

Terms of Reference

Greater Male Waste-to-Energy Project

Project Management, Design and Construction Supervision (PMDCS) Consultant

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A Background

1. The Greater Malé capital region and its outer islands (classified as Zone 3 in the national solid waste management policy) suffer from severe environmental pollution and deteriorating livability because of inadequate collection and haphazard disposal of solid waste. Zone 3 covers 35 inhabited islands, 73 tourist resorts, 14 city hotels, and 177 guest houses, in the North Ari Atoll (Alifu Alifu Atoll), South Atoll (Alifu Dhaalu Atoll), Malé' Atoll (Kaafu Atoll) and Vaavu Atoll, including the capital city of Malé, with a total population of 216,000 (51% of Maldives). Lack of a sustainable system to manage the 774 tons per day (tpd) of solid waste generated in Zone 3 (results in waste spillage into the ocean, and open dumping and burning of garbage at the 30-year old 10-hectare dumpsite on Thilafushi Island which has no pollution control measures creating a public health and an environmental hazard.¹ Plumes of smoke visible from the capital Malé, the international airport and nearby resorts compromise air quality and pose nuisance to residents and tourists, while leachate and plastics contaminate the surrounding marine environment.
2. The Government of Maldives is committed to improve the environmental conditions and to strengthen the solid waste management (SWM) system in the country. For Zone 3, the government plans to develop a sustainable regional waste management facility on a newly reclaimed 15 ha land on Thilafushi island adjacent to the current dumpsite. The facility will include a 500 tons per day waste to energy treatment plant (WTE) including a bottom ash processing plant, a landfill for air pollution control (APC) residues and bottom ash including leachate treatment plant. The facility will be developed through a Design-Build-Operate (DBO) Contract (the "Contract") pursuant to the FIDIC Gold Book, with design and build period proposed to be financed by the Asian Development Bank (ADB), Asian Infrastructure Investment Bank, ADB's Japan Fund for Joint Crediting Mechanism, and the government under the Greater Male Waste to Energy Project (the project). The government will cover the cost for the 20 years operation period. The project will mitigate greenhouse emissions and will be registered as joint crediting mechanism.
3. A shortlist of pre-qualified firms was finalized in fourth quarter 2019 and invitations for bids for the DBO contract is expected by December 2019. The DBO Contractor (the "Contractor") will be awarded in the fourth quarter of 2020, with the facility to be commissioned within 3.5 years after the notice to proceed. Included in the scope of the Contractor is design, build and operation of the facility, and also preparation of the permitting application for the construction and operation of the WtE plant. The volume of the design-build (DB) component of the DBO Contract is expected to be around \$120 million.
4. The WTE facility will receive waste that is collected in Zone 3 and transferred to Thilafushi Island. Collection and transfer of solid waste is not part of the Contractor's scope. Besides this waste, a stockpile of baled waste that is generated in the transition phase after closing the dumpsite and the commissioning of the WTE will also be incinerated.

¹ The population is expected to grow to 300,000 within the next five years. In 2022 the expected generation of municipal solid waste (MSW) of residents, commercial and industrial entities and institutional bodies is approximately 115,000 tonnes which is complemented by another 70,000 to 100,000 tonnes of construction and demolition waste. Breakdown of solid waste by type: construction and demolition = 530 tpd (68%), household = 149 tpd (19%), resort = 48 tpd (6%), commercial = 27 tpd (3%), airport = 9.3 tpd (1.2%), industrial = 6 tpd (0.8%), market = 2.5 tpd (0.3%), hazardous = 1.5 (0.2%), and end-of-life vehicles = 0.65 tpd (0.1%). Source: Government of Maldives, Ministry of Environment and Energy. 2018. Feasibility Study for an Integrated Solid Waste Management System for Zone III (including Greater Malé) and Preparation of Engineering Design of the Regional Waste Management Facility at Thilafushi. Malé

5. The Ministry of Finance (MOF) is the executing agency while Ministry of the Environment (MOE) is the implementing agency. MOE will own and be in charge of the WTE facility operations. The state-owned Waste Management Company Ltd. (WAMCO) or other contractors will be the supplier of waste to the WTE facility. The Environmental Protection Agency (EPA) is responsible for regulatory activities for waste management and pollution prevention. The State Electricity Company Ltd. (STELCO), Greater Malé Industrial Zone Limited (GMIZL), Ministry of Planning and Infrastructure and Malé City Council are relevant stakeholders.
6. With respect to the FIDIC terminology, MOE will be the Employer.

Further information

7. The Greater Male Waste to Energy Project will complement the ongoing Greater Male Environmental Improvement and Waste Management Project (GWEIWMP), assisted by ADB \$33 million grant. GWEIWMP supports (i) solutions for immediate control of nuisances from Thilafushi Island dumpsite and interim measures to manage the incoming waste until a new treatment facility is commissioned (e.g. baling of municipal solid waste); (ii) development a construction and demolition (C&D) waste treatment plant; (iii) island waste management centers in outer islands; and (iv) installing an appropriate collection and transfer system in Malé and other islands/resorts in Zone 3, including transfer stations in Malé and Villimale, (v) construct a disassembling plant for end-of-life vehicles, (vi) institutional capacity building and public awareness in sustainable SWM and reduce, reuse and recycling.
8. The state-owned Waste Management Company Ltd. (WAMCO) operates the waste collection in Malé, Hulhumale and Villimale and dumps waste on a dumpsite on the island of Thilafushi. On inhabited islands, the islands councils are in charge of collection and basic disposal. WAMCO took over the operational responsibility for waste management in December 2015.
9. The government also plans to i) rehabilitate the existing dumpsite in Thilafushi and ii) develop a transfer station in Hulhumale. The dumpsite rehabilitation invitation for bids is expected in the fourth quarter of 2020 or first quarter 2021. These two components are proposed to be financed on a parallel basis by the Islamic Development Bank.

B Objectives of the Assignment

10. To successfully implement the Greater Male Waste to Energy Project through high quality management, design and construction supervision, the government (executing agency and implementing agency also referred as the Client) will require the support of a professional engineering and management consulting firm ("the Consultant"). The firm will assist in the delivery of the different project components, which include the design, construction and initial operations (including capacity building of EPA and Employer in monitoring operations) of WTE facility and associated landfill of air pollution control residuals and non-marketable incineration bottom ash.
11. The Consultant will act as Employer's Representative (ER, FIDIC Gold Book) during the design and build period and the first two years after the successful commissioning of the WTE plant (operation period).

C Scope

12. The Consultant's scope evolves from the roles and responsibilities stipulated in the relevant general conditions of the FIDIC Gold Book.
13. The Consultant is expected to provide inputs relating to the conceptual and detailed engineering and design reviews, construction supervision and contract administration, project management and monitoring, cost control, ensure compliance with social, environmental, occupational health and safety aspects, amongst others, provide capacity building support but not limited to the following:
 - i. Ensure that the facilities and the equipment are designed according to the Employer's Requirements that are part of the DBO Contract;
 - ii. Supervise, monitor and control the progress of design and construction of the WtE facility and the ancillary components in sufficient detail by, for example but not limited to, design reviews, inspection of manufacturing and construction sites, site meetings etc., as necessary and stipulated in the relevant contracts;
 - iii. Monitor and manage any occurring interface during the construction activities of the Contractor and the contractor carrying out the dumpsite rehabilitation and minimize their impact on the timeline of the Project;
 - iv. Supervise the construction of the new landfill and validate the bottom liner system construction Quality Assurance/Quality Management;
 - v. Monitor and control the construction activities to minimize their environmental impact;
 - vi. Monitor and control the commissioning and trial run operations including the tests on completion of the design-build period of the WtE plant including all ancillary facilities;
 - vii. Support the Employer during processing of claims and invoices submitted by the contractors;
 - viii. Assure that the contractor complies with relevant ADB safeguard standards;
 - ix. Instruct and train the Employer's and EPA's staff in performance analyses and monitoring related to statutory compliance and to the performance guarantees of the WtE plant and its ancillary facilities;
 - x. Draft a Joint Crediting Mechanism (JCM) methodology and support the Employer in registering the WtE facility for the GHG emission reductions;
 - xi. Support the Employer during the first two years after of operation after issuing the commissioning certificate to monitor and review the performance of the DBO facilities.

D Responsibilities and Deliverables

14. The overall responsibility to deliver the outputs will rest with the consulting firm through the Team Leader/Project Manager. The Consultant will ensure timely delivery of the documents, establish coordination among all stakeholders and within the team members of the Consultant, scheduling mobilization/demobilization of team members and to interact with the Client on regular basis and as needed.
- D.1 Project Management
15. Project management, control and monitoring responsibilities and tasks the Consultant will assume are as follows:
 - i. Plan and manage the project, and assist the Employer on the project management, including risk management, cost control, scheduling, monitoring, auditing, reporting, and compliance monitoring for the project required under both the government and ADB rules

and guidelines;

- ii. Review, comment and, if required, approve the Contractor's programs that are to be submitted including all pertinent activities and work packages, analyze critical paths, responsibilities and functions assigned and flag any time and cost over-run if required;
 - iii. Prepare a work programme for each of the Consultant's team members in line with the Contractor's schedule;
 - iv. Establish, coordinate and manage the information exchange between the Consultant, Contractor and the Employer and, as the case may be, other Project stakeholders;
 - v. Attend meetings necessary to manage the Project, prepare minutes and control the outcomes decisions taken;
 - vi. Establish a document control and proper filing system for project offices, including official correspondence, drawings, site instructions, variation orders and site records;
 - vii. Monitor open topics, claims of the Employer towards the Contractor, defects to be rectified, potential malfunctions of equipment etc. and track solutions to be implemented;
 - viii. Review and recommend on the Contractor's claims for progress payments;
 - ix. Review and examine the Contractor's requests for variation orders, extra items, new rates, claims for time extension and extra payment, filed by the contractor etc. and submit recommendations for approval, if appropriate;
 - x. Develop and implement procedures for timely payments to the Contractor and monitor for compliance;
 - xi. Assist constructively and submit recommendations in resolving any potential difficulty or dispute that may arise between the Contractor and the Employer;
 - xii. Prepare essential reports and documents including quick report on progress, quality, disbursement or any other relevant matter as may be required by the Client, Employer or the ADB and other funding institutions;
 - xiii. Assist the Employer in conducting regular meetings with all stakeholders, Contractor, and other government entities, etc., to discuss progress and issues related to implementation, and prepare minutes for recording and circulation;
 - xiv. Establish all necessary records and the procedures of maintaining/updating such records for each package and component of the Project;
 - xv. Assist on liaison with local authorities and government agencies, liaison with ADB and other funding institutions. Assist the Client/Employer in reporting to these institutions;
 - xvi. Review all proposed sub-contractors and verify their insurance, performance bond and collateral warranty or hereto relating parent company guarantees;
 - xvii. Assist the Client in ensuring compliance with all loan covenants during Project implementation and assist in reporting towards the funders.
16. Besides the responsibilities above, the Consultant will work closely with the Employer's project management unit by sharing relevant and requested information.

D.2 Review of the Design of the DBO Contract Components

17. The Consultant's responsibilities with respect to the design stages will include the review and approval of the proposed designs (submitted by the Contractor) including concept, detailed and works designs.
18. As per DBO Contract, the detailed design will be provided in packages to facilitate an appropriate design progress to develop the WtE facility and the residual waste landfill including permit application within 3.5 years. The Contractor may apply Building Information Modelling (BIM) to facilitate a smooth design and construction.

19. The Consultant's scope will include, but is not limited to, the following:

- i. Review the design program of the Contractor with respect to feasibility, critical paths, achievement of milestones etc.
- ii. Agree with the Contractor on the format and content to be delivered during the design stages, such as concept, detailed and works design, to achieve a timely delivery of the works included in the contract package;
- iii. Assist the Employer in facilitating the Contractor to obtain the permit upon due consultation with the EPA, Ministry of Planning and Infrastructure, and key authorities or stakeholders;
- iv. Agree with the Contractor on a defined conceptual design status in line with the milestones as per contract to limit variations during later design and construction stages;
- v. Review, examine and, if required, approve during the different design stages (concept, detailed, works), drawings, design reports, calculations, technical specifications of equipment and materials etc., in due course as per phasing requirements that are stipulated in the DBO Contract;
- vi. Check the design towards the functional and design criteria and specifications, H&S and environmental aspects, operability matters, flood and storm resilience, product quality and the supply chain to be established;
- vii. Arrange and manage design review meetings in Malé to expedite and to facilitate a smooth design review;
- viii. Monitor the design progress and inform the Employer about any deviations and potential delays;
- ix. Suggest design changes if necessary and advise the Employer on these changes and potential cost and schedule implications by furnishing appropriate reports. In the event costs have to be borne by the Contractor, advise the Employer accordingly;
- x. Review and, if needed, approve the contractor's method statements, site organization arrangements, utilities, shipment plans etc.;
- xi. In the event procurement/manufacturing is carried out during the design stage, inspect or coordinate the inspection of manufacturing of critical components of the WtE plant as per contractual provisions incl. the review of certificates, technical specifications and workmanship;
- xii. Check the hazard and operability (HazOp) analyses and hazard area classification drawings;
- xiii. Review, comment and, as the case may be, approve the plans and documents the Contractor has to submit during the design-build phase, such as, but not limited to, operations and maintenance plan, the Contractor's environmental management plan (CEMP), quality management and assurance plan, the H&S plan, residual waste and landfilling plan, the programme on tests on completion of design-build, etc.; and
- xiv. Ensure disaster- and climate-resilient features are incorporated in the final designs.

D.3 Construction Supervision

20. The Consultant will:

- i. Review method statements, work drawings and construction methodology for their correctness and adequacy prior to the start of works, report findings and propose/recommend modifications or corrections to any defect or omissions and issue for execution; monitor impact and report on physical progress of the works and financial disbursements;

- ii. Maintain sufficient site-based staff, with clear allocation of duties, to monitor, inspect and closely follow up the day-to-day construction activities in line with the timely requirements of the construction works;
- iii. Maintain daily records of execution progress in an appropriate format to be shared with the Employer;
- iv. Co-ordinate with all stakeholders to achieve timely completion of contractual obligations on the part of Contractor and the Employer;
- v. Review any upcoming design changes in the course of the construction and advise the Employer on potential cost and design/construction schedule implications;
- vi. Monitor the Contractors' performances against the stipulated milestones and the agreed project progress, furnish an updated list of open topics and advise the Employer about any expected or unexpected delay and potential cost implications;
- vii. Check the adequacy and quality of the Contractor's input in terms of material, equipment & machinery, personnel and safety arrangements prior to commencement of the works and periodically during the construction activity;
- viii. Inspect and control the executed works and the supplies of equipment to be in compliance with the approved work drawings (design for construction) and with the Employer's Requirements;
- ix. Review, inspect and/or coordinate the review and inspection of manufacturers of major and critical components and their manufacturing sites pursuant to the Contract provisions with respect, but not limited, to certificates evidencing skills and experiences of workers, documented and certified materials used, technical specification of (sub)components embedded, the general workmanship and the final product quality;
- x. Monitor the assembly of components and its progress towards expected milestones;
- xi. Agree with the Contractor on the test programme prior to completion of the design-build, attend the tests, review the test reports and endorse test certificates;
- xii. Review and approve the as-built-documentation and, as the case may be, request changes prior to acceptance;
- xiii. Record and follow up on defects identified during the design-build period and ensure that all defects are remedied within the time stipulated;
- xiv. Scrutinize the quality assurance system and quality control plan of the Contractor, prepare quality compliance and progress reports;
- xv. Support and assist the Employer in Contract administration and compliance with contractual conditions and ADB's Project Administration Manual;
- xvi. Support the Employer during the processing of payment and claims providing any necessary input (such as measurement of works progress, judgement and information concerning milestone achievements, acceptance of variation orders, deduction of retention money);
- xvii. Assist the Employer in forecasting the progress of works and finalization of periodic targets for the expenditure and disbursement.

D.4 Commissioning Supervision

- 21. Responsibilities of the Consultant related to commissioning of the DBO contract components will include:
 - i. Maintain a sufficiently staffed and skilled team to keep up with the responsibilities assigned during the commissioning period including the demonstration of performance guarantees that were defined in the Contract;
 - ii. Support the Contractor, as far as required, to obtain the necessary permits to conduct

- the commissioning activities;
- iii. Assist the Employer in making available the required amount of waste prior to the tests on completion of the design-build;
- iv. Review and approve the Contractor's test programme on the completion of the design-build and agree with the Contractor on a final programme;
- v. Request to commission parts and sections of the works if need be;
- vi. Attend and monitor the commissioning tests (incl. pre-commissioning) and trial operations including the tests on completion of design build to demonstrate the performance requirements, standards and guarantees;
- vii. Furnish commissioning attendance protocols and highlight issues that might affect the scheduled tests on completion of design build;
- viii. Review the test reports on completion of design-build and make necessary comments and adjustments, and, in the event of failure of the tests, request the Contractor to conduct a retest;
- ix. Support the Employer during any claims related to the commissioning period;
- x. After due consultation with the Employer, issue the commissioning certificate upon successful completion of the test on design build;
- xi. Summarize the performance of the facilities being tested and give necessary instructions to the Employer and the EPA relating the performance monitoring and the compliance measurements.

D.5 Environmental and H&S Components

22. Responsibilities related to environmental, occupational health and safety are:

- i. assist PMU in meeting requirements of ADB SPS and government on environment, occupational health and safety, and labor standards.
- ii. assist PMU in obtaining all necessary permissions and complying with statutory requirements;
- iii. ensure Contractor submits requirements per EMP and government clearances/permits,
- iv. provide support to Contractor in preparing the Contractor's EMP (CEMP) to ensure ADB SPS and conditions in government clearances are incorporated accordingly;
- v. assist PMU in updating the EIA for any change in scope, design, location, or unanticipated impacts that are not reported in the EIA;
- vi. review any changes in the Contractor's design and support PMU in ensuring environmental assessment, impacts avoidance and mitigation measures are reflected in the CEMP and updated EIA
- vii. assist the Contractor and the PMU in all EPA related clearances, and ADB's no-objection, and monitor and control construction and assembly compliance against the updated EIA, ADB's safeguards policy statement (2009), and CEMP;
- viii. monitor the contractors' compliance with all safety requirements as stated in DBO contract and CEMP, during and prior to any construction activity.
- ix. assist in preparation of accident report and keeping accident records on-site as required;
- x. monitor the implementation of the CEMP during construction and pre/post construction phases;
- xi. assist PMU in continuing stakeholders engagement, consultantations, information disclosure and addressing complaints/grievances;
- xii. develop public awareness program and materials to support wider understanding of

- the project, potential impacts and measures to ensure impacts are avoided, mitigated and affected people, if any, are compensated;
- xiii. assist PMU in preparation of environmental monitoring reports
- xiv. coordinate with external environmental experts on results of independent monitoring and support PMU to prepare corrective actions, if required
- xv. provide and organize trainings/workshops/seminars on environmental safeguards, occupational health and safety, and labor standards
- xvi. assist PMU in review of contractor's health and safety program and in monitoring its implementation
- xvii. support PMU during ADB review missions
- xviii. support PMU in developing data management system on environmental safeguards; and
- xix. other tasks related to environmental safeguards, occupational health and safety, and labor standards

D.6 Capacity Building of EPA and the Employer's Personnel

23. Given the limited capacity of both the Employer's and EPA's staff to monitor the facility, the Consultant will provide training for the eligible MOE and EPA staff. The timing of the training activities will be aligned with the construction progress and the visits during the Operation Service Period to provide a firm understanding of the built facilities. The waste supplier's personnel will be included as far as necessary.
24. The Consultant's scope will cover the following aspects:
 - i. Prepare a training program for the Employer's and EPA's staff on monitoring the WtE plant and its ancillary facilities with respect to environmental compliance and best operational performance;
 - ii. Conduct induction training for the Employer and EPA amongst others on the following subjects relating the design:
 - a) Technical design and construction characteristics of the WtE plant built and its ancillaries, particularly the furnace, boiler, turbine and APC system, landfill and leachate treatment;
 - b) Continuous emission monitoring systems, its functionality and calibration;
 - c) Access to the Plant Information Management System PIMS);
 - iii. Instruct the EPA and the Employer's staff on relevant H&S aspects, such as
 - a) Fire hazards, safety, fighting and alarm system;
 - b) Operating highly pressurized vessels;
 - c) Handling chemicals, dust and toxic substances;
 - iv. Detail the operations and maintenance of a WtE plant, amongst others:
 - a) Input control and fueling according to stoker capacity diagram and the hereto relating bottle necks (boiler, turbine, bottom ash quality etc.)
 - b) Bunker management and mixing of waste for a steady state operations;
 - c) Function and malfunction of the CEMS and how to detect those;
 - d) Use of the SCADA (or DCS archives) and the interfaces to SCADA via the PIMS for a constant access of data;
 - e) Necessary down times for inspection, revision or overhaul and typical annual maintenance schedule (incl. expenses) and its consequences towards the waste delivery;

- v. Monitoring the facility is regarded as a primary task of both EPA and the Employer which makes it necessary to enhance the capacity in the following subjects:
 - a) Reporting requirements towards the contractor;
 - b) Scrutinizing regular reports, e.g. by assessing throughput, steam generation and flue gas volume vs. backwards calculated calorific value;
 - c) How to utilize the access to archived SCADA data and to online data via the PIMS;
 - d) Calibration records of essential components (weighbridge, crane scales, CEMS);
 - e) Operational meetings on the facilities performance;
 - f) Solving any potential conflicts prior to arbitration and what to tolerate and where to intervene.
 - vi. Contract management, such as performance guarantees and damages mechanisms, asset replacement fund utilization, milestones, timeframes for payments, dispute resolution etc.;
25. The training will be complemented by appropriate visits of the construction site and the operating plant to facilitate a better understanding of the characteristics of relevant components that are of a particular importance for EPA and the Employer (such as the continuous emission monitoring system, the APC system, the residue handling etc.).

D.7 Operation Service Period

26. The Consultant will be responsible within the first two years after issuing the commissioning certificate of the WTE facilities and components to assist the Employer to monitor and control the Contractor's performance amongst others in the following areas:
- i. Follow up on a timely remediation of defects after issuing of the commissioning certificate and scrutinize the Contractor's final claim for reimbursement of the retention money as per DBO contract provisions;
 - ii. Assist the Employer in inspecting the facilities and reviewing their performance using the relevant data as per SCADA records or any other records to be made available by the Contractor with respect to
 - a) the waste delivery (quality and quantity) and performance of WAMCO's C&D waste processing unit,
 - b) the compliance to statutory requirements,
 - c) the performance parameters and guarantees as per DBO contract,
 - d) the production and quality of bottom ash and prospects of the bottom ash marketing;
 - e) the production and contract compliant landfilling of APC residues;
 - f) the consumption of supplies;
 - g) scheduled down-times of the facility;
 - h) the envisaged and applied maintenance;
 - iii. Suggest appropriate measures (e.g. within the DBO contract) in the event the Contractor fails to meet performance standards/guarantees;
 - iv. Advise the Employer of any issues identified during visits and suggest rectifications;
 - v. Prepare reports on each inspection visit;
 - vi. Upon reasonable request by the Employer, assist in solving occurring contractual issues arising out of the operations.

27. The responsibility of the Consultant will include two visits per year of appropriate staff of a duration of at least two weeks each to accommodate both the inspection and the training needs as per section D.6.

D.8 JFJCM Related Project Components

28. To apply for the Joint Crediting Mechanism (JCM), MoE will define the JCM methodology and prepare a project design document, and monitoring methodology that will be submitted for final approval and registration with the JCM. The Consultant will collaborate closely with MoE and take into consideration the requirements as defined in Annex 1. To obtain the approval, the Consultant will:
- i. Draft JCM methodology for the proposed WtE and assist the project management unit (PMU) to have the methodology approved;
 - ii. Draft a project design document for the proposed JCM project, assist PMU to have the project design document validated, and have the project registered;
 - iii. Conduct a local stakeholder consultation (LSC) as required for the JCM process.
 - iv. Conduct a capacity building of the PMU to meet the requirement for the JFJCM including monitoring of GHG emission reductions, drafting a monitoring report, having the monitoring report verified, and requesting issuance of JCM credits;
 - v. Assist PMU to conduct monitoring and draft monitoring report, have the monitoring report verified, and request issuance of JCM credits;
 - vi. Train PMU staff in carrying out the JCM monitoring, reporting and verification process.

E Qualification Requirements for the Key Experts & Team Composition

29. **Expected qualification requirements and tasks assigned to the Key Experts:** The Consultant will provide experts to cover all aspects of the facilities as per the contractual agreements either being concluded already or to be tendered (e.g. fire engineering expertise). Because of the nature of a WtE facility, several experts may be required for the one or other field of expertise. It will be within the Consultant's discretion to name as many experts as deemed necessary to cover all elements of the WtE plant and its ancillaries that are subject of this DBO contract. The team composition and minimum requirements are as follow.
30. **Team Composition with estimated Input:** The Consultant team will comprise of International Key-experts (87 person-months), National Key-experts (76 person-months), and non-key experts (33 person-months) excluding those required for Consultant's administrative, clerical and support staff. The Consulting firm will be engaged for 5 years to cover 3.5 years for the DBO design-build and the first two years of the operation service period. The expert's positions with their estimated inputs are provided in Table 2 below.

Table 2: Team Composition

I International Key Experts		Person Months
1	Team Leader cum WtE Expert	22
2	Financial/Commercial Expert	1.5
3	Site Engineer(s)	32
4	Civil Engineering Experts (infrastructure/structural)	6
5	Process/Mechanical Engineering Experts	7
6	Electrical Engineering Expert	3
7	Instrumentation and Control Engineering Expert	3
8	Environmental Safeguard Expert	6
9	JCM Expert	6
International Key Experts Sub-Total		87
II National Key Experts		
1	Deputy Team Leader/Construction Management Expert	34
2	Financial/Commercial Expert	6
3	Contract Management Expert	6
4	Civil/Structural Engineering Experts	10
5	Mechanical Engineering Experts	7
6	Electrical Engineering Expert	7
7	Environmental Expert	6
National Key Experts Sub-Total		76
III Non-Key Experts		
1	Assistant site engineers (international)	12
2	Other international experts (fire/building service engineers etc.)	6
3	Assistant site engineers (national)	15
Non Key Experts Subtotal		33
Overall total		196

31. **Team Leader cum Waste-to-Energy Expert (International):** The Team Leader cum WtE Expert will be responsible for overall project management and administration, construction supervision, quality control and monitoring, contract management, establishment of construction management and project performance monitoring and reporting system, assist in resolving contractual issues, preparation of progress and other reports as required. Jointly with the team, the Team Leader will fulfill the role of Employer's Representative. The Team Leader cum WtE Expert (International) will preferably i) be graduate mechanical/civil/environmental engineer and post graduate in project management or contract management with a certificate like or similar to PMP®, ii) have at least 15 years of working experience in WtE works of similar complexity and volume (400 tpd or higher, USD 50 million or higher), iii) experience and sound knowledge of FIDIC contract conditions and DBO contract management, and iv) knowledge and experiences in the application of building information modelling (BIM), and experience with international financial institutions (IFI) funded projects will have added advantage.
32. **Financial Expert (International):** The Financial Expert will support the Employer in financial management issues. He/she will work closely and supervise with the Employer in all matters related to the subject. Financial Expert (International) will preferably i) be a post graduate in economics or finance, ii) have at least 15 years of experience in carrying out economic and financial analysis of large (preferably similar) projects, and iii) good knowledge of ADB or other IFIs procedures/policies, and experience in WtE projects will have added advantage.
33. **Site Engineer(s) (International):** The Site Engineer(s) will be the point of contact towards the Contractor and the Employer for all construction related aspects and issues. He/she will

manage all day-to-day activities with the support of the national Deputy Team Leader and specialist construction and assembly supervisors (non-key assistant site engineers, both international and national) as required. He/she will be i) either a technician or a graduate engineer in mechanics/civil engineering with a post-graduate in construction management, ii) have at least 15 years of experience in similar projects and will be familiar with supervising and monitoring a WtE plant's construction site, iii) preferably will have knowledge of FIDIC Gold Book or similar DBO contract packages.

34. **Civil Engineering Experts (International):** Civil Engineering Experts will be responsible for the review and approval of civil engineering designs/drawings/details submitted by the Contractor. They will assist in monitoring and ensure quality assurance and control. Civil Engineering Experts (International) will preferably i) be graduates in civil engineering, and, as required per, expertise with post graduates in structural engineering, geotechnics, landfill engineering etc. ii) have 10 years of experience in the relevant design and design review in similar work environments, iii) be versed in the application of relevant CAD tools, iv) construction supervision, design and implementation related to similar works in low-lying land, knowledge of BIM and related tools will have added advantage.
35. **Process or Mechanical Engineering Experts (International):** Process or Mechanical Engineering Experts will be responsible for review of design, drawings and data, technical specifications and P&IDs prepared by the Contractor, ensure quality assurance and quality control. They will assist in resolving technical and contractual issues. Process or Mechanical Engineering Experts (International) will preferably be i) post graduates in process/mechanical engineering, ii) have 10 years of experience in process or mechanical engineering related to WtE facilities such as, but not limited to, cranes, furnace, boiler, turbine and water steam system, APC system etc., iii) be familiar with the application of relevant process engineering and CAD applications, and iv) construction supervision and implementation of works related to WtE facilities and knowledge of BIM will be regarded as advantage.
36. **Electrical Engineering Expert (International):** Electrical Engineering Expert will be responsible for review and approval of designs, drawings, specifications and data, ensure quality assurance and quality control, assist in resolving technical and contractual issues. Electrical Engineering Expert (International) will preferably i) post-graduate in electrical engineering, ii) have 10 years of experience in electrical engineering designs of similar projects, 5 years thereof in the WtE field, and iii) construction supervision and implementation of works related to WtE plants will have added advantage.
37. **Instrumentation and Control Engineering Expert (International):** Instrumentation and Control Engineering Expert will be responsible for review and approval of lay-out, design, drawings, data related to SCADA/DCS, ensure quality assurance and quality control of SCADA/DCS design and implementation, assist in resolving technical and contractual issues. Instrumentation and Control Engineering Expert (International) will preferably i) hold a post-graduate in instrumentation & control engineering, ii) have 10 years of experience in instrumentation and control engineering design and implementation, 5 years thereof in the field of WtE facilities, iii) be versed in the application of relevant process engineering and CAD applications, and iv) experience in construction supervision in the WtE field will be regarded as advantage.
38. **Environmental Safeguard Expert (International):** Environmental Expert will be responsible for management and supervision of environmental safeguard requirements in line with the

Contract, EIA including ADB SPS (2009) and the Government of Maldives. Among the responsibilities will be the preparation and implementation of environmental safeguard action plan, review of the (updated) EIA report, monitor the implementation of the CEMP. Environmental Safeguard Expert (International) will preferably i) be graduate in civil engineering, environmental science, structural engineering, environmental management or related field. Post graduate degree related to the field will be an advantage; ii) have 10 years of experience in preparing, and/or carrying out EIA/IEE/EMP, 5 thereof in WtE facilities-related projects, and iii) good knowledge of ADB or other IFI safeguards policies, design and construction with respect to implementation of environmental safeguards will have added advantage.

39. **JCM Expert (international):** The expert will have experience in carbon offset mechanisms and knowledgeable in rules on the Joint Crediting Mechanism (JCM). The expert will have a bachelor's degree in science, environment, or engineering; with 10 years of post-qualifying experience; have worked in at least two JCM or similar activities, to develop documents, prepare trial calculations and measurement systems, to establish the emission reductions accrued. The consultant will have experience in developing methodologies that have been approved under the JCM scheme preferably. Knowledge and experience of waste to energy system are assets. The qualification will be verified by JFJCM Secretariat of the ADB.
40. **Deputy Team Leader Cum Construction Management Expert (National):** Deputy Team leader cum Construction Management Expert will assist the international team leader, will support in overall project management and administration, construction supervision (jointly with the international site engineer(s)), quality control and monitoring, contract management, establishment of construction management and project performance monitoring and reporting system, assist in resolving contractual issue, preparation of progress and other reports as required. Deputy Team Leader cum Construction Management Expert (National) will preferably i) be graduate mechanical or civil engineer and post graduate in engineering or management, ii) have 10 years of working experience in leading and managing construction and/or turn-key projects and iii) sound knowledge of FIDIC contract conditions and contract management will be preferred. Experience in externally funded projects will have added advantage.
41. **Contract Management Expert (National):** Contract Management Expert will support the management and administration of the Project effected by the Team Leader and Deputy Team Leader. He/she will assist in establishment of the contract management and reporting system. He/she will elaborate an adequate documentation on contract administration, time & cost control, variations and change orders, billing & payments to the contractors. He/she will be responsible for documentation to ensure adequate progress of works, control the project and minimize the cost over-run and time over-run, timely review and disposal of contractor's claims. Will assist in resolving contractual issue and dispute resolutions during implementation. Contract Management Expert (National) will preferably i) be graduate in process, mechanical, or civil engineering and post graduated in contract management, ii) have 10 years of experience in contract administration related to procurement of Works and Goods for urban infrastructure projects, and iii) sound knowledge of FIDIC contract conditions and experience with IFIs will be regarded as advantage.
42. **Civil/Structural Engineering Experts (National):** Civil/Structural Engineering Experts (National) will assist the international Civil Engineering Experts in the review of the design of all civil/structural engineering elements as required and as submitted by the Contractor. Civil/Structural Engineering Experts (National) will preferably i) be graduate civil engineers,

and will be post-graduated in structural, geotechnical, building services engineering, ii) have 7 years of experience in civil/structural, geotechnical and building services engineering , iii) be versed in the application of relevant CAD tools, and iv) construction supervision, design and implementation related to similar works. Experience in externally funded projects will have added advantage.

43. **Mechanical Engineering Expert (National):** Mechanical Engineering Expert will assist the international Process/Mechanical Engineering Experts in the review of the design of all process and balance of plant related documents and drawings and P&ID as required and submitted by the Contractor. Mechanical Engineering Expert (National) will preferably i) be post graduated mechanical engineer, ii) have 10 years of experience in mechanical designs and implementation of goods and plants in multi-lot projects, iii) be versed in the application of relevant CAD tools, and iv) construction supervision of similar works will be preferred. Experience in externally funded projects will have added advantage.
44. **Electrical Engineering Expert (National):** Electrical Engineering Expert will be responsible for review and approval of designs/drawings/details as submitted by the Contractor, for the quality assurance and quality control and resolving contractual issued related to his/her field of expertise. The Electrical Engineering Expert (national) will assist the international expert in reviewing the electrical engineering design and the documentation, drawings and specifications submitted by the Contractor. Electrical Engineering Expert (National) will preferably i) be a graduate electrical engineer, preferably post graduate in control engineering, ii) have 10 years of experience in electrical design and implementation in multi-lot projects, iii) be versed in the application of relevant CAD tools, and iv) construction supervision of similar works will be preferred.
45. **Environmental Safeguard Expert (National):** The national Environmental Safeguard Expert will support the PMU and the international Environmental Safeguard Expert in the overall management and implementation of environmental safeguard policies of ADB and the Government of Maldives. Environmental Safeguard Expert (National) will preferably i) be graduate in civil engineering, structural engineering, environmental engineering, environmental management, environmental science or related field. ii) have minimum of 5 years work experience on monitoring/supervision capacity, and iii) sound knowledge of ADB procedures and policies, design and construction supervision, design and implementation of similar works will be preferred.
46. **Non-key experts and supporting staff:** The Consultant is expected to deploy non-key experts having qualifications and experience as necessary to deliver the project, such as, but not limited to:
 - i. International engineers to support the design review, to attend the factory acceptance testing, the commissioning procedures etc. of the DBO contract's scope;
 - ii. National and international site engineers;
 - iii. CAD operators and office support staff.

F Reporting Requirements and Time Schedule for Deliverables

47. **Reporting Requirements:** During the performance of the services, the Consultant will prepare required reports for submission to the Employer/Client in electronic form and/or hard copies as per Employer's instructions and in English language. The report format will be consistent with the requirements of ADB and Government of Maldives and will be proposed by the

Consultant in its inception report. The reporting formats will be subject to amended time-to-time in consultation with the Client. As a minimum the Consultant will submit following reports at periods stated in Table 3 hereunder.

Table 3: Reporting Requirements

Reports	Number of Copies	Time Schedule
Inception Report	Electronic copy only	Within a period of 30 days from the date of issuance of Notice to Proceed.
Monthly Progress Reports	Electronic copy only	Every month within 5 days of the commencement of next calendar month.
Quarterly Progress Reports	Electronic copy only	Every quarter within 10 days of commencement of next quarter.
Annual Progress Report	Electronic copy and 3 hard copies	Every year within 15 days of commencement of next year. For the purpose of Annual Progress Report the year will mean and refer either to Calendar year or other suitable period as the Client may decide in consultation with the Consultant.
Draft Completion Report	Electronic copy and 3 hard copies	Within 30 days of completion of Consulting Services Assignment.
Final Completion Report	Electronic copy and 3 hard copies	Within 30 days of issuance of Client's comments on Draft Completion Report.
Training programme for the capacity building	Electronic copy	At least 30 days prior to the commencement of the first training session
Any other reports	As required	As and when required by the Client.

G Employer's Input and Counterpart Personnel

48. Services, facilities and property will be provided by the Employer: Office accommodation with power and water supply for office establishment on site and in Malé.
49. Professional and support counterpart personnel will provided by the Employer.

H Inputs, Project Data and Reports to Facilitate Preparation of the Proposals

50. The Consultant will have access to the following inputs, project data and reports available with Client to facilitate preparation of the Proposals:
 - a) Data, reports, maps etc. as available with the Employer;
 - b) Feasibility reports, design reports and drawings as available with the Employer.
51. Any other input the Consultant deems necessary and the Employer is able to share will be provided upon request by the Consultant.

I Commencement of the Assignment

52. It is envisaged that the assignment will start three months prior to awarding the DBO contract (pls. refer to clause **Error! Reference source not found.**) to allow the Consultant to familiarize with the Contract.

ANNEX 1: REQUIREMENTS FOR EXECUTING AND IMPLEMENTING AGENCIES OF THE JAPAN FUND FOR THE JOINT CREDITING MECHANISM (JFJCM) GRANTS

1. The Ministry of Environment (MOE) will be responsible for developing a Waste to Energy plant project in Thilafushi under Greater Male Waste to Energy Project in the Maldives as a joint crediting mechanism (JCM) projects, and for fulfilling requirements as the project participant of the JCM project.
2. MOE will develop the JCM methodology and submit it to the JCM Joint Committee (JC) for approval. In case the methodology is not approved, MOE will revise the methodology and make best efforts to have it approved by the JC. Methodology approval is to be achieved before JCM project registration.
3. Upon methodology approval, MOE will prepare a project design document (PDD), hire an accredited third-party entity (TPE) to validate the project, and submit the project for registration to the JC. In case the project is not registered, the MOE will make necessary revisions to the PDD considering comments received and make best efforts to have the project registered. Project registration is to be achieved before commissioning of the project supported under the JFJCM.
4. MOE will monitor the project in line with the PDD and prepare a monitoring report at least once a year, based on the recorded monitoring data. The monitoring report will be reported to ADB. MOE will monitor the JCM project from commissioning until the end of the project operation or the expiry of the JCM bilateral document between the Maldives and Japan, whichever is earlier.
8. The Waste to Energy project supported under the JFJCM cannot apply for any other international carbon market mechanisms.