



# NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL, SRINIVASNAGAR, MANGALORE-575025

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Date: 14/10/2024

## Corrigendum No. 02

With reference to the Bid for “**Supply, Installation, and Commissioning of 1000 kg/day Prefabricated Biogas Plant for Organic Waste at Paradip, Odisha**” (for Tender Ref. Number.: “**NITK/CSR/BP/Project/2023-24/04**” Dated: **17/09/2024**, please note the following changes:

**Subject: Additions/Corrections to Technical Specification:**

### 1. Place of Delivery Clarification:

- **Details Before this Corrigendum:** Conflicting information regarding the delivery location, mentioning NITK, Surathkal, and Paradip, Odisha.
- **Modification:** The **Place of Delivery** for the biogas plant is confirmed to be **Paradip, Odisha**. The mention of delivery to NITK, Surathkal, should be disregarded.

### 2. Biogas Productivity Clarification:

- **Details Before this Corrigendum:** Biogas productivity was mentioned as 50 kg per ton of organic waste input.
- **Modification:** The biogas productivity is clarified as **125 m<sup>3</sup>/ton** of organic waste input. This is based on a biogas yield conversion factor of **0.4**, which is commonly used for biogas production.

### 3. Digester Volume:

- **Details Before this Corrigendum:** The digester volume was specified as 32 m<sup>3</sup>.
- **Modification:** The 32 m<sup>3</sup> digester remains unchanged in the specifications and is supported by an advanced **Bio-health Monitoring and Intervention Technology**, which ensures stable operation with lower water addition, minimizing the need for chemical intervention when handling organic/food waste. However, if a vendor’s system operates with a different digester volume or design, they may provide a detailed technical justification in their bid submission for consideration.

### 4. Hydrolysis Tank & Temperature Control Clarification:

- **Details Before this Corrigendum:** Hydrolysis tank and temperature control with geyser were included in the BoQ.
- **Modification:** If a vendor’s system integrates the hydrolysis phase in the main digester or has in-built temperature control, they may provide a technical justification for omitting these modules in their bid submission for consideration.

## 5. Gas Control Valves & Sensors:

- **Details Before this Corrigendum:** Unclear specifications for gas control valves and sensors.
- **Modification:** All **inline gas control valves** should be **flameproof** and **IP65 rated**. Pressure sensors must be **flameproof**, with the diaphragm made of **SS316 or SS316L** to ensure durability and safety in corrosive and high-pressure environments.

## 6. Make of Critical Components:

- **Details Before this Corrigendum:** Make and model were provided only for pressure sensors and PLC.
- **Modification:** Vendors are required to source critical components, such as **feeding pumps, sludge pumps, slurry pumps, circulating pumps, ignition transformers, SMPS, pH sensors, and slurry dewatering machines**, from **reputed manufacturers**.

The following are **suggested reference** makes/models for critical components, which vendors can follow or propose **equivalent options**:

Feeding Pumps: **Grundfos**, Vertical Multistage Pumps, Warranty: 1-2 years.

Sludge Pumps: **Wilo**, Warranty: 2 years.

Slurry Pumps: **KSB**, Centrifugal Slurry Pumps, Warranty: 1 year.

Circulating Pumps: **Kirloskar Brothers Ltd.** (India), Warranty: 1-2 years.

Ignition Transformers: **Danfoss**, High Voltage Ignition Transformers, Warranty: 1 year.

SMPS: **Siemens**, Warranty: 2 years.

pH Sensors: **Endress+Hauser**, Digital pH Sensor, Warranty: 1 year.

Slurry Dewatering Machines: **Avalon Separation Technologies**, Automatic Sludge Dewatering Machine, Warranty: 1-2 years.

The above mentioned makes and models are suggested for **reference purposes** only. Vendors are **not compulsorily** required to use these specific brands but may propose any reputable brands, provided that a **clear justification** is given in the technical bid to explain the suitability of the proposed components.

While the minimum warranty period is 1 year, vendors must provide an **extended warranty** of up to 3 years, as this is the required warranty for this plant. Extended warranties beyond the minimum will be **considered positively in the evaluation**.

Vendors should specify the **make and model, warranty period of all critical components in the technical bid**, along with a clear **justification for their selection**, explaining why the chosen components are suitable for the specific application, ensuring that the components meet quality, performance, and durability standards.

## 7. Slurry Dewatering Machine:

- **Details Before this Corrigendum:** Slurry dewatering machine capacity was mentioned as 7.5 hp.
- **Modification:** Considering the scale of the 1-tonne biogas plant at Paradip, a **1.5 hp to 2 hp Slurry Dewatering Machine** should be sufficient to handle the slurry produced, with a capacity of **1-3 m<sup>3</sup>/hr**. The machine should handle organic waste slurry effectively, with a screen size of **0.3 mm to 0.5 mm**, and it is preferable for the machine to feature full automation for efficient operation and ease of maintenance. **Vendors are required to specify the make and model** of the machine/component in detail in the technical bid, ensuring alignment with the plant's operational needs and efficiency requirements.

## 8. Additional Accessories Clarification:

- **Details Before this Corrigendum:** Additional accessories were listed without clarity on whether they are optional or mandatory.
- **Modification:** All the **additional accessories**, including cylinder cascades, CO<sub>2</sub> scrubber, and compressor, are considered **optional** for the initial phase of the project. However, vendors are **required to quote for these additional accessories** in their bid submission, providing a proper **justification** for the pricing and the specifications. These accessories may not be procured in the current phase, as the initial budget is intended to cover the core biogas plant setup. Nonetheless, it is essential that the vendors quote these additional components to allow for future consideration, based on potential funding in subsequent phases of the project.

## 9. Additional Accessories: Gas Management System – Twin Balloon Compression, Process Vessel - High Pressure Storage, CO<sub>2</sub> Gas Scrubbing: (Details of Compressor, Neoprene Balloons, CO<sub>2</sub> Scrubber):

- **Details Before this Corrigendum:** Make and specification for 8-bar gas compressor and accessories were not fully provided.
- **Modification:**

**8-bar Gas Compressor:** The compressor should be **flameproof** and must include a **pressure switch** for safety. The vendor should clearly specify the **make, model**, and technical specifications of the compressor, ensuring compatibility with the plant's biogas handling system.

**Neoprene Balloons (Gas Storage):** The neoprene balloons should be made with **hot air binding** or **high-frequency welding** to ensure durability and gas containment. The vendor must specify the capacity, material grade, and storage capability of these balloons.

**CO<sub>2</sub> Scrubber:** The scrubber must include a **water pump** and an **air stripping column blower** of **reputed manufacturers**. The chiller for the CO<sub>2</sub> scrubber should have a capacity to maintain a **dew point of -20°C to -40°C**. The vendor should specify the make, model, and cooling capacity of the chiller and ensure the integration of these components for effective CO<sub>2</sub> removal and gas purification.

Vendors are required to specify the make and model of these accessories in their technical bid, ensuring they meet the specified requirements for the safe and efficient operation of the biogas plant.

10. **Additional Accessories: Gas Management System – H<sub>2</sub>S Removal System:**
- **Details Before this Corrigendum:** The H<sub>2</sub>S removal system was not specified with ppm levels. The tender mentioned only CO<sub>2</sub> scrubbing.
  - **Modification:** The **H<sub>2</sub>S removal system** should ensure output levels of **less than 5 ppm/m<sup>3</sup>** for high-pressure gas applications. **Advanced adsorbent materials** should be used to achieve the required gas quality standards. Vendors are required to specify the make and model of the above-mentioned H<sub>2</sub>S removal system separately (as item No.19) in their technical bid, ensuring they meet the specified requirements of the biogas plant.
11. **Additional Accessories: Gas Management System – Moisture Control:**
- **Details Before this Corrigendum:** The moisture control system was not specified with ppm levels. The tender mentioned only **CO<sub>2</sub> scrubbing**.
  - **Modification:** In addition to CO<sub>2</sub> scrubbing, **moisture levels** must be reduced to below **10 ppm/m<sup>3</sup>** using a **desiccant dryer** with a dew point of **-20°C to -40°C** to ensure the required gas quality for high-pressure compression. Vendors are required to specify the make and model of the above-mentioned moisture control system separately (as item No.20) in their technical bid, ensuring they meet the specified requirements of the biogas plant.

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**(Buyer)**

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Bidder Query	Buyer Response
<p>1. It is mentioned in the tender document that biogas productivity is 50 kg per ton of organic waste input, please clarify whether 50 m<sup>3</sup> or 50 kg of raw biogas per ton @ 50 to 55% methane. Theoretically 1kg of LPG is equivalent to 2.2 m<sup>3</sup> of raw biogas @ 5000 kcal/m<sup>3</sup> @ 57% CH<sub>4</sub>. But, practically while cooking, the consumption of biogas will be on higher side, and it will not match the above theoretical data due to raw biogas and also the burner efficiency.</p>	<p>The <b>original 50 kg/ton</b> biogas productivity mentioned in the tender is clarified and converted to <b>125 m<sup>3</sup>/ton</b> of organic waste input. This is based on a <b>biogas yield conversion factor of 0.4</b>, which is a commonly used value for biogas production from food/organic waste under standard conditions. The conversion between biogas and LPG is explained, and the practical implications of burner efficiency are acknowledged without changing the feasibility of the project.</p>
<p>2. Digester volume is mentioned as 32m<sup>3</sup> only, which seems to be on lower side. Due to low digester volume (HRT is low), VFA (volatile fatty acids) accumulation will happen frequently which decreases the pH. Frequent/regular addition of alkaline regulator is required to maintain the pH and stabilize the digester (whenever VFA is found to be on higher side). Due this condition, biogas plant cannot be operated with its full/maximum load on a continuous basis without adding chemicals, which is an unhealthy way of Biogas plant operation. In a biogas plant with maximum raw material feed is food waste, the above condition occurs very commonly and hence we suggest to go with higher digester volume.</p>	<p>The <b>32 m<sup>3</sup> digester</b> specified in the tender should be supported to operate efficiently due to the inclusion of an advanced <b>Bio health Monitoring and Intervention Technology</b>. This type of system allows for stable digestion with <b>lower water addition</b> (hence lower digester volume possible), minimizing the risk of <b>VFA accumulation</b> and reducing the need for frequent chemical intervention, even when food waste is the primary feedstock. Unlike conventional systems, which may struggle with smaller digester volumes, this technology ensures continuous and optimal operation without relying on chemical pH regulation. <b>However, if a vendor's system operates with a different digester volume or design, they may provide a detailed technical justification in their bid submission for consideration.</b></p>

<p>3. H<sub>2</sub>S removal system mentioned in the tender document might be suitable for direct thermal application. But, as per the tender specification wherein the gas is further processed for CO<sub>2</sub> removal, high pressure compression, gas filling in high pressure cylinder. In this case, H<sub>2</sub>S removal system must give an output of less than 5ppm/m<sup>3</sup>. For such a requirement, just iron filling is insufficient. Please ensure the adsorbent type and its volume to achieve &gt;5 ppm/m<sup>3</sup> level.</p>	<p>For direct thermal application iron fillings are suitable. The <b>H<sub>2</sub>S removal system</b> specified in the tender will be upgraded to ensure output levels of less than <b>5 ppm/m<sup>3</sup></b>, which is necessary for high-pressure gas applications. The system should include advanced adsorbent materials, beyond just iron filling, to meet the required gas quality standards. The modification will be specified in Corrigendum.</p>
<p>4. In additional accessories (Gas Management System), only CO<sub>2</sub> scrubbing is suggested in the tender specification. For high pressure compression &amp; cylinder filling purpose, H<sub>2</sub>S and moisture level must be less than 10ppm/m<sup>3</sup>. After CO<sub>2</sub> gas scrubbing, moisture must be removed using desiccant dryer (-20 or -40 deg dew point).</p>	<p>The <b>Gas Management System</b> will be updated in the corrigendum to ensure that, in addition to CO<sub>2</sub> scrubbing, both <b>H<sub>2</sub>S and moisture levels</b> will be reduced to below <b>5-10 ppm/m<sup>3</sup></b> using <b>advanced adsorbents</b> and a <b>desiccant dryer</b> to achieve a dew point of <b>-20°C to -40°C</b>, ensuring gas quality suitable for high-pressure compression and cylinder filling.</p>
<p>5. Please clarify whether the inline gas control valves must be flame proof and IP65 rated.</p>	<p>Yes, all <b>inline gas control valves</b> specified in the tender must be <b>flameproof</b> and <b>IP65 rated</b> to ensure safety and reliability in handling biogas under high-pressure conditions.</p>
<p>6. Please clarify whether the pressure sensor must be flame proof and the MOC of diaphragm should be SS316 or SS316L.</p>	<p>Yes, the <b>pressure sensor</b> must be <b>flameproof</b>, and the <b>material of construction (MOC)</b> for the diaphragm should be <b>SS316 or SS316L</b> to ensure durability and safety in corrosive and high-pressure environments.</p>
<p>7. In slurry management, the dewatering machine capacity mentioned is 7.5HP. For this smaller capacity plant, 2 to 3HP or 1 to 3m<sup>3</sup>/hr machine with screen size of 0.3mm to 0.5mm is more than enough, please clarify.</p>	<p>Thank you for your input. We agree that for this smaller capacity plant, a <b>1.5 to 2 hp dewatering machine</b> with a capacity of <b>1 to 3 m<sup>3</sup>/hr</b> and a screen size of <b>0.3mm to 0.5mm</b> will be sufficient, and we will make the necessary modifications in the specifications.</p>

<p>8. The model &amp; makes are given only for Pressure sensors and PLC. Please mention the make for all motors, pumps such as feeding pumps, sludge pumps &amp; slurry pumps, circulating pump (Heating Arrangement), ignition transformer, SMPS, pH sensor, slurry dewatering machine and geysers make &amp; model.</p>	<p>Vendors are required to source critical components from <b>reputed manufacturers</b>. The tender will be updated to include <b>suggested references for the makes/ models, with details of reputed vendors</b> for all critical components, such as <b>feeding pumps, sludge pumps, slurry pumps, circulating pumps, ignition transformers, SMPS, pH sensors, and slurry dewatering machines</b> ensuring clarity and uniformity in the equipment specifications.</p>
<p>9. In Additional Accessories, please do mention the make of 8 bar gas compressor (whether the gas compressor must have flame proof motor, pressure switch make), neoprene balloon GSM with binding by Hot air or high frequency welded, CO<sub>2</sub> scrubber water pump make, air stripping column blower make, CO<sub>2</sub> scrubber chilled water make with chiller capacity.</p>	<p>We will ensure that the <b>8-bar gas compressor</b> has a <b>flameproof motor</b> and appropriate <b>pressure switch</b> with a new corrigendum.</p> <p>The <b>neoprene balloon</b> will be specified with <b>GSM and binding using hot air or high-frequency welding</b> for durability and safety.</p> <p>Additionally, we will ensure that the CO<sub>2</sub> scrubber include a <b>water pump, an air stripping column blower, and chilled water system</b>, including the required <b>chiller capacity</b> procured from <b>reputed manufacturers</b>.</p>
<p>10. The CO<sub>2</sub> scrubber must give methane purity of 95%, please confirm.</p>	<p>Yes, the <b>CO<sub>2</sub> scrubber</b> specified in the tender is designed to achieve a <b>methane purity of 95%</b>, ensuring high-quality biogas suitable for further applications like compression and cylinder filling.</p>
<p>11. Please confirm the 250bar high pressure cylinder compressor make.</p>	<p>The make of the <b>250-bar high-pressure cylinder compressor</b> should be sourced from a <b>reputed manufacturer</b> to ensure reliability and safety. vendors are required to specify the make and model of these accessories in their technical bid, along with a clear justification for their selection.</p>

<p>12. Please confirm all the slurry line in the plant is UPVC or CPVC and the intermediate gas line within the plant is UPVC/CPVC.</p>	<p>All <b>slurry lines</b> in the plant will be made of <b>UPVC</b> for durability and chemical resistance, while the <b>intermediate gas lines</b> within the plant can be made of <b>CPVC</b>, ensuring safe and efficient gas transport under the operating conditions.</p>
<p>13. The 5bar gas line (MS seamless pipe material supply &amp; pipeline laying) of 5km from gas storage vessel is in supplier's scope.</p>	<p>As this is not mentioned in the specifications, the <b>5 km gas line</b> (MS seamless pipe material supply and pipeline laying) from the gas storage vessel is <b>not required</b> and is outside the scope of the supplier.</p>
<p>14. Please clarify whether the valves used in digester are SS flanged or SS screwed. Also mention the valves used in gasline are SS flanged or SS screwed.</p>	<p>The valves used in both the <b>digester</b> and the <b>gas line</b> are specified as <b>SS flanged</b> to ensure durability and ease of maintenance under the operating conditions.</p>
<p><b>Clause: SECTION 2: CONDITIONS OF CONTRACT.</b></p> <p>1. The supplier should quote the rate for <b>Door Delivery (FOR).</b></p> <p>3. <b>The item should be landed at NITK, Surathkal</b> and this responsibility is with the bidder. (Page No. 17)</p> <p><b>Annexure-L</b></p> <p>An idea behind the biogas plant which is to be <b>installed in the Paradip municipality</b> is to convert organic waste available to energy. The generated Biogas will be compressed and <b>supplied to local Ahaar Kendras</b>, thereby reducing reliance on LPG. (Page no. 39)</p> <p><b>Queries:</b></p> <p><b>Please clarify the Place of Delivery of the pre-fabricated Biogas Plant &amp; related accessories.</b></p> <p><b>Whether it will be NITK, Surathkal, or Paradip, Odisha?</b></p>	<p>The <b>Place of Delivery</b> for the pre-fabricated biogas plant and related accessories is confirmed to be <b>Paradip, Odisha</b>, where the plant will be established. The mention of delivery to <b>NITK, Surathkal</b> in the <b>Conditions of Contract</b> was an oversight and should be disregarded. We apologize for the confusion, and the correct location for delivery and installation is <b>Paradip Municipality</b>, as outlined in the project scope.</p>
<p>15. <b>Clause: Bill of Quantity</b></p> <p>1. Hydrolysis Tank (6m<sup>3</sup>) with Aeration pumps</p> <p>2. Temperature Control with Geysers (Page no. 42)</p> <p><b>Queries:</b></p>	<p>We understand that biogas plant designs may vary across vendors, and some systems may integrate the <b>hydrolysis phase</b> directly into the digester while others have a separate <b>hydrolysis tank</b>. In this tender, we have included a separate</p>



<p>In our Biogas Plant, we do not have any separate hydrolysis tank. The hydrolysis phase will take place in the same digester itself along with the remaining 3 phases/steps in anaerobic conditions only. Temperature control will be in-built.</p>	<p><b>hydrolysis tank and temperature control system with a geyser</b> as part of the Bill of Quantities, as these components are critical to ensuring flexibility across different system designs and the proper operation of the anaerobic digestion process.</p> <p>However, if your system effectively handles the <b>hydrolysis phase within the main digester</b> and has <b>in-built temperature control</b>, you may provide the relevant technical justification for omitting these separate modules in your quotation. The final objective is to ensure optimal anaerobic digestion performance, and we are open to considering different approaches, as long as the system meets the functional requirements outlined in the tender.</p>
<p><b>16. Clause:</b>  <b>Additional Accessories Required:</b></p> <ul style="list-style-type: none"> <li>- Cylinder cascades</li> <li>- CO2 water scrubber</li> <li>- Compressor</li> </ul> <p>Page No. 47-48</p> <p><b>Queries:</b>  <b>Please clarify are these accessories optional or mandatory?</b></p> <p>If not optional, the allotted budget (i.e. INR 44,00,000) is not sufficient to provide the mentioned additional accessories along with the Biogas plant.</p> <p>Therefore, <b>we request to extend the budget limit to facilitate the additional required accessories.</b></p>	<p>All the <b>additional accessories</b> listed, including <b>cylinder cascades, CO2 water scrubber, and compressor</b>, are <b>optional</b> for the initial phase of the project. These components are listed as part of potential future expansions or upgrades, and the current budget of <b>INR 44,00,000</b> is intended to cover the core biogas plant setup.</p> <p>The bidder must quote separately for these additional accessories, but they are not mandatory to procure for this phase of the project. The core focus remains on establishing a fully functional biogas plant within the allocated budget. We are open to revisiting these accessories in future phases, contingent on the availability of additional funds.</p>

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