

**REQUEST FOR EXPRESSIONS OF INTEREST
(CONSULTING SERVICES – FIRM SELECTION)**

COUNTRY: Bangladesh.

NAME OF PROJECT: Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project
(Bangladesh PRIDE (P170688))

Credit No.: IDA-6676 BD

Assignment Title: Feasibility & transaction advisory services for integrated solid waste management facility
at BSMSN.

Reference No.: PMC-10-BSMSN-BEZA

The Government of the People's Republic of Bangladesh has received financing from the World Bank toward the cost of the Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project, a project under Bangladesh Economic Zones Authority (BEZA), and intends to apply part of the proceeds for consulting services.

Thus, BEZA wants to proceed with developing and implementing the comprehensive / integrated SWM facilities under a PPP structure, with a leading service developer/operator/provider as the private partner. In this context, BSMSN under Private Investment and Digital Entrepreneurship (PRIDE) Project financed by The World Bank Group, wishes to hire a Feasibility & Transaction Advisory Services to support and work with BEZA to execute the assignment. .

BEZA now proposes to invite Consulting firms to provide consulting services ("the Services") including, but not limited to, the following:

Phase 1

Component 1 : Component-1 is divided into two main and distinct sub-components (Component 1-a and Component 1-b).

Component1-a: Preparation of the detailed feasibility report and recommend a suitable PPP contract structure

Component1-b: Develop an interim SWM plan, following the ES/regulatory requirements through assessment of existing and likely SW generation until the commencement of operations of the integrated SWM facility under a PPP structure, current of SWM practices within BSMSN and assist BEZA in its implementation.

Phase 2

Component 2: Market Sounding

Component 3: PPP procurement

This assignment is proposed to be undertaken in two clear phases: Phase 1 will comprise the Detailed Feasibility Assessment and if approved by BEZA and other Government of Bangladesh entities, then BEZA will move ahead with Phase 2 of the assignment, which will comprise Market Sounding and PPP Procurement. At



the end of Phase 1 of this assignment, BEZA, at its discretion, could decide not to move ahead with the conduct of Phase 2 of this assignment.

Implementation period of the Services is estimated to be for a period of 24 months.

The details Terms of Reference (TOR) for the assignment can be found at the following website: www.beza.gov.bd. The final updated TOR will be included in the Request for Proposal document to be subsequently issued to only the shortlisted firms after completion of the shortlisting process.

The Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) Development Project now invites eligible consulting firms ("Consultants") to indicate their interest in providing the Services. Interested Consultants should provide information demonstrating that they have the required qualifications and relevant experience to perform the Services. The shortlisting criteria are:

1. At least 10 years (from the date of publication of this REOI) of experience in working on infrastructure PPP projects, particularly in conduct of detailed feasibility studies of infrastructure projects and providing transaction advisory services for PPP projects.
2. Experience of successfully completing at least 2 assignments of conducting detailed feasibility studies of infrastructure projects proposed to be developed as PPP projects.
3. At least 3 Transaction Advisory assignments of having facilitated successfully signed PPP contracts, in the last 10 years.
4. Experience of having successfully conducted Detailed Feasibility Studies and Transaction Advisory services to INTEGRATED SOLID WASTE MANAGEMENT Facility projects through PPP arrangement will be an advantage, though not mandatory.
5. Experience of working on detailed feasibility studies or PPP Transaction advisory assignments in South Asia or South East Asia will be an advantage, though not mandatory.

Key Experts will not be evaluated at the shortlisting stage.

The attention of interested Consultants is drawn to Section III, paragraphs, 3.14, 3.16, and 3.17 of the World Bank's "Procurement Regulations for IPF Borrowers" July 2016, Revised November 2020 ("Procurement Regulations"), setting forth the World Bank's policy on conflict of interest related to the assignment as per paragraph 3.17 of the Procurement Regulations.

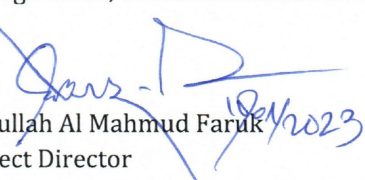
Consultants may associate with other firms to enhance their qualifications but should indicate clearly whether the association is in the form of a joint venture and/or a sub-consultancy. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected. In the case of the joint venture, each member of the joint venture should have at least one specific experience indicated above and General experience (10 Years). It is preferred that the joint venture should not include more than four members. The criteria to be used for short listing may normally include: core business and years in business, relevant experience, technical and managerial capability of the firm. The qualifications of sub-consultants will not be considered in the evaluation of EOIs for shortlisting purposes.



A Consultant will be selected in accordance with the **Quality and Cost Based Selection (QCBS) method; Market Approach-International** set out in the Procurement Regulations.

Further information can be obtained at the address below during office hours [i.e., 0900 to 1600 hours].

Expressions of interest may be delivered through courier service or in person (hard copy along with a USB drive) or through email to the address below by 06 February 2023, 1500 HOURS Bangladesh time. If delivered through email, the client shall not be responsible for the confidentiality of the EOI.


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TERMS OF REFERENCE FOR FEASIBILITY & TRANSACTION ADVISORY SERVICES FOR INTEGRATED SOLID WASTE MANAGEMENT Facility AT BSMSN

1. Background

Bangladesh Economic Zones Authority (BEZA) is a government agency setup under Prime Minister's office of Bangladesh to establish, license, operate, manage and control economic zones in Bangladesh. The Bangabandhu Sheikh Mujib Shilpa Nagar (BSMSN) is the largest economic zone in Bangladesh. This Economic Zone has been succinctly divided into several zones. BSMSN will be built with cutting-edge infrastructure and utilities, with an emphasis on green technologies and climate resilience mechanisms to help the zone become more ecologically friendly, addressing climate change and environmental conservation. One of the core initiatives of the project lies in its green development objective. As per the recommendation of the BSMSN master plan, BEZA envisages to plan, develop and implement a solid waste management facility aimed at managing mixed industrial and municipal solid waste, including collection, transfer, sorting, treatment, disposal, coupled with resource recovery and recycling of waste in a phase-wise/modular approach in BSMSN. The Solid Waste Management facility needs to be comprehensive and aligned to deliver on the Vision 2041 of the Government of Bangladesh. BEZA is keen to implement the Integrated Solid Waste Management Facility (ISWMF) as a public-private partnership (PPP) project.

In this context, a technical study was conducted by a leading consulting company to conceptualize and assess the preliminary viability of SWM services in BSMSN under PPP mode. The technical study will be made available to the consulting firm. The feasibility study should build on the work done by the technical study.

Thus, BEZA wants to proceed with developing and implementing the comprehensive / integrated SWM facilities under a PPP structure, with a leading service developer/operator/provider as the private partner. In this context, BSMSN under Private Investment and Digital Entrepreneurship (PRIDE) Project financed by The World Bank Group, wishes to hire a Feasibility & Transaction Advisory Services to support and work with BEZA to execute the assignment. .

2. Objective(s) of the Assignment

The main objective of this assignment is to support the development (design, construct, operation) of a SWM facility in BSMSN with PPP modality by carrying out a feasibility study (including technical, financial and environmental and social feasibility), detailed under the **Scope of Work** table below. This feasibility study will be used to design, construct and operate the SWM Facilities later on. The study will also develop a bankable PPP structure and basing on the status of feasibility this would also provide a transaction advisory service to procure a Private Sector Partner (PSP) including preparation of bid and contract document.



The detailed feasibility study would be informed by the Technical and Financial Assessment study (referred above and annexed the executive summary) undertaken for the ISWMF Project at BSMSN Economic Zone, would comply with World Bank Environmental and Social Standards, procurement and other requirements, follow GIIP and be in line with Government of Bangladesh requirements for PPP Projects, to support BEZA in securing requisite internal approvals, as well as approvals from PPP Authority and Cabinet Committee on Economic Affairs (CCEA).

3. Scope of Work

The major areas of the scope of work are summarized in Table below.

Component/ Phases	Task
Phase 1	Component-1 is divided into two main and distinct sub-components (Component 1-a and Component 1-b).
Component 1	
Component1-a: Preparation of the detailed feasibility report and recommend a suitable PPP contract structure	Task 1: Based on the technical studies available, identify a integrated, sustainable and implementable solid waste management system for BSMSN through detailed feasibility study (including technical, financial and environmental and social) on SWM of BSMSN which would include, but not limited to: a) Detailed site assessment and analysis of the nature and quantity of both, industrial and domestic solid waste likely to be generated, in various time frames, viz., first 5 years, 5-10 years, etc., to understand and plan the technical solution for integrated solid waste management in BSMSN in later stage; b) estimated revenue projections, based on different tariff scenarios (in line with existing tariff in domestic solid waste management in Bangladesh and tariff for management of industrial solid waste in neighbouring countries with similar economic development) and assessment of multiple potential and feasible sources of revenue for delivering SWM services including any potential for revenues from waste to energy, resource recovery, recycling if applicable, over the PPP contract period; c) Conceptual/indicative layout of the sorting, recycling, treatment and landfill facilities, including phasing of the proposed activities, proposed onsite infrastructures, including connectivity and utility requirements etc; d) Propose optimum specifications of all elements of onsite infrastructure of the ISWMF and their estimated capital and O&M costs; e) Financial Analysis and Assessment, including development of detailed project cost, O&M cost and revenue estimates, and develop a detailed financial model, based on financing assumptions from consultations with potential domestic and international financiers and on a bankable PPP structure, that could potentially include revenue share with BEZA; f) Economic

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	<p>Analysis and Assessment, including development of a model to arrive at EIRR and ENPV for the project; g) assess environmental and social risks and impacts, based on World Bank ESF, GIIP and Government of Bangladesh standards, including climate risk assessment and recommendations; h) legal & regulatory assessment to ensure that the proposed project configuration is in line with the BSMSN Master Plan, BEZA's Green and Resilience Economic Zone (GREZ) guidelines and Government of Bangladesh standards, with recommendations on the optimal PPP structure, in line with Bangladesh's PPP Act and PPP Authority's PPP guidelines and also if any amendments are required to facilitate implementation of the proposed project; and i) PPP modality options and recommendation on optimum risk sharing matrix, given the inputs received from interactions with BEZA, potential private sector partners and potential financiers, to understand their expectations.</p> <p>Task 2: Support BEZA in preparing reports and presentations that may be required to seek approvals from CCEA and any other Government of Bangladesh institution and in addressing any issues raised/ clarifications sought or revisions in the feasibility report required by the CCEA or any other government organization prior to approving the project for implementation under the PPP Act.</p>
<p>Component1-b: Develop an interim SWM plan, following the ES/regulatory requirements through assessment of existing and likely SW generation until the commencement of operations of the integrated SWM facility under a PPP structure, current of SWM practices within BSMSN and assist BEZA in its implementation.</p>	<p>Task-1: Based on an assessment of (i) the existing and projected (over the 3 years) development within BSMSN, through interactions with BEZA and BSMSN investors; (ii) current waste management practices for mixed industrial/domestic waste , including their approximate total volumes (type and quantity); (iii) technical capacity to manage such waste, current waste management practices in BSMSN and in other BEZA economic zones (to provide an insight into likely practices); (iv) availability of waste disposal site(s); (v) Consultation with relevant stakeholders propose SWM plan that can support a solution, in line with Government of Bangladesh's regulatory requirements and BEZA's GREZ guidelines, until the commencement of operations of the integrated SWM facility under a PPP structure. The interim SWM plan should incorporate a phase wise implementation strategy beyond the tenure of this interim plan such that it can be integrated into the long term, PPP ISWM Project.</p> <p>Task 2 : Develop an interim SWM project implementation plan, including bid documents and draft contract to attract a private sector contractor / service provider, if required, and also a detailed phase-wise time frame for implementation of the interim project.</p>

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<p>Phase 2</p> <p>Component 2: Market Sounding</p>	<p>Task 1: Market Sounding 'Briefing Document' to be prepared, based on the above approved feasibility report and PPP structure</p> <p>Task 2: Conduct market sounding with targeted potential national/international developer/operator/service provider with experience of developing similar project through structured questionnaire and/or in-depth discussions, to gauge their interest levels in participation and also to ascertain if the proposed feasibility study and PPP structure addresses their concerns / inputs shared in the initial market sounding</p> <p>Task 3: Recommend final PPP modality/risk-sharing structure by incorporating inputs from market sounding (if any changes are required).</p>
<p>Phase 2</p> <p>Component 3: PPP procurement</p>	<p>Task 1: Recommend appropriate procurement process – single stage or two stage, including justifications for the recommendation, in line with World Bank, BEZA and Government of Bangladesh's guidelines</p> <p>Task 2: If BEZA decides on two stage procurement process, prepare RFQ/ISD documents in accordance with Bangladesh law/PPP act and in line with World Bank's guidelines / frameworks</p> <p>While recommending procurement process, preparing various bidding documents and during evaluation of bids, adhere to and comply with the World Bank provisions regarding any specific issues relevant to the project, if any</p> <p>Task 3: a) Reach out to leading national/international developer/operator/service provider of SWM projects to try and attract maximum interest and bids for the project; b) Prepare documents / presentations required and support BEZA in the preparation and conduct of Pre-bid meetings / road shows / interactions with interested bidders;</p> <p>Task 5: Support bid evaluation committee in their initial evaluation of responses to RFQ (in case of two stage bid process);</p> <p>Task 6: Prepare RFP and the draft PPP agreement and other relevant agreements, if required, and support BEZA in responding to queries, etc., while securing relevant approvals for the same;</p> <p>Task 7: Support bid evaluation committee in their evaluation of responses to RFP;</p> <p>Task 8 : Provide support in the negotiation of the PPP agreement</p>

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	<p>with the preferred bidder and contract signing;</p> <p>Task 9: Prepare a comprehensive management plan for BEZA, in accordance with the provisions of the PPP agreement, to help BEZA in the management of the Project and its risks, rights and obligations and deliver at least 2 training workshops of 1-2 days each, to share this with BEZA in detail</p> <p>Task 10: Support BEZA in its role in helping the project / PPP Partner achieve financial close.</p> <p>Task 11: Any other support that may be required through the management of bid process, negotiation and signing of the PPP agreement and financial close.</p>
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This assignment is proposed to be undertaken in two clear phases: Phase 1 will comprise the Detailed Feasibility Assessment and if approved by BEZA and other Government of Bangladesh entities, then BEZA will move ahead with Phase 2 of the assignment, which will comprise Market Sounding and PPP Procurement. **At the end of Phase 1 of this assignment, BEZA, at its discretion, could decide not to move ahead with the conduct of Phase 2 of this assignment.**

4. Detailed Tasks:

Component 1: (a) Undertake detailed feasibility with PPP option recommendations and (b) prepare an interim SWM plan:

Component 1-a- Preparation of the detailed feasibility report and recommend a suitable PPP contract structure

The detailed feasibility report is expected to be developed based on the technical study. The detailed feasibility study will include the proposed integrated SWM facility including all the identified sub-project components and options as discussed in the earlier study for BSMSN. The detailed feasibility study will be followed by the recommendation of a suitable PPP contract structure. The detailed feasibility study will include the following:

A. Technical due diligence. The consultant will carry out the technical due diligence, analysis, and assessment of the project, including:

(i) A comprehensive assessment of the proposed site for the integrated waste management facility. This assessment will include, amongst others the following aspects : (a) location of the industries and residences, the generators of waste, within BSMSN; (b) availability or possibility of making available utilities and other external infrastructure required at the site; (c) possibility of supporting

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a phase-wise implementation plan for the facility; (d) possible environmental and social impact; (e) different methods/techniques of SWM. (f) other relevant aspects;

(ii) Proper and comprehensive benchmarking exercise should be done considering all the required and relevant parameters applicable for the proposed SWM facility;

(iii) A comprehensive forecast of the volumes per type of waste (domestic, industrial, hazardous, etc.), likely to be managed by the SWM project should be done, based on a well-structured and comprehensive consultation with BEZA, current and potential tenants/ unit industries and other similar operating economic zones in Bangladesh and neighbouring countries' economic zones, and any other relevant stakeholder;

(iv) Based on the above assessment of the types and volumes of waste to be managed by the SWM facility, and an assessment of waste treatment technology options, prepare a comprehensive project configuration for the integrated solid waste management project, that details all elements of the project (collection, transfer, sorting, recycling, treatment, landfill, etc.) and their technologies/processes and delivers on the requirements of the Government of Bangladesh's environmental norms, BEZA's GREZ guidelines, BSMSN's master plan, etc.

(v) The consultant should prepare conceptual/indicative layout of the proposed SWM facility in line with the overall master plan for BSMSN (annexure 02) keeping linkages and connectivity to the rest of BSMSN and also to various infrastructure facilities within BSMSN;

(vi) The consultant should undertake baseline survey (environment and social), technical investigations (topographic and geo-technical) and provide detailed technical specifications and engineering designs of all proposed infrastructure facilities, which should include detailed cost estimates based on estimated bill of quantities (BoQ) and BEZA approved rates for each infrastructural component along with their operation and maintenance costs, including costing of environmental and social management/mitigation plan, resilience and monitoring requirements, providing a solid estimate of the project cost and O&M cost of the project (input into the Capex and Opex estimation of the financial feasibility);

(vii) Based on the assessment of the quantum and nature of waste managed (estimated above), the consultant should project revenue from resource recovery, recycling and treatment over the PPP contract period;

(viii) The consultant should identify all the linked projects and facilities, if any, related to the integrated SWM facility at BSMSN. The implications and impacts of these projects and facilities should be factored in the overall technical and financial viability of the SWM project;

B. Legal and Regulatory framework and Project structure



The consultant will undertake a detailed analysis of the legal and regulatory framework in Bangladesh pertaining to SWM projects, within Economic Zones. This analysis should include, amongst others, the following:

- (i) Review existing laws/acts that govern the generation and management of municipal/industrial solid waste in Bangladesh;
- (ii) Review existing laws/acts that governs the inception, planning, approval and implementation of SWM projects in Bangladesh;
- (iii) Explore the existence of SWM projects within the municipal/industrial areas and evaluate the policy or legal/regulatory framework under which such projects were implemented and are governed, particularly explore any projects that is operating within an industrial zone and providing the services directly to industrial consumers within the industrial zone
- (iv) Informed by the above reviews and assessments, the Consultant should evolve alternative project structuring and implementation options. The consultant would identify the pros and cons of each such structure from the point of view of (a) delivering on BEZA's objectives from the project and being amenable to BEZA's preferred risk sharing matrix; (b) attractiveness to potential private sector participants; (c) risk profile and its impact on bankability; (d) project implement-ability, in terms of project phasing, implementation time period and associated risks; and (e) any other factors that the consultant deems appropriate;
- (v) Develop a recommended project structure, including justifications for the same, with a well-defined implementation phasing and list of approvals or licenses that would be required and the associated challenges and time frames for the same

C. Financial Analysis and Assessments. The consultant will carry out a detailed financial analysis and assessment of the project including:

- (i) prepare capex (covered in A vi above), operating and maintenance cost estimates (covered in A vi above), tariff policy based on current tariffs in operational economic zones in Bangladesh, cost recovery/revenue generation options based on best practices or any other factors deemed relevant by the consultant over the likely tenure of the concession period, which are based on verifiable data and are sufficient to support project implementation and operation and which include step-ups and indexation where relevant, and indexation mechanism for various cost items;
- (ii) Evolve a financing plan based on (a) evaluation of financing structures of recently financially closed similar or other infrastructure PPP projects in Bangladesh or neighbouring developing economies; (b) interacting with potential sources of debt, sub-debt and equity in Bangladesh and also some potential international financiers and the corresponding terms and conditions of the same; (c) securing inputs from BEZA regarding the funds available under the World Bank supported PRIDE project for supporting this project; (d) interactions with potential private sector partners to understand their preferred or likely financing structure for this / similar projects;



(iii) Prepare a detailed financial model in Microsoft Excel for the entire project, based on the revenue projections, project cost estimates and O&M cost estimates derived in the technical due diligence section of the feasibility study and the proposed financing plan. The financial model should include, but not be limited, to the following:

- a. Assessing if the project is financially feasible and bankable, at different levels of revenue share with BEZA, based on its Project and Equity IRRs, NPV, Debt Service Coverage Ratio and other metrics of feasibility assessment;
- b. Undertaking sensitivity analysis, i.e., "what if" scenarios, across various key parameters of the project to assess whether the project is financially feasible and bankable even under various adverse scenarios
- c. determining value for money (VFM) for BEZA under PPP structure; and
- d. evaluating other commercial structures as may be required;

The financial model should include appropriate accounting, depreciation and tax treatments relevant for the project. The financial model should allow for the input of an array of assumptions and outputs that are typical for similar SWM projects to calculate pretax project IRR, project IRR, WACC, NPV, equity IRR, DSCR and LLCR. The financial model should provide outputs including projected financial statements (cash flow, balance sheet, profit and loss, etc.), feasibility metrics, project returns, etc., and provide outputs in tabular and chart forms.

The financial model in Microsoft Excel should be provided to BEZA in an unlocked form, i.e. formulas visible and editable in cells and, as a minimum, the models should include all of the above mentioned parameters and be for at least the likely PPP contract period.

Conduct walk-through of the financial model for BEZA as may be required; make and deliver presentations to other agencies of the Government of Bangladesh, like the Prime minister's Office (Line Ministry) and others, the World Bank, and other parties as requested on the financial analysis and other aspects of the project and respond to any queries or clarifications sought.

D. Economic Analysis and Assessment. The Consultant will carry out an economic analysis of the project in accordance with the guidelines of the Government of Bangladesh including:

- (i) review the macroeconomic context of the project to provide an understanding of the economy's overall performance and outlook, and of how specific macroeconomic factors may affect project performance;
- (ii) undertake demand analysis and analysis of the positive impact on the environment for the project; demand an environment impact analysis would provide the basis for estimating the scale of, and economic benefits from, the investment project;
- (iii) identify the project rationale for public intervention which can be based on the failure of (a) markets to adequately provide what society wants, or (b) public institutions to deliver public goods or services;
- (iv) help identify demands/problems to be solved by the project, the project intervention, outputs, expected outcomes and impacts;

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- (v) identify project alternatives; least-cost analysis to be undertaken to identify the preferred alternative; the basis for selecting the preferred alternative should be clearly explained, particularly if it is not the least-cost alternative in economic terms;
- (vi) undertake and compare project benefits and costs in economic terms using with-project and without-project scenarios for each major project component; the basic criteria for assessing the project economic viability will be economic net present value and economic internal rate of return for subprojects/linked projects and total project; border parity pricing should be applied for major tradable cost and revenue items, along with other appropriate conversion factors;
- (vii) undertake distributional analysis of project benefits to project beneficiary and stakeholder groups, and the extent to which they gain from benefits or bear costs associated with the project; undertake poverty impact assessment where necessary;
- (viii) undertake sensitivity and risk analysis; where possible undertake a quantitative risk analysis and explicitly include probability distributions of key uncertain variables;

Undertake a value for money analysis to assess whether the project is beneficial economically and financially

E. Environmental and Social Assessment and Preparation of ESMP. As part of this exercise, consulting team will conduct an assessment of potential impacts of proposed SWM facility on the environmental and social issues on the proposed site, including resettlement, if required. The consultant team will follow the ESF of WB while conducting the ES assessment. This may not be a full environmental and social impact assessment (ESIA), or resettlement plan but a comprehensive review of the key ES issues. Information from different ES instruments (ESMF, ESIA, BMP etc.) developed so far for the PRIDE project may also be referred.

A review of the baseline study of physical environment should be included for the proposed site, which may include but not be limited to: i) climate, ii) land use/topography, iii) agriculture, iv) ecology, v) air quality, vi) noise, vii) soil quality and geology, viii) surface water, and ix) ground water etc.

In addition, an assessment of the biological environment should be undertaken and should include, but not be limited to: i) vegetation, ii) flora and fauna, iii) animals, and iv) ecologically sensitive/protected areas or special areas in the surrounding community.

Lastly, a review of the human and social environment should be undertaken and should include, but not be limited to: i) occupational health and safety and community health and safety, ii) socioeconomic, land acquisition and resettlement issues, iii) working & labour condition, iv) minority/child issues iii) historic and cultural aspects, if applicable.

This review should also specifically address issues related to gender, the disadvantaged and the vulnerable, and i) if and how women and girls, the disadvantaged in particular will be impacted by the project and ii) how they can be included in the benefits that the community will derive from the project.

At this stage, the consulting firm should highlight areas of significant problems or highlight key ES issues and propose ways of both appropriate mitigation measures the problems and designing management plans in light of GREZ guidelines of BEZA (GREZ) and WB. for moving forward. While undertaking this review, it should be kept in mind that the site will be utilized for a variety of industry sectors and green infrastructure facilities for which these impacts on the physical and social environment must be identified and mitigated in the future. All mitigation measures along with the regulatory and safeguard requirements for both the environmental and social aspects should be quantified in such a way that the costs can be included directly in the financial and economic analysis.

The output of the consultant firm should include a detailed Terms of Reference for a Detailed Environment and Social Impact Assessment study and Management Plans to be undertaken at a later stage as per ESF of WB.

F. Climate risk assessment. Based on an initial climate risk screening assessment of the project, the performance of the proposed investment is likely to be affected by future changes in climate conditions and their impacts including temperature increase, precipitation increase, flood, and land slide risk. To achieve the impact and outputs of the proposed investments, a climate risk and vulnerability assessment (CRVA) is required to provide a detailed and focused risk and vulnerability assessment that will identify and, to the extent possible quantify risks to the project from climate change and variability, and provide corresponding adaptation measures. Outputs of the CRVA will be used by the PPP SPV to finalize detailed design.

Scope of work.

- (i) Conduct a climate change vulnerability and risk assessment for the project area to identify vulnerability of the planned infrastructure, and adaptation measures to be incorporated into the project design;
- (ii) review existing studies, data and information on current and projected climate change risks and vulnerability for the proposed specific geographic areas and sectors covered by the project;
- (iii) identify climate risks and vulnerabilities and potential adaptation options and practices as inputs to modelling and/or assessment of climate change impacts on relevant aspects of the project;
- (iv) conduct technical and economic assessments of potential climate risk and vulnerability adaptation options and practices relevant to the project;
- (v) within the context of the project, assess existing policies, laws and regulations and/or institutional framework for adaptation and identify ways to enhance the enabling environment (if necessary);

G. PPP Options. The consultant should identify and evaluate all the possible PPP options for implementing the Integrated SWM Project at BSMSN, and recommend the one best suited to this project. The pros and cons of each option should be evaluated rigorously across an exhaustive set of relevant criteria, which would include, amongst others, the following:

- i. Deliver on BEZA's objectives from this project;



- ii. Maximization of SWM capacity and utilization/recovery of resources within BSMSN;
- iii. Optimal risk sharing between BEZA and the Private Sector Partner, with each partner bearing the risks that they are best equipped to address / mitigate
- iv. Attractiveness to potential private sector participants / bidders
- v. Financial returns to the private sector partner and BEZA (if the option recommends investment participation by BEZA from its receipts from PRIDE Project)
- vi. Bankability, i.e., levels of comfort to potential lenders to the project
- vii. Ability to absorb the funding available to BEZA for this project from PRIDE project, in a manner that optimizes BEZA's financial returns as well as is in line with BEZA's capacity to manage this investment;
- viii. Maximizes BEZA's and the Government of Bangladesh's Value-for-money;
- ix. In line with the current legal and regulatory framework;
- x. Any other criteria that the Consultants believe to be appropriate for this evaluation

The consultant should detail out the recommended PPP option across all its dimensions, including the roles and responsibilities of BEZA and the private sector partner. The Consultant should also outline the pros and cons of the recommended PPP option and also its risks and potential risk mitigation measures.

The consultant would support BEZA in preparing reports and presentations that may be required to seek approvals from CCEA, DoE and any other Government of Bangladesh institution and in addressing any issues raised/ clarifications sought or revisions in the feasibility report required by the CCEA or any other Governmental entity prior to approving the project for implementation under the PPP Act.

***The feasibility study report shall be prepared in accordance with the scope as detailed above including the requirements of the Planning Commission of Bangladesh.*

If the Project is approved by BEZA and appropriate entities of the Government of Bangladesh, BEZA would move ahead with Phase 2 of this assignment, comprising Market Sounding (Component 2) and PPP Procurement (Component 3).

Component 1-b: Assessment of existing SW generation and management within BSMSN and preparation of an interim SWM plan, informed by the ES/regulatory requirements and the proposed implementation strategy for the Integrated SWM PPP project

The consultant should conduct an assessment of existing type/quantities of solid waste generated by the project area and the likely solid waste generated within the next 3-4 years or so, current method of solid waste management, current disposal site being used and its appropriateness as a landfill site, examining institutional capacity to deliver on solid waste management, legal/regulatory/health concerns with respect to current SWM practices, and any other aspects the Consultant deems to be important.

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Based on this assessment the Consultant should develop an interim SWM solution, to cater to solid waste management until the Integrated SWM PPP Project commences operations, i.e., a period of 3-4 years. The interim solution should include recommendations on the optimal approach and proposed organizational structure and staffing for waste management during this interim period and should also take into consideration the likely project configuration of the Integrated SWM PPP Project. The interim SWM solution shall address the all regulatory, environment and social management plan/cost for monitoring and mitigation requirements along with an overall implementation strategy which identifies the steps, decisions and actions needed to implement the recommendations of the study, including terms of reference for any required technical assistance to build institutional, financial and private sector participation capacity and also bid / procurement documents and draft contracts, if required, to attract private sector service providers to deliver on this solution

The consultant shall provide hands-on assistance to BEZA during this interim period to implement the recommendations in a timely and integrated manner.

Component 2: Market Sounding

In this component the transaction advisor would engage in detailed consultation with potential private sector entities interested in this project.

Objectives

The main objective of market sounding is to test private sector's ability to assume risks that are to be transferred via the PPP contract from BEZA to the private sector. The objectives of the market sounding are to:

- Generate interest in the proposed SWM Project, and encourage new, private sector parties to come forward with their ideas.
- Understand the expectations, maturity and readiness of potential market participants in the project, and the factors affecting their level of interest.
- Test the market's appetite to share the risk of development and the size, scale and scope of the market for potential participation.
- Receive market views and feedback on how the potential development of the project could best be undertaken.
- Understand the merits of different development and procurement routes, to inform the next stages of project development

Market sounding would focus on the private sector as a whole, rather than on any individual company. The Consultant, together with BEZA, will conduct a Market Sounding exercise with existing and potential promoters, funders, financiers, developers, advisors, construction

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contractors and other industry participants to assess market interest in the SWM Project at BSMSN. It includes no element of evaluation, and there is no commitment of any kind involved.

The Consultant should conduct at least one offline market sounding workshop in Dhaka, inviting as many potential members of the target audience as possible, in association with BEZA and engage intensively to get a good understanding of the attractiveness and challenges with the project and proposed project structure. The Consultant should build in the costs for conduct of such a 2-3 hour workshop, including costs for venue, catering, etc., in Dhaka, into its financial proposal.

The other interactions as part of the market sounding exercise could be undertaken on a one-on-one or group basis, virtually or physically, by the Consultant.

Process

To provide respondents with some relevant background, the Advisor will also produce a **Market Sounding Briefing for SWM Project (the 'Briefing Document')**. This Briefing Document would include a brief description of the SWM Project, including its sub-projects, the total estimated capacity of the project, the estimated size of the investment, the broad contours of the PPP model, the role of BEZA as a Contracting Authority, and other key aspects of the project as deemed appropriate.

The consultations should be undertaken by a mix of using a free-flowing discussion as well as a discussion based on a broad guideline, covering specific areas, agreed on with BEZA, prior to the start of the Market Sounding interaction. The areas of discussion may be structured under the following topics, amongst others:

- a. interest in the project
- b. the readiness, maturity and capability of the market
- c. structuring the development process
- d. barriers and enablers to sharing risk of development

Component 3 : PPP Procurement

Upon approval of the Detailed Feasibility Assessment and decision by BEZA to move forward with the PPP transaction, , the Transaction Advisor is expected to:

- Review whether the Business Case remains valid and if required, revise accordingly;
- Based on the output of the Market Sounding exercise and other inputs, evaluate and recommend whether the PPP Procurement should be a two-stage process or a single stage process, along with sound justifications for the same;
- Support BEZA in selecting appropriate procurement process, preparation of bidding documents, evaluation of bids, and contract agreement development complying with WB provisions on any specific issues relevant to the project;
- If BEZA chooses a two stage process and if the PPP Authority and other appropriate Government of Bangladesh entities have approved the same, then the Advisor would draft a Request for Pre-Qualification (RfQ), including an Information Memorandum and seek BEZA's and the PPP Authority's approval of the same;



- Support BEZA to advertise and market the project to enhance the competitiveness of the bid process ;
- Support BEZA in the preparation and conduct of pre-bid meeting(s) with all interested private sector partners and also help BEZA draft minutes of such meeting(s) and draft responses and clarifications to all questions raised at the pre bid meeting(s);
- Support the bid evaluation committee, as required, in evaluating the responses to the RfQ and in developing a short-list of bidders;
- Draft the Request for Proposal and the draft PPP contract / agreement, in line with the PPP Act and other similar PPP contracts / agreements executed in Bangladesh in the recent past. Discuss these drafts with BEZA and the PPP Authority and secure approval for the same, including from the Government of Bangladesh's Law Department, if possible, at this stage (else, this would be mandatorily required prior to finalization of the concession agreement and prior to signing of the agreement);
- Support BEZA in responding to any queries and clarifications from short-listed bidders;
- Support the bid evaluation committee, as required, in evaluating the responses to the RfP and in identifying the preferred bidder and the top one or two fall-back bidders (in order of preference);
- Support BEZA in negotiating and signing the PPP Contract / agreement and support BEZA in its role of facilitating the process of the project achieving financial close;
- Within 1 month of signing the PPP Contract / Agreement, the Advisor should prepare a comprehensive project management plan for BEZA, in accordance with the provisions of the PPP Contract / agreement, including formats for regular reports and project MIS, to help BEZA in the management, monitoring and supervision, of the Project and its risks, rights and obligations. The Advisor should undertake at least two detailed training workshops of 2-3 days each, on implementation of this project management plan, including gaining a detailed understanding of BEZA's role in monitoring and supervision and its risks, rights and obligations on the project, for personnel identified by BEZA.

5. Expected Time Schedule

The total duration of consulting services is estimated to be 24 **months** (9 months for the feasibility study and proposed PPP structure and securing approval of CCEA and other Government of Bangladesh authorities; 9 months for procurement phase until commercial close or signing of the PPP Agreement as well as to develop project monitoring manuals and training BEZA personnel in project implementation monitoring and supervision; 6 months (starting with signing of PPP agreement) to support the preferred bidder in achieving financial close). The implementation schedule expected is as shown in table.

Key Activities	Tentative Dates
Invitation of EOI	13 th January 2023
Issue of RFP	01 st March 2023

Commencement of Consulting Services	20 th August 2023
Expected Termination of Consulting Services	20 th August 2025

6. Expertise Required

The required key experts for this work is given below:

Key Experts and indicative Expected Person-Months (PM)

SN	Position	No	MM	Total
1	Team leader / Waste Management expert	1	12	12
2	Waste Treatment expert (including Waste to Energy)	1	6	6
3	Waste Management Expert	1	8	8
4	Circular Economy (Recycling/Reuse) expert	1	4	4
5	PPP/project financing	1	13	13
6	Environmental Specialist	1	4	4
7	Social Specialist with gender and land experience	1	4	4
8	Procurement Specialist	1	9	9
9	Legal Expert	1	6	6
Total		8	66	66

Note: The above are purely estimates of the number of person months of engagement likely to be required for each position and are not definitive. Consultants should base their proposals based on their own estimates of person months of involvement required for each Position to deliver on the scope of work outlined above.

7. Qualifications

The following table provides minimum qualifications (educational background and professional experience) required for each Key and non-key Expert.

Qualification of Key Experts

SN	Position	Qualification	Experience
	Key Expert:		

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SN	Position	Qualification	Experience
	Key Expert:		
1	Team leader / Waste Management Expert	Master's degree in Environmental Science/Management, Civil Engineering or any other relevant field. Advance academic or professional qualification in Industrial Resource Efficiency or Waste Management will be given preference.	<ul style="list-style-type: none"> • Minimum 15 years general experience in infrastructure sector & PPP Projects • Minimum 10 years experience in waste management projects . • Experience of having successfully completed at least 2 Feasibility Studies for integrated waste management projects and 2 Transaction Advisory Assignments for Waste Management PPP projects. • Experience of working on waste management projects in Asia/South East Asia will be given preference.
2	Waste Treatement Expert (including Waste to Energy)	B.Sc Degree in Civil/ Mechanical/ Electrical Engineering/Environmental Science or any other relevant filed. Any advanced degree/professional qualification in the relevant field will be given preference.	<ul style="list-style-type: none"> • Minimum 10 years general experience in Waste Management and/or Waste Treatment projects . • Minimum 5 years specific experience in designing, developing, undertaking feasibility assessments of waste treatment and waste to energy projects . • Experience of working on at least 02 (Two) waste treatment (including waste to energy) projects. • Experience of working on waste treatment and waste to energy projects in Asia/South East Asia will be given preference.
3	Waste Management Expert	Master's degree in Environmental Science/Management, B.Sc. Degree in Civil Engineering or any other relevant field. Advance academic or professional qualification	<ul style="list-style-type: none"> • Minimum 8 years general experience including in waste management projects. • Experience of having successfully completed at least 2 Project Configuration

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SN	Position	Qualification	Experience
	Key Expert:		
		in Industrial Resource Efficiency or Waste Management will be given preference.	and Feasibility Studies for Integrated Waste Management projects, <ul style="list-style-type: none"> • Experience of working on waste management projects in Asia/South East Asia will be given preference
4	Circular Economy/ Sustainability (Recycling/Reuse) Expert	Masters of Science in Environmental Economics/ Economics/Natural Resource Management/Environmental Science, Engineering or Management or any other relevant field	<ul style="list-style-type: none"> • Minimum 10 years experience of working on waste management projects.. • Minimum 5 years experience of designing / structuring or implementing or operating recycling and reuse in waste management projects . • Experience of designing, structuring, implementing or operating at least 01 (One) waste management project in Asia/South East Asia
5	PPP/Project Financing Expert	Master's degree in business administration/procurement/ Accounting/ Law or Engineering or in a similarly related field. Advanced academic / professional qualification in PPP will be given preference.	<ul style="list-style-type: none"> • Minimum 10 years general experience in PPP or infrastructure finance . • Minimum 5 years experience in advising on PPP projects. • Experience of completing at least 02 feasibility studies and 02 transaction advisory assignment in PPP projects. • Experience of working in waste management project in PPP modality in South Asia/South East Asia will be given preference,

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SN	Position	Qualification	Experience
	Key Expert:		
6	Environment Expert	Bachelor's degree in environmental science/environmental management or other relevant field. Any advanced degree/diploma/professional qualification in the relevant field will be given preference.	<ul style="list-style-type: none"> • Minimum 10 years general experience in environmental aspects of projects • Minimum 5 years specific experience of working on environment aspects of infrastructure projects. • Experience of working in the development at least 01 (One) waste management project. • Experience of working in South Asia / South East Asia will be given preference.
7	Social Expert	Master's degree in Social Sciences, Sociology or other relevant field. Any advanced degree/diploma/professional qualification in the relevant field will be given preference.	<ul style="list-style-type: none"> • Minimum 10 years general experience in social aspects of projects including gender and land experience • Minimum 5 years specific experience of working on social aspects of infrastructure projects. • Experience of working in the development at least 01 (One) waste management project. • Experience of working in South Asia / South East Asia will be given preference.
8	PPP Procurement/ Transaction Advisory Expert	Master's degree in business administration/procurement/ Engineering (Bachelor) or in a similarly related field. Advanced academic qualification in procurement and supply chain management (e.g. MCIPS, CPSM) and professional certification in PPP will be given preference.	<ul style="list-style-type: none"> • Minimum 10 years' experience of procurement in infrastructure projects. • Experience of transaction advisory / procurement of at least one infrastructure PPP project, preferably in South Asia. • Experience of working on at least one World Bank or other Multilateral financed infrastructure project, as a procurement expert.

SN	Position	Qualification	Experience
	Key Expert:		
9	Legal expert	Bachelor's degree in law or other relevant fields. Any advanced degree/diploma/professional qualification in the relevant field will be given preference.	<ul style="list-style-type: none"> • Minimum 10 years general experience in commercial law • Minimum 07 years specific experience in legal issues related to infrastructure projects • Experience of working on at least Two infrastructure projects in Bangladesh. • Preference will be given to those who have the experience of working on waste management projects in Bangladesh.

8. Deliverables and Tentative Time Schedule for Deliverables

Deliverable No.	Payment Schedule	Deliverables / milestones	Timeline
Deliverable - 1	1 st Payment (10%)	Inception report with presentation- including detailed work plan, methodology and resourcing proposed to undertake the study and identification of key risk items, along with feedback from the field visit for the project.	Within 1 month
Deliverable - 2	2 nd Payment (5%)	Interim report , including key findings of the preliminary assessment for the interim SWM plan for BSMSN, along with presentation to BEZA	Within 3 months
Deliverable - 3	3 rd Payment (10%)	Draft Final Feasibility Report with presentation and workshop on the Feasibility Study as per requirements of the ToR.	Within 5 months

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Deliverable No.	Payment Schedule	Deliverables / milestones	Timeline
Deliverable - 4	4th Payment (5%)	Final Report on the Interim SWM Plan and implementation plan	Within 5 months
Deliverable - 5	5th Payment (10%)	Final Feasibility Report: Comprehensive Feasibility Report Prepared, incorporating BEZA's comments and Bankable PPP SWM Project Structured.	Within 6 months
Deliverable - 6	6th Payment (10%)	Market Sounding Report based on Stakeholder Consultations, workshop and presentation of the same to BEZA	Within 10 months
Deliverable - 7	7th Payment (10%)	Preparation of draft RFQ/ISD document and approval of the same by the World Bank	Within 12 months
Deliverable - 8	8th Payment (5%)	Assistance in Pre-bid Meeting(s), response to bidder queries, support bid evaluation committee in evaluation of proposals received in response to RFQ/ISD and assist in preparation of evaluation report	Within 14 months
Deliverable - 9	9th Payment (10%)	Preparation of draft RFP and PPP agreement and Presentation / Workshop for BEZA; and getting the drafts approved by BEZA and the World Bank.	Within 15 months
Deliverable - 10	10th Payment (10%)	Assistance in Pre-bid Meeting(s), response to bidder queries, support bid evaluation committee in evaluation of proposals received in response to RFP and Preparation of evaluation report	Within 18 months
Deliverable - 11	11th Payment (5%)	Assistance in negotiations, assistance in getting necessary approvals from CCEA, law ministry and issuance of Letter of Award (LOA)	Within 19 months
Deliverable - 12	12th Payment (10%)	Contract Signing, Supporting BEZA in its role of facilitating the preferred bidders	Within 24 months

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Deliverable No.	Payment Schedule	Deliverables / milestones	Timeline
		achieving Financial Close for the project. Preparation of Project Management Plan and at least 2 training workshops of 1-2 days each for BEZA personnel on implementation of the project management plan	

****10(Ten) copies of each report has to be submitted along with a soft copy**

9. BEZA's Input and Counterpart Personnel Services, facilities, and property to be made available to the Consultant by BEZA are as follows:

- (i) introduce the Consultant to relevant Government of Bangladesh stakeholders in the collection of pertinent information on project sites;
- (ii) provide access to the project site and furnish information related to land area, etc. of the project site;
- (iii) usage of the conference room for stakeholders' meetings/workshop;
- (iv) furnish information on industrial units that have been allotted land to establish manufacturing facilities in BSMSN and make introductions to some of these companies, if required and
- (v) try and support the Consultant with information on any other aspects related to the economic zone and introductions to other appropriate Government agencies

BEZA will nominate a senior resource as a single point of contact for the Consultant and will also nominate a core team who will be responsible to interact with the Consultant on a regular basis and be the first point of evaluation / assessment of all Consultant's outputs.

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ANNEXURE 01

Technical advisory on solid waste management including landfill,
biogas plant, sorting and recovery material facility (waste treatment)
at BSMSN-Zone 2

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Executive summary

The first phase of the Prefeasibility Study is to establish the baseline through the analysis of the current situation in relation to the management of Municipal Solid Waste in Bangladesh. For this purpose, the institutional and organizational framework is analyzed, identifying and describing the main institutions involved (Government of Bangladesh, Bangladesh Economic Zone Authority (BEZA), etc.) and the possible business models (direct provision, complete PPP, mixed PPP...).

At the same time, the analysis of the legal framework related to this study has been developed, where the general regime for environmental management is addressed (National Environmental Policy, Bangladesh Environment Conservation Act, National Environmental Management Action Plan), the strategies for managing solid waste (National Strategy for Waste Management) or the guidelines for specific types of waste (Bangladesh Standards and Guidelines for Sludge Management, Medical Waste Rules, Draft Hazardous Waste Management Rules) are revised.

To conclude, the contextual framework directly related to waste management is addressed. To this end, a series of projections are established regarding the population and waste generation in BSMSN, the geographic area to which the scope of the project is delimited. The timeframe defined for these projections is between 2023 and 2043, in which population and waste generation projections are made based on the latest information available, different hypotheses and three (3) scenarios:

- **Scenario 1.** During Phases 2 & 3 50% of the employees of BSMSN zone 2 and their families will be living in the residential area of industrial city (BSMSN), while the rest of the employees will commute thanks to the transportation systems developed in the area.
- **Scenario 2.** During Phases 2 & 3 25% of the employees of the entire BSMSN and their families will be living in the residential area of industrial city (BSMSN), while the rest of the employees will commute thanks to the transportation systems developed in the area.
- **Scenario 3.** During Phases 2 & 3 50% of the employees of the entire BSMSN and their families will be living in the residential area of industrial city (BSMSN), while the rest of the employees will commute thanks to the transportation systems developed in the area.

After having analyzed the data provided by the three (3) scenarios, it has been decided to establish "**Scenario 2**" as a **baseline for the present study**. It is the base scenario, where most of the employees do commuting and only the 25% of employees and their families live in BSMSN. This is the most reasonable and probable scenario according to BEZA.

Once the projections in terms of waste generation have been established, the technological alternatives for waste management, treatment and valorization are presented and analyzed, categorized as follows:



- Solid waste separation and collection
- MSW treatment options:
 - Mechanical treatment / MRF / Sorting plants
 - Bio-drying
 - Aerobic composting
 - Biomethanization / Anaerobic Digestion
 - Thermal processing (pyrolysis, gasification...)
- ISW treatment options:
 - Non-hazardous ISW treatment technologies: similar to MSW
 - Hazardous ISW treatment technologies: chemical, physical, biological, thermal...
- Sludge treatment options:
 - Dewatering
 - Biological treatment (anaerobic digestion, composting...)
 - Thermal treatment (pyrolysis, gasification, oxidation...)
 - Physico-chemical treatment for hazardous sludge: immobilization, precipitation, centrifugation...)

The second stage focuses on the pre-selection of these technological alternatives that integrate the different scenarios, which is carried out through the following tools: i) assessments obtained in the SWOT analysis of alternative technologies, ii) references of operation and functioning of the combination of technologies, iii) BATs and latest trends in waste treatment in other countries and iv) local context and the objectives defined for BSMSN.

Finally, after establishing the baseline for the study, together with Scenario 2 selected for solid waste generation projections and the technological options analyzed, some alternatives have been studied, which include different options for RDF and syngas / biogas treatment. Although the objective of this consultancy is to propose alternatives for the integral solution of the problem of solid waste management in BSMSN, the consultant proposes to do so in a realistic, modular and phased manner. For this reason, it is planned to divide the time frame of the project into four stages (5 years period for each stage).

- Stage I (2024-2028)



- Stage II (2029-2033)
- Stage III (2034-2038)
- Stage IV (2039-2043)

Moreover, this Consultancy includes not only the present Pre-Feasibility Study (PFS) for Waste Management services, but also three captive PFSs: sorting plant, waste to biogas plant and thermal treatment plant. For each PFS (general and captive studies), the following components have been defined and analyzed:

- Capacity justification: including the sizing of the proposed infrastructures in terms of treatment capacity and operating regime in the time frame of the study.
- Parameters and specifications: including a flow chart of each of the proposed infrastructures together with the estimated needs in terms of surface area, CAPEX, OPEX and revenue forecast.
- Contribution to the final objective: including the waste avoided in landfills resulting from the application of the combination of technological alternatives included in the analysis.
- Mass balance: including a breakdown of the flow of tons/year into and out of each of the processes.
- Timeline: planning, within the timeframe of the study, of the construction and start-up of the different infrastructures included in the study.

Table 1. Summary of proposed PFS.

Proposed PFS	Description	Technologies
Solid waste management services	General PFS including information for the whole solid waste system (included in captive PFS) + waste collection and landfilling	Waste collection Clean MRF Dirty MRF Biodrying Anaerobic digestion Composting Biogas treatment Pyrolysis or gasification Syngas treatment Landfilling
Waste Sorting	<ul style="list-style-type: none"> • Recovery of dry recyclables • Production of RDF to be treated in a thermal treatment 	Clean MRF Dirty MRF Biodrying
Waste to Biogas Plant	<ul style="list-style-type: none"> • Recovery of dry recyclables • Production of compost • Biogas production to generate: <ul style="list-style-type: none"> ○ Electricity 	Anaerobic digestion Composting Biogas treatment

	<ul style="list-style-type: none"> ○ Biomethane ○ Steam (out of scope) 	
Thermal Treatment Plant	<ul style="list-style-type: none"> • Recovery of metals • Production of char / slags • Syngas production to generate: <ul style="list-style-type: none"> ○ Electricity ○ Biomethane ○ Steam (out of scope) 	Pyrolysis or gasification Syngas treatment

The following figure shows a summary with a series of diagrams showing the three (3) proposed scenarios, as well as the main analysis parameters defined for each one of them: i) Mass balances, ii) how each of these three (3) scenarios would contribute to avoid waste from being disposed in the landfill.

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ESCENARIO 2.A: MRF + AD + Pyrolysis

VALUABLE MATERIALS

SANITARY LANDFILL

MSW	2024	2,261	t/year
	2028	31,080	t/year
	2033	55,034	t/year
	2043	119,311	t/year



SORTING PLANTS /MRFs		
2028	31,080	t/year
2033	55,034	t/year
2043	119,311	t/year

Dry recyclables		
2023	3,677	t/year
2033	6,768	t/year
2043	18,636	t/year

RDF



PYROLYSIS	2028	15,640	t/year
	2033	29,719	t/year
	2043	66,988	t/year



ORGANIC WASTE			
2028	6,880	t/year	
2033	23,420	t/year	
2043	117,434	t/year	

STP SLUDGE

	2024	29,200	t/year
	2028	29,200	t/year
	2033	43,800	t/year
	2043	91,250	t/year



AD + COMPOSTING	2028	36,080	t/year
	2033	67,220	t/year
	2043	208,684	t/year

Char			
2028	3,258	t/year	
2033	6,192	t/year	
2043	13,956	t/year	

Syngas			
	2028	12,069	t/year
	2033	22,933	t/year
	2043	51,692	t/year

Compost			
2028	8,117	t/year	
2033	16,013	t/year	
2043	52,474	t/year	

% DIVERSION

MSW FROM LANDFILL

Phase I	2028	67%
Phase II	2033	77%
Phase IV	2043	85%

Rejections	
2028	12,697
2033	18,055
2043	34,689

Direct to landfill	2024	31,461	t/year
	2028	-	t/year
	2033	-	t/year
	2043	-	t/year

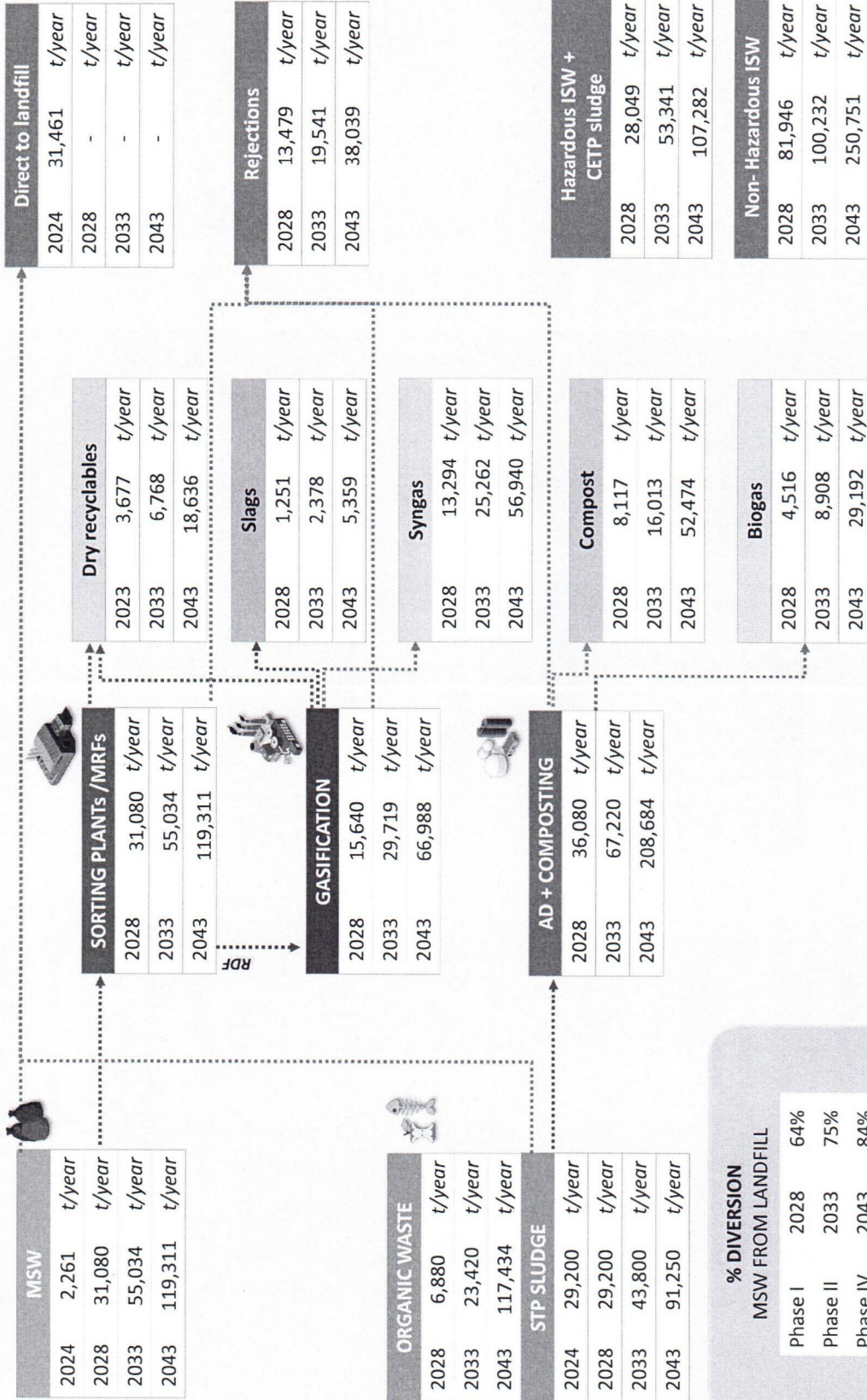
Hazardous ISW + CETP sludge	2028	28,049	t/y
	2033	53,341	t/y
	2043	107,282	t/y

Non-Hazardous ISW	2028	81,946	t/year
	2033	100,232	t/year
	2043	250,751	t/year

ESCENARIO 2.B: MRF + AD + Gasification

VALUABLE MATERIALS

SANITARY LANDFILL



ESCENARIO 2.C: MRF + AD + Cement kiln

MSW	2024	2028	2033	2043
	2,261	31,080	55,034	119,311
	t/year	t/year	t/year	t/year

Sorting Plants / MRFs	2028	2033	2043
	31,080	55,034	119,311
	t/year	t/year	t/year

VALUABLE MATERIALS

Dry recyclables	2023	2033	2043
	2,643	5,501	16,253
	t/year	t/year	t/year

RDF TO CEMENT KILN	2028	2033	2043
	15,640	29,719	66,988
	t/year	t/year	t/year

SANITARY LANDFILL

Direct to landfill	2024	2028	2033	2043
	31,461	-	-	-
	t/year	t/year	t/year	t/year

Rejections	2028	2033	2043
	12,697	18,055	34,689
	t/year	t/year	t/year

ORGANIC WASTE	2028	2033	2043
	6,880	23,420	117,434
	t/year	t/year	t/year

STP SLUDGE	2024	2028	2033	2043
	29,200	29,200	43,800	91,250
	t/year	t/year	t/year	t/year

AD + COMPOSTING	2028	2033	2043
	36,080	67,220	208,684
	t/year	t/year	t/year

Compost	2028	2033	2043
	8,117	16,013	52,474
	t/year	t/year	t/year

% DIVERSION MSW FROM LANDFILL			
Phase I	2028	67%	
Phase II	2033	77%	
Phase IV	2043	85%	

Hazardous ISW + CETP sludge	2028	2033	2043
	28,049	53,341	107,282
	t/year	t/year	t/year

Non- Hazardous ISW	2028	2033	2043
	81,946	100,232	250,751
	t/year	t/year	t/year

Biogas	2028	2033	2043
	4,516	8,908	29,192
	t/year	t/year	t/year

Once all the waste treatment and valorization alternatives have been defined, together with their main technical components, a financial and cost-benefit analysis is performed.

Financial analysis

A financial model has been developed in Excel and has been used to estimate the fees that would be required in order for the Waste Management System (WMS) to be operative and, considering that the system would be built and operated by a private firm, cover a certain amount of return on the investment. Three structures for the WMS are analyzed:

- Waste collection only
- Waste management only (no collection but with sorting, organic waste management, and landfill construction)
- Waste collection and management

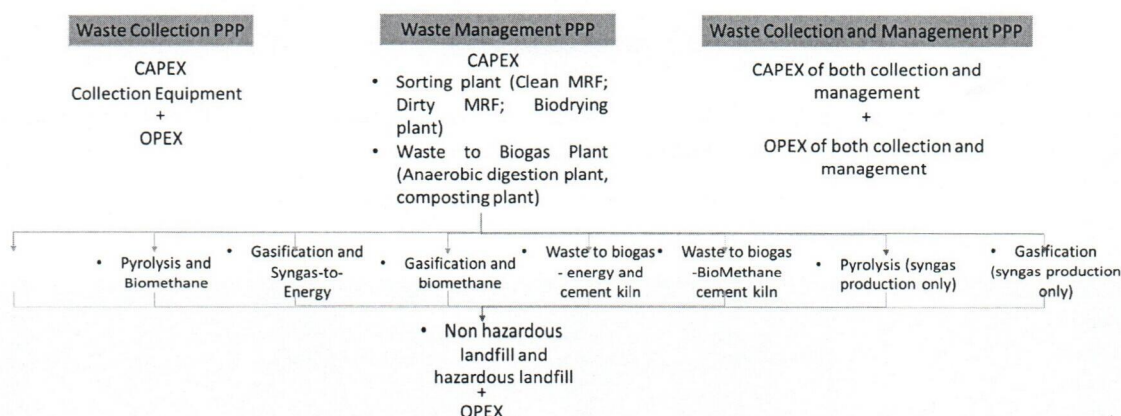
Additionally, eight (8) different technology choices are selected for the waste management analysis:

- Pyrolysis for thermal treatment and electricity production of the biogas and syngas
- Pyrolysis for thermal treatment and biomethane from the biogas and syngas
- Gasification for thermal treatment and electricity production of the biogas and syngas
- Gasification for thermal treatment and biomethane from the biogas and syngas
- No thermal treatment (selling of RDF for cement kiln) and electricity production of the biogas
- No thermal treatment (selling of RDF for cement kiln) and biomethane from the biogas
- Waste management with only pyrolysis component (without biomethane or electricity production technology)
- Waste management with only gasification component (without biomethane or electricity production technology)

The combination of analyzed scenarios can be represented as follows:

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Figure 1. Business model and technological choices



The fees calculated are a result of all the information being fed into the model (investment and operational costs according to business model and technological choices, as well as five year loans structure, a tax structure according to that in place for the Bangladesh economic zones, and a target Internal Rate of Return (IRR) of 15% for the project and 20% for equity). The fee (assuming no tax is applicable to the charging of this service) is multiplied by the estimated amount of municipal waste that would enter into the system and be charged to the producers of that waste.

The results for the fees according to the business model used are presented:

Waste collection PPP

In this scenario, a private firm invests in and operates the entire waste collection system for 20 years but is not responsible for the management of said waste. **This also assumes no costs are incurred in the disposal of that waste.**

Table 2. Fee results for waste collection PPP.

Waste collection PPP				
MSW fee USD (2021) /ton	Sludge fee USD (2021) /ton	Hazardous waste fee USD (2021) /ton	Equity %	Loan %
14	N/A	N/A	45%	55%

In the case of only a collection PPP, there are no fees for sludge or hazardous waste as it would all be municipal waste that is collected.

Waste management PPP

In this scenario, a private firm operates everything except collection of waste, and is responsible for the sorting of organic and inorganic waste, treatment of organic waste, thermal treatment and disposal in landfills both for hazardous and non-hazardous waste. The firm would charge either the waste collector or

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BEZA who would, in either case, pass on the charge to the waste generators. The results in this business model vary according to the technologies employed in the system.

Table 3. Fee results for waste management PPP

Technology selection	Municipal waste fee USD (2021)/ton	Sludge fee USD (2021)/ton	Hazardous waste fee USD(2021)/ton	Equity %	Loan %
Pyrolysis and Syngas-to-Energy	83	168	43	44%	56%
Pyrolysis and Biomethane	92	168	43	45%	55%
Gasification and Syngas-to-Energy	88	168	43	43%	57%
Gasification and Biomethane	97	168	43	44%	66%
Waste to biogas – energy and cement kiln	87	168	43	42%	58%
Waste to biogas – BioMethane and cement kiln	90	168	43	44%	56%
Pyrolysis (syngas production only)	78	155	43	46%	54%
Gasification (syngas production only)	83	155	43	45%	55%

All the results give a project IRR of 15% or higher and an equity IRR of 20%. Since the sludge and hazardous waste fees are not used to get to the overall equity IRR of 20%, these are the same for all the scenarios except the last two. In those two scenarios there is no technology investment in turning syngas to electricity purposes or biomethane, the syngas produced in the anaerobic plant is sold and the revenue is ascribed to the sludge fee, which allows for a lower sludge fee.

As to the market feasibility of these prices, a benchmark on the fees the market is willing to pay for solid waste collection, treatment and disposal operations was gathered.



Table 4. Comparative information sources on fees charged for waste management

Location	Year	Fee	Scope	Source
DCC	2002/03	16 USD/t	Total SWM	(JICA, 2005)
Bangladesh	2002	3.3 USD/t	Only collection	(Islam, 2002)
Dhaka	2009	4.2 USD/t	Willingness to pay for collection service	(Rafia Afroz, 2009)
Sakhipur	2019	13-20 USD/t	Organic waste collection and composting	(Nath, et al., 2017; WaterAid, 2020)
DSCC	2020	32.5 USD/t	Total SWM	Dhaka Tribune 15.09.2020

As can be seen, most recent information suggests that a fee of up to 32.5 USD/ton could be charged. This, however, is sensibly less than the estimated fee results, with the cheapest alternative (78 USD/ton). In this case, possible subsidies from BEZA or extra payments may be considered, however, in the discussions with the client, it was stated that this was not currently an option. Barring that, the existence of companies which may be open to paying that amount if a high-quality environmental treatment of their waste is assured would be a way to make it viable. In this sense, further consultations with a company that currently processes waste (Geocycle) mentioned that a 100 USD/ton price was within the margin of what they charged for receiving waste for full disposal. Considering this, then the range of prices obtained are feasible for specific clients.

Waste collection and management PPP

In this scenario, a private firm operates everything from collection of waste to final disposal and is responsible for the sorting of organic and inorganic waste, treatment of organic waste, thermal treatment and disposal in landfills both for hazardous and non-hazardous waste. The firm would charge directly to the waste generators or BEZA who would, in that case, pass on the charge to the waste generators. The results in this business model vary according to the technologies employed in the system and are basically the sum of the municipal waste fees resulting from the last two alternatives (collection and management).

Table 5. Fee results for waste collection and management PPP.

Technology selection	Municipal waste fee USD (2021)/ton	Sludge fee USD (2021)/ton	Hazardous waste fee USD(2021)/ton	Equity %	Loan %
Pyrolysis and Syngas-to-Energy	97	168	43	43%	57%
Pyrolysis and Biomethane	105	168	43	43%	57%
Gasification and Syngas-to-Energy	101	168	43	42%	58%

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Gasification and Biomethane	110	168	43	43%	57%
Waste to biogas – energy and cement kiln	100	168	43	41%	59%
Waste to biogas – BioMethane and cement kiln	103	168	43	41%	59%
Pyrolysis (syngas production only)	91	155	43	44%	56%
Gasification (syngas production only)	97	155	43	43%	57%

All the results give a project IRR of 15% or higher and an equity IRR of 20%. Since the sludge and hazardous waste fees do not have a specific collection component ascribed to it, their levels remained the same as in the waste management only scenario. As in the past analyzed scenario, the system that includes collection and processing of biogas for energy purposes but no thermal treatment, as all remaining inorganic residues would be sold as cement kiln, is the cheapest with an estimated fee of 82 USD / ton.

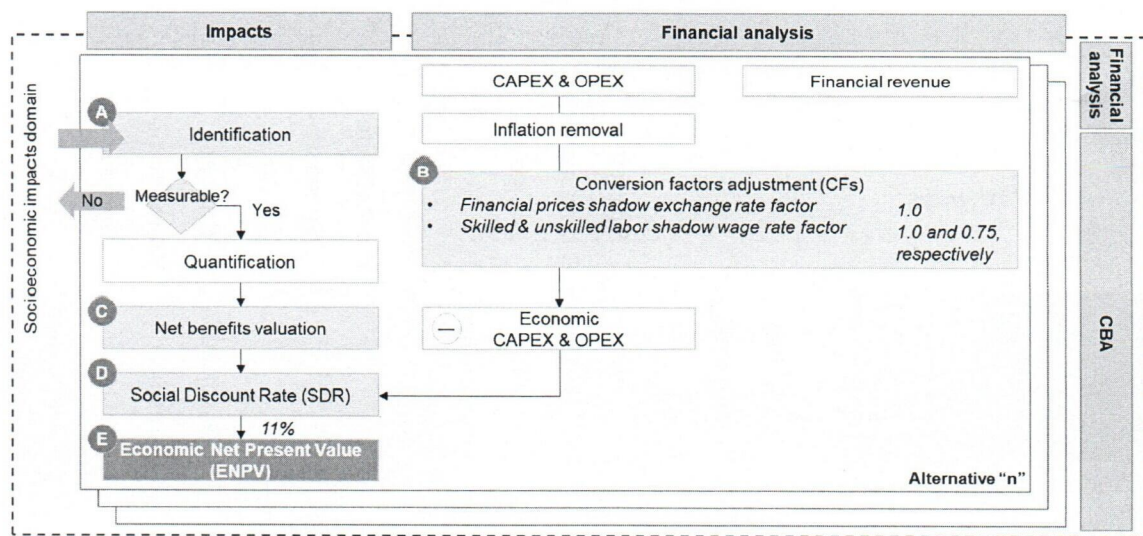
Cost-Benefit Analysis (CBA)

Project economic analysis provides a systematic framework to identify, quantify, value, and compare costs and benefits of a project by bringing together various diverse impacts in a single comparable measure of project worth.

Following the scope of this pre-feasibility study, the consultant conducted a formal high-level, pre-feasibility Cost-Benefit Analysis with the aim of knowing whether the waste management alternatives being studied would represent a net increase to the Bangladeshi society's worth.

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Figure 2. Framework for the waste management cost-benefit analysis.



Source: IDOM

CBA's results

Following the waste management services at BSMSN-Zone 2, the scope covered in this document includes the following activities and components.

Table 6. Scope of alternatives assessed

Pathways:					Energy	Biomethane	Biogas				Energy	Biomethane	Syngas	CHAR	Energy	Biomethane	Syngas	TAR		
Ref	Alternative	# options	Collection	Clean MRF	Dirty MRF	Biodrying	AD	AD	AD	Composting	Pyrolysis	Pyrolysis	Pyrolysis	Pyrolysis	Gasification	Gasification	Gasification	Gasification	NH landfill	Landfill
0	Waste management	6	✓	✓	✓	✓	D.1	D.2	-	✓	A.1	A.2	C.1	-	B.1	B.2	C.2	-	✓	
A	Sorting plant	1		✓	✓	✓														
A.1	Pyrolysis to energy	1									✓			✓						
A.2	Pyrolysis to biomethane	1										✓		✓						
B.1	Gasification to energy	1													✓			✓		
B.2	Gasification to biomethane	1														✓		✓		

✓ Activities and components comprising each alternative

Scope of this document

Source: IDOM

The impacts identified and their monetary valuation stand as follows:

Table 7. Monetary value of quantifiable impacts

Category	Impact	Escalated value (2021 USD)
Environmental	Leachate pollution <i>Moderate to high concentrations of polluting leachate</i>	6.04
	Land usage	25.71
	CO ₂ emissions from landfill disposal	61.45
	CH ₄ emissions from landfill disposal	821.50
	CO ₂ emissions saving from recycling (Δ vs conventional production)	61.45
	Severe smell from waste treatment plant requiring reconstruction with filter installations	4.72
Social	3Rs cultural gain	0.66
	Workers' expertise gain	0.27
Economic	Revenue from recycling	<i>Depending on the material and its market price (see Error! Reference source not found.).</i>
	Levelized cost of coal-fired power plant energy	186.87

Source: See the Cost-Benefit Analysis Chapter

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Waste management CBA's results

Following the premises and activities previously explained and after using 11.0% as the SDR for the economic discounting (which is consistent with the values used by other Governments in the region), the expected return entailed by the **waste management services** at BSMSN-Zone 2 would likely be:

Table 8. Waste management services' CBA economic profitability by alternative

Scope	Waste management services							
Alt.	A.1 Pyrolysis & syngas- to-energy	A.2 Pyrolysis & biometha ne	B.1 Gasificati on & syngas- to-energy	B.2 Gasificati on & biometha ne	D.1 Waste to biogas – energy & cement kiln	D.2 Waste to biogas – biometha ne & cement kiln	C.1 Pyrolysis (syngas productio n only)	C.2 Gasificati on (syngas productio n only)
ENPV (MUSD)	-75.1	-58.6	-79.6	-62.5	-76.2	-47.4	-41.9	-45.4
CBA IRR	-3.3%	0.5%	-3.5%	0.2%	-5.4%	1.8%	4.0%	3.8%

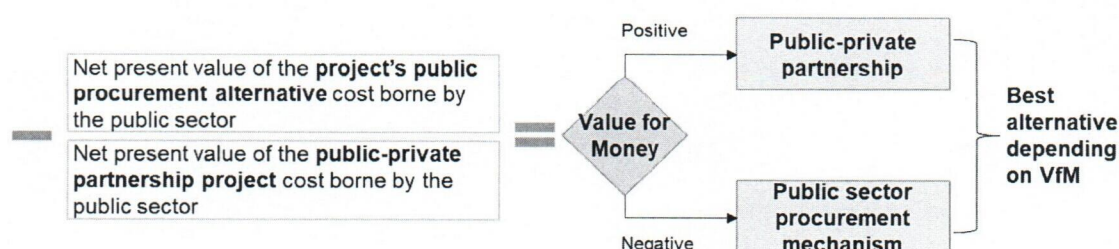
Source: IDOM

Value for Money (VFM)

The VFM is part of a public comparison analysis that constitutes a key procedure to determine if the project should be carried out through either a (i) public-private partnership (PPP) or a (ii) traditional public procurement mechanism.

This kind of analysis is important because it allows one to understand that **a public infrastructure and services investment project should only be pursued through a PPP route if it generates VFM for the public sector and therefore, the society.**

Figure 3. Value for money analysis



Source: IDOM

The steps followed to complete this assessment included:

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- Risks' identification and allocation
- Quantification of the total cost of the public sector procurement alternative
- Quantification of the total cost of the public-private partnership project (PPP)

Waste management VFM's results

Considering the total costs of the (i) public-private partnership (PPP) and the (ii) traditional public procurement mechanism, **from the public sector point-of-view** the VFM analysis indicates that, in any of its various alternatives, proceeding with all the components for the waste management at BEZA at once **should be done following a public works approach to maximize the value of the public money spending**. If we consider only waste collection services, a PPP may be feasible.

Table 9. Waste management services' VFM results (MUSD, base year: 2021)

Alternative	NPV PSP	NPV PPP	VFM
Pyrolysis and Syngas-to-Energy	-10.8	10.6	-21.4
Pyrolysis and Biomethane	-11.1	10.6	-21.7
Gasification and Syngas-to-Energy	-12.4	11.0	-23.4
Gasification and Biomethane	-11.1	11.0	-22.1
Waste to biogas – energy and cement kiln	-7.9	9.2	-17.1
Waste to biogas –BioMethane and cement kiln	-6.8	9.2	-16.0
Pyrolysis (syngas production only)	-11.2	10.0	-21.1
Gasification (syngas production only)	-10.8	10.3	-21.1

Source: IDOM

ANNEXURE 02

Masterplan of BSMSN

