Appendix 6

APPLICATION TO ACCESS

JAPAN FUND FOR THE JOINT CREDITING MECHANISM (JFJCM) RESOURCES

For Grant component of an Investment Project, for Stand-alone Grant Project, and for Non-sovereign project

I. Basic Data

Title of Proposed Project	Greater Male Waste to Energy Project (Phase 2 of Greater Male Environmental Improvement and Waste Management Project)
Country	Maldives
Sector	Urban
Amount Requested from JFJCM	$10 million
Non-JFJCM Loan amount and source of the project	$127.12 million (tbc – exclusive of financing charges) - Asian Development Bank (ADB): $60 million, - Asian Infrastructure Investment Bank (AIIB): $40 million (tbc), - Islamic Development Bank: $19.39 million - Government of Maldives (GOM): $7.73 million
Planned ADB Approval Date	Q2 2020
Duration	60 months from October 2020 to September 2025
Name of Project Officer	Luca Di Mario, SAUW ldimario@adb.org +63 2 632 5079
Name of Director	Norio Saito, Director SAUW nsaito@adb.org +63 2 632 6858
Division/Resident Mission	Urban Development and Water Division, SARD

II. Specific data

1. Description of the project and the subcomponent/s with the advanced low carbon technology

The Greater Male Environmental Improvement and Waste Management Project (the Project) will establish an integrated regional solid waste management system in Greater Male including collection, transfer, treatment using waste-to-energy (WtE) technology, disposal, recycling, dumpsite closure and remediation, public awareness in reduce-reuse-recycle (3R), and to strengthen institutional capacities for service delivery and environmental monitoring.

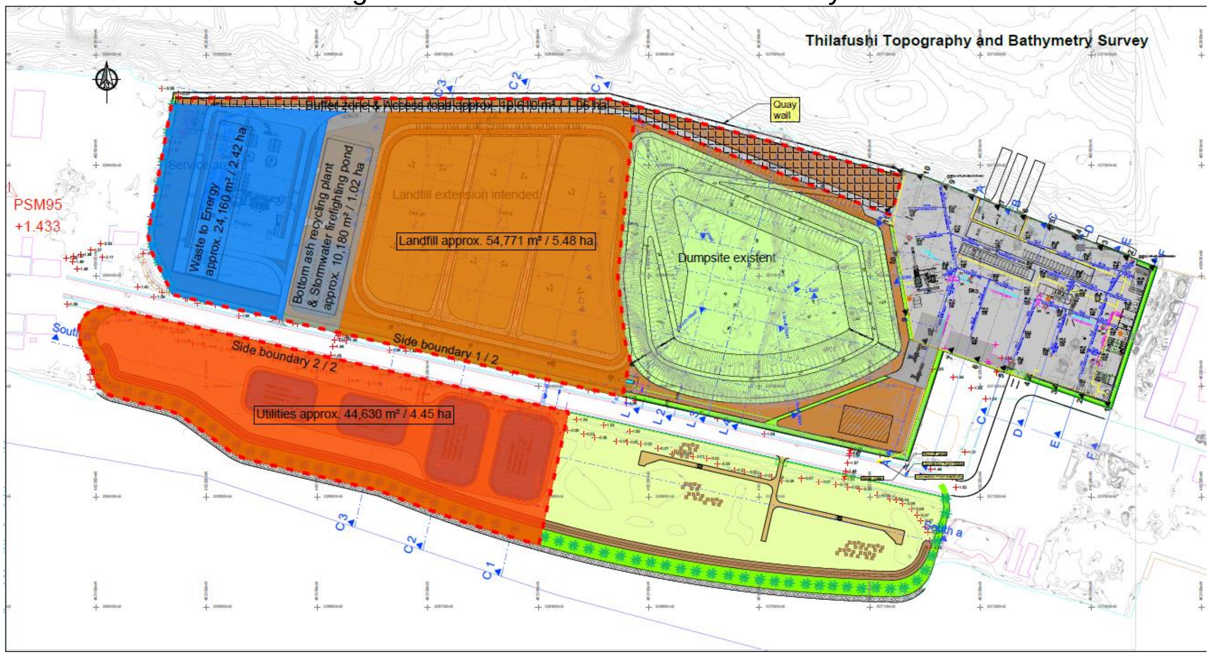
The project will be implemented in two phases. Phase 1, with an estimated cost of $40 million, was approved by ADB in 2018, has the following components: (i) improved waste collection and transfer in Greater Male, (ii) improved dumpsite management and logistics on Thilafushi Island, (iii) improved island waste management systems, (iv) strengthened institutional capacity of WAMCO, (v) awareness campaign and behavior change, and (vi) project management, design, and supervision support.

Phase 2 (Greater Male Waste to Energy Project) is planned for ADB approval in 2020, with total estimated cost of $137.12 million (exclusive of contingency and financing charges). It includes the following components: (i) development of regional waste management facility with 500 tons/day WtE plant with up to 11 MW power generation, (ii) Thilafushi dumpsite rehabilitation and remediation, (iii) strengthened institutional capacity to monitor standards and performance of WtE, and (iv) improved public awareness

The development of a 500 tons/day WtE plant envisioned under the Greater Male Waste to Energy Project seeks funding from the JFJCM. The required land (approx. 15 ha) has been reclaimed by the Government to accommodate the plant and ancillary facilities on the island of Thilafushi, which is an industrial island 6 kilometers from the capital Male.

Figure 1: Location of Thilafushi

Figure 2: Thilafushi Provisional Site Layout



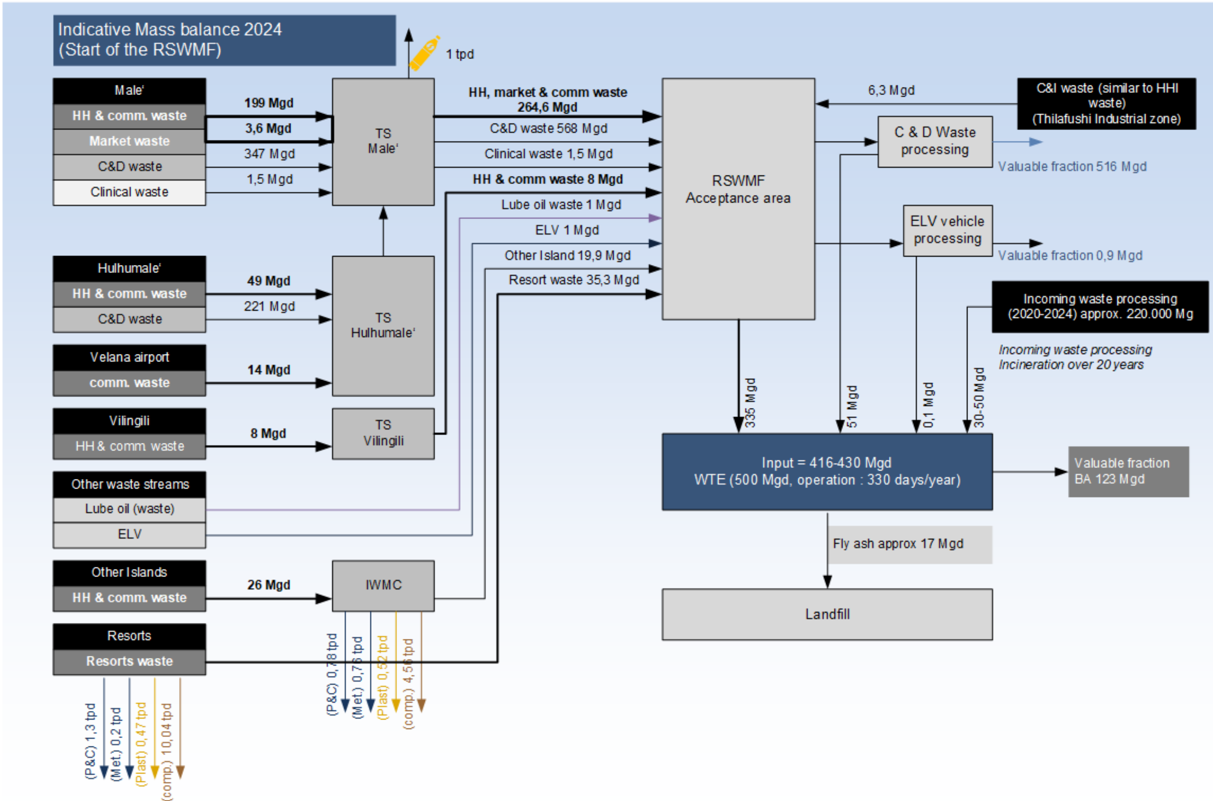
Government capacity to operate and maintain Phase 1 and Phase 2 (WtE) is supported by the Clean Authority of Tokyo (CAT), which is the public body in charge of coordinating solid waste management across Tokyo. The Project will reflect the lessons learned from the Tokyo model to effectively construct and operate the WtE system as well as to build trust for the WtE among the surrounding communities.

The project will provide integrated and sustainable solid waste management services in the Greater Malé region (Malé, Villingili & Hulhumalé) including the inhabited islands in atolls of Kaafu, Alifu Alifu, Alifu Dhaalu and Vaavu. The project area has a population of approximately 220,000 (51% of Maldives) which is spread over 35 islands and 73 tourist resorts. The population is expected to grow to 300,000 within the next five years due to the significant development of Hulhumale. Together with commercial and industrial entities, institutions and about 1 million tourists, in 2022 the residents will generate approximately 115,000 tons of Municipal Solid Waste (MSW) per year (around 315 tons per day) which is complemented by another 70,000 to 100,000 tons of construction and demolition waste (CDW). Around 10 to 15% of the CDW material is assumed to be flammable.

The 500 tons/day plant size considers projected waste growth in the Greater Male region up to 2038 and the incineration of waste bales during initial years of operations. The waste bales will be produced as temporary solid waste management solution on Thilafushi until the WtE will be commissioned. After 2039, it is planned to install additional treatment line to meet the growing waste management requirement. An indicative mass balance of the waste in the Greater Male area at the start of the WtE (2024) is summarized in Figure 3.

The latest waste audit carried out by the feasibility study consultants confirmed previous waste surveys and showed the following composition: food & kitchen waste 40%, green & garden waste 10%, other organic waste 10%, paper and cardboard 12%, plastic 10%, hazardous waste 1%, metal 4%, glass 3%, and other 10%. The net calorific value (NCV) of the waste is 7.5 MJ/kg.

Figure 3: Indicative Mass Balance of the waste in the Greater Male area (2024)



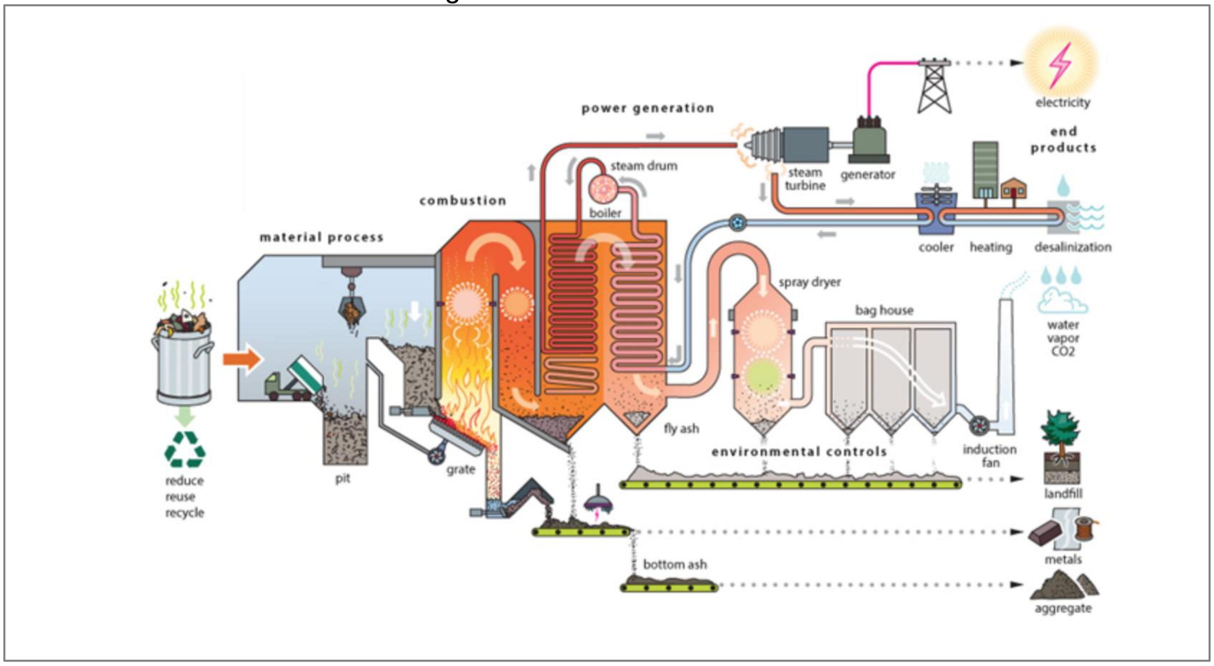
The project feasibility study selected a state-of-the-art WtE treatment based on a grate incineration due to land constraints on Thilafushi and sustainability considerations (best practicable environmental option). This WtE process is a well-known, reliable and robust disposal solution that can accommodate best the urgent needs for an environmental improvement of the waste management in the Maldives and that can cope with a broad variety of untreated waste.

The WtE subcomponents are:

- Waste reception and bunker/refuse pit
- Furnace including feeding hopper and pusher, moving grate and wet de-asher
- Boiler including superheaters and economizer
- Flue gas cleaning
- Extraction condensing type turbine and sea water cooled condenser
- Generator

The basic WtE process is shown in the following schematic diagram:

Figure 4: Basic WtE Process



The final design of the facility will be subject to the Design-Build-Operate (DBO) Contractor. A DBO procurement was chosen to minimize operational risks as such facility requires specialist know how that is not available in the Maldives.

All equipment the DBO contractor will install has to meet state-of-the art design and durability criteria such as 8,000 hours/year availability, high standards for protection of the corrosion prone boiler zones, redundancy of important equipment (waste feeding cranes, boiler feed water pumps, cooling water pumps etc.). The facility will be built as a two-train unit (250 tons/day x 2) thus allowing to accommodate any overhaul or revision without compromising the waste disposal entirely for the period of the overhaul.

Emission standards the flue gas treatment system has to meet will follow the latest European regulations while the capacity of local EPA will be strengthened to enable operational monitoring of the facility (partnership with the Clean Authority of Tokyo is addressing this). Furthermore, ADB will finance one year of monitoring of the facility through the design and construction supervision consultant that will be recruited to manage the entire design-build period.

The extraction condensing turbine will allow a versatile usage of the energy surplus the facility is generating either by producing electricity or both heat and electricity. The usage of surplus energy will depend on the local requirements such as production of ice flakes, water, generation of cooling energy etc.

The Government of the Maldives is planning to develop Thilafushi island as an industrial hub and plans are maturing to construct a bridge between the capital city of Male and the island that would facilitate to link the electricity grid on Thilafushi with the Male network. Once the network link is established, the power surplus of the WtE facility that is envisaged to be in the range between 6 and 9 MW (increase overtime) that can be fed into the network substituting diesel-based electricity generation that is the still predominant source of power generation in the Maldives. Given the current status of the waste treatment and the land scarcity of the Maldives, the WtE facility may be regarded as a measure that must not be delayed.

If the power link does not materialize via the bridge, the local grid operator STELCO may consider a submarine cable as the fuel savings due to the power fed into by the WtE plant are so significant that such submarine cable will provide a quick return on investment.

Calculating the CO2, the power output as per section 7 has been applied.

The outcomes from the implementing the subproject are (i) cleaner environment with no litter and smoke reaching Male or resorts, (ii) reduced leachate pollution into marine environment, and (iii) reduced emissions of greenhouse gasses (GHG). The impact is a healthy living environment in Greater Male.

The cost of the Project (base costs plus taxes) is currently expected to be about $137.12 million (tentative), with financing from ADB ($60.0 million), AIIB ($40.0 million), JFJCM ($10.0 million), Islamic Development Bank ($19.39 million), and the Government of Maldives ($7.73 million). According to Government consultants preparing DBO, the preliminary cost estimate for the WtE subcomponent (incl. the residue landfill) is $95.8 million (base costs plus taxes).

In the current schedule, bidding and procurement is expected in Q4 2019 to Q4 2020, with construction beginning in Q1 2021 and commissioning in Q4 2024. The design life time of the WtE subcomponent is more than 30 years. A 20 years operation and maintenance period is foreseen in the contract package.

2. Background of the project

Solid waste management in the project area is a top priority that has been acknowledged by the previous and the current government.

To date the majority of the waste generated within Zone 3 is dumped haphazardly on the island Thilafushi which is located close to the capital Malé. Waste from Malé, Hulhumale and Vilimale is delivered with landing crafts while resorts are using a vessel called “dhonis”. The island Thilafushi itself has been created using both MSW and CDW as reclamation material for more than 25 years now. Starting in 1992, land has been reclaimed from the lagoons to build up the artificial island.

Greater Male severely lacks an organized and environmentally sustainable solid waste management system. Waste management is operated by the recently established (2015) Waste Management Corporation Limited (WAMCO). Though the collection system is working under the conditions found in Male, there is no separate collection of construction, demolition, and hazardous wastes and no source separation of recyclables.

On small islands and low-cost resorts waste is dumped on beaches or in the deep ocean, and backyard burning or setting fires to open dump sites is a common practice on small islands with limited public awareness of 3R approaches.

Collected waste from Male, Hulhumale and Vilimale is transported on barges to the artificially created, industrially zoned Thilafushi Island located 6 kilometers from Male. The 30-year old 10-hectare open dumpsite managed by WAMCO has no leachate control systems and deliberate burning result in plumes of smoke and severe air pollution hazards to on-site workers, Male residents, and surrounding tourists generating frequent complaints. On-site equipment and site logistics are not sufficient or optimal to efficiently manage the growing volumes of incoming waste.

Reducing the GHG emissions is an urgent issue in Maldives as stated in the Maldives’ climate change mitigation target as described in its Nationally Determined Contribution (NDC) submitted to the United Nations Framework Convention Climate Change (UNFCCC) secretariat in April 2016. According to the NDC, Maldives has outlined a series of policies and measures that the country commits to implement up to 2030, in the energy, transportation and waste sectors. The expected mitigation impact of these policies and measures will be a 10% reduction in total national GHG emissions by 2030, compared to the projected emissions under a business as usual scenario. The 10% reduction expressed above could be increased up to 24% in a conditional manner, in the context of sustainable development, supported and enabled by availability of financial resources, technology transfer and capacity building.

3. Anticipated technology specification and usage

As mentioned above, the main objective of the Project is to implement a ready-to-use and state-of-the-art technology that is capable to process a wide range of untreated waste and that is robust and reliable. The feasibility study consultant of the Government of the Maldives evaluated various technologies and compared them with respect to their technical, environmental, social and economic aspects.

(1) Grate incineration: Incineration on a moving grate can offer manifold examples throughout the world (more than 2,400 treatment lines), can process a wide range of untreated waste, is known for its reliability and robustness and is applied by many waste management companies and public bodies worldwide. Because of these factors, the lower investment and operational expenditures, and particularly, because of the urgent need for a disposal solution, the grate incineration was ranked highest.
(2) Gasification: The Government's consultant compared the currently available gasification technologies for MSW (fixed and fluidized bed, plasma). All of them require a tailored waste input and an advanced waste collection and pre-processing system prior to the thermal treatment. Given the current status of the waste management in Male and in Zone III, the requirements for waste pre-treatment, the lower energy output, the need for constant auxiliary fuel (fixed bed) and the higher CAPEX and OPEX for these technologies, they were not considered for the tendering.
(3) Combination of incineration and anaerobic digestion of the biological waste material: The residues from the pre-processing and from the anaerobic digestion would then be incinerated. Though this option can be superior with respect to the energy output, the land required for the two facilities and the higher costs do not favor this option.

Given the evaluation, the grate incineration technology is selected. The track record of incineration with the moving grate technology shows the reliability and the range of wastes can be processed effectively.

4. Anticipated technology provider (to confirm the implementation and operation record)

Because of the mode of the procurement, the tender does not focus only on the technology providers only but has to also take into considerations waste management companies and O&M companies that can evidence their experiences in operating WtE plants that were built based on either PPP/BOT or DBO contracts.

Based on a pre-evaluation of the market, the following potentially interested companies were identified:

Babcock & Wilcox (O&M company and technology provision through a Danish subsidiary)
China Everbright (O&M company)
China National Electric Engineering (EPC contractor and O&M company)
CNIM S.A. (technology provider and O&M company)

Hitachi Zosen (technology provider and O&M company)
JFE Engineering (technology provider and O&M company)

Keppel Seghers (technology provider and O&M company)
Mitsubishi Heavy Industries Environmental & Chemical Engineering (technology provider and O&M company)
Posco Engineering & Construction Ltd (EPC contractor and O&M company, technology provision via a German subsidiary)
Suez Environnement (O&M company)

Urbaser (O&M company)
Wheelabrator (O&M company).

As it can be assumed that O&M companies team up with technology providers, the following technology providers were additionally included in the evaluation to extend the range of O&M companies that were not addressed in the first round:

Steinmüller-Babcock Environment
Termomeccanica

O&M companies that denied having an interest in the project were Veolia, FCC, Beijing Capital Environment and Sembcorb.

5. Technical specifications and evaluation and qualification criteria for procurement of the subcomponent

A design build operate (DBO) contract will be used as a procurement method, and the contractor will be awarded through international competitive bidding. Some of the main required specifications and qualifications are as follows.

(1) Technical Specifications

Main features of the state-of-the art WtE facility are robustness, reliability and durability of the electro-mechanical and civil components. As such, the following will be requested to the DBO contractor:

- Overall durability criteria for the civil and electro-mechanical part such as life time expectancy for the civil components of 50 years, turbine 40 years, moving grate 30 years, electrical components 30 years, fans/pumps 15 years, etc., all steel equipment and steel structure to be corrosion protected, track record for the grate technology applied;
- Minimum material thickness of erosion/abrasion/corrosion prone components (such as feeding hopper, pusher duct, boiler walls etc.)
- Redundancy of certain crucial components (waste cranes, boiler feed water and condensate pumps, hydraulic systems, cooling water pumps, etc.)

The basic specifications for the WtE and ancillary facilities are summarized in the table below. The final design and arrangement of the facilities within the project site will depend on the DBO Contractor. The Contractor will be required to adopt state-of-the-art incineration technology.

Table 1: Preliminary Design Parameters of the WtE and Ancillary Facilities

Parameter		**Range/Data/Type**	**Remarks**
WtE - Facility			
Capacity	t/y	167,000	
	t/hr	21	
No of trains		2	
NCV	kJ/kg	6,500 – 9,500	

Design NCV	kJ/kg	7,500	
Expected IBA amount	%	25	of input
Baled waste input	%	min. 10	of nominal mechanical capacity
Overload	%	10	of nominal thermal and mechanical capacity
Furnace		grate system 850°C, 2s	roller, forward or reciprocating
Boiler		natural circulation	horizontal or vertical boiler passes, cladding of corrosion prone boiler components
Turbine		extraction condensing	robustness is crucial, no. of turbines subject to DBO Contractor, extraction rate is yet to be defined, the final capacity of the turbine will depend on the Contractor's design
Re-cooling unit		sea water cooling	environmental sensitivity of coral reefs to be considered
APC system		Semi-Dry or dry system	final design subject to DBO Contractor meeting European emission standards is compulsory, minimising volume of residue
IBA processing		maturation, FE/NON-FE, crushing, screening	tradable volume subject to market
Residue landfill			
Total volume	m3	560,000	incl. base liner system or asphalt base and leachate collection system, for APC residues and non-marketable IBA (and other rejects)
No of cells		> 3	final design subject to DBO Contractor
Envisaged life time of landfill	years	> 15 years	subject to IBA recycling and marketing
Leachate treatment			
Treatment system		reverse osmosis	
Capacity	m3/d	120	expected throughput up to 55 m3/d (capacity reserve to cope with exceptional leachate volume due to weather conditions)
Brine disposal	m3/d	max. 14	via APC system of WtE

Also, the O&M shall be supervised on a daily basis by the Plant Manager who has more than 10 years of operation management experience at WtE facility. Engineering manager of primary technology provider and engineers of major equipment manufacturers shall be resident until performance of the WtE operation (8,000h/year).

(2) Evaluation Criteria

The Bid shall comprise two envelopes submitted simultaneously, one containing the Technical Bid and the other the Price Bid, both envelopes enclosed together in an outer single envelope. In the Technical Bids evaluation process, the Employer will carry out a detailed technical evaluation to determine whether the technical aspects are in compliance with the Bidding Document. The evaluation criteria are under development, which will be used by the Employer to examine and compare the technical aspects of the Bids on the basis of the information supplied by the Bidders, taking into account the following:

a) General aspects such as completeness of the proposals, the description of the EPC and project management, the health and security and environment management plan consideration, the preliminary operations and maintenance plan, their considerations towards disclosure of information to the public and etc;
b) The bidders' capabilities to mobilise the required sub-contractors, the necessary equipment and personnel that need to be specified accordingly;

c) The grate technology applied by the bidders must be a proven one, at least three years of successful operation;
d) Some aspects such as thickness of wear prone components are specified which the bidders have to comply with;
e) The potential energy output;
f) All performance guarantees must be met, such as 8,000 hours availability (needs to be proven), operations within the stoker capacity diagram meeting the specified steam temperature and pressure and the emission standards at the stack and for the effluent of the leachate treatment and etc;
g) Redundancy aspects, e.g. as for the cranes, for the boiler feed water supply, the cooling water supply etc.
h) Design criteria to be taken into account, amongst others, the expandability of the facility (a third line) which needs to be considered in the design of certain components and elements of the facility;
i) Compliance with standards;

The Bid that does not meet minimum and/or maximum acceptable standards of completeness, consistency, detail and performance guarantees, will be rejected for non-responsiveness;

Cost evaluation will be made on a life-cycle cost (LCC) basis, which means that both the initial cost, the operation and maintenance costs (variable and fixed costs) will be taken into account for evaluation. In addition to this, the incentive given to the contractor to generate electricity has to be taken into account. As the WtE facility will be producing a power surplus, for comparison reasons the overall energy sales which the Employer will accrue will be taken into consideration as well. In addition, if the bidder proposes to utilize the energy generated by the WtE to produce goods such as water as more reasonable and effective energy usage than the electricity for the grid, the revenue from the goods sale also can be taken into consideration when calculating the LCC. All costs and revenues during the O&M period will be discounted with an interest rate of 4% to get the net present value. The 4% were chosen to consider ADB's grant and both the concessional loan being provided by ADB and the more commercially oriented interest rates offered by AIIB and ISDB. Taking into account that an evaluation applying a low discount rate favors designs with high initial capex that can be operated at lower costs, which is in the interest of the Government of Maldives, the 4% are deemed reasonable.

Life Cycle Cost = Costs for the Design-Build + NPV(fixed O&M fee related the technology and technology provider) + NPV(variable O&M fee related the technology and technology provider) + (NPV(electricity incentive) + NPV(asset replacement costs) – NPV(electricity sales)) .

(3) Qualification Criteria

A pre-qualification process was conducted from May to August 2019, and shortlisted bidders will be invited to participate in the bidding process. The qualification of the bidders will be assessed with the following criteria (excerpt):

(a) Participation in at least two WtE DBO contracts (or similar long term BOT or PPP contracts) where design-build has been successfully or substantially completed within the last 10 years and that is similar to the proposed facilities, where the value of the Applicant's participation exceeds 75% of the total value of the reference contract (For

JV, all partners combined must meet requirement as follows: 1) either one partner must meet requirement, or 2) any to partners must each demonstrate one successfully or substantially completed contract of similar size and nature). The reference contracts shall comply with the following criteria:

- The minimum facility throughput capacity for each contract shall be 250 tons/day;
- The operating and maintenance period specified in the contract shall be ten years or more.

(b) Minimum average annual turnover of not less than $64 million within the last 3 years.

(c) Lead/managing partner for a Design-Build-Operate contract (or similar long term BOT/PPP contract) for waste to energy plant of at least 250 tons/day capacity, where the design-build has been successfully or substantially completed within the last ten years (For JV, one partner must meet requirements).

(d) O&M of a at least one waste to energy plants of at least 250 tons/day capacity (For JV, one partner must meet requirements). Each reference contract shall comply with the following criteria:

- The O&M component of the contract is either ongoing or was completed no more than five years ago;
- If the contract is ongoing, the contract has been running for two years or more;
- The O&M contract specifies an operating and maintenance period of ten years or more;
- The subject WtE facility has been operating successfully since commencement of the O&M contract, meeting the specified emission requirements.

The prime technology provider, including its consolidated subsidiaries, must have the experience of having completed at least three contracts of nature, size and complexity similar to the proposed (sub-)contract of WtE for municipal solid waste including design, engineering, procurement, manufacturing, transportation, installation and testing/commissioning. Each reference contract shall be for a plant with a capacity of at least 250 tons per day and under operation for more than 10 years. The prime technology provider shall also have one reference contracts outside the (sub-)contractor's home country. The prime technology provider shall have an experience of providing flue gas treatment process that complies with prescribed environmental standards of reference contract.

The Bid evaluation will be conducted by the Employer (Ministry of Environment, Maldives) and substantially supported by a team of international consultants including a DBO specialist, WtE mechanical engineer, a WtE O&M specialist and a WtE financial evaluation specialist.

6. If the specific provider and technology is identified, the spec of the technology

No specific provider and technology are identified.

7. Estimated reduction amount of CO_2 emission from energy sources by the advanced low carbon technology, energy efficiency improvement and/or renewable energy capacity installed and total reduction amount of GHG emission.

In accordance with the proposed outline of the methodology shown below in section II.9, the estimated emissions in tons of carbon dioxide equivalent are 592,796 tCO2e for 20 years as shown in Table 2 below. The process for its calculation can be found in the Annex IV: JCM monitoring plan sheet, which is drafted based on the JMC_MM_AM001_ver01.0. https://www.jcm.go.jp/mm-jp/methodologies/75/monitoring_spreadsheet_file

Table 2. Estimated Emission Reductions from the WtE JCM Subcomponent

Year	Reference emissions		Project emissions		Emission reductions		Accumulated GHG ERs	
	GHG total	CO2 only	GHG total	CO2 only	GHG total	CO2 only	GHG total	CO2 only
Unit	tCO2e	tCO2	tCO2e	tCO2	tCO2e	tCO2	tCO2e	tCO2
2025	11213.3	11213.3	40033.5	34751.7	-28,820.2	-23,538.4	-28,820.2	-23,538.4
2026	24504.3	17292.2	40891.6	35550.3	-16,387.3	-18,258.1	-45,207.5	-41,796.5
2027	36407.2	23703.8	41775.4	36372.9	-5,368.2	-12,669.1	-50,575.7	-54,465.6
2028	47474.4	30458.9	42685.8	37220.2	4,788.6	-6,761.3	-45,787.1	-61,226.9
2029	58087.6	37571.8	43623.5	38092.8	14,464.1	-521.0	-31,323.0	-61,747.9
2030	68508.9	45054.7	44589.3	38991.6	23,919.6	6,063.1	-7,403.4	-55,684.8
2031	78922.5	52921.4	45584.1	39917.5	33,338.4	13,003.9	25,935.0	-42,680.9
2032	81248.0	52974.0	45471.8	39813.0	35,776.2	13,161.0	61,711.2	-29,519.9
2033	83140.7	53006.4	45343.9	39693.9	37,796.8	13,312.5	99,508.0	-16,207.4
2034	84725.3	53038.1	45216.2	39575.1	39,509.1	13,463.0	139,017.1	-2,744.4
2035	86078.3	53069.8	45089.0	39456.8	40,989.3	13,613.0	180,006.4	10,868.6
2036	87253.2	53101.4	44962.4	39338.9	42,290.8	13,762.5	222,297.2	24,631.1
2037	88287.1	53132.4	44835.8	39221.1	43,451.3	13,911.3	265,748.5	38,542.4
2038	89208.0	53163.4	44709.9	39103.9	44,498.1	14,059.5	310,246.6	52,601.9
2039	90035.8	53194.3	44584.1	38986.8	45,451.7	14,207.5	355,698.3	66,809.4
2040	90784.6	53224.6	44458.7	38870.1	46,325.9	14,354.5	402,024.2	81,163.9
2041	91466.3	53254.8	44333.9	38754.9	47,132.4	14,499.9	449,156.6	95,663.8
2042	92089.1	53284.3	44209.4	38638.1	47,879.7	14,646.2	497,036.3	110,310.0
**2043	92089.1	53284.3	44209.4	38638.1	47,879.7	14,646.2	544,916.0	124,956.2
**2044	92089.1	53284.3	44209.4	38638.1	47,879.7	14,646.2	592,795.7	139,602.4
Total	1,473,612.8	909,228.2	880,817.1	769,625.8	592,796	139,602		

** The values of 2042 are used for 2043 and 2044 because the JCM_MM_AM_001 can only calculate the values for 18 years. This is considered conservative as the actual values (emission reductions) in 2043 and 2044 are estimated higher than in 2042.

For the scenario analysis to calculate the emission reductions above, the following data on the waste incinerated and net energy outputs were assumed.

Table 3: Waste to be incinerated and net energy output (incl. baled waste)

	Waste Incinerated (t)	Net Energy Output (MWh)
2025	143,600	15,574
2026	146,900	24,017
2027	150,299	32,922
2028	153,800	42,304
2029	157,406	52,183
2030	161,120	62,576
2031	164,946	73,502
2032	164,514	73,575
2033	164,022	73,620
2034	163,531	73,664
2035	163,042	73,708

2036	162,555	73,752
2037	162,068	73,795
2038	161,584	73,838
2039	161,100	73,881
2040	160,618	73,923
2041	160,138	73,965
2042	159,659	74,006
2043	159,181	74,047
2044	158,705	74,088

As stated in the section II.1 above, the proposed 500 tons/day plant can deal with the waste growth in the Greater Male region up to 2038. While it is planned to install additional treatment line to meet the growing waste management requirement in 2039, the above data does not include the additional line for the purpose of fairly calculating the energy output and GHG emission reductions materialized by the JFJCM grant.

For the first 3 years (2025-2027), the annual GHG emission reductions are expected to be negative (increase) due to small contribution of methane emission reductions and low energy surplus fed into the grid. It is suggested to wait issuance of the JCM credits until the total negative emission reductions are offset by the positive emission reductions achieved in subsequent years, which will be in 2031. This approach is taken in one of the approved methodologies under the CDM (para 109 of ACM0022 "Alternative waste treatment processes" Ver. 02.0):

> *"In the case that overall negative emission reductions arise in a year, CERs are not issued to project participants for the year concerned and in subsequent years, until emission reductions from subsequent years have compensated the quantity of negative emission reductions from the year concerned. (For example: if negative emission reductions of 30 t CO2e occur in the year y and positive emission reductions of 100 t CO2e occur in the year y+1, 0 CERs are issued for year y and only 70 CERs are issued for the year y+1.)"*

Meanwhile, the project aims to make the emission reductions materialized earlier than 2030 by several measures, such as 1) increasing net energy output by the plant (increasing the demand) during the first six years (2025-30), which will replace diesel generation, 2) considering to incinerate the waste to be collected from other islands in the adjacent zones (outside zone 3), and 3) refining the parameters within the methodology based on the local conditions.

8. Co-benefit of the environment and region
   (Describe the reduction of environmental pollution, including air or water pollution, solid waste treatment or conservation of natural resources, and/or (b) other social economic benefits, including increased job creation opportunities and better access to basic infrastructures)

The Project will bring significant environmental, social and economic co-benefits.

(a) Reduction of the MSW directly disposed in the landfill site will result in
   a. improved health of the residents by minimising the odour and smoke from spontaneous combustion;
   b. improved marine ecosystem by minimising the waste dumping to the ocean;

c. expanded lifetime of the landfill site (minimised waste volume to be delivered to the landfill).

(b) Reduction of diesel oil use will result in improved energy security and trade balance of the government as the Maldives heavily depends on diesel for power generation, which is entirely imported.

9. The applied JCM MRV methodology (If not existing, the rough proposal of JCM methodology)

The methodology to be applied for the Project will be considered based on the approved methodology: JCM_MM_AM001_ver01.0 (Power generation and avoidance of landfill gas emissions through combustion of municipal solid waste (MSW)).

(1) Title of the methodology:

Power generation and avoidance of landfill gas emissions through combustion of municipal solid waste (MSW)

(2) Summary of the Methodology

(i) GHG emission reduction measures:

(a) Installation of MSW incinerators avoids emissions of methane associated with disposed organic waste in a solid waste disposal site (SWDS);
(b) Electricity generated by the project facility displaces electricity from a grid or captive power generator which is generated using fossil fuels resulting in GHG emission reductions.

(ii) Reference emissions: Reference emissions are calculated as a sum of the following emissions:

(a) CH_4 emissions from SWDS: Calculated from the amount of MSW and fraction of each waste type incinerated in the incinerator using the first order decay (FOD) model; and
(b) CO_2 emissions from a grid or captive power generator: Electricity fed into the grid by the project facility multiplied by the emission factor of displaced electricity.

(iii) Project emissions: Project emissions are calculated as a sum of the following emissions:

(a) CO_2 emissions from combustion of fossil carbon contained in MSW: The amount of MSW multiplied by the fraction of fossil carbon content and the conversion factor of carbon;
(b) N_2O emissions from combustion of waste: The amount of MSW multiplied by the N_2O emission factor associated with incineration;
(c) CO_2 emissions from electricity used to operate the project facility: Electricity used to operate the project facility multiplied by the emission factor of electricity; and
(d) CO_2 emissions from auxiliary fossil fuel consumption associated with incineration: The amount of fossil fuel consumption associated with incineration multiplied by the emission factor of the fossil fuel.

(iv) Monitoring parameters:

(a) Quantity of MSW fed into incinerator (wet basis);
(b) Quantity of electricity generated by the project facility;
(c) Quantity of electricity consumed by the project facility; and

(d) Quantity of auxiliary fossil fuel consumed.

(3) Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The project newly installs an incinerator, waste heat recovery boiler, exhaust gas treatment equipment and turbine generator.
Criterion 2	The project incinerates municipal solid waste (MSW) which has been disposed at a SWDS where the generated landfill gas is not recovered, and generates electricity from steam produced in waste heat recovery boiler.
Criterion 3	There is a plan to operate the project facility for more than 5 years.

(4) Reference scenario

A project which applies this methodology incinerates MSW and generates electricity. In Maldives, MSW is usually disposed in open dump sites without recovering landfill gas. Although some initiatives exist to treat waste with alternative methods such as incinerating MSW, the cost of alternative treatment of waste hampers its installation. Therefore, without the financial assistance the alternative waste treatment facility would not be bankable. As a result, BaU for MSW treatment is open dumping and setting fire to the waste and BaU emissions are CH_4 emissions from decomposition of MSW at a SWDS and CO_2 emissions from fossil fuels combusted to generate electricity which would be displaced by the project. CH_4 emissions from decomposition of MSW at a SWDS are calculated based on a first order decay (FOD) model.

To assure net emission reductions, the model correction factor which accounts for uncertainty of the model to calculate emissions from decomposition of MSW is set conservatively. Therefore, the reference emissions are a summation of conservative CH_4 emissions from decomposition of MSW at a SWDS and CO_2 emissions from fossil fuels combusted to generate electricity which would be displaced by the project.

(5) Calculation formulas

(i) Calculation of reference emissions:

$$\mathrm{RE_p} = \mathrm{RE_{CH4,p}} + \mathrm{RE_{elec,p}}$$

Where:

$\mathrm{RE_p}$	=	Reference emissions during the period *p* [tCO_2e/p]
$\mathrm{RE_{CH4,p}}$	=	Reference emissions from decomposition of MSW at a SWDS during the period *p* [tCO_2e/p]
$\mathrm{RE_{elec,p}}$	=	Reference emissions from electricity generation during the period *p* [tCO_2e/p]

Reference emissions from decomposition of MSW at a SWDS during the period *p* ($RE_{CH4,p}$) is accounted only from the next calendar year after its disposal at a SWDS (or incineration) due to delay in generation of CH_4 from the time of disposal at a SWDS.

$$RE_{CH4,p} = \sum_{y=p\_start}^{p\_end} \left[\varphi \times (1-f) \times GWP_{CH4} \times (1-OX) \times \frac{16}{12} \times F \times DOC_f \times MCF \times \sum_{i=1}^{y-1} \sum_{j} \left\{ W_i \times P_j \times DOC_j \times e^{-k_j(y-1-i)} \times \left(1-e^{-k_j}\right) \right\} \right]$$

Where:

$RE_{CH4,p}$	=	Reference emissions from decomposition of MSW at a SWDS during the period *p* [tCO_2e/p]
y	=	The N[th] year from the first disposal (or incineration), extending from the first year of the period *p* (*y=p_start*) to the last year of the period *p* (*y=p_end*). If *y* is equal to 1, methane generation cannot be accounted.
p_start	=	The N[th] year from the first disposal (or incineration), which is the first year of the period *p*
p_end	=	The N[th] year from the first disposal (or incineration), which is the last year of the period *p*
φ	=	Model correction factor to account for model uncertainties
f	=	Fraction of methane captured at a SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere
GWP_{CH4}	=	Global Warming Potential of methane [tCO_2e/tCH_4]
OX	=	Oxidation factor (reflecting the amount of methane from a SWDS that is oxidized in the soil or other material covering the waste)
$\frac{16}{12}$	=	Conversion factor [tCH_4/tC]
F	=	Fraction of methane in the SWDS gas [volume fraction]
DOC_f	=	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in a SWDS [weight fraction]
MCF	=	Methane correction factor
i	=	The N[th] year from the first disposal (or incineration), extending from the first year in the time period in which MSW is disposed at a SWDS (*i* = 1) to year *y* (*i* = *y*)
W_i	=	Quantity of MSW fed into incinerator in the year *i* (wet basis) [t]
P_j	=	Fraction of the waste type *j* [weight fraction]
DOC_j	=	Fraction of degradable organic carbon in the waste type *j* [weight fraction]
k_j	=	Decay rate for the waste type *j* [1/yr]
j	=	Type of waste

$$RE_{elec,p} = EG_{elec,p} \times EF_{elec}$$

Where:

$RE_{elec,p}$	=	Reference emissions from electricity generation during the period *p* [tCO_2e/p]
$EG_{elec,p}$	=	Quantity of electricity generated by the project facility during the period *p* [MWh/p]
EF_{elec}	=	Emission factor for electricity generation [tCO_2e/MWh]

(ii) Calculation of project emissions

$$PE_p = PE_{COM\_CO2,p} + PE_{COM\_N2O,p} + PE_{EC,p} + PE_{FC,p}$$

Where:

PE_p	=	Project emissions during the period *p* [tCO_2e/p]

$PE_{COM\_CO2,p}$ = Project emissions of CO_2 from combustion of fossil carbon contained in waste associated with incineration during the period *p* [tCO_2e/p]

$PE_{COM\_N2O,p}$ = Project emissions of N_2O from combustion of waste associated with incineration during the period *p* [tCO_2e/p]

$PE_{EC,p}$ = Project emissions from electricity consumption by the project facility during the period *p* [tCO_2e/p]

$PE_{FC,p}$ = Project emissions from auxiliary fossil fuel consumption associated with incineration during the period *p* [tCO_2e/p]

$$PE_{COM\_CO2,p} = EFF_{COM} \times \frac{44}{12} \times \sum_{j} \left(\sum_{i=p\_start}^{p\_end} W_i \times P_j \times \frac{DC}{100} \times FCC_j \times FFC_j \right)$$

Where:

$PE_{COM\_CO2,p}$ = Project emissions of CO_2 from combustion of fossil carbon contained in waste associated with incineration during the period *p* [tCO_2e/p]

EFF_{COM} = Combustion efficiency of incinerator [fraction]

$\frac{44}{12}$ = Conversion factor [tCO_2/tC]

i = The N^{th} year from the first incineration

p_start = The N^{th} year from the first incineration, which is the first year of the period *p*

p_end = The N^{th} year from the first incineration, which is the last year of the period *p*

W_i = Quantity of MSW fed into incinerator in the year *i* (wet basis) [t]

P_j = Fraction of the waste type *j* [weight fraction]

DC = Dry matter content of MSW [%]

FCC_j = Fraction of total carbon content in waste type *j* [tC/t]

FFC_j = Fraction of fossil carbon in total carbon content of waste type *j* [weight fraction]

j = Type of waste

$$PE_{COM\_N2O,p} = \sum_{i=p\_start}^{p\_end} W_i \times EF_{N2O} \times GWP_{N2O}$$

Where:

$PE_{COM\_N2O,p}$ = Project emissions of N_2O from combustion of waste associated with incineration during the period *p* [tCO_2e/p]

i = The N^{th} year from the first incineration

p_start = The N^{th} year from the first incineration, which is the first year of the period *p*

p_end = The N^{th} year from the first incineration, which is the last year of the period *p*

W_i = Quantity of MSW fed into incinerator in the year *i* (wet basis) [t]

EF_{N2O} = Emission factor for N_2O associated with incineration [tN_2O/t waste]

GWP_{N2O} = Global Warming Potential of nitrous oxide [tCO_2e/tN_2O]

$$PE_{EC,p} = EC_p \times EF_{elec}$$

Where:

$PE_{EC,p}$ = Project emissions from electricity consumption by the project facility during the period *p* [tCO_2e/p]

EC_p = Quantity of electricity consumed by the project facility during the period *p* [MWh/p]

EF_{elec} = Emission factor for electricity generation [tCO_2e/MWh]

$$PE_{FC,p} = \sum_{fuel} \left(FC_{fuel,p} \times NCV_{fuel} \times EF_{CO2,fuel} \right)$$

Where:

$PE_{FC,p}$	=	Project emissions from auxiliary fossil fuel consumption associated with incineration during the period *p* [tCO_2e/p]
$FC_{fuel,p}$	=	Quantity of auxiliary fossil fuel consumed during the period *p* [kL or m^3/p]
NCV_{fuel}	=	Net calorific value of fuel [GJ/kL or m^3]
$EF_{CO2,fuel}$	=	CO_2 emission factor of fuel [tCO_2/GJ]
fuel	=	Type of fuel

(iii) Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$

Where:

ER_p	=	Emission reductions during the period *p* [tCO_2e/p]
RE_p	=	Reference emissions during the period *p* [tCO_2e/p]
PE_p	=	Project emissions during the period *p* [tCO_2e/p]

Details of the data and parameters fixed ex ante and to be monitored or calculated ex post, with the assumption used for calculating emission reductions in the section 7, are summarized in the Annex III.

10. The Schedule of JCM application (Month and Year)

Draft of JCM methodology	September 2023
Preparation of Project Design Document (PDD)	March 2024
Validation of PDD	May 2024
Submission of PDD to the Joint Committee	July 2024
Monitoring	January 2025– December 2031 (This is the period required for the emission reductions to become positive)
Verification of the monitoring	February 2032

III. Incremental costs of the adoption of the advanced low carbon technologies (amount of grant requested from JFJCM)

(Note: JFJCM requires incremental cost calculations, comparing the “business as usual” option vs. the “more advanced low carbon” option.)

In Maldives, MSW is usually disposed in open dump sites. The key challenge of introducing advanced WtE is its high initial investment required, and without external assistance, such advanced WtE will not be installed. Given the classification of Maldives assessed by the IMF as high risk of the distress, the most concessional financing option through the JFJCM grant (in conjunction with the ADB grant and concessional loan) is necessary to ensure the bankability of the project. Therefore, the proposed WtE as a whole is considered as incremental. According to the government consultants preparing DBO, the preliminary cost estimate for the WtE subcomponent (incl. the residue landfill) is $95.8 million (base costs plus taxes), and $10 million is requested from the JFJCM.

IV. Cost estimation table of Grant and loan (only component which will be supported by the fund)

Category	Amount of Grant Allocated in $ million	Amount of loan or other sources in $ million
1. Waste to Energy facility	9.5	86.3
2. Technical, procurement, supervision, and planning support	0.5	5.0
a. Basic design, tender assistance (bid document, bid evaluation, and contract negotiation), and construction supervision including safeguard monitoring	0.0	5.0
b. JCM related operational expenses (methodology and project design document preparation, auditing firm for validation and verification)	0.5	0
TOTAL	**10.0**	**91.3**

V. The following are attached for more details:

Annex I - Design and Monitoring Framework

Annex II - Project Concept Paper

Annex III - Data and parameters fixed ex ante and to be monitored or calculated ex post for the proposed JCM methodology

Annex IV – Draft JCM monitoring plan sheet (for calculating GHG emission reductions)

Annex III: Data and parameters fixed ex ante and to be monitored or calculated ex post for the proposed JCM methodology

(a) Data and parameters fixed *ex ante*

Parameter	Description of data	Source
φ	Model correction factor to account for model uncertainties Default value: 0.80 The conservative value was selected from the default values φ_{default} in the tool.	CDM Methodological Tool “Emissions from solid waste disposal sites” (Version 07.0)
f	Fraction of methane captured at a SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere Default value: 0	Decided taking into consideration the situation in Maldives
GWP_{CH4}	Global Warming Potential of methane [tCO_2e/tCH_4] Default value: 25	Table 2.14, of the errata to the contribution of Working Group I to the Fourth Assessment Report of the IPCC
OX	Oxidation factor (reflecting the amount of methane from a SWDS that is oxidized in the soil or other material covering the waste) Default value: 0.1	CDM Methodological Tool “Emissions from solid waste disposal sites” (Version 07.0)
F	Fraction of methane in the SWDS gas [volume fraction] Default value: 0.5	CDM Methodological Tool “Emissions from solid waste disposal sites” (Version 07.0)
DOC_f	Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in a SWDS [weight fraction] Default value: 0.5	CDM Methodological Tool “Emissions from solid waste disposal sites” (Version 07.0)
MCF	Methane correction factor: No water table above the bottom of the SWDS. 0.3 is selected as the	CDM Methodological Tool “Emissions from solid

	landfill is constantly smoldering and fires are set deliberately. Select one of the followings taking into consideration the situation of the project. (1) In case of a water table above the bottom of the SWDS, estimate the MCF using the following equation. $$MCF = MAX\left\{\left(1-\frac{2}{d_y}\right), \frac{h_{w,y}}{d_y}\right\}$$ $h_{w,y}$ = Height of water table measured from the base of the SWDS [m] d_y = Depth of the SWDS [m] (2) In case that the SWDS does not have a water table above the bottom of the SWDS, select the applicable value from the following: ● 1.0 for anaerobic managed solid waste disposal sites. These have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste; ● 0.5 for semi-aerobic managed solid waste disposal sites. These have controlled placement of waste and will include all of the following structures for introducing air to the waste layers: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system; ● 0.8 for unmanaged solid waste disposal sites– deep. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 meters; ● 0.4 for unmanaged-shallow solid waste disposal sites or stockpiles that are considered SWDS. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 meters. This includes stockpiles of solid waste that are considered SWDS. ● 0.3 for the given situation that the current	waste disposal sites" (Version 07.0)

<table>
<tr><td></td><td>operator constantly set fire to the dumped waste.</td><td></td></tr>
<tr><td>DOC_j</td><td>Fraction of degradable organic carbon in the waste type *j* [weight fraction]

Default values for DOC_j:

<table>
<tr><th>Waste type *j*</th><th>DOC_j [% of wet waste]</th></tr>
<tr><td>Wood and wood products</td><td>43</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge)</td><td>40</td></tr>
<tr><td>Food, food waste, beverages and tobacco (other than sludge)</td><td>15</td></tr>
<tr><td>Textiles</td><td>24</td></tr>
<tr><td>Garden, yard and park waste</td><td>20</td></tr>
<tr><td>Nappies</td><td>24</td></tr>
<tr><td>Glass, plastic, metal, other inert waste</td><td>0</td></tr>
</table></td><td>CDM Methodological Tool “Emissions from solid waste disposal sites” (Version 07.0) and Table 2.4, chapter 2, volume 5 of 2006 IPCC guidelines for National GHG Inventories</td></tr>
<tr><td>k_j</td><td>Decay rate for the waste type *j* [1/yr]

Default values for k_j:

<table>
<tr><th colspan="2">Waste type *j*</th><th>k_j [1/yr]</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textiles</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other (nonfood) organic putrescible garden and park waste</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.40</td></tr>
</table>The default values k_j for Tropical (Mean annual temperature>20 degree C) and Wet (Mean annual precipitation>1000mm) were selected taking into consideration the climate condition of Maldives.</td><td>CDM Methodological Tool “Emissions from solid waste disposal sites” (Version 08.0)</td></tr>
</table>

<table>
<tr><td>P_j</td><td>Fraction of the waste type *j* [weight fraction]

Before the validation of a proposed project, take at least one sample in each season (both rainy and dry) from MSW transported to a SWDS within the same municipality where the project facility is to be constructed, weigh each waste fraction (measure on wet basis) taking into consideration the waste type *j*, as provided in the tables for FCC_j and FFC_j, and average each waste fraction *j* among the samples.</td><td>Study conducted by the project participants</td></tr>
<tr><td>EF_{elec}</td><td>Emission factor for electricity generation [tCO_2e/MWh]

The emission factor has been set to 0.72t CO_2/MWh referring to the Maldives Low Carbon Development Strategy http://orbit.dtu.dk/files/96933631/LCDS_report_final_June_2014.pdf</td><td>For grid electricity: PDD of the most recently registered CDM project hosted in Maldives or the latest version of the “Tool to calculate the emission factor for an electricity system” under the CDM at the time of validation

For captive electricity: CDM approved small scale methodology AMS-I.A.</td></tr>
<tr><td>EFF_{COM}</td><td>Combustion efficiency of incinerator [fraction]
Default value: 1 (100%)</td><td>Table 5.2, chapter 5, volume 5 of 2006 IPCC guidelines for National GHG Inventories</td></tr>
<tr><td>FCC_j</td><td>Fraction of total carbon content in waste type *j* [tC/t]

Default values for FCC_j:

<table>
<tr><td>Waste type *j*</td><td>FCC_j
[% of dry weight]</td></tr>
<tr><td>Paper/cardboard</td><td>50</td></tr>
<tr><td>Textiles</td><td>50</td></tr>
<tr><td>Food waste</td><td>50</td></tr>
<tr><td>Wood</td><td>54</td></tr>
<tr><td>Garden and Park waste</td><td>55</td></tr>
<tr><td>Nappies</td><td>90</td></tr>
<tr><td>Rubber and Leather</td><td>67</td></tr>
</table>
</td><td>CDM approved consolidated baseline and monitoring methodology ACM0022 “Alternative waste treatment processes” (Version 02.0)</td></tr>
</table>

<table>
<tr><td></td><td><table><tr><td>Plastics</td><td>85</td></tr><tr><td>Metal*</td><td>NA</td></tr><tr><td>Glass*</td><td>NA</td></tr><tr><td>Other, inert waste</td><td>5</td></tr></table>*Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common.</td><td></td></tr>
<tr><td>FFC_j</td><td>Fraction of fossil carbon in total carbon content of waste type j [weight fraction]

Default values for FFC_j:

<table><tr><td>Waste type j</td><td>FFC_j (%)</td></tr><tr><td>Paper/cardboard</td><td>5</td></tr><tr><td>Textiles</td><td>50</td></tr><tr><td>Food waste</td><td>-</td></tr><tr><td>Wood</td><td>-</td></tr><tr><td>Garden and Park waste</td><td>0</td></tr><tr><td>Nappies</td><td>10</td></tr><tr><td>Rubber and Leather</td><td>20</td></tr><tr><td>Plastics</td><td>100</td></tr><tr><td>Metal*</td><td>NA</td></tr><tr><td>Glass*</td><td>NA</td></tr><tr><td>Other, inert waste</td><td>100</td></tr></table>*Metal and glass contain some carbon of fossil origin. Combustion of significant amounts of glass or metal is not common.</td><td>CDM approved consolidated baseline and monitoring methodology ACM0022 “Alternative waste treatment processes” (Version 02.0)</td></tr>
<tr><td>DC</td><td>Dry matter content of MSW [%]

Before the validation of a proposed project, take at least one sample in each season (both rainy and dry) from MSW transported to a SWDS within the same municipality where the project facility is to be constructed, weigh each sample in wet and dry basis, calculate the fraction of dry matter content for each sample, and average the values obtained.

The dry matter content of the MSW is 65% based on the feasibility study.</td><td>Study conducted by the project participants</td></tr>
<tr><td>EF_{N2O}</td><td>Emission factor for N_2O associated with incineration [tN_2O/t waste]</td><td>CDM approved consolidated baseline and monitoring methodology</td></tr>
</table>

<table>
<tr><td></td><td>Select one of the following default values taking into consideration the situation of the project.

Default values for EF_{N2O}:
<table><tr><td>Type of waste</td><td>Technology / Management practice</td><td>EF_{N2O} [tN_2O/t waste wet basis]</td></tr><tr><td>MSW</td><td>Continuous and semicontinuous incinerators</td><td>$1.21*50*10^{-6}$</td></tr><tr><td>MSW</td><td>Batch-type incinerators</td><td>$1.21*60*10^{-6}$</td></tr></table></td><td>ACM0022 “Alternative waste treatment processes” (Version 02.0) and Table 5.6, chapter 5, volume 5 of 2006 IPCC Guidelines for National GHG Inventories</td></tr>
<tr><td>GWP_{N2O}</td><td>Global Warming Potential of nitrous oxide [tCO_2e/tN_2O]

Default value: 298</td><td>Table 2.14, of the errata to the contribution of Working Group I to the Fourth Assessment Report of the IPCC</td></tr>
<tr><td>NCV_{fuel}</td><td>Net calorific value of fuel [GJ/kL or m^3]

Decide from the specifications described on invoices or other commercial/contractual evidence.

36 GJ/m^3 (fossil fuel/diesel)</td><td>Invoices or other commercial/contractual evidence</td></tr>
<tr><td>$EF_{CO2,fuel}$</td><td>CO_2 emission factor of fuel [tCO_2/GJ]

Select a value for the fuel combusted by the project from the IPCC default values at the upper limit of the uncertainty at a 95% confidence interval.

0.0748: Selected the value for diesel at the upper limit of the uncertainty at a 95% confidence interval from the IPCC</td><td>Table 1.4, chapter 1, volume 2 of 2006 IPCC Guidelines for National GHG Inventories. Upper value is applied.</td></tr>
</table>

(b) Parameters to be monitored or calculated *ex post*:

Parameters	Description of data
W_i	Quantity of MSW fed into incinerator in the year *i* (wet basis) [t] See the Table 3 in JFJCM application

p_start	The N^{th} year from the first disposal (or incineration), which is the first year of the period *p*
p_end	The N^{th} year from the first disposal (or incineration), which is the last year of the period *p*
$EG_{elec,p}$	Quantity of electricity generated by the project facility during the period *p* [MWh/p] See the Table 3 in JFJCM application
EC_p	Quantity of electricity consumed by the project facility during the period *p* [MWh/p] Has been set to 0, as the facility is always able to generate the electricity for self-consumption.
$FC_{fuel,p}$	Quantity of auxiliary fossil fuel consumed during the period *p* [kL or m^3/p] 18,000 m3/18 years The estimation was made based on the following: a) The facility has an envisaged down time of 2 lines per year of one week, having a demand during this period of around 1.5 MW, i.e. 250 MWh during the entire 7 days. Assuming another one week due to unforeseen incidents and assuming a genset efficiency of 30%, the overall diesel consumption is around 170 m^3/year (NCV of diesel 10 MWh/m3). b) Furthermore, to heat up the processing lines after a down time, between 2 and 3 litter fuel oil or diesel/ton MSW incinerated are required usually, hence, between 330 and 500 m3/year additionally. c) While it is 670m3/year in total as calculated above, 1,000 m3/year is assigned to make it conservative. Hence, the overall auxiliary fuel consumption over 18 years would be 18,000 m3.