



**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**

**TERMS OF REFERENCE**

**PROVISION OF TURNKEY TECHNICAL SERVICES RELATED TO THE DESIGNING, SUPPLY,  
DELIVERY AND INSTALLATION OF INTERNET OF THINGS TECHNOLOGY SYSTEMS FOR  
DATA CENTER, DATA COLLECTION AND TRANSMISSION IN OLKARIA GEOTHERMAL  
COMPLEX IN KENYA**

## **I. GENERAL BACKGROUND INFORMATION AND AIM OF THE PROJECT**

Access to reliable and cost-effective energy is critical for economic growth and sustainable development. Kenya continues to struggle with electrification, rapid urbanization, population growth, outages during peak demands interrupting production and industries as well as the dry season due to depletion of hydropower storage. Endowed with substantial geothermal energy resources estimated at 10 GW, Kenya paves the way in the region in many aspects. With its ambitious 100 % electricity access target by 2030, feed-in tariff policies and record investments, Kenya's installed geothermal power generation capacity accounts currently for 29.1%<sup>1</sup>.

Moreover, despite large geothermal potential in the region, Kenya remains the sole county with the installed geothermal power capacity. Unsurprisingly so, the main barriers to development of geothermal technology remain. Among the most commonly recognized, there are long gestation period, capital intensity and high risk in exploration phase. There is also a vast potential for improvements of energy management and applications of innovative, advanced technologies in order to increase access to stable electricity, improve operations of existing installations as well as enhancing local and institutional capacities. Management of the facility including reservoir management constitutes the foundation of the operations of a geothermal power plant.

In response to the above challenges and opportunities, leveraging on its technical capacity in sustainable energy development, UNIDO is developing several programmes in the region funded by bi-lateral donors and other institutions in alignment with country sectorial policies, United Nations Development Assistance Framework and Sustainable Development Goals.

The Sixth Tokyo International Conference on African Development (TICAD VI) was held from 27 to 28 August 2016 in Nairobi, Kenya. Prime Minister Shinzo Abe of Japan announced at the Opening Session of TICAD VI on 27 August 2016 Japan's intention to invest in energy infrastructure projects, in particular geothermal power generation in

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<sup>1</sup> Updated Least Cost Power Development Plan, Study Period: 2017-2030, ERC of Kenya, June 2018

Africa. Thereby the Note Verbale was exchanged between UNIDO and the Government of Japan in Vienna on 22 November 2016 (Note Verbale No. PMJ/NV/229/2016) to execute projects assisting African countries in order to enhance their energy sector through Japanese geothermal power generation and its related technologies.

In April 2017, UNIDO launched jointly with the Government of Japan a global programme on “Generating energy capacity from geothermal power generation and its related technologies for sustainable development” (“the UNIDO Geothermal Programme”). The main objective of the Programme is to assist in development of African countries by enhancing their energy sector through Japanese geothermal power generation and its related technology.

Meanwhile, Japan International Cooperation Agency (JICA) answered to the request to implement a technical cooperation project on capacity strengthening of operation and maintenance (O&M) with the Internet of Things (IoT) technologies for the Olkaria Geothermal Power Station owned and operated by Kenya Electricity Generating Company Ltd. (KenGen). KenGen aims to double its power generation capacity at the Olkaria Geothermal Power Station within next five years while maintaining the current capacity factor by enhancing O&M capabilities in order to minimize potential O&M troubles. UNIDO was invited by JICA to participate in the project, specifically in the area of introduction of IoT technologies.

Therefore, this project “Capacity strengthening of operation and maintenance with IoT technologies for Olkaria Geothermal Power Station” (“the UNIDO Project”) was formulated under the umbrella of the UNIDO Geothermal Programme and the project will be implemented in close collaboration with JICA. The UNIDO Project will focus on demonstrating, deploying and transferring IoT technologies from Japan to Kenya and necessary capacity building as described below, consequently leading to contribution to the Sustainable Development Goals (SDGs) 7, 9 and 13.

## **II. The Scope of Supply**

The UNIDO Project will be implemented to enhance KenGen’s capabilities as a power generating company at the Olkaria Geothermal Power Station through O&M capacity

strengthening using IoT technologies.

The trajectory toward ultimate goals achievable by IoT technologies could be described as below:

Phase 1: Data Centralization, Accumulation and Data security

Phase 2: Introduction of Cloud Service

Phase 3: Remote Monitoring and Support

Phase 4: Preventive and Predictive Maintenance

Data centralization and accumulation is a prerequisite for remote monitoring, preventive maintenance and predicative maintenance and the UNIDO Project will focus on “Data Centralization and Accumulation”, covering Olkaria I-AU (Unit 4, 5), II (Unit 1, 2, 3), IV (Unit 1, 2) and V (Unit 1, 2) and observation wells. The centralization and accumulation of data will be achieved with installations of collection equipment, transmission infrastructure and storage infrastructure. The centralized and accumulated data could be utilized for assessment and analysis of performance of plant and reservoir in the future. Therefore, the data centralization, accumulation and data security consist of:

- Installation on Data Centre composed of data storage infrastructure and applications for data usage
- Installation of Collection and Transmission Systems
  - Collection and Transmission System for Power Plant Data
  - Collection and Transmission System for Wet Bulb Temperature Data
  - Collection and Transmission System for Reservoir Management Data

The image of data flow to seek by the project can be found in Section A of chapter VIII.

The UNIDO Project will also develop technical training programme for the installed system for KenGen O&M and ICT staff.

The chart below summarizes the Scope of Supply.

Item	
1	Installation of Data Centre
2	Installation of Collection and Transmission Systems
	Collection and Transmission System for Power Plant Data
	Collection and Transmission System for Wet Bulb Temperature Data
	Collection and Transmission System for Reservoir Management Data
3	Development and Execution of Technical Training Programme

The project site is predetermined. Prevailing conditions at the site should be considered in any bids, such as environmental conditions, hydrogen sulphide, weather, inside/outside system and equipment locations, shading, accessibility, and potential for vandalism or theft of components, etc. Therefore, a site visit by bidders is mandatory prior to submission of the bid. The site has acceptable physical access for installing the system.

Bidders are requested to propose on the turnkey basis, meeting the Technology Requirements defined in Section B of this chapter.

#### **A. Technical Requirements**

The complete system should be installed and fully operational in the delivery timeframe outlined in the Table 1 Delivery Timeframe under Chapter V hereinbelow, with the unit installed and commissioned within twelve months of signing of the contract under the selected contractor. A brief work plan and timeframe of works to be performed are to be submitted in the proposal.

The Project entails the technology transfer to Kenya through a licensing agreement, as described in the section F. Licensing Agreement under the Chapter II.

The Bidder shall provide all detailed technical, civil, mechanical and electrical engineering designs and drawings of the system and auxiliary equipment to be installed

as necessary. The Bidder shall also provide detailed facility specifications for installing the system at the project work site with necessary civil works. These specifications shall be in such detail as to ensure that the technology, if installed according to these specifications, shall operate fully, properly and efficiently in achieving the data centralization and accumulation subscribed with required finishes and to the direction and approval of the UNIDO on-site supervisor, potential asset owner and project counterpart official.

Necessary civil works include, but are not limited to the following:

- Fabrication, welding and installation of peripheral accessories
- Site and land preparation works
- Installation of all electrical works
- Metal works including necessary fencings and gates as appropriate
- Piping /Cabling to the asset base
- Safety and theft preventive provisions as appropriate

The Bidder shall design, construct, test and commission the operation of the system before transferring the technology system to Kenya on a turnkey basis taking environmental aspects and social conditions of the identified site fully into account.

The bidder shall involve the manufactures of the existing power generation equipment so as to safeguard the long-term integrity, reliability and availability of the existing power generation equipment including turbines and generators as well as avoid unexpected shutdowns and damages to the existing power generation equipment. The bidder shall provide the system that is scalable and easy to integrate to other plants not included in the scope of the project. The solution provided by the bidder shall incorporate cyber security solution complete with equipment and knowledge transfer.

The Bidder shall ship to the site, store safely and assemble the system together with its auxiliary equipment on site in accordance with delivery timeframe (Chapter V.). The Bidder shall conduct output testing and provide certification of the operation of the system (commissioning) at the project site. The Bidder shall also provide a certificate of output testing witnessed, completed and signed by UNIDO (please see Chapter V. for more details).

The Bidder shall provide and conduct a detailed technical training programme for KenGen's managerial/supervising, operating and technical personnel in order for the installed devices and facilities to be used and maintained properly and effectively. The Bidder shall also provide operating and maintenance instructions, manuals and drawings in English. The Bidder shall provide a certificate of training completion countersigned by UNIDO, the trainee, the potential asset owner, and the project counterpart official as well as the Bidder. The Bidder shall also provide an acceptance certificate of the instructions and manuals that has to be countersigned by UNIDO, the project counterpart official and the Bidder.

The Bidder shall conduct troubleshooting visits to the project sites, as needed and when requested by the operator, during the defect liability period (DLP) (up to two years after acceptance of the system by all the parties), provided any breakdown shall be its responsibility during the DLP. The Bidder shall also provide two-year worth of spare parts of the strategic equipment as appropriate to ensure its uninterrupted operation during the DLP. A list of spare parts and their local availability is to be included in the proposal.

The Project includes closed and detailed monitoring and evaluation of the process during project implementation. The Bidder shall propose the monitoring and evaluation procedure, and assist and provide technical guidance in the monitoring and evaluation component of the UNIDO Project during the system's demonstration.

The Bidder shall have a reporting responsibility to UNIDO according to the schedule to be given in the contract document. The quality and quantity as well as the schedule of reporting will be described in the contract document.

The Bidders' representative shall participate in the Project Technical Committee (PTC) where the Bidder shall respond to inquiries by stakeholders. The PTC oversees and confirms the progress of the project and discusses any issues arising during project implementation. This is a task level monitoring and decision-making body. The PTC will meet at least every three months. When urgent and necessary updates on any arising technical issues need to be shared, ad-hoc PTC meetings will be held.

**Prior to submitting a proposal, the Bidder, at his/her own responsibility and expense, is required to visit and inspect the site and to satisfy himself/herself in all matters relating to: the nature of the work; materials necessary for the completion of the works; the completeness of work plan to achieve the requirement as per this ToR; the means of access to the site; and any other issues which could influence or affect the completion of the works. In this regard, schedule for the site visit will be available upon confirmed intention to bid.**

The proposal shall stipulate if plant downtime would be required in implementation of the project. If plant downtime would be required, the proposal shall contain the plant downtime plan specifying plants subject to any potential outages and their length.

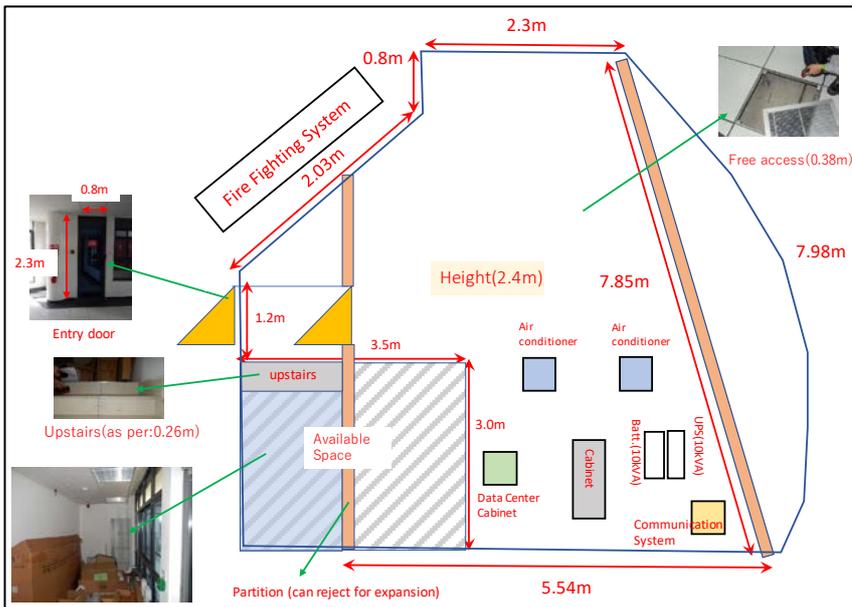
The proposal shall contain a sample Site Safety Plan complying the Occupational Safety and Health Act (OSHA). UNIDO places a high priority on selecting and working with the contractors that can clearly demonstrate a commitment to the occupational safety of its workers. The Site Safety Plan must indicate that workers assigned to conduct rehabilitation works will have access to hardhats, safety goggles, safety shoes and other protective equipment. The Site Safety Plan must also indicate that the company will have a First Aid kit on site. The UNIDO onsite supervisor will confirm the presence of a First Aid kit on site. Furthermore, the project site is located in the Hell's Gate National Park and the contractor is required to comply with the working times as specified by the Kenya Wildlife Services which controls and administers the park.

## **B. Technology Requirements**

### **1. Installation of Data Centre**

The data will be centralized and accumulated at "Data Centre" that will be newly established in the existing corporate data centre in the Geo Plaza at the Olkaria Complex. All the data transmitted from the plants will be stored in a newly installed data server and further transmitted to a newly installed server for O&M management with applications (conditions monitoring system, performance management system and operation management system). Furthermore, well data and well-related operational data included in the data transmitted from the plants and stored in the new data server

will be transmitted to the existing server for well data.



The technology of the Data Centre system must meet the following key criteria.

- 1) Data server shall be installed with below specifications:
  - Capacity and power source redundancy
  - I/O Tag: more than 20,000 points (Total)
  - Storage capacity with 5,000 points/h × 10 years and 5,000 points/s × 5 days (Total)
  - Scalability of expanding data and I/O tag
  - Protection for hydrogen sulphide
- 2) Server for O&M management shall be installed independently from the data server for applications for data management and analysis with below specifications:
  - Capacity and power source redundancy
  - I/O Tag: more than 20,000 points (Total)
  - Storage capacity with 5,000 points/h × 10 years and 5,000 points/s × 5 days (Total)
  - Scalability of expanding data and I/O tag
  - Protection for hydrogen sulphide
- 3) The applications for data management and analysis include:
  - Condition monitoring system
  - Performance management system
  - Operation management system
- 4) The condition monitoring system is to monitor power plant data from remote

location by client function via communication cable with functions of:

- Data processing and calculations
- Generation of trend graph, correlation graph and factor analysis chart with time range selection, zoom and legend, overlap, alarm & events function. Four graphs per page can be displayed at minimum.
- Storage of operational data used for the application
- Hard copy request
- Alarm display with thresholds set
- Data/Information guidance

5) The performance management system is to calculate and manage performance of power plant with functions of:

- Correlation and regression analysis upon real-time calculation
- Analysis of deviation from the range set and/or from the standard trend upon real-time calculation
- Fault tree analysis with flow chart configuration
- Analysis of specific steam consumption (SSC)
- Calculation of:
  - ✓ Thermal efficiency
  - ✓ Steam turbine efficiency
  - ✓ Turbine nozzle occlusion rate
  - ✓ Performance of condenser
  - ✓ Performance of cooling tower

The calculation basis for performance of cooling tower shall be defined. (e.g. based on "CTI Code ATC-105 (2000)")

- Hard copy request

6) The operation management system is to store and manage records of daily/monthly operation and performance reports. The operation management system is also to store and manage trouble history, work instruction and other documents related to operation. The system has a function of hard copy request.

7) Accessories necessary for operation of Data Center such as power cable, communication cable, optical fiber cable, media convertors, engineering PCs, etc. shall be installed properly.

8) The existing data server in the laboratory shall be integrated in the project, checking

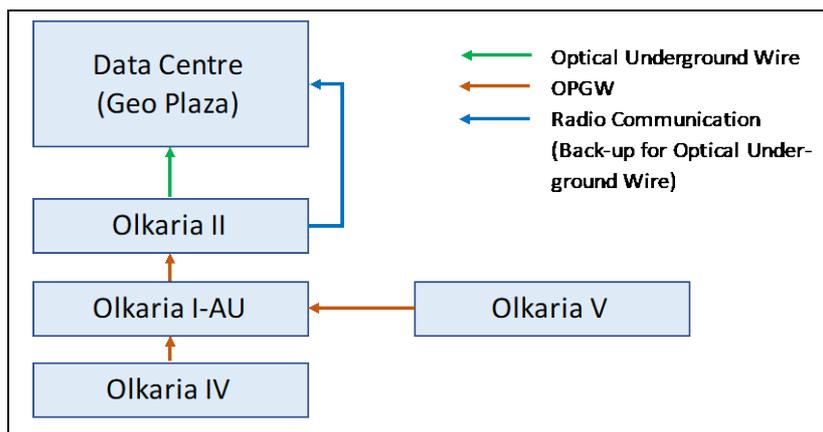
capacity.

## 2. Installation of Collection and Transmission Systems

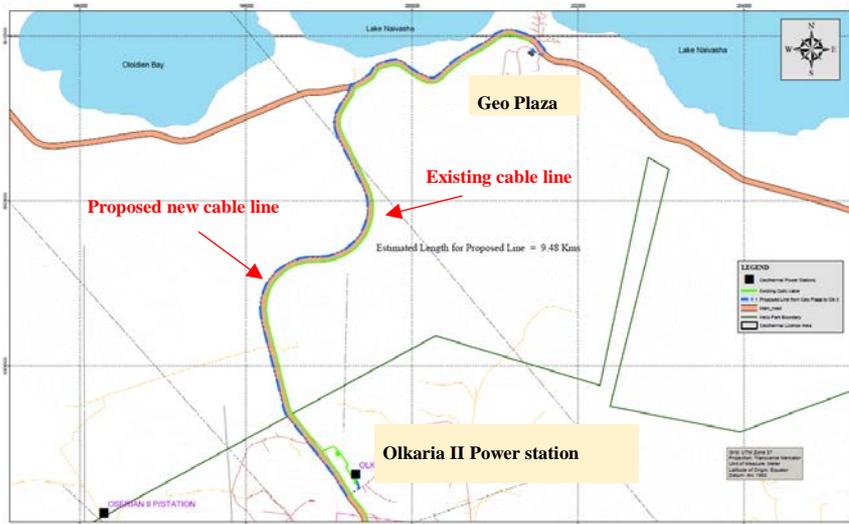
The Data to be centralized and accumulated at the Data Centre can be classified into three categories: power plant data, wet bulb temperature data and reservoir management data. The collection and transmission systems shall be installed according to the classification.

### 2-1. Collection and Transmission System for Power Plant Data

Power plant data derived from distributed control system (DCS) at the plants will be transmitted to the Data Centre via OPC servers and optical fibre cables. The image of data transmission in this respect is below.

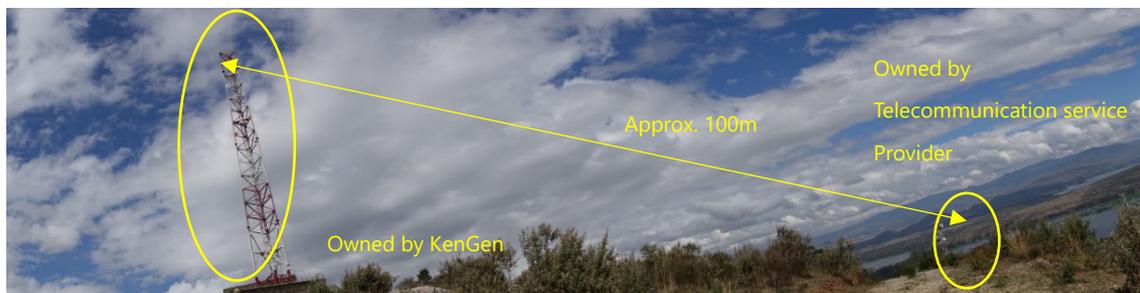


The data will be gathered at Olkaria II via optical fiber ground wire (OPGW) owned by Kenya Electricity Transmission Company (KETRACO) and managed by Kenya Power and Lighting Company (KPLC), and then transmitted to the Data Centre through the optical underground wire. The optical underground wire between Olkaria II and the Geo Plaza at the Olkaria Complex may need to be reinforced due to the limited capacity of the existing optical underground wire.



Layout of Optical Underground Wire from Olkaria II to Geo Plaza

In addition, backup transmission system for the optical fibre underground cable by radio communication utilizing the mast will be installed. The range of possible data transmission with the mast is expected to be within 30 km from the mast and the communication will be on 2.4 GHz free band of UHF (Ultra High Frequency) with a maximum of 50 Mbps at speed.



Distance to KenGen’s Mast from Telecommunication Service Provider’s Mast

Coordinates of KenGen’s Mast

Mast Location	Easting	Northing	Ground Elevation
Oserian Hill Repeater Mast	200576.54	9907904.40	2,230m

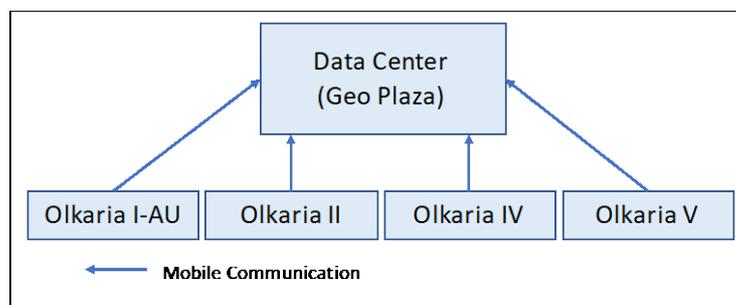
While an OPC server is necessary at each plant for DCS data from the plants to be integrated, an OPC server will need to be installed at Olkaria II (currently not installed).

The technology of the collection and transmission system for power plant data must meet the following key criteria.

- 1) OPC Server shall be newly installed for Olkaria II with engineering PC with below specifications.
  - Capability of handling data transmission without problems in operation
  - Capacity and power source redundancy
  - Protection for hydrogen sulphide
- 2) The optical underground wire between Olkaria II and the Geo Plaza may need to be reinforced. Route and construction method shall be considerate of damage and theft control.
- 3) Devices necessary for radio communication, such as radio modem, gateway, lightening protection, repeater, cabinet, etc. shall be installed properly. The mast that KenGen owns shall be utilized and radio communication shall allow two-way communication between Olkaria II and the Geo Plaza.
- 4) Accessories necessary for operation of collection and transmission system for power plant data such as power cable, communication cable, optical fiber cable, media convertor, client PC with printer, etc. shall be installed properly.

## 2-2. Collection and Transmission System for Wet Bulb Temperature Data

In the Olkaria Geothermal Power Station, specific steam consumption (SSC) is adopted to assess and evaluate the performance of power generation as the whole plant. In order to interpret SSC accurately and identify exact causes of fluctuation in performance, it needs to be correlated with wet-bulb temperature. Wet-bulb temperature, therefore, will be collected at each unit and transmitted to the Data Centre via mobile communication. The image of transmission of data is below.



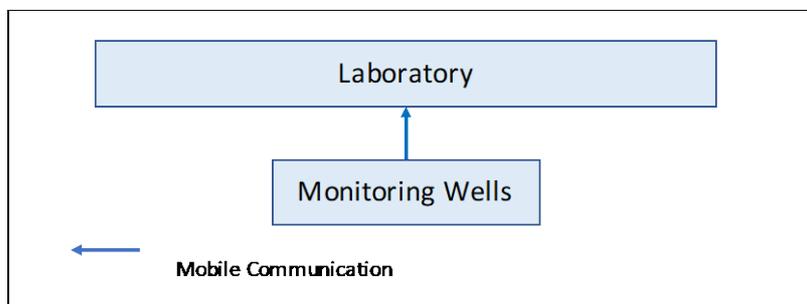
The technology of the collection and transmission system for wet bulb temperature data

must meet the following key criteria.

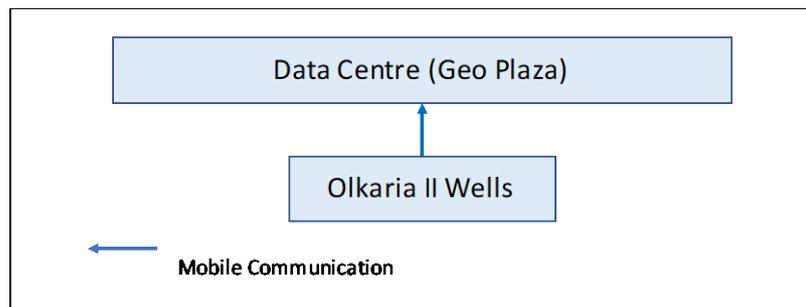
- 1) At least one piece of instrument for wet bulb temperature shall be installed at each unit of the power plants.
- 2) The instrument shall be installed according to the CTI Code ATC-105 (2000).
- 3) The instrument shall cover 0-50 degrees Celsius.
- 4) Necessary devices for measurement of wet bulb temperature data shall be waterproof and installed properly.
- 5) The communication for wet bulb temperature data shall be mobile communication.

### **2-3. Collection and Transmission System for Reservoir Management Data**

For the management of reservoir at Olkaria, collection and transmission systems will be installed for reservoir pressure data at observation wells respectively: OW39A, OW723, OW737, OW907B, 912B and 917. Currently, reservoir pressure data at observation wells are delivered manually once a month. In order to obtain real-time data, transmission systems will be installed for reservoir pressure data to be transmitted to the existing data server in the Laboratory at the Olkaria Complex via mobile communication. The image of data transmission for monitoring wells is below.



Moreover, some devices for transmission to the Data Centre will be installed for well data (production well and reinjection well) at Olkaria II with mobile communication. Well data at the Olkaria I-AU and Olkaria IV, on the other hand, can be derived from distributed control system (DCS) at the plants and transmitted to the Data Centre via OPC servers and optical ground wires together with power plant data. The image of data transmission for the Olkaria II wells is below.



The technology of the collection and transmission system for reservoir management data must meet the following key criteria.

#### Collection and transmission system for reservoir pressure data

- 1) The communication for reservoir pressure data from the observation wells shall be mobile communication and necessary devices for mobile communication shall be installed properly.
- 2) Pressure transmitters for reservoir pressure data shall be installed with the equivalent specifications to the existing pressure transmitters.
- 3) Batteries for the collection and transmission system for reservoir pressure data shall discharge for 1-month with redundancy.

#### Collection and transmission system for well data at Olkaria II

- 4) The communication for well data from Olkaria II shall be mobile communication and necessary devices for mobile communication shall be installed properly.
- 5) For well data from Olkaria II, necessary and sufficient devices for measurement shall be installed. Some existing pressure transmitters and flow transmitters could work, and those transmitters shall not be replaced and be utilized.

### **C. Other Requirements**

1. All work shall meet the standards specified herein and shall conform to approved and accepted standards for the industry and comply with all applicable safety codes in Kenya.
2. Specifications are provided to establish minimum technical standards.
3. The design and selection of materials for work shall be appropriate for the environmental conditions of 50 degrees centigrade ambient temperature.

4. All materials shall be new and the best quality available within the market, shall follow the market standard and shall be of the latest technology at the time of installation.
5. All equipment must be installed and commissioned in accordance with all documented guidelines, i.e. manufactures' manuals: (i) Conditions of Use, (ii) Installation and operational manuals, and (iii) All applicable safety codes.
6. During and at implementation of work, debris shall not be allowed to spread unnecessarily into adjacent areas or to accumulate in the work area itself. All such debris, excess and discarded materials shall be cleaned up and removed at the completion of the job and/or at the end of each work day. Final payment will be dependent on the removal of all construction debris, demolition debris and rubbish with proper disposal off-site.
7. UNIDO officials have the right to request a pre-shipment inspection for all the materials to be used in the project.
8. UNIDO and KenGen officials may inspect the sites at various points in the installation to ensure that work is being conducted in accordance with the Contract.
9. The contractor shall establish and maintain an effective quality control plan for the technology. The quality control system shall consist of plans, procedures, and organization necessary to produce a product, which complies with the contract requirements. UNIDO and KenGen shall inspect that products are produced according to the quality control system.
10. The contractor is required to provide a supervisor fluent in English to supervise all installation works. This supervisor is required to be present, on site, during all working hours and will also be responsible for compiling daily construction reports (with photos).
11. The equipment description should also be provided in English.
12. The contractor shall have or assign representative and or a local agency at time of bidding.
13. Prior to commencement of the work, the contractor and any subcontractors, whose presence is necessary or requested, shall meet in conference with UNIDO's onsite supervisor to discuss and develop a mutual understanding relative to the details of the administration and execution of this contract. This will include but not limited to the following:

- Official asset hand-over certificate countersigned by UNIDO onsite supervisor, asset owner, project counterpart official, and the contractor (receiving the site)
  - Updated project schedule to reflect the start date
  - List of project supervisor and foremen with full contact details
  - Site specific safety plan
  - Establish daily progress reporting system
  - Security requirements and other risks
  - Other aspects of this project that warrant clarification and understanding
14. The contractor's site supervisor shall be held responsible for the quality of work on the job. The site supervisor is the individual with the responsibility for the overall management of the project on behalf of the contractor.
  15. The contractor shall guarantee the quality and completeness of all his/her work, supplies and services specified in this ToR.
  16. Mechanical, electrical, performance and safety guarantees for the machinery and equipment supplied, and processes/technologies transferred should be provided for two years after commissioning (after obtaining the acceptance certificate), for installed and commissioned installations.
  17. The contractor is responsible for the correction of Defective Materials and Workmanship for two years after the date of commissioning and receipt of the signed project completion letter (including acceptance certificate.)
  18. Any Work found to be defective or non-conforming to the Contract, the contractor shall correct it as soon as practicable after receipt of written notice from UNIDO to do so.
  19. The contractor shall comply with the provisions of data protection, confidentiality and non-disclosure during and after the execution of the project.

#### **D. Content of the Bidder's Technical Proposal**

The technical proposal must be submitted in English and separated from the financial proposal. It needs to be delivered in hard copy as well as in electronic version on a USB flash drive. A response is required for every item requested below. If data are not available or if the information requested is not relevant or applicable to the proposed technology, the Bidder should state so and provide an explanation. The submission of marketing brochures that do not provide relevant technical information is not allowed.

The Bidder must state categorically whether or not their offer is exact to the tender specifications and if not, the Bidder should indicate any deviations.

In the technical proposal, the Bidder shall provide all relevant technical details of the technology, operation and maintenance. The data should include the following:

1. General descriptions
  - (a) Description of the proposed unit of the technology to be installed, including descriptions of relevant mechanical items and parts.
  - (b) Detailed description of operation and maintenance procedures.
  - (c) Detailed training programme for managerial/supervising, operating and technical personnel in Kenya.
  - (d) Offered systems have to fulfil the Kenyan legislation and industrial standards if any.
2. System specifications including:
  - (a) Capacity
  - (b) Typical operating parameters.
  - (c) Total physical size (dimensions) of the system.
3. Component specifications and overall layout of the system
  - (a) Description and specifications of the technology, including single line diagram
  - (b) Representative drawing(s) showing the overall layout and general configuration(s) of the system.
  - (c) General facility specifications for the existing facilities and relation thereof.
  - (d) Specifications of peripheral items.
  - (e) Requirements on site specification such as room for placement of the Data Centre, control panel, cabling, access roads, etc.
4. Standard operating procedures and general maintenance requirements related to the use of the technology.
5. List of previous installations and projects, and descriptions of the Bidders' relevant history/proven track record of related projects/qualifications to perform work as per this ToR in Japan and the region of the project site.
6. The Bidders' confirmation and commitment to complete all the works within the timeline indicated in the Terms of Reference.
7. List of personnel with their qualifications, estimated man/hours for key activities.

(Bidders must provide the curriculum vitae of key staff members including site supervisor and foremen that clearly demonstrate that they have more than 5 years of direct and relevant experience working on similar types of projects in Japan and outside of country).

8. Brief work procedure and work plan, timeline (proposed timeline with clear milestones) of project, taking the plant downtime and working times into consideration.
9. Maintenance plan, procedure and the Bidder's responsibilities for two years after the date of commissioning including scheduled site visits.
10. Monitoring and evaluation procedure to be conducted during project implementation.

Table 2 at the end of this document is a list of technical data and specifications required of the Bidder for their technical offer (Item #1-3 of above.) If there is not enough space, information could be attached in one or more separate sheets. If certain data are not available or applicable to the technology, the Bidder should include an explanation. Do not attach marketing literature unless it directly relates to a question.

#### **E. Content of the Bidder's Financial Proposal**

The financial proposal must be submitted in English and separated from the technical proposal. It needs to be delivered in hard copy as well as in electronic version on a USB flash drive. A response is required for every item requested below. The price quotes shall be specified in United States of America dollars, free of any tax (such as VAT) or duty. The financial proposal should clearly provide costs of each procured item under the turnkey installation. It also includes output testing, and commissioning of the system and training.

In the financial proposal, the Bidder shall provide information regarding costs and delivery timeframes, as follows:

1. Labour costs for preparing the technical documentation of the equipment including equipment specifications, general arrangement drawings, sub-assembly drawings, and detailed drawings; for each drawing and related engineering work, the estimated time in days should be provided.
2. Detailed cost breakdown of manufacturing the equipment, with timeframes.

3. Detailed cost breakdown of testing the equipment on site or at the Bidder's site, with timeframes.
4. Cost of freight to transport the equipment to the project site including clearances at the border of Kenya. All equipment has to be delivered to project site including unloading.
5. Detailed cost breakdown of construction, civil work and installation of the technology at the project site, with timeframes.
6. Detailed cost breakdown of output testing and certification of operations (commissioning) of the technology at the project site, with timeframes.
7. Detailed cost breakdown of other expenses, including troubleshooting, spares of parts of procured item as appropriate to ensure uninterrupted operation during the demonstration phase of two years.
8. Detailed cost breakdown for a training programme involving managerial/supervising, operating, and technical personnel in Kenya, with timeframes.
9. Detailed cost breakdown for monitoring and evaluation of the process.
10. Detailed cost breakdown related to participation in PTC meetings in Kenya.

Table 3 at the end of this document is a template for financial data required of the Bidder for their financial offer. If there is not enough space, tables could be expanded and information could be attached in one or more separate sheets. If certain items are not relevant to the technology, the Bidder should include an explanation.

#### **F. Licensing Agreement**

The licensing agreement shall be made between the operating entity of installed system, namely KenGen, and the contractor after the system installed has achieved the required results and quality of outputs. The license will cover the country of Kenya and it would cover only the installed system.

The present practice is to transfer ownership to UNIDO, which will then be responsible for further ownership transfers and contractual arrangements with a designated public entity and/or the operating entity for providing services under agreed conditions. Hence, the ownership of the technology units will be transferred from UNIDO, consistent with UNIDO rules and regulations, during the project realization and after successful

installation, commissioning and when the units are fully operational and giving the required results. The transfer of title will include the hardware, software, database and passwords alongside all the warranty and guarantees including after sales services.

As noted, the operating entity would continue operations beyond the project life. With regards to the installed system, the issue of the ownership after the demonstration phase has to be agreed upon. A solution regarding ownership after the demonstration phase will be prepared upon delivery of the turnkey system and its successful demonstration and the required results of the project and will be a matter of approval by the Government of Kenya based on the recommendation of the PSC.

The licensing agreement should consider, inter alia,

- Terms and condition for the license (geographical coverage);
- Ownership of the technology assets during the UNIDO project intervention;
- Ownership of the technology after the UNIDO project intervention;
- Modalities and transaction costs for transferring the license in case of deployment of the technology to a third party.

The bidder shall state any reservations or conditions with regard to the license in the proposal.

### **III. SYSTEM AND PERFORMANCE GUARANTEE REQUIREMENTS**

The contractor should apply the best available technology in each procured item. The contractor should guarantee technological, mechanical and electrical performance in accordance with international practice and standards. The safety guarantee should also be in accordance with international practice and standards.

The contractor should warrant that each part delivered is conform to the specifications in all respects including, but not limited to, physical characteristics, operating characteristics, space requirements, power requirements, maintenance characteristics, compatibility, and the like, as may be agreed to in writing by the parties.

The contractor should provide a minimum two-year guarantee that the parameters related to the performance of the technology mentioned in section B will be of high

quality and that these parameters will be met during the commissioning, trial runs/start-up and steady state operations.

The contractor should guarantee the quality of all the work specified in the section above on the Scope of Supply. The contractor should guarantee that the equipment to be supplied shall be new and up-to-date, without any defectiveness in or arising from workmanship or materials, without incorrect operation, and that the technical guarantee will apply for 24 months (two years) starting from the date of the certificate of commissioning countersigned after the successful output testing. (Term requirements are described separately in the “Technical Requirement” section of this ToR.) The contractor shall immediately repair or replace at own expense and as soon as practicable any defective good within the warranty period. It implies that the contractor shall make the most important spare parts readily available in the DLP (2 years after the commissioning of the installed system) as part of its responsibility. Also, the contractor shall provide critical spare parts once the warranty is expired.

The contractor’s responsibility shall be valid until the expiry of the guarantee period. The contractor is required to intervene and rectify each operating defect, defectiveness or irregularity that are due to misuse of equipment, accidents, negligence of standard operating procedures (SOPs), faulty reinstallation or any damages, as well as the ones caused by imperfect manufacturing or material faults of the equipment. Anything beyond the contractor’s guarantee will be at cost of the host counterpart.

The contractor shall guarantee that its supply and services would be provided in the agreed quantities and quality and according to international standards within the agreed timeframes and contract costs. The prerequisite for this, however, is that the operating entity fulfils in full measure its responsibility in line with the timeframes of the project.

Furthermore, the contractor will inform UNIDO as well as the other parties of the project, if equipment, work, components and materials supplied under the responsibility of the operating entity do not fulfil the safety standards or if the training of the staff did not reach the standards required for the safe operation of the installed system.

There will be a distinction between the technical provider's liability and the operator's liability. Technical provider's liability is on all the equipment supplied by the technology contractor of the project and is valid for two years of the project. The operator's liability is on all the remaining items not supplied by the contractor.

#### **IV. REPRESENTATIVE IN THE COUNTRY**

The contractor shall have a representative and/or a local agency in the country or region, who will be in charge of the technical support during installation and after. The technical qualifications, proficiency in the local language, and complete contact information of this representative must be included in the cover page of the offer. A written confirmation of availability shall be provided.

The contractor's representative, if invited, shall participate in Project Technical Committee meetings of the project. The contractor shall respond to inquiries of the public and private partners, and its representative should attend the meetings of the public and private partners, if invited.

The table below lists the deliverables and timeframe from the date the contract is signed. The contractor shall prepare equipment for dispatch to the project site destination in adequate packaging and will prepare and submit a list of goods sent to the project site location listing the serial numbers when available.

**V. Delivery Period**

**Table 1. Delivery Timeframe**

Activity	P - Month														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Survey for Designing of the System and Technical Training	█	█	█												
Manufacturing				█	█	█	█	█	█						
Transportation										█	█				
Installation										█	█				
Adjustment												█			
Technical Training													█		

## **A. Deliverables**

The contractor shall provide the following deliverables with defined deadlines:

1. A project report that includes summary of detailed survey of pre-selected installation sites, specification of equipment to be supplied and technical training course to be conducted in English; within THREE MONTHS after contract sign.
2. A locally adapted functional unit of the system adapted to local environment and conditions; TWELVE MONTHS after contract signature.
3. Factory acceptance and quality assurance certificate countersigned by the Bidder and sub-contractors in case that the equipment is manufactured outside of Japan prior to installation.
4. Technical and technological documents, including engineering drawings, engineering specifications, operation and maintenance manuals, and other technical and technological information of a like nature, of the system for Kenyan condition in English on DELIVERY OF EQUIPMENT TO SITE in 3 copies.
5. Acceptance certificate of the instructions and manuals countersigned.
6. Technical training to support up to 5 key system operators in the project site for the system on DELIVERY OF EQUIPMENT TO SITE.
7. Operation and maintenance support for two years including scheduled site visit.
8. Supply of spare parts for basic service and maintenance.
9. Certificate of installation and acceptance of civil work countersigned prior to the third party output testing.
10. Certificate of training acceptance for local system operators countersigned prior to commissioning.
11. Certificate of Output Testing by third party prior to commissioning for the unit.
12. Commissioning Certificate after the successful third-party output testing.
13. A technical assessment report in English summarizing the results of system installation ONE MONTH after the unit installation.
14. Certificate of training completion countersigned.

## **B. Reporting**

The contractor shall submit the following deliverables to the UNIDO to summarize activities conducted and results achieved:

1. The design and blue print of the complete system and a final work plan including

timeline.

2. Progress Reports of each milestone in English: Detailing the activities carried out during the reporting period including submission of revised project document and technical assessment report.
3. Report of completion of installation.
4. Final Project Report in English: Detailing all the activities carried out under the contract.

All documents will be provided to UNIDO with 1 electronic copy, consisting of the following electronic files:

- PDF file
- Original work files (WORD, POWER POINT, EXCEL, etc.).
- Photographs of before and after the installation of the system.

The electronic copy can be provided via e-mail, if the nature and size of the files make it possible. Otherwise, the electronic copy will be provided in a CD or DVD copy. All deliverables and related documents will be provided in English.

All written material submitted to UNIDO should be of such quality that no additional technical editing is required.

## **VI. CONTRACTOR'S RESPONSIBILITIES**

The contractor shall provide complete and detailed facility specifications, including space and all infrastructure needs, and shall provide all necessary advice and assistance in the preparation of the site. Agreements between the contractor/operator and hosting entity shall be made prior to the date of delivery to ensure that the premises are ready and available to house the technology according to the detailed facility specifications provided by the contractor and that all delivery and installation areas are suitable.

The contractor shall be responsible for the shipping, erection, installation and commissioning of the system at the project site and for making it fully operational including the civil works.

After installing the system, the contractor shall provide a notification in writing that the system is ready for output testing by third party. Output testing is intended to ensure that the technology operates in accordance with the technical specifications, is adequate to perform as warranted by the contractor, and substantiates a satisfactory level of performance reliability prior to its acceptance. Detailed output test protocols and acceptable parameters will be approved beforehand by the contracting parties. Output testing will be conducted at the project site and the test results will be made available for review by relevant agencies of the Government of Kenya, representatives of the public interest and UNIDO. In the event the technology does not meet the specifications or a satisfactory level of performance during the initial output testing, the contractor may continue output testing on a day-to-day basis until the specifications and standards of performance are met by own expenses. If after 60 calendar days from the start of output testing the technology still has not met the specifications and acceptable levels of performance, the contractor may be declared to be in breach of the contract, the contract terminated, and liquidated damages may apply; or the contractor may be allowed to provide a replacement at no additional cost; or the contractor may be allowed to continue the output testing for an additional thirty (30) calendar days. In such a situation, the contractor can offer, and, if accepted, to continue the output testing for an additional thirty (30) days at his/her own cost. In all cases, three sides agreement should be signed by UNIDO, the operating entity and the contractor.

When the results of output testing show conformity to the specifications and an acceptable level of performance, and upon approval of the test results and certification by the Government of Kenya and UNIDO, the contractor can certify in writing the operation of the technology at project site and the technology operation can then be handed over to the operating entity in an agreed timeframe.

The contractor shall provide assistance and training to managerial/supervising, operating, and technical personnel from Kenya. The contractor shall provide an instruction manual that shall include detailed instructions for machine operation, process controls, basic maintenance and troubleshooting and component replacement. The manual and drawings should be written in English. Three copies of the manual and drawings in English should be provided to KenGen. Two copies of the manual and

drawings in English should be provided to UNIDO.

**Table 2. List and Tables of Technical Data and Specifications**

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General Descriptions  
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A. DATA CENTRE SYSTEM

B. COLLECTION AND TRANSMISSION SYSTEM FOR POWER PLANT DATA

C. COLLECTION AND TRANSMISSION SYSTEM FOR WET BULB TEMPERATURE DATA

D. COLLECTION AND TRANSMISSION SYSTEM FOR RESERVOIR MANAGEMENT DATA

E. Civil Work

(Enclose necessary specifications for work including for fabrication, welding and installation of peripheral, Site and land preparation works, Concrete works, Installation of all electrical works, Metal works including necessary fencings and gates and power house)

F. DETAILS OF ANY OTHER EQUIPMENT not covered above or any other information relevant to the Performance testing of the system:

**Table 3. Table for Offer of Supply and Services**

Note: Expand the number of rows of the table as needed. All prices should be shown in *US dollars*. Under Compliance, the Bidder should note if the item does not meet the required specifications or other parameters in the tender specifications and indicate the Bidder’s alternative specifications or parameters in the column. Under delivery timeframe, the Bidder should specify delivery time (in *days*) from the date the contract is signed.

**Specification of Supply**

UNIDO REQUIREMENTS		TO BE COMPLETED BY THE BIDDER					
Item	Name and required parameters	Quantity	Unit Price	Total Price	Item	Compliance	Delivery Timeframe
			USD	USD		Yes/No	# of Days
	<b>I.) Technical Services, incl.</b>						
1							
2							
...							
	<b>Sub-total</b>						
	<b>II.) Equipment, parts, supplies</b>						
1							
2							
...							
	<b>Sub-total:</b>						
	<b>III.) Installation, commissioning</b>						

	<b>IV.) Cost of transportation &amp; Insurance</b>					
	<b>V.) Training for system operation</b>					
	<b>Total price:</b>					

<b>Conformance With Tender Specifications</b>	
Is your financial offer in exact conformity with the tender specifications?	<b>(Yes or No)</b>
If not, indicate there are deviations:	

## VII. EVALUATION CRITERIA

The following criteria shall be used to evaluate incoming proposals:

1. Experience in prior technical feasibility study for the system to be installed in developing countries;
2. Existence of technology demonstrations and transfer related to the system to be installed in power generation in developing countries;
3. Experience in collaboration with local institutions both in Japan and outside Japan on the system to be installed;
4. Sufficient delivery capacity of the system to be installed;
5. Supply of the system to be installed that has a technical feature specified in this ToR.
6. Knowledge of designing the system to be installed at geothermal power station.
7. Existence of manufacturing strategy for further cost reduction and technology dissemination including localization of assembly and manufacturing;

The proposals will be evaluated as follows: Technical and commercial evaluation is carried out by technical experts of UNIDO. The counterpart entity(ies) will be also consulted and invited for evaluation of the proposals.

**Please note that in the process of the evaluation of the proposal documents will be shared with external evaluators and/or project partner. If any of the submitted documents are of confidential nature, clearly state so in the proposal.**

## VIII. ANNEXES

### A. Image of Data Flow

