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<table>
<tr><th>Sl. No.</th><th>Reference</th><th>Provision as per Bidding Document</th><th>Clarification requested/ Query</th><th>Response/ Answer</th></tr>
<tr><td>1.</td><td>Remote Monitoring
(Clarification list 02, Sl no 34)</td><td></td><td>As per Clarification 02, Sl no 34, it is confirmed that Remote monitoring is required. However, there is no reference of any specification clause. Kindly confirm what is expected against “Remote Monitoring”.</td><td>Remote monitoring shall contain a remote copy of all footage recorded, system events and alarm. It shall also contain a copy of all stored events and alarms, stored cctv footage a minimum of 2 weeks and ability to trouble shoot system from remote.</td></tr>
<tr><td>2.</td><td>Control Building Auxiliary Services
(Clarification list 02, Sl no 36)</td><td></td><td>As per the referred clarifications, we are not considering any works pertaining to HVAC, Firefighting, Security system works in the Control Building at Nanyuki, Rumurati & Isiolo. Kindly confirm.</td><td>An integrated HVAC and firefighting (fire detection, suppression and fighting) and security system works (access control and alarms) will be provided by the contractor at the surveillance monitoring station at the Laikipia Air Base</td></tr>
<tr><td>3.</td><td>Telecommunication
(Clarification list 02, Sl no 41)</td><td></td><td>We presume that all telecommunication Equipment are existing at Nanyuki, Rumuruti & Isiolo S/S and present scope is limited to connection of ADSS Cable from Terminal Gantry to Telecommunication Equipment inside Control Building for all the above mentioned Substations. Kindly confirm.</td><td>Upgrade of the telecommunication equipment (multiplexers) where necessary to match with the rest of the network and ensure the upgraded multiplexer is manageable remotely from the Central Network Management System at NCC. The scope shall include upgrade of multiplexer inclusive of software, hardware and licenses. Also, remote station for integration to the network including SCADA, telephony and tele-protection.
Changes to be effected in the price schedule accordingly. Schedule 1
<table>
<tr><th>Item</th><th>Description</th><th>Unit</th><th>Qty</th></tr>
<tr><td>3.13</td><td>Nanyuki communication upgrade</td><td>Lot</td><td>1</td></tr>
<tr><td>3.14</td><td>Isiolo communication upgrade</td><td>Lot</td><td>1</td></tr>
<tr><td>3.15</td><td>Rumuruti communication upgrade</td><td>Lot</td><td>1</td></tr>
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</table>

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<tr><td></td><td></td><td></td><td></td><td>Schedule 4<table><tr><th>Item</th><th>Description</th><th>Unit</th><th>Qty</th></tr><tr><td>4.4.7</td><td>Installation, testing & commissioning, and remote integration to the network at Nanyuki</td><td>Lot</td><td>1</td></tr><tr><td>4.4.8</td><td>Installation, testing & commissioning, and remote integration to the network at Isiolo</td><td>Lot</td><td>1</td></tr><tr><td>4.4.9</td><td>Installation, testing & commissioning, and remote integration to the network at Rumuruti</td><td>Lot</td><td>1</td></tr></table></td></tr>
<tr><td>4.</td><td>Cable Trench
(Clarification list 02, Sl no 74 & 89)</td><td></td><td>As per Clarification 2, Sl no 74, 132kV Cables shall be installed in Cable Trench for the 1.5km stretch within 2m of edge of road reserve. We presume that Cables shall be installed in RCC Trench with Covers and laid on Cable Trays/Support. However, as per Sl no 89 of Clarification 2, it is mentioned that the trench shall be backfilled.

The above two clarifications are contradictory. Generally trenches will have restricted air circulation without backfilling. If backfilling is needed we can directly bury without concrete walls.

Kindly confirm the actual requirement as it will have impact on the selection of 132kV Cable Cross section.</td><td>No backfilling in the concrete trench section</td></tr>
</table>

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
5.	Surveillance/Detection system (Clarification list 119, Sl no 120 & 121)		For the Surveillance/detection system including CCTV, we presume that the required Auxiliary Power (UPS, Battery, DG set etc) shall be beyond the purview of this contract. Suitable Power supply provisions at required points shall be arranged by employer. Kindly confirm.	All auxilliary systems (power supply included) for the surveillance/detection system is called for in the scope of work by the EPC
6.	Type Test Report for 132kV Cable		We presume repetition of Type Test's for 132kV Cable's & accessories are not mandatory and Reports of Similar Cables (As per IEC 60840) can be submitted for approval. Kindly confirm.	Proposed cable matching requirements must have Valid (within 3 years) Type test certificate.
7.	Metallic Sheath (Clarification list 02, Sl no 63)		As per the referred clarification, we understand that metallic Sheath shall be Corrugated Aluminium only. Accordingly, we shall correct the offered data in Technical data sheet in bid submission. Kindly confirm.	Confirmed, corrugated aluminum metallic sheath is required. .
8.			We are studying the offer and together with our collaborators, due to the complexity of the design and the data that we have at the moment, in order to offer a professional offer, as KETRACO deserves, we ask you to offer us 2 more weeks to present the offer, until 4.05.2021. It is necessary to take information from the Protection and Control systems of the existing substations and process the information to carry out the technical documentation and the economic offer	Refer to addendum 1 and 2
9.	Price Schedule 1 item 3.9, material for connection of		Please mention the specification of the existing OPGW and Conductors.	Refer to clarification 3, query 54 & 56

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
	OPGW and conductor is required.		Also please note that there's a guarantee table for the OPGW while it is clear from the scope that there will be no supply for OPGW, please clarify	
10.	Vol 2 of 2 Employer's Requirement | Clause 2.13	**2.13. Fire Resistance** All cable sections installed in air will have an over sheath with a fire performance that conforms to the requirements of, • IEC 60332-1 (Fire) • IEC 60332-3A (Fire) • IEC 61034 (Smoke) • IEC 60754 (Minimal Halogen) Ideally, over sheath materials will also have an oxygen index of less than 30% and a temperature index of greater than 260.	Regarding cables fire resistance , the usual method for HV cables in tunnels or troughs is to apply fire coating material using airless machine , fire coating material was applied over the MDPE outer sheath after cable installation, fire coating material will meet all the requirements in the tender Hence , please advise about the availability to keep the Sheath Material for the project MDPE and use fire coating wherever required or not.	HDPE outer sheath is required. Provide fire resistance as requested
11.	Vol 2 - Technical Specifications I Clause 7 Detection /Surveillance Systems		Please specify the estimated quantity for the required cameras (or the length of the fence where the cameras will be put on) and advice where to add it in the price schedule.	It's the responsibility of the bidder to offer the best competitive bid. The CCTVs are to be provided on the KENHA road reserve portion and the KDF fence.
12.	Vol 2, Employer's Requirement I Clause 1.6.2 Nanyuki - Rumuruti Secondary Electrical Works		As of our understanding from your reply that there will be NO submission for updating protection system before bidding, but it should be considered in bidder's cost. Please confirm.	It's the responsibility of the bidder to provide the protection for the cable section. The detailed design for protection will be provided to the winning bidder for the existing substations.
13.	Price Schedule 1, item 1.4 Earthing and bonding cable		While the indicated 60 V refers to the max. permissible induced voltage on metallic sheath during normal operation,	It's the bidder responsibility to conduct requisite investigations.

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
			Please clarify the maximum permissible induced voltage during fault operation which would affect directly the max. minor section length*	
14.	Vol 2 Employer's Requirement I Clause 1.10.2 Temperature 2.2 Particulars of Environment	Minimum temperature 1° C Maximum temperature 45°C Max. Conductor temperature 80°C (Include Maximum Cable temperature.) Annual average temperature 25° C **Particulars of Environment** Ambient Air Temperature, Indoor Maximum +40°C 24 Hour Average Maximum +30°C Minimum +10°C	The max. Air Temperature according to KETRACO is max. 36°C, while the Ground Temperature has a higher value 40°C, we need to know the correct value to submit the current rating for concrete trough.	Air temperature 36 degrees C Ground temperature 40 degrees C
15.	Vol 1 Section IX Contract Forms | Appendix 1 Terms of Payment P249.	**Schedule No. 1.** Eighty percent (70%) of the total or pro rata CIP amount upon Incoterm "CIP", …….. **Schedule No. 2.** Eighty percent (70%) of the total or pro rata EXW amount upon Incoterm …….	The value written is different from the value in brackets. Please advise which value to follow.	It should be: Seventy percentage (70%)
16.			In the document received about the MAF MANUFACTURY AUTORIZATION FABRICAN, we can find next text:	"We hereby extend our full guarantee and warranty in accordance with clause 11.1 of the general conditions, with respect to the goods offered by the above firm."

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
			"We hereby extend our full guarantee and warranty in accordance **with Clause 21.1 of the General Conditions**, with respect to the goods offered by the above firm". But in the General Conditions we cannot find any information about the Clause 21.1. Please clarify. The supplying companies, collaborators in the project, request information on the mentioned clause, before signing the document.	
17.			We are studying the offer and together with our collaborators, due to the complexity of the design and the data that we have at the moment, in order to offer a professional offer, as KETRACO deserves, we ask you to offer us 3 more weeks to present the offer, until 10.05.2021.	Refer to addendum 1 and 2
18.	Price Schedule		The quantities in the price table do not match with the lengths of the indicated route and neither with the lengths of the technical specifications. Also, the quantities in Schedule 1 do not match with the quantities in Schedule 4. We appreciate if you could send us the updated the EXCEL Price Table.	The bidder to use provisional quantities in the price schedule including amendment where applicable as per previous clarifications.
19.	Clause 2.24.2.2. Electrical Tests VOL 2		The AC withstand voltage test on cable only of 5Uo for 1 hour as indicated in Clause 2.24.2.2. Electrical Tests	Comply with the employer's requirements. All tests in relevant IEC, IEEE, CIGRE standards/guidelines will be conducted.

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
			is not included in IEC 60840:2020 and thus it will not be applicable, please confirm.	
20.	Clause 2.24.2.3. Tests on Cable components VOL2		Please clarify the testing standard for Impact test on metallic sheath indicated in Clause 2.24.2.3. Tests on Cable components.	IEC TR 61901
21.			Owing to on-going Covid-19 pandemic that has slowed down pace in gathering documentations like bid bond, we humbly requests for an extension of current submission deadline Nanyuki Underground Cable Line Tender from the current April 19th 2021 to May 14th 2021. We hope you shall consider our extension application favourably.	Refer to addendum 1 and 2
22.	Vol 2 - Employer's Requirement | Clause 7 Detection/Surveillance Systems Technical Specifications & Technical Datasheets For Underground Cable Detection and Surveillance.	**7.16 SPECIFICATIONS** CCTV MATRIX VIDEO MANAGEMENT SYSTEMS DVR CODEC/IP CAMERAS MONITORING AND CONTROL SYSTEM PROCESSOR INSTALLATON SERVICE TOOL	After studying the specifications and requirements, we found there are very detailed requirements and parameters about this system. Considering that there is no general international standard for such system, we believe that the required detection/surveillance system is a specified product designed by a certain manufacturer therefore, kindly please suggest us the manufacturer of this detection/surveillance system together with the detailed contact information.	There is no manufacturer in consideration.
23.	Vol 2 - Employer's Requirement |	Handheld Data Collector Specifications Technical Data sheets for Handheld Data Collector	There are very detailed requirements and parameters in the Specification and Technical Data sheet including some special physical parameters, we assume the	There is no manufacturer in consideration.

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
	Clause 8 Handheld Data Collector Specifications & Technical Datasheets for Handheld Data Collector.		required handheld data collector shall be supplied by the specified manufacturer, kindly please suggest us the manufacturer together with the detailed contact information.	
24.	Vol 2 – Employer's Requirement |Clause 1.6.1 - Definite Work Clause 1.41 - Responsibility of Contractor Clause 1.42 - Additional services of Contractor Staff	**Clause 1.6.1** - Maintenance of the cable system of the transmission lines until the completion of the defects liability period. **Clause 1.41** - ……During the period of maintenance, the Contractor shall make such arrangements as to ensure the attendance on the Site, within a reasonable time of his being called upon to do so, of a competent representative for the purpose of carrying out any work of maintenance for which the Contractor shall be liable and during such part or parts of the said period as the Employer's representative shall deem it necessary, the said representative shall be continuously available on the Site…….. **Clause 1.42** - If the Employer's representative shall so require, the Contractor shall provide the services of skilled workmen for the repair of any defect with the Works or for any adjustments necessary which may occur in the period between KETRACO commencing to use any Section of the Works (whether taken over or	From the above we presume that O&M Engineers are not required to be present at site for the whole DLP period and will be called upon by the client during any repair or defect. If not, please clarify the role & responsibility of O&M Engineers for the same period.	The Bidder/Contractor shall make the best arrangement suitable for him as long as the services of competent representative are availed within reasonable time upon called by the Employer. For the price schedule 4, item 5.6.2, it indicated the number of engineers under Employer for training purpose which has been revised in clarification 3 item 61.

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
	Price Schedule 4, Item 5.6.2 - Operation & Maintenance Engineer	not) and the expiry of the period of maintenance. **Price Schedule:** Training as per Scope of Works; Operation and Maintenance Engineers - 6.		
25.	Section VII General Conditions | Clause 10.1. Taking Over of the Works and Sections	**10.1 Taking Over of the Works and Sections** 10.1.1: Except as stated in GC Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in GC Clause 8.2 [Time for Completion] and except as allowed in GC Clause 10.1.3(a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this GC Clause. 10.1.2: The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.	Kindly confirm when the taking over certificate will be issued to the contractor and retention money will be released in case the commissioning & charging of the line is delayed for the reasons not attributable to the contractor.	The GCCs related to delays not attributable to the contractor will be applied accordingly

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
26.	Vol 2 – Employer's Requirement | Clause 1.9 Price schedule 4, item 1.2.2	……Provision shall be made to establish a vehicle access track along the length of the cleared strip to for purposes of construction. Any alternative route for the track may be agreed with the Engineer. On handing over any section of works, the Contractor shall hand over relevant access tracks in a condition suitable for the Employer's maintenance vehicles and, for those originally belonging to the Employer, in no worse condition than originally recorded Establishment of required vehicle access track and maintenance road along the cleared line route	Based on price schedule 4, Item.1.2.2 **"Establishment of required vehicle access track and maintenance road along the cleared line route";** please provide the markup layout for access track. Whether top layer of road is gravel or bitumen or concrete & please provide the width of road required whether 2m wide or 3m wide or 5m wide. Also provide the section details of access track required.	Normal construction earth access road as prepared and used by the contractor shall be handed over to the employer. Note, it shall not be continuous for safety reasons
27.	Price schedule 4, Item 1.2.3 Installation of farm gates	Installation of Farm Gates – 5 Sets	Technical specification Cl.1.9, and Price schedule reference cl.1.2- Bush clearing, **access roads** and gates; cl 1.2.2.	This is provision for use where the parcel of land is fully fenced.
28.	Revised proposed route layout drawing titled: NANYUKI-RUMURUTI VERSES AIRBASE		What does this part sketch mean? Please clarify as the image is taken from double circuit location.	This shows the ROW for the double circuit section as 11 m. Please note that the ROW is constricted in the KENHA road reserve to only 2 meters.

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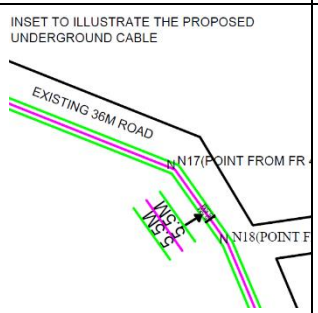
Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
				
29.	Clarification 2: Sl No. 121. Surveillance System		1. Please confirm if the CCTV surveillance is required for the complete cable route or only for the KDF fencing route (i.e almost 1.5 Km). 2. Also if the bidder has to consider separate poles and foundations for CCTV or the same needs to be mounted on outer fencing of KDF. 3. Where exactly Control & monitoring system of whole surveillance system is to be installed? 4. We presume that Arrangement for Auxiliary supply & backup supply for the surveillance system is not under bidder scope and that the client will provide the same. Please clarify.	1. Along the KDF and British Army fence (KENHA road portion) 2. Pole mounted. Provide separate poles 3. In the Laikipia air base. See clarification 2 4. Bidder to provide all the necessary primary, secondary and auxiliary systems for the surveillance system
30.	Section III - Evaluation and Qualification Criteria | Clause 2.7 Subcontractors/manufacturers	**2.7 Subcontractors/manufacturers** Subcontractors/Manufacturers for the following major items of supply or installation services must meet the following minimum criteria, herein listed for that item: …….	Refer to page 63 & 64 in Volume 1 (is it a condition to be owned to Main Contractor?	It's the responsibility of the bidder to source for the manufacturers and subcontractors for the execution of the entire contract if he wins the bid.

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31.			Distance between Each one and place of installation	Not clear.
32.			Cable at Air Temp. 35 degree, and at direct buried 40 !!!!!!	Air temperature 36 degrees C Ground temperature 40 degrees C
33.			System quantities and drawings - Type of used cameras (normal or wireless - dome or PTZ) - location of main workstation - is it require a pole or be installed on a military fence only - Is GUI (graphic user interface) will be required	Bidders responsibility for quantities and design. The monitoring system cameras is to be installed at every 200m-250m interval. The set up should be such that cameras there are installed per section to face each other for redundant coverage. Cameras to be both wired and wireless capable long range industrial outdoor Bullet cameras to cover the extent of the UG cable area. Main workstation is in Laikipia air base (KDF) Cameras will be Pole mounted. The installations shall be powered by solar system with battery backup. The details of the installation are attached to this clarification. A GUI is required.
34.			Is it DAS (distrbuted acoustic system) where the vibration only required to be monitored and alarmed (actions such as digging - excavation - intrusion ..etc) ? Or any other parameters must be monitored also.	Adhere to the specification provided and provide the appropriate designs
35.			Is CCTV system will be a part of intrusion detection system (i.e. the cameras must direct to locate the intrusion point) or CCTV is standalone system which will be used to monitor the fence of military area	CCTV will monitor the cable against intrusion /vandalism in the KDF fence area and the KENHA road reserve. In the complete cable route, other sensor technologies as per employer's requirements

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				must be employed. These shall work together as the intrusion detection system.
36.			More details are required about thermocouple from the customer	Thermocouples should be Type T made from copper-constantan. Non-linear resistances (Transient Voltage Limiter) should be provided on both leads of the thermocouple before connecting them to the measuring devices. the monitoring systems must be designed to minimize outside noise. Extension grade" thermocouple wire should be provided for connections. Battery powered data loggers should be provided that can record for 12 months suitable for outdoor installation in a water tight enclosure in an underground vault/manhole. The dataloggers should be ready for remote transmission to Nanyuki substation SCADA
37.			induced voltage required if availbale, also at short circuit (received from Tech office)	It's the responsibility of the bidders to estimate for the bidding purposes and later on provide a complete solution at implementation stage without cost implications.
38.	Vol. 2 of 2 - Technical Requirements | Clause 3.9.5 Site Tests on Earth Resistance	……Where the earth resistance is measured at more than 0.2 ohms then this result must be brought to the immediate attention of KETRACO.	earth resistance is measured at more than 0.2 ohms then this result must be brought to the immediate attention of KETRACO. (clarify this value at Joint Bay or substation, it very low resistance to be achieved outdoor)	Adhere to the specifications provided.
39.	Vol. 2 of 2 - Technical Requirements | Clause		it was mentioned that cables traugh will not be filled with back filling in volume 2, meanwhile at prebid	No backfill in concrete trough

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	5.3.2.2. For cables installed in surface troughs		meeting pt no. 89 they mentioned it will be filled and drawing are not final , so please confirm once more if the cables traugh will be filled with backfilling or not.	
40.	PART 2: Employer's Requirements, Cl. No. 4.1.2, Armouring method of UGFOC cable,		Technical specification clause 4.1.4 mentioned that UGFOC cable armoring shall be provided inner sheath by corrugated stainless tape & cable rodent and termite proof. Whereas technical specification Clause 4.1.2 specified underground installation and must be all dielectric fully armored. So please clarify the armoring method shall be adopted either dielectric or stainless tape.	Bidders to refer to the Technical Specifications provided in the updated datasheets provided in Clarification list 3. The UGFOC cable armoring shall be corrugated steel tape armored cable.
41.	PART 2: Employer's Requirements, Cl. No. 4.1.4, UGFOC General Construction, Page 99		Please note that height of the corrugations shall be minimum 0.6 mm and the pitch of the corrugated tape shall be max. 2.5mm. Please note this requirement will not help to improve the performance. Hence please clarify the requirement of corrugated tape.	Bidders to refer to the Technical Specifications provided in the updated datasheets provided in Clarification list 3.
42.	PART 2: Employer's Requirements, Cl. No. 4.2.1, UGFOC Mechanical properties, Page 102		Technical specification clause 4.2.1 mentioned that UGFOC cable shall withstand a load of value ≤9.81 x 2.5 x W is the weight of 11 km of the cable @ strain ≤0.25%. Whereas Technical specification Cl. 4.5.1 indicated Fiber strain as ≤0.6. Hence please confirm UGFOC cable shall withstand a load of value ≤9.81 x 2.5 x W is the weight of 1 km of the cable @ strain ≤0.6%.	Bidders to refer to the Technical Specifications provided in the updated datasheets provided in Clarification list 3. The cable shall meet load standards specified for outdoor directly buried UGFOC

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
43.	PART 2: Employer's Requirements, Cl. No. 4.2.1, UGFOC Mechanical properties, Page 102		Technical specification Cl. 4.2.1 mentioned that UGFOC cable crush load as 4kN / 100x10mm. whereas 10mm piece of cable is not possible for crush test. Hence please amend load of 4kN/100mm instead of 4kN/100 10mm.	Bidders to refer to the Technical Specifications provided in the updated datasheets provided in Clarification list 3. UGFOC crash resistance shall be 2200 N/10cm
44.	PART 2: Employer's Requirements, Cl. No. 4.2.1, UGFOC Mechanical properties, Page 102		Technical specification Cl. 4.2.1 mention that UGFOC impact load shall withstand an impact caused by mass of weight 50N. Whereas Cl.4.5.3 specified impact energy 10J, radius 300 Sq.mm for Impact Resistance Test. Hence please suggest that impact load test value.	Bidders to refer to the Technical Specifications provided in the updated datasheets provided in Clarification list 3. The cable shall meet test standards specified for outdoor directly buried UGFOC
45.	Price schedule No.4, Sl. No. 6.4, Recovery of existing towers		Customer clarification No.2, Sl. No. 115 specified that dismantling Existing towers along the cable route should be dismantled as well as the replacement of the terminal tower for Nanyuki - Isiolo. Whereas price schedule No.4, Sl. No.6.4 indicates 8 Nos. of recovery of existing towers. Hence please reconfirm quantity of dismantling towers.	Refer to clarification 3, query 9
46.	Price schedule No.4, Sl. No. 6.4, Recovery of existing towers		Please confirm dismantling of any other existing towers with foundation for 16.8km double circuit power cable between Nanyuki - Rumuruti.	The towers specified in the price schedule and clarification 3, query 9 are all the towers along the cable route.
47.	Price schedule No.4, Sl. No. 6.5, Breaking of cast foundations		Prices schedule No.4, Sl. No. 6.5 mentioned 10 Nos. of breaking of existing cast foundation. Whereas prices schedule No.4, Sl. No. 6.4 indicates 8 Nos of recovery of existing towers. Hence please clarify quantity of breaking of cast foundations.	The quantities in the price schedule remains and clarification 3, query 9.

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48.	PART 2: Employer's Requirements, clause 6, Drone Quantity, Page 123		Please note that Unmanned Aerial Vehicle (Drone) quantity not specified in technical specification Cl. 6, Page 123. Hence Please clarify the quantity requirement for this specific tender package.	Refer to Price Schedule, item 5.8
49.	PART 2: Employer's Requirements, clause 3.9.5 Site Tests on Earth Resistance		As per technical specification Cl. 3.9.5 mentioned the earth resistance value less than 0.2 ohms at cable Joints. Whereas generally earth resistance as 8 to 10 ohms on a transition tower between an underground cable and an overhead line. Kindly provide the value of earth resistance at 132kV Cable Joints.	Comply with the employer's requirements
50.	1.6.1 Definite Work		"*Three class 'B' road crossings via micro tunnelling*" – Clarify the requirement of Tunnel Boring for Cables in road crossings i.e., a) What is the minimum & maximum diameter of Tunnel boring to be adopted? b) Provide a typical section of the required Cable crossing in tunnel boring	It's the bidders responsibility subject to approval by the client and relevant authority.
51.	Third Party Inspection:		Apart from the test witnessing/inspection of goods at Vendor works in presence of Employer/Contractors Representative. Is there any additional inspection to be carried out by the nominated inspection agency	Yes, during design and installation phases at site
52.	Time Extension		Our Cable manufacturers have requested additional time to design the suitable Cable for this project. We would like to kindly request you to extend the deadline	Refer to addendum 1 and 2

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
			for Tender submission for three weeks, i.e., from 19th April 2021 to 10th May 2021	
53.	Soft Copy submission of tender documents		considering the Covid 19 Pandemic, Both Passenger and Cargo Flight operations are affected badly. We request KETRACO to consider electronic version (Password protected PDF) of tender documents through Email.	Refer to addendum 1 and 2
54.			Within the scope of the KETRACO tender and regarding the next submission date (**deadline April 19**), would it be possible to postpone the deadline for the submission by a few days/weeks? Indeed, in order to allow us to better refine our study taking into account the local content (local prices, local specifications, etc.) and in order to have an offer that is both technically and financially competitive, we would like to know if the submission's date could be extended. Could you, considering the details that we bring to your attention, come-back to us regarding our request?	Refer to addendum 1 and 2
55.	Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad		What do you mean by the cable surveillance system in schedule No.1? Does this item include the CCTV cameras, sensor cable & UAV? If the answer is no, where should we insert the price of the CCTV system, sensor cable & UAV?	There are two separate items 1.Cable surveillance: includes, cameras, sensors and all associated systems 2.UAV Provide them on different circuits

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Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
56.	Appendix 1. Terms and Procedures of Payment		It is mentioned that payment will be done from African Development Bank through Direct transfer to the contractor. Can KETRACO accept to open an LC for the contractor instead of direct transfer, which is a common practice for funded project?	No
57.	Volume 2, Detection/ Surveillance Systems		Will there be a fenced area where the precision locating fiber optic sensor will be used? Or will it only be used for the underground cable?	Cable Right of Way will not be fenced except the riser structure areas. Where the existing fences are damaged, the contractor has to repair accordingly.
58.	Volume 2, CCTV system		For the cameras, which areas do we need to monitor? Are we monitoring the route of the UGC or a different area? If a different area, please advise about the size of the area so that we can design the CCV system?	Cable on KENHA road reserve and along KDF fence
59.	Volume 2, CCTV system		For Wireless cameras, does the wireless have to built-in to the camera or can the wireless be via wireless bridge?	Built- in to the camera
60.	Volume 2, UNMANNED AERIAL VEHICLE (UAV) SPECIFICATIONS		For the UAV, which area need to be monitored using the UAV? What is the size of this area needed to be covered by the UAV?	UAV will be used for ad hock survey and surveillance. It is not part of the automated cable surveillance system
61.	Volume 2, UNMANNED AERIAL VEHICLE (UAV) SPECIFICATIONS		Will the UAV need to be integrated to the VMS or is this not required?	What is VMS?
62.	Pre bid clarifications- 3; Sr no. 48: Duties & Taxes		**As per point 48: (1a & 1b) Import Duties and Taxes on Imported Machinery and Equipment.**	Submit the bid as per requirement. Evaluation shall be carried out with the guideline of the financier.

Clarification List - 04

Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
			Local taxes & import duty shall be reimbursed to the contractor by the employer. Please clarify the following 1. We understand that bidder doesn't have to include import duties in the **Price Schedule: 1. Supply Foreign (UG) as per CIP Incoterms**. 2. Import duties will not be considered for bid evaluation.	
63.	Pre bid clarifications- 3; Sr no. 48: Duties & Taxes		Kindly provide the timeline for reimbursement of taxes & duties from the time it is paid to the concerned authority.	Not relevant at this stage.
64.	Price Schedule		Kindly share the revised price schedule reflecting the changes mentioned in Clarification no.2 & 3.	Bidders shall update accordingly and submit.
65.	EHV Cable: Technical data schedule		Kindly share the revised technical data schedule of EHV Cable as per the changes described in Clarification no. 2 & 3.	Bidders shall update accordingly and submit
66.	Metallic Sheath (Clarification list 03, Sl no 99 & Clarification list 02, Sl no 106)		As per clarification 02, Sl no 106, it was confirmed by KETRACO that the short circuit withstand current for Metallic sheath shall be 31.5kA/1s. However, as per Clarification 03, Sl no 99 the same is to be proposed by the bidder. Kindly note that the short circuit withstand capability of metallic sheath is as per owner's requirement and hence we request to retain 31.5kA/1s for uniformity in bidding process. Kindly confirm.	31.5 kA 1s

Clarification List - 04

Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
67.			As per the clarification, control & monitoring system needs to be installed approx. 5 Km from the cable route. Kindly clarify the following points. 1. We presume the auxiliary & backup supply is readily available or KETRACO will arrange and bidder need not to consider the same in scope of works. 2. Kindly provide the FO cable routing up to control & monitoring system. 3. Bidder has to consider the CCTV for the below route. 	1. Bidder scope to include all auxiliary systems including power 2. FO routing is responsibility of bidder 3. Image provided is not clear for clarification. 4. The general idea is correct as this appears to be the KDF fence and the KENHA road sections (next to BATUK). But route is from approximately points MN5 to L.

Clarification List - 04

Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
68.	Section II Bid Data Sheet | Clause ITB 22.1 and Addendum 1 and 2	**The deadline for bid submission is:** Date: 5th April 2021…….. Time: **10.00 a.m.**	Kindly confirm that the deadline for bid submission could be extended to the 21st May	Refer to addendum 1 and 2
69.	Section III Evaluation and Qualification Criteria | Clause 2.4.2 Specific Experience	(a)Participation as contractor, management contractor, or subcontractor, in at least **three (3)** contracts within the last **ten (10)** years, each with a value of at least **US$ 12 million,** that have been successfully and substantially completed and that are similar to the proposed Works……	Kindly clarify that Design, supply installation and commissioning contracts of 30 km (and above) underground cable Transmission lines of voltages132Kv (and above) with values that are less than US$ 12 million would meet the requirement (The value of each contract performed as the contractor could be less than US$ 12 million due to the fact that equipment have been supplied by the project owner).	Adhere to the specifications in bidding document Clause 2.4.2 Specific Experience under Evaluation qualification criteria
70.			Within the scope of the KETRACO tender and regarding the next submission date (deadline April 19), we would like to request to extend the Bid submission by few weeks. Indeed, to allow us to better refine our study taking in to account the local content (local prices, local specifications, etc.) and to have an offer that is both technically and financially competitive. Further, our suppliers are also requesting for some more time to provide us competitive prices. So, we hope you will take our request in to consideration and do the needful.	Refer to addendum 1 and 2
71.	Section II Bid Data Sheet | Clause ITB 22.1 and Addendum 1 and 2		According to your Clarification No.5, we have to revise part of our design and quotation. So, we kindly request for an extension up to 30th April 2021, please consider it, thanks.	Refer to addendum 1 and 2

Clarification List - 04

Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
72.	Clarification no 3, item 6 and 100		As per Clarification no 3, Response no 6 and 100 specifies HDPE Outer sheath, whereas as per response no 60, fire resistance is also applicable on outer sheath. Please clarify type of outer sheath required.	HDPE Outer sheath
73.	Clarification 3, item 70 and 94		As per 132 kV Technical Data sheet, nominal Insulation thickness is 20 mm, whereas as per Clarification no 3, Response no 70 & 94, the Insulation thickness is to consider 16 mm. Please confirm.	Refer to clarification clarification 3, query 70 and 94
74.	Section III Evaluation and Qualification Criteria | Clause 2.4.2 Specific Experience		We have noted the given Qualification Requirement for Form EXP 2.4.2 (a) and corresponding clarification response. We request you to please consider the project experience of 110 kV voltage level on the basis of XLPE cable laid in the project. XLPE Cable used in 110 kV project is type tested/well suited and for 132 kV & above voltage level. We shall submit the relevant type test reports of XLPE Cable as well. Request to please consider the 110 kV project reference as well towards meeting the Qualification requirement.	Adhere to bidding document requirement of 132kV voltage level and above.

Clarification List - 04

Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
75.	Section II Bid Data Sheet | Clause ITB 22.1 and Addendum 1 and 2		We have received the Clarification no 3 on 7th April and noted response towards cable design and Tower drawings. We need time to study the new documents to prepare the technical compliant and competitive. Thus, we request you to please extend the deadline of bid submission by 3-4 weeks.	Refer to addendum 1 and 2
76.	Section III Evaluation and Qualification Criteria | Clause 2.4.1 General Experience	Experience under contracts in the role of contractor, subcontractor, or management contractor for at least the last fifteen years [15] years prior to the applications submission deadline, and with activity in at least nine (9) months in each year.	Considering the different profession and scope of parties under the Joint Venture, Consortium or Association, it's not fair for all the parties to fulfill the general experience. Especially for cable, which is a main product in this project, cable manufacturers shall be allowed in the Joint Venture without meeting all the General experience. We would like to request you that as for General Experience requirement for Joint Venture, Consortium or Association, At least one partner must meet the requirement.	Adhere to the specification in the bidding document as per clause 2.4.1 under evaluation and qualification criteria.
77.	Section III Evaluation and Qualification Criteria | Clause 2.7 Subcontractors/manufacturers	Subcontractors/Manufacturers for the following major items of supply or installation services must meet the following minimum criteria, herein listed for that item: Supplier for underground cable, fibre optic cable, earthing and accessories: The vendors must have successfully manufactured and supplied similar items (132 kV and above) for the last fifteen (15) years in conditions to those prevailing on site, and the items shall have at least ten (10)	Considering the supply experience long time ago does not make too much sense for project implementation works, and it can reduce competition for such a project which is not in benefit of the Employer. We suggest that the Employer should focus on the experience and performance of the bidders during recent years. We would like to request the following change can be adopt: Supplier for underground cable, fibre optic cable, earthing and accessories, The vendors must have successfully manufactured and supplied similar items	Adhere to specifications in the bidding document clause 2.7 under Evaluation and Qualification criteria.

Clarification List - 04

Sl. No.	Reference	Provision as per Bidding Document	Clarification requested/ Query	Response/ Answer
		years of successful field operations outside the country of origin in conditions similar to those at site.	(132 kV and above) for the last five (5) years in conditions to those prevailing on site, and the items shall have at least five (5) years of successful field operations outside the country of origin in conditions similar to those at site.	
78.	Clarification 3, query 3		Please kindly confirm the conditions for the contract coming into effective.	Under Particular Conditions 1.1.3.3, replace the words 'effective date' with 'commencement date' Particular Condition 8.1.1, the following are the conditions precedence to Commencement: a. This Contract Agreement has been duly executed by both the Employer and Contractor; b. The Contractor has issued to the Employer the Performance Guarantee in the prescribed form; and c. The Employer has paid the Contractor the Advance Payment against receipt by the Employer of the Advance Payment Guarantee in the prescribed form.

Clarification List - 04

ADDITIONAL SPECIFICATIONS FOR THE DETECTION/SURVEILLANCE SYSTEM

The proposed solution shall entail installation of CCTV surveillance units along the entire stretch of the underground cable. The general surveillance unit shall compose of two solar panels, two IR illuminators for two bullet cameras facing opposite directions (to monitor the underground cable area) at an interval of 200-250m, and two wireless communication transmitters to create a wireless network.

This surveillance unit shall be housed in a heavy-duty meshed-cage structure for security of the components. The general design of the cage shall be 2m*2m (to support the up to two 2m*1m solar panels installed at the optimum tilt and azimuth angles) and it shall be 5m high. It shall also be equipped with an access door. Solar power demand calculations shall be provided by the bidder and shall ensure a minimum 2-day power autonomy is provided by the solar power system for all equipment provided. To provide additional redundancy, the power systems of any 5 consecutive surveillance units shall be connected in parallel via underground power cables.

The 5m high mounted latticed structure made of structural steel of grade S275 as per BS EN 10025; Comprising of RHS columns min. size 75x50; min. thickness 5mm and angle sections min size 50x50x5mm thick; brackets and sections shall have min. 5mm thickness; all steel shall be galvanized and bolted at the joints; min. bolt dia 12mm; and anchored to a base plate min. 25mm thick and anchor rods Grade 56 on a RC foundation base to S.E's detail. End plates shall be joined by continuous structural quality welding to BS EN 1011; Hollow sections in non-corrosive galvanized steel shall be provided with drain holes at least 10mm dia at all low points. The top of the structure shall have a slope as per the calculated tilt and azimuth angles for on either side to support 2 units of 2m x 1m solar panels on the angle sections in either direction. Provide angles support for the mounting of surveillance cameras and IR illuminators which shall be suspended at the central point of the structure directly beneath the solar panels. Include excavation for foundation in soft material. The structure shall be secured with a heavy gauge steel grillage mesh on the four sides (with cut out for the cameras) to the Employers approval. The structure shall have lightning protection made from copper and placed at the top center of the structure in between the solar panels. The lightning rod shall be safely and securely wired on the side of the structure using a copper wire to ground where it shall be grounded using a copper rod directly driven at least 2m deep 1m away from the structure. Each structure shall also be directly grounded using aluminum rods buried at least 2m deep from at one corner of the structure.

In the caged housing, there shall be a heavy duty rugged IP66 rated outdoor enclosure with passive cooling to house the solar batteries and charging system and all other electronics. The enclosure shall be well ventilated, and it shall be securely bolted mounted on a concreted floor.

The terminal units – one at the end substation(s) vicinity and/or at the cable sealing end – shall be special units with PTZ and Bullet cameras.

To Note: Vision of all the entire section(s) between two adjacent jointing locations must be clearly covered thus the need for installation of cameras facing each other between sections at an interval of 200-250m.

The minimum requirements of each CCTV surveillance unit include:

- 2* Outdoor Wireless IP Bullet Cameras

- 2* Solar Panels
- 4* Solar AGM Batteries
- 2* Long range Wide Angle IR illuminators
- 2* Wireless Transmitters
- 1*MPPT Solar Charger Controller
- Solar and Camera Wiring
- Battery Wiring
- Panel, Battery and load disconnector switches and/or MCB's

Laikipia air base (KDF) shall house the Surveillance and Monitoring system. The system shall be powered from the station supply but shall also be supported by a backup power supply. A copy of the surveillance data and system shall also be located in Rumuruti substation with a similar backup power supply system. Optical fiber along the line shall be used to transmit this data to Rumuruti substation. This shall be comprised of:

- Video Surveillance Node server and software in Laikipia air base
- 2* Monitoring screens, mouse pad, keyboard, PTZ camera control modules in both Laikipia air base and Rumuruti substation
- 4hr battery backup supply at both locations
- 1* Network switch at both locations
- Long range wireless Receiving Antenna mounted on the substation building at the Laikipia air base

OVERVIEW OF THE PROPOSED SOLUTION FOR THE UNDERGROUND FIBER OPTIC CABLE DETECTION SYSTEM

The Terrain Following Detection System shall comprise of a Brillouin-based distributed fiber sensors. The system is based on Brillouin scattering for distributed dynamic strain sensing. The configuration to be employed shall be BOTDR (Brillouin Optical Time Domain Reflectometer) in which a pulsed pump light and continuous wave probe light with frequency difference equivalent to the Brillouin frequency shift are launched at the two ends of the underground cable following sensing fiber.

The underground cable following sensing fiber shall be a pair of fiber optic cables – per circuit per detection direction – buried directly above the underground high voltage cable at any two different depths (as per manufacturers recommendation and/or efficient sensing depths for security alarming function) for optimum detection of strain as a result of soil disturbance. Two equipment shall be installed at terminal ends which shall provide redundancy of measurement for both circuits. The sensing fiber shall be field-repairable if damaged by replacing the damaged section with a spare sensor cable section and a splice kit with encapsulating compound and an enclosure.

The sensing solution and data shall also be routed to remote location for information and alarming purposes. The system shall be configured to work in cohesion with the CCTV surveillance system in that the location output for a cable strain shall be used as an input for CCTV system as an activator for both, recording, recognition, alarming and all other security functions available.

The BOTDR shall be supplied as 4 rackable units installed at both ends with complete packages and licenses for redundancy per circuit as well as two portable units as spares. The system shall be installed securely in the IP66 weather proof and rugged outdoor panels.

Clarification List - 04

A visual monitoring system shall also be included at both Nanyuki, Rumuruti and KETRACO Headquarters for visual monitoring of the security status of the UG cable system. Ethernet to Optical Switches, and optical boosters if necessary(to be supplied as approved by the Employer), shall be used to route the surveillance system data from the cable sealing end stations (at both ends of the UG cable) to the terminal stations; Nanyuki and Rumuruti. Optical power budget calculations shall be used to engineer the optical link between the cable sealing ends and the terminal stations. The visual monitoring system shall contain a graphic representation of the complete underground cable complete with alarming capabilities at all locations depending on the surveillance system output. The system should also contain messaging and email notifications to an initial configurable maximum of 10 persons which can later be increased. The messaging and notification function shall contain all necessary fault details with a minimum of fault location coordinates and distance as well as intensity if fault.

ADDITIONAL TECHNICAL SPECIFICATIONS

1. **Outdoor Wireless IP Bullet Camera**

Image Sensor: 1/2.8” 2.0 megapixel progressive scan CMOS sensor,
Resolution: 1920*1080 resolution,
Day/Night Mode: Auto/Color/Monochrome (removable infrared-cut filter) mode,
Electronic Shutter speed: 1/100000s to 1s electronic shutter speed,
Wide Dynamic Range: 128dB wide dynamic mode,
Backlight Compensation: Supported
Digital Noise Reduction: Self-adaptive to 2D or 3D DNR,
Defog: Automatic/Manual,
Image Stabilization: Electronic Image stabilization,
IR coverage: Upto 80meters
Angular field of view: Horizontal:[43° Wide 14°(Tele)] and Vertical:[22° (Wide) 9° (Tele)],
Video Compression: H.265/H.264/MJPEG,
Multiple streaming: Double Full HD streams and Treble streams (30fps or 25fps),
Audio compression G.711a/G.711u/G.726/OPUS,
Network protocols: (TCP,UDP,IPv4, IPv6, DHCP,DHCPv6,DNS,ICMP,SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS),
Steaming Transmission: Unicast/multicast,
Stream encryption: AES 128/192/256 encryption algorithm,
Inteligent analytics: (Loitering detection, Intrusion detection, Abandoned object detection, Removed object detection, Target colour recognition, Humans and vehicles distinguish, motion detection, tampering detection),
Alarm actions :[Alarm output, SD card recording and snapshot],
Ethernet interface (1xRJ-45 10/100Base-T self-adaptive Ethernet port),
Serial Interface: At least 1*RJ-45 10/100Base-T self-adaptive Ethernet port,
Alarm Interfaces: 2 channel input and 2 channel output,
Audio interfaces: 1 channel input and 1 channel output,
Memory card slot: Built in 32G memory slot,
Power Supply: [DC12V±25%, DC24V±25%,AC24V±25%, POE(IEEE802.3at)],

Power Consumption: Maximum power consumption 20W,
Surge Suppression: 6kV surge voltage protection IEC61000-4-5 compliant,
Vandal Proof Class: IK10 vandal-proof metal casing IEC62262 compliant,
IP Protection class: IP66 minimum, complies with IEC61000-4-5,
Anti-corrosion specification: 10 day salt spray test IEC60068-2-11 compliant.

2. IP Pan Tilt Zoom Camera

Image Sensor: 1/2.8" 2.0 megapixel progressive scan CMOS sensor,
Resolution: 1920*1080 resolution,
Day/Night mode: Auto/Multicolor/Monochrome,
Electronic Shutter Speed: 1/100000s to 1s,
Iris Diaphragm: Automatic iris diaphragm,
Gain Control: Automatic/Manual,
Wide Dynamic Range: 120dB wide dynamic mode,
Backlight Compensation and highlight Suppression: supported,
Digital Noise Reduction: self-adaptive to 2D or 3D,
Defog: Automatic/Manual,
Image stabilization: G-Sensor unit Electronic Image stabilization,
Focal Length: 4.5mm-135mm,
Zoom: 30X Optical zoom and 16X Digital zoom,
Angular field of view: Horizontal: [60.89° Wide 2.67°(Tele)] and Vertical: [37.34° (Wide) 1.51° (Tele)],
Rotation angle: (Horizontal:0° to 360°, Vertical: -20° to +90°),
Horizontal Rotation Speed: [Manual: 0.1°/s to 450°/s, Preset≥450°/s],
Vertical rotation speed: [Manual: 0.1°/s to 400°/s, Preset≥400°/s],
Preset positions: 256,
Tour scan: 8 scan lines each with 32 preset positions,
Pattern scan: Max of 5 scan lines each 10minutes,
Park Action: [Home position, preset position tour, pattern scan, horizontal scan, vertical scan, random scan, frame scan and panoramic scan],
ISP Packages: 5 defined scenarios (outdoor, indoor, motion capture, lowlight, and backlight modes),
Video Compression: H.265/H.264/MJPEG,
Multiple streaming: Double Full HD streams and Treble streams (30fps or 25fps),
Communication Interface: One RJ-45 10/100/1000Base-TX self-adaptive Ethernet port,
Network protocols: (TCP,UDP,IPv4, IPv6, DHCP,DHCPv6,DNS,ICMP,SIP, RSP, SSL, NTP, SNMP, 802.1x, QoS, DDNS),
Alarm interface: (4-channel alarm input and 1-channel alarm output(pigtail),
Unicast/multicast steaming transmission and stream encryption capable,
Event Triggers: (motion detection, covering detection, alarm input, intelligent analytics alarm and network disconnection),
Ethernet interface: (1xRJ-45 10/100Base-T self-adaptive Ethernet port),
Storage interface: Micro SD cards in 64GB maximum memory slot of Speed class≥6,
Media security: AES128/192/256 encryption algorithm,

Power supply: [DC12V±25%, DC24V±25%, AC24V±25%, POE(IEEE802.3at)],
Maximum power consumption 45W,
EMC Compatibility: Complies with EN 55022 Class B, EN 55024, EN 50130-4, EN61000-6-1/3/2, EN 61000-3-2/3 and FCC Part 15 Subpart B Class B.
Lightning Surge Suppression: 6kV surge voltage protection IEC61000-4-5 compliant,
Vandal-proof Class: IK10 vandal-proof metal casing IEC62262 compliant,
Anti-Corrosion: 10 day salt spray test IEC60068-2-11 compliant.

3. Solar Panels

60 cell monocrystalline IP8 Anodized aluminum frame with Tempered Glass with AR coating
Maximum dimensions of 2000mm* 1050mm*50mm solar panel,
MC4 connector type
Junction Box: IP68 with 3 Bypass Diodes
STC Electrical Properties (minimum) [Standard Test Conditions of Irradiance=1000W/m2, Ambient Temperature=25°C, AM1.5]

Maximum Power, Pmax:360W,
MPP Voltage, Vmpp:36.5V,
MPP Current, Impp: 9.87A,
Open Circuit Voltage, Voc:42.7V,
Short Circuit Current, Isc:10.79A,
Module Efficiency: 20% ,
Maximum system Voltage:1000V,
Power Tolerance: 0~+3%

NOTC Electrical Properties(minimum) for 360W Module [Nominal Operating Cell Temperature Conditions of Irradiance=800W/m m2, Ambient Temperature=20°C and wind speed of 1m/s]

Maximum Power, Pmax:271W,
MPP Voltage, Vmpp:36.4V,
MPP Current, Impp:7.45A,
Open Circuit Voltage, Voc:40.2V,
Short Circuit Current, Isc:8.68A

Certifications: IEC 61215, IEC61370-1/2, UL 1703, IEC 61701, IEC62716, Type 1 Module Fire Performance (USA) or Fire Resistance Class C (ULC/ORD C1703) (Canada).

4. Solar AGM Batteries

12 V, minimum 205Ah @20Hr Polypropylene Deep Cycle VRLA AGM/Non-spillable/Maintenance free batteries 8 years' minimum life according to IEC61427,
Maximum charge current of 20% of C20
Electrical Specifications:

Capacity Ah: 174Ah (10Hr),205 (20Hr), 210Ah (48Hr), 213Ah (72Hr), 216Ah (100Hr)
Energy: 2.46kWh (20Hr)
Internal Resistance: 4.5mΩ
Short Circuit Current: 2790A

Note: Batteries to be connected in twin parallel array of 2*12V batteries connected in series for a 24V system with a power capacity of 410Ah.

5. Long Range Wide Angle IR Illuminators

Infrared Wavelength: 850nm (Semi-covert),
Input Voltage: (24-36) VDC or 24VAC,
Maximum Power Consumption: 25 Watts,
IP Protection rating: IP67 Outdoor,
Pan/Tilt U-bracket included,
Illumination ranges: 120ft (150°), 174ft (90°, 285 ft (60°*30°), 400ft (30°), 530ft (20°*10°), 800ft (10°).
Capabilities:

- Integration via I/O Ports
- Ability to sync with camera or any other system,
- Automatic On/Off capability,
- Night/Day switch via built-in photocell.

6. Wireless Transmitter

IEEE 802.11 a/n compliant, Max 300Mbps (5GHz),
Supported Radio Technologies:

- 802.11a/n: Orthogonal frequency-division multiplexing,
- 802.11n with 20/40 MHz channl width
- 802.11a with 20 MHz channel width

Modulation types 802.11a/n: BPSK/QPSK,16-QAM, 64-QAM.
Supported data rates (Mbps):

- 802.11a: 6,9,12,18,36,48,54
- 802.11n: 6.5 to 300 (MCS0 to MCS15)

Two 10/100 Base-T Ethernet Ports, one of which supports 24V Proprietary PoE Input while other supports extension of internet signal
Max Transmit Power: 27dBm,
Maximum power consumption:4.5W
13dBi 5GHz antennas with P2P transmission in long range distance,
WEP Encryption 64/128/152 bit.
IP65 Waterproofing housing,
AP/CB/CR/WDS Modes,
4 SSIDs support+VLAN tagged supported,
Web configuration and EX controller software,
SNMP V1/V2c/V3, MIB I/II supported,
WEP/WPA/WPA2 wireless encryption (WPA-EAP using TKIP or AES),
Hide SSID in beacons,
MAC address filtering,
Wireless STA client connection list,

IPv4/IPv6 enabled,
PPPoE equipped/PPoE Pass-through.

7. MPPT Solar Charger Controller

Maximum Battery current: 50 A,
Nominal Maximum Operating Power rating of the system: >1200W for 24V, >1800W for 36V, >2500W for 48V
Peak efficiency:99%,
Nominal System Voltage:24VDC, 36V or 48V
Battery Operating Voltage:8-72VDC,
Maximum self-consumption: <30mA @ 48V
Communication Interfaces: VE.Direct, Bluetooth, Ethernet port,
Temperature operation range: -40°C to +45°C.
Humidity protection: 100% non-condensing
Electronic Protection Features:

Solar: Overload, Short circuit, High Voltage
Battery: High Voltage
High Temperature
Lightning and Transcient Surges
Reverse Current at Night

Charging Algorithm: 4 Stage: Bulk, Absorption, Float, Equalize
Certifications: CE and RoHS Compliant, FCC Class B Part 15 Compliant
Features: Bluetooth Smart built-in to set-up, monitor, update and synchronize the Charge Controllers.

Synchronized parallel charging for up to 10 units which be synchronized.

Fully discharged battery recovery function to initiate charging even if the battery has been discharged to zero volts. System should be able to reconnect to a fully discharged Li-ion battery with integrated disconnect function.

System to Included: Bluetooth smart battery monitors to be used to communicate battery voltage and temperature pluggable display.

8. Monitoring screens, mouse pad, keyboard, PTZ camera control modules

Specifications:
32" LED HDTV Monitor featuring 1080p, 60Hz, Inputs: 2 HDMI, 1 USB, TV with stand, Control keyboard, optical mouse with pad, PTZ control system.

9. Monitoring and control system

System Requirements
PC Minimum Requirements:
Processor: Intel Core I7
Operating System: Windows 10 / Server 2012, 64-bit.
Memory: 16 GB of Ram
Hard Disk: 2TB Hard Drive
Video graphics card: NVIDIA GeForce GTX 1080

Sound Card and Speaker

Hardware Options
62A16055-A01
8-Port RS232 Serial Expansion Card
Required for systems with two or more serial connections to hardware
62A16056-A01
4-Port Serial to Ethernet Rocket Hub
Used for Migrating Server
62A16058-A01
Video Graphics Card for PC - NTSC Format
(128 MB display memory)
62A16059-A01
Multi Input/Output Card
Allows RS-485 communication with auxiliary security devices:
(8) relay inputs, (4) relay outputs
62A16060-A01
Network Card for Multi Input/Output Card
RS-232/RS-485 network controller for up to 32 MIO cards
(Required for each network)

10. Battery backup supply

Output Power capacity: 2.7kW/3.0kVA
Nominal Output voltage: 230V, configurable for 220V, 230V, or 240V nominal output voltage
Output voltage distortion: less than 5% at full load
Output frequency: 47 - 53 Hz for 50 Hz nominal, 57 - 63 Hz for 60 Hz nominal
Output Connections: (8) IEC 320 C13 (Battery Backup), (2) IEC Jumpers (Battery Backup), (1) IEC 320 C19 (Battery Backup)
Nominal Input Voltage: 230V, 220V or 240V
Input frequency: 50/60 Hz +/- 3 Hz (auto sensing)
Input Connections: IEC-320 C20, Schuko CEE 7 / EU1-16P, British BS1363A
Input voltage range for main operations: 160 - 286V
Battery type: Maintenance-free sealed Lead-Acid battery with suspended electrolyte: leak proof
Typical recharge time: 3hour(s)
Interface Port(s): USB
Control panel: Multi-function LCD status and control console
Audible Alarm: Alarm when on battery, distinctive low battery alarm, configurable delays
Surge energy rating: 365Joules
Filtering: Full time multi-pole noise filtering, 0.3% IEEE surge let-through, zero clamping response time, meets UL 1449
Operating Temperature: 0 - 40 °C
Audible noise at 1 meter from surface of unit: 53.0dBA

Online thermal dissipation: 375.0BTU/hr
Certification: CE, CSA, EAC, EN/IEC 62040-1, EN/IEC 62040-2, RCM, VDE

11. Network switch

8* 10/100/1000 Mbps Gigabit Ports, Auto MDI/MDIX Crossover for all ports,
Store-and-forward Switching Scheme,
Full/half-duplex for Ethernet/Fast Ethernet Speeds,
IEEE 802.3x Flow Control,
Plug-and-play Installation,
RoHS Compliant,
IEEE 802.1p QoS (4 Queues, Strict Mode),
Supports Cable Diagnostics,
Supports 9720 KBytes Jumbo Frames,
60Wmax 24VDC power supply.

12. Ethernet to Optical Switches

IEEE Standards: 802.3, 802.3ab, 802.3z, 802.3x, 802.3af, 802.3at, 802.1x, 801.1w, 802.1D, 802.1Q
Network Ports: (8) 10/100/1000Mbps Copper Ports (RJ-45)
Copper Ports: Shielded RJ-45, 10/100Mbps, auto-negotiation, auto-MDI/MDI-X
SFP Slot: 100/1000Base-FX compliant slot for standard SFP transceiver
Console: Connector: Shielded RJ-45, Interface: RS-232
Network Cables: Copper Port: Cat5 up to 100 meters; SFP Slot: 50/125, 62.5/125 MM Fiber, 9/125 SM Fiber
VLAN Function: Port-based VLAN, 802.1Q Tag-based VLAN
Port Link Aggregation: Static trunking groups: 2 max., Ports/Groups: 2, LACP link aggregation
QoS Function: 4 priority queues, Classification: Port-based, 802.1p, IP DSCP
LED Indicators: Per Unit: Power, Management Status; Per Copper Port: Speed/Link/Activity Status; Per SFP Slot: Speed/Link/Activity Status; Per PoE Port: Power Status
Relay Output: Alarm: Power Failure, Specific Port Fault; Interface: 2 terminal contracts (30VDC/1A max. or 120VAC/0.5A max)
Web Management: Web Browser Software; System Settings, Port Status/Statistics, Port Control, VLAN, QoS, Link Aggregation, Port Mirroring, Firmware Upgrade 802.1x, 802.1w, Configuration Backup and Restore
SNMP Support: SNMP v1, v2c Management MIB-II, Private MIB for PoE Control, Event Traps
DC Power Input: Screw Terminal Block: 2 pairs of +/- contacts, Operating Voltage Range: +7 ~ +60VDC
Power Consumption: 9W max.
Environment: Operating Temperature: -40°C ~ +70°C; Relative Humidity: 5% to 95% non-condensing
Approvals: FCC Class A, VCCI Class A, CE mark Class A, IEC 60950-1 safety, EN 61000-6-4 emission, EN 61000-3-2, EN 61000-3-3, EN 61000-6-2, Immunity for industrial environment, IEC 60068-2-64 Vibration, IEC 60068-2-27 Shock 50G test, NEMA TS2 environment

Clarification List - 04

TECHNICAL SPECIFICATIONS OF THE UNDERGROUND FIBER OPTIC CABLE DETECTION SYSTEM

1. Single ended Brillouin OTDR for Strain measurements

DTSS (Distributed Temperature and Strain Sensing) Specifications

Brillouin Single End DTSS Techology software
Laser safety: Class 1
Distance Range: 100m to 200km
Measurement time: from 1min to several hours
Spatial Resolution (IEC 61757): 1m (upto 10km); 5m (upto 40km)
Spatial step (sampling resolution): 8cm min
Temperature range: 200°C to 700°C; (relative to frequency range of 9-13GHz)
Temperature Repeatability (IEC 61757): 1°C
Strain Range: -30,000με to +40,000 με; (relative to frequency range of 9-13GHz)
Strain Repeatability (IEC 61757): 20μ
Combo Temperature and Strain Repeatability (IEC 61757): 2μ AND 50μ
Measurement Variables: Strain, Temperature, Brillouin Spectrum & Shift, OTDR (loss), Monitoring for Rackable solution units only.

Rackable Units Specifications:

Interfaces: 2*RJ45 Ethernet 10/100/1000baseT ports
Media: Solid State Disk 32GB
2U unit
Power supply: 48VDC, Dual inputs
Power Consumption: <50W
Operating Temperature: +5°C to +45°C
CE Compliant EMI/ESD
Optical Switch: 8 ports with SC/APC, 1E09 switches with AC/APC connector

Portable Units Specifications:

Screen: 10.4” TFT colour and touch screen
Interfaces: 2*RJ45 Ethernet 10/100/1000baseT ports
Media: SATA hard disk 250GB
Power supply: AC 110/220V. battery offering minimum 3 hours operation
Power Consumption: <50W
Operating Temperature: -10°C to +45°C
CE Compliant EMI/ESD
Optical Switch: 4 ports with E2000/APC with cord and caps, 1E09 switches

Clarification List - 04

2. Sensor Cable

The sensor cable shall be SINGLE MODE ITU-T G.652.D fiber with the following characteristics:

Dimensional Specifications			
Fiber curl	≥4.0m radius of curvature		
Cladding Diameter	125.0±0.7µm		
Core-Clad Concentricity	≤0.5µm		
Cladding Non-circularity	≤0.5%		
Coating Diameter	242±5µm		
Coating-Cladding Concentricity	<12µm		
Environmental Specifications			
Temperature Dependence	Test condition: -60°C to 85°C		Induced attenuation: ≤0.05dB/km
Temperature Humidity Cycle	Test condition: -10°C to 85°C up to 98& RH		Induced attenuation: ≤0.05dB/km
Water Immersion	Test condition: 23°C to 2°C		Induced attenuation: ≤0.05dB/km
Heat Aging	Test condition: 85°C to 2°C		Induced attenuation: ≤0.05dB/km
Damp Heat	Test condition: 85°C at 85% RH		Induced attenuation: ≤0.05dB/km
Optical Characteristics	**@1310nm**	**@1550nm**	**@1625nm**
Maximum attenuation	≤0.32dB/km	≤0.18dB/km	
Point Discontinuity	≤0.05dB	≤0.18dB	-
Mode field Diameter	9.2±0.4µm	10.4±0.5µm	-
Dispersion		≤18ps/(nm.km)	≤22ps/(nm.km)
Macrobend loss 1 turn on 10mm Mandrel 10 turns on 15mm Mandrel 100 turns on 25mm Mandrel	 - - ≤0.01dB	 ≤0.5dB ≤0.05dB ≤0.01dB	 ≤1.5dB ≤0.3dB ≤0.01dB
Maximum individual fiber Polarization Mode Dispersion (PMD)	≤0.1ps/√km		
Performance Characterizations			
Core Diameter	8.2 µm		
Numerical Aperture	0.14 (measured at 1% power level of a 1D far-field scan at 1310nm)		
Effective Group Index of Refraction (neff)	@1310nm: 1.4676 @1550nm: 1.4682		
Rayleigh Bakcscatter Coefficient (for 1nm Pulse Width)	@1310nm: -77dB @1550nm: -82dB		