offices are the arms of the M/D administration and their line department in the monitoring of waste

collection company performance, dissemination of relevant legal documents and promotion of community awareness, installation of environmental signs and preparation of relevant reports to the province and provincial DoE (Min, 2016).

Institutional Setting in Phnom Penh City

In Phnom Penh City, Phnom Penh Capital Administration (PPCA) bears the responsibility for ensuring the provision of waste management service, while coordinating technical supports from respective Departments of line ministries, as previously described. Figure 22 below is a visual representation of Phnom Penh's role in coordinating various stakeholders, while Table 9 explains the roles played by respective departments in relation to waste management governance.

However, Sub-decree No. 113 (2015) promoted further de-concentration of the service delivery, allowing subnational governments to delegate, in part or in whole, the responsibility to lower governance tiers. As a result, reform of governance in the waste sector took place, with a range of responsibilities being transferred to the Khans and Sangkats, as excerpted below:

- Khan administrations shall be responsible for the implementation the duties they receive, and fulfill the role of supporting and coordinating the process of cleaning, collection and transportation services and urban garbage and solid waste field services in the municipality and is tasked as follows:
  - Managing and implementing the duties they receive to manage urban garbage and solid waste;
  - Participating and cooperating in the implementation of programs for urban garbage and solid waste management; and
  - Participating in tracking the implementation of cleaning, collection and transportation services and urban garbage and solid waste field services within their jurisdiction.
- Commune-Sangkat administration shall be responsible for the implementation of the duties they receive through the delegation and fulfill the role of supporting and coordination of cleaning, collection and transportation services and urban garbage and solid waste field services within their jurisdiction and is tasked as follows:
  - Managing the implementation of urban garbage and solid waste management as per the delegation;
  - Participating in widespread education and dissemination of using cleaning, collection, transportation of urban garbage and solid waste services within their jurisdiction;
  - Participating in providing comments regarding the preparation of cleaning, collection, transportation of urban garbage and solid waste program within their jurisdiction;
  - Participating in tracking the implementation of cleaning, collection, transportation and fields of urban garbage and solid waste services within their jurisdiction;
  - Participating in solving problems related to cleaning, collection, transportation and fields of urban garbage and solid waste services within their jurisdiction; and
  - Participating in enhancing the implementation of legal measures and legal documents concerning urban garbage and solid waste.

Accordingly, MoU has been signed between each Khan and the waste collection company under the existing concession contract between the company and PPCA, with the daily coordination and implementation of the collection service taking place in a decentralised fashion.

Phnom Penh's Waste Management Governance - Stakeholder Map

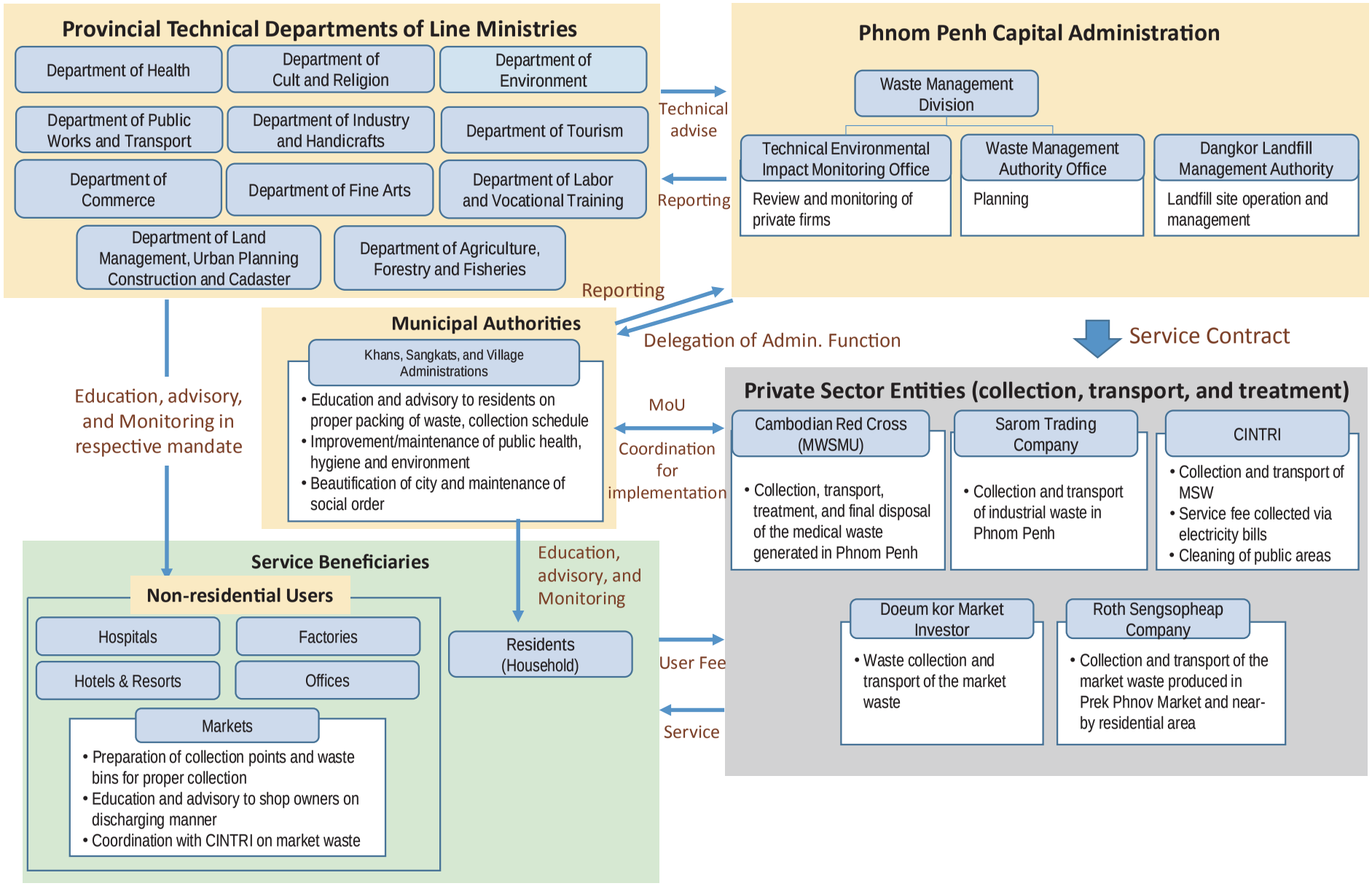


Figure 22: Stakeholder Map of Phnom Penh Waste Management Governance

Table 9: Roles and Responsibilities of Departments of Line Ministries in Phnom Penh's Waste Management

1. Department of Public Works and Transportation • Their roles and responsibilities are to clean up parks and other public areas and pack waste correctly so that CINTRI can collect and transport waste timely. • Work closely with local police and authorities/monitor the parks, and implement the penalty who those throw the waste on the parks. • Report achievements/progress regularly to PPCA.
2. Department of Culture and Fine Arts • Managing and cleaning resorts and parks in Wat Phnom, and discharging waste correctly and that matches with CINTRI collection schedule/timetable.
3. Department of Environment • Service as a secretary for PPCA in designing action plan on waste collection, temporary storage, transportation and disposal. • Working with PPCA; especially division of waste management of PPCA, and local authorities such as Khans and Sangkats to monitor the waste management issue at the local level, and evaluate master plan on waste collection from CINTRI and other waste collectors. • Working with khans and Sangkats on awareness-raising, installing banners, implementing the penalty. • Reporting waste management issues to PPCA.
4. Department of Tourism • Their roles/responsibilities are to provide guidance/awareness-raising to resorts, tourist sites, guesthouse, hotels and local and foreign restaurants about waste separation, discharging/packing timely with the collection schedule.
5. Department of Education, Youth and Sports • Their roles/responsibilities are to provide guidance/awareness-raising to public and private schools about waste separation, discharging/packing timely with the collection schedule.
6. Department of Commerce • Provide guidance and awareness-raising to trader/sellers/service providers that are registered in the department of Commerce to participate in waste management in Phnom Penh. They have to prepare waste containers and pack properly, as well as discharge timely for waste collectors.
7. Department of Industry and Handicraft • Provide guidance and awareness-raising to handicraft business and other business activities that are under that control and management of the Industrial Department to participate in waste management in Phnom Penh. They have to prepare waste containers and pack properly, as well as discharge timely for waste collectors.
8. Department of Labor and Vocational Training • Provide awareness raising to factories, enterprises, as well as the workers to participate in implementation waste management strategy (better packing/discharging, waste separation)
9. Department of Cult and Religion • Provide awareness-raising/dissemination to all pagodas to participate in the implementation of plans and strategies for improvement waste management practice, waste collection programs; especially on major festivals/events. At the same time, every pagoda needs to set up the garbage bins, and avoid discharge waste in front of the pagoda gates and near the pagoda walls. These will affect public order and well-being.
10. Department of Health • The department shall disseminate to every hospital, clinic, small and large clinic in Phnom Penh to the implementation of plans and strategies to improve solid waste management. Department has to encourage hospitals and clinics to pack the medical waste correctly, and separate waste properly, as well as discharge timely for collection and transportation.
11. Department of Land Management, Urban Planning, Construction and Cadastre • The department shall disseminate the fine/penalty measures to all construction site owners who do not discharge their waste properly. The department shall also disseminate the timetable of waste collection to all construction owners. It necessary to cooperate with local authority and specialised/relevant department to punish owners of construction sites.

Source: Developed by Drafting Taskforce based on Interviews with Relevant Stakeholders

4. Overview of Major Challenges

The major waste management challenges of Phnom Penh identified based on the status report in the previous chapter, as well as the discussions during the consultative meetings are summarised below.

1: Municipal Solid Waste (MSW)

Solid Waste Disposal in an expanding city

MSW disposal in Phnom Penh is totally reliant on a single landfill with rudimentary sanitary practices. The available space in the landfill will not be able to keep pace with the growth of daily waste unless waste is reduced, diverted, or recycled. Building new dumps is prohibitively more expen- sive in the city with accessible land becoming increasingly expensive while acquisition of land and construction of a prospective landfill site require continuous discussion with the neighboring residents.

Uneven access to solid waste collection service

Phnom Penh's khans vary markedly socioeconomically, geographically and in terms of infrastructure depending on their location. While inner khans have almost complete coverage of waste collections, the outer khans have significantly fewer and poorer roads than the developed inner core and subsequently much poorer collection rates. A 2014 UN Habitat study focused on outer khans estimated that nearly 40% of urban poor communities in Phnom Penh had no access to solid waste collection. Such communities also tend to be poorer and less able to advocate on their own behalf as regards capacity to pay or in requesting better services or infrastructure. Further, collection services often do not reach certain areas where operations are prevented by narrow streets, even in central areas of the city. In addition, the definition of waste to be collected under the contract between waste collection company and PPCA leaves room for different interpretation, causing a dispute over the waste collection service. As a result, bulky waste are often not collected by the company, fostering illegal/ inappropriate disposal.

Unsystematic waste discarding and collection practices

While Phnom Penh's inner khans have access to solid waste collection, coordination on proper discharge practices between residents, local authorities, and the waste collector is lacking: Collection points and schedules developed by the waste collection company are not widely recognised by the users, and the collection service is also delayed due to traffic.

As a result, trash is piled in front of residences and shops on the street in an unsanitary manner, and informal collection points have sprung up around the city. Waste pickers often scatter the trash in search of recyclable materials. During the rainy season the waste can disperse during flash floods, entering the drainage system or creating unsanitary conditions on local streets. While local residents and CINTRI crews are aware of these informal collection locations around the city, no systematic database or institutional knowledge of such exists. Further, the ambiguity around actual collection points has not been properly addressed.

Landfill Management

Phnom Penh's final disposal site is operated with minimum controls, such as waste weighing and leveling using heavy machines, but without practices such as soil cover, leachate treatment and use of personal protection gear for site workers. While the environmental and health risks of the current practice are known by PPCA, inadequate financial resources pose an obstacle for renewing infrastructure and purchasing the necessary equipment for daily operations, thus improvement in working conditions and the wellbeing of waste pickers is also a consideration that needs to be addressed.

2: Construction and Demolition (C&D) Waste

Lack of formal institutions and mechanism for collection, disposal and reporting

While a construction boom in Phnom Penh is clearly evident, there are no official statistics on the amount of C&D waste being generated, nor a systematic accounting of where it ends up. As the city continues to grow and experience major real estate development the environmental impact is also expected to increase, thus a comprehensive study on the waste generation and practices is urgently required to determine the intensity of the issue, followed by efforts to establish a formal system to prevent illegal dumping and promote diversion of C&D waste from the landfill through 3R.

3: Medical Waste

Incomplete Source Segregation

Currently, medical waste from both public and private medical facilities in Phnom Penh it is mainly managed by the Cambodian Red Cross (CRC). Despite its reportedly full-service coverage and existing national guideline on medical waste management, source segregation of medical wastes by classification is not fully implemented by generators. As a result, medical wastes are discharged and flowing into the general MSW stream, posing grave public health and environmental risks.

4: Industrial Waste

Weak Compliance with Existing Regulations, Absence of Policy Targets and Interventions, and Environmentally Unsound Management of Final Disposal Site

Based on national laws, the generators of industrial waste bears the legal responsibility for the management of the waste generated. While many factory owners rely on a fee-based collection and disposal service provided by a private waste management company, illegal disposal and evasion of user fee payment are still often observed. The landfill is managed as an open dump site with minimum control such as weighing and leveling, and has no soil cover or leachate treatment to prevent negative environmental impact.

Efforts to reduce the waste generated upstream or tap into the potential for reuse or recycling are not common,

which limits the potential to promote diversion of waste from the final disposal site. Policy targets, laws and regulations, as well as effective intervention are absent, and the quantity and quality of data for visualising the current status (waste generation, source, type) in order to develop appropriate policy responses are both inadequate.

5: Waste Electric and Electronic Equipment (E-Waste)

Lack of Formal Institutions and Mechanism for Collection, Disposal and Reporting

E-Waste generated in Phnom Penh is collected for resale or undergoes basic treatment for resource recovery, where the recyclable materials are exported while residuals are discarded and re-merge in the MSW stream. The mode of resource recovery and disposal of residuals poses environment and health risks and thus needs to be transitioned to environmentally sound practices. In addition, since the collection, treatment, disposal as well as trading of E-Waste and recovered resources are predominantly handled by the informal sector (i.e., by unregulated business entities), which is unmonitored in terms of quality of waste and resources, it is difficult to visualise the actual status quo and develop appropriate policy responses.

6: Governance of Waste Management

Lack of Comprehensive Strategy and Action Plan for addressing Waste Challenges

As an outstanding public challenge for Phnom Penh, improvement of the waste management service has been referenced in the city's previous policy documents, as discussed in the introduction. However, while such strategies have identified challenges and policy directions PPCA may take in the sector, there has been no policy document dedicated specifically to improving waste management governance that addresses all the challenges in a broad and comprehensive manner.

Participatory Approach to Waste Management Governance

While public participation is an indispensable element for successful waste management, efforts are still limited in promoting it. In order to bring about behavioral change at the individual level, citizens need to be informed of how PPCA intends to address the challenges and what roles each actors can play. It is also equally important that citizens and relevant stakeholders are provided with opportunities to be involved in the planning stage as well. While some channels are established to this end, greater efforts are required to gain cooperation from the stakeholders.

Weakness of Public Finances and Human Resources for Waste Management

In order to improve and maintain an effective waste management system, a strong financial foundation as well as technical and managerial expertise are both indispensable. However, PPCA currently lacks a constant stream of public finances necessary to design and deliver its operations, develop the pool of expertise and fulfill its role as a facilitator of waste management governance. This also poses a major challenge for developing waste

management infrastructures, in that despite numerous infrastructure development projects financially supported by external partners, their sustained operations become difficult without the corresponding public finances for daily operation and management beyond the initial capital investment.

Deteriorating Waste Management Services

Financing is also a major challenge for the private sector, on which Phnom Penh relies for delivering substantial waste management operations. Deteriorating profit due to inadequate and incomplete collection of user fees is a serious hurdle to private sector entities making the necessary investment to improve the waste management service, while deteriorating service quality is often the reason why users refuse to pay the fee, causing a vicious negative spiral.

Chapter III

Moving Forward
A Waste Management Strategy

Chapter III Moving Forward –A Waste Management Strategy

1. Development of Waste Management Strategy and Action Plan

In its attempt to address the above challenges, PPCA has developed a holistic waste management strategy and associated action plans, in order to guide its own actions, to share the vision and intended actions on the city's waste management service with the wider society, to promote collaboration with relevant stakeholders towards implementation, and by so doing, establish a sound waste management system for the benefit of citizens.

2. Guiding Principles

The following guiding principles are used as the foundation on which the strategic actions are developed, in order to bring about a shift from the current un-sound waste management practices to sound and sustainable waste management:

- Waste Management Hierarchy: The Waste Management Hierarchy is a strategic tool which prioritises actions for establishing an environmentally sound waste management system, and is based on the 3Rs concept, including:

    a. *Reduce (minimisation)* – reduce waste being generated through redesigning products and/or changing social patterns around how products and services are produced and consumed.
    b. *Re-use* – repeat use of goods, repair goods that can be repaired, or find alternative uses for wastes.
    c. *Recycling* – return wastes with recoverable material for re-processing.
    d. *Energy Recovery* – Conversion of waste to energy (fuels, heat and power), including as generation of biogas from anaerobic digestion, incineration with energy recovery, gasification and pyrolysis.
    e. *Controlled Disposal* – Final disposal to a controlled landfill directly or through incineration without energy recovery.
    f. *Uncontrolled Disposal* – Final disposal to an uncontrolled landfill.

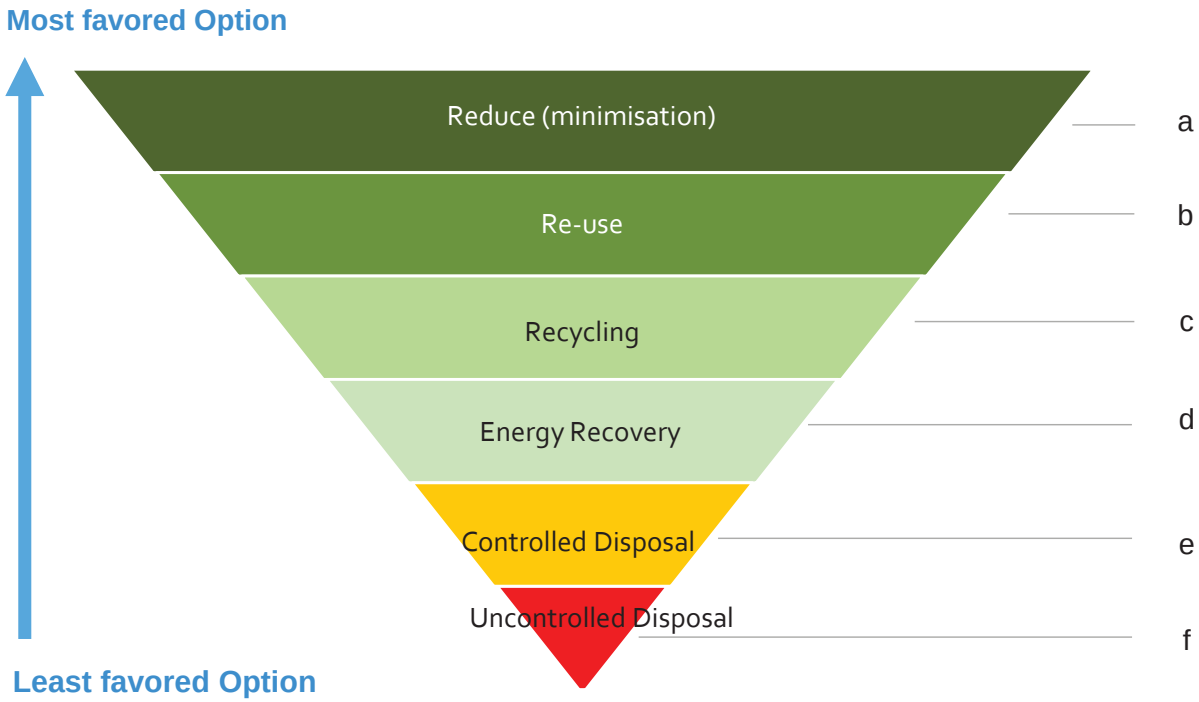


Figure 23: Waste Management Hierarchy

- Resource conservation: Entails promoting the most efficient use of resources, including resource recovery and waste avoidance.

- Polluter-Pays Principle: A principle that holds that those responsible for causing pollution or generating solid waste should pay the cost for dealing with the pollution, or managing the solid waste (collection and disposal) in order to maintain ecological health and diversity.

- Precautionary Principle: A principle that dictates that a lack of scientific data/information certainty should not be used as a reason for not acting to prevent serious or irreversible environmental damage or degradation.

- Proximity Principle: A principle that maintains that waste should be dealt with as close to the source of generation as possible. This reduces transportation costs, and also reduces risks of contamination of the environment during transport.

- Consultation Principle: A principle that conveys the importance of all levels of Government consulting and working with people and organisations throughout the development and implementation of waste management strategies and action plans.

- Shared responsibility: In this context, zero waste is a shared responsibility and requires partnerships and collaborations between all sectors of government, industry, research institutions, NGO's, and the general community.

3. The City We Aspire to (Vision)

PHNOM PENH AS SUSTAINABLE, GREEN AND ENVIRONMENTALLY FRIENDLY CITY WHERE RESOURCE CONSUMPTION IS SUSTAINABLE

The Urban Development Master Plan of Phnom Penh Capital City (2015), which provides a framework for the city's mid- to long-term development, envisions that the City of Phnom Penh will be "a competitive political, economic, business and cultural centre of Cambodia with sustainable and equitable development". The Waste Management Strategy and Action Plan of Phnom Penh is also aligned with such vision, in that waste and resource management contributes towards realisation of the societal vision. Given the current global policy and economic trends, achievement of a resource efficient society is an imperative in light of attaining the strategic interests of Phnom Penh and improving the livelihoods of its citizens.

4. Our Missions

PPCA assumes the following four missions which will guide its waste management policies towards realisation of the above vision.

1) Protecting environment and promoting healthy livelihood of the citizens
2) Establishing a society where waste is reduced, reused and recycled, thus wastes are reduced to minimum level
3) Making contribution to low carbon society through waste management sector
4) Promoting participation of / collaboration among governments, citizens and businesses for effective waste management

5. Duration of this Strategy

This strategy will guide the actions of PPCA and the relevant stakeholders from 2018 to 2035 (17 years). However, the strategy will be periodically reviewed and modified by PPCA in order to adapt to the changing policy environment.

6. Goal (Qualitative) and Targets (Quantitative) to be Achieved

6.1. Overall Goal

ESTABLISHING SOUND WASTE MANAGEMENT SYSTEM

The ultimate goal of this strategy and action plan is to establish a sound waste management system which minimises waste and resource use through the collaboration of various social actors, thereby reducing subsequent negative environmental and health impacts.

6.2. Targets

Target Field	Indicators	Baseline (Sample Year) *e: estimated figure	Short-term Targets (by 2023)	Mid-to-long-term Targets (by 2035)
Action Area 1: Improvement of Waste Collection				
1-1	Waste Generation per Capita (kg/capita/day)	0.98kg e (2015)[1]	1.0kg/cap/day[2]	1.0kg/cap/day[2]
1-2	Waste Collection Rate	75% e (2016)	90% or more[3]	100%[3]
Action Area2: Promotion of Recycling				
2-1	Recycling Rate[3] (Non-organic Recyclables)	n/a[5]	50% or more[3]	95% or more[3]
2-2	Recycling Rate[3] (Oganic Waste)	n/a[6]	5% or more[2]	20% or more[2]
Action Area 3: Improvement of Management of Final Disposal Site				
3-1	Leachate Management	Currently do not exist	Install	New controlled landfill operational with sanitary management practice.
3-2	Landfill Gas Management	Currently do not exist	Ventilation installed where risk of collapse is confirmed. Flaring or gas collection employed if resources are available.	
3-3	Working Condition	Currently do not exist	Personal protection gears introduced.	
3-4	On-site Resource Recovery	Currently relying on waste pickers	Collaboration with waste pickers initiated with their role officially recognised.	
Action Area 4: Management of Special Waste				
Construction and Demolition (C&D) Waste				
4-1	Data Management	Currently do not exist	Initial data survery conducted Basic reporting mechanism initiated	Waste data collected periodically and made available to the public.
4-2	Waste collection rate	n/a[5]	90% or more[3]	100%[3]
4-3	Recycling Rate[3]	n/a[5]	85% or more[3]	100%[3]
Medical Waste				
4-4	Waste Collection Rate	n/a[5]	95% or more	100%
Industrial Waste				
4-5	Waste Collection Rate	n/a[5]	85% or more[3]	100%[3]
4-6	Recycling Rate[3] (Non-organic Recyclables)	n/a[5]	85% or more[3]	95% or more[3]
4-7	Recycling Rate[3] (Oganic Waste)	n/a[5]	5% or more[2]	20% or more[2]
E-Waste				
4-8	Data Management	Currently do not exist	Initial data survery conducted Basic reporting mechanism initiated	Waste data collected periodically and made available to the public.

Target Field	Indicators	Baseline (Sample Year) *e: estimated figure	Short-term Targets (by 2023)	Mid-to-long-term Targets (by 2035)
4-9	Treatment Methodology	Pose high risk to environment and health	20% or more is treated through environmentally sound methodologies	50% or more is treated through environmentally sound methodologies
Action Area 5: Stakeholder Engagement				
5-1	Feedback mechanism	limited	Feedback channels are prepared and made accessible	Feedback channels are prepared and made accessible
5-2	Curriculum for Environmental Education	n/a[5]	Environmental education containing both lecture and practice is implemented in more than 20% of schools in Phnom Penh	Environmental education containing both lecture and practice is implemented in all the schools in Phnom Penh
5-3	3R Practice	n/a[5]	Initial data survery conducted More than 5% respondent confirms daily 3R practice	Periodical survery conducted More than 20% respondent confirms daily 3R practice

Notes:

1. Inventory data from MoE (2015)
2. Based on National Waste Management Strategy of Cambodia
3. Phnom Penh Capital City Strategic Action Plan for Climate Change
4. Defined as "ratio of potentially recyclable material that has been diverted out of the waste disposal stream and therefore not entering landfills =(waste diversion rate)". See pp71-72. *The Drafting Committee of the State of the 3Rs in Asia and the Pacific (2018). The State of the 3Rs in Asia and the Pacific* for details.
5. Data currently not available. Data survey will be conducted to set baseline and monitor progress.
6. Indicative figure derived by the following equation is used as a proxy for baseline:

   Amount of organic waste diverted for composting in Dangkor (t/day, 2017) /
   Amount of MSW brought into the Dangkor final disposal site (t/day, 2016) x
   Ratio of organic waste based on waste composition survey (2013)
   = 50t / 1,966t x 51.9% = 4.9%

   However, due to extraction of recyclable materials before the arrival of waste into Dangkor, the ratio of organic waste at the final disposal site is considered higher than the ratio used above, which is sampled at the waste generation point. This results in potential over-estimation of the derived figure above. (Based on the discussion at the Final Review Meeting at PPCA, 28 May 2018)

7. Action Areas

The Waste Management Strategy and Action Plan of Phnom Penh aims to sets five action areas to achieve the goal and targets above:

Action Area 1: Strengthening systematic waste discharge & collection system and enhancing service quality

The area which requires most immediate action is waste discharge and collection. PPCA will work with waste generators (residents, commercial institutions, etc.), waste collection companies as well as Khan and Sangkat Administrations to improve public information on solid waste management and enhance social acceptability of waste discharge and collection. PPCA will make efforts to increase public awareness of the negative consequences of improper waste management practices, behavior change for better practices, as well as their accountability in paying for better waste management services. This can be done through bridging agreements among stakeholders on their discharging behavior (use of plastic bags for packing waste, draining water before packing waste, etc.), designated collection points and temporary storage spaces/containers, collection means

and schedules, and areas of collection service coverage.

Taking into account the ongoing decentralisation of waste management administration, PPCA will provide the necessary assistance to Khan and Sangkat administrations to ensure their performance in monitoring and evaluation of the service providers and waste generators in their respective jurisdiction.

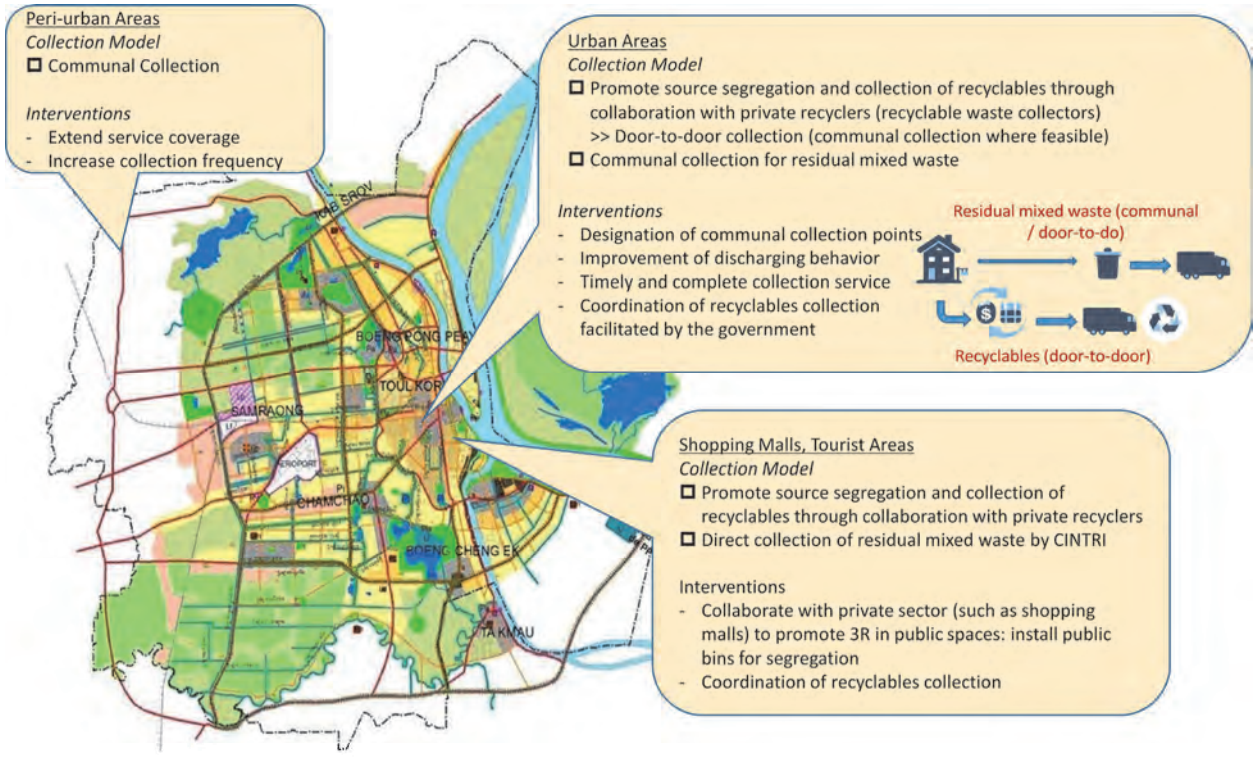


Figure 24: Example of Employing Different Collection Models for Different Regions

Action Area 2: Promote recycling through waste separation, involve private recycling sector, and promote the use of recycled products

Developing and diversifying intermediate treatment and recycling options is one of the most critical action areas for diverting incoming waste at the final disposal site and for promoting resource circulation. This is especially so when improvement of the waste discharge/collection system (Action Area 1) is expected to result in an increase of waste amount collected and disposed of at the final disposal site. In addition, increased use of recovered resources would mean less dependency on imported virgin materials. Given the increasingly volatile commodity prices in the global market, improved resource efficiency would reduce the negative economic impact from price fluctuation, contributing to resilience of Phnom Penh's economy.

Recycling capacity can be enhanced through both engaging private recyclers and inducing voluntary actions by waste generators. To attract private recyclers, access to stable, homogenous and contaminant-free material inputs is a major issue of interest. However, achieving high-level source separation from households requires extensive and continuous efforts through awareness raising and other economic/regulatory solutions, while it is an indispensable element of this strategy.

For these reasons, PPCA will first aim to invite private recycling companies by diverting wastes with desirable qualities from large scale producers such as schools, hotels, restaurants, offices and factories. Expanding the variety and scale of recycling options as well as extending segregated collection to households for recycling purpose will be planned and implemented gradually in a phased approach. These actions will be complemented by schemes to encourage and support voluntary actions of the waste generators, primarily households. The city's recycling capacity can be improved gradually in a phased approach, accompanied by revision and enforcement of corresponding segregation rules.

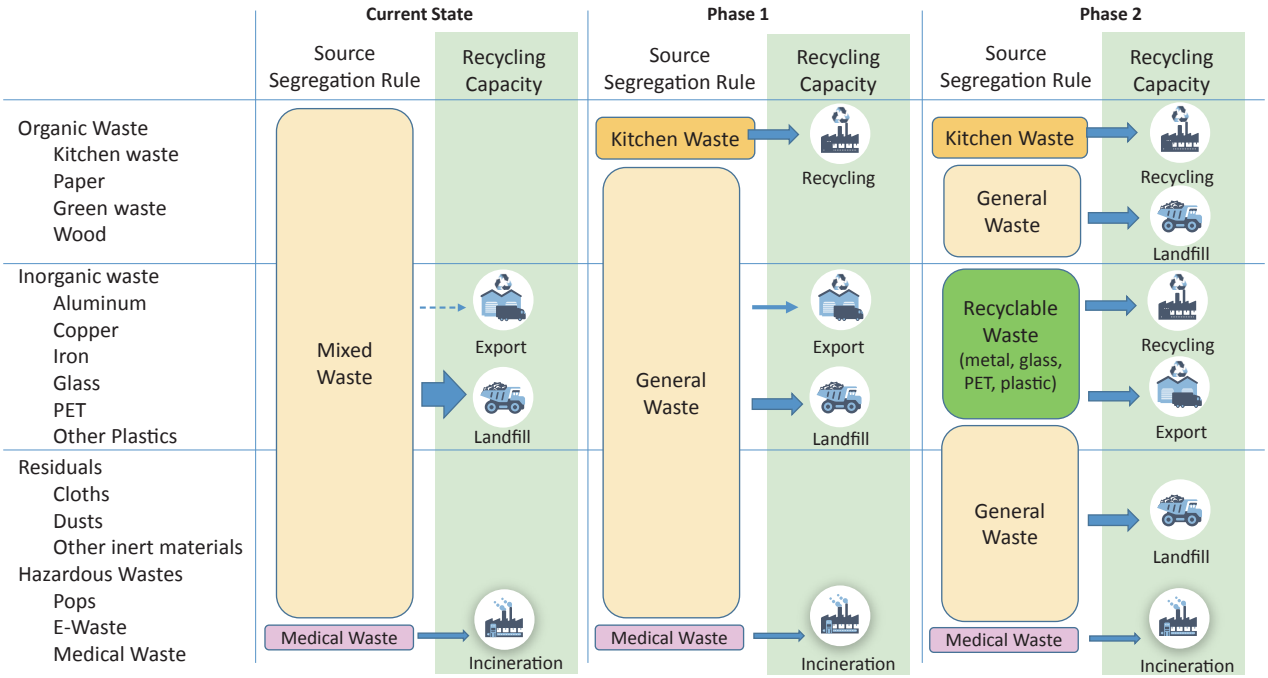


Figure 25: Phased Approach to Introduction of Source Separation based on Recycling Capacity

Source segregation will start for the waste types whose treatment/recycling capacity is secured in later stage.

Action Area 3: Promote environmentally sound management of waste disposal and mitigate impact on environment and human livelihood

While pursuit of complete waste collection and promotion of 3Rs (Reduce, Reuse, Recycle) upstream shall be prioritised, reducing negative environmental and human impacts downstream by strengthening the management of the final disposal site is also an integral component of the sustainable waste management system. In Action Area 3, the infrastructure and, more importantly, maintenance and operation of the final disposal site will be gradually strengthened to realise a sanitary landfill. Introduction of resource recovery measures such as landfill gas collection and a waste separation platform will also be considered as potential options where resources are made available.

These technical improvements will be accompanied by efforts to secure corresponding financial resources. PPCA will explore different financing options including increasing the waste disposal fee and injecting the city's annual budget, based on estimation of the costs required for environmentally sound management of the disposal site. The social dimensions of landfill management, such as protecting the health of landfill workers and formalisation of the informal waste sector (example: waste pickers and unregulated waste shops) will also

be addressed.

Action Area 4: Management of special waste stream

Establish system for C&D Waste

Among the multiple waste types categorised under MSW, C&D waste has emerged as a major burden on the city's waste management system due to its volume, and may require special attention. In order to address the increasingly apparent problem of C&D waste, such as its burden on the final disposal site, multiple interventions will be introduced.

First, laws and regulations must be set up and implemented at the city level to clarify the roles and responsibilities and guide the actions of different stakeholders. PPCA will make efforts to strengthen collection and management of data on C&D waste to ensure that policy development is based on the actual status on the ground (generation, collection, treatment and disposal). PPCA will also promote 3Rs of C&D waste through engaging and collaborating with the relevant industrial actors, while strengthening measures against illegal disposal of C&D waste.

Medical Waste

The medical wastes generated within Phnom Penh are currently managed by Red Cross Cambodia based on a service contract with each medical facility, and are incinerated before final disposal at the segregated pit at Dangkor. PPCA, as the governing institution, will assist responsible Departments and Ministries in conducting awareness raising activities and occasional inspections targeting medical facilities to ensure appropriate segregation and disposal of medical wastes in compliance with the national policy and guideline.

Industrial Waste

With strong developments in textile, construction, tourism and agricultural sectors, a 2017 World Bank report has estimated Cambodia's real growth rate to be approximately 6.9%, making its economy one of the fastest growing in the world (World Bank, 2017). With the ongoing development of the industrial sector, the need for appropriate management of waste that originates in industrial processes is also increasing, as it heavily impacts on the environment and human life. With the national legal framework citing the generator as the primarily responsible entity for proper management of industrial waste, PPCA will strengthen monitoring and oversight in order to ensure implementation within its jurisdiction.

The first step is to ensure that all generators conduct environmentally sound treatment and disposal of the generated waste either by themselves or through private industrial waste management company services. Considering the low capacity of typical generators to self-treat waste, the PPCA will prioritise ensuring that all the relevant generators are under valid contracts with the designated waste management company as well as strengthen monitoring of illegal disposal and treatment.

PPCA will also, in cooperation with relevant departments, in line with Action Area 2, promote the recycling of

valuable industrial waste through attracting investments in the field by proactively facilitating potential business matching between industrial waste generators and recyclers.

E-Waste

In synchrony with its economic development, the consumption of information and communication technology equipment as well as traditional electric and electronics are rapidly increasing in Phnom Penh, which adds to the E-Waste generated in the city. PPCA aims to prevent the stream of E-Waste from seeping into the MSW stream by enhancing efforts to divert E-Waste to the E-Waste recycling business sector. To this end, regulations, emission standards and operational guidelines on E-Waste management are developed and disseminated to the recyclers to control the E-Waste management practice, while a database on recyclers and E-Waste is compiled, and lists of best performing recyclers are developed and disseminated. E-Waste collection campaigns targeting consumers can be organised in collaboration with private sector entities (shopping malls and electronics stores), which is aimed at enhanced collection with a view to replacement purchasing.

Action Area 5: Sharing visions and engaging stakeholders for collective action

Inviting citizens, industries and NGOs to take part in planning and implementation is an indispensable part of waste management governance of the city. Considering that wastes are generated through our daily lives, it takes behavioral changes at the individual level to effectively address such waste issues. Sharing the vision, mission and intended actions widely among society through public outreach is the most effective first step to induce individual actions. In addition, local government policies and plans receive greater acceptance from society when procedural fairness is improved through providing opportunities for learning, representation, discussion as well as delivering and reflecting opinions on various waste management topics.

Environmental education needs to be given special consideration in light of its ability to equip the next generation (next consumers and waste generators) with an understanding on their responsibilities, for nurturing a desire to protect the natural environment as the foundation of our livelihoods, and bringing about behavioral change towards sustainable lifestyles. While such measures may not result in immediate and visible impacts, they are nonetheless indispensable actions for making gradual improvements towards a less resource-intensive society in the long term.

For public outreach, ideally an outreach strategy should be developed and periodically updated to clarify how different target stakeholders can be approached as well as engaged with through tailored actions. A mixture of different multimedia approaches (print, digital, TV, radio, etc.) and opportunities (events, formal education, etc.) will be considered to maximise the effectiveness of communication to each social actor.

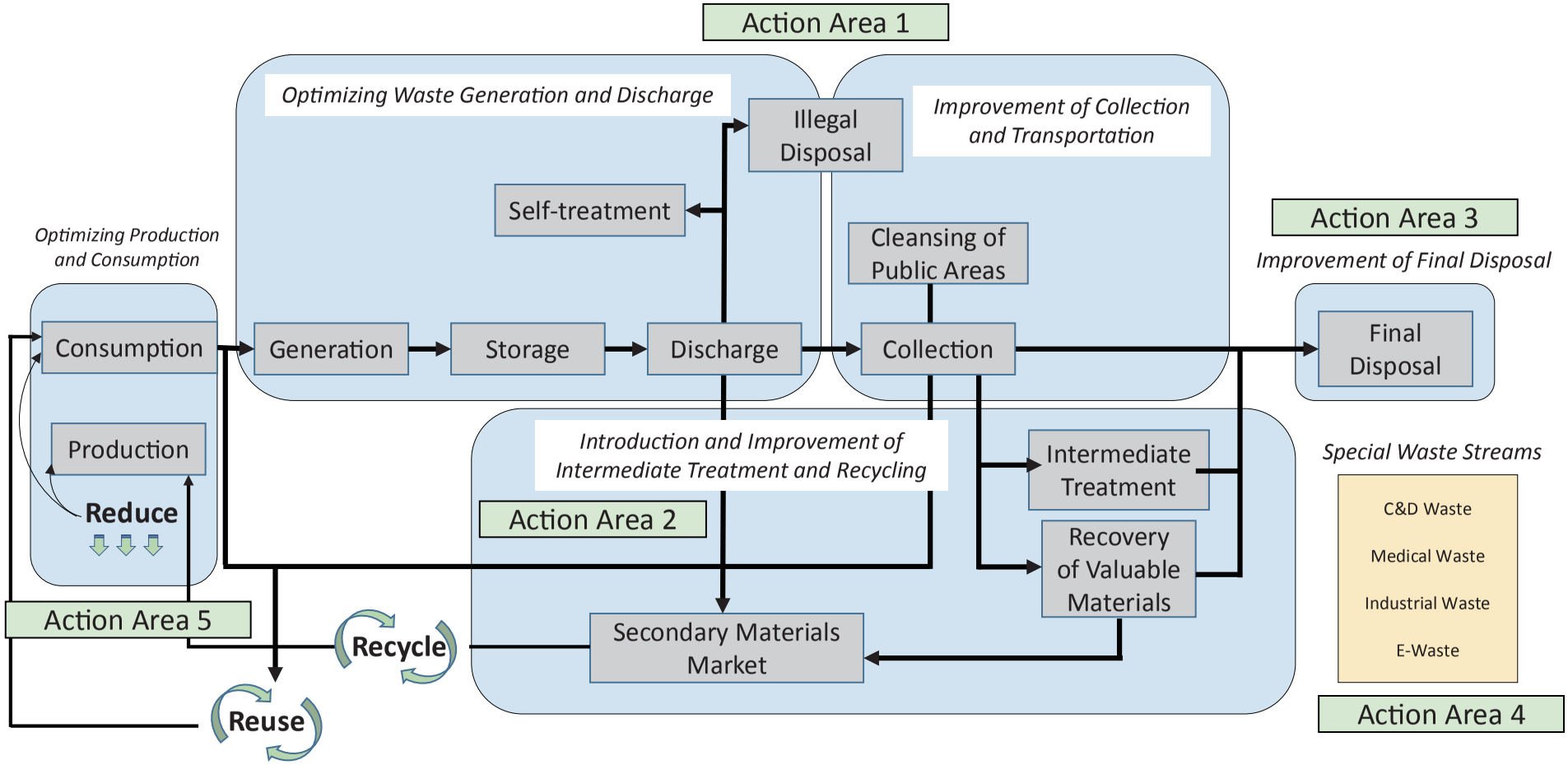


Figure 26: Areas of Intervention for Developing Integrated Waste Management System and Relevant Action Areas

8. Overall Structure of Strategy and Action Plan

The below diagram describes the overall structure of this strategy.

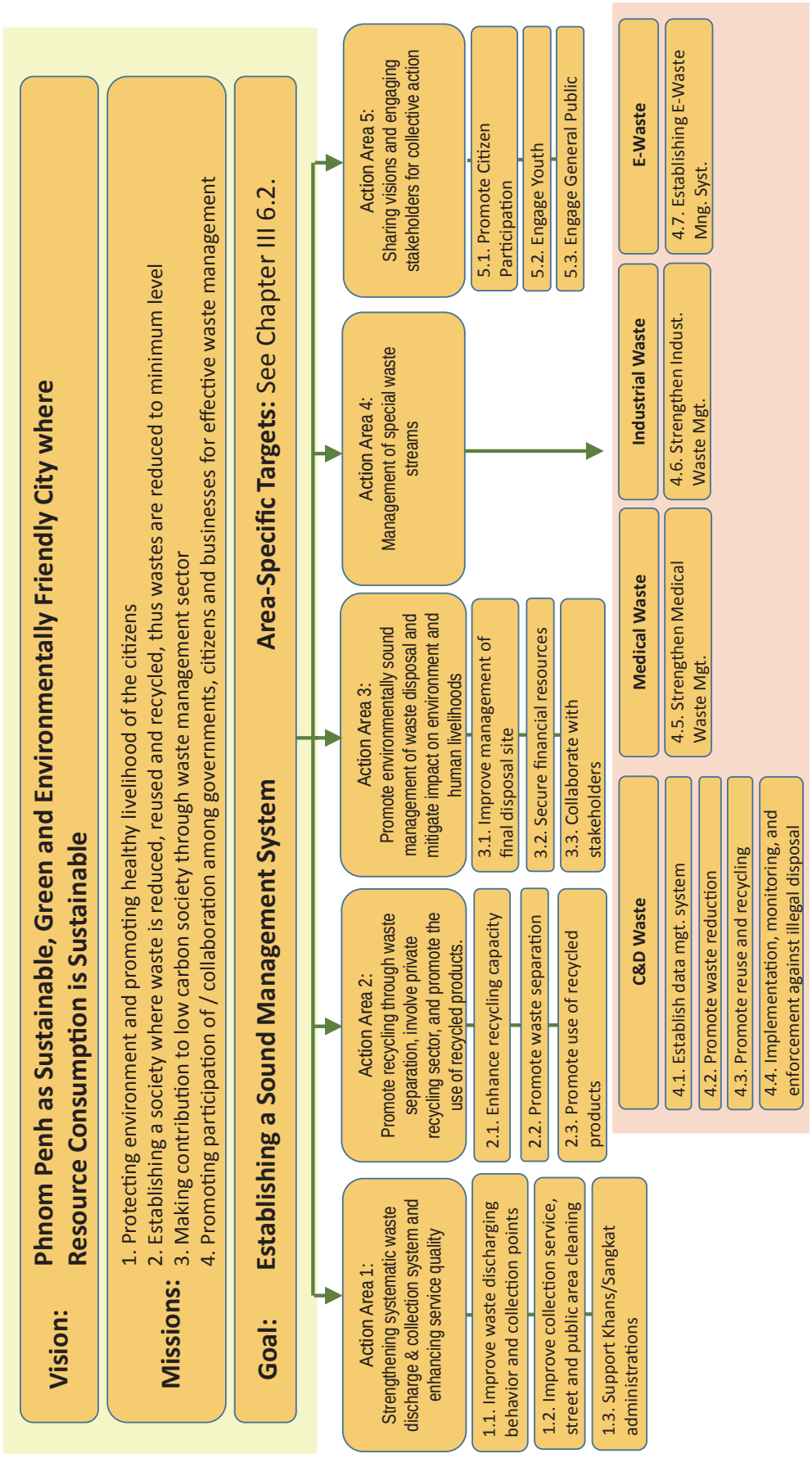


Figure 27: Overall Structure of Strategy and Action Plan

IV

Chapter IV

Action Plan

Chapter IV Action Plan

1. Action Area 1: Strengthening Systematic Waste Discharge & Collection System and Enhancing Service Quality

Action 1.1. Improve waste discharging behavior and designated waste collection points

Objective

To improve waste packing and discharging practices of residents (waste generators), and to have garbage released at designated points in a timely and organised fashion to enable effective collection by the waste collection company.

Current Status

In Phnom Penh, waste packing and discharging are carried out in a disorganised and untimely manner both at the household level and in public spaces.

- Phnom Penh residents commonly mix different types of waste into the same garbage bin/bag with contents such as wet wastes, dry wastes, E-Wastes, HCW and household hazardous wastes. In some case, bulky wastes are also discharged together with general mixed wastes in inappropriate packaging.
- Residents are permitted/requested to leave their wastes in front of their house. Those who live on the first or higher floor are allowed/guided to put their wastes next to the common stairs which are publicly used by everyone. However, such wastes are usually left at street corners, along canals or in any available public spaces as to avoid dirtying their premises or common access stairs/spaces.
- Wastes are generally packed into plastic bags (usually used plastic bags) and/or wicker bins in or without plastic bags. Such waste, which is usually overflowing from containers, eventually forms waste heaps, which contributes to the city's unhygienic and unsanitary appearance, and is difficult to collect. This usually happens in the evening.
- Many households are still unaware of the pickup location and schedule to discharge their waste.
- The implementation of waste discharge guidelines is very scarce in the capital; only 36% of residents are taught or informed about waste management practices. As a result, waste is discharged mainly during late hours, which starts to rot in the streets, is scattered, and eaten by street animals and street scavengers.
- In some public areas where CINTRI has limited access, rubbish is discharged at a communal level in piles in the middle of the road, disrupting traffic around the area. In some instances, uncollected waste can greatly affect the hygiene and environment of the area. Additionally, illegal dumping and littering is endemic, as is the attitude of discarding waste directly onto streets, despite the presence of public bins or containers. In some cases waste bags are left adjacent bins.
- Littering and illegal dumping in Phnom Penh is a cultural norm and self-reinforcing and self-perpetuating form of public behaviour. There are very few educational campaigns or advertisements

to educate on environmental responsibilities and how to discharge waste correctly.

- A number of containers (dumpsters) have been placed in some areas, which act as a temporary storage/containerisation system. However, such container areas are usually dirty due to waste that has spilled or direct discharged out of them. As a result, complaints relating to cleanliness of the dumpsters are transferred from one place to another due to unsystematic management.

Actions

a. Decide on a waste separation rule based on the treatment capacity of the lower stream:

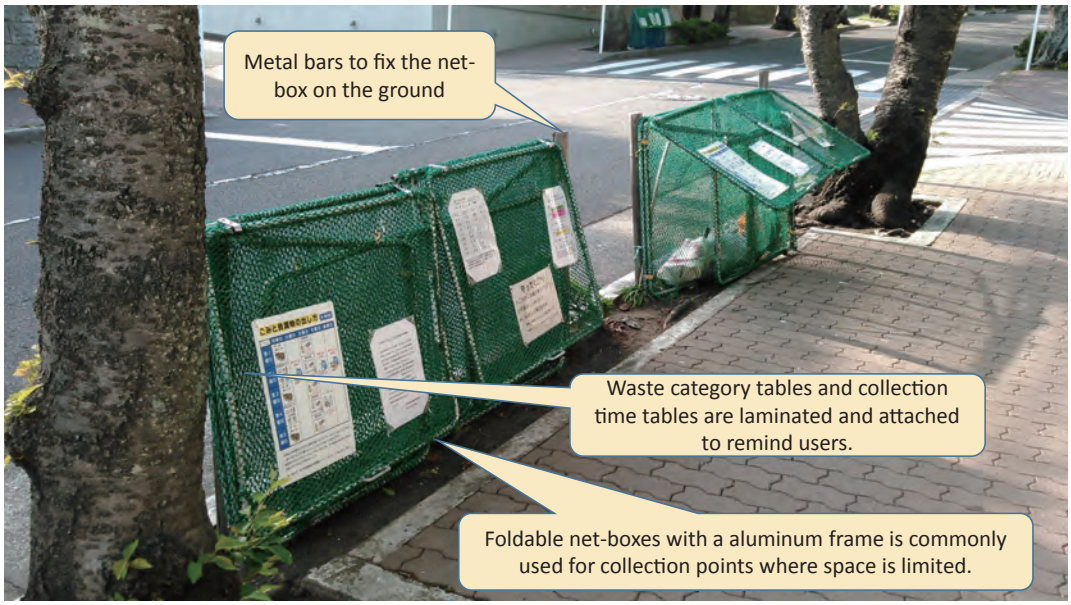
- PPCA will develop a city-wide waste separation rule based on the actual treatment methodologies and their capacities available and in operation. The treatment methodologies may include composting, anaerobic digestion system for organic waste, as well as various recycling methodologies for non-organic recyclables (cans, glass, metal, plastic, etc.).
- Concerns of the waste treatment companies/institutions will be taken into account in developing a separation rule, including the condition in which waste is discharged. For instance, the digester facility may require residents to reduce contamination (non-organic residuals) to maintain the quality of output product to sustain its operation.
- It is strategically important that waste categories be added gradually, starting from waste types for which actual treatment methodologies are available.

  Also see:
  - Figure 25: Phased Approach to Introduction of Source Separation based on Recycling Capacity
  - Action Area 2: Promote Recycling through Waste Separation, Involve Private Recycling Sector, and Promote the Use of Recycled Products

b. Development of manual for waste packing and discharge:

- Based on the separation rules above, PPCA will develop a manual on storage, packing and discharging of residential and commercial waste targeting the residents, in accordance with the national waste management guideline.
- The manual will cover various topics including, but not limited to:
  - Roles and responsibilities among waste generators, collection companies, Khan and Sangkat administrations, and PPCA
  - Waste categories with clear definition and comprehensive catalogues of examples
  - Clear guidance on how to pack and discharge waste for respective waste categories
  - Designated waste collection points (to be discussed among residents, Khan/Sangkat administrations, and collection companies)
  - Clear collection method and schedules for respective waste categories
  - Classification of waste producers/sources should be identified, such as residential (household wastes), markets, bus stations, restaurants, hotels/guesthouses, resorts, public parks/spaces, residential gated communities (borey), high rise buildings and street markets.

Example: Source Separation Practice in Japanese municipalities



c. Designation and design of waste collection points with minimal equipment

- Khans/Sangkat administrations will develop waste collection plan including the mode of collection service: door-to-door, or communal collection (using communal collection points).
  Also see: *Action 1.2. Improve Collection Service, Street and Public Areas Cleaning*
  - In the urban town centre, door to door collection can be maintained with improvement of waste packing and small temporary spaces for discharging.
  - While door to door (curbside) and heap discharge are dominantly practiced in the urban centre, container/heap discharge and illegal dumping are still commonplace in peri-urban areas.
- Khan and Sangkat administrations will facilitate the designation of waste collection points by seeking cooperation and understanding of the residents (waste generators) as well as assistance from waste collection companies and PPCA.
  - Waste discharge/collection points shall be arranged in accordance with collection methods.
  - The designated collection points can be setup in public spaces, to which residents living nearby (within approximately 100-150 m) can bring their waste just before the collection time.
  - In addition to this temporary space, PPCA will work with Khan/Sangkat administration to source permanent designated spaces for large-scale containers where residents or mobile traders can discharge their wastes outside regular collection times, where such measures are feasible.
- In peri-urban areas, container/heap discharge practices would remain valid in order to ease and save on the collection time. This can be performed by either individual residents bringing their wastes to the container or small push carts for collecting wastes from door to door for transfer to the container. PPCA will work with Khan/Sangkat administrations to secure spaces and design a user-friendly platform so that both individuals and push carts can unload wastes easily.
- PPCA in close collaboration with Khan/Sangkat administrations and private contractors will upgrade existing collection schedules for all areas of the town (See Action Area 1). At present, daily collection will be carried out in urban-centre areas and three times a week for peri-urban areas. The waste collection schedule will be updated and disseminated by Khan/Sangkat administrations in consultation with the waste collection companies and PPCA to achieve consistency and optimisation throughout the city.
- PPCA will also develop a waste collection schedule for household recyclable materials, bulky wastes and hazardous wastes, which needs to be consistent with waste packing and discharge times.

d. Outreach programme for dissemination of new waste management and discharge rules:

- A new manual will be distributed to the public to initiate the waste management operation based on the new arrangement, which is a critical step for implementation.
- Conduct awareness-raising programmes utilising multiple media channels.
  - The programme shall prioritise creating an ideal form of waste discharge behavior in the minds of the citizens, urging them to internalise such behavior.
  - In order to draw attention to the target audience, outreach materials will be designed to be appealing.
  - Various media will be combined for broad dissemination: advertisements can take the form of educational clips with catchy slogans on TV, radio or billboards.
  - The messages conveyed will not only guide the public on how, when and where to discharge waste but also how to be environmentally conscious and responsible.

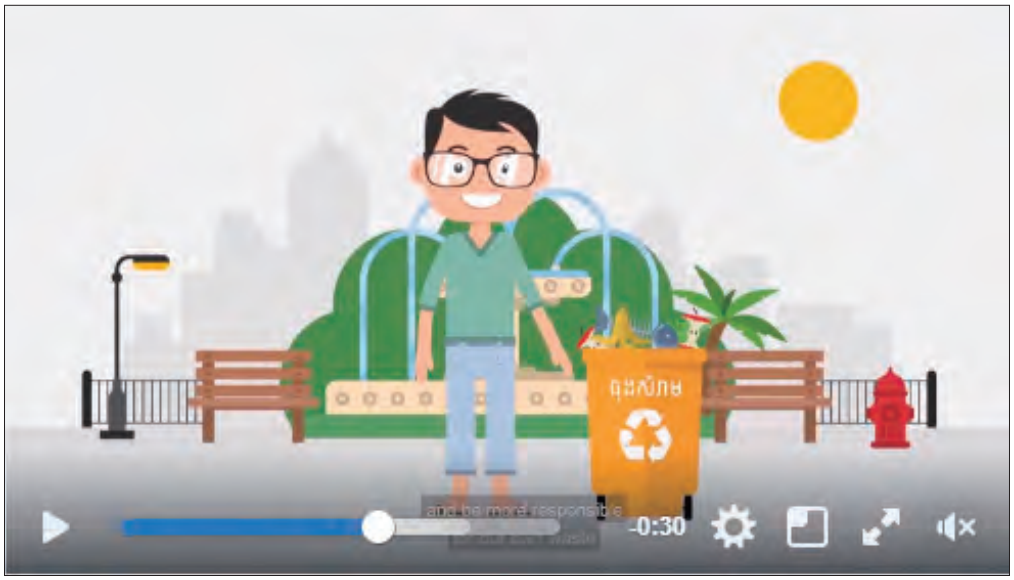


Figure 28: "*Phnom Penh Saat* (Clean Phnom Penh)" - Example of Outreach Video on Waste Discharging Practice

Source: JCI Cambodia, 2017

- Social media marketing campaigns can be used to enhance public awareness. For instance, Facebook could be used as a medium connecting people to waste collection schedule and pick up locations, recent waste management news, educational videos and waste management events so that citizens can participate actively in the sector.

e. Implementation/Enforcement of new waste management and waste discharge rules:

- Implementation of the new waste management rules based on the newly developed manuals can be initiated step-by-step to allow time for users as well as executive personnel of PPCA and other city departments to become familiarised with the new system.
- To effectively and efficiently implement the new waste management rules/manuals, the local authorities, specifically Khan and Sangkat administrations will make vigorous interventions to ensure rules and manuals are recognised and followed by all stakeholders.
- Khans and Sangkats shall inform and advise households under their jurisdiction regarding the waste packing, discharge and collection policy, and provide the manual containing key information such as collection areas and pickup schedules. In detail, the officers shall also guide households on the right method to package and discharge their waste, and the nearest location where they can discharge their waste.

f. Strengthen measures against illegal disposal/ littering:

- Distribute waste bins and banners/signs in public spaces to prevent littering, through potential collaboration with private sector (see box below). The signs should be made visible and large enough to attract people's attention throughout the city.
- Ensure implementation and enforcement, as well as revisions where necessary, of the existing regulation and instructions on littering and penalties/fines such as:
  - Notification on Waste Storage, Cleansing, Waste Discharge and Penalties on Improper Waste

Discharge in Phnom Penh Capital, No. 13 SCN.KKS (2 July 2013)

- Instruction Plan on the Application of Penalties to Promote Environmental Sanitation Improvement in Phnom Penh Capital No. 9 PKNN.S (2 April 2010)
- Instruction on Penalties on Waste Disposal in Public Areas No. 16 SCN.S (25 March 2010)
- Collected fines are to be used to benefit waste management practice and research. Ensuring compliance requires collaboration and cooperation among the relevant stakeholders: police, village chief, Khan and Sangkat.

▪ Where feasible and appropriate, PPCA may also consider installing cameras in public spaces to deter against littering and illegal dumping.

"Littering in eateries - a dysfunctional habit among Phnom Penh dwellers?"
"It is time to adopt a different mindset when it comes to rubbish as it affects your health, sanitation and even your overall image as a citizen of Cambodia!"

(Paraphrased summary recommendations from a blog entry in Urban Voice Cambodia, March 2017)

Although many citizens in Phnom Penh complain about garbage, they also fail to dispose of trash properly and persistently litter restaurants and small street side eateries, which degrades the image of the city. How can this dysfunctional behavioral habit be stopped?

Solution 1. As a customer, dare to be different. Be the role model for yourself, your family and your friends. Dispose of used napkins properly and inform wrongdoers of their behaviour. Make everyone aware of their behaviour in public.

Solution 2. Owners of restaurants should be asked to place large and clearly visible bins for the use of their customers.

Solution 3. Owners of restaurants should be asked to print instructions not to litter in a large, attention-grabbing and highly visible format and placed strategically for customers to read and act on.

Solution 4. For the long term vision, promote environmental education. Making citizens aware of the impact of garbage and of the importance of reducing, reusing and recycling, as well as of proper disposal is more powerful and effective than laws and regulations, because it is a self-driven act.

Action 1.2. Improve collection service, street and public area cleaning

Objective

To improve the waste collection service so that no waste is left uncollected. The collection service should cover 100% of the residents within the city's administrative boundaries. In addition, street and public spaces should be cleaned up regularly to a social acceptable level.

Current Status

In Phnom Penh, current waste collection and street clean up services are under the management of the main waste collection company CINTRI, while public parks/spaces are under Phnom Penh DPWT and the Phnom Penh Department of Culture and Fine Art. This private contractor is tasked with providing smaller-scale solid

waste collection services from specific points (in many instances markets), followed by transportation to and disposal at a site designated by Capital Administration. The company employs around 1,652 workers and owns approximately 359 garbage trucks, 9 street sweeping trucks, 262 push carts, 74 dumpsters and around 362 mobile garbage bins for its waste collection service in Phnom Penh.

In the current practice, all types of wastes are mixed and discharged together for collection.

There are a number of challenges with the current waste collection service practices:

- A large portion of the collection vehicles owned by CINTRI are second-hand thus breakdowns are frequent, affecting regular collection service.
- The generated waste in Phnom Penh is generally wet with over 60% water content. With a small leachate storage tank beneath the hoop of rear waste bucket, leachate usually spills out during transportation, causing social complaints over its cleanliness and hygienic practices.
- The waste collection company manages the collection schedule for the entire Phnom Penh Capital City, which is highly challenging given the traffic congestion, narrow roads, road access, shortage of workers, distance to the landfill, etc.
- A high proportion of the labour force/workers is engaged in the collection operation as a result of improper waste packing and discharge practices in the city, such as in shoveling wastes from the ground to the garbage truck or collecting waste by hand, which scatters the waste.
- CINTRI's workers who are responsible for collecting waste into the garbage trucks generally follow the trucks on foot and pick up recyclable materials during waste collection. This reduces waste collection operational efficiency and adds to the negative image of waste collection practices in the city.
- Mobile traders, in particular in public parks, generally scatter their waste around the area, requiring additional efforts/labour for the clean-up.

Actions

a. Introduce performance and capacity assessment of waste collection contractors. PPCA and Khan Administrations shall develop a framework to assess the capacity of the private contractors contracted to provide waste collection services in the city. This is to ensure that the contractors are sufficiently capable of preparing collection plans to fulfill the requirements set out in the collection schedule and manuals. The assessment criteria could include (i) technical personnel and experience in solid waste management, (ii) equipment, (iii) implementation with waste collection companies and Khan Administrations.

b. Introduce improvements to existing collection/operation plan for each Khan, including organisation of a collection schedule, designation of community collection points (where appropriate), and routes in consultation with waste collection companies and Khan Administrations.
   - Organised Collection Schedule/Plan: PPCA in close collaboration with Khan/Sangkat administrations and contractors will develop a waste collection plan aligned with a set collection schedule, and waste packing and discharge guidelines. For instance, PPCA will coordinate Khan/Sangkat administrations

to work with with collection company in formulating a waste collection plan which is implementable by taking into account (i) different means of collection/equipment, (ii) transport route arrangements, (iii) waste collection operations/practices at different waste generation sources, (iv) cleanliness of the discharge points/spaces, (v) collection equipment storage, (vi) proper training or management of workers, (vii) hygiene and personal protection equipment for workers, and (viii) safety practices/ prevention.

- In areas with long time periods between usual waste discharge times and waste collection times, waste collection company and Khan administrations shall introduce cost-efficient measure to organise waste storage in a way that does not impact on public cleanliness.

  The public should be made aware of the schedule through the posting of a collection schedule on the official websites of PPCA and collection company, via mobile application and distribution on social media, banners and flyers.
- Organised street sweeping and public park/area cleaning schedule/plan: PPCA will define clearly the roles and responsibilities of private contractors and relevant departments (DPWT and department of culture and fine art). PPCA in close collaboration with Khan/Sangkat administrations and the above responsible bodies will upgrade the street sweeping schedule and plan as well as for public parks. The schedule and plan should be aligned with collection schedule and manuals of waste packing and discharge.
- For street sweeping, PPCA will need to ensure that the contractor is capable and allocate sufficient resources to perform the job. In this sense, PPCA will need to seriously review and evaluate the proposed street sweeping plan by taking into account (i) service coverage, (ii) different means of sweeping/equipment, (iii) proper training or management of workers, (iv) hygiene and personal protection equipment for workers, and (v) safety practices/prevention.
- The coverage of street sweeping can be subjectively set based on the importance of the street for the public and/or aesthetics of the city. PPCA will produce a road map with streets to be swept highlighted so that contractors can see clearly their tasks to perform.
- Support from local authorities and PPCA shall be guaranteed in order to find locations to store push carts and unload waste.
- Khans/Sangkats will designate and maintain waste discharge/collection points.
- Ensuring transparency of the collection company's service provision would mean the PPCA could monitor if the operator is providing a fair service to all households, as well as whether any irregularities in service across Phnom Penh have occurred, e.g., to ensure that the collection staff are not accepting bribes or tips from certain households to obtain preferential service treatment for particular locations.

c. Introduce and encourage the implementation of community-based waste collection practices in areas where the trucks have difficulty accessing, to avoid illegal discharge practices and non-payment of waste collection.

   Many NGOs in Phnom Penh have implemented practicable schemes to deploy community-based waste management. This is a cost-effective practice that can be achieved by community mobilisation, procurement of waste collection carts and tools and formation of a community-scale waste management committee.

   - A group of informal private sector individuals could be involved in house-by-house waste collection.

Such individuals should be in charge of collecting waste from houses using specially built carts and moving it to transfer bins/stations strategically placed by the local authorities (Khan/Sangkat) in accessible roads. The waste could then be collected by collection trucks in line with the schedule.

d. Improved communication between PPCA and waste collector company to monitor the operation of waste collection: Waste collection company(ies) should use data management technologies available to them to track, plan, schedule, analyse and monitor the process.

- Analytical reports should be regularly shared with city stakeholders
- Feedback mechanism: A feedback mechanism should be in place to allow clients/citizens to make complaints or give feedback on their waste collection experience, in which the feedback can be anlysed to provide justified solutions. The collection company should cooperate with local authority personnel to work on guiding residents, monitor the discharge behaviour, flag illegal discharging/ dumping of wastes and increase participation.

e. Review of Waste Service Fee for Efficient collection

An economic analysis of the fee system can be conducted to identify realistic fees to provide a comprehensive and sustainable collection service. The collection company can contribute by providing operational reports to prove transparency as well as for use in mapping out a better fee system. Two successful approaches to a pricing system are quantity-based and weight-based pricing.

- For quantity-based pricing, the collection fee for each household varies depending on the number of waste bags disposed and the size of each bag. The smaller or fewer the bags, the lower the collection fee is.
- For weight-based pricing, a collection fee is charged based on the weight of the discharged wastes. Regardless of the consumption level, people would be encouraged to dispose of as little waste as possible through intensively recycling their recyclable waste.
- Pricing flexibility: evaluation based on type of business and its size to determine how much they should pay for the collection fee instead of a fixed amount for every business.
- Once the segregation rules are fixed and enforced, differentiated rates can also be considered/applied to those waste generators who segregate waste (lower rate) and those who do not (higher rate) in order to incentivise segregation.

f. Redefine the partnership with the current collection company towards transition to a competitive market

This could be achieved through waste value creation, lower market concentration by zoning areas among waste collection companies or/an establishing a bidding process to increase competition.

- Introduction of competitive bidding: PPCA will evaluate the possibility of introducing an open and competitive bidding process to improve waste collection efficiency. Although the exclusive contract with collection company (CINTRI) is not due to expire in the near future, this strategy can be effective in the long run. The tactic implies that the PPCA would divide the city up into various zones which various companies would openly bid for, which would allow the PPCA to review all the companies and choose the most appropriate ones. Moreover, having individual companies each being responsible for one specific zone within the city would encourage each firm to improve its service and maximise the efficiency of waste collection. Motivating more investments in the sector could also build and enhance waste value in the market.

- Explore the possibility of initiating contract with a new waste collection company for those waste types that are not currently collected by the current collection company, such as bulky waste.

Action 1.3. Support khan/sangkat administrations to strengthen their monitoring and implementation

Objective

To assist Khan/Sangkat officials in implementing the solid waste programme and monitoring the level of service provision of the waste collection provider.

Current Status

With the introduction of Sub-decree 113, Khan and Sangkat administrations are expected to play important roles in urban garbage and solid waste management, in particular in supporting and coordinating cleaning, collection and transportation services within their jurisdiction.

With the presence of sub-decree 113, instead of contract agreements, Khan administrations under supervision of PPCA have been forming MoUs with collection company for the collection service in their jurisdictions. Two inspectors per Sangkat are employed by the Sangkat administrations to oversee the overall performance of the service provider and to guide residents on proper packing and discharging as well as to catch illegal dischargers. It was found to be quite efficient in dealing with waste scattering and illegal discharge.

While the two employed inspectors managed to coordinate well with the service provider (CINTRI) and residents, they lacked appropriate guidance on the key performance indicators needed to monitor the service provider. The means of communication and reporting lines are not well defined or structured.

Actions

a. PPCA will develop a guideline indicating key target/performance indicators for each Khan for the implementation. This could include, but is not limited to (i) service coverage, (ii) collection rate, (iii) collection frequency, (iv) material recycling, (v) waste scattering, (vi) public complaints, and (vii) cleanliness and hygienic condition of the areas.

b. Working team/committee at the Khan level will be formed to coordinate between the collection company and residents, monitor the performance of the service provider and plan the solid waste management in their Khan jurisdiction. This working group should be technical and financially supported by PPCA or the Khan itself to ensure its functioning.

c. PPCA, in collaboration with other stakeholders, will conduct a capacity development programme for Khans and Sangkats personnel, in particular the working team, in order to prepare a waste management plan and monitor the performance of the service provider.

d. The approach of having two inspectors per Sangkat for the day-to-day monitoring and guidance of the residents on proper waste packing and discharging could be further applied. These inspectors can be included in the Khan working team and be further trained.

e. Organise a management framework by training local authorities on the technical aspects of waste disposal including mapping, tracking and monitoring of waste collection. Allocate tasks and train Khan administrations on how to perform monitoring by making use of a hotline system, such as Facebook, WhatsApp and other social networking apps.

2. Action Area 2: Promote Recycling Through Waste Separation, Involve Private Recycling Sector, and Promote the Use of Recycled Products

Action 2.1. Enhance recycling capacity through promoting grass-roots actions and facilitate the creation of a domestic recycling industry

Objective

To enhance the city's recycling capacity through 1) promoting grassroots actions and 2) facilitating the creation of domestic recycling Industry by evaluating the possibility of establishing a local recycling system, adopting appropriate technology and engaging households and the private sector.

Current Status

- Recycling activities of limited scale are observed in Phnom Penh. While some recyclable materials are collected unsystematically by the informal sector (waste collectors and buyers) for simple processing such as dismantling, the majority is exported to neighboring countries for recycling in the absence of recycling infrastructure. Also, this often incurs additional costs such as transport fees at the border.

- In addition to local organisations such as CSARO which accept organic waste from Daeum Kor Market for composting, several private companies are exploring the business potential targeting both organic and inorganic wastes. In response to increasing stream of incoming waste to final disposal site, PPCA is also exploring potential measures for engaging recycling companies.

Actions

a. Conduct a feasibility study (economic analysis) towards establishing a local recycling industry
   - The first step for this is to understand the local recycling system and compile evidence for deciding whether recycling industry can be established in the city. The study will be assisted by authorities/ relevant institutions in identifying secondary materials markets.
   - The economic analysis will include, but is not limited to, cost assessment of the entire chain of recycling operations including collection, sorting, as well as both initial and running costs for the actual recycling operations.

- The study will be conducted by PPCA for various recycling technologies in collaboration with stakeholders.

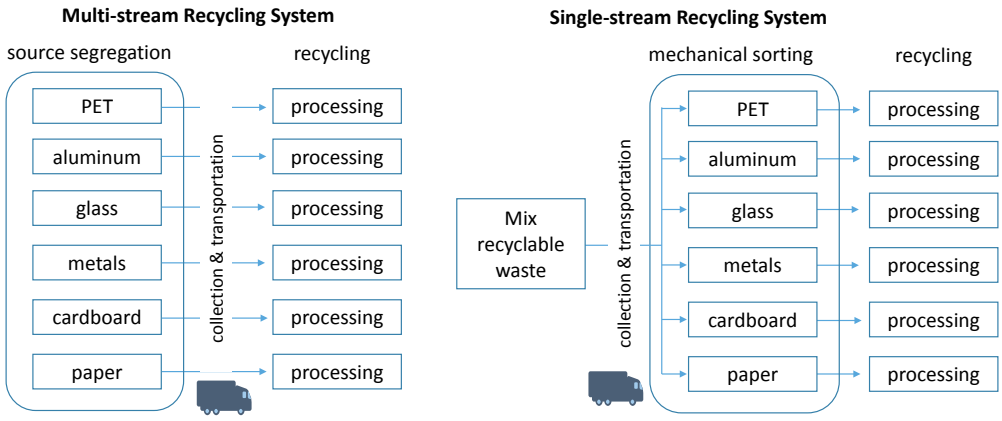
b. Evaluate appropriate recycling technology solutions

In relation to the above, appropriate technologies suited to Phnom Penh's operating environment will be evaluated in terms of technical, economic and socio-political perspectives. For instance, potential technologies for organic waste may include: composting, anaerobic digestion (and extraction of biogas), animal feeding, biomass recycling (sugar cane residuals to paper, coconut residuals to charcoal...etc), vermi-composting and processing with black soldier fly larvae.

Multi-stream Recycling System and Single Stream Recycling System

A single-stream recycling system is a network of machinery that uses a combination of technologies to sort materials for recycling, including PET, aluminum, tin cans, cardboard and paper. The application of single stream recycling can be considered as a solution for sorting unsegregated non-organic recyclable wastes.

On the other hand, in a multi-stream recycling system, recyclable materials are source-segregated by the waste generators based on the material characteristics, and collected for/ transported to processing facilities.



Both recycling systems have advantages and disadvantages, which are explained below:

Psychological Effect of Source Segregation on Promoting 3Rs

Introduction of the single stream system may relieve waste generators from the task of source-segregation, allowing all the recyclable waste to be discarded, collected/transported and sorted for further processing. For this reason, the approach has the potential to realise wider participation from residents, thus may result in larger amounts of wastes collected. However, being able to dispose of mixed waste can potentially set back efforts to promote 3Rs, diverting the attention of waste generators away from the importance of waste prevention, reduction and reuse that is critical for establishing a resource-efficient society.

Financial and Human Resources Required

Due to the various technical components involved, the single stream system is likely to require a strong resource base, both in terms of financial and human resources. In addition to the initial capital costs for processing facilities, running costs for daily operation and maintenance, sustained availability of technical experts for the work is critical to sustain the system.

On the other hand, a multi-stream recycling system requires less capital and technical expertise for the sorting operation while it could potentially require more resources for collection operations, depending on how the source-segregated recyclables are collected: by-category collection will likely cost more than lump-sum collection of multiple categories, thus requiring more vehicles, fuel and staffs.

Quality Control of Output Materials

For any recycling system, reducing contamination of the input materials (recyclables) is the key to improving the quality of output materials (secondary materials). From this perspective, a single stream system is likely to cause cross-contamination of the recyclables, reducing the value of the recovered resources and hence the profitability of the recyclers – a critical element for the sustainability of the entire waste/resource management system. If properly implemented, a multiple stream system has the potential to reduce such contamination, but requires cooperation of the waste generators and robust ongoing efforts of the government.

Ensuring Material Flow - Importance of Recyclers, Market and End Users

Multi-stream and single-stream systems both require a recycling sector (public or private) capable of processing the collected recyclables into secondary resources. Also, most of the recyclables and secondary resources are traded in the market, recycled back to production processes, and remarketed as products. Keeping this material (i.e., product) flow in mind, the set of policy interventions for promoting recycling should accommodate an enabling environment across this chain, including measures for promoting consumption of recycled products (see Action Area 2.3). Such a policy package enshrined in this strategy needs to be continuously updated in order to address emerging challenges in the future.

c. Providing support for recycling companies

Taking into account Cambodia's recycling market, which is still young and forming, PPCA will proactively attract and support private recyclers who express an interest for starting and expanding businesses. In organising the business environment in corporation with other departments, clarification/simplification of administrative procedures and subsidies (if budgetary sources are secured) may also be considered towards this goal.

d. Attract investment in the sector by encouraging and building on the emerging market of domestic private recyclers

- Hold consultative meetings to establish communication between prominent business associations and private recyclers towards facilitation of direct & stable procurement of recyclable materials from commercial generators, i.e., businesses in Phnom Penh (hotels, restaurants, shopping malls, other).
- Establish a database of private recyclers and intermediaries as well as of businesses willing to subscribe to recyclables collection, and centralise information on volumes of inorganic and organic waste generation from subscribed commercial generators in Phnom Penh. At the very least, this initiative will encourage and exemplify waste separation practices, first at the business level, then later on the citizen level.
- Identify best practices in methods of recyclables collection, determine the costs of recovery and transport and advise on final recycling options and markets.
- Early domestic municipal waste recycling market actors (both formalised and informal) already operate in Cambodia, and specifically in Phnom Penh: 1) NGO projects such as CSARO and COMPED have cooperated with certain city markets in Phnom Penh to source organic waste for composting, 2) numerous shops exist to recycle old machinery and equipment parts (mostly formal), 3) peri-urban farmers collect organic waste (food scraps) from restaurants as livestock feed, 4) many individuals and informal collectors operate on private arrangements to collect plastic bottles (mainly PET), aluminum cans, and cardboard boxes.
- PPCA will support and endorse a scale-up of operating domestic recycling businesses through increased intake of waste or pilot a new recycling/recovery facility for a recyclable waste stream that has been ignored in Phnom Penh to date (plastic bags, plastic cups and straws).
- Towards an enhanced diversion of organic waste and C&D wastes, the following areas can be considered as a priority for attracting private investments:

  Collection and recycling of:

  1) Organic waste from markets (Deumkor market, Chbar Ampov, etc.)

  2) Food waste from restaurants and hotels

  3) Residual wastes from slaughterhouses

  4) C&D waste

  - Regulatory measures should be implemented in order to increase recycling.
  - Organic wastes (1-3) should be separated for composting and for conversion into gas through biogas technologies.
  - Cooperation among the recycling companies and the generators is crucial.
  - Certificates (socially responsible shops) can be issued for compliant generators as an incentive and a means to increase awareness.
  - For 3), bins and dumpsters will be arranged via discussion among stakeholders to carefully control the quality of inputs to the degradation system.

e. Promote grass-roots voluntary actions for recycling

- Promote decentralised composting at the household/community level by:
  - Incentivising segregation of organic wastes.
  - Distribution of information materials on composting methods to waste generators.

Centralised and Decentralised Composting Systems

A centralised composting system is often employed to treat large volumes of organic waste and produce compost products which can be marketed or distributed for free for agricultural and horticultural use. The system requires capital for initial investments, operation & maintenance, as well as technical and management expertise.

On the other hand, decentralised systems such as home-scale or community-scale composting are normally less technically- and capital-intensive, utilise inexpensive and locally available materials, and produce products that are often used privately.

For both systems, removing contamination from input organic components for controlling the output product (compost), and the availability of arable land which can accept the resulting compost are the keys for operational sustainability. (see Annex VI)

- Promote decentralised use of food waste (composting and biogas systems) targeting private sectors, particularly large-scale generators such as the food service industry and hospitality industry. A campaign to encourage voluntary actions and training programmes for skills development can be implemented.

Action 2.2. Promote Waste Separation

Objective

To promote active public involvement in waste categorisation by raising public awareness on its benefits, establishing an effective approach to waste categorisation and integrating the public into the system.

Current Status

Waste categorisation activities at source are very rare in the capital. At the household level, people receive small monetary incentives to segregate the “marketable” share of their waste and sell it to door-to-door scavengers. The wastes are then passed through several intermediaries until reaching the recycling firms located mostly outside the country. Overall, the whole transactional process is very unsystematic and inefficient.

- Waste segregation is mostly non-existent in the city. Although waste categorisation bins are distributed in some public spaces, people are not aware of their use and are not using them in the right way. In fact, no signs of guidance to demonstrate waste categorisation methods to the public can be found.

Actions

Waste categorisation is a gradual solution, meaning it requires long-term strenuous efforts from all relevant stakeholders before satisfactory result can be seen. Below are some of the sub-actions that can be implemented to promote waste categorisation behavior among Phnom Penh residents:

a. Modify existing legal tools to officialise segregation rule(s).
   Two segregation categories (organic and inorganic) may be proposed as the first step, considering the city has not introduced source segregation in the past. Households, restaurants and other businesses should be taught how to differentiate between the two types of waste, package them separately and dispose of them in their designated bins.

b. Awareness Raising and Educational Campaigns: the first and fundamental step to waste categorisation is to promote public awareness and active involvement in the process.
   - A waste separation guide (manual) will be made available in interactive form such as a short movie, animation, story book, game and widely distributed to the public through TV, social media, posters, etc.
   - Workshops and trainings on waste categorisation methods and benefits to the public shall be organised periodically. The aim is to activate public involvement in environmental campaigns, especially those related to waste management.

c. To promote 3R by implementing waste segregation in public spaces such as parks and tourist spots, waste segregation bins shall be made widely available and accessible to the public. PPCA will continue to install waste segregation bins to public spaces in the city. In case the bins are not available, PPCA shall inform and the residents on alternatives methods of waste segregation, such as use of different colored bags to package different types of waste for collection. PPCA will also encourage public institutions such as schools, markets and shopping malls to implement source segregation as their own initiative.

d. Promote source segregation of recyclables at the household level while promoting collaboration with informal recycling shops to ensure the city-wide collection of recyclable materials, facilitated by PPCA.

Figure 29 : A Model Waste/Material Flow based on Source-segregation and Collection of Recyclable Materials

Action 2.3. Promote the use of Recycled Products

Objective

To promote the use of recycled products by encouraging the development of labeling system for recycled products

Current Status

According to a report on MSWM in Cambodia, about 86 tonnes of waste is recycled every day in the capital, mainly through the informal recycling stream. Of the total collected waste, 39.7 tonnes is recycled daily, which represents only 4.3% of all the city's discharged waste (Sethy, 2017).

- Most recycling activities occur at an informal level as there are only a few formal recycling facilities in the country (paper making firms).
    - At the household level, waste is sold to informal door-to-door scavengers at very low rates.
    - The collected wastes are then sold for minimal profit to local middlemen who then sell on the bulk consolidated waste to recycling facilities in the neighbouring countries of Vietnam, Thailand and Malaysia. For the scavenger, for instance, a kilogram of tin is worth USD 0.35, while copper is worth USD 3.2.
- Households are not sufficiently incentivised to invest the time to categorise waste because of the low incentive to do so.

Actions

a. Collaborate with national institutions towards establishing a labeling scheme

Establish a labeling scheme for recycled products by classifying and branding recycled and unrecycled products differently. Each package of recycled products should be stamped with a green recycled label to distinguish it from others. Systematically communicating product information to consumers, such as which secondary materials are used, should be a prerequisite.

b. Encourage consumers to use recycled products

- Identify/introduce/promote local products made from recyclables
- Promote green purchasing through awareness-raising campaigns and encouraging consumers to support the use of recycled products.
- Promote flea markets and second-hand shops to encourage market-based re-use activities.

c. Introduction of Green Public Procurement Law

Bringing about a change in consumption habits via PPCA in order to support the use of recycled products and promote the use of green products (e.g. use of recycled paper) would be an effective intervention to increase the consumption of recycled products. The public procurement law/regulation both at national and local level can set out clear requirements and environmental standards.

d. Measures for changing individual behaviour of relevant stakeholders

- Awareness raising campaign on substituting the use of non-reusable objects (e.g., plastic bags) with reusable ones (e.g., paper or cloth bags). Moreover, PPCA will promote efficient lifestyles in which citizens use or consume resources wisely and reuse and recycle in any way possible.
- Providing easy access to recycling options: To further penetrate the market, a supply of recycled products/services should be available in different streams and forms. As stated above, PPCA shall encourage innovative recycling solutions and their application. With promotion by PPCA, citizens will be exposed to a wide range of recycling services, which would increase choice.
- Capacity building on recycling: Train staffs of PPCA, Khans, Sangkats, as well as citizens and relevant stakeholders in recycling technologies and practices.
- System for monitoring and progress measurement (See Chapter V)

3. Action Area 3: Promote Environmentally Sound Management of Waste Disposal and Mitigate Impact on Environment and Human Livelihoods

Action 3.1. Improve management of Final Disposal Site

Objective

To improve the current landfill management to an acceptable level for the public, to ensure the safety of workers, and to integrate the informal waste pickers into landfill management system.

Current Status

At present, Dangkor landfill site operates with no proper control measures. During 2009-2012, the landfill was operated as a semi-aerobic landfill under the appropriate guidance of JICA. However, it gradually became a type of open dumpsite where wastes are dumped into the landfill cell unseparated by waste type, with no daily or regularly applied soil cover, and no leachate treatment facility measures, resulting in impacts to underground water. This has also caused a public health risk for the hundreds of waste pickers whose livelihoods depend on the landfill site, due to the limited quantities or absence of personal protection gear. Further, their resource recovery activities are unregulated and disorganised.

51.9% of solid waste generated in Phnom Penh is organic, which is a potential source of pollutants producing bad smells, leachate and methane (CH_4). As a result, complaints from the surrounding residents are frequent, while potential leachate contamination to groundwater and to adjacent rice fields, as well as greenhouse gas emissions to the atmosphere are presumed. In addition to these environmental impacts is the inevitable impact on the health of the waste pickers on the site.

PPCA has been inviting proposals from international project developers for improving the landfill site through different technology solutions. As of 2018, several proposal were submitted to PPCA for consideration including incineration facility with energy recovery system and biogas facility. While technology solutions with potential of reducing waste amount and generating energy can canter the needs of Phnom Penh, the relevant costs associated with both initial investment as well as operation & maintenance of the system; availability of

technical expertise; existence of viable national policy and regulatory environment that would allow power generators to sustain profitability need to be taken into account in technology selection. Most of them propose introducing a thermal Waste-To-Energy (WtE) plant as a viable option for reducing the volume of MSW from landfilling (environmental value) and generating energy at the same time.

Actions

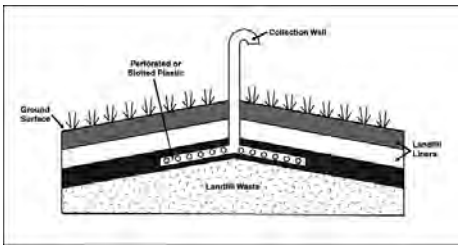
Landfill improvement is an immediately required action in order to raise the standards of municipal waste management in Phnom Penh Capital City. The landfill will need to be progressively improved from the current operation as an open dump to a semi-sanitary landfill (for the existing landfill) and eventually to a fully sanitary landfill (for future landfill sites). The recommendations listed below are mostly immediate actions for the existing landfill with considerations and practices to be adopted at future landfill sites (currently under decision by PPCA). Considering the current disposal site rapidly approaching its maximum capacity, the planning and preparatory actions for the next landfill (sanitary landfill) site will also be initiated.

a. Restarting proper maintenance/operation of the landfill

Improvement can start from less cost-intensive measures rather than introducing techno-resource intensive measures. The Standard Operation Procedures (SOP) for landfill operation and maintenance should be prepared and implemented.

- Monitor height of landfill to prevent the collapse of waste piles. (see Annex VI)
- Regular interval soil cover: The size and design of the cells, and frequency and volume of soil coverage should be decided with proper evaluation of the volume/ type of waste and underground water level, etc. The experiences of other countries under similar circumstances can be utilised and applied for this action.
- Monitor and continuously improve waste and leachate discharge practices from waste collection trucks. Waste collection trucks that enter the landfill must be in proper working condition with a) metal tailgate cover to prevent spillage of waste, and 2) a leachate sump tank (under the truck) with leakage protection. Leachate spillage and waste scattering should be prevented along the entry and exit roads to the landfill. If trucks need to discharge leachate, a dedicated space should be demarcated in order to direct the discharge into the leachate collection pond. In addition, the collection vehicles need to be cleaned post-operation.
- Enhance Personal Protection Equipment (PPE) for workers and waste pickers involved at the landfill: Continuously provide, free-of-charge, boots, gloves, masks and other protective equipment for temporary use for landfill workers and waste pickers. Promote the importance and encourage the use and proper storage of PPE at all times.
- Piloting passive landfill gas collection methods: : since over 50% of disposed waste is organic, carbon dioxide (CO_2) and methane (CH_4) emissions from decaying waste at Dangkor are at critically high levels. A typical collection system, either passive or active, is composed of a series of gas collection wells placed throughout the landfill. It is fairly common for landfills to vent the gas into the atmosphere without any treatment; other treatment options include flaring the gas (combustion technologies) and energy recovery (non-combustion technologies).

Passive gas collection systems use collection wells, also referred to as extraction wells, to collect landfill gas. The collection wells are typically constructed of perforated or slotted plastic and are installed vertically throughout the landfill to depths ranging from 50% to 90% of the waste thickness. Vertical wells are typically installed after the landfill, or a portion of a landfill, has been closed.



Leachate in the course of passing through waste matter, extracts all soluble or suspended solids becoming highly mixed substance often containing toxic components. Currently, leachate collects in naturally low areas of open landfill cells and is sometimes redirected into leachate collection pond for evaporation. Due to the absence of cell lining, leachate seeps into the ground contaminating ground.

b. Development of Landfill Infrastructure

- Establish a leachate collection and treatment system: Liquid product from waste is called "leachate". Leachate, in the course of passing through waste matter, extracts all soluble or suspended solids and turns into a mixed substance often containing toxic components. Currently, leachate collects in naturally low areas of open landfill cells and is sometimes redirected into leachate collection ponds for evaporation. Due to the absence of a cell lining, leachate seeps into the ground and contaminates the groundwater. Therefore, improvement of this system is of utmost priority.
  - Commission a study on a phased approach to introduce locally appropriate technologies to collect and treat leachate at the Dangkor landfill and other future landfills in a manner that would prevent negative impacts on the soil, ground water and waterways.
  - Develop Infrastructure for discharging leachate from collection trucks.
  - Build canals surrounding the landfill to collect leachate in a wastewater pond, to avoid release into canals or other water bodies.
- Install an infirmary at the landfill site
- Expand the waste discharging platform to improve the safety of staffs and scavengers.
- Renew obsolete heavy equipment (excavators and bulldozers) for more efficient operations.

c. Prepare for transiting to waste separation platform

On its premises, Dangkor landfill has a pilot facility for sorting organic waste and preparing it for composting. Establishment of a full-scale Material Recovery Facility (MRF) is preferred, but organising a simple platform for waste pickers to segregate the recyclable materials could be immediately implemented. Waste pickers can be divided into many groups for shift-style working. (Also see Action 3.3. Collaboration with Informal Sector.)

d. Attract specialists and strengthen human resources for landfill management

Capacity building on landfill management for all the landfill staffs should be performed using both local and international aid resources. These include but are not limited to:

- Mapping of current technical capacity of staff working at the landfill and identification of areas where improvements and additional capacity are needed (profile description, level).
- Delegation of relevant staff to trainings and demonstration visits locally, regionally or internationally

with clear mission plans, outcomes and responsibility for local implementation of learnings

- Seek and request technical assistance (TA) from international donors (JICA, ADB, others) in the form of specialist exchange visits to facilitate transfer of know-how on specific aspects of landfill management
- Connect with internship programmes from Cambodia's technical universities (ITC, RUPP, etc.) to attract young talent to work on landfill-related engineering/structural/environmental challenges

e. Improve waste amount recording tools and methods

- Records of waste amounts in Phnom Penh landfills have been kept since 2003, which allows for accurate information on the deposited waste amounts. Access to and analysis of the recorded data is at a minimal level as data is recorded manually and stored locally using Microsoft Access. Currently, the Landfill Management Unit at PPCA implements a cloud-based software application to record and store data on the amounts of waste entering landfills. The new system will allow tracking waste amounts in real time and show more accurate waste data segregated by Khan/Sangkat level.

f. Monitoring of Health and Environmental Impacts

- Conduct study on ground water pollution.
- Conduct study on health impact of landfill operations on neighboring residents, landfill workers and scavengers.

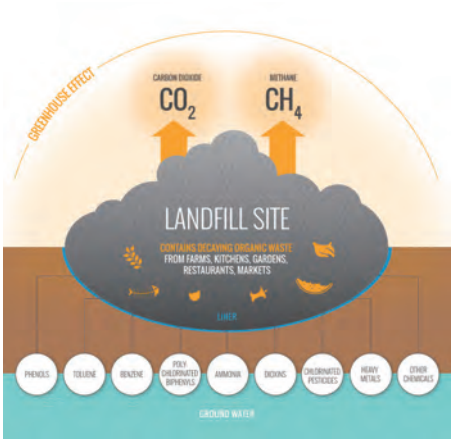
An estimation of GHG and Short Lived Climate Pollutants (SCLP) emissions at Dangkor Landfill, Phnom Penh

Landfills across the globe are major contributors to GHG emissions, among other negative impacts on the environment. Municipal Solid Waste (MSW) landfills are the third largest source of human-related methane emissions on the planet.

Based on Cambodia's Initial National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 2000, the waste sector contributed around 1% to the country's overall GHG emissions contributing over 229,000 tonnes CO_2eq per year. As one of the early estimations, it is considered to be an underestimate with "no regular data collection and lack of data" being mentioned as constraints for accurate estimations. A paper by Hoklis and Sharp (2014), calculates GHG emissions from the Phnom Penh landfill at 331,400 tonnes CO_2eq per year. Other independent set of estimations from Institute of Technology of Cambodia suggest total GHG emissions associated with solid waste landfilling in Dangkor, Phnom Penh city amount to around 283,584 tonnes eq of CO_2/year. While it is hard to say with certainty which figure is the most accurate, one can notice that the estimations are all within a close range.

The main contributor to GHG emissions in landfills is the methane gas (CH_4) formed from decomposing organic waste. Methane is a very powerful GHG, more than 25 times more potent than carbon dioxide (CO_2). GHG sources from the waste management sector also include carbon dioxide (CO_2) emissions released through decomposing waste as well as from transporting waste. Other emissions include Black Carbon (BC) resulting from open burning. Black Carbon (BC) is listed as a short-lived climate pollutant (SCLP) and also absorbs sunlight, contributing to the greenhouse effect.

The offensive odor in landfills is caused by components of landfill gases such as methane, ammonia and hydrogen sulfate. Methane is flammable and in high concentrations can lead to explosions, posing a hazard to landfill staff and nearby communities. Methane emissions from landfills also represents a lost opportunity to capture and use a significant energy resource. Methane emissions from landfills also represent a lost opportunity to capture and use a significant energy resource. Passive and active methane collection methods are used to control the impact of GHG gases from landfills. In passive gas collection systems, collection wells help relieve gas pressure and release (vent) methane from closed landfill pits.



In developed countries, gas-based waste to energy (WtE) technologies are used to capture methane from landfills and use it to generate clean electricity.

- Active gas collection systems are considered the most effective means of landfill gas collection, and include vacuums or pumps to move gas out of the landfill and piping that connects the collection wells to the vacuum. This would require significant investments in piping and valve systems and need to be included in the early stages of landfill development planning.

Action 3.2. Securing Financial Resources for Sustainable Landfill Management

Objective

To improve the financial resources for a sustainable landfill management system.

Current Status

Currently, the site charges a disposal fee of USD 0.75 for every tonne of waste brought onto its premises. However, studies suggest that environmentally sustainable management of the landfill would require increasing the disposal fee. On the other hand, CINTRI has suspended the payment of disposal fee since January 2018 due to insufficient fund. This non-payment continues as of July 2018 despite repeated request by PPCA for payment.

Actions

a. The first step is to prepare a comprehensive cost estimate for environmentally sustainable management of the landfill site, covering the entire life cycle, including costs for closing and post-closure maintenance and monitoring, as well as construction of a new landfill site after closure of the current one.

b. Increase the waste disposal fee (tipping fee) to meet the financing demand clarified by the above action. An appropriate rate can be determined based on the estimated total cost and related factors such as financial ability to pay of those who bring-in the collected waste. Consultations with fee payers (waste collectors) will be conducted to seek their understanding and cooperation in determining an appropriate rate. In connection with the separation strategy (*see Action Area 2*), different rates can be applied for mixed waste (higher rate) and separated waste (lower rate) to incentivise separation, and/or depending on the waste source/type (residential, commercial, industrial, institutional waste).

c. Allocation of the city's annual budget can also be considered for landfill management/enhancement in addition to the waste disposal site. The potential for including other public financing options such as public bonds, trust funds, and/or private financing initiatives (PFI), and/or public and private partnerships (PPP) can also be explored.

d. Keeping accurate records of incoming waste is also critical to providing key source information for financial decision-making, such as calculating the remaining lifetime of the landfill. (See Action Area 3.1.-d; and Section V on Data Management.)

Action 3.3. Collaborate with Stakeholders

Objective

To collaborate and integrate the informal sector into the proper waste management system.

Current Status

Currently, the actors, waste streams, waste data and scale of economy in relation to the informal sector (waste pickers, small-scale collectors, waste dealers/exporters) is not well understood. The contribution of waste pickers to the city's waste management system through resource recovery activities is both invaluable and underestimated; their potential goes unacknowledged. Also, the protection of health of workers is another cause of concern. (Also see Annex VI)

Actions

a. Prepare transition towards waste separation platform
   See Action 3.1.-c

b. As regards the mid-to-long term plan for collaborating with or integrating the informal sector, it could start with documenting and acknowledging the contribution the informal sector plays in the city's solid waste management. Studies and past experiences in other countries shows that quantifying the contribution of the informal waste sector to reductions in municipal waste handling costs, environmental costs, poverty alleviation, downstream employment generation and health costs needs to be undertaken to support the demand for integration. In order to be sustainable, integration models must establish statistically that the costs and the ensuing benefits are worthwhile.

c. Implement an awareness-raising campaign to increase the status of the informal sector, which is important in order to improve public attitudes surrounding informal sector activities.

d. Formalisation of informal sector
   Specifically, PPCA can promote informal sector integration in various ways, such as: Recognise waste pickers as important actors in the recycling chain; Develop a functioning source segregation scheme; Recognise and provide incentives for the informal waste sector through excise, tax and other concessions; Constitute boards or forums with equal representation of waste pickers, traders and PPCA; Register all waste pickers and itinerant buyers and find ways to provide contributory social security; Create a clear legal and policy framework for informal waste sector integration; Favour informal sector organisations in the contracting process by simplifying contractual terms; Provide low-interest loans to organisations of waste pickers seeking to bid for tenders and contracts; Reserve waste collection and small-scale processing for small and medium informal waste collection enterprises; Reserve land in development plans for decentralised processing of organic wastes; Reserve space for recycling sheds, material recovery facilities, storage of recyclables, intermediate processing; Offer credit to assist in constructing safe, durable workshops; Provide access to markets (roads); Guarantee freedom from arbitrary fines and penalties ; Provide technical support services in upgrading technology and industrial processes.

e. Incorporation of informal recyclers into waste collection system of PPCA. Measures may include introduction of register/permit schemes to control/restrict access, hiring of waste pickers as staffs of material recovery facilities to be set up on the premises of the landfill site, and provision of safety equipment and measures.

4. Action Area 4: Management of Special Waste Streams

Special Waste 1: Construction and Demolition (C&D) Waste

Action 4.1. Establishment of data management system

Objective

To promote data collection throughout the waste value chain, from generation, collection to treatment and disposal, for better management of C&D waste.

Current Status

The construction boom in Phnom Penh is clearly evident, but there are no official statistics on the amount of C&D waste being generated there, nor systematic accounting of where it ends up. As the city continues to grow and experience more major real estate development, a formal system with clear rules and regulations and data-collection will be necessary for C&D waste.

Actions

a. Introduction of by-category waste data collection at construction sites, final disposal sites and/or recycling facilities.

   All the construction projects, landfill authorities as well as recycling companies should keep records of C&D by category and weigh all wastes as obligatory processes. They should not receive permits to operate without signing a declaration to maintain records of C&D data, which can help in tracking amounts and flows of C&D waste.

   Local authorities (Khans and Sangkats) are tasked with monitoring such data records every six months as well as collecting such data from the stakeholders and sharing it with the Khan and PPCA. Those who breach their record-keeping obligation should be fined and have their work/business permits revoked.

b. Promote open access to, and usage of, public information concerning the types of property (single family residential; multi-family residential; and commercial & non-residential, etc.), and square measures so that amounts of C&D waste generated can be estimated and fed into the planning and management functions.

   PPCA is to collect construction information on properties prior to construction from construction companies and provide open access to such information online. This enables estimation of C&D waste during construction and comparison with actual C&D waste produced after construction, for more efficient planning and management of C&D waste. Further, environmental institutes and other stakeholders conducting research on C&D waste can access data more easily and speed up their research on C&D waste management.

Action 4.2. Promote Waste Reduction

Objective

To minimise the C&D waste entering the final disposal site as well as reduce illegal dumping of C&D waste.

Current Status

No efforts have been taken to minimise construction waste generation at the design, procurement and production stages. Further, no awareness raising programmes for educating stakeholders on the importance and benefits of effective reduction of waste generation exist.

Actions

a. Improve awareness of all the stakeholders involved in C&D waste generation and management.
   - Organise consultative dialogues with stakeholders (construction companies) to raise awareness on the importance and benefits of the rules and responsibilities of C&D waste management as well as rules and responsibilities for the stakeholder's management.
   - Establish more advanced collaborative networks among construction companies which focus on Reuse, Reduce and Recycle and share knowledge via such networks.
   - It is important that all contractor, sub-contractor employees and other stakeholders receive training in job site recycling procedures so that C&D waste is properly separated at source and properly managed. The PPCA should also organise workshops on waste minimisation for all stakeholders so they can learn and train themselves to overcome all the current challenges.

b. Encouragement of sustainable construction:
   The PPCA will boost new entrants to innovative waste management solutions and the use of green technology for construction; for example, interlocking reusable bricks. Revisions to traditional methods of construction should take place by focusing on the environmental impacts of the end products rather than profitability alone. The construction should be planned, designed and carried out in innovative and eco-friendly ways in line with the principle of a circular economy. Further, the agency responsible for supervising environmental protection in construction projects will be allocated for proper supervision to maintain standards of construction.

c. Impose disposal fees at the final disposal site.
   The disposal fee for the C&D should be set based on the comprehensive cost estimation of the sustainable maintenance of final disposal site covering the entire life cycle. Differentiated rate can be set for C&D waste based on the weight in order to incentivise the C&D waste producer to focus more on reduction or minimisation of C&D waste.

d. Revision/update and implementation of existing regulations on C&D waste with introduction of a penalty as a disincentive to illegal disposal.

Action 4.3. Promote Reuse and Recycling

Objective

To minimise landfill disposal and limit the need to produce materials from virgin sources, resulting in a net environmental benefit.

Current Status

The rapid urbanisation taking place in Phnom Penh means increased construction of buildings, roads and bridges, etc., which has led to a rise in C&D waste. However, existing legislation does not adequately facilitate the reuse and recycling of C&D waste, and no definite regulations or guidelines for reuse and recycling of C&D waste exist.

Actions

a. Maximising the use of demolition waste in construction and minimising construction waste through planning/designing and progress monitoring throughout all construction phases.
   Materials generated should be reused on site or salvaged for subsequent reuse to the greatest extent possible and final disposal should be considered only as a last resort. The warehousing of salvaged materials can facilitate reuse in future projects and architectural salvage sales can allow the public to acquire material resources that have been removed from decommissioned buildings.

b. Conduct research to identify innovative initiatives to avoid the need for disposal and also appropriate recycling technologies for C&D waste.

   Several markets could make beneficial use of C&D waste: Waste timber can be recycled as shuttering or hoarding, or sent for reprocessing as medium density fiberboard, waste concrete can be utilised as filler materials for roads, and stones can be segregated and reused in construction work. Bitumen and asphalt can also be recycled for use in road projects.

Action 4.4. Implementation, monitoring, and enforcement against illegal disposal

Objective

To monitor and control the illegal dumping of waste in the environment, which causes pollution, and manage proper disposal of C&D waste to the final disposal site.

Current Status

There is no formal monitoring, reporting, collection or disposal mechanism for construction waste. Although Sub-decree 113 (Urban Solid Waste Management) stipulates the responsibilities of the generators and the contractors of C&D waste for proper storage, collection, transportation and final disposal, and allows generators to dispose of generated C&D waste at the final landfill site either by themselves or via contractor services, in practice C&D waste

is not accepted by the landfill sites in Phnom Penh due to the city's aim of extending the lifespan of the site, unless wastes are brought in by contractors. As a result, much waste is dumped along the river, public spaces, and city outskirt. In addition, C&D waste from households are often not collected by CINTRI on the ground that such wastes does not fall under MSW defined by the contract between the company and PPCA. This is also encouraging illegal/ inappropriate disposal of C&D waste.

Actions

a. Develop and disseminate a guideline on C&D waste covering proper monitoring and disposal of the waste to the final disposal site without environmental pollution. Such guidelines will promote a coherent, integrated approach where C&D waste is given due consideration throughout the duration of a project, including monitoring and illegal disposal. It will also include a proper waste management plan for specific wastes which exceed threshold sizes.The management of hazardous components of C&D waste such as asbestos will be governed by the relevant national legal instruments, and is subject to the guidance and approval of MoE.

b. Preventive measures against illegal disposal.
   - The life of the final disposal site will be expanded by extending the area of the landfill in case there is insufficient space for C&D waste. However, disposal of materials left over after reuse and recycling should be possible upon paying for such. Rock and sand can be used as alternative materials for the daily cover in landfills.
   - The monitoring should be strengthened to include enforcement in the case of illegal disposal. The penalty imposed on polluters should maintain effectiveness in order to act as a deterrent to illegal dumping.
   - Potential introduction of new waste management company can also be explored where feasible.

Special Waste 2: Medical Waste

Action 4.5. Strengthening the Medical Waste Management System

Objective

To eliminate inappropriate medical waste disposal among health service providers and further enhance efficiency of the current medical waste management.

Current Status

Currently, medical waste from both public & private medical facilities in Phnom Penh is mainly managed by Cambodian Red Cross (CRC). Despite its reportedly full-service coverage and existing national guideline on medical waste management, segregation of medical wastes by classification is not fully implemented by generators. Many clinics and small medical facilities in Cambodia are not aware of classification and segregation rules for medical waste, especially the many unauthorised clinics in Phnom Penh. As a result,

medical wastes are discharged, collected and disposed of together with MSW at Dangkor Final Disposal Site without detoxification treatment. Such process poses grave public health and environmental risks to landfill workers, nearby residents, and the wider public.

Actions

While MoH and DoH, supported by the relevant and responsible ministries, have primary jurisdiction over medical waste management in the city, PPCA, in line with its legal capacity, will assist the relevant responsible national and subnational agencies through, but not limited to, the following measures:

a. Assist MoH and DoH in conducting awareness raising and training programmes on medical waste management for all health service institutions. The programmes are designed to equip medical professionals with a clear understanding on and capacity to manage medical waste, proper disposal techniques, and the risks associated with improper discharge of medical waste.

b. Assist MoH and DoH in organising a public awareness campaign to increase understanding on the risks of being exposed to medical waste targeting citizens.

c. Consult with and assist MoH and DoH in conducting periodical inspections on all medical facilities to ensure appropriate medical waste discharging practices in compliance with the national guideline.

d. Consult with MoH and DoH about the possibility of establishing a reporting mechanism (such as a hotline) for the general public to report any unlawful discharging practices of any medical institutions.

e. Consult with and assist MoH and DoH in conducting periodical inspection on CRC to ensure collection, intermediate treatment (incineration and other relevant treatment), and final disposal of the medical waste are practiced in compliance with the national guideline, and negative public health and environmental risks are neutralised or minimised. Management of smoke and fly ash from incineration as well as use of personal protection gear by the operation staffs will be monitored.

f. Assist CRC towards effective planning and implementation of medical waste management services where appropriate:
   - Large-scale distribution of bins specifically designed for medical wastes.
   - Expansion of current medical waste incinerator and other related equipment to cope with the increasing amount of medical waste.
   - Increase the number of collection trucks to improve collection efficiency.
   - Set clear pick-up schedules: As contact with medical waste could lead to even more immediate and serious consequences than with normal waste, disposed medical waste should be collected as soon as possible to avoid the risk of exposure, especially to scavengers sifting through such waste. CRC should design an effective pickup schedule that correlates with the normal disposal behavior of each area within Phnom Penh. The schedule will then be distributed to all stakeholders, especially health facilities.
   - Ensure sustained operation of sound final disposal site specifically dedicated for medical waste.

Special Waste 3: Industrial Waste

Action 4.6. Strengthening Oversight Mechanism to Ensure Implementation

Objective

To strengthen monitoring and oversight in order to ensure appropriate and environmentally sustainable management of industrial waste by the generator, based on the polluter-pays-principle.

Current Status

Currently, the management of industrial wastes is licensed by MoE to a private sector company, Sarom Trading Company, which provides collection, transportation and final disposal service based on a service contract between the company and the generator. While treatment and disposal of industrial waste, according to the national legal framework, is stipulated as the responsibility of the generator, in reality illegal/improper treatment and disposal are still prominent (for instance, incomplete segregation of municipal and industrial waste), while non-payment of service fees to the waste management company is frequent. (see Annex VI)

Actions

a. Development of sub-national regulation which clarifies the responsibility and cost-burden of the stakeholders as well as punitive measures, based on Extended Producer Responsibility (EPR).

b. Creation of special unit/position for industrial waste management within the Waste Management Division where appropriate.

c. Development of technical standards and guidelines for environmentally sustainable recycling and treatment practices.

d. Develop and update a database on industrial waste generators within Phnom Penh, including basic company profile, waste type, amount of waste produced and degree of hazard, as well as information on how wastes are treated (self-treatment or through outsourcing in compliance).

e. Creation of a periodical forum for local government-stakeholder dialogue, to communicate the regulations, inform the technical standards / guidelines, raise awareness on the industrial waste issues, and bring about behavioral changes. Industrial unions/groups of different sectors that can act as an intermediary to individual companies will be invited to play a key role in this process.

f. Enforcement of regulations, standards and guidelines through exposure of non-complying companies through occasional inspection with application of punitive measures for non-compliance (including illegal disposal and sub-standard practices).

g. Promotion of Reduce-Reuse-Recycle (3R) of industrial waste, in cooperation with industrial actors,

through encouraging “reduce” and “reuse” within their production processes within relevant safety standards, and through promoting investment by interested private recyclers. PPCA will act as a catalyst to facilitate business matching between waste generators and recyclers. The compiled database on waste generators will be fully utilised in this process. Introduction of source-separation by the waste generator will also be critical to promoting recycling.

h. Capacity development targeting industrial waste management companies towards sustainable intermediate treatment and final disposal.

i. Conducting continuous capacity development of the PPCA officers tasked with industrial waste governance towards better policy planning, execution, monitoring and further policy development.

Special Waste 4: Waste Electrical and Electronic Equipment (WEEE)

Action 4.7 Addressing illegal disposal, regulating E-Waste management practices, and diverting valuable E-Waste to resource trading

Objective

To divert the E-Waste from seeping into the MSW stream through enhancing the stream of valuable E-Waste to resource trading.

To combat illegal disposal and curb unsustainable E-Waste management practices such as open burning and back-yard smelting as cheap methods of resource recovery.

Current Status

Today, E-Wastes generated in Phnom Penh are either directly disposed of as general solid waste and end up in the final disposal site, or follow a similar pattern after a few cascade uses of the product, including reuse, repair, or extraction for material recovery. While most of the E-Waste management processes in Phnom Penh are concentrated in collection, dismantling and export, cases are reported whereby valuable resources are extracted through inappropriate procedures causing environmental and health consequences. In this context, Sub-decree on E-Waste Management No.16 entered into force in February 2016, which clarified the responsibility of E-Waste business actors (collectors, repair shops, dismantlers, and recyclers). However, it is expected to take time before substantial changes can be observed in actual operational practices on the ground.

Actions

a. Develop and update a database on E-Waste recyclers within Phnom Penh, including basic company profile, E-Waste types handled, amounts of E-Waste received, sold, and residual disposed of with the degree of hazard, as well as information on how the wastes are treated.

b. Develop an E-Waste inventory in cooperation with DoE and MoE based on the above survey.

c. Dissemination of MoE Guideline on environmentally sustainable management of E-Waste targeting waste collectors, dealers and dismantlers.

d. Conduct awareness raising activities on health and environmental impacts on inappropriate treatment of E-Waste, particularly focusing on backyard smelting.

e. Develop subnational regulation on the emission standards and recycling operation standards in collaboration with MoE, DoE, MoIH, DoIH, and other relevant agencies.

f. Develop a list of certified recyclers demonstrating satisfactory E-Waste management based on the standards. Publicise and distribute the list to potential E-Waste generators to facilitate disposal and collection.

g. Organise E-Waste collection campaigns targeting general consumers (household generators) in collaboration with shopping malls and E-Waste trader/recyclers to enhance collection rates/amounts.

h. Strengthen monitoring and periodical inspection for controlling illegal disposal and inappropriate/sub-standard management practices.

5. Action Area 5: Sharing Visions and Engaging Stakeholders for Collective Action

Action 5.1. Promote Citizen Participation in Waste Management Planning

Objective

To realise effective implementation based on improved relationships between SNAs and citizens through enhancing public participation across the management cycle (planning, implementation, monitoring and revisions) of the waste management strategy.

Current Status

Involvement of the general public is minimal across the whole management cycle. While the city has been exerting efforts to provide learning opportunities on waste management topics on several occasions, an official feedback mechanism has yet to be institutionalised and citizens have limited opportunities for delivering and reflecting their opinions on city waste management planning, implementation and monitoring.

Actions

a. Promotion of information disclosure

Promotion of information disclosure is an effective methodology to initiate/enhance public participation in the waste sector. Stimulating public discourse on waste issues would help create political momentum.

- Publish relevant administrative documents including waste management legislations, budgets and annual reports online to better communicate the strategy on the city's website. (Procedural dimension)
- Share collection schedules, separation/discharging rules online and at collection points for better exposure to the public. (Technical dimension)

b. Collect and reflect the voice of the general public through establishing a feedback mechanism on the city's waste management policy development:

- Organise public hearings and/or conduct opinion surveys
- Organise the City Waste Management Conference
- Recruit (open recruitment), assign, and invite representative(s) of residents to key meetings on waste management.
- Utilise information/communication technologies (ICTs) such as Social Networking Service (SNS) as a potential channel for collecting feedbacks where feasible.

Action 5.2. Engage Youth through Environmental Education

Objective

Teaching and engaging young generations is an important strategy to expanding and sustaining efforts towards a sustainable green society. PPCA will raise awareness among the young on the negative impacts resulting from improper management of waste by promoting local capacity building at schools, awareness raising and education to encourage youth participation and enhance environmental awareness.

Current Status

In 2016, a program has been initiated by the Ministry of Education Youth and Sport (MoEYS) and MoE for the promotion and mainstreaming of environmental protection and natural resources management into the curriculum.However, the current educational programmes/curricula contains limited components for environmental education focusing on waste/resource management.

Actions

a. Co-develop school curriculum for environmental education together with appropriate stakeholders, including education agencies, schools and curriculum development experts. The curriculum will contain, among various environmental issues, waste and resource challenges both at the global and local level. The case of Phnom Penh can be introduced as an example, with the aim of encouraging voluntary actions by

students or schools in such topics as waste separation and resource conservation.

b. Develop educational materials to be utilised in the curriculum, such as leaflets or short books. Create a 30 minute educational video for showing in schools, developed in collaboration with DoEYS and schools. The video will be designed to convince the audience on waste issues and their personal action, and may feature a brief summary of waste/resource challenges in Phnom Penh and the world, history of materials (from harvesting to production, consumption, transformation to waste and disposal), Phnom Penh's vision, and what the audience can do to protect the environment.

c. Develop guidelines on teaching methods and train school teachers/managers to support curriculum implementation on the ground.

d. City Environment Award – a competitive point-prize system that awards schools with the highest recycling amounts/rates or the most creative recycling initiative, which could be instituted for encouragement. Drawing contests can also be considered for elementary schools.

e. Provide opportunities for field learning (i.e., internships, volunteers) to high-school students through promoting cooperation between high schools and various institutions.
   - Such opportunities can be offered in the penultimate year of study.
   - Collaborating institutions can include the MoE.
   - The programme length can vary from short-term (1 week) to long-term (two-month utilising summer break).
   - Such programmes can also serve as an opportunity to support recruiting efforts by the accepting institutions to identify prospective professionals in the field.

f. Attach billboards, posters and signs around schools featuring tips on waste reduction and on recycling; disseminate inappropriate waste littering and environmental consequences through educational media booklets and magazine content.

Action 5.3. Engage and Develop Capacity of General Public and Private/Public Sector

Objective

Raising awareness and deepening collaboration with the public including various economic actors is another important pillar for promoting 3Rs and achieving waste/resource management goals. Through collaborating with various institutions and utilising an appropriate media-mix, PPCA should encourage citizens to understand the importance of protecting city's environment, and develop the capacity to induce their actions towards sustainable lifestyles at the individual level.

Current Status

- Phnom Penh residents are mostly unaware of the importance of packing and storing their waste properly, and most people pack waste in a mixed fashion, making it difficult to separate for recycling and

composting. There is a widespread habit of not throwing trash in the rubbish bin but on the street or discharging it in appropriate locations but at incorrect times due to low awareness of collection timetables.

- Phnom Penh lacks the most rudimentary programmes for medical waste disposal, many hospitals dispose of their medical waste in the city dump which is unlined, and has children scavenging in it daily.
- There are currently no incentive programmes to foster private sector participation in recycling and good waste management practices

Actions

a. Conduct various awareness raising events targeting citizens and the public sector to promote waste reduction and reuse in their respective activity domains.
   - Organise environmental fairs in each Khans to promote recycling in the community. These events should be organised annually through collaboration with PPCA, volunteers and local community-appointed heads.
   - Introduce environmental information and education campaigns, by using door-to-door methods teaching residents how to recycle and the impact of incorrect waste practices on the environment and health, as well as the role of waste sector workers (including informal sector) in improving the city's hygiene and protecting the environment.
   - Distribute materials such as leaflets and manuals to households and attach stickers to trash bins and around the market areas to encourage recycling.
   - Use local media such as newspapers, radio and TV to create awareness. Short videos shall be made available in partnership with the university, with the aim of raising awareness on environmental challenges.
   - Introduce awareness raising/training program on waste management targeting staffs of all SNAs to promote their understanding on the entire waste manage chain, as well as on promoting appropriate waste management practices.
   - Involve collection companies in the citizen awareness raising campaign by organising workshops in collaboration with the companies in local residents, to inform the Khans about collection schedules and locations as well as the best recycling and waste management practices.

b. Engage private sector by evaluating incentives (economic and non-economic) and market strategies to encourage appropriate waste management and 3R behaviours.
   - PPCA can encourage businesses to integrate and promote 3R in their own business processes by highlighting/communicating the benefits of improving waste and resource management, both in economic and non-economic terms (e.g., cost reduction from use of non-virgin materials or efficient resource utilisation through improved production processes).

Example: Promoting Waste-to-Energy in Cement Industry

A cement company *Chip Mong Insee* has recently established a new production centre in Kampot and is accepting qualified industrial waste from factories and rice mills from several cities and provinces as a substitute for coal in their kilns. The source destinations currently includes Phnom Penh, Takeo, Kampong Speu, and Kandal, but is also looking for more waste suppliers. Such transactions can be mutually financially beneficial for both parties in reduced expenses for business operations (waste management costs for waste generators, and energy costs for the cement company) while reducing the overall environmental impact from their activities.

- A clean business award can be considered for use in targeting different sectors (e.g., hotels, transport, manufacturing) to encourage sustainable business management practices in promoting 3R in the business sector.
- Introduction of tax alleviation for businesses/investments advancing sustainable business management can also be considered as a complement to the award programme.
- Encourage/promote/facilitate community groups, institutions, businesses to initiate/continue recyclables trading with recycling companies through, for instance, development and dissemination of contact list of recycling companies.

6. Implementation Table – Priority Actions, Role Demarcations, and Indicators

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
ACTION AREA 1 STRENGTHENING SYSTEMATIC WASTE DISCHARGE & COLLECTION SYSTEM AND ENHANCE WASTE COLLECTION SERVICE QUALITY						
Action 1.1. Improve Waste Discharging Behavior and Designated Waste Collection Points						
a. Decide Separation Rule		Separation rule fixed	PPCA, all line departments, Khan/Sangkat, relevant stakeholders			
b. Development of Manual		Waste discharging / collection manual for waste generators developed	PPCA, DoE, Khan/Sangkat, CINTRI			
c. Designate Waste Discharge Points	Designate temporary discharge points	Temporary discharge points designated	PPCA, Khan/Sangkat, CINTRI			
	Designate permanent discharge points	Permanent discharge points designated	PPCA, Khan/Sangkat, CINTRI			
d. Outreach Programme for Dissemination of New Waste Management and Discharge Rule	Awareness raising program	Number of awareness raising events organised Number of participants to the event	PPCA, DoE, Khan/Sangkat			
	Social media campaigns	Number of campaigns organised Number of participants for the campaign	PPCA,DoE/MoE, Khan Sangkat			
e. Implementation of Waste Management and Discharge Rule	Daily advisory/implementation of the new rules/manual	Number of advisory staffs Time spent for implementation	Khan/Sangkat Supported by PPCA, DoE			
f. Strengthen Measures against Illegal Disposal	Place bins, and post banners/signs	Bins, bannars and signs installed	PPCA, DoE/MoE, Khan/Sangkat			
	Implemment exhisting instructions on penalty for non-compliance	Number of non-compliances reported	Khan/Sangkat Supported by PPCA, DoE			
	Installing cameras against illegal disposal	Number of illegal disposals reported	PPCA, DoE/MoE			
Action 1.2. Improve Collection Service, Street and Public Area Cleaning						
a. Introduce performance/capacity evaluation		Capacity/performance evaluation conducted	PPCA, DoE			
b. Improve/develop collection plan	Develop collection schedule/plan (household waste collection)	Waste collection plan developed	District, DoE			
	Organise waste storage (household waste collection)	Waste storage installed	PPCA, DoE, Khan/Sangkat			
	Develop collection schedule/plan (street sweeping)	Waste collection/sweeping plan developed	Khan, CINTRI, DoE			
	Review/evaluate collection plan (street sweeping)	Number of reviews conducted	Khan, DoE,			
	Develop a service map of the road to be covered (street sweeping)	Service map prepared	Khan, CINTRI			
	Identify storage space for small collection carts	Number of cases where space problem is solved	Khan/Sangkats Supported by CINTRI			
	Designate/maintain collection points	Number of designated collection points maintained	PPCA, Khan			
	Examine service performance of collection company	Performance evaluation conducted	Khan Supported by Sangkats and PPCA, DoE			
c. Introduction of community-based collection practice		Number of community-based collection schemes launched The service coverage extended by the collection scheme	Khan/Sangkats Supported by residents, NGOs			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
d. Improve communication b/w PPCA and collection company	Request analytical report on service	Report on service delivery submitted	Khan/Sangkats, PPCA			
	Introduce feedback mechanism	Feedback mechanism introduced	Khan/Sangkats Supported by CINTRI			
e. Economic analysis to review service fee		Economic analysis conducted Review and change of service fee	PPCA Supported by relevant ministries/ departments			
f. Introduction of competitive market	Introduction of open bidding	Introduction of open bidding	PPCA			
Action 1.3. Support Khan/Sangkat Administrations to Strengthen their Monitoring and Implementation						
a. Develop guidelines and indicators for implementation		Guideline and indicators developed	PPCA, DoE, Khan/Sangkat			
b. Formation of Khan Committee for coordination & monitoring		Number of Khan Committees established Frequency of Khan Committees organised	PPCA, DoE, Khan/Sangkat			
c. Develop capacity for Khan related to management planning		Number of capacity development events organised Number of participants in the events	PPCA, DoE, Khan/Sangkat, line departments			
d. Sustain inspectors for monitoring/ guidance		Number of inspectors active in each Khan	PPCA, DoE, Khan/Sangkat			
e. Train local authority		Number of training events organised Number of participants to the event	PPCA, DoE			
ACTION AREA 2: PROMOTE RECYCLING THROUGH WASTE SEPARATION, INVOLVE PRIVATE RECYCLING SECTOR, AND PROMOTE THE USE OF RECYCLED PRODUCTS						
Action 2.1. Enhance Recycling Capacity through Promoting Grass-Roots Actions and Facilitate the creation of a Domestic Recycling Industry						
a. Conduct economic analysis for establishing recycling industry	In-depth analysis of current recycling system	Report of the feasibility study conducted including: 1. Export market potentials for the recycled products 2. Cost Benefit Analysis for establishing recyclign facilities	PPCA Support by DoIH, DEF, DoC, DoE, CDC			
	Cost-Benefit Analysis for establishing recycling facilities					
b. Identification of appropriate recycling technology solutions		Report on technology evaluation conducted				
c. Providing support for recycling companies		Number of new recycling companies established/attracted				
d. Attract investment in recycling sector	Formation of consultative meetings (recyclers generators)	Number of consultative meetings organised Number of waste generators and recyclers participating in the event				
	Establish database on recyclers	Database established				
	Identify best practices	Number of best practices identified and replicated				
	Support existing recycling businesses	Supportive measures implemented				
e. Promote grass-roots voluntary actions for recycling	Promote decentralised composting sytem at household /community level	Number of new composting initiatives launched Number of information materials distributed	Khan/Sangkat admin., DoE Supported by PPCA			
	Promote decentralised use of food waste targeting private sector	Number of campaign/workshops organised Number of participants in the campaign/ workshop				
Action 2.2. Promote Waste Separation						
a. Modify existing legal tools to officialize segregation rule(s)		Amendments introduced to the existing legal tools	PPCA Supported by DoE, Khans/Sangkats			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
b. Awareness raising and Educational Campaign	Distribution of waste separation manual	Number of manuals distributed	PPCA Supported by DoE, Khans/Sangkats			
	Workshops and trainings	Number of training events organised Number of participants in the event				
c. Distribute waste segregation bins		Number of segregation bins distributed	Khan/Sangkat admin. Supported by PPCA, DoE			
d. Promote collaboration with informal sector recyclers to ensure collection of recyclable materials		Collaboration with informal sector recyclers promoted	Khan/Sangkat admin. Supported by PPCA, DoE, DoIH			
Action 2.3. Promote the use of Recycled Products						
a. Establish a labeling scheme		Labeling scheme initiated	Relevant Ministries, PPCA, DoE			
b. Encourage the use of recycled products by consumers		Policy measures implemented	PPCA Supported by Khan/Sangkat admin., DoI, DoE			
c. Introduction of Green Public Procurement Law		Green Public Procurement Law enacted and implemented	PPCA, DoE			
d. Measures for changing behaviour of relevant stakeholders	Awareness raising programme	Number of awareness raising events organised Number of participants in the events	PPCA Supported by Khan/Sangkat admin., DoE			
	Improve accessibility to recycling options	Accessibility improved	PPCA Supported by Khan/Sangkat admin., DoE			
	Capacity building on recycling	Number of capacity building events organised Number of participants in the events	PPCA Supported by Khan/Sangkat admin., DoE			
	Introduce monitoring and progress measurment	Monitoring and evaluation scheme introduced	PPCA, DoE			
ACTION AREA 3: PROMOTE ENVIRONMENTALLY SOUND MANAGEMENT OF WASTE DISPOSAL AND MITIGATE IMPACT ON ENVIRONMENT AND HUMAN LIVELIHOOD						
Action 3.1. Improve management of Final Disposal Site						
a. Restarting Proper Maintenance/Operation	Monitor height of waste pile to prevent collapse	Practice restarted	PPCA, Landfill Management Team, competent Khans			
	Daily soil cover					
	Improve waste discharge practice from collection truck					
	Personal Protection Equipment					
	Piloting passive landfill gas collection					
	Prepare equipment and procedural manual for preventing and extinguishing landfill fires					
b. Development of Landfill Infrastructure	Leachate treatment system (chemical treatment)	Infrastructure developed	PPCA, Landfill Management Unit			
	Expand discharge platform					
	Renew heavy equipment for daily operation (Excavator, Bulldozer)					
c. Prepare Transition to Waste Separation Platform		Waste separation platform established and operation initiated	PPCA, Landfill Management Unit			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
d. Attract Specialists and Strengthen Human Resources	Evaluate tech. capacity and identify areas for improvement	Capacity eveluation conducted	PPCA, Landfill Management Unit			
	Delegate staffs to training/site visits	Number of participants in the training program				
	Seek technical assistance from donors	Knowledge transfer program conducted				
	Connect with internship programs	Internship conducted				
e. Improve Waste Amount Recording Tools/ Methods		Volume of waste data produced	PPCA, Landfill Management Unit, CINTRI			
f. Monitoring Health and Environmental Impacts	Conduct study on groundwater pollution	Environmental impact assessment report	PPCA, DoH, DoE			
	Conduct study on health impact	Health impact assessment report				
Action 3.2. Securing Financial Resources for Sustainable Landfill Management						
a. Prepare cost estimation for sustainable management		Cost estimation developed	PPCA/landfill Management Unit			
b. Increase waste disposal fee		Disposal fee set	PPCA/landfill Management Unit, relevant stakedholders			
c. Re-evaluate financing options for landfill improvement		Financing option identified	PPCA/landfill Management Unit, relevant stakedholders			
d. Maintain and utilize accurate record of incoming waste		MRF installed	PPCA/Landfill Management Unit			
Action 3.3. Collaborate with Stakeholders						
a. Prepare transition to waste separation platform		Approx. 20-30% of waste pickers employed at MRF	PPCA/landfill Management Unit			
b. Documenting and acknowleding the role of informal sector		Waste pickers at the landfill organised and registered at the landfill site Education/training opportunities are provided to the waste pickers (4-5 times/year).	PPCA/landfill Management Unit			
c. Awareness campaign to change public perception		Regular campaign organised by PPCA and DoE/landfill Management Unit	PPCA/landfill Management Unit, Khan/ Sangkat, DoE			
d. Formalisation of informal sector		Regulations and rules for formalising waste pickers developed	Landfill Management Unit, PPCA			
e. Incorporating informal sector into subnational government system		Waste pickers in the landfill are employed to work in the landfill (MRF, composting facilities)	PPCA/Landfill Management Unit			
ACTION AREA 4: MANAGEMENT OF SPECIAL WASTE STREAMS (C&D, MEDICAL AND INDUSTRIAL WASTE)						
Construction and Demolition (C&D) Waste						
Action 4.1. Establishment of data management system						
a. Establishment of Categorical Waste Data		Data generation and collection mechanism established Volume of data generated and collected	PPCA/Khan Supported by DLMUPC, DoE, Waste collection companies, Landfill Management Unit			
b. Estimation of C&D Waste Generation		Volume of data made accessible to the public	PPCA/Khan Supported by DLMUPC, DoE, Waste collection companies, landfill Management Unit			
Action 4.2. Promote Waste Reduction						
a. Awareness Raising		Number of companies reached out to as a result of awareness raising activities	PPCA/Khan Supported by DLMUPC, DoE			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
b. Promotion of Sustainable Construction		Number of policy interventions introduced	PPCA/Khan Supported by association of construction companies and relevant stakeholders			
c. Introduction of Disposal Fee		Introduction and implementation of disposal fee	PPCA/Khan Supported by DLMUPC, DoE, Waste collection companies, landfill Management Unit, Dept. of Economy and Finance			
d. Revision/Update and Implementation of Existing Regulation on C&D Waste		Regulation updated and implemented	PPCA/Khan Supported by DLMUPC, DoE			
Action 4.3. Promote Reuse and Recycling						
a. Promotion of Reuse		Policy intervention introduced for the promotion of reuse of C&D waste	PPCA/Khan Supported by industiry association of construction companies, relevant stakedholders			
b. Identification of Appropriate Technology		Treatment technologies implementable under local conditions identified	PPCA/Khan Supported by industiry association of construction companies			
Action 4.4. Implementation, monitoring, and enforcement against illegal disposal						
a. Develop & Disseminate Guideline for C&D Waste		Guideline developed Number of guidelines (hardcopies or e-copy) distributed/accessed	PPCA/Khan Supported by DLMUPC, DoE			
b. Advise Waste Generators to bring-in C&D Waste at Landfill.		Policy intervention introduced Number of illegal waste disposals reported	PPCA/Khan Supported by DLMUPC, DoE			
c. Moniroting and Enforcement		Number of illegal waste disposals reported	PPCA/Khan, DoE, Landfill Management Unit			
Medical Waste						
Action 4.5. Strengthening Medical Waste Management System						
a. Awareness Raising and Training for Health Service Institutions		Number of awareness raising events organised Number of medical professionals reached through the events	MoH and DoH Supported by PPCA, MWMU, DoEYS			
b. Awareness Raising Campaign targeting Citizens		Number of awareness raising events organised Number of citizens reached through the events	MoH and DoH Supported by PPCA, MWMU, DoEYS			
c. Conduct Periodical Inspections		Number and frequency of inspections conducted	MoH and DoH Supported by PPCA, MWMU			
d. Establish Reporting Mechanism for Unlawful Disposal		Reporting mechanism established	MoH and DoH Supported by PPCA, MWMU			
e. Conduct periodical inspection to CRC		Inspections conducted and results recorded and published	MoH and DoH Supported by PPCA, MWMU			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
f. Assist CRC towards effective planning and implementation	Distribution of bins for medical waste	Dissemination rate (= medical institutions with appropriate bins / all the medical institutions in Phnom Penh)	Medical wasate management unit Supported by DoH, DoE, PPCA			
	Expantion of current medical waste incinerator	Existence/volume of untreated medical waste due to the lack of incineration capacity	Medical wasate management unit Supported by DoH, DoE, PPCA			
	Increase the number of collection trucks	Number of collection trucks	Medical wasate management unit Supported by DoH, DoE, PPCA			
	Set clear collection schedule	Collection schedule set	Medical wasate management unit Supported by DoH, DoE, PPCA			
Industrial Waste						
Action 4.6 Strengthening Oversight Mechanism to Ensure Implementation						
a. Development of subnational regulation		Subnational regulation developed	PPCA, DoIH, DoE			
b. Creation of Special Unit/Position for Indusrial Waste Management		Creation of special unit/position	PPCA, DoIH, DoE			
c. Develop standards/guidelines for treatment/recycling		Standards/guidelines developed	PPCA Supported by MoE, DoE			
d. Develop and update database on waste generators		Database developed Volume and frequency of updates	PPCA Supported by waste generators, MoE, DoE, waste management companies			
e. Creation of forum for government-stakeholder dialogue		Platform developed Volume and frequency of information exchanges	PPCA Supported by waste generators, MoE, DoE, waste management companies			
f. Enforce regulations via inspection and punitive measures		Inspections conducted and results recorded and published Number of non-compliances recorded	PPCA, Khan/Sangkat administrations			
g. Promotion of 3R through "match-making"		Number of business relations established through facilitation by PPCA Volume of waste diverted from landfill due to the recycling	PPCA Supported by waste generating companies, MoE, DoE			
h. Capacity development of waste mgt. companies		Number of capacity development events organised Number of participants in the events	PPCA Supported by Khan/Sangkat administrations, waste generating companies			
i. Capacity development of PPCA officers		Number of capacity development events organised Number of participants in the events	PPCA, DoIH, DoE			
E-Waste						
Action 4.7 Addressing illegal disposal, regulating E-Waste management practices, and diverting valuable E-Waste to resource trading						
a. Develop & update database on recyclers		Database developed Volume and frequency of updates	PPCA Supported by DoE, Khan/Sangkat admin.			
b. Develop an E-Waste inventory		Data inventory developed Volume and frequency of updates	PPCA Supported by DoE, Khan/Sangkat admin.			
c. Disseminate MoE guideline on E-Waste management		Number of guidelines distributed/accessed	PPCA Supported by DoE, Khan/Sangkat admin.			
d. Conduct awareness raising		Number of awareness raising events organised Number of participants in the events	PPCA Supported by DoE, Khan/Sangkat admin., DoEYS			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
e. Develop subnational regulation		Subnational regulation developed	PPCA Supported by DoE			
f. Develop & disseminate a list of certified recyclers		List of certified recyclers developed and disseminated Number of waste generators reached	PPCA Supported by Khan/Sangkat administrations, waste generating companies			
g. Organise E-Waste collection campaign		Number of campaigns organised Number of participants in the campaign	PPCA Supported by Khan/Sangkat administrations, collaborating companies			
h. Strengthining monitoring/inspection against illegal disposal		Inspections conducted and results recorded and published Number of non-compliances recorded	PPCA Supported by DoE, Khan/Sangkat administrations			
ACTION AREA 5: SHARING VISIONS AND ENGAGING STAKEHOLDERS FOR COLLECTIVE ACTION						
Action 5.1. Promote Citizen Participation in Waste Management Planning						
a. Promotion of Information Disclosure	Publish administrative documents online.	Number of waste management documents published or available online The accessibility/exposure of such documents to the general public	PPCA Support by DoEYS, DoE, DoT			
	Share collection schedule, discharging rules..etc online	Existence of feedback mechanism installed				
b. Establishing Feedback Mechanism	Organise public hearings	Number of public hearings organised				
	City waste management conference	Number of events organised				
	Recruit, assign and invite citizen reps to planning	Number of citizen representatives included in the planning				
	Utilize ICTs such as SNS for collecting feedbacks	Use of ICTs/SNS				
Action 5.2. Engage Youth through Environmental Education						
a. Co-develop School Curriculum for Environmental education		School curriculum developed	PPCA, MoE, MoEYS, DoE, DoEYS			
b. Develop Educational Materials		Educational materials developed				
c. Develop Guidelines on Teaching Methods		Guideline on teaching method developed				
d. City Environment Award		Number of schools participating in City Environment Award program				
e. Provide Field Learning Opportunities to students		Number of field learning programmes developed and opportunities provided to high school students				
f. Signage, Posters in School Premises		Number of billboards, posters & signs				
Action 5.3. Engage and Develop Capacity of General Public and Private/Public Sector						
a. Awarenes Raising Events targeting Citizens	Environmental fair	Number of events organised	PPCA, relevant stakeholders			
	educational campaign for recycling and impact	Number of activities organised	PPCA, relevant stakeholders			
	Awareness raising materials	Number of awareness raising materials distributed to public	PPCA			
	Awareness raising via public media	Number of estimated audiences reached though various media components	PPCA, relevant departments, collaborating media (tvs, radio stations, news papers… etc.)			

Actins	Sub-Actions	Indicators	Stakeholders to be involved (Leading and supporting organisations)	Priority		
				Short Term	Mid Term	Long Term
	Trainign public sector workers	Inclusion of environment component (including waste management) in the training curriculum	PPCA			
	Involve CINRI for awareness raising	Number of activities organised	PPCA, CINTRI			
b. Engage and Develop Capacity of General Public and Private/Public Sector	Communicating the benefits of improving waste and resource management	Number of private sector institutions approached / communicated	PPCA, industrial organisations of various sectors (i.e. hotel, garment, manufacturing… etc.)			
	Clean Business Award	Number of companies participated in the award programor	PPCA, industrial organisations of various sectors (i.e. hotel, garment, manufacturing… etc.)			
	Introduction of tax alleviation for sustainable business management	Tax alleviation scheme introduced	PPCA, relevant ministries and departments			
	Promote recyclables trading	Number of groups, institutions, businesses engaging in trading	PPCA, relevant stakeholders			

V

Chapter V

Management of Project Cycle, Data and Finance

Chapter V

Management of Project Cycle, Data and Finance

1. Management of Project Cycle, Data and Finance - Ensuring Implementation and Service Quality

Securing adequate financial resources, development/adaptation/dissemination of appropriate technologies, forging partnerships with and building capacity of the relevant stakeholders, as well as developing a sound system for data monitoring and accountability frameworks are all important in order to ensure the implementation and the service quality of the strategy and action plan. PPCA will make its utmost efforts so that these MoI are secured for sustaining its public service

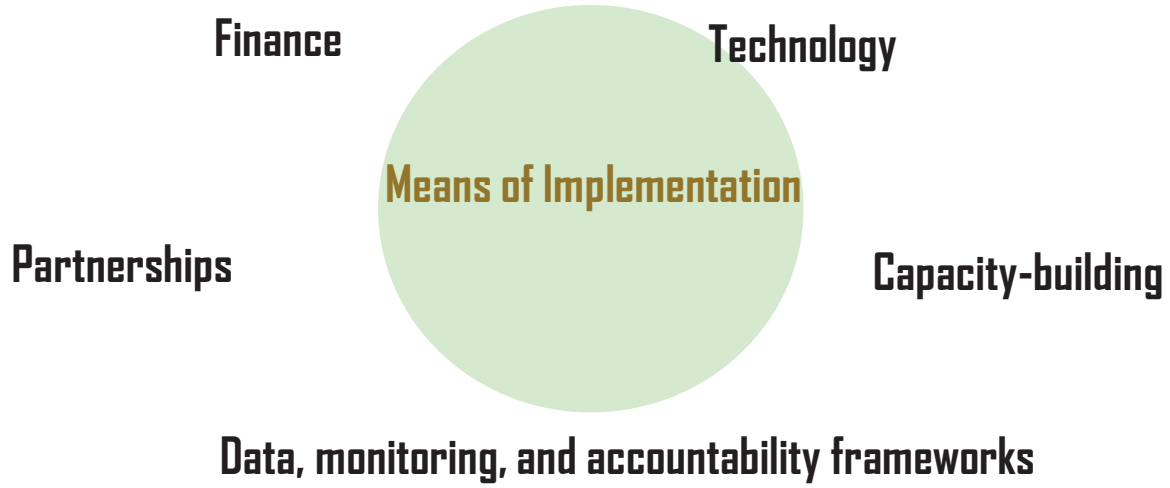


Figure 30: Means of Implementation

2. Managing Progress Based on PDCA Cycle

This waste management strategy as well as its project activities will be implemented, monitored, evaluated, reviewed and updated following the PDCA cycle outlined below.

Stage 1: Plan – Preparation and Drafting of the Strategy

- Conduct baseline study and utilise the updated management and scientific knowledge as a basis for discussion on strategy development.
- Understand situation, challenges and conduct gap analysis
- Set scope, vision, mission and goals of the strategy
- Identify and take into account stakeholder concerns and management challenges through consultations with relevant parties.
- Choose policy options on waste prevention and recycling and draft action plans
- Ensure inter-departmental coordination and forge political agreements for strategy development.

Stage 2: Do – Implementation and Monitoring of the Strategy

- Formalise strategy through appropriate administrative procedures.
- Disseminate strategy through various public outreach activities.
- Mobilise resources (financial, human, and political) and deepen collaboration with relevant partners towards implementing the action plans.
- Undertake regular monitoring to acknowledge progress, and keep records of progress and/or key performance indicators for evaluations in the future.

Stage 3: Check – Evaluation and Review of the Strategy

- Analyse and assess the progress/project results against goals and targets.
- Review progress with relevant stakeholders and submit results to the independent evaluation committee.
- Identify and analyse areas of success and failures, and determine the contributory factors.

Stage 4: Action – Updating the Strategy based on the evaluation

- Expand successful cases.
- Re-assess the evolving operating environment, and modify/reset the strategy to address emerging challenges.

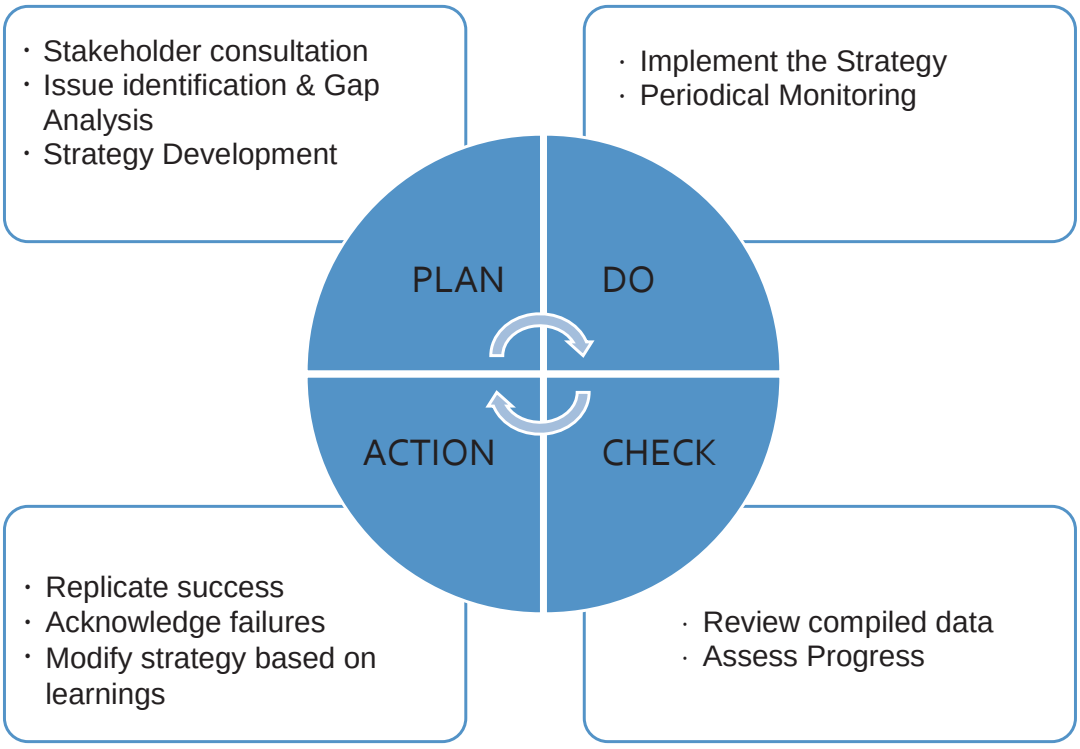


Figure 31: PDCA Cycle

3. Strengthen Data Generation for Better Decision-making and Project Management

In order to promote evidence-based policy making in the city's waste management and to control the quality of services delivery, PPCA will boost its efforts and capacity to generate and maintain the basic key indicators representing the state of waste management in the city.

To this end, PPCA will:

- Keep accurate records of incoming waste at the landfill site, primarily of waste amount, and gradually expand the record items to include waste type, sources and/or area of generation/collection.
- Utilise collected data for planning, implementation, monitoring and evaluation of the strategy, as well as relevant decision-making.
- Utilise capacity development opportunities provided externally to develop data management skills of the responsible staff members.
- Develop a support network through partnership with NGOs, private sector entities, Khan/Sangkat administrations, to request their cooperation in data collection.

Useful Resources:

- Data Collection Tool for Urban Solid Waste Management (World Bank)
  http://siteresources.worldbank.org/INTUSWM/Resources/463617-1202332338898/User-Manual-Data-Collection-Tool-for-SWM.pdf
- 3R Policy Indicators Factsheets Series (IGES)
  https://pub.iges.or.jp/pub/by/tags/3r-policy-indicators-factsheets-series

4. Securing Financial and Human Resources for Sustainable Service Delivery

In order to meet the public service needs of the citizens, PPCA will exert utmost efforts to secure the operational human resources necessary to sustain and enhance its service delivery.

To this end, PPCA will:

- Promote its efforts to identify and generate its own financial resources to sustain its waste management governance.
- Seek opportunities for public-private partnerships to attain effective service delivery with economic efficiency where feasible.
- Deepen its collaboration with external institutions (national institutions, development partners, private sector entities) towards attracting development finance and projects.
- Recruit appropriate PPCA staffs in order to ensure quality public service.

Conduct its own capacity development activities and/or utilise external opportunities when available to strengthen the planning and operational capacity necessary to conduct waste management administrations. Areas of capacity

development may include: data management, information and public relations management, waste management and recycling technologies, economic analysis, waste and resource management policy development and, public management.

VI

Chapter VI

Annexes

Chapter VI ANNEXES

ANNEX I - REFERENCE MATERIALS

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Annex II - Pilot Project Plans

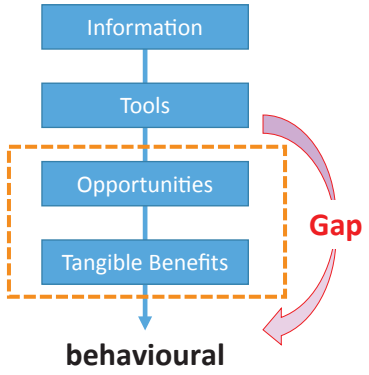
Pilot Project 1

Participatory Programme for Advancing Recycling in Schools in Phnom Penh (PPAP)
Enhancing behavioural change towards environmentally sustainable lifestyle through Introduction of Hands-on Experience in Environmental Education

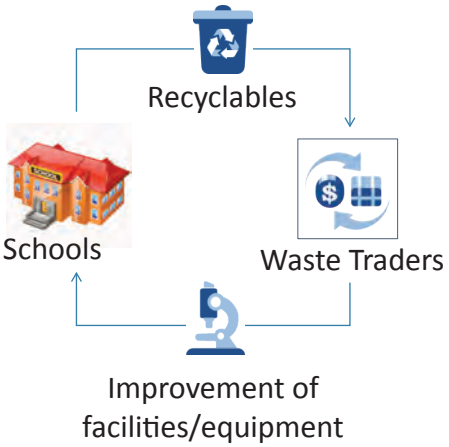
Description

Many recycling awareness-raising initiatives and projects are designed and implemented on the assumption that individuals will start recycling if adequate information on the health/environmental costs/benefits and tools such as how-to manuals are provided to the target audience is provided. However, voluntarily actions do not necessarily occur without the opportunity (for instance, recycling) to exercise such knowledge or recognition of the tangible benefits of such actions.

Based on this understanding, the pilot project will focus on the environmental education currently implemented in schools in Phnom Penh, and introduce hands-on experience to engage in 3R activities, complementing the classroom lectures. Through providing these opportunities to act as well as visualise the tangible benefits of 3R, the project aims at enhancing awareness and motivations to practice 3R in daily life, inducing behavioural change.



Specifically, students will be requested to bring recyclable materials generated in each household to school as a part of practical exercises. The collected recyclables will be stored in school premises until they can be sold to private waste collectors, and the income derived therefrom will be used to purchase educational equipment and materials. This exercise can also form the basis of fundamental education on collective decision-making and financial management, where such needs exist. In addition, organisation of city-wide competitions as well as a Cambodia-Japan online student dialogue mediated by CCET can also be considered as measures to motivate students to participate in the programme.



Project Implementers and Collaborators

- Phnom Penh Capital Administration (PPCA)
- Department of Education, Youth and Sports (DoEYS)
- Selected elementary schools in Phnom Penh
- IGES Centre Collaborating with UNEP on Environmental Technologies (CCET)
- Cambodian Education and Waste Management Organization (COMPED)

Expected Results and Contribution to the Strategy

Once implemented, students will be equipped with an enhanced understanding on the benefits of promoting 3R based on real-life experiences, and may wish to practice 3R in daily life. Presenting the "how" and the "tangible benefits" would narrow the gap between knowledge and behavioural change at the individual level, which represents the core foundation to promoting 3R in the city in collaboration with its citizens. The programme is directly relevant to Action Areas 1, 2, and 5, particularly Action 5.2 – *Engage Youth through Environmental Education"*.

Expected Budget

Approximately USD 30,000

Financiers:

UN Environment through IGES Centre Collaborating with UNEP on Environmental Technologies

Expected Duration

Approximately 3 months

Pilot Project 2 "Clean Up! Community Based Solid Waste Management in Phnom Penh" 2017-2018

Description

"Clean Up! Community Based Solid Waste Management in Phnom Penh" project activities will be implemented in Boeung Tompun area, namely in Prek Ta Kong 1 community, Chak Angrae Leu, Meanchey district and in Khva community, Dangkor district.

Project implementer

A local NGO, UPWD is responsible for implementation of all activities in the target communities, and the project will become part of UPWD environmental sanitation activities implemented in the area in partnership with People In Need (PIN).

Urban Poor Women Development (UPWD) was established in 1997 in Phnom Penh by a group of professionals who recognised the importance of supporting urban poor women and their communities. Since then, UPWD has supported tens of urban poor communities through community organising, enumeration and mapping, urban health, water and sanitation as well as disaster risk reduction projects. UPWD donors include: PIN, Misseror, HBF, The Asia Foundation, and Bread for the World. UPWD employs 14 permanent staff members and manages an annual budget of USD 200,000.

Expected Contribution to the Strategy

This project was selected from four project proposals encompassing areas such as recycling, zero-waste coffee shops and community-based waste management. As a pilot project, the community based waste management proposal was chosen, which was carried out between Nexus and PPCA in July 2017 as a response tool to existing waste collection problems in hard-to-reach areas of peri-urban Phnom Penh. Project activities started in

late 2017 and continued until end of 2018.

Based on the financial arrangement between Nexus and UPWD, UPWD will report to PPCA on a biannual basis (two times) in 2018 to update on the project progress and results.

Waste management is the biggest issue for urban poor communities, which lack public waste collection. According to an STT study from 2014, 72% of communities in outer districts of Phnom Penh lack a regular waste collection service. The main reasons for this include limited physical access to locations, lack of space to install containers on the main roads, accountability issues with CINTRI and poor waste management habits of some community members. As a result, many communities dump rubbish into rivers and lakes as well as under their houses. Other waste disposal methods include burning and to certain extent recycling. Waste which is not properly managed exacerbates health risks such as diarrhea, skin rashes, eye diseases and several other infections.

Moreover, the presence of rubbish in the communities perpetuates the social stigma of urban poor and risks of eviction.

The proposed project applies the Community Based Waste Management approach developed by UPWD and already piloted in several communities in Phnom Penh in activities focused on two communities in Boeng Tompun area, both of which face similar issues with waste collection and lack of awareness and tools for proper waste management:

1. Prek Ta Kong 1 community, Chak Angrae Leu, Meanchey district – 357 households
2. Khva community, Dangkor, Dangkor district - 184 households

The model was built based on several key activities:

- Feasibility study and needs assessment
- Formation of Waste Management Committee and establishing of regular communication channels with local authorities
- Design of behavioural change communication tools
- Environmental Sanitation events and presentation of the model to the community
- Waste collection service
- Waste pickers collecting rubbish and discarding it in CINTRI containers (waste pickers receive a small fee from community members)
- Awareness raising campaign through events and outdoor campaigns (billboards).

<u>Anticipated Budget</u>

Nexus' contribution to the pilot project is USD 5,000 between July and December 2017 to support project preparation and community mobilisation activities.

Project co-financing and total value of the project.

Nexus (5,000) + UPWD/PIN (10,000) = USD 15,000

Financiers

Nexus and UPWD/PIN

Annex III - Financial Management

1. Baseline - Waste Collection Tariff and Other State Budgetary Information

Public Financing

The Law on Administrative Management of the Capital, Provinces, Municipalities, Districts and Khans (Organic Law) stipulates the responsibility of sub-national institutions to secure the necessary financial sources to fulfill their administrative roles and responsibilities, and of achieving effectiveness, transparency and accountability for their fiscal administration, and provides revenue categories in sub-national financing as detailed below:

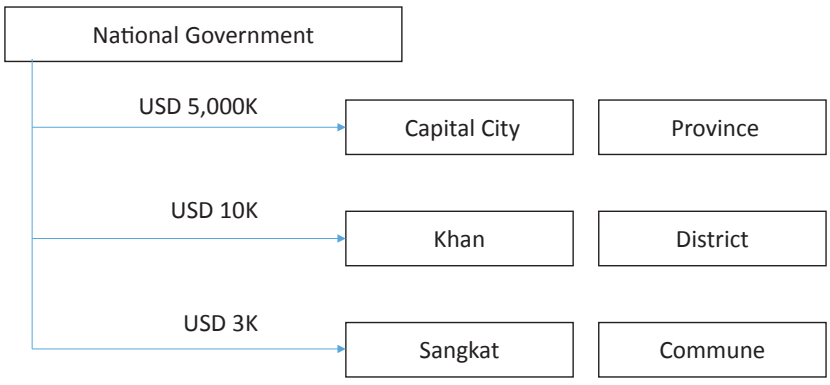
1. Sub-national Revenues
    - Local tax
    - User fee, compounding fee and non-tax revenues

2. Revenues from National Government
    - Local allocation tax
    - Revenues by intergovernmental transfer from national government
    - Implementation fee for the special services provided by sub-national governments for national government agencies and institutions

3. Other Revenues

Figure 32 below shows streams and the average scale of the intergovernmental transfer from the national to sub-national governments in 2013 (Kamiko, 2016). In reality, sub-national governments are almost entirely dependent upon such revenues from national governments whose limited budgetary scale often translates into limited public service delivery.

Accordingly, the public financing for waste management is limited in scale in Phnom Penh City.



Notes

* Figures are average budget scale per unit as of 2013

** Figures are based on provisional exchange rate of USD 1 = KHR 4,000

Figure 32: Flow of Intergovernmental Transfer from National to Subnational Administrations as of FY2013

Source: Kamiko (2016) based on Top Management Seminar on Decentralisation and leadership Towards Local Needs and Changing Society

In 2015, Cambodia's Ministry of Environment issued a Circular Decree on the Implementation of Environmental and Hygiene Service Programme, which was at improving solid waste and wastewater management for a total of 26 cities across the country other than Phnom Penh municipalities. Listed under the national budget as per the MoEF, the overall funding of this programme is 5,000 million Riels (USD1.25 million) for 2015, which is to increase to 9,000 million Riels (USD 2.25 million) in 2016. However, as the fund is intended to support financially weak municipalities, Phnom Penh City is not currently entitled for the disbursement, and is expected to self-finance its waste management services.

Moreover, the financial viability of the Dangkor landfill site, operated and managed by PPCA, is another issue of concern. Currently, the site charges a disposal fee of USD 0.75 for every tonne of waste brought into its premises. However, according to an analysis of the landfill conducted by JICA (2005), managing its sanitary status to a satisfactory level would require increasing the disposal fee to USD 4.4/t with additional grant assistance, or USD 5.92/t without grant assistance (JICA and MPP, 2005). On the other hand, CINTRI has suspended the payment of disposal fee since January 2018 due to insufficient fund. This non-payment continues as of July 2018 despite repeated request by PPCA for payment.

Financing Private Waste Management Operations under Concession Contract

A significant share of Phnom Penh's waste management services are outsourced to, and thus independently financed by the private company CINTRI, which provides collection and transportation of MSW based on user fees ranging from USD 1–100. Service fee collection can be considered nominally successful as such tariffs are included in private electricity bills, following a cooperative agreement reached between CINTRI and the Electricite du Cambodge (EDC) (Sang-Arun et al., 2011).

However, CINTRI's service model continues to face issues in terms of achieving overall financial sustainability, in that although service fees are collected to finance its waste collection and transport services, they reportedly do not cover the entire operational costs, which include street cleaning and final disposal.

Consequently, CINTRI's street cleansing and waste collection services are not meeting expected performance levels, with the service coverage unable to expand further to peripheral areas of the city without a corresponding increase in revenue.

The company's household waste collection operations are also experiencing difficulties, faced with the need to improve overall performance by, for instance, increasing salaries of its staff, while at the same time addressing criticism from its users regarding unsatisfactory services received – despite a modicum of awareness of appropriate waste practices and involvement in formal decision-making processes of the users. Accordingly, local authorities have contemplated eliminating CINTRI's fee from users' electricity bills, thus eliminating the public's cause to complain to EDC. In this regard, as fees from waste collection represent the main source of funding for the company's waste management services, the financial sustainability of CINTRI's operations has a large bearing on the quality of Phnom Penh's waste management system as a whole.

Costs of Waste Management Services

According to the World Bank and USAID, it is common for municipalities in developing countries to spend 20–50% of their municipal budgets on solid waste management.

- Total cost for solid waste collection, transfer, and disposal is typically USD 40-80/tonne
- 60-70% of the total waste management cost is typically allocated for collection
- 50-70% is allocated for recurring expenses – labor, oil, and other variable costs

The main costs of waste management service should ideally be covered by collecting fees in order to sustain operation. Other sources may include national government funds, or development finance, public-private partnerships, loans from capital markets and carbon financing.

Financing by National Government and External Institutions

This section summarises recent trends in financial support from the national government, development partners and private sectors for sustainable delivery of efficient waste management services:

- In 2017, Ministry of Environment managed to collect over USD 300,000 in fees to the government environment foundation and about KHR 3 billion in revenue from a service offering.
- The RGC has been cooperating actively with development partners, including ADB and JICA with a focus on waste management and capacity training on environmental valuation and pollution control. In 2016, a budget of USD 2 million was attributed to waste management alone. In 2017, development funding on climate change resilience amassed USD 2.81 million from IFAD, LGCC II, and ADB.
- Presently, there are many private companies and major foundations with areas of interest in environmental issues including waste management, such as Unilever and Chevron. Fund amounts are not disclosed and depend on proposals sent directly to the organisation in question.

2. Potential Sources of Waste Management Funding

The table below provides a list of developing partners and private foundations which provide financing opportunities in the waste sector.

Donor Name	Priority	Priority Notes	Donor contact person & details	Type of donor	Funding Strategy (including opportunities and risks)
Developmental Sector					
ADB	High	ADB works through the governments of its developing member countries but can award contracts for components of projects and technical assistance activities	Cambodia Resident Mission No. 29 Suramarit Blvd. (268/19) Sangkat Chaktomuk, Khan Daun Penh, Phnom Penh, Cambodia Office Hours: Monday to Friday, 08:00 - 12:00, 13:00 - 17:00 Tel: + 855 23 215 805, 215 806, 216 417 + 855 23 215 807	Multilateral Institution	ADB fund in Cambodia encompasses three main strategic goals: (i) inclusive economic growth, (ii) environmentally sustainable growth; and (iii) regional cooperation and integration. The country partnership strategy 2014-2018 stipulates that ADB will cooperate hand-in-hand with the government to fulfill of The Rectangular Strategy for Growth, Employment, Equity and Efficiency (RSIII) and NSDP 2014-2018.
AFD	High	AFD cooperates with PPCA and supports Phnom Penh Water Supply Authority and EDC, providing Key urban services.	Agency of Phnom Penh: 5, 106 Street, BP102, Sangkat Wat Phnom Khan Daun Penh PHNOM PENH Tel: +855 23 426 360 +855 23 426 036 Fax: +855 23 426 243 afdphnompenh@afd.fr	Public Development Bank	AFD promotes public-private initiatives such as energy efficient street lighting and waste-to-energy projects. AFD's main strategy is to mobilize private investment for (i) Urban Planning; (ii) Renewable Energy; (iii) Transportation (tramway transportation in Phnom Penh, and Rural Road Improvement Project II for 193.9 km in Tbong Khmon Province)
The Asia Foundation	Low		The Asia Foundation – Cambodia House No. 59 Oknha Peich (St 242) Phnom Penh, Cambodia Tel: + 855 23 210-431	Non-profit international development	Asia Foundation has been addressing natural resource management in Asia and aims its funding & supports at: - Effective natural resource management for sustainable development - Building capacity in government, business & private community to alleviate climate change effects & risks associated with natural phenomena - Consolidating environmental aspects into a framework/plan or policy at natural & urban levels In Cambodia, it has undertaken previous research on solid waste management and worked with various stakeholders in the sector to incorporate an effective waste management strategy for Phnom Penh Municipality: e.g., in 2013 it worked actively with Cintri on a waste collection reform programme and was actively involved in waste- and environment-related programmes including Urban Services Programme & ECO-Asia Programme.
DANIDA	Medium	Cambodia is not a priority country	Team Leader Rights and Governance Thea Lund Christiansen Development Policy and Global Cooperation (UGS) Tel. +45 33 92 12 24 thechr@um.dk	Government	One of DANIDA's top priorities is sustainable growth and development, in which it aims to help and fund projects of its specialisation, including energy, water, agriculture and food. Though DANIDA's strategy indicates environmental protection as one of its main target areas, its work in Cambodia in this area currently focuses more on rural regions, including protection of natural habitat and tackling deforestation.
European Union	High				EU's main strategy is to support the government of Cambodia in various sectors ranging from Agriculture, Natural resource management & Education to Public Financial Management & Trade.

Donor Name	Priority	Priority Notes	Donor contact person & details	Type of donor	Funding Strategy (including opportunities and risks)
GIZ	Medium		**Office contact:** GIZ Office Cambodia Country Director Thomas Waldraff giz-kambodscha@giz.de **Office address:** GIZ Office Cambodia Phnom Penh Tel: +855 23 860 110 + 855 23 2127 83 giz-kambodscha@giz.de **Postal Address:** P.O. Box 81 Phnom Penh Cambodia	Government	GIZ works in two main areas: (i) Health and Social Security and (ii) rural development, with activities focused on capacity building within Cambodian government and civil society. In 2016, GIZ undertook the GIZ Land Rights Programme to support capacity development for urban planning in the MLMUPC. GIZ has been working in collaboration with MULMUPC in the sector of spatial planning at various scales for over 20 years, and recently has worked in four provinces - Battambang, Kampong Chhnang, Kandal and Takeo. GIZ has also initiated programmes for cities, the environment, and transport in the ASEAN region.
Global Affairs Canada	Low	Accepts unsolicited proposals and forwards them to Canadian organisation	http://international.gc.ca/world-monde/funding-financement/apply_funding-demande_financement.aspx?lang=eng	Government	Canada funds project related to the 2030 sustainable development which include sustainable cities & community, renewable energy, climate actions & responsible consumption. There is no indication of funding to Cambodia in the waste management sector.
International Finance Corporation (IFC)	High		Country Manager:Kyle Kelhofer E-mail: kkelhofer@ifc.org Head of Office:Sarak Duong 11th Floor, Exchange Square, #19&20, Street 106, Phnom Penh Tel: (+855) 23 263 200 E-mail: sduong@ifc.org	Global Development Institution	IFC adopts a three-pronged approach in the development of green buildings including resource use and energy efficiency: (i) Help develop regulations for green buildings and enforcement capacity; (ii) Certification Programme requiring 20% reduction from baseline in energy, water, and material use; (iii) Linking green building development to the financial sector to provide green mortgage products which offer better loan conditions. In addition, IFC has been working on the Cambodia Rice Sector Support Project to promote Cambodia as a high-quality rice producer and exporter. The IFC programme also aims to develop energy efficiency in which energy utilised in the rice sector is generated from organic materials together with effective waste and equipment Management.
JICA	High		JICA Cambodia Office 6th,7th,8th Floors, Building #61-64, Preah Norodom Blvd, Phnom Penh, Cambodia (P.O.Box 613, Phnom Penh, Cambodia) Tel : +855 23 211673 Fax : +855 23 211675	Government	JICA is one of the main potential partners for Phnom Penh Green City Development projects. its works in the infrastructure development for Phnom Penh City includes: Urban Planning, Urban Vulnerability (flood protection, drainage and sewage improvement), Clean Energy, Transport Sector, Built Environment & Manufacturing (Development of Water Supply, and Capacity Development Projects - CJCC), and other projects in Phnom Penh for Education and Healthcare sectors.
KOICA	High		Tel: +855 23 964 150/1/3 Fax: +855 23 964 152 E-mail: cambodia@ koica.go.kr Address: Phnom Penh Tower, 12th Floor, #445,	Government	KOICA has implemented a waste management project in Cambodia since 2012. The project in 2012–2014 aimed at improving capacity and establishing an effective waste management strategy for Cambodia. It also focuses on certain urban planning projects, including: establishment of a National Base Map, Master Plan for National Spatial Data Infrastructure in Cambodia, Capacity Building for Capital Market Development in Cambodia, and project for Cambodia's National Science and Technology Master Plan (2014–2020).

Donor Name	Priority	Priority Notes	Donor contact person & details	Type of donor	Funding Strategy (including opportunities and risks)
MFAT	Medium		Ministry of Foreign Affairs and Trade 195 Lambton Quay Private Bag 18 901 Wellington 6160 New Zealand Tel: +64 4 439 8000	Government	MFAT introduced the Sustainable Development Fund in 2010 and to date has funded over USD 79 million for New Zealand NGOs globally. Applicability of the fund for other types of NGOs is unclear. Regardless, MFAT already has a history of funding many NGOs in Cambodia, in the area of WASH, including ADRA.
Netherlands Development Cooperation	High	Directly to organisation	https://www.government.nl/contact	Government	Focus areas include: clean water, carbon emission reduction, waste reduction, clean-up of contaminated soil, improving air quality, tackling climate change, and depletion of natural resources and biodiversity.
NORAD	High	Cambodia is not a priority country	VISITOR ADDRESS Bygdøy allé 2, 0257 Oslo POSTAL ADDRESS Pb 8034 Dep. 0030 Oslo EMAIL postmottak@norad.no Tel: +4723980000	Government	Aims at enhancing capacity building in higher educational institutions in 6 target sectors, including natural resource management & environment. NORAD has supported a number of Climate and Forest projects in various countries, and has supported INTEPOL's projects aimed at encouraging law enforcement to combat forestry crimes in Amazon and Mekong Basin region, which includes Cambodia.
SIDA	High		10th floor, Phnom Penh Tower 445, Monivong Blvd, (St. 93/232) Sangkat Boeung Pralit, Khan 7 Makara Phnom Penh Postal address Embassy of Sweden P.O. Box 68 Phnom Penh Cambodia Phone, fax, email: Tel: +855 23 861 700 Fax: +855 23 861 701 E-mail: ambassaden.phnom-penh@gov.se	Government	In Cambodia, SIDA has focused on: - Promoting democracy & gender equality - Enhancing education & employment for better economic opportunities especially for the vulnerable - Promoting the environment; resilience to environmental impact, climate change and natural disasters. In 2016, SIDA cooperated with the government and several NGOs in developing a policy and development plan for the Global Sustainable Development Goals. It has also partnered with Forum Syd, a programme that aims to engage private organisations in Cambodia in projects related to climate and sustainable use of resources.
UNDP	High	Contact local office directly for funding opportunities.	#53, Pasteur Street, Boeung Keng Kang I P.O. Box 877, Phnom Penh, Cambodia Tel: +855 23 216 167 / 214 371 Fax: +855 23 216 257 / 721 042 E-mail (General): registry.kh@undp.org (Media Related): communications.kh@undp.org Website: www.kh.undp.org	UN	UNDP aims to accomplish sustainable, inclusive and resilient human development and the Sustainable Development Goals (SDGs). Its purpose is to tackle chemical & waste management by supporting countries in financial and technical resources, and improve the holistic management of chemicals and waste at national, regional and global levels. It aims to "minimise unsustainable consumption and production patterns which lead to resource depletion, waste generation and pollution". In Cambodia, it has launched, funded or been involved actively in various projects including "Cambodia Climate Change Alliance (CCCA), Cambodia Community Based Adaptation Programme, Promoting Climate Resilient Water Management and Agricultural Practices in Rural Cambodia, Sustainable Forest Management, UN-REDD Programme and REDD+ Readiness Project".

Donor Name	Priority	Priority Notes	Donor contact person & details	Type of donor	Funding Strategy (including opportunities and risks)
UNIDO	High		UNIDO Country Representative: Mr. Narin Sok Address: Phnom Penh Center, Building A, Room 611, 6th Floor Corner Sihanouk Blvd (St. 274) & Sothearos Blvd Sangkat Tonle Bassac, Khan Chamkarmon Phnom Penh 12301 CAMBODIA Tel: +855 23 860927	UN	Since 1993, UNIDO in Cambodia has focused on: Agro-industry, trade capacity skills development, renewable energy, resource efficiency, small and medium enterprise development, and environment management, including reduction of POPs emissions. In 2015, it provided USD7.5 million fund to 5 countries in Asia region including Cambodia to tackle waste management issue through the Global Environment Fund.
UNCDF	High		Mr. Hong Ngin Financial Inclusion Specialist Mr, Kosal Sar National Technical Specialist Address: 53, Pasteur Street, Boeung, Keng Kang I Phnom Penh PO Box 877 Cambodia Tel: +855 23 216 167	UN	UNCDF's work in Cambodia focuses mainly on financial inclusion and local development programmes. It has worked in various fields, including youth empowerment, energy efficiency, and climate change resilience. Some of its environmental projects include LGCC and Local Climate Adaptive Living Facility (LoCAL). In 2015, 80% of the total fund was used to support local government climate change initiatives. Between 2015-2016, it invested in 64 projects in climate change resilience.
USAID	High	Directly to organisation	Polly Dunford, Mission Director USAID/Cambodia, U.S. Embassy Phnom Penh No 1, Street 96, Wat Phnom Phnom Penh Daun Penh, Phnom Penh Cambodia Phone +855 (23) 728 300 Fax +855 (23) 430 263	Government	USAID launched The Municipal Waste Recycling Programme (MWRP) in South East Asia (currently only Vietnam, Sri Lanka & Philippines). The 4-year programme aims to tackle the issue of waste management in the region by alleviating the amount of plastic waste. The program is yet to be launched in Cambodia. However, USAID has supported the Low Emission Development Strategies (LEDS) programme and the Clean Technology Initiative - Private Finance Advisory Network which develops clean-energy projects. Meanwhile, USAID has also funded other environmental projects focusing on forests and natural resource management.
World Bank	High	Directly to the organisation	113 Norodom Blvd. Phnom Penh Tel: +855 23 861 300 Fax: +855 23 861 301/302	Multilateral funding institution	Although the World Bank's fund does not encompass waste management in Cambodia presently, the area of waste management is still considered one of its priorities. World Bank provides finance & advice on solid waste management through means including "traditional loans, results-based financing, development policy financing, and technical advice". It addresses the whole cycle of waste management from waste disposal to waste recycling & treatment. Through its Country Engagement Strategy, World Bank's projects have also been involved with transport, energy, and disaster resilience.

Donor Name	Priority	Priority Notes	Donor contact person & details	Type of donor	Funding Strategy (including opportunities and risks)
Private Sector					
IKEA Foundation	Medium	Does not accept unsolicited proposals	No contact information. https://www.ikeafoundation.org/contact-us/	Private Foundation	IKEA Foundation focuses its funding on 4 main areas: Home, Health, Children's education, and Income. IKEA has supported We Mean Business coalition with a Euro 40 million grant. The grant's purpose is to provide incentives and supports to businesses to implement solutions that tackle climate change – for example by sourcing 100% renewable power – to help reduce climate change risks faced by all communities. Nevertheless, to date in Cambodia, IKEA has only partnered up with Save the Children to tackle the area of Safe Education.
H&M	Medium		Corporate Governance Liv Asarnoj Tel: +46 8 796 55 00	Corporation	H&M's vision is to create a sustainable fashion industry. In 2015, H&M foundation initiated its Global Innovation Challenge - Global Change Award to seek innovative Ideas to recycling textiles.
Mitsui	High		Mitsui & Co., Ltd. Address No. 29A, Mao Tse Toung (St. 245), 12302, Phnom Penh, Cambodia Tel: +855 23 217 548	Corporation	Mitsui's 3 main areas of focus are international exchange, education & environment. In the environmental sector, Mitsui aims to tackle environmental issues and establish a sustainable and harmonious environment in Japan and overseas. Overall, it has funded over 548 environmental projects across the globe in 4 main focus areas: global environment, resource circulation, ecosystems and the symbiotic society, people-and-society relationship.
Unilever	High		Address: No. 443A, Street 105, Sangkat Boeung Prolit, Khan 7 Makara, Phnom Penh Tel: +855 23 990 055 Email: Monica.Soy@unilever.com Website: www.unilever.com	Corporation	Unilever is committed to establishing a circular economy and reducing environmental impact through the Unilever Sustainable Living Plan. Unilever has adopted a zero waste to landfill strategy and tackles food waste by recycling the packages it uses.
Chevron	High		Street 274, 4th Floor Phnom Penh Center Sangkat Tonle Bassac, Khan Chamkamon Phnom Penh, Cambodia	Corporation	Since 2014, Chevron has organised several campaigns across Cambodia to tackle environmental issues, such as a cleaning campaign along the shoreline of Ochheuteal Beach in Sihanouk Ville city and in Prek Leap Primary School in Phnom Penh.
Coca Cola	High	Directly to organisation	Address: #287, Phum Mittapheap, Khan Russey Keo Province / Capital City: Phnom Penh, Cambodia Tel: +855 23 428 995 Website: http://www.thecoca-colacompany.com Email: llina@coca-cola.com.kh	Corporation	Coca Cola has 3 main focus areas: - Women: economic empowerment and entrepreneurship - Water: access to clean water, water conservation and recycling - Well-Being: education, youth development and other community and civic initiatives In Cambodia, it has sponsored the water replenishment programme in collaboration with Cambodian Women for Peace and Development (CWPD) and UN-HABITAT to ensure access to clean water and efficient use of water and wastewater management in its operations. Coca Cola Cambodia has also supported Planet Water Foundation to conduct a hygiene training programme and put water filtration systems in place to provide safe, clean water to rural communities in Cambodia.

Donor Name	Priority	Priority Notes	Donor contact person & details	Type of donor	Funding Strategy (including opportunities and risks)
C&A Foundation	Low	Directly to organisation	http://www.candafoundation.org/who-we-are/contact-us/	Corporation	C&A Foundation has adopted a 'circular fashion strategy' that seeks out innovative ideas for producing reusable clothes (aimed at textile recycling). In 2016, it provided a Euro 250,000 fund to Circle Economy, a social enterprise targeting textile recycling. C&A Foundation has also supported the "Sea Without Plastics" initiative with a Euro 50,000 fund to tackle the problem of plastic waste in oceans and rivers.
Citi Bank	Medium	Directly to organisation	https://www.citibank.com/citi/contact/form.htm?foundation	Corporation	Citibank aims at solving issues related to infrastructure, affordable housing, environmental sustainability and financial inclusion through the application of technological advances. In the environmental sector, Citibank is committed to financing USD 100 billion in clean energy, technology, and infrastructure projects for development of a sustainable economy.

3. Carbon Financing

Organic waste in a landfill generates methane, a powerful GHG (see Action Area 3). Since it has a much higher global warming potential (GWP) than carbon dioxide, it is efficient, from a GHG standpoint, to convert it to carbon dioxide in the process of power generation, which means it can be captured and used to produce electricity. Further, as Cambodia is a signatory to the Kyoto Protocol, it is able to trade carbon emissions with developed and developing countries.

Reduction of GHG emissions from the waste sector, such as through capturing methane, can be converted to certified emission reductions (CER) for trading in the carbon market. Bilateral crediting mechanisms such as the Joint Crediting Mechanism of Japan (JCM) finances investments in low-carbon technologies in host countries (such as Cambodia), ensuring GHG reductions can be jointly used by Japan and host countries to achieve their respective GHG emission reduction targets.

The GCF is a new global fund (financial mechanism) set up in the wake of the Paris Agreement on Climate. It aims to support the efforts of developing countries in responding to climate change. Funds are disbursed in the form of grants, loans, equity to Accredited Entities (in Cambodia this is the MoE or PPCA or partnership) for projects addressing emissions reductions.

A number of projects certifying carbon emissions from MSW are registered in the region (Vietnam, Indonesia for example). Cambodia project developers could design projects based on the lessons learned and technologies used in existing projects. A high level of governance and robust monitoring systems are required to successfully implement carbon projects in the MSW sector.

4. Public Private Partnerships

Increasingly, public–private partnerships (PPP) have emerged as a way of improving MSW service performance, as they incur lower costs. Private Sector Participation (PSP) in SWM would both improve efficiency and effectiveness through better management, new investments and technologies.

Below are some suggestions as to how PPP and PSP models could be integrated into the system in Cambodia.

Recent Trends in Private Sector Entries in Recycling Industry

Twinagri

- Twinagri is a Singaporean-owned local agricultural firm specialised in research and provision of new agricultural technology around South-East Asia. In Cambodia, the firm focuses mainly on processing organic waste into fertiliser, which is distributed to farms across Cambodia, while also providing agricultural training to local farmers. Recently, it has become a supplier to Mong Rithy Group, Cambodia's largest agricultural firm.
- The company has stated the possibility of recycling glass into sand, which could also be used as a component for producing organic fertiliser. As glass is substantially made of sand, proper glass-crushing machines can be used to break it down to its raw components, which could include soda ash, sand and limestone, which can then be separated and reused.

Gomi Recycle 101

- Gomi Recycle 101 is a Japanese company specialised in recycling plastic & rubber wastes into furniture parts. For 2016, its plans included investing in a recycling facility in Svay Rieng to produce end-recycled products for local markets.

Chipmong & Phnom Penh Economic Zone

- Chipmong, one of Cambodia's biggest corporations, is looking to invest in Cement Kiln. The company is seeking to purchase industrial wastes with high heat intensity that can be used as an input or substitute for coal. Currently, industrial waste in PPSEZ is collected by SAROM Trading. However, PPSEZ is partnering with UNDP to find possible ways to improve waste management in its zone with possible ventures with Twinagri and Gomi Recycle, aimed at addressing waste management challenges through a business-driven model.

The Role of Government to Facilitating Development of Recycling Industry (Action Area 2)

For new entrants in the sector to be sustainable, immense support and active involvement from various governmental and developmental bodies are encouraged. To assist here, an easily-accessible platform containing detailed information on potential donors and investors would be highly beneficial for such companies. This platform could also act as a communication medium connecting companies with potential buyers. In this case, the government could play a major role in paving the way for recycling markets by incentivising investment (e.g., through tax alleviation), boosting demand and trading of recyclable products, while also establishing a recycling supply-chain ecosystem that binds and connects all relevant stakeholders together.

Annex V - Sample Cost Estimation for Implementation

The below table provides sample cost estimations for implementing actions under the strategy. The estimate was co-developed by participants to the Final Strategy Formulation Workshop and the drafting team as preliminary figures for future discussion. Accurate cost estimations need to be obtained for the actual implementation of each actions under this strategy.

Action Area 1: Sample Cost Estimation for Information Session for Citizens on Waste Management

- Half day x 100 attendants x 10 times per year
- Expected Participants: Khans, Sangkats, residents and other waste generators

	Budget Item	Cost Estimation(USD)
1	Meeting venue and equipment	500
2	Catering	500
3	Transportation cost for participants	250
4	Meeting materials for participants	200
5	Banners and backdrop	200
6	Misellenous	350
	Sub-total	2,000
	Total for 10 events	**20,000**

Action Area 2: Sample Cost Estimation for Workshops for Promoting Voluntary Grass-roots Actions

- Full day x 10 days x 100 attendees x 4 time/year
- Expected participants: residents, business owners

	Budget Item	Cost Estimation(USD)
1	Renting meeting room and media	500
2	Coffee break & Lunch	3,000
3	Logistics for workshop	1,000
4	Backdrop	250
5	Misellenous	500
	Sub-total	5,250
	Total for 10 events	**52,500**

Action Area 3: Sample Cost Estimation for Improving Final Disposal Site

- Based on the calculations, the workshop participants concluded that the current disposal fee/tipping fee charged to incoming waste trucks needs to be increased to USD 3.50/t at minimum in order to cover the operational costs in the table below.

	Budget Item	Cost Estimation(USD)
1	Equipment/bulldozers = USD 200,000 × 7 units =	1,400,000
2	Compactors = USD 200,000 × 3 units =	600,000
3	Labour/staff = USD 170 × 50 people =	8,500
4	Repair and maintenance costs for equipment (bulldozers and compactors)	100,000
5	Dumping platform (steel plating for road cover for trucks to enter landfill) = USD 100 × 1,200 =	120,000
6	Spraying/anti-odour = USD 600 × 12 months	7,200
7	Utility/operational cost/oil/gasoline = 20,000 × 12 months	240,000
8	Soil cover = 350,000USD	500,000
9	Leachate system/treatment = USD 50,000	100,000
10	Weight = USD 50,000/year	50,000
11	Road = 7 m × 2,000 × USD 30 =	42,000
12	Tree planting (labour: USD 5 × 200 workers)/year	1,000
13	Fence for landfill (2 × USD 20 × 4,400 m)	176,000
14	New building/office	40,000
15	Other expenses	20,000
16	MRF	500,000
	Total per year	**3,904,700**

Action Area 5: Sample Cost Estimation for Conducting Awareness Raising Campaign for Environmental Education

- Installation of waste bins in the public areas for promoting source segregation
- Public outreach through media-mix

	Budget Item	Cost Estimation(USD)
1	Waste separation bins x 100 units	19,000
2	Awareness T-shirts x 1000 units	10,000
3	Color Leaflets x 1000 copies	300
4	Banners across the streets x 50 units	2,500
5	Production and broadcast of educational program via TV and SNS: 1 min. x 2 spots	10,000
6	Rental Tuk Tuks x 10 units x 2 months for daily broadcasting of the awareness messages	12,000
7	Misellenous	500
	Total per year	**54,300**

Annex VI - Roles and Responsibilities

Sechkdey Nenam (Instruction) on the Implementation of Improving Task for Solid Waste Management in Phnom Penh Capital is currently being drafted to provide clarity of roles played by different stakeholder in waste management governance, and improve waste management service in the city.

The draft instruction contains 10 objectives:

1. Enhance participation of the public and other stakeholders cooperation on the improvement of city beauty and environment
2. Enforce the city solid waste cleaning, collection and transportation service in Phnom Penh
3. Set up the schedule for the city solid waste cleaning, collection and transportation service for smooth waste discharge, collection and transportation
4. Change habit of the citizen of illegal disposal and turn to properly store their waste and on schedule waste discharge
5. Educate citizen to sort their waste properly for reuse and recycling as well as to reduce waste to landfill substantially
6. Reduce plastic waste consumption
7. Strengthen the expansion of the city solid waste cleaning, collection and transportation service to the area where it is not yet having the service, esp. the new 20 Sangkats from Kandal province
8. Seek for investment partnership to recycle waste at landfill for energy, biogas or compost, etc.
9. Enforce the regulation effectively on solid waste management in Phnom Penh
10. Join concerns, join implementation and join responsibilities to make Phnom Penh Capital clean without waste from 2014 onwards.

Roles and Responsibilities Defined in the Draft Sechkdey Nenam

1. Waste Management and Environment Division of PPCH

a. Encourage waste collection company to prepare clearly the program for waste cleaning, collection, and transportation for each street in Phnom Penh.
b. Inspect and give warnings and fines to waste collection companies in Phnom Penh which are fail to perform on good cleaning, timely collection as set in the waste transportation program; as well as making dirt and leachate on the streets.
c. Encourage Cintri to expand solid waste cleaning, collecting and transporting service to areas not yet available (besides 20 new Sangkats).
d. Reset the price table and edit service price for all residents, business place, service, company, factory, enterprise, public, and private sectors in Phnom Penh Capital city.
e. Compromise on cleaning service fee when has a dispute or protest between the clients and service providers.
f. Encourage local authorities to monitor, coordinate, and adjust the operations of the waste collection company to operate efficiently.
g. Take action on construction site owners to properly store construction waste and

construction materials and take action on the transportation of sand, rock, soil, activity that fall on the streets, affecting the environment's public orderliness.

h. Guide to all residents, businesses, services, companies, factories, enterprises, public and private sectors in Phnom Penh to have trash bins.

i. Educate, guide, and encourage all citizens and traders must to take the waste to waste bin properly follow the waste collection program and location determined.

j. Take lead and collaborate to produce educational spots for public dissemination to citizens about the waste separation, waste storage, waste packages, waste disposal, and time of waste collection with radios and televisions.

k. Advise to all markets to be environmental friendly by doing regular cleaning and locating suitable containers to be properly installed and transported.

l. Set and divide the respective task between the market contractor (Pheasy), car parking contractor (surrounding the market) and waste collection company about their task in cleaning and collecting waste inside the market, around the market and at the parking lots.

m. To prepare proper roads for trucks into the landfill that does not cause the traffic jam for garbage trucks.

n. Advise to Sarum Trading Co., Ltd., which manages the industrial waste landfill to prepare properly landfill with technical standards, good environment, and not affecting the people in the area

o. Find the possibility of investment partners in the collection, management and solid waste recycle.

p. Orient and monitor project plan, measure and work direction to strengthen and expand the scope of waste management, waste separation and fines to be coverage for all Khans and Sangkats throughout Phnom Penh.

q. Prepare various regulations such as Decision, Deika and Measures to encourage waste management and solid waste collection services can take place smoothly without obstruction and on time.

r. Continue to encourage the implementation of waste separation plan throughout Phnom Penh.

s. Use existing penalties and create a punishment working group consisting of Phnom Penh Capital Hall, Departments, relevant entities to effectively inspect and advise and penalty to the perpetrators following Deika on measures and Fine mechanism for disposal, cleaning, waste collection and transportation in Phnom Penh Capital City as well as other related regulations.

t. Strengthen strict penalties to everywhere for those who throw away the waste and to the waste collection company that is not properly performed according to the tasks set out in this instruction.

u. Monitoring and encourage to Khans, Sangkats, departments and relevant entities to carry out the tasks set out in this instruction effectively and conduct assessments to find the missing points for improvement.

v. Monitoring meeting and evaluates on the work that the service providers and relevant organisations have implemented so far and continues to implement effectively as well as summarize the results of the work to report to the Governor of Phnom Penh.

w. Improve the landfill infrastructure and operation to avoid any traffic jam of waste transportation and take record of any incidents at the landfill for reporting and intervention on time.

x. Prepare planting trees around the landfill to reduce odor emitted from the landfill that affecting to environment and surrounding people.

y. Improve drainage system for waste leachate and treatment system before its overflow into public canals.

2. CINTRI Company

1. Develop Planning and Business Responsibility

a. Have to strictly respect and implement with all regulation, laws, contracts, and other regulations related with cleaning, collecting and transporting solid waste services.

b. Be responsible for solid waste cleaning, collecting, and transportation from residential areas, business places, services, companies, factories, enterprises, public and private entities in Phnom Penh to be regularly clean following its waste collection program.

c. Develop business plan, Service Management short term-long term, Waste Collection operation activity plan in its service area send to PPCH for consideration and approval.

d. Develop detail activity plan about the waste collection service according to the actual circumstances of each Khan, Sangkat, by setting the number of means of transportation, collection materials, and sufficient workforce to ensure cleaning is well performed.

e. Ensure the waste cannot be congestion in the streets at risk, such as demonstrations, or strikes of CINTRI's workers who did not want to transport waste.

f. Have enough trucks, machinery, tool, and materials for waste collection service to ensure the effectiveness of doing this service.

2. Develop Solid Waste Cleaning, Collection and Transportation Program

a. Develop and set solid waste cleaning, collection and transportation program clearly with the consent of local authorities and PPCH.

b. Promote and provide waste collection program to all local authorities, Khans, Sangkats, villages, residents, business location, enterprises, services, factories, public and private entities in Phnom Penh to know for easy to release waste in parallel with transport times.

3. Prepare to storage waste bin in Market, Parks, Public

a. Prepare to have enough public waste bins in public parks, commercial centers, markets, Boulevard and major roads, and at the point, close to public institutions,

etc., in accordance with the practical needs, in collaboration with Khan / Sangkat authorities so as to facilitate the waste storage.

b. At some markets need to add more big waste bins to separate wet waste and dry waste (Damster Waste Bin) for proper waste separation.

c. Eliminate the waste containers near the canal (open sewage system).

4. Education

a. Collaborate with Waste Management Division to develop program and short training spots in media to educate citizens to know about the waste transportation system and waste collection schedule for properly discharge their waste in consistent with waste collection schedule.

b. To Collaborate with local authorities, departments, relevant entities to regularly educate people in Phnom Penh about proper waste cleaning, separation, package, storage, and waste disposal with every way.

5. Waste clean, collection and transportation to landfill

a. Ensure the soil cleaning on the streets and bridges are regularly clean with the waste collection schedule at some roads and bridges, which were set. Soil waste shall be placed in waste bins or carts for immediately transportation, not store along the roads or bridges.

b. Ensure the waste collection to waste trucks dose not litter on the road, and clean the collection site to be clean.

c. Ensure waste transportation to landfill by avoiding waste littering, leachate along the streets and waste flying in the air.

d. To ensure waste cleaning, collection and transportation in all streets are clean and on time as set in program. In the case of being late (not follow the program) it will be under a warning and fines.

e. Develop waste collection by carts at small roads that waste trucks could not reach in.

f. Collaborate to reduce and eliminate illegal waste depot and large waste storage places (Damster) that affect to city beauty and environment through increasing waste carts and direct transfer to waste trucks.

g. If waste collection service is late from 2 days onwards, the company needs to provide information in writing letters to Phnom Penh City Hall with clear reasons.

h. Do not pauses waste collection service at all residential, business place, service, company, factory, enterprise, public and private entities in Phnom Penh Capital city without any prior agreement from Phnom Penh City Hall.

i. Implement waste cleaning, collection and transportation service to all its service areas, no matter those areas have not enough economy competency.

j. While collecting waste at residents, waste trucks must drive slowly and find a suitable location for parking following the traffic law properly as well as make a suitable sound or lights to inform to the citizen.

k. Employees, and workers of the company must wear their uniforms, which are properly labeled and safe at the time Complete the task.

l. Company shall be provide the bonus to workers during Khmer New Year, Phcum Ben Day, and Water Festival for their continue to provide the waste collection service during the holiday.

m. Develop and set up the location for waste collection points (Rent or Purchase) for proper waste transfer to ensure not affect to traffic, public welfare and beauty.

n. Establish collection points for the storage of waste carts and other materials for providing better service and do not leave them at public areas.

6. Means of Solid Waste Transport and Road Cleaning

a. Use waste trucks that are good quality and having proper technical standard, number plates, and vehicle technical inspection following the traffic law to ensure to providing service safety and efficiency.

b. Add enough means of waste transportation as required with real demand of Khans and Sangkats to the current and future increasing amount of waste.

c. Use waste trucks which are suitable with road size and traffic situation in Phnom Penh Capital City.

d. Continue to install more trucks for road cleaning in Phnom Penh and these trucks and equipment must ensure its quality and technical standards.

7. Collecting Fee of Waste Cleaning, Collection and Transportation

a. Proper implement through the basic price table of waste transportation service fee that set by Phnom Penh City Hall.

b. Must pay landfill fee to Phnom Penh City Hall following the content guidelines as set in letter No. 322 SCN of the Council of Ministers dated 13 March 2007.

c. Compromise the waste transportation service fee with citizen and business owners who have appeal; adjust price in consistent with its types of locations to be appropriate and do not to exceed the price that set in the basic price table of waste transportation service fee with prior agreement from Phnom Penh City Hall before making contracts with the customers.

d. Comprehensively disseminate about the basic price table of waste collection and transportation service fee to customers and public.

8. Report and meeting participation

a. Prepare monthly reports, quarter, semester and annual reports about its working result that implemented and target of work to Phnom Penh City Hall regularly and copy to departments and relevant entities.

b. Regularly participate in meetings through the invitation from Phnom Penh City Hall and local authorities. At any meeting if company director cannot participate, company representative will be participate instead of director and must to have right to decide and answer in the meeting.

9. Management, Monitoring, and Collaboration

a. Company should collaborate with authorities, Khans and Sangkats on solid waste collection service to be effective.

b. One representative of company should be assigned to each Sangkat, so it is easy to contact and handle the work on time.

3. Khans/Sangkats

a. Educate and introduce to citizens to proper waste packaging, storage, and waste disposal at the place and time that have set in waste collection program.

b. Monitor on waste collection service implementation and contact to waste collection company to collect and clear all waste, and regularly clean at their own location.

c. Promote and encourage on recycling activities or solid waste recycle at their own location.

d. Strictly management on Junk shops and all types of solid waste recycle places, also advice to those owners to get permission from Phnom Penh City Hall.

e. Do statistics or inventory on all solid waste recycle places and amount of waste types that have recycle at their own location then report to Phnom Penh city hall.

f. Take lead of the Khans and Sangkats' police and environment officers to prevent, advise and fine to who dispose their waste illegally at public area.

g. Prepare and request to environment department to put forbidden banners for illegal waste disposal at some main places.

h. Facilitate to set up location for waste collection points and public waste bins that do not affect the traffic, public welfare and beauty.

i. Follow up on waste cleaning of waste collection service to be regularly, and to disposal waste at the place that set by competent institutions and Phnom Penh city hall.

j. Encourage all local market committees to disseminate waste collection program and task assigned to seller in and around the market to apply effectively together.

k. Monitor and follow up the activities of waste generation, cleaning, collection and transportation that are not implemented in accordance with the deadline by giving a warning and fines.

l. Assign its local legal enforcement officers to punish those who throw their waste littering illegally, improper discharge their waste in terms of location and timetable of waste collection program.

m. Ensure that there is no waste congestion in their location by cooperation with waste collection company.

n. Monitor and promote the activity of waste transportation through the task assigned regularly. In the case that the companies have not complied with their transportation programs, including waste littering from the trucks during their transportation, flow of leachate along the road, and remaining waste pile, please report to the PPCH about the location where the company did not perform to get advise and punishment to the company.

o. Organize public street order for selling, parking, and etc. to make it easier for companies to clean up, collection and transportation waste.

p. Guide people to take care of cleanliness and clean the sidewalks in front of their houses or location. In case of failure to follow the instructions, they will receive a warning or penalties.

q. Introduce the citizens to participate in eliminating waste depot on the roadside, the streets, the public streets and the sewers.
r. Direct the relevant authorities to conduct procedures in accordance with the procedures of solid waste management and waste services in their respective localities.
s. Be responsible for keeping public awareness campaign every three months in order to remind people about environmental hygiene, or to organize a public cleaning program in collaboration with waste collection company, volunteer, students and NGOs.
t. Collaborate to reduce public waste pickers by checking the time between waste discharge and waste collection.
u. Cooperate with the company to agree on the program of waste discharge and waste collection and specify the exact location for waste storage.
v. Advise the construction site owner should properly dispose of construction waste without mixing with the general waste.
w. Every festivals or events must advise the event owners to make sure that the sites are cleaned at the end of the events, such as weddings, concerts, etc.
x. Identify the wrong perpetrator who has disposed their waste illegally and summon the person for education and fines.
y. Sub-committees of Khan / Sangkat shall make reports on the situation of waste, fines, results, challenges, solutions and suggestions, then report monthly to PPCH and copy them to relevant departments.

4. Duties and obligations of Citizens

a. Participate in cleaning and maintain around the houses, businesses, services, and public areas, and keeping your waste bins and public waste bins proper and firmly.
b. Separate and pack your garbage and throw them in a waste bin or plastic bag in front of your home or proper place and generate on time.
c. Discharge your waste in accordance with the collection and transportation program within 1 hour before the truck come. In any case of late, do not leave garbage on the sidewalk or on the road
d. For branch and tree leafs must cut it shortly and package properly to make it easily inserted into the truck.
e. Owners are required to transport their construction waste without leaving on the sidewalk or on the road.
f. For vacant landlords, they must close the fence and prevent waste from being disposed of there, cause of creating an illegal deport that affects the residents living nearby.
g. Do not throw waste on the streets, on the roads, in the canals, in the markets, or in public places in Phnom Penh.
h. Do not allow waste to scatter or discharge waste water in front of the houses,

landlord and plots around its home, and not to be disposed at another location or area.

i. Do not allow your pets to poop on the ground and tear waste bag in front of your home and public area.

j. Every wedding party, ceremony, and other events that will take place in front of the house, business location and on the streets, the program owner will be responsible for clearing and collecting garbage, packing and storing properly after the ceremony.

k. In the case of a dispute about collection and transportation fee waste owners must be discussed with local authorities and service providers in order to reach agreement on payment of fees and to be paid on a regular basis.

5. Public Markets

a. Each market committee has to cooperate with the waste collection and transport service provider to determine the waste collection site properly so that service providers can collect and transport waste on time.

b. Have at least 2 big containers available to store organic waste and inorganic waste as much as possible and the actual situation without compromising welfare and traffic congestion.

c. Continue to advise sellers to separate the waste into two types, organic and inorganic waste, and properly packaged in their waste bins.

d. Monitor the task of cleaning and collecting waste of market contractor and contractors of parking centers around the market thoroughly.

e. Install waste bins as much as possible to serve people's disposal of waste in the market during shopping.

f. Educate and fines to those who throw waste littering in the market.

6. Market Investors, Contractors of Parking Centers around the Market and Market Contractors

a. Market investors have to ensure the environment in and around the market clean regularly and responsibility to organised temporary waste storing

b. For market contractors have responsibility for cleaning and collecting waste in and around the market regularly and transport to market container.

c. For contractor of parking centers have responsibility to clean and collect waste in and around parking center both market side and in front of citizen’s house site regularly and transport to market container.

7. Phnom Penh Capital Department of Environment

Must serve as an assistant to PPCH in cooperation with the Waste Management Division as follows:

a. Prepare strategy and action plans on waste collection and transportation,

temporary waste collection points, and waste disposal in Phnom Penh.

b. Educate and disseminate laws and regulations related to solid waste management in Phnom Penh.
c. Organize data management by the information technology system on sources and types of solid waste and statistics of waste recycling business in Phnom Penh.
d. Participate in monitoring the Master Plan and a detailed plan on the solid waste collection program conducted by CINTRI and other service providers.
e. Instruct to environmental officers in each Khans to cooperate with Khan and Sangkat authorities to inspect the situation of waste and provide services to clean, collect and transport solid waste regularly and report to Khans to find the solution.
f. Inspect, advice, and punish companies that clean, collect and transport waste, service providers of waste management, departments, units and stakeholders who violate this guideline by implementing the laws and regulations adopted by PPCH.
g. Provide close collaboration with Khan and Sangkat authorities to prepare penalties and provide training to law enforcement agencies on effective enforcement mechanisms and procedures.
h. Continue to organize banners on illegal banners within fines for waste littering under Inter-Ministerial Declaration (Interior – Environment) No. 80, dated February 25th, 2003 in some public places where people always throw their waste.
i. Monitor and evaluate the results of the waste separation and reduction of plastic bag consumption in markets and reporting results to PPCH.
j. Review and evaluate the implemented results to give competition scores for Khans, Sangkats, markets, units and relevant departments who have good practices.

8. Phnom Penh Capital Department of Public Works and Transport

a. Clean and collect waste along the gardens, resorts and public places under its competent jurisdiction and packaged properly to store at designated location as soon as CINTRI collection arrive. And do not place them in a public trash bins that is located in these locations.
b. Set up the place for waste bins in the garden and check the amount of waste bin can be enough.
c. Strengthening the park's security agencies to increase alerting, punishing and fines those who are throwing waste in the park and location under it competent to be active and strict.
d. Clean and collect the garbage and waste at the sewers regularly and transport them to the landfill.
e. Cooperate with police forces of Phnom Penh Capital and local authorities to intervene in all types of offenses, which constitute an obstacle to the process of cleaning, cleaning and fines for disinherited dumpsters in public opinion.
f. Collaborate with Waste Management Division, DoE and Waste Cleaning, Collection and Transportation Company to clearly prepare its activity plan for waste cleaning,

collect and transportation at its management site.

g. Prepare regular reports on the performance of the work done and the monthly orientation to the PPCH.

9. Phnom Penh Capital Department of Land Management, Urban Planning, Construction and Cadastre

a. Give advice to all construction site owners to keep the construction waste inside the fence of the construction zone and do not mix the construction waste with general waste.

b. For new buildings such as: big buildings, Borey, private supermarkets, public markets, hotels, public and private establishments, public and private hospitals, factories, restaurants, resorts, pagodas ... in its construction project (plan), it is necessary to prepare and install waste storage space and a large container with suitable waste amount storage capacity.

10. Phnom Penh Capital Department of Health

Advise all hospitals, poly clinics, and small/large clinics in Phnom Penh should implement the guidelines on implementation of the task of improving solid waste management in Phnom Penh especially proper packaging of medical and residual wastes by separate and discharge at the specified time.

11. Phnom Penh Capital Department of Information and Phnom Penh Television Channel 3

a. The Department of Information should introduce all TV and radio presenters to disseminate the contents of the guidelines on how to improve solid waste management in Phnom Penh.

b. Phnom Penh television Post # 3 has the following tasks:

- Prepare reports, interviews and dissemination activities to improve the implementation of regulation related to solid waste management in Phnom Penh.
- Continuing to disseminate the awareness, punishment and waste separation spots more often.
- Prepare new video spots that educate and advise the citizen to participate in the waste cleaning in front of their houses, maintain sewage system regularly by properly store, pack, separate and discharge their waste at the specified time in cooperation with the waste management Division and related departments.
- Disseminate the waste collection and transportation program at Khans, Sangkats and this Instruction to make everyone aware and implement.

12. Phnom Penh Capital Department of Tourism

a. To educate, promote and guide all tourist resorts and tourist destinations as well as tourism business owners to separate, storage, package and generate of waste properly at the specified time.

b. Determine the assessment rating of clean resort without waste littering through clean city policy.

13. Phnom Penh Capital Department of Education, Youth and Sports

a. To disseminate the plan of waste separation and waste collection programs to all public and private schools in Phnom Penh and ask them to disseminate to the students and practice for the clean city.

b. Introduce all schools to install waste bins and education by creating a competition program on public awareness about storage and discharge of waste in Phnom Penh.

14. Phnom Penh Capital Department of Commerce

Give some advises to all business locations and services which signed the listed at Department of Commerce to incorporate this instruction and require them to have waste bin as well as storage, package, separate and discharge of their waste properly at the specified time.

15. Phnom Penh Capital Department of Industry and Handicraft

a. Give some advises to factory owners, handicrafts and business locations under the management of the Department of Industry to incorporate the guidelines on implementation of the task of improving the waste management in Phnom Penh as well as storage, package, separate and generate of waste properly at the specified time.

b. Extracts the data of factory locations and solid waste processing facilities in Phnom Penh.

16. Phnom Penh Capital Department of Labor and Vocational Training

a. To promote and advise factory owners, enterprises, trade unions, staffs, workers and employees to follow instructions on implementation of the task of improving the waste management in Phnom Penh, which is intended for storage, package, separate and generate of waste properly at the specified time.

b. Encourage to separate resident waste from industrial waste, as well as to recommend installing waste bin for storage both kind of waste properly.

17. Phnom Penh Capital Department of Cult and Religion

To introduce and disseminate to all pagodas to contribute to the implementation of this instruction and waste collection program, especially on the occasion of the major

festivals which have many Buddhist are available to understand and practice as well as having enough waste bins.

18. Phnom Penh Capital Department of Culture and Fine Art

a. Manage and responsibility for cleaning, collecting and packing waste at Wat Phnom Resort and store it in designated place.

b. To disseminate the task of improving the management of waste disposal in Phnom Penh to MC, artists and comedians to promote through the forum and on TV, contributes to making Phnom Penh clean.

19. Police Commissioner and Department of gendarmerie in Phnom Penh

Collaborate with local authorities, departments, units, and intervention agencies in all types of offenses, which constitute a constraint to the process of providing solid waste services and fines for public waste dumpsters.

20. Other Departments and Units

Disseminate this instruction as well as solid waste collection schedule to its officers and staffs to contribute to the implementation of each one to be the first exemplary.

21. NGOs and importance relevant partners

a. Helps to mobilize financial and technical support in order to contribute solid waste management in Phnom Penh.

b. Support study tours and training courses related to waste management both locally and internationally.

c. Help to prepare documents to attract donors and investors who are interested in doing business in the management and recycling of solid waste.

d. Help to promote information on the importance of good practices in solid waste management in accordance with 3Rs (Reducing, Reuse and Recycling) to stakeholders.

e. Assist in designing short video spots about the impact of improper waste management to the citizens through the media.

Annex VI - Images of Waste Management Practices

Leachate Management in Dangkor Landfill site

Waste pile at Dangkor landfill site

Heavy vehicle used in Dangkor landfill site

Trucks used in Dangkor landfill site

Waste pickers at work in Dangkor

Collected waste being traded

Landfill fire and fire fighters at Dangkor

Landfill fire and smoke at Dangkor

Dangkor after landfill fire

Illegal disposal in open areas

Used electronics disposed in the street of Phnom Penh City

C&D waste disposed on the side walks Phnom Penh City

Hazardous waste and bulky waste

Religious articles disposed in the side walks

Industrial waste from garment factory 1

Industrial waste from garment factory 2

Annex VII - Map of Dangkor Landfill Site

Annex VIII – Examples of Waste Treatment and Disposal Technologies

1. Decentralised Home Scale Composting System

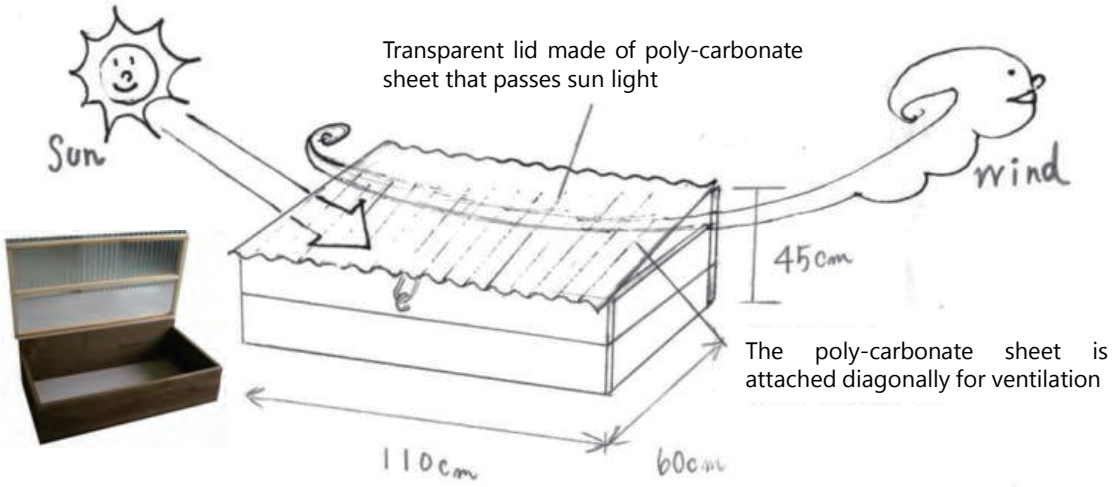
Composting is a range of techniques to promote degradation of organic materials with the presence of oxygen, producing CO_2 and stabilised residuals called compost. While there are diverse sub-categories of composting techniques, small scale home composting systems are widely used in many countries for promotion of organic waste diversion.

Bacteria de Kiero, an extinction-type composting system using wood, soil and poly-carbonate lid, as an example of home scale composting. Unlike conventional home composting systems, Kiero only contains natural soil as base materials, requires less mixing/maintenance work, can digest almost any edible food, produce less ordure, dramatically reduce the volume, and prevents insects if maintained properly.

While it still requires some maintenance work, preparation of materials (wood, black soil), and methods for utilizing produced compost (such as gardening) for its sustainable use, its compact and replicable design, ease of maintenance is considered fit for application in urban context.

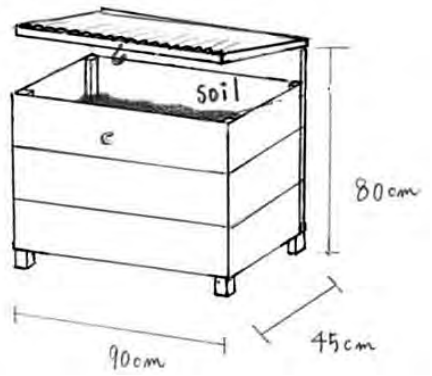
Bacteria de "Kiero"

The first generation designed for placing directly on the ground.



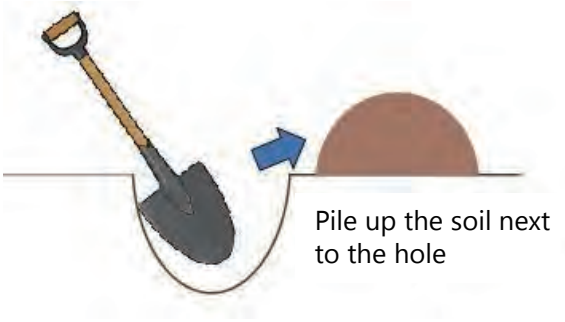
Veranda de "Kiero"

The second generation with closed bottom (a few halls are placed for ventilation) designed for installation on balconies.



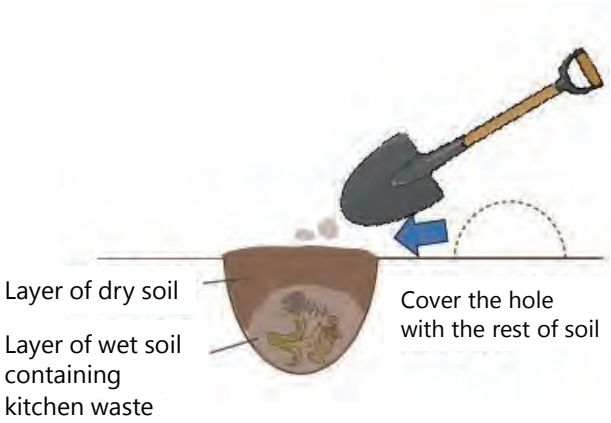
How to use *"Kiero"*

1. Dig a hole of of approx. 20cm in depth and put kitchen waste in the hole. If the hole is not deep enough, it may produce distinct ordure and/or attract insects.



2. Mix kitchen waste and base soil. This is the most important step. The waste will be better digested if exposed well to the soil. Continue mixing until it becomes dirty. Crushing any large objects will also enhance the degradation process.

3. Cover the hole with dry soil. Bad ordure and insects can be prevented by creating a layer of dry soil.



Tips

Mixing the previous spot and exposing the mixed soil to air will speed up the degradation.

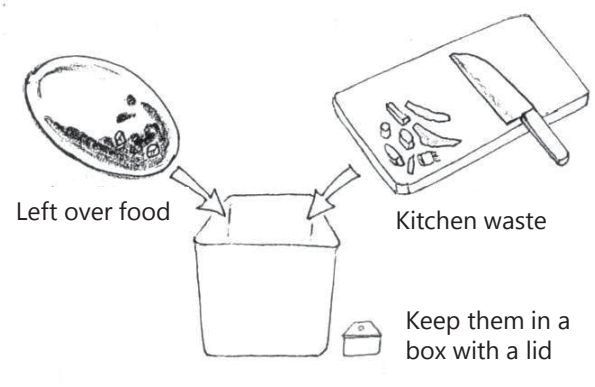
Degradation

Requires approx. 5days (temp: 30-40C)

Digestive capacity

Bacteria de Kiero – approx. 800g/day

Veranda de Kiero – approx. 500g/day



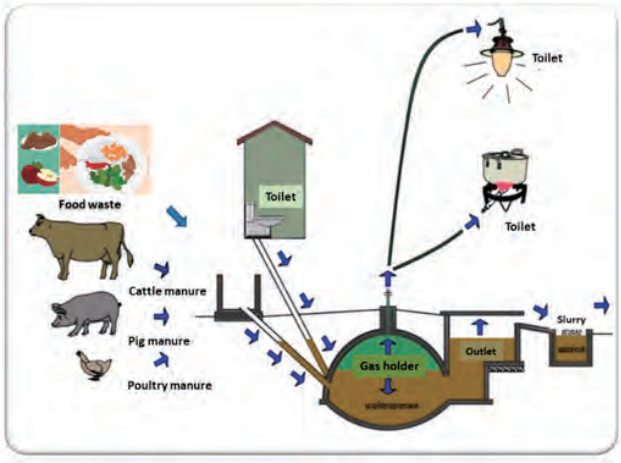
Digestable waste

Any kitchen waste other than thick bones, shells, large seeds, or materials rich in lignin (coco shells, sugar cane) can be digested, but at different speed. Foodwaste, meat, fish tends to be digested quickly, while root vegetables, corns, and soy bean shells require more time.

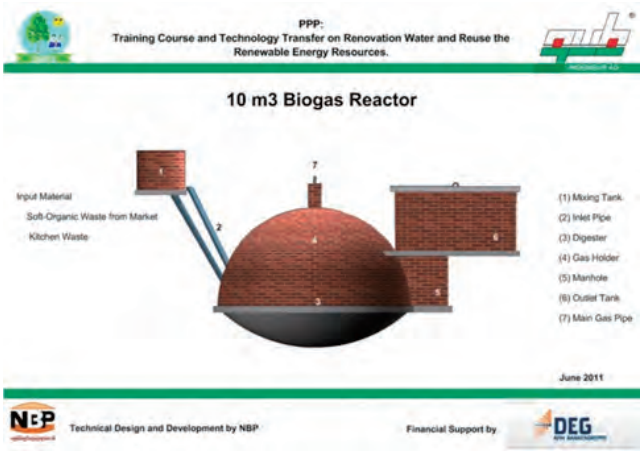
*Contents in this section were developed under the permission of *Kiero Hayama*.

2. Anaerobic Digestion System

Anaerobic Digestion systems (bio-digesters) utlise organic waste degradation in the absence of oxygen, and capable of producing biogas containing 50-60% methane. The biogas can be utilised as source of energy and can alternate fossil fuels though application in cooking stove or power generator. The slurry expelled from the outlet is used for horticulture or agriculture.



As an example, this section introduces outline of fixed dome AD system presented by a developer NBP during *Training Course and Technology Transfer on Renovation water and Reuse Reviewable Energy Resources.*



Input Materials

The digestion system can accept most of the food / kitchen waste such as fruits, vegetables and meat, except for those rich in lignin content such as sugar cane, coconut shell, and palm fruit.

Resulting Bio Gas

1 m^3 Biogas is enough for:

- Substitute 4-5 kg of fuelwood
- Replace 0.6-0.7 L of kerosene
- Equal to 1.6 kg of charcoal
- Replace 0.45 kg of gas LPG
- For cooking 2.5 h
- For lighting 5-6 h
- Create electricity 1.6-1.7 kWh
- Run machine 1hp for 2 hours

More information on organic waste treatment technologies including composting and AD systems in general can be found in *Sang-Arun, J., Kim Heng, C., Rithy, U., Phalla, S. (2011). A Guide for Technology Selection and Implementation of Urban Organic Waste Utilisation Projects in Cambodia. Institute for Global Environmental Strategies, Japan.*

Khmer:
http://www.comped-cam.org/Documents/developmentguideline/IGES2011-Promoting-OWU-Cambodia-Printed_Khmer.pdf

English:
https://pub.iges.or.jp/pub/guide-technology-selection-and-implementation

3. Waste Incineration System with Energy Recovery (WtE)

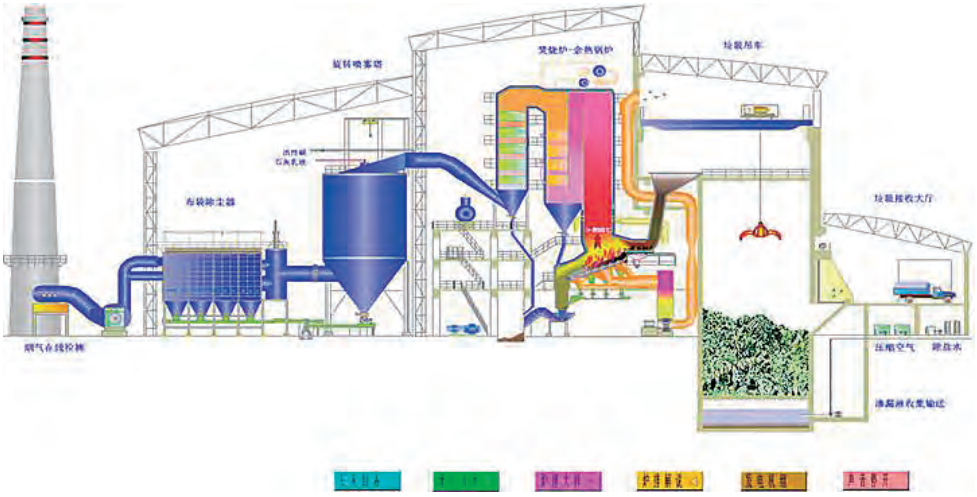
Overview

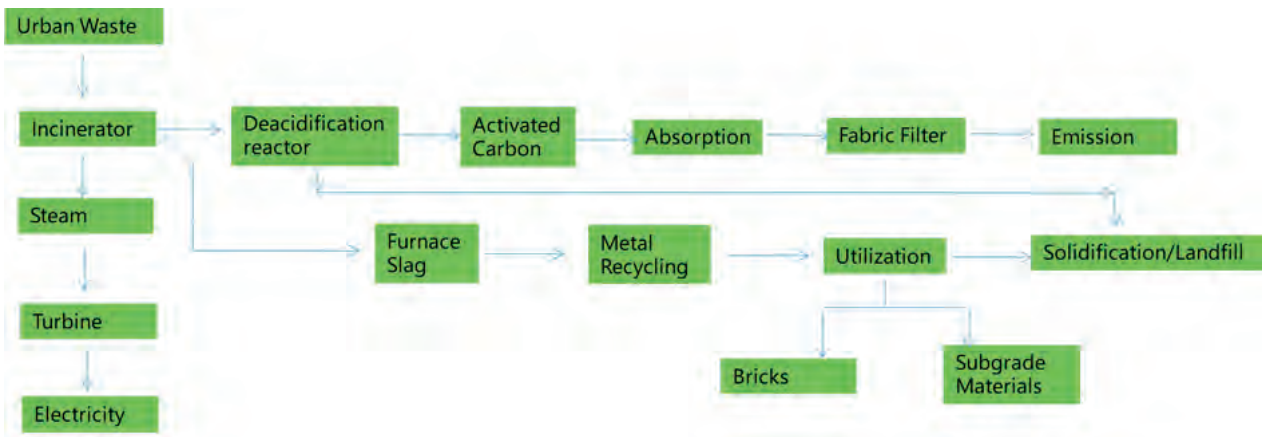
- Area : 10 acres
- Daily capacity : 2,100 tons
- Annual capacity : 760,000 tons
- Incineration treatment technology : Mechanical grate incinerator
- Incinerator capacity: 3 x 700 tons/day
- Steam turbo-generator set : 2 x 24MW
- Total investment : 186 millionUSD
- Annual generating capacity : 150 million kwh
- Suggested price for sales to EDC : USD 0.12/ kwh

Waste-to-Energy, or waste incineration system with energy recovery is utilised in some developed countries as a major waste treatment technology.

Followings are extractions from a technology proposal submitted to PPCA by a WtE developer for potential application in the city.

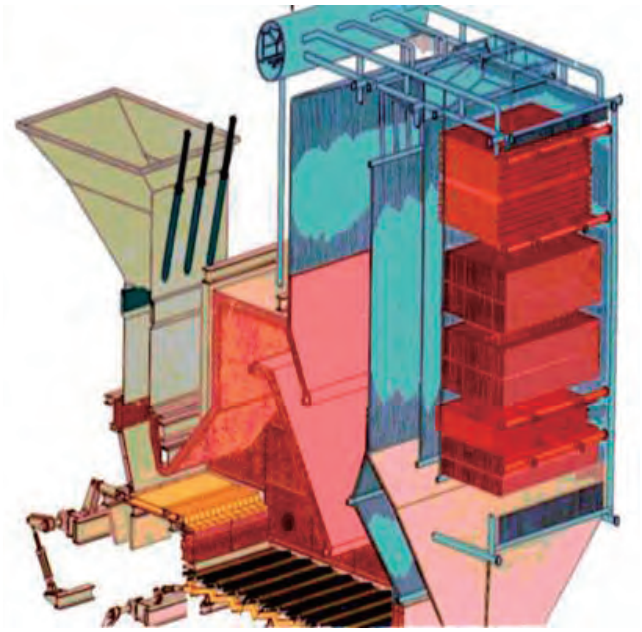
Process Flow Diagram



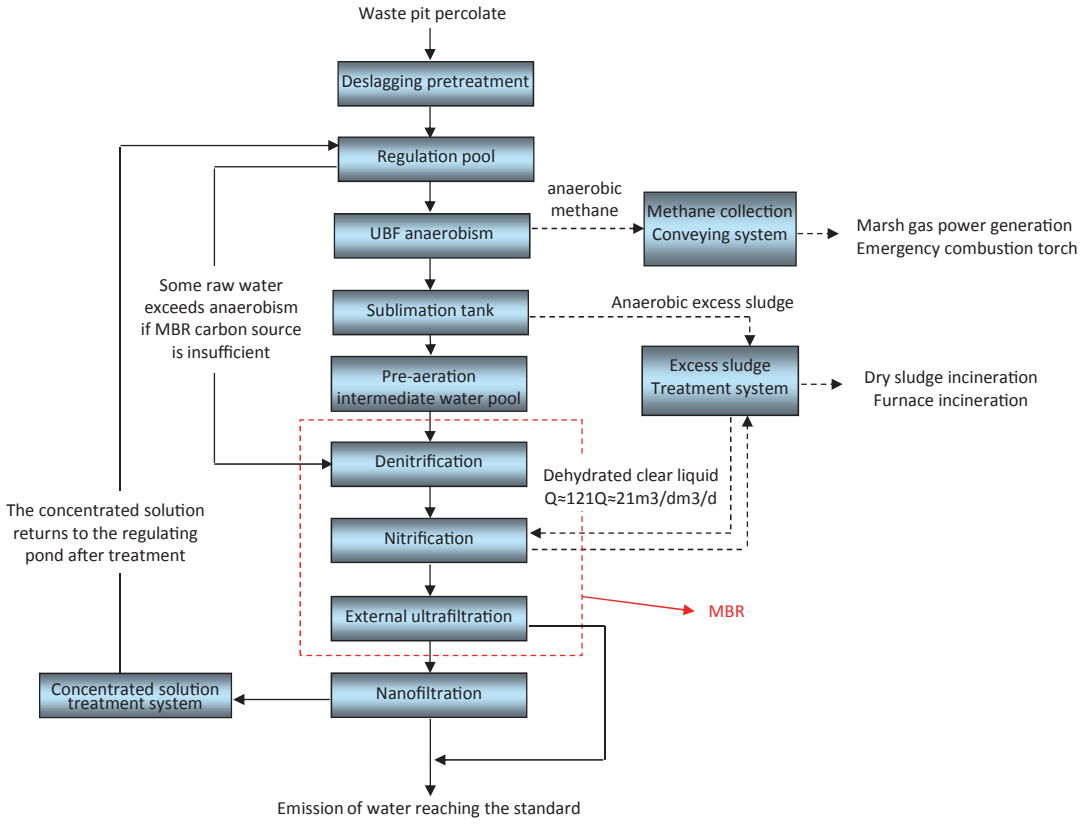


The mechanical grate incinerator has the following characteristics：

- The technology is mature, the automation degree is high, the operating conditions are good, almost all international large incineration plants adopt the furnace type.
- It can adapt to the characteristics of high water content and low calorific value of domestic waste, so as to guarantee complete combustion of the waste.
- The waste can be directly sent to the furnace for combustion without pretreatment, and the operating cost is relatively low.
- The service life is long, it is stable and reliable, operating maintenance is convenient, and the supporting technology and equipment have been developed in China.



The process adopted in design of percolate treatment system of the project is as follows: deslagging pretreatment + UBF anaerobism +external type MBR + nanofiltration



*Source: PPCA, 2018

4. Sanitary Landfill Management under Tropical Climate

Preparing final storage for waste is a final defense for

However, the tropical climate of Phnom Penh pose challenges to sanitary landfill management that can prevent negative impact on human health and surrounding environment. International Solid Waste Association (ISWA) proposes a set of guiding principles /methodologies for designing and operating final disposal site in a sanitary manner under such unique natural condition as "best available technologies/practices". The followings are the key elements :

Site Selection

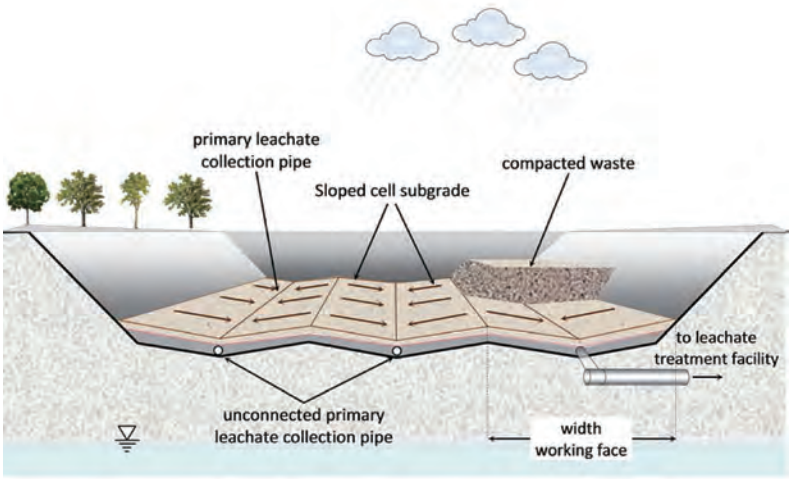
- Potential impact to neighboring community and environment including distances from residential area, from water resources, and from airports
- Geological and hydrogeological conditions
- Topography and seismic conditions in the area
- Risk of flooding, subsidence and landslides
- Travel distance of transportation vehicles
- Access to cover soil for daily operation and final closure

Designing

- Application of compacted clay layers as baselining system instead of expensive HDPE sheet
- Construct liner surface sloped with minimum of 2%
- Ensuring sufficient drainage capability to avoid waste slide from water saturation by employing leachate collection pipe protected by composite layer (gravel, geotextile, protective soil layer)
- Ensuring mechanical stability by keeping the waste slope within 25% and securing benching for large-scale landfills of more than 30m in height

Operation

- Daily record keeping of waste amount for better operational and financial planning (determining appropriate deposit fee for sustainable operation)
- Securing large enough working space for unloading operation to allow for smooth and efficient unloading operation and truck movement
- Waste compaction for saving land space, better mechanical stability, and reducing odour, risk of landfill fire and leachate generation
- Potential use of unutilized compost or demolition waste as soil cover as "best available practice"
- Multi-stage leachate treatment (anaerobic and aerobic treatment followed by a maturation pond or constructed wetland) as a low-cost solution. Arranging these components in a way that leachate flow is driven by gravity can also avoid introduction of pumps for leachate transfer.
- Landfill gas management through application of 1) methane capture system for power generation, 2) flaring, or 3) methane oxidation layer depending on availability of resources.

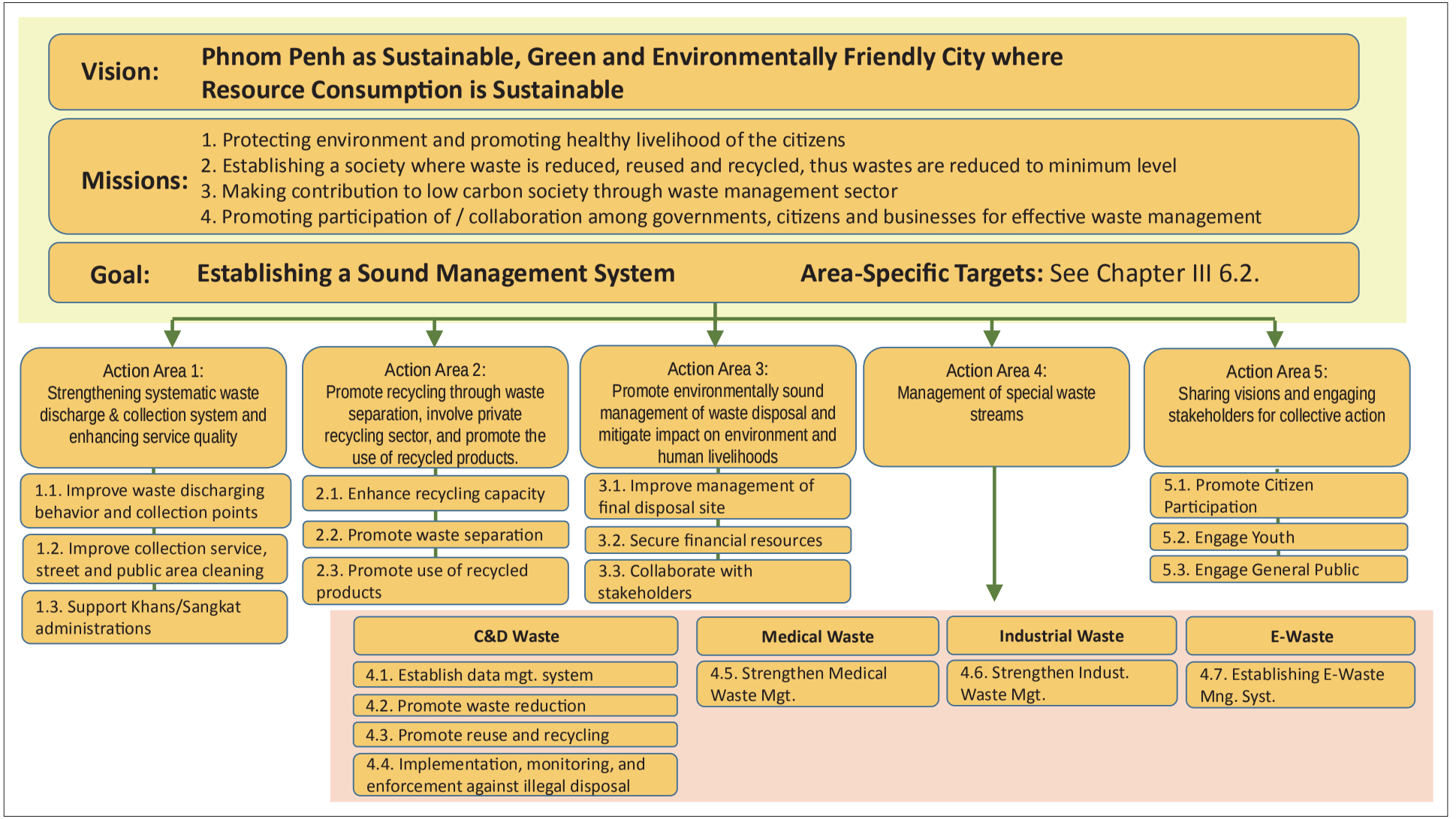


Schematic diagram of sanitary landfill with leachate system (adapted from Qian et al, 2002)

Reference (ISWA Guidelines):

- Munawar, E., & Fellner, J. (2013). Guidelines for design and operation of municipal solid waste landfills in tropical climates. ISWA–the International Solid Waste Association.
- Greedy, D, et.al. (2010). Landfill Operational Guidelines 2nd Edition. ISWA-the International Solid Waste Association.

Annex IX - Overall Structure of Strategy and Action Plan



Phnom Penh Capital Administration
Address: # 69, Preah Monivong Blvd., Sangkat Srah Chak, Khan Daun Penh, Phnom Penh
Website: http://phnompenh.gov.kh/

United Nations Environment Programme
International Environmental Technology Centre
Address: 2-110 Ryokuchi koen, Tsurumi-ku, Osaka 538-0036, Japan
Website: www.unep.org

Cambodia Climate Change Alliance
Address: Ministry of Environment,
No. 503 Road along Bassac River,
Sangkat Tonle Bassac, Chamkamon, Phnom Penh
Website: http://www.camclimate.org.kh/en/activities/cambodian-climate-change-alliance.html

IGES Centre Collaborating with UNEP on Environmental Technologies,
Institute for Global Environmental Strategies
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Website: www.ccet.jp

Nexus Carbon for Development
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