Terms of Reference

For

"Preparation of Detailed Project Report for Construction of Waste treatment Plant in Janakpurdham Sub Metropolitan City. "

1. Introduction and Background

All over the world, waste management is a major concern for authorities as well as urban populations. Increased urbanization, changing lifestyles, increased economic activity, and population growth have all contributed to significant environmental stress, which is most seen in the amount of waste being produced in cities. Waste-to-energy involves the conversion of waste materials into either gas or electricity. These waste sources may originate from households, industries, commercial enterprises, and institutional settings such as offices. The term 'waste' denotes a residual product that is not usable within the context of a production process.

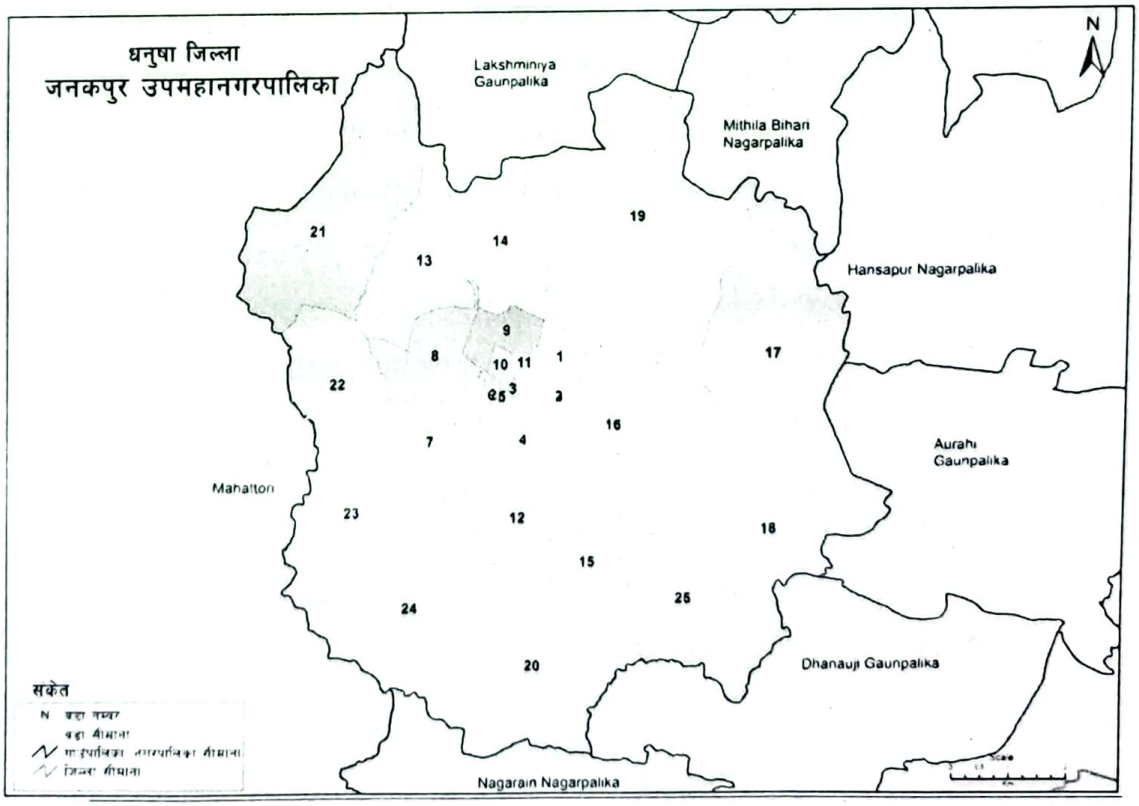

Fig: Map of Janakpurdham Sub-Metropolitan City

The Nepalese government has placed considerable emphasis on producing electricity through Renewable Energy (RE). It has established a target to generate 10% of the total electricity from renewable sources. Janakpurdham is rapidly emerging as one of Nepal's most swiftly developing urban centers and holds the distinction of being the largest sub-metropolitan city in the nation. Initial census findings from 2021 reveal that Janakpur Sub-Metropolitan City (JSMC) encompasses 41,941 households and a total population of 195,438 individuals, with a gender distribution of 51% male and 49% female. However, despite its growth, the management of solid waste in JSMC currently lags modern standards in terms of efficiency. Presently, there exists no designated landfill site, and the city lacks facilities for recycling or implementing specialized systems for the proper collection and disposal of medical or industrial waste.

2. Objectives of the Study

- The main objective of this study is to prepare a detailed project report (DPR) along with engineering design and drawings for the Waste Treatment Plant in JSMC. Specific objectives of the assignment are:
- To conduct a comprehensive feasibility study that includes technical, financial, and socioeconomic viability along with a site assessment as guided by AEPC's Feasibility Study Guidelines - MSW Biogas Plant, 2014.
- To construct a waste treatment plant under Public Private Partnership (PPP) model that effectively transforms municipal solid waste (MSW) into usable energy and other byproducts.
- To mitigate the negative effects of waste disposal on the environment by using modern technologies for energy production and waste treatment.
- To ensure compliance with all relevant regulations and standards about environmental protection, health, and safety.
- To minimize the quantity of waste disposal and waste generation in JSMC.

3. Scope of Work

- The scope of the proposed consulting service will include, but not be limited to the following areas of engineering: mechanical, electrical, instrumentation & control, civil, and environmental engineering.
- Under the assignment objectives following are the main Scope of Work.
- To understand their needs and evaluate their readiness for the large-scale Waste to Energy (WtE) system, the consultant needs to interact with Janakpurdham Sub- Metropolitan City.
- Formulate an in-depth project plan that includes schedules, financial projections, resource needs, and risk mitigation techniques.
- Include interested parties to get feedback and fix issues. Participants may include government departments, environmental organizations, and possible investors.
- Design the WtE plant layout, including waste reception, sorting, processing, and energy conversion facilities.
- Conduct comprehensive market study and select appropriate technologies for waste treatment, energy recovery, emissions control, and residue management.
- Ensure compatibility with existing infrastructure and environmental regulations.
- Acquire data and evaluate technology that can reduce the quantity of waste that ends up in landfills.
- Detailed design includes single line diagrams, comprehensive drawings, planning, layout, and plant operation flow details with drawings (up to 3D system drawings).
- Gender and Social Safeguard Assessment.
- Project SWOT analysis.
- Risk Assessment and mitigation measures.
- Project Economics consists of project component costs, operation and production cost, raw material cost details, profitability analysis and business projection for 25 years of operation.
- Financial Analysis and possible market for the produced gas/electricity and fertilizer.

- Recommend proven technologies readily available to treat solid waste to help meet the relevant environmental and other waste management obligations along with pre-digestion, digestion, and post digestion of the digested slurry.
- Propose project completion schedule details.
- Preparation of Detailed Engineering Drawing, Design and specification followed by the BOQ for tendering purpose.

4. **Methodologies and Tools**

The Consultant is required to outline detailed approaches and methodologies for executing this task. This involves conducting a desk study, engaging in consultations with pertinent stakeholders and municipal authorities, conducting fieldwork, reviewing available technological options, and recommending the most appropriate and cost-effective approach tailored to Nepal's specific context. Close collaboration with JSMC/NREP and municipal entities is essential to gather inputs during site identification and report preparation. The Consultant will prepare Detailed Feasibility Study reports following the format outlined in the "AEPC's Detailed Feasibility Study Guidelines-MSW Biogas Plants, 2014.

5. **Timing**

- **The anticipated timeframe for completing the scope outlined above, including the study reports and final report production, is set for 1 month. The specific schedule for each activity will be determined during the Contract Agreement phase.**

6. **Terms of Payment**

- Terms of Payment Budget and Payment shall be made as per the agreement. Proposed payment schedule shall be as following:

Payment Schedule:

- Advance: Maximum 20% (Twenty) Percentage of agreement amount-Advance against unconditional advance bank Guarantee from Class "A" Commercial Bank of Nepal. Advance will be paid in equal two installments: immediate after contract signature and progress of the assignment.
- First: Maximum 10% (Ten) Percentage of agreement amount-After submission and approval of Inception Report.
- Second: Maximum 70% (Seventy) Percentage of agreement amount-After submission and Approval of Draft Report.
- Final: Remaining Agreement Amount-After submission and Approval of Final Report. (TDS and Advance will be deducted as per rule)

7. **Outputs and Deliverable:**

- One hard copy and one electronic copy of the draft study reports after the survey.
- Three hard copies and 1 electronic copy of the final reports.
- All the items above shall be submitted first as drafts for JSMC/NREP review and comment and then as final reports.

8. **Qualification and Responsibility of the Human Resources Requirement:**

The team should be composed of at least the following professionals and support staff as per the requirement.

1. **Team Leader:** One Team Leader with at least a master's degree in the field of science/energy/environment/management or economics and more than 10 years' experience in renewable energy sector.
    - Develop a comprehensive project plan outlining timelines, milestones, and resource requirements.
    - Coordinate with stakeholders to define project scope, objectives, and deliverables.
    - Ensure alignment with organizational goals and regulatory requirements.

- Lead and motivate a multidisciplinary team comprising engineers, technicians, and support staff.
- Assign tasks and responsibilities to team members based on their skills and expertise.
- Prepare regular progress reports, status updates, and presentations for project stakeholders.
- Document lessons learned and best practices for future reference and knowledge sharing.
- Proactively plan and lead to achieve the project objectives, which may entail carrying out additional tasks/activities not mentioned in the scope of work.
- Deploy, in a timely manner, adequate number of design personnel as per the agreed terms.
- Ensure timely completion of all concept reports, preliminary designs, feasible options and detailed design reports, Safeguard documents, IEE/EIA documents all deliverables as prescribed.

2. **Environmental Expert:** Environmental Experts with at least master's degree the field of energy/environment with more than 10 years professional experience in the energy/environment sector.
    - Conduct thorough assessments of potential environmental impacts associated with the waste-to-energy plant project.
    - Identify and evaluate risks to air quality, water resources, soil integrity, and biodiversity.
    - Ensure compliance with national and local environmental regulations, permits, and standards.
    - Promote the integration of sustainable practices into project design, construction, and operation.
    - Advocate for resource conservation, waste minimization, and energy efficiency measures.

- Explore opportunities for incorporating renewable energy technologies and green infrastructure into the project.
- Engage with stakeholders, including community members, environmental organizations, and government agencies.
- Identify potential environmental risks and vulnerabilities associated with project activities.
- Conduct risk assessments to evaluate the likelihood and potential consequences of environmental incidents.
- Implement lessons learned from previous projects to enhance environmental outcomes and project sustainability.

3. **Social Expert**: Social Experts with at least bachelor's degree in the field of Sociology and more than 10 years of professional experience in the safeguard related field.
    - Engage with local communities, governmental bodies, environmental organizations, and other stakeholders to understand their concerns, expectations, and requirements regarding the WtE plant.
    - Evaluate the potential social impacts of the WtE plant on the surrounding communities, including aspects like employment opportunities, public health, property values, and quality of life.
    - Organize public meetings, workshops, and consultations to gather feedback from the community regarding the proposed WtE plant, addressing their questions, concerns, and suggestions.
    - Ensure that the WtE plant does not disproportionately impact marginalized or vulnerable communities, adhering to principles of environmental justice and equity.
    - Assess the potential impact of the WtE plant on cultural heritage sites, traditions, and practices in the area, and propose measures to mitigate any adverse effects.
    - Assess the potential health and safety risks posed by the WtE plant to workers, nearby residents, and the environment, and propose measures to minimize these risks.

4. **Solid Waste Management Specialist:** Bachelor's in engineering or environmental Study or related degree (Preferably Postgraduate in Engineering or Environmental Study or related degree) with preferably more than 8 years' professional experience in solid waste management specialist/designed.
    - Conduct thorough assessments of potential environmental impacts associated with the waste-to-energy plant project.
    - Identify and evaluate risks to air quality, water resources, soil integrity, and biodiversity.
    - Ensure compliance with national and local environmental regulations, permits, and standards.
    - Promote the integration of sustainable practices into project design, construction, and operation.
    - Advocate for resource conservation, waste minimization, and energy efficiency measures.
    - Explore opportunities for incorporating renewable energy technologies and green infrastructure into the project.
    - Engage with stakeholders, including community members, environmental organizations, and government agencies.
    - Identify potential environmental risks and vulnerabilities associated with project activities.
    - Conduct risk assessments to evaluate the likelihood and potential consequences of environmental incidents.
    - Implement lessons learned from previous projects to enhance environmental outcomes and project sustainability.
    - Design waste treatment processes and systems for the efficient conversion of solid waste into usable energy products, such as electricity, heat, or biogas

5. **Mechanical Engineer:** Bachelor's in mechanical engineering or related degree (Preferably Postgraduate in related degree) with preferably more than 5 years'

experience in the field of mechanical engineering. Experience in the field of mechanical engineering in waste to energy or project is desirable.

- Evaluate and select appropriate mechanical equipment and systems for the waste-to-energy plant based on technical requirements and project objectives.
- Specify the technical parameters, performance criteria, and operational requirements for mechanical components, such as boilers, turbines, conveyors, and material handling systems.
- Develop detailed mechanical designs and engineering drawings for the waste-to-energy plant as part of the DPR.
- Ensure that mechanical designs comply with applicable codes, standards, and regulations governing waste-to-energy facilities.
- Coordinate with other engineering disciplines, including electrical, civil, and environmental, to integrate mechanical systems seamlessly into the overall plant design.
- Ensure compatibility and coordination between mechanical equipment and other plant components to optimize performance and efficiency.
- Provide input for cost estimation related to mechanical equipment procurement, installation, and commissioning.
- Collaborate with cost estimators and project managers to develop accurate budget estimates for mechanical aspects of the project.
- Address environmental and safety considerations related to mechanical systems in the DPR.
- Identify potential environmental impacts and safety hazards associated with mechanical equipment and propose mitigation measures.
- Prepare technical documentation for mechanical systems, including equipment specifications, datasheets, and design calculations.

6. **Electrical Engineer**: Bachelor's in electrical engineering or related degree (Preferably Postgraduate in related degree) with preferably more than 8 years' experience in the field of electrical engineering in waste to Energy or project is desirable.

- Develop detailed electrical designs and engineering drawings for the waste-to-energy plant as part of the DPR.
- Design electrical distribution systems, including power generation, transmission, and distribution within the plant.
- Specify electrical equipment requirements, such as generators, transformers, switchgear, and control systems, based on project needs and technical specifications.
- Ensure that electrical equipment selected for the plant meets applicable standards and regulations.
- Coordinate with other engineering disciplines, such as mechanical, civil, and environmental, to integrate electrical systems into the overall plant design.
- Ensure compatibility and coordination between electrical components and other plant systems to optimize performance and efficiency.
- Provide input for cost estimation related to electrical equipment procurement, installation, and commissioning.
- Collaborate with cost estimators and project managers to develop accurate budget estimates for electrical aspects of the project.

7. **Civil Engineer**: Engineers with at least bachelor's degree in the field of engineering/energy/environment and more than 5 years professional experience in the energy sectors. Preference shall be given to the engineers having proven experience in biogas sector.
    - Conduct site assessments to evaluate the suitability of potential locations for the waste-to-energy plant.
    - Consider factors such as land availability, soil conditions, topography, and environmental impact.
    - Develop detailed civil and structural designs for the waste-to-energy plant infrastructure, including buildings, foundations, and support structures.
    - Ensure that civil designs comply with relevant codes, standards, and regulations.

- Prepare land use plans and layouts for the waste-to-energy plant site, including access roads, parking areas, and utility corridors.
- Optimize land utilization to maximize operational efficiency and minimize environmental impact.
- Conduct geotechnical investigations to assess soil conditions and foundation requirements for the waste-to-energy plant infrastructure.
- Provide recommendations for foundation design and soil stabilization measures.
- Design drainage systems and stormwater management facilities to prevent flooding and erosion on the waste-to-energy plant site.
- Incorporate sustainable drainage practices to minimize runoff and protect water quality.
- Provide input for cost estimation related to civil and structural works, including site preparation, earthworks, and construction of infrastructure.
- Collaborate with cost estimators and project managers to develop accurate budget estimates for civil aspects of the project.
- Prepare technical documentation for civil and structural designs, including drawings, specifications, and calculations.
- Compile all relevant civil engineering information into the DPR to support project planning and decision-making.

8. **Financial Analyst:** Financial Analysts with at least BBA or equivalent and more than 8 years of professional experience in financial analysis of business plan.
    - Develop financial models to forecast project cash flows, revenue projections, and investment returns over the project's lifecycle.
    - Identify potential sources of project financing, including equity investment, debt financing, grants, and subsidies.
    - Evaluate financing options and structures to optimize the project's capital structure and minimize financing costs.
    - Perform financial feasibility analysis to assess the economic viability and financial sustainability of the waste-to-energy plant project.

- Determine key financial metrics, such as net present value (NPV), internal rate of return (IRR), and payback period, to evaluate project profitability.
- Prepare financial reports and documentation for inclusion in the DPR, including financial projections, cost-benefit analysis, and investment appraisal.
- Present financial analysis findings and recommendations to project stakeholders, investors, and financing partners.

9. **Waste quantity Enumerators:** Waste quantity enumerators (surveyors) with at least bachelor's degree in engineering.
    - Conduct field surveys to collect data on the quantity, composition, and characteristics of municipal solid waste (MSW) generated within the project area.
    - Utilize sampling techniques and waste measurement tools to gather accurate and representative data on waste volumes and types.
    - Verify the accuracy and completeness of waste quantity data collected through field surveys.
    - Cross-reference data with existing waste management records, reports, and municipal databases to ensure consistency and reliability.
    - Sort and analyze waste samples to determine the composition of MSW, including organic, recyclable, and non-recyclable fractions.
    - Record data on the percentage by weight or volume of different waste components, such as food waste, plastics, paper, glass, and metals.
    - Use collected data to estimate future waste generation rates and trends based on population growth, economic development, and consumption patterns.
    - Develop waste generation projections for different scenarios and time horizons to support long-term planning and decision-making.
    - Utilize geographic information systems (GIS) software to map waste generation hotspots, distribution patterns, and collection zones within the project area.

- Conduct spatial analysis to identify optimal locations for waste collection points, transfer stations, and the waste-to-energy plant site.

10. **Support staff:** Support staffs with at least Bachelors in any discipline with one year experience on office work.
    - Provide administrative assistance to the project team, including scheduling meetings, organizing documents, and managing correspondence.
    - Maintain project files, records, and databases in an organized and accessible manner.
    - Assist in the preparation and formatting of documents, reports, and presentations related to the DPR.
    - Ensure that all documentation is accurate, complete, and compliant with project requirements.
    - Enter data into spreadsheets, databases, and other software systems as needed for the DPR preparation.
    - Verify data accuracy and completeness and assist in data quality control measures.
    - Conduct research and gather information on relevant topics, regulations, and best practices related to waste-to-energy plant projects.
    - Compile research findings and information into summaries, reports, or presentations for the project team's review.
    - Facilitate communication and coordination among project team members, stakeholders, and external parties.
    - Schedule meetings, distribute meeting agendas and minutes, and follow up on action items as needed.
    - Provide technical support to project team members in using software applications, tools, and equipment for DPR preparation.
    - Assist with troubleshooting technical issues and resolving challenges encountered during the DPR development process.