Project_Scoping
URBAN PATHWAYS
2018

BHUTAN PROJECT SCOPING

WASTE MANAGEMENT

Wuppertal Institut

UN HABITAT
FOR A BETTER URBAN FUTURE

UN environment

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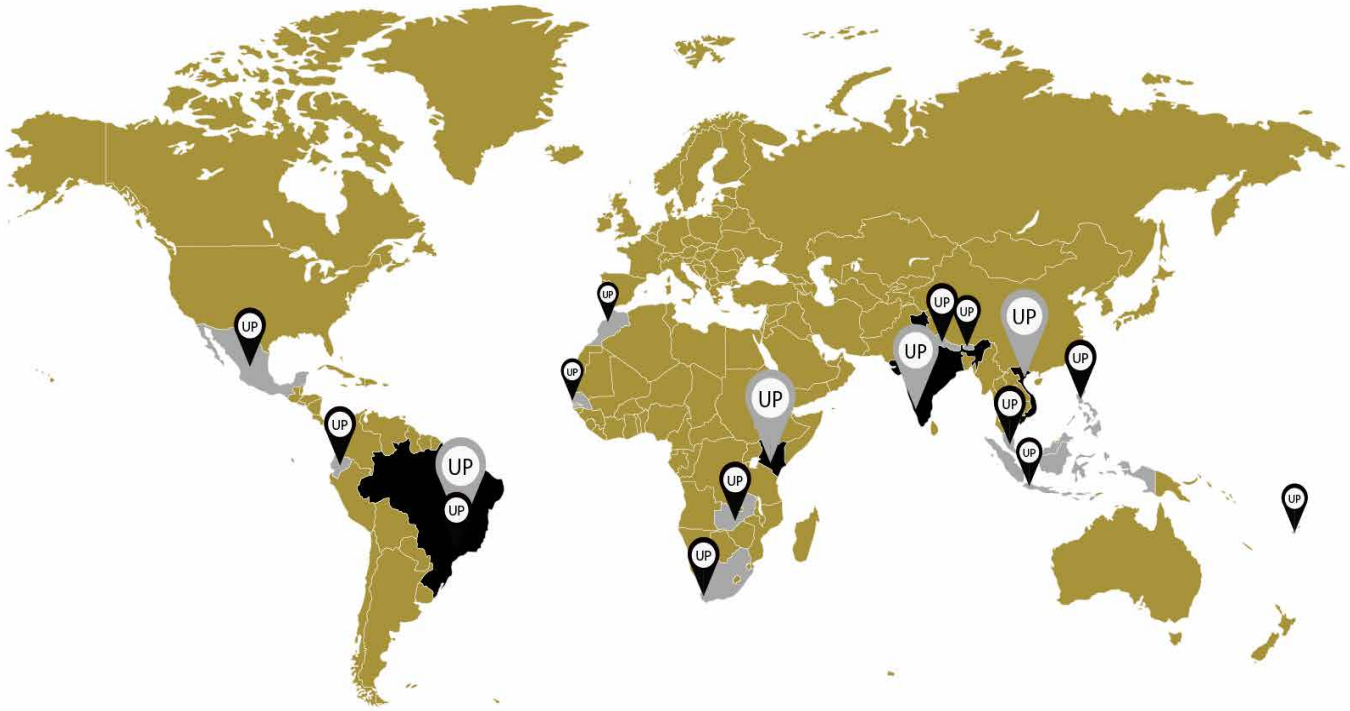


URBAN PATHWAYS REPLICATION CITIES

WASTE MANAGEMENT IN THIMPHU

Thimphu is the capital of Bhutan which is located within an area space of 1,794.87 km2,. A population of 116,012 lives in Thimphu Dzongkhag in 2015 with an estimated population density of 64.6 per km2 (National Statistics Bureau, 2017a) and future projection foresee the city to grow. Thimphu's households are 100% electrified. 64.3% of Thimphu's land is covered by the forest (in 2016) (National Statistics Bureau, 2017a), which contributes in net carbon sink.

The main challenges in waste management in urban areas in Bhutan (including Thimphu) are illegal dumping of waste (although waste collection services are available) and lack of cooperation in segregation and disposal of waste. Thimphu has piloted evening waste collection services and CCTV surveillance to monitor illegal dumping (Ghalley, 2017). The availability of not enough waste compost plants and landfill sites are also an issue in Thimphu. To tackle this, the city is planning to explore technology either to make composting faster or to establish a bio-gas plant (which requires waste segregation at the source) (Bhutan Times, 2017). Greener Way and Clean City are private companies (outsourced by Thimphu municipality) to manage waste in Thimphu.

COUNTRY OVERVIEW

POPULATION OF 779,666

BHUTAN

OVERVIEW

Bhutan is a landlocked developing country, located in South Asia. A population of about **779,666** lives in a total area of 38,394 km^2, which makes Bhutan's population density of 20.3 person per km2 (National Statistics Bureau, 2017). Of the total population, urban population comprises of 39% with annual growth rate of 3.2% recorded in 2016 (World bank, 2018). Thimphu is the capital of Bhutan which is located within an area space of 1,794.87 km^2. A population of 116,012 lives in Thimphu Dzongkhag in 2015 with an estimated population density of 64.6 per km^2 (National Statistics Bureau, 2017a) and future projection foresee the city to grow. Other larger cities with above 20,000 people are Phuntsholing, Samdrup Jongkhar and Punakha. Bhutan's economy is based on hydropower, agriculture, and forestry. The country's GDP per Capita is US$ 2,879.07 and has a GDP growth rate of 7.99% (2016) (National Statistics Bureau, 2017). **Gross National Happiness** (GNH) is the guiding philosophy of Bhutan's socio-economic development for the prosperity and happiness of the people in Bhutan, whose main four pillars are: **1. good governance; 2. sustainable socio-economic development; 3. cultural preservation, and 4. environmental conservation.** As per the second national greenhouse gas (GHG) inventory, Bhutan is a net sink of greenhouse gases (GHG). This is due to the huge forest cover the country has, currently 70.46%, and a constitutional mandate to maintain the forest cover above 60%. Thimphu's land covered by the forest is 64.3% (in 2016) (National Statistics Bureau, 2017a), which contributes in net carbon sink. The sequestration by forest in Bhutan is estimated at 6.3 million tons of CO_2 and emissions in 2013 amounted to an estimated 2.2 million tons of CO_2 equivalent. The emissions from Bhutan's agriculture sector have more or less remained constant, but emissions from sectors such as industrial processes and transport are increasing. During the period 2000 - 2013, emissions from the energy sector, industrial processes and waste management increased by 191.6%, 154.3% and 247.54% respectively.

GROSS NATIONAL HAPPINESS

SCOPING STUDY SUMMARY

WASTE MANAGEMENT

Waste management is an important issue in Bhutan, mainly in **urban areas** (from household, commercial and industry) due to increasing quantity of waste and its related emissions. The composition of municipal solid waste generated in Bhutan includes high organic matter (around 50%), followed by paper and paper boards (around 15%) and plastics (around 10%). The main challenges in waste management in urban areas in Bhutan (including Thimphu) are **illegal dumping of waste** (although waste collection services are available) and lack of cooperation in segregation and disposal of waste. Bhutan intends to minimise GHG emission on waste through application of zero waste concept and sustainable waste management practices. It includes enhancing 3R principles of waste management including conversion of waste into resources, and improving the current system and infrastructure for waste management (Royal Government of Bhutan, 2015). The capital city, Thimphu, has piloted evening waste collection services and CCTV surveillance to monitor illegal dumping (Ghalley, 2017). The availability of not enough waste compost plants and landfill sites are also an issue in Thimphu. To tackle this, the city is planning to explore technology either to make composting faster or to establish a bio-gas plant (which requires waste segregation at the source) (Bhutan Times, 2017). Greener Way and Clean City are private companies (outsourced by Thimphu municipality) to manage waste in Thimphu. In order to improve Bhutan's solid waste management system, a holistic approach of **Integrated Solid waste management in the cities** is required. However following challenges/barriers exist in Bhutan for waste management:

URBAN AREAS

ILLEGAL WASTE DUMPING

INTEGRATED SOLID WASTE MANAGEMENT

TECHNOLOGICAL CHALLENGES

- **There is an absence** of local know-how on waste management technologies and systems. There is not enough effort made on research and development for new upcoming waste management practices.
- **There are no manual** or criteria developed for selection of appropriate waste management technologies by the municipalities.

FINANCIAL/FISCAL CHALLENGES

- **Low financial viability** of waste management projects.
- **High cost** of lending from commercial banks.
- **High equity** requirement for commercial lending.

POLICY & REGULATORY CHALLENGES

- **The enforcement** of existing policies and regulations on waste management is weak.
- **Municipalities lack understanding** of relation between waste management and climate change and potential social and economic benefits from the waste management
- **There is absence** of standards for by-products i.e. compost or biogas at the national level.
- **There is no regulated market** for sale of waste output such as compost, biogas etc. in the country.

LACK OF CAPACITY

- **Municipalities** do not have in-house capacity to make technological options for waste management.
- **There is a lack** of skilled staff in the country in order to operate and maintain waste management plant & machinery.
- **There is a lack** of capacity to test and certify by-products i.e. compost or biogas.
- **There is an absence** of a robust national/ sub-national data monitoring mechanism on waste.
- **Weak coordination** among the relevant institutions.

OTHER CHALLENGES

- **General awareness** among citizens regarding need of waste segregation & management is low.
- **The terrain of the country** makes it difficult to find suitable lands for waste treatment projects.
- **Quantity of waste** generated in individual municipality/ town is low (besides large towns such as Thimphu) creating a barrier to sustainable business around waste management.

PLANNED ACTION

Integrated Municipal Solid Waste Management (ISWM) system typically involves timely collection of waste; its temporary stocking if required, and transportation; its treatment, and reduce volume; and ultimately safe disposal. An effective ISWM system is based on the specific local conditions and is developed with due considerations to protection of public health, environment and aesthetics. The key infrastructure components are: containers for primary collection, a treatment facility and a sanitary landfill site with all necessary safeguards.

INTEGRATED SOLID WASTE MANAGEMENT

In addition, a robust ISWM system requires a municipality to take proactive initiatives towards community participation through sustained awareness generation, behavioral change, cooperation and compliance. Continuation of solid waste treatment and disposal sites in particular is affected by the 'NIMBY Syndrome' (Not in My Back Yard) and to that effect the municipality needs to have effective communication and build partnerships as well as offer some incentives to the affected community. Finally, it is to be recognized that effective municipal solid waste management is about managing material, manpower and technology & machinery and it involves significant expenses. Therefore, the implementing institution needs to have all the necessary systems and process in place for measurement, human resources management, and maintenance of equipment.

In order to make improvements in the solid waste management system in Bhutan, a holistic approach is to be adopted to improve all service components of existing waste management system in all the participating towns. This includes improvement of door to door waste collection services with introduction of waste segregation at source, secondary collection & transportation system and development of waste treatment & disposal facility.

Following interventions & measures on soild waste management are required:

- Technological measures
  - Technical assistance
  - Collection and transportation of MSW from source to treatment facilities
  - Treatment of MSW
  - Testing and labelling of compost
  - Testing and labelling of biogas
- Financial measures
- Policy & regulatory measures
  - User charge
  - Standards setting for by-products
- Capacity building and awareness raising

PLANNED ACTIONS

The **planned actions** aim to implement waste management practices in seven municipalities and towns of Bhutan: Thimphu, Phuentsholing, Gelephu, Samdrupjongkhar, Paro, Punakha and Bajo. These sites have been chosen for different reasons. Thimphu is the capital city and the most populated city of the country, while Phuentsholing, Gelephu and Samdrupjongkhar are at the border to India and have access to recyclable markets there. Paro, Punakha and Bajo, all border to Thimphu, are fast-growing towns. These municipalities and towns altogether cover about 25% of the country's population, which is around 195,000. The project is planned to work in collaboration with relevant private sectors such as Greener Way, Clean City, Royal Society for Protection of Nature, Clean Bhutan and Green Road.

The project will help to streamline the waste management practices, create awareness for better waste management, create jobs in green sectors and demonstrate feasibility and viability of waste to energy (such as biogas) through pilot plan established in Thimphu.

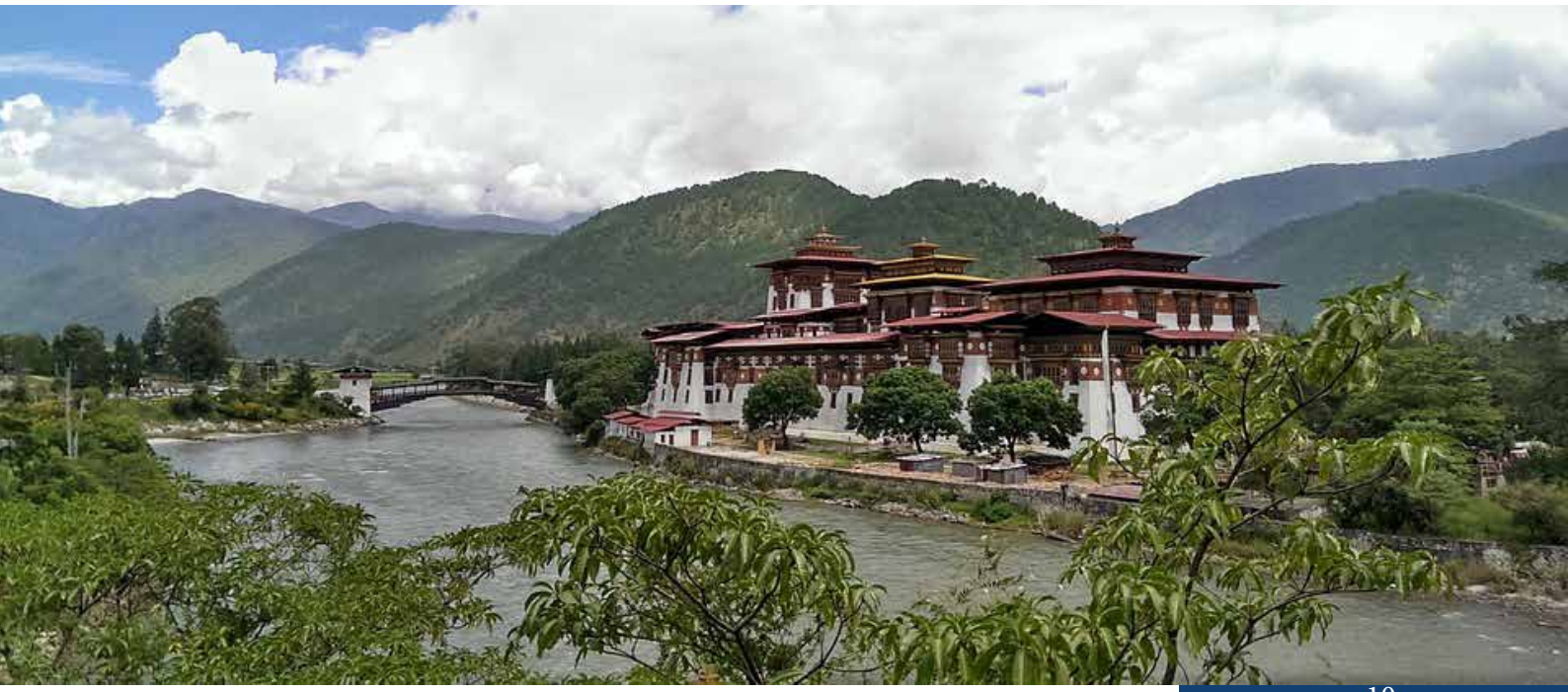
LOCAL & NATIONAL FRAMEWORK

Implement 'Integrated Solid Waste management in Thimphu and other cities'

Bhutan has following Rules, Regulations, Policies, Acts pertaining to waste management issues in the country:

- 12th Five Year Plan Guidelines (2019-2023)
- 11th Five Year Plan (2013-2018)
- Economic Development Policy, 2016 (Draft)
- National Strategy and Action Plan for Low Carbon Development, 2012
- Waste Prevention and Management Act, 2009
- Waste Prevention and Management Regulation, 2012
- Waste Prevention and Management (Amendment) Regulation, 2016
- National Strategy + Action Plan – Integrated Solid Waste Management, 2006
- National Integrated Solid Waste Management Strategy, 2014
- Alternative Renewable Energy Policy, 2013
- Local Government Act of Bhutan, 2009 & Local Government (Amendment) Act of Bhutan, 2014

Bhutan's comprehensive regulation for the waste minimisation and management is its policy on Waste Prevention and Management Regulation 2012 (Ghalley, 2017). The key stakeholder in waste management comprises of Gross National Happiness Commission under Royal Government of Bhutan, the Ministry for Works and Human Settlements, National Environment Commission (NEC), Clean Bhutan (a civil society organisation with the Civil Society Organisation Authority, Royal Government of Bhutan), Green Road (a public-private partnership that use plastic waste in road making), and private companies (e.g. Greener Way and Clean City in Thimphu) for waste collection and segregation.



The proposed planned project for 'Integrated Solid Waste management in Thimphu and other cities' is applied to 'Nationally Appropriate Mitigation Action (NAMA) facility' with the title 'Nationally Appropriate Mitigation Action in Municipal Solid Waste Sector (Organic) in Bhutan'. It is planned to be implemented by Gross National Happiness Commission and NEC under Royal Government of Bhutan.

This NAMA for the solid waste sector aim to solve the problem of waste management (starting from waste segregation at source to its final treatment) and bring about a transformational change in the field. The potential for this change is closely linked to the specific context of the NAMA, the sector and the broader strategies (mitigation, green growth, sustainable development) of the country. The NAMA has elements of promoting innovation in the waste sector, private sector involvement, generate impacts beyond the scope of the project, and ability to replicate and scale up beyond the seven municipalities/towns covered under the project. NAMA contributes to the agenda of propagating organic farming by provisioning of organic compost produced through the project implementation. The NAMA envisages the private sector playing the key role in mobilizing finance, upgrading waste management technology through research and development, enhancing manufacturing capacity, providing jobs – including a 50% target for women - and implementation on the ground.

The waste management projects under this NAMA is planned to be implemented in the initial two years including all other supporting infrastructure and policy/ regulations. However, MRV for NAMA will continue to 2030 to assess the impact of the NAMA in the long term.

PROJECT FINANCING & IMPLEMENTATION

The NAMA caters to the entire value chain of MSW management in the identified municipalities/towns including segregation at source, collection & transportation, storage, treatment of MSW and finally safe disposal of the remains. NAMA identifies the following technological measures covering the entire value chain.

Technological measures

- Technical assistance:

To support waste management project implementation in each identified municipality/ town, NAMA will support technical assistance to do the following:

Detailed site assessment and preparation of detailed project reports for each municipality/ town

Bid model document preparation & management of bids

Management of contracts throughout the implementation of projects

NAMA

Collection and transportation of MSW from source to treatment facilities:

Segregation of waste at source is critical for the success of MSW management and therefore NAMA will provide a special emphasis to put on segregation of MSW at source in dry and wet waste into recyclable and non – recyclable waste and further in to degradable and non-degradable waste.

The main infrastructure required for this measure are a) Household bins; b) Community bins; c) Litter bins; d) Auto-tippers and e) Refuse compactors.

TREATMENT OF MSW

The MSW in Bhutan has high organic components with other recyclable and non-recyclable material and inerts. Composting is considered the most suitable way to treat organic part of MSW is composting, while recyclable material will be sold to recycling companies or integrators. Other non-recyclable material and inerts will be sent to the landfill site. It is required to establish material recovery facility (MRF) for further segregation of collected dry MSW into recyclables (glass, plastics, paper, metals) and non-recyclables at the site of treatment facility. All the wet waste would be transported to the treatment facility directly. Recyclable material will be sold to recycling companies or integrators.

With MRF, it is estimated that only about 15% of total MSW collected will continue to go to the landfill sites thereby increasing the life of landfill. The installation of composting plants will treat the organic waste in each identified municipality.

Composting is considered to be a good choice for developing nations like Bhutan to manage MSW economically, effectively & in an environmental friendly manner, because of the reasons given below:

It is relatively less complex technology compared to other technologies

It requires significantly low capital investment compared to other technologies

Its energy requirements are very low

It reduces acidic leachate and metal precipitation; and it is an excellent source of carbon and some nutrients when compost land applied

It can be used also in cases of low quantity of waste generation

Testing and labelling of compost

It is important that the by-product i.e. compost generated in the treatment plants, meets minimum standards for use in farms. This will accentuate the confidence of market in the produced compost thereby catalysing demand. For this purpose, a testing and labelling program is to be established. The Soil and Plant Analytical Laboratory (SPAL) already has testing facilities which will be enhanced with required testing instruments to support the NAMA. The testing of compost from each treatment plant will be tested regularly where the samples will be collected by the local municipality officers and sent to SPAL lab in Thimphu. A report on the test of compost will be generated by SPAL and provided to the municipality in order to check its acceptance. Once issued, the producing plant would be eligible to use such label/ certificate on its product. Broadly, SPAL would need one unit each of Segmented Flow Testing, X-ray diffraction, Scanning Electron Microscope with other supporting instruments. The need for capacity building of staff is discussed under section “capacity building measures”.

Testing and labelling of biogas

Similar to compost, biogas produced by the Thimphu treatment plant will be tested to ensure the quality of gas produced for targeted applications i.e. fuel in automobiles, fuel for cooking replacing LPG. SPAL under MoA already has testing facilities which will be appended with required testing instruments to support the NAMA. The testing of biogas from each treatment plant will be tested regularly where the samples will be collected by the local municipality officers and sent to SPAL lab in Thimphu. A report on the test of compost will be generated by SPAL and provided to the municipality in order to check its acceptance. Once issued, producing plant would be eligible to use such label/ certificate on its product.

Capacity Development & Awareness Raising Measures

Building capacity and creating awareness are important to the success of NAMA. The capacity building will be targeted at different levels of NAMA implementation, including MRV.

CAPACITY BUILDING

NAMA proposes to undertake several awareness creating and outreach campaigns in the country through various media such as mass media like radio, workshops, conferences, school level competitions and outdoor displays in the municipalities and towns at other places of general gathering. These programs will be designed at national as well as municipality & town level, with emphasis on women's role.

Nama
Financial measures

The implementation of NAMA requires financial support for setting up the collection and transportation infrastructure, waste treatment facilities, operating & maintenance of these facilities, setting up of testing facilities and training & development cost, capacity building & technical assistance etc. A NAMA Support Fund (NSF) will be established to provide initial funding to the project developers for project implementation.

The loan under NSF will be provided at 4% annual interest rate, which is lower than the current commercial loan interest rate of 12%, with repayment period of 10 years. To facilitate easy equity participation, it is proposed to have a debt to equity structure of 70:30. Bhutan already provides tax holiday for ten years for priority sectors such as waste management services. The interest income generated from the projects is proposed to meet mainly the expenses to run the operations of loan process, disbursement and recovery besides any other incidental expenses.

FINANCIAL REQUIREMENTS

Total cost of NAMA implementation is estimated at around USD 26.4 million of which 17.5 million of is to be covered by Government of Bhutan through provisioning of land to private players for developing facilities besides the ongoing support in terms of tax concession and tax holidays.

The initial financial need would be for the investment in installation of plant & machinery and setting up of needed infrastructure. It is proposed that the recurring operation & maintenance cost will be borne through the annual revenue generated through the project operations. It is estimated that the operating revenues will also be able to cover for the debt repayment and interest accruing on it. The NAMA Finance required for the intervention/measures are listed below:

Technical Assistance (420,000 USD)

1. This component will support the development of model bid documents, bidding process and management of contracts awarded to private players for implementation of projects. National and/ or international experts will be hired for carrying out the activities.

Implementation of projects

1. **Collection & transportation of MSW: 1,858,820 USD**
This covers the cost of providing for infrastructure such as land, waste collection bins, waste carrying trucks with dumpers, civil & electrical works.

2. **Treatment & disposal of MSW including land cost: 21,800,750 USD**
This covers the cost of waste treatment plant including the cost of land, plant & machinery and civil & electrical works, installation & commissioning, on-site testing facility for biogas and compost.

3. **Testing and labeling of compost & biogas: 1,000,000 USD**
This would cover cost towards purchase of necessary instruments in SPAL laboratory for carrying out testing of compost. This also covers the cost of training of staff for using the instruments and conducting quality tests and procedures.

4. **Capacity building & awareness programs: 672,500 USD**
This pertains to cost towards training of staff at TTIs, training of staff at FIs, setting up of PMU for NAMA management, development of Central Monitoring System (CMS) and awareness and outreach programs

5. **NAMA management cost: 720,000 USD**
This cost will cover annual expenses for running PMU and managing CMS.

IMPLEMENTATION

The implementation of projects under NAMA will be supported through technical assistance by national and/ or international experts who will support in developing detailed project reports, model bid documents, management & award of bids and management of contracts for each municipality and town.

The interventions will be executed under a long-term agreement between the private players and the appropriate governing authority of the NAMA (e.g. the Implementing Entity or the Financial Trustee). It is proposed that the private party of the Public-Private-Partnerships is chosen through an appropriate selection process (e.g. through a transparent bid process). The finance will support actual implementation of infrastructure for collection & transportation, treatment plants and labeling & certification facility at site and at the national level in Thimphu.

NAMA envisages a number of revenue streams to support a financially sustainable project operation, for providing enough for servicing debt and adequate return on the investment made by the private sector. Primary sources of revenue are:

user charges for the waste collection from households and commercial establishments,
the sale of compost and
sale of recyclables such as plastics, glass & paper.

NAMA & POLICY & REGULATORY MEASURES

User charge

Currently, Bhutan has no provision of charging a user fee from waste generators. It is proposed under the NAMA that user charges will be levied to the households, commercial establishments and institutions, and other waste generators. The implementation of user charges will make support the projects financially as well as create a market based development where Government's role will be left to providing policy & regulatory support to private sector developers. The charges are proposed based on the type of waste generator.

Standards setting for by-products

As noted earlier, any compost or biogas produced by the treatment facilities will be required to undergo quality testing and assurance so that market has confidence in these products. For that, standards will be set for compost. Bhutan Standards Bureau (BSB) will set standards for compost in consultation with the Department of Agriculture. The Soil and Plant Analytical Laboratory (SPAL) while testing and issuing certificates will follow these standards.

Further project AMBITION

GHG Mitigation

The GHG emission reductions from the planned NAMA project are estimated at about 34,103 tCO2e between 2019-2030 . The impacts would keep accruing for many years thereafter. GHG mitigation can be achieved in two potential ways – 1) due to avoidance of methane release openly from waste dumping in open/ unsecured landfills and 2) due to recovery of useful resources i.e., energy, compost etc. which would have otherwise been produced using GHG intensive means e.g., energy generation from fossil fuel combustions.

Avoidance of Methane release

Waste in an open landfill with no scientific and secured management decays exponentially, which is a baseline scenario in Bhutan. It generates methane when it decays in anaerobic conditions. The critical parameters for this estimation include waste characteristics i.e. quantity of waste, composition of waste, current practice of waste disposal i.e. managed or unmanaged landfills, aerobic or anaerobic decomposition and other factors i.e. climate conditions, methane correction factor, oxidation factors among others. The assessment is carried out using First Order of Decay (FOD) equations. FOD assumes that methane generation potential of the waste that is disposed in a certain year will decrease gradually throughout the following decades.

Recovery of useful resources

With an establishment of a baseline for recovered product and using available information, GHG mitigation potential will be estimated. For example, in case of energy generation from mitigation action, baseline of energy generation in the absence of mitigation action would be identified and emissions related to this generation will be deemed as baseline emissions which the mitigation action would help avoid. The emission reductions resulting from the projects are considered as project related emission using conservative approach.

SUSTAINABLE DEVELOPMENT & TRANSFORMATIVE CHANGE

The proposed project will help to ensure that the NAMA focuses not just on GHG emissions reduction but also on sustainable development, national development goals and transformative change.

Bhutan committed to remain carbon neutral in 2009. Following this, a National Strategy and Action Plan for Low Carbon development was developed in 2012. Then the commitment was reaffirmed in NDC that was submitted in 2015. To minimize GHG emissions through application of zero waste concept and sustainable waste management practices is one of the mitigation measures proposed under the NDC.
Managing municipal solid waste also has strong connection with Sustainable Development Goals (SDGs) in particular, Goal 3 – Good health and wellbeing, Goal 5 – Gender equality, Goal 6 – Clean water and sanitation, Goal 11 – Sustainable cities and communities, and Goal 13 – Climate action.

The transformative change of the NAMA can be seen well through the application of a theory of change approach (as defined by the Center for Theory of Change). The theory of change approach "defines all building blocks required to bring about a given long-term goal. This set of connected building blocks—interchangeably referred to as outcomes, results, accomplishments, or preconditions—is depicted on a map known as a pathway of change/change framework, which is a graphic representation of the change process" (Rhett, 2010).

The overall hierarchy of activities, outputs, outcomes, impacts and the overall paradigm shift for the NAMA can be seen in table below:

ACTIVITY	OUTPUT	OUTCOME	IMPACT (STRATEGIC LEVEL)	TRANSFORMATIONAL CHANGE
• Physical implementation of interventions • Financial/ fiscal incentives • Policy/ regulatory measures • Capacity-building • Create awareness	• Reduced interest rate on loan for MSW management projects • Increased debt: equity ratio for MSW management projects • Application of user charge on MSW generators • MSW management in municipalities/towns	• Prevent MSW from going to unmanaged dump sites • GHG emissions reduction	• Promotes waste management practice in municipalities & towns • Promote organic farming • Healthier living conditions due to improved air quality and thereby improved quality of life • Create jobs & business opportunities • Gender disaggregated development	• Shift towards low-emission sustainable development pathways

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