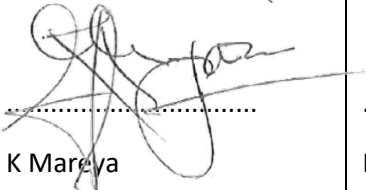

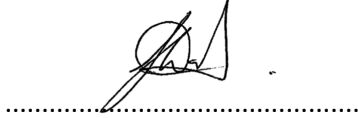
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	KOMATI THERMAL POWER PLANT ENGINEERING CONSULTANCY AND ADVISORY SERVICES REPOWERING AND REPURPOSING WITH: 100MW Solar PV 150MW (600MWh) Battery Energy Storage System 1X125MW Synchronous Condenser Conversion 70MW Wind Turbine Farm	Revision: 1
		Date: 08 July 2022
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Compiled by:  K Mareya Senior Engineer Prof Date: 2022/07/08	Functional Responsibility:  B Mashimbye Middle Manager Engineering Date: 08/07/2022	Authorised by:  Luke Walker Senior Manager Project Portfolio Date: 08 July 2022
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ABSTRACT

This document defines the Terms of Reference required from the Consultant for the provision of Engineering services and Technical Assistance during the development and execution of the Just Energy Transition Project – Phase 1: Repurposing of Komati Coal Fired Power Plant with up to 100MW Solar PV, 150MW Battery Energy Storage System, 125MW Generator Conversion to Synchronous Condenser, and up to 70MW Wind Farm in the Republic of South Africa.

DOCUMENT RETENTION TIME

This document is a Quality Record and shall be retained in accordance with Eskom Quality standards.

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ABBREVIATIONS

This list contains the abbreviations used in this document.

Abbreviation or Acronym	Definition
BESS	Battery Energy Storage System
BoP	Balance of Plant
C&I	Control and Instrumentation
CA	Contract Agreement
DOR	Division of Responsibility
DS&I	Design, Supply and Installation
ECP	Engineering Change Proposal
ESIA	Environmental and Social Impact Assessment
EPC	Engineering Construction and Procurement
FEED	Front End Engineering Design
HVAC	Heating, Ventilation and Air conditioning
ISO	International Organisation for Standardisation
ITP	Inspection and Test Plan
MW	Megawatt
PPSD	Project Procurement Strategy for Development
PV	Photovoltaic
PQMP	Project Quality Management System and Plan
SAT	Site Acceptance Test
SHE	Safety, Health, Environment
OE	Owner's Engineer also referred to as the Consultant in these Terms of Reference

DEFINITIONS

Term	Definition

1. BACKGROUND OF THE PROJECT

- (1) In line with South Africa's Just Energy Transition (JET) and in support of the decarbonization of the minerals and energy sectors in a socially acceptable manner, *ESKOM HOLDINGS SOC LTD* of *SOUTH AFRICA* embarked on the Just Energy Transition Project (JETP) which is to be financed by the World Bank to pilot Eskom's Just Energy Transition (JET) under Eskom's 2035 Strategy and Road Map by Decommissioning and Repurposing Komati Coal Fired Power Plant.
- (2) *ESKOM HOLDINGS SOC LTD*, commissioned Studies in May 2021 supported by the World Bank, to investigate plant retiring implications and re-purposing options. A Draft Report was prepared and issued, outlining Decommissioning and Repurposing Options and recommendations for the 1000MW Plant. *ESKOM HOLDINGS SOC LTD* intends to implement the following recommended technologies in two phases as part of the repowering and repurposing of Komati Power Station:
 1. PHASE 1 - PROJECTS
 - a. Komati 100MW Solar PV Plant
 - b. Komati 150MW (600MWh Capacity) Battery Energy Storage System
 - c. Komati 1X125MW Generator Conversion to Synchronous Condenser
 - d. Komati 70MW Wind Farm (based on available private wind resource data)
 2. PHASE 2 – PROJECTS
 - a. Komati 50MW Solar PV (reliant on rehabilitation of Ash Dam Complex)
 - b. Komati 3X125MW Generator Conversion to Synchronous Condenser
- (3) *ESKOM HOLDINGS SOC LTD*, seeks to appoint an Owner's Engineer (here after called the Consultant) whose primary task shall be to assist Eskom with the development of front-end engineering designs, bidding documents and bid evaluations, and monitoring and supervision of detail design, construction, commissioning, and initial operation of the various plants to be undertaken by an EPC Contractor.
- (4) The Client intends to procure the 100 MW Solar PV, the 150 MW Battery Energy Storage System (Capacity 600MWh), 1X125MW Generator Conversion to Synchronous Condenser, and 70MW based on 10 x 7MW wind turbines. Wind installations through Design, Supply, and Installation (DS&I) Contract, which may herein be referred to as EPC and does not form a part of these Terms of Reference.

2. CLIENT'S OBJECTIVE

- (1) The *Client*, *ESKOM* requires Engineering Consultancy and Advisory Services in the planning, development, implementation, and closure of Phase 1 of Repowering and Repurposing Project at Komati Power Station. The required Engineering Consultancy and Advisory Services shall serve as an Advocate, Implementing Partner, and an Oversight Agent for the Client, applying due diligence, in all aspects of planning, development, implementation, and closure of the Project across all the technologies included under Phase 1 of Repowering and Repurposing Project at Komati Power Station.
- (2) The Consultant shall act on behalf and for Eskom within the mandate provided to them by their appointment. Eskom shall delegate authority to the Consultant's to the extent required for execution of these scope of services. The Consultant is the appointed Design Authority on behalf of Eskom in terms of monitoring compliance of the Regulatory Requirements applicable to the Project and under the directive of Eskom as the Client. Eskom has the overall responsibility for the Project as the Client. The Consultant shall ensure that the performance of their Services under these Terms-of-Reference complies with Regulatory Requirements.

- (3) The Client's overall objective for the Engineering Consultancy and Advisory Services broadly encompasses all front-end engineering design including but not limited to the development of functional specifications, bidding documents and bids evaluations for the selection and appointment of the EPC Contractor, construction supervision and quality assurance during execution of the EPC Contract, commissioning & testing supervision, and provision of training.

3. SCOPE OF SERVICES

- (1) The scope of services required for the Engineering Consultancy and Advisory Services includes but is not limited to:
1. Project Planning and Development Phase
 2. Conceptual and Basic Designs (Front End Engineering Design) Phase
 3. Detail Design during EPC Contract Phase
 4. Construction, Commissioning, Testing, and Handover Phase
 5. Performance Guarantee and Defects Period Phase
 6. Capacity Building/Training
- (2) The general Consultant's scope shall comprise the following Activities. Battery Limits will be defined in more detail in the Division of Responsibilities (DOR) Document to be jointly agreed between the Client and the Consultant after contract award.

4. DESCRIPTION OF ENGINEERING CONSULTANCY AND ADVISORY SERVICES

4.1 Project Planning and Development Phase Activities

The scope of services required includes but is not limited to:

- (1) **Project Planning and Schedule Management** including but not limited to:
1. Project definition and preparing early project schedules, plans and design criteria including related deliverable.
 2. Development of a work breakdown structure (wbs) and integrated engineering schedules covering all aspects of project development and execution, identifying all interfaces required for the successful delivery of the project. The schedules shall include integrated resource plans covering engineering, procurement, construction, and commissioning phase activities. The schedules must be developed to level 4, which will include as a minimum the following:
 - a. All milestones
 - b. All key activities
 - c. All Sub-activities
 - d. Works instruction level
 - e. Risk catered for using float
 3. Use a scheduling tool that is agreed upon with the Client for its scheduling and shall ensure all programmes and schedules developed for the Project are compatible with the Client's scheduling software. (Primavera Etc.)
- (2) **Project Risk Monitoring and Management** including but not limited to:
1. Proactive management of risk reduction and support, in line with the Eskom's Integrated Risk Management Framework
 2. Development and management of an integrated engineering risk register and management plan as per Eskom Requirements.

3. Conduct risk reviews as part of scheduled workshops or progress review meetings, to review risk status and mitigation progress. As a minimum, a risk review must be scheduled to coincide with the end of a design phase review.
- (3) **Quality Management and Assurance** including but not limited to:
1. Compliance with the requirements listed in the Client's standard document, 'Contract Quality Requirements', document identifier – QM 58, for all the Clients Quality requirements.
 2. Development and submission of a Project Quality Management System and Plan (PQMP) for this contract, describing project quality requirements and requirement for continued compliance to the requirement of ISO 9001.
 3. Preparation and submission of a project Inspection and Test Plan (ITP) for all equipment included in the scope, detailing all system elements, and shall itemizing the required quality levels for each of these components. These quality plans and ITPs shall be submitted to the Client for review and inclusion of Client's intervention points. The Consultant shall be responsible for:
 - a. Identification of any contractor deviation and non-conformance to the technical specifications of the contract. All items identified, shall be reviewed by the Client. Where the Client identifies any deviation and non-conformance the Consultant shall be notified.
 - b. Providing recommendations to the Client for acceptance or rejection of all work and material which do not fully conform to the contracts, and recommendations to the Client of remedial actions on all matters concerning the implementation and execution of the contracts.
 4. Development and maintenance of a complete quality control schedule, showing the anticipated inspections as per quality intervention points, as shown on the manufacturer's inspection test plans.
- (4) **Integration Management** including but identification of all interfaces between all engineering disciplines and processes from system and subsystem level through to individual component level. The Consultant shall coordinate and manage all interfaces and shall provide the following services:
1. Definition of a detail description of the interfaces and system level technical integration through development of detailed DOR Matrices for all project packages.
 2. Providing sub-system and equipment level technical integration through the management and coordination of limits of supply and services documentation for all project packages as defined in the Division of Responsibility Matrix.
 3. Providing individual component level technical integration through the management and coordination of Terminal Point Schedules
 4. Ensuring the consistency of the limits of scope and supply documentation between different disciplines for a specific procurement package and between different procurement packages.

4.2 Conceptual and Basic Design Phase (FEED) Activities

The scope of services required includes but is not limited to:

- (1) Conducting and Overseeing Site Selection Studies including Geotechnical, Geohydrological and Topographic, Micro-siting and any additional studies required by the project
- (2) Development and preparation of conceptual and basic designs, and layout plans
- (3) Reviewing of Eskom's prior studies, investigations, and concept designs
- (4) Competition of Concept Designs integrating them to Existing Infrastructure, and Services

- (5) Reviewing the Engineering Deliverables provided by the Eskom and/or Third Parties
- (6) Development of Technical, Functional and Quality Specifications
- (7) Defining minimum Warranty Requirements and the Performance/Functional Guarantees for all procurement packages, for implementation and operation phase
- (8) Development of Comprehensive Bidding Documents
- (9) Development of Bid Technical Evaluations
- (10) Partaking in the Bid Evaluation Process
- (11) Working with the Client's Contracts Management in developing Contract Documents
- (12) Providing permitting assistance and addressing related environmental concerns

4.3 Detail Design during Design, Supply & Install (DS&I) Phase Activities

The scope of services required includes but is not limited to preparation of project planning and monitoring framework, providing assurance on engineering design, and undertaking detailed reviews of architectural, civil, structural, mechanical, electrical and instrumentation designs, construction, operating, commissioning, testing and handover plans. The following specific activities and documents are anticipated to be reviewed to ensure proper understanding of the respective Contractors' Detail Design basis for the project:

- (1) **Civil & Structural Engineering Activities and Documents Review** including Site Plan / Conceptual Plant Layout; Grading, Paving, and Drainage Plans; Foundation Design; Road Design and Earth Works; Geotechnical, Geohydrological and Topographic Assessments; Miscellaneous Standard Details. Foundation design verification based on geotechnical recommending improvements if foundation is found to be unsuitable.
- (2) **Electrical Engineering Activities and Documents Review** including, Project Collection System; Earth Matt Design Plan; Inverter and Transformer Arrangement and Layouts; Relaying, Protection, Phasing, Synchronizing and Metering Three-line diagrams; Lighting Systems; single line diagrams of all electrical collection system (i.e., MV cabling; Layout drawing of the cable routing diagrams; Cable block diagrams and termination schedules; Specification and sizing of cables and preparation of the cable schedules; Bill of Materials
- (3) **Lines/Wires Engineering Design** including Overhead Line Design Requirement
- (4) **Grid Integration** including Grid Planning studies to approve the point of connection, Grid code requirements.
- (5) **Control & Instrumentation Engineering Activities, and Documents Review** including Control System Analogue & Digital Logics, and C&I drawings; Operating and control philosophies; SCADA System Design and Communication Network; Plant Information System / Plant Control Monitoring System; Cabling, racking, trunking, trenches, and power distribution & supplies; Earthing of all systems; Fire Detection System; Meteorological System; Building Management System (BMS); Control and Server Room Requirements
- (6) **IM and IT Design** including Telecommunication services (telephones, internet, intranet, email); Eskom Plant Data System (PDS) interface.
- (7) **Physical Security Design** including Site security risk assessment and security Design; Security Perimeter fences (complying with Eskom Non-Lethal Energized Fence Standard); CCTV Surveillance; Integrated Access control system; Alarm and intrusion detection system; Plant security systems interface to existing security systems where available.
- (8) **Low Pressure Services Design** including HVAC system design; Fire protection design; Potable water supply; Sewage Treatment
- (9) **Project Acceptance Plan;** Construction Schedules; Unknown/Variable elements in Schedule; Potential Schedule Risks; Specific Schedule Milestones; Quality Assurance Plans.

- (10) **Commissioning and Test Plan;** Commissioning Checks (Checklists) and Acceptance Tests (Results); Performance Test Procedures; Performance Guarantees. Performance witnessing and analysis, assessment of construction risks and issues
- (11) **Operation and Maintenance Plan;** Acceptance Certificates; Performance Guarantees and associated liquidated damages; Construction Records & Drawings; Test Records and Certificate of Compliance (CoC); Handover Documentation and Information; Permits & Licences.

4.4 Construction, Testing, Commissioning and Handover Phase Activities

The scope of services required includes but is not limited to:

- (1) Construction Supervision and Project Management and providing on-site monitoring of project progress throughout the construction period, giving suggestions for correction and improvements as required.
- (2) Reviewing completion test procedures & results; assessing contractor compliance with performance tests; witnessing and giving a professional opinion on the performance tests; and issuing provisional and final certificates of completion in line with conditions of the EPC Contract.
- (3) Organizing monthly progress review meetings with the EPC contractors in association with Eskom and providing weekly reports throughout the construction period of the project.
- (4) Mobilizing appropriate experts at the project site location for the full duration of this Phase, and any services that may be necessary for the successful execution of the Project.
- (5) Handover complete documented records, and data packs for all equipment to Client as specified after contract award.
- (6) **Construction Supervision and Monitoring** including but are not limited to the following tasks for successful execution of the EPC contract:
 - 1. Defining standards of performance including compliance with the necessary planning and environmental permit conditions
 - 2. Specifying any performance-critical materials, and fabrication standards. Assessing adequacy of QC/QA programs
 - 3. Overseeing construction, and fabrication, and provide expediting, inspection, and witnessing of testing during manufacturing of major components, at the Clients discretion. Agreeing with the test protocols, witness any system connection tests and confirm the results
 - 4. Monitoring and documenting progress against agreed programme of all project components and identifying potential critical activities. Issuing certificates of Milestone compliance as per the EPC Contract Agreements
 - 5. Supervision of the construction and commissioning. Assessing if appropriate construction environmental, health and safety standards are being enforced
 - 6. Monitoring and recording performance of the contractor (and sub-contractors), quality of materials and workmanship against the agreed design, specifications, and performance criteria
 - 7. Reviewing, acceptance and performance testing procedures' results of factory and site testing. Contract completion testing - review test protocols, ensure test witnessing plans are adequate and confirm the test results
 - 8. Providing measurement certification, payment recommendation, and technical input for waiver. Endorsing Completion Certificates with all supporting documents which acknowledges the quality and completeness of components for payment milestones. Issuing certificates of project partial completion and project completion in accordance with EPC Contract agreements.

- (7) **Start-up, Testing and Plant Commissioning Supervision and Monitoring** following mechanical completion including:
1. Cold commissioning (including any standard factory acceptance tests)
 2. Hot commissioning and
 3. Process qualification over a period of weeks
 4. Developing punch lists and document warranty items in preparation for performance testing and handover from commissioning to start-up
 5. Manage Construction Design and Field Changes
 6. Assist with Training after start-up
 7. Assist with resolution of problems that arise during the initial warranty period, such as dealing with performance expectations
 8. Verification and testing will be performed as specified in the project technical documentation and will include energized equipment.
- (8) Completion and Handover of all systems will be done in accordance with the approved Project Handover Procedures developed by the Consultant and accepted by the Client. The Consultant reviews product documentation on the completion of construction and installation prior to handing over systems to the commissioning organization. Completion of the Engineering Services will be achieved after:
1. Acceptance of the final deliverables and calculations
 2. Acceptance of the as-designed drawings and documents
 3. Acceptance of the quality assurance data packs
 4. Acceptance of design criteria and specifications
 5. Acceptance of as-designed operational requirements
 6. Transfer of engineering systems and procedures
 7. All Hazop studies and recommendations signed off
 8. Compilation of close-out report using template provided by the Client
 9. Final completion occurs at the end of the defects liability period and
- (9) The Consultant assists the Client to ensure final close out reports with the different stakeholders (Internal to Eskom and World Banks) reports are finalised within the first 3 month after Completion.

4.5 Performance Guarantee and Defects Period Phase Activities

- (1) The Consultant shall remain available for monthly review visits to the plant for a period of 1 year (extendable under conditions described in this Terms of Reference).
- (2) The Consultant shall undertake analysis of O&M related issues, changes, and explanations for changes to the O&M procedures & plans that may have affected historical or may affect future project performance; any major equipment failures, significant O&M events, warranty items or occurrences that would affect historical or future project performance.
- (3) A comprehensive report will be the outcome of each visit covering the analysis hereinabove with remedial measures which will be discussed with Eskom.

4.6 Capacity Building/Training Activities

- (1) The Consultant is also expected to build capacity for Eskom to be able to effectively supervise the O&M work in later years of operations, supervise design and construction of future projects and provide on the job training for Eskom engineers involved in this project. The Consultant will also help Eskom prepare an O&M plan and training plan.

- (2) The Consultant shall provide training and skills transfer for the services and works to various categories of the Client's staff. A skills transfer plan and execution document shall be developed by the Consultant and submitted to the Client for acceptance. The required Client personnel for skills transfer shall be specified by the Consultant.
- (3) Training provided by the Consultant shall be practical, hands-on, and directly applicable to the Services. General training based on similar Services is not acceptable. The training provided shall capacitate Eskom to be able to supervise engineering designs, construction and operations of similar projects and shall include a training module in the area of O&M for Eskom's O&M Personnel. Such training should cover the areas (not limited to), such as, breakdown maintenance, routine maintenance, preventive maintenance, list of major spares and their functioning
- (4) The local facilities for training shall be provided by the Client which shall comprise a suitably sized airconditioned room (could also be done remotely using electronic platforms) to accommodate trainees as well as trainee and trainer desks, an overhead projector and flipchart or white board.
- (5) The Client will bear the cost of salaries, accommodation, travelling expenses and other allowances of their personnel during the training. All other training costs shall be borne by the Consultant.
- (6) The Consultant shall provide all course material including manuals in English and shall include all Third-Party documentation. The dates for training shall be included and shown in the Consultant's programme. The supply of drafts, pre-print proofs and printed copies of training documentation shall be planned by the Consultant in such a way that the required training is complete before commissioning of the Plant commences. It is anticipated that five (5) man months will be adequate for the preparation of training materials and that training can be provided by the Consultant's Project personnel during the course of their normal duties.

5. TECHNOLOGY SPECIFIC ENGINEERING CONSULTANCY AND ADVISORY OF SERVICES

5.1. Solar Photovoltaic (PV) Design and Battery Energy Storage System (BESS)

5.1.1. Solar Photovoltaic (PV) Concept Design (FEED)

Complete Basic Design including but not limited to the following information:

- (1) Initial Site Inspections and Site Assessment
- (2) Oversee Geotechnical, Geohydrological and Topographic Studies
- (3) Solar Resource and Energy Yield Assessment
- (4) Interconnection Point with Network Planning Studies:
- (5) Grid Integration Studies.
- (6) Site rehabilitation and preparation requirements
- (7) PV Layout Development:
 1. Module Technology to be used,
 2. Number of Strings, Inverters, Arrays with Driveway Layouts.
 3. Final Installable Capacity (AC and DC),
- (8) CAPEX and OPEX Estimation
- (9) LCOE Estimation

5.1.2. Battery Energy Storage System (BESS) Concept Design (FEED)

Complete Basic Design including but not limited to the following information:

- (1) Initial Site Inspections and Site Assessment
- (2) Oversee Geotechnical, Geohydrological and Topographic Studies

- (3) Interconnection Point with Network Planning Studies
- (4) Grid Integration Studies.
- (5) Site rehabilitation and preparation requirements. In conjunction with decommissioning Consultant team (separate appointment)
- (6) Battery Energy Storage System Layout Developments:
 - 1. All Civil Works, interlinking roads, BESS foundations
 - 2. Energy Storage System
 - 3. Battery Management System,
 - 4. Power Conversion System
 - 5. BESS Management & Control
 - 6. A Collection System,
 - 7. Communication System,
 - 8. Metering System
 - 9. Quality of Supply
 - 10. Safety
 - 11. Firefighting,
 - 12. HVAC Systems, and
- (7) CAPEX and OPEX Estimation
- (8) LCOE Estimation

5.1.2. Detail Design during DS&I Contract Phase

Solar PV and BESS Design including but not limited to:

- (1) Independent Analysis and Assessment of the impact of climate / weather (precipitation, temperature, humidity) at site on plant performance, including battery cooling requirements; Battery and Battery Management System (BMS) design for the proposed use cases
- (2) Independent review of energy projections
- (3) Review of siting for each solar field and solar plant layout
- (4) Review of shading assessment
- (5) Estimate of the gross energy production
- (6) Assessment of the losses
- (7) Assessment of the Plant Management Control Systems and its ability to balance overall production with storage utilization
- (8) Assessment of the net energy production (solar with battery system, including parasitic battery losses particularly from but not limited to cooling)
- (9) Review of the proposed project design, including suitability of solar panels, inverters, batteries, control systems (SCADA and Energy Management Systems), transformers, electrical systems (A.C & D.C), plant design requirements, proposed design of project facilities
- (10) Review of original equipment manufacturer (OEM) technical specifications, drawings and test reports, and work instructions and protocols
- (11) Review of proposed site layout, and mechanical and electrical layouts
- (12) Review of design, drawing, testing and soil investigation reports of all civil foundation (solar mounting pile, transformer etc.), roads, control room, drain, fence, cable trench and other civil works with suitable recommended structures/foundations.
- (13) All electrical system review like equipment designing, engineering drawing, cable schedule, earthing, transmission line system, lightning, fire-fighting system etc., ensuring proper design and functionality requirements for integration of solar & storage system,
- (14) Review and testing of all electrical BOP works (substation, bay-extension, transmission lines, etc.).

- (15) Review of all As-Built drawings of the Project. Design
- (16) Review of all the components linked to the said project as in the scope of consultant (and not limited to the above)
- (17) Review of design pertaining to BESS, SCADA, and EMS
- (18) Review of design, performance as well as the systems' historical and projected reliability and operations under various operating conditions.
- (19) Risks and issues associated with the proposed solar with storage project to be identified.
- (20) Opine on the capacity and stability of the electrical grid in respect of the impact of the Project.
- (21) The review shall include Generation, load patterns, short circuit levels, protection coordination, statistics, and characteristics of grid system, based on such studies as prepared by others.
- (22) Review of compliance with the World Bank's Environmental and Social requirements, and consistency of the mitigation measures proposed in the environmental and social impact assessment with the plant design.

5.2. Synchronous Condenser Conversion - 1X125MW Generator

5.2.1. Basic Engineering Assessments

- (1) Basic Engineering Assessment of the Current Condition and Suitability of Plant Provide a basic engineering assessment of the current condition, remnant-life and possible refurbishment and life-preservation requirements of units 5, 6 and 7 and a fourth spare generator, together with the relevant auxiliary plant and infrastructure, at Komati Power Station to operate the generators as synchronous condensers (SCO).
- (2) The basic engineering assessment should include, but is not limited to:
 - 1. For units 5, 6 and 7 indicate the current condition and high-level remnant life of:
 - a. the synchronous generator and parts of the centre line, where necessary, but excluding the turbine.
 - b. any auxiliary plant necessary for the conversion,
 - c. control and instrumentation systems,
 - d. electrical auxiliary, protection, excitation, and evacuation plant up to the HV yard 275 kV bus bar,
 - e. the immediate civil structure pertaining to the generator unit,
 - f. any other plant or structures deemed necessary for an SCO conversion and
 - g. the current condition and remnant life of a (fourth) spare generator.
 - 2. Establish what plant is suitable and feasible to be re-used for an SCO conversion and indicate:
 - a. The extent of any refurbishment and/or modification and/or replacement that is needed.
 - b. The remnant life of the respective plant after improvement.
 - c. The indicative costs for refurbishment and/or modification and the financial feasibility of each.
 - d. Indicate any further in-depth assessments that may be required and the associated indicative costs.
 - 3. Indicate life preservation requirements and the associated indicative costs for preserving the plant for later use for the following scenarios:
 - a. On-site in its current location in the turbine hall.
 - b. Off-site at a storage facility (including relocation).

5.2.2. Front End Engineering Design (FEED) Study

- (1) Conduct a FEED study for converting the three 125MW air-cooled Siemens Energy designed synchronous generators of units 5, 6 and 7 and a fourth spare generator of the same specification at Komati Power Station to operate as a synchronous condenser (SCO). The intended application of the SCO is to provide inertia to the electrical transmission system. The objective of this study is not to determine the need for, or the optimal location, in the Transmission network for the SCO. It is intended to inform Eskom on the options, costs, and feasibility of repurposing the decommissioned generators at Komati Power Station.
- (2) The study shall include, but is not limited to, the following:
 1. An overview of the following general conversion configurations,
 - a. The synchronous generator completely on its own with no additional load.
 - b. Retaining the centreline without the turbine blades and cylinders.
 - c. Removing and replacing the turbine with a fly wheel. The option should indicate the maximum inertia that can be added to a generator as well as the optimal fly-wheel size for inertia vs. cost.
 - d. and indicate the recommended optimal configuration based on cost, achieved inertia and operational life.
 2. The following installation scenarios shall be considered:
 - a. Keeping the synchronous generators of units 5, 6 and 7 in the existing Komati Power Station turbine hall, and possibly utilizing the fourth spare generator in addition.
 - b. Relocating and converting the generators of units 5, 6 and 7 and the fourth spare to a new installation building at Komati. Allow removal of existing turbine hall. This scenario shall include a total benefit analysis vs scenario (i) above.
 - c. Relocating and converting the generators of units 5, 6 and 7 and the fourth spare to new installation sites elsewhere. Relocation shall indicate the possibility of locating different units to more than one new site, as is feasible, and reusing auxiliary plant where possible.
 - d. Relocating the 4th spare generator to a new location elsewhere and establishing a SCO installation.
 3. For each installation scenario, consider options for converting one, two or all the generators of units 5, 6 and 7, including the fourth spare generator. Indicate any potential cost benefits that can be obtained by sharing common plant if more than one unit is converted to operate together and if there is an optimal combination.
 - a. A comparative analysis of all options, indicating for each respectively the:
 - i. technical operational specifications,
 - ii. operation and maintenance requirements,
 - iii. estimated operational life and plant availability,
 - iv. estimated timelines for implementation,
 - v. indicative costs for:
 1. implementation (initial investment)
 2. operation and maintenance
 3. total life cycle
 4. The detailed scope of work shall further include, but is not limited to, the following:
 - a. Summary of operating modes, including start and stop
 - b. Synchronous-condenser-mode capability curve
 - c. Layout drawings

- d. Basic rotor dynamics assessment
- e. Fault torque assessment
- f. Requirements and technical specification of, including but not limited to:
 - i. foundations
 - ii. oil system
 - iii. HVAC system (heating, ventilation, and air conditioning)
 - iv. control and instrumentation
 - v. excitation system
 - vi. protection
 - vii. start-up and synchronization system
 - viii. electrical auxiliary load
- g. Detailed modification requirements and specifications of the respective plant.
- h. Diagrams of the respective systems.
- i. Start-up and synchronization system:
 - i. assessment of options (pony motor vs inverter system)
 - ii. equipment and system integration
- j. Disassembly, lifting and moving equipment and requirements.
- k. Moving and preservation of the steam turbine.
- l. An engineering Report.

5.3. 70MW Wind Farm Concept Design (FEED)

Complete Concept and Basic Design including the following information:

- (1) Pre-Feasibility - (Desktop Studies based on available private wind resource data)
 - 1. Wind Resources Analysis
 - 2. Technical Evaluation of Sites
- (2) Site Concept Lay-out (Design Layout & Drawings)
- (3) Wind Turbine Generator Technology Options
 - 1. Determine Wind Turbine Generator Technology
- (4) Wind Resource Campaign Review (based on available private wind resource data)
- (5) Wind Resource Assessment & Characterisation
 - 1. Analyse Wind Resource Measurement (based on available private wind resource data)
- (6) Interconnection Point with Network Planning Studies:
- (7) Grid Integration Studies.
- (8) Develop Site Concept Layout
- (9) Perform Technical Evaluation of Sites
- (10) CAPEX and OPEX Estimation
- (11) LCOE Estimation

6. REPORTS AND PROGRAMMES

6.1. List of Reports

- (1) Within 20 working days of the signing of the contract, the Consultant shall submit an Inception Report giving a detailed work plan and assignments for each individual in the team.
- (2) The Consultant shall submit Progress Reports (Interim Reports) on a monthly basis, within one week after the end of each calendar month. The progress report, using the activity schedule as a basis, covers the following issues and Engineering Controls:

1. Cost, Schedule, and Technical Performance to date.
 2. Estimated Cost, Schedule, and technical accomplishment at contract completion.
 3. Highlights.
 4. Progress on planned earned and actual man-hours.
 5. Full-time equivalent of man plan for the project.
 6. Level 1, 2 and 3 integrated schedules with engineering float.
 7. A loaded project plan on Primavera or MS Projects.
 8. Problem areas and Corrective Actions.
 9. Risk Progress Report, describing progress with mitigating actions and changing risk status
- (3) The Progress Reports are discussed during scheduled Progress Review Meetings. The Consultant proposes to the Client a schedule for the Progress Review Meetings. The Progress Review Meetings are held within one week after receipt of the progress report. The Client keeps minutes of these meetings.

6.2. Schedule of Deliveries

- (1) The Consultant shall submit a Programme for all reports and deliverables listed in this document for acceptance by the Client within 4 weeks after contract award. The Client's target delivery dates for Deliverables and review meetings shall be discussed and agreed to with the Consultant prior to execution of any of the project activities. The Consultant uses the agreed to-and-signed off target delivery dates, as an input to develop the programme and activity schedule.
- (2) The list below is indicative of activities and timeframes and will be expanded / refined during the contract award/execution time. The activities of the project will not be contained in combined documentation for all services. The documentation will be provided for each service separately but with combined executive summary document including all services.

S. No.	Activities of Project	Time frame
1	Contract agreement signing and kick-off meeting along with an inception report with detailed completion schedule plan	15 days from the date of NOA
	Concept and Basic Design Phase	
	The Consultant shall provide a preliminary Concept Design Report including scenario analysis for all services and options for review	As per the agreed Consultant's detailed Completion Schedule Plan
	The Consultant shall provide the reviewed Concept Design Report including Layout and Functional Specification (Approved or commented Drawing and Report)	As per the agreed Consultant's detailed Completion Schedule Plan
	The Consultant shall provide the reviewed Comprehensive Bidding Documents (Approved or commented Functional Specification and Works Information or Scope of Work)	As per the agreed Consultant's detailed Completion Schedule Plan
	Detail Design Phase - EPC Contract	
2	The Consultant shall provide the reviewed drawings/documents (approved or commented drawing).	Within 5 working days from the date of submission of drawings/ documents
3	Consultant shall recommend response to any communication received by Eskom from EPC contractor	Within 5 days from the date of receipt
4	Design review meetings shall be conducted.	Every Fortnight initially and weekly once the project moves critical path.
5	All Drawing reviews completion.	8 months from the date of CA
	Construction, Testing, Commissioning & Handover Phases	

S. No.	Activities of Project	Time frame
7	Progress Review Meeting as per Section 5.1	Every month and as decided by Engineer In-Charge of Eskom
8	Representative to be arranged for factory level / plant level pre-dispatch inspection	Within 5 working days from the intimation mail/letter/ any suitable electronic medium.
9	Inspection report submission	Within 3 days from the date of completion of inspection.
10	Submission of Material Receipt Note along with supporting documents	As and when required. Reports shall be reviewed and certified within 4 working days.
11	All site inspection checklist (recording the activities and works/equipment inspected, in appropriate format) submission	Inspection checklist along with measurement certification shall be reviewed and certified within 3 working days.
12	Recommendation or certification of measurements of work progress	Weekly progress report to Eskom. Also, to maintain daily progress register at site. All parties to sign it.
13	Completion of Quality and Safety reports (Environmental and Social safeguards)	Weekly progress report to Eskom. Also, to maintain daily site incident register at site. All parties to sign it.
14	Expediting Submission of testing and pre-commissioning reports	Depends case to case basis
15	Preparation of punch list	7 days from commercial operation date
16	As-built drawing completion along with full compliance of pending punch point items	2 months from the date of Commissioning.
17	O&M review and report	Every month from the date of operational acceptance
	Capacity Building/Training	
18	Submitting Training Plan and conducting trainings	Ongoing activity/ co-terminus and concurrent with project activities

- (3) The Consultant shall confirm the method for Review and Acceptance of Deliverables with the Client four weeks after contract award. Deliverables generally follow the process outlined in the table below:

Ref*	Task	Responsibility
A	Prepare document	Consultant
B	Internal Review	Consultant
C	Approve for Client Review (e.g. Rev. a)	Consultant
D	Submit for Review	Consultant
E	Forward review comments	Client
F	Review Meeting (if required)	Consultant and Client
G	Review minutes distribution	Consultant
H	Update document	Consultant
I	Approve (e.g. Rev. 1)	Consultant
J	Submit for Acceptance	Consultant
K	Accept deliverables	Client
L	Written approval of deliverables	Client
	*Refer to paragraphs below	

- (4) In the event that the Consultant, after consultation with the Client, does not agree with some of the Client's review comments, the Consultant lists these comments to motivate the disagreement and submits this list to the Client.
- (5) The Schedule and the Scope of planned Review Meetings is developed by the Consultant and accepted by Eskom. The objective of review meetings is to discuss issues that relate to the design of Structures, Systems and Components (SSC) or the review of Deliverables.
 1. The Consultant ensures that all follow-up actions are carried out within the time stipulated.
 2. The Client may, in addition to the scheduled review meetings indicated, request additional reviews.
 3. The Client may involve independent third parties in any of the review meetings.
 4. Minutes of meetings will not form any basis of variations or amendments to the contract. The Client communicates contract variations or amendments formally to the Consultant in terms of the provisions in the Contract.

6.3. Period of Performance

- (1) The estimated duration of this Consultancy Services to Eskom is for a total period of **36 (Thirty) months** which primarily includes the Project commissioning timelines of **24 Months** plus 12 months of the first year Project operations. Eskom may decide to continue with the services of Consultant after one year of stabilized operations subject to satisfactory performance with terms and conditions and scope of services mutually agreed either through extension of the contract or through a new contract. For any reasons the project timelines are extended, the Consultant's consulting period also shall be increased without any cost escalation.
- (2) The Consultant shall deploy personnel who shall regulate the project as per the project progress and TOR.
- (3) The Consultant duration of contract shall be completed against one-year completion of operation and maintenance of the Project including submission of all as-built drawings and other reports of the Project by the Consultant. All such drawings and reports shall remain the property of the Eskom and shall not be used for any purpose other than that intended under these Terms of Reference. The Consultant services shall stand completed on acceptance of all the required deliverables of the Consultant and issue of Completion Certificate by Eskom to the Consultant.

7. COMPETENCY AND EXPERIENCE REQUIREMENTS OF THE CONSULTANT

The Consultant shall provide a mature and experienced Project Management Team headed by the Consultant's Team Lead (Project Manager) who has the overall responsibility for the management of the Consultant's Terms of Reference and the necessary supporting staff as well as Site-in-Charge Engineers. Site in Charge shall be responsible for the overall project monitoring, reporting and shall provide expert guidance and advice to Eskom on technical issues arising during construction phase. All the Project Engineering required under this contract shall be performed by the Consultant in consultation with the Client's Project Engineering Team.

7.1 Firm's suitability, Competence and Qualification Required

- (1) **In Solar Domain:** Previous experience as an Owner's Engineer (OE) or Lender's Engineer (LE) for cumulative capacity of 100 MW or more. Successful completion of at least one similar assignment of not less than 50 MW capacity which should have been completed and operational for at least one year.

- (2) **In Battery Storage Domain:** Owner's Engineer (OE) or Lender's Engineer (LE) can associate with other firms (if the lead firm doesn't meet the qualification criteria on its own). Minimum of 3 BESS Projects installed and operating of any size, of which 2 BESS projects should be of at least 50 MW. Experience in executing solar with storage projects will have preference.
- (3) **In Synchronous Condenser Conversions:** Previous experience as an Owner's Engineer (OE) or Lender's Engineer (LE) for the conversion of a Steam Turbo-Alternator with a capacity of at least 100MW or more, to operate as a synchronous condenser. One Project of not less than 100 MW capacity which should have been operational for at least one year.
- (4) **In Wind Domain:** Previous experience as an Owner's Engineer (OE) or Lender's Engineer (LE) for cumulative capacity of 50 MW or more. Successful completion of at least one similar assignment of not less than 50 MW capacity which should have been completed and operational for at least one year
- (5) In addition to the above, the consulting/management firm's core business relevance and overall experience in the sector (new renewable power generation systems) and capabilities in terms of institutional strength, institutional quality management systems, good track records and references are some of the aspects considered as general suitability indicators for shortlisting.

7.2. Key Expertise Required

- (1) The Key experts to recommended by the Consultant shall have the following minimum qualifications and competencies/experiences:
 1. Suitably Degreed Engineer/s (BSc/B.Eng./B.Tech.)
 2. Professional Engineering Certification with the Engineering Council of South Africa (ECSA), The South African Council for the Project and Construction Management Professions (SACPCMP), or from any equivalent professional accreditation bodies or affiliation with a professional engineering body or institute recognised by the Washington Accord for the engineering team and adequate professional liability insurance
 3. Knowledge of International and local standards related to utility-scale and grid connected BESS and Solar PV Plants, and must be familiar with the Solar PV and BESS technologies currently available
 4. Extensive international experience and successful track record in the main role of Solar PV and BESS deployment and application from inception to hand-over
 5. Experience with integration of new renewable power generation systems or components thereof into an existing power system and have evaluated renewable power plants for grid code compliance and are aware of the requirements for testing and operating the plant
- (2) The key staff requirement provided in the Table 2 below is indicative of the minimum requirements. The actual number, expertise, and level of effort (expert-months) offered by the Consultant shall be based on the **methodology and approach** provided in the **technical proposal of the consultant during preparation of the technical proposals offered**.
 1. The Consultant shall **submit CVs and Statements of Exclusivity and Availability** for the key experts. Key Experts' CVs should clearly indicate the start date and the end date (month and year) of each assignment. Each assignment in the CV should be numbered and the same number should be written on the respective signed supporting document.
 2. Any qualifications, skills and experience stated in the respective CV of an expert must be substantiated by **supporting documents** (with accurate translation into English if required) such as copies of degrees or diplomas, professional registration and employers' certificates and marked with appropriate reference number

3. The Consultant shall **submit CVs for experts other than the key experts** in the tender and the tenderer will have to demonstrate in their offer that they have access to experts with the required profiles. All experts must be independent and free from conflicts of interest in the responsibilities they take. The Consultant shall allow for the number of expert months each expert is likely to be used in Table 1 below. The actual duration will be agreed between the Client and Consultant
 4. The Consultant shall **submit resumes of each support staff** member of the site engineering team to Eskom for approval with the response to RfP and any change from the original team shall be done on like-for-like basis and after approval from Eskom. In case Eskom feels Consultant team needs to be strengthened based on activity at site, Consultant shall depute all such additional manpower to site after discussion with Eskom. The Support staff shall be guided by a designated Key Expert.
- (3) The Consultant shall deploy 3-Member Engineering Team from the Key Experts Pool specified above, (2 (two) Electrical Engineers and 1 (one) Civil Engineer) at Eskom Komati Power Station, Eskom shall make seating arrangement for the members at Eskom's premises.
 - (4) In addition, the Consultant shall have a Project Monitoring Team from the pool of support staff stated above based at Komati Site with at least 4-Member Engineering Staff, comprising of 2 (two) Electrical Engineers and 2 (two) Civil Engineer, see Table 2.
 - (5) The Consultant must arrange for their equipment, vehicles and accommodation at Site and Eskom will make arrangements for consultant team to be allowed free and unfettered access to the Site and other approvals and permissions as deemed necessary for successful and timely completion of the project activities.

Table 2: Required Key Expertise

Item	Resources	Qualifications	Min Years' Experience	Number of Persons	indicative key expert input (Expert-months)
1	Project Team Lead	BSc Eng./B. Tech Eng.	15 in Power Gen, including 7 in Renewables as an OE/IE	1	36 (Phase 1 =12 & phase 2=24)
2	Deputy Team Leader	BSc Eng./B. Tech Eng.	15 Engineering & Integration Management, 5 in Renewables as an OE/IE	1	36 (Phase 1 =12 & phase 2=24)
3	Project Contract Expert	Undergraduate degree in relevant fields of studies.	10 direct years of experience with successful completion of at least two similar assignments	1	12
4	Solar PV Expert	BSc Eng./B. Tech Eng.	15 including 5 in Solar, 7 as an OE/IE	1	12
5	Battery Energy Storage Expert	BSc Eng./B. Tech Eng.	15 including 5 in BESS Systems, 7 as an OE/IE	1	12
6	Synchronous Condenser Conversion Expert	BSc Eng./B. Tech Eng.	15 including 5 in Synchronous Condenser Conversions, 7 as an OE/IE	1	12
7	Wind Turbine/Farm Expert	BSc Eng./B. Tech Eng.	15 including 5 in Wind, 7 as an OE/IE	1	12

8	Civil & Structural Design Expert	BSc Eng./B. Tech Eng.	15 including 5 in designing of construction buildings	1	12
9	Electrical System Design Expert including Transmission System	BSc Eng./B. Tech Eng.	15 including 5 in electrical system design	1	18
10	C&I & Communications Expert	BSc Eng./B. Tech Eng.	15 including 10 in C&I & Communications System Design	1	10
	Support Staff				
11	Civil & Structural Engineer*	BSc Eng./B. Tech Eng.	10 including 5 in Solar/ large RE projects. Full knowledge of all relevant Codes	2	20 (10 each)
12	Electrical Engineer* cum site in charge (Substations, Transmission)	BSc Eng./B. Tech Eng.	10 with at least 2 solar and battery storage Projects of minimum 25 MW Capacity, cumulative experience of not less than 100 MWp	2	30 (15, each)
13	Mechanical Engineer* cum site in charge Wind Turbines	BSc Eng./B. Tech Eng.	10 with at least 2 Wind Projects of minimum 20 MW Capacity, cumulative experience of not less than 50 MWp	1	15
14	Mechanical/Electrical Engineer* cum site in charge Synchronous Condensers	BSc Eng./B. Tech Eng.	10 with at least 2 Power Plant Projects of up to 100MVA Generation Conversion	1	15
* Registered with a recognised professional body					
** Construction Experience					
Note: Note that lead experts proposed by bidders will be required to carry out the work. Substitutions will only be allowed under limited circumstances and only with express written consent of the Eskom.					

7.3. The assignment Contract type

- (1) The assignment's contract model would be hybrid of Lump-Sum and Time-based contracts.
- (2) The first phase of the assignment which covers Project Planning, Concept and Basic Design, Detail Design Reviews during EPC Contract, and Tender Support Phase will be Lump-Sum type while the second phase for Construction supervision, Testing, Commissioning, Handover Phases & training will be Time-based contract.

8. PERSONNEL AND FACILITIES TO BE PROVIDED BY CLIENT

8. 1. Data

- (1) All relevant supporting documentation that the Client has referenced in this Terms of Reference will be made available to the Consultant when the contract commences, or during contract negotiations as required by the Consultant.

- (2) Any additional cost resulting from Compliance with new procedures (not stated below) issued by the Client will be compensated.

8.1.1. Client's Policies and Procedures

The Consultant shall as a minimum comply with the procedures furnished below and new procedures issued by the Client throughout the execution of the Services:

- (1) Health and Safety Specifications - 32-757
- (2) The Eskom Code of Ethics - Standard 32-527
- (3) COVID-19 related Standard & Guidelines - 240-155326818
- (4) COVID Health and Safety - Government Regulation No 11128
- (5) Generation Project Life Cycle Model - 240-82737649
- (6) Project Engineering Change Management Procedure - 240-53114002
- (7) Design Review Procedure - 240-53113685
- (8) Contract Quality Requirements - QM 58
- (9) Operating Regulations – 240-7041386534

8.1.2. Prior Studies, Investigations and Reports

The Client shall make the following prior studies, investigations and reports available to the Consultant:

- (1) Technical Analysis on Retiring and Repurposing of Four Coal Plants in South Africa, Project P-2021-00547". - Komati Draft Report Revision 3 Issued On 25 February 2022.
- (2) Komati Thermal Power Plant, Decommissioning and Repurposing Project Scoping Report (PSR) Dated 10 February 2022 Prepared by The World Bank Group and Eskom
- (3) Technical Analysis on Retiring and Repurposing of Four Coal Plants, South Africa. Questionnaire-Task 1 Power System Analysis – KOMATI. Final Version 29 September 2021.
- (4) Technical Analysis on Retiring and Repurposing of Four Coal Plants, South Africa. Questionnaire-Task 1 Power System Analysis- Electrical Part – KOMATI. Final Version 08 July 2021.
- (5) State of Plant Assessment Report for Komati Power Station: Unique Identifier: 285-169231 Rev 0, 24 May 2021.
- (6) Spread Sheet with List of Buildings and Plant That Are Temporary, Permanent or Plant.
- (7) All environmental historical reports and relevant Komati RTS Documentation

8.2. Local Services

- (1) The Client shall provide Open plan Offices at the Site of Works, Komati Powers Station or Sunninghill in Johannesburg as deemed appropriate from time to time.
- (2) Telephone and Internet facilities (specifically related to the Project) will also be made available.
- (3) Given that the South African government has recommended that mobility be restricted to comply with the Coronavirus pandemic rules, it is therefore anticipated that remote working will continue for the foreseeable future and that online platforms such as MS TEAMS will be used for conducting meetings and training. The Consultant shall comply with all COVID-19 government regulations.

8.3. Personnel

- (1) Eskom shall appoint a Project Team responsible for determining project scope and end state following completion of works. The Team shall have an Engineering Design Work Lead (EDWL) to take full responsibility for managing the Consultant's work and for ensuring delivery on the

project. A Project Engineering Manager shall serve as Project Manager and to establish a Project Team to engage regularly with the Consultant for efficiently completing the various delivery items.

- (2) The project team will meet at least monthly, and the Consultant will report progress at these meetings, as instructed by the Project Engineering Manager. The Project Engineering Manager will confirm that the Consultant has satisfactorily completed each deliverable before invoices can be submitted to Eskom for payment.
- (3) The activities will be carried out in South Africa. It is anticipated that the team-leader and co-team leader of the Consultant's team will be located in Mpumalanga province for much of the duration of the contract.

9. INSTITUTIONAL ARRANGEMENTS

9.1. Access to Design Information

- (1) The Consultant shall have access to the Client's design information relevant to the Services described in these terms of reference

9.2. Changes to Client Furnished Information

- (1) The Consultant shall not alter the content of any Client furnished information or data for detail design, procurement or construction purposes (without having an ECP).
- (2) Modifications are proposed by means of Engineering Change Proposal (ECP) notifications (the review period is 21 days or as per conditions of the contract). The Client will provide the Consultant with the template for an ECP and the procedure for executing and managing ECPs.

1. If the Consultant:

- a. cannot meet the Client's technical requirements, or comply with the contractual technical baseline as set out in the Terms of Reference; or
- b. needs to revise a document that has been approved or that has been released as part of a technical baseline by the Consultant; or
- c. wants to suggest a modification to the specification or design for which the Client is responsible.

[...] he notifies the Client, using the Engineering Change Proposal (ECP).

2. The notification includes a detailed motivation, a description of the proposed design or interface changes and the impact (cost, scope, and time in terms of project program), if any, on the Programme, prices, or any other contractual agreements.
3. In the event of this notification leading to a change in the documentation for which the Client is the document change authority, the Client is responsible for initiating design change proposals, and if approved, updating the design documents. When approved, the Consultant is informed in terms of the contract, and the updated design documents are issued.