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FACTSHEET

COMBINED HEAT AND POWER: PROJECT PROCUREMENT

There is a growing interest among municipal entities operating wastewater treatment plants (WWTPs) to improve the energy and operational efficiency of these facilities. This is prompted by the need for municipalities to cut costs and contribute to global and national efforts to reduce greenhouse gas (GHG) emissions.

Anaerobic digestion (AD) sludge treatment and combined heat and power (CHP) projects address wastewater treatment, independent power production, and renewable energy objectives that should be included in the Municipality's Integrated Development Plan (IDP). The municipal officials who wish to develop AD/CHP projects will have to ensure that these objectives are included in annual performance plans or relevant internal planning processes, in order to support the project development process.

In an attempt to reduce the technical and financial risks to a municipality as far as possible, the team who worked on the feasibility study and project development process for a CHP project for the City of Tshwane's Zeekoegat WWTP, is sharing the lessons learned around the procurement steps to follow to enable a timely and low risk process.

These lessons learned are valuable to South African municipalities that are considering anaerobic digestion sludge treatment and CHP technology implementation at their WWTPs. The City of Tshwane project will generate 450 kilowatts (kW) of electricity by means of a CHP plant at an existing anaerobic sludge digester at the Zeekoegat WWTP, i.e., a retrofit CHP development.

This is part four of a four-part factsheet series based on lessons learned from a feasibility study and project development process for a combined heat and power project at the City of Tshwane's Zeekoegat Wastewater Treatment Plant and existing projects at the City of Johannesburg and eThekwini Municipality.

The following factsheets and additional resources in this series can be found on Climatelinks.org.

- Overview
- Ideal Design & Structure
- Project Development
- Case Study
- CHP GHG Calculator

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AD/CHP projects require highly specialized technologies, and municipalities that are planning to use, or have used these technologies have opted for long-term "design, build, operate and maintain" project structures. A long-term project that aims to reduce the technical and financial risks to a municipality and increase the affordability will extend the project's financial obligations beyond the three years covered in the annual budget process. The long-term contracting could also be matched with the expected lifespan of the CHP plants that further reduces the operational risks and increases the viability of the plant.

To enter into a contract of more than three years, the municipality will have to follow the prescribed process under Section 33 of the Municipal Finance Management Act (MFMA). Competitive procurement, including Public Private Partnerships (PPPs), must also comply with Section 120 of the MFMA and the following:

- ✓ **Bid Specification**: This is informed by the outcome of the feasibility and council resolution.
- ✓ **Bid Evaluation**: The comparative evaluation of bids received against the bid specification.
- ✓ **Bid Adjudication**: The Supply Chain Management Department strictly administers this process and no interference by any other individual is allowed in this process.

THE SECTION 33 PROCESS

To satisfy the requirements of Section 33 of the MFMA, the Accounting Officer or Municipal Manager has to follow the steps set out below at least 60 days before the date of the municipal council meeting at which the contract is to be approved.

1. Comply with Section 21A of the Municipal Systems Act by:
    a) the **draft contract** and an **information statement** summarising the municipality's obligations in terms of the proposed contract; and
    b) initiate a **public participation process** with the local community and other interested groups or individuals to comment on the proposed contract.
2. Request an assessment and the recommendations of:
    a) National Treasury;
    b) the National Department responsible for local government; and
    c) the responsible National Department if the contract involves the provision of water, sanitation and electricity, on the proposed project.

Section 33 also requires the municipal council to consider:

1. the impact that the projected financial obligations of the project would have on the municipality for future financial years of project operations;

2. the impact of the project's financial obligations on the municipality's future municipal tariffs and revenue;

3. feedback from the public participation process; and

4. the recommendations made by National Treasury and the National Department responsible for local government.

The Zeekoegat feasibility team carried out a benchmark exercise with the City of Johannesburg and eThekwini Municipality officials that were involved in the Section 33 process implementation in the past. In general, their experiences were positive, with the exception that officials were hesitant or even "scared" to embark on the Section 33 process only because of their lack of experience with the process.

The procurement process should also be aligned with the municipal financial management and accountability cycle, as outlined in the "Local Government Budgets and Expenditure Review" published by National Treasury.

THE IDEAL STRUCTURE – THE PROJECT AND TEAM LEAD

The additional complexity brought about by the Section 33 requirements calls for a strong project development team, that is highly experienced and skilled, to ensure that the project analysis and the preparation work for submission to the relevant government departments will yield positive recommendations, specifically from National Treasury.

Based on the experience with the Zeekoegat CHP feasibility, it is suggested that the project development team should include technical experts, i.e., individuals that have experience with WWTPs sludge train operations, AD and CHP operation, dewatering and aerobic sludge treatment, and experts with financial viability assessment experience.

The Municipal Council cannot and will not approve the project without a strong and positive recommendation from National Treasury on how the projected financial obligation will impact the municipality. The submissions will have to be well structured and thought through for the team to be able to effectively defend the affordability[1] of the project. Affordability is a cornerstone of the feasibility study phase. Therefore, the feasibility study should show the financial impacts of the project, i.e., the estimated initial capital expenditure, and the likely capital and operational costs over the full project cycle.

[1] Affordability is whether the cost of the project over the whole project term can be accommodated in the municipality's budget, given its existing commitments.

It cannot be emphasized enough that a strong project team needs to be established, and if the skills and experience are not available in the municipality, budget needs to be made available to appoint external individuals to strengthen the team. Additional support could also be provided by external agencies or organizations like the DMRE, GIZ, KFW, the National Treasury's Cities Support Program, GreenCape, the Water Research Council, and the NCPC to identify or appoint such experts.

FEASIBILITY ANALYSIS

Pre-feasibility or scoping of the WWTPs will include an infrastructure and operation audit on the sludge train[2] of the selected WWTPs. As the project's financial viability depends primarily on the methane (CH_4) that could be generated, therefore, a detailed audit of the biogas potential is required. Also, the project team needs to gain insight into the capability and the serviceability of the sludge train infrastructure to accurately assess the upgrade or upgrades required to ensure an effective wastewater sludge-to-energy project.

To improve the financial viability of the project, the project team should also investigate the opportunity to include other revenue streams as part of the project, especially in areas where value is not sufficiently extracted. To convert dewatered sludge to an industrial organic fertiliser is an obvious example. Another example is selling Renewable Energy Certificates (RECs)[3] into the voluntary South African market, as happens in the United States.

The most important element of the feasibility study would be to do a financial analysis for the different options identified for the AD/CHP project. The plant configuration that provides the most optimal financial viability will be used as the basis to develop the bid specification.

THE BID SPECIFICATION

The municipality may adopt one of two approaches to develop the bid specification:

First, the municipality could, based on the preferred process and technological approach, contract a consulting firm to carry out a complete design of the AD/CHP plant and draw up a technical specification based on the design. It would seem that this approach is widely used in municipalities, and is well suited for short-term capital infrastructure projects, as the deliverables are well defined and easy to manage during the implementation phase. Although this approach is easy to contract and to manage the contractors during the implementation phase, it does not allow enough room for innovation and lower-cost solutions to enter the wastewater treatment sector.

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[2] The sludge train includes activities involving solids separated from suspension in either the primary settling tanks (PSTs) or the secondary clarifier and the anaerobic treatment of the sludge to produce biogas and stabilised sludge. The dewatering and secondary thermal treatment of the sludge are also included in the sludge train.

[3] A renewable energy certificate, or REC (pronounced: rĕk), is a market-based instrument that represents the property rights to the environmental, social and other non-power attributes of renewable electricity generation. RECs are issued when one megawatt-hour (MWh) of electricity is generated and delivered to the electricity grid from a renewable energy resource. zaRECs (Pty) Ltd. administers the South African voluntary Renewable Energy Certificate (REC) market along the lines of the European Energy Certificate System (EECS) specifications on behalf of members of the voluntary Renewable Energy Certificate South Africa market participant's association (RECSA).

Another approach to the bid specification is to include the design in the contracting process, which allows for contactors that are highly experienced in the design, build, operation, and maintenance of AD/CHP plants to design a system that is affordable, that includes the most appropriate technology, that incorporates the highest level of applicable innovation, and is easy and low-cost to operate and maintain. Contractors will also use the technology that they are familiar with.

Therefore, it is recommended that the procurement process should not follow the traditional method of design-bid-build[4] ("DBB"), i.e., the municipality does not have to design and produce bid documents, including construction drawings and technical specifications, on which various general contractors will in turn bid to construct the AD/CHP project.

What is proposed for these projects is the adoption of performance-based contracting where the contractor is tasked with undertaking and taking on the risk of the design of the plant. This could be achieved through an Engineering, Procurement and Construction (EPC) contract whereby the municipality provides output specifications and has little input into the design. Compared to a DBB contract where the municipality provides a high-level design outline that the contractor has to refine and detail engineer, under an EPC contract, the contractor is expected to provide performance guarantees of the completed facility.

These models allow for flexibility to accommodate innovation by the bidders in terms of technologies to be considered. This approach will minimise technical and financial risks by increasing the affordability and reducing operational and maintenance risk to the municipality. It also creates an opportunity for the main contractor to sub-contract certain portions of the contract to other expert engineering companies. These benefits have been confirmed by representatives of the City of Johannesburg and eThekwini Municipality for the projects they have implemented in the past.

BID EVALUATION

Including the design phase in the bid specification could increase the complexity of the bid evaluation and adjudication since different contractors could potentially offer equipment or plant options that are not technically or financially comparable.

The increase in complexity to effectively evaluate bid submissions could be countered by adding an additional layer of "Technical Evaluation" before the official municipal Bid Evaluation Committee (BEC) starts its process. A "Technical Bid Evaluation Team" should be appointed by the municipality to carry out a detailed technical assessment of the bid submissions.

The team will study the experience and track record of the contractor and potential sub-contractors to design, build, operate, and maintain the solution offered in the submissions. The team will report its findings, including through a risk-assessment and a financial obligations report, to demonstrate the affordability of the different solutions to the BEC.

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[4] In the DBB system, the municipality appoints an independent team of consultants on a fee basis, who completely designs the CHP project and prepares bid documentation upon which competitive bids are obtained from the contractors. The successful bidder enters into a direct agreement with the municipality and carries out the work in accordance with the design and specifications provided.

To ensure that the Technical Bid Evaluation Team follows due process, the team should be coordinated by an experienced procurement practitioner (of the municipality) who must ensure that information is seamlessly transferred to the BEC.

The team appointed to carry out the technical evaluation will have to be independent and highly experienced in all operational and maintenance processes included in the bid specification; they should also have the necessary financial modelling skills to evaluate the affordability of the project. The technical team will therefore most probably consist of more than one technical expert, as AD/CHP projects will include a wide spectrum of processes.

The municipality should allocate a budget towards the appointment of the Technical Bid Evaluation Team, as it is unlikely that these highly specialised technical skills exist within the municipality, and time should be allowed in the project development process to identify and contract these specialists.

METHOD OF CONTRACTING

As the contract will govern the implementation of the project through both the capital infrastructure phase and the operational and maintenance phase of the project, care should be taken in the development of the contract or contracts.

The first step is to appoint a highly experienced transactional advisor, with primarily a legal and contractual background, supported by a strong technical team that understands the detailed implementation of both anaerobic digester sludge and CHP technology.

The Zeekoegat feasibility and CHP project development team studied similar projects implemented in South Africa and the Southern African region to guide the recommendations that were made. Valuable lessons have been learnt from these examples and it became clear that the best approach would be to structure the contract over more than one phase to ensure the contracting approach fit the requirements of each of the contracting phases.

The design and build activities should be structured as the first contracting phase that could run for a period of one to two years depending on the requirements of the bid specification, or to the point when a certificate of completion is issued. The contract should clearly define the equipment specification to be installed and the contracting fee that will be paid to the contractor, including the schedule of payments linked to the project delivery schedule.

The municipality should appoint a team consisting of technical experts who are independent and experienced in the operation of the activities that form part of the design and build phase of the contract. The technical team may consist of more than one technical expert to evaluate whether the plant conforms to the specification of the contract. One of the technical experts, either an internal or an external resource, should be appointed as project engineer to act on behalf of the municipality to ensure the contract requirements are met.

As previously indicated, the municipality should allocate a budget for the appointment of technical experts if these specialised resources are not available internally and time should be allowed in the project development process to identify and contract these individuals.

At the completion of the design and build phase, and when the certificate of completion has been issued, the same contractor should be appointed for a defect liability period and for the operations/maintenance contract within this period. By combining full operations and maintenance implementation within the defect liability period, the municipality can reduce AD/CHP project implementation risk. However, municipal procurement may not allow simply appointing the same contractor – it will either be:

a) three-year contract (one-year construction and two-years operations and maintenance) and any extension of this contract should be through a new Request for Proposal (RFP) risking a new entity managing the plant; or
b) Section 33 process and enter into a long-term contract.

During the **defect liability period**, the contractor has to conform to the requirements set out by the project engineer, appointed by the municipality, and repair defects which may appear during the operation of the installed plant, or rectify plant equipment that does not meet the requirements as set out in the contract. The project engineer will ensure that the installed plant, at the end of the defect liability period, fulfils all the conditions required by the contract.

The **defect liability period** contract will continue for a period of one year or will continue until all work instructed by the project engineer has been carried out.

The third and final phase of the project is an operations/maintenance contract covering the period the municipality requires the AD/CHP project to be operational, minus the project phase one and two time periods.

CHP plants have an expected lifespan of seven to 10 years, depending on the technology used, so the municipality may therefore need to have a contract for at least the expected lifespan of the critical electricity generation equipment.

During both the operating and maintenance phases of the project, the contract fee will be split into two billing components based on a reward and penalty structure. The municipality will pay for operational costs, defined as:

- A fixed monthly operations and maintenance fee linked to the mechanical availability of the AD/CHP plant, which covers the fixed costs of the site such as the overhead cost recovery of plant operations – the fixed monthly fee component does not depend on the quantity of biogas or power produced, but will depend on the level stabilisation of the sludge. Sludge will have to comply to A1 or A1a requirements. If the municipality requires the contractor to finance the development the fixed monthly cost, it will also include a fee that will cover the cost of capital (debt repayment and interest).

- A variable operational cost, which accounts for the actual running cost of the power plant based on the units of power produced each month. The charge rate in Rand per kilowatt-hour (kWh) is constant, but the number of kWhs produced varies per month. This depends on the quantity of biogas produced, and therefore creates an incentive for the contractor to operate the sludge train at the highest possible efficiency.