

	Scope of Work	Kusile Power Station
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1. Introduction

This Scope of Work outlines the high-level scope for replacement of traditional lights with energy-efficient LED lighting solutions at Kusile Power Station. As part of the transition to more sustainable and cost-effective lighting systems, a key component of the project will include emergency LED replacements for critical areas that require continuous illumination during power outages.

There had been a concerning deterioration of lighting across the station where issues of frequent replacements, spares and maintenance capacity issues contributed greatly. That is due to short lifespan of the traditional lights and obsolescence were most light manufactures no longer produce traditional lights. This lighting upgrading project aims to provide reliable lighting solutions and ensuring compliance with safety regulations and supporting operational continuity.

2. Supporting Clauses

2.1 Scope

This document describes the scope of work to be carried-out by the appointed contractor. The Lighting Replacement Project is divided into two phases, A and B. Below is the scope of work for Phase A and only covers the following plant areas:

- Boiler Plant (Unit 1 to Unit 5) including PJFF and Flue Gas Ducts
- Turbine Plant (Unit 1 to Unit 5)
- Water Treatment Plant.
- FGD Recirculation Pumps House
- Compressor Houses (West and East)
- Diesel Generator house
- Aux Bay and the Offices

The High-Level Scope to be executed is as follows:

- Removal of traditional lights.
- Disposal, scraping and storage of traditional lights.
- Supply of LED lights
- Installation of LED lights
- Commissioning (Including testing, conduction lighting survey etc.)
- Providing datasheets and signed quality documentation (QCPs).

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2.1.1 Purpose

The purpose of the Scope of Work is to clearly define the tasks, processes, and deliverables required for the successful replacement of traditional lighting systems with LED lighting at Kusile Power Station. This includes the installation of emergency LED fixtures to ensure continuous lighting during power outages.

2.2 Applicability

This document applies to Kusile Power Station only.

2.3 Effective date

This will be effective from the day of Authorization.

2.4 Normative/Informative References

2.4.1 Normative

- [1] ISO 9001 Quality Management Systems
- [2] 240-56356396 - Earthing and Lightning Protection Standard
- [3] 240-55714363 Eskom Generation Power Station Lighting and Small Power Standard Rev 2
- [4] SANS 10389-1 Part 1: Artificial lighting of exterior areas for work and safety
- [5] SANS 1464-22:2024: Safety of luminaires Part 22: Luminaires for emergency lighting
- [6] SANS 10114-1:2023: Interior lighting Part 1: Artificial lighting of interiors Informative
- [7] NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT 59 OF 2008

2.5 Definitions

Supplier	Service provider assigned for supplying and delivering technical service.
Contractor	Service provider assigned for supplying and delivering technical service.
Employer	Eskom, Kusile Power Station
Plant	Any structure, machinery, apparatus, or equipment which does not fall within the scope of the operating regulations for high voltage systems, and excludes, mobile, portable lifting equipment, domestic circuits' appliances, and tools
KKS coding	The Identification System for Power Stations (KKS) is a system for identifying plants, systems, subsystems, equipment items, electrical and I&C cabinets, as well as buildings and rooms

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2.6 Abbreviations

Abbreviation	Description
HPS	High Pressure Sodium
IP	Ingress Protection
ITPL	Inspection and Test Plan List
kV	Kilovolts
LED	Light-emitting diode
m	Meters
mm	Milli-Meters
PPE	Personal Protective Equipment
QCP	Quality Control plan
SANS	South African National Standards
W	Watt

2.7 Roles and Responsibilities

- a) Supplier shall comply with Eskom's policies and site regulations, adherence to Eskom's Life Saving Rules, adherence to Generation Occurrence Management Procedure, Smoking Policy, zero tolerance on alcohol usage, etc.
- b) The successful Contractor shall utilise/provide skilled and suitably qualified staff with current experience in the following but not limited disciplines.
 - Competent Person according to OHSAS Act
 - Occupational Health and Safety Act 85 of 1993
 - Quality Management Control and Assurance procedures
 - Method Statement writing
 - Plant lighting monitoring commissioning and (lighting survey)
- c) Supplier shall provide the handover package, signed, and accepted by the employer.
- d) All staff brought onto site in connection with this SOW should be able to fluently speak, understand and write in English.
- e) Ensures that throughout the duration of the contract, they conform and adhere to the safety, health, and environment regulations.
- f) The supplier ensures that all staff brought to Kusile PS site have a valid fitness certificate based on the specified plant man-job specification.
- g) The supplier shall be responsible or held liable for any defects arising from manufacturing, transportation, and handling.

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2.7.1 Employer (Eskom):

- a) Compile and submit scope of work with technical specifications.
- b) Performs Quality Control on delivery at the Employer premises.
- c) Liaise with all relevant stakeholders for any input.
- d) Provide all necessary to ensure that the Works Information is in accordance with Eskom policies and procedures.
- e) Arrange technical evaluation sessions.
- f) Compile and present mandate to negotiate and arrange negotiation meetings when required and give feedback to relevant tender committee.
- g) Keep record of all tender documentation.

2.7.2 Communication and Correspondence

Correspondences shall be written formally on the letter head format of the organisation and addressed to the relevant person.

- a) All correspondence includes but not limited to:
 - i. Kusile Power Station
 - ii. Employer's Contract number
 - iii. Contract description
 - iv. Correspondence subject matter
 - v. Employer's name and contact details.
 - vi. Contractors contact details.
 - vii. Date

Where appropriate the correspondence includes the Employer's reference and is delivered as a single package or as per the agreed contract terms.

All communications from the Contractor are numbered sequentially with a prefix as advised by the Employer. The Employer responds in like manner. The prefix and numbering system are decided upon at the Inaugural meeting.

2.7.3 Quality and Documentation Control

- a) During the tender process a quality criterion will be defined that the Contractor must comply to.
- b) The Contractor shall ensure that any witness, hold, and inspection points are strictly adhered to.
- c) All Quality References and Standards as stipulated in this document will be adhered to.
- d) The Contractor to comply with the Employer's quality documentation management system and processes.

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2.8 Process for Monitoring

This document shall follow the:

- 240- 53114026 Project Engineering Change Management Procedure.

It shall be updated and revised by Generation Engineering, upon review by the relevant stakeholders.

2.9 Related/Supporting Documents

N/A

3. Scope of Work

3.1 Plant Description

There are different types of lights installed in different plant areas for different purposes and applications. Below are the types of lights installed per plant.

3.1.1 Types of Lights per plant

Light Description	Plant Areas
70W LED Bulkhead Replacement for 100W HPS Bulkhead Light	<ul style="list-style-type: none">• Boiler and PJFF Plant• Turbine Plant• Compressor Plant• Water Treatment Plant
80-90W LED Floodlight Replacement for 150W HPS Floodlights	<ul style="list-style-type: none">• Boiler and PJFF
600x600mm LED Panel Light replacement for 2ft Fluorescent 24W Tubes	<ul style="list-style-type: none">• Admin Building• Aux Bay Offices
600x1200mm LED Panel Light replacement for 5ft Fluorescent 54W Tubes	<ul style="list-style-type: none">• Aux Bay• Admin Building
4ft LED Light replacement for 4ft Fluorescent 54W Tubes	<ul style="list-style-type: none">• Aux Bay
280W LED High Bay replacement for 600W High Bay Light	<ul style="list-style-type: none">• Turbine Hall• Recirc Pump House• Diesel Generators House• Water Treatment Plant
5 - 9W LED Bulb replacement for 9W Energy Saving Bulbs	<ul style="list-style-type: none">• Control Rooms• Aux Bay• Admin Buildings

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3.2 General

- a) The contractor takes full professional accountability and liability for all temporary works designs done by the Contractor.
- b) Any discrepancy or ambiguity between the Employer's Specifications or requirements is immediately brought to the attention of the Project Manager for clarification.

3.3 Planning and Scheduling

- Develop phased installation plan to minimize disruptions to power station operations. Where necessary, schedule work during non-operational hours.
- Coordinate closely with operational teams to ensure adherence to safety protocols during the installation process.

3.4 Installation

- Remove existing traditional lighting fixtures across the station and ensure safe and environmentally compliant disposal, especially for hazardous materials like mercury in fluorescent bulbs.
- Install new LED fixtures, retrofit existing ones if necessary, and upgrade electrical infrastructure where needed.
- Request Employee installation before commissioning.
- Test all installations to verify compliance with the design specifications, ensuring correct brightness levels and automatic switching through day-night switches.

3.5 Lights Replacements

Below is a list of direct LED replacements for various traditional lighting fixtures. These suggestions are based on typical lumen output and wattage equivalency, providing energy-efficient alternatives without compromising on lighting quality. For each category, the approximate wattages and types of LED fixtures considered for a one-to-one replacement are included.

Direct LED Replacement for 100W HPS Bulkhead Light

- Replacement LED: 70W LED Bulkhead (With 120° beam angle)
- Lumen Output: 4000-6000 lumens
- Notes: LEDs in the 70W range can typically replace 100W HPS due to their higher efficiency, providing similar light levels with lower energy consumption. Look for fixtures with a colour temperature of around 3000K-4000K to match the warm light of HPS.

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Direct LED Replacement for 2ft Fluorescent 24W Tubes

- Recommended LED Panel Light: 600x600mm LED Panel Light
- Wattage: 18W
- Lumen Output: 2,000-3,000 lumens
- Notes: A 600x600mm LED panel is ideal for replacing smaller 2ft fluorescent fixtures, offering improved light distribution and a cleaner aesthetic in commercial or office spaces. Panels are available in a range of colour temperatures, typically from 3000K to 6500K.

Direct LED Replacement for 5ft Fluorescent 54W Tubes

- Recommended LED Panel Light: 600x1200mm LED Panel Light
- Wattage: 36W
- Lumen Output: 4,000-5,500 lumens
- Notes: This size panel can replace multiple 5ft fluorescent tubes in larger areas, such as offices, hallways, or conference rooms, providing even, flicker-free light that enhances both visibility and comfort.

Direct LED Replacement for 400W High Bay Light

- Replacement LED: 150W LED High Bay (With 120° beam angle)
- Lumen Output: 15,000-20,000 lumens
- Notes: For replacing 400W high bay lights in industrial or warehouse settings, 150W LED high bay fixtures provide a direct energy-saving replacement. High bay LEDs offer superior lighting with options for different beam angles and colour temperatures.

Direct LED Replacement for 600W High Bay Light

- Replacement LED: 280W LED High Bay (With 120° beam angle)
- Lumen Output: 15,000-20,000 lumens
- Notes: For replacing 400W high bay lights in industrial or warehouse settings, 280W LED high bay fixtures provide a direct energy-saving replacement. High bay LEDs offer superior lighting with options for different beam angles and colour temperatures.

Direct LED Replacement for 9W Energy Saving Bulbs

- Replacement LED: 5 - 9W LED Bulb
- Lumen Output: 15,000-20,000 lumens

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Direct LED Replacement for 5ft Fluorescent Tubes

- Replacement LED: 18W LED Tube
- Lumen Output: 1800-2200 lumens
- Notes: A 5-foot fluorescent tube (typically 36-40W) can be replaced by an 18W LED tube, providing similar brightness with reduced energy consumption. Make sure to choose the right colour temperature and whether it's a plug-and-play or ballast-bypass type.

Proper installation as per the above selections ensures that the lighting system operates effectively, providing uniform illumination and enhancing the overall aesthetic of the space. Ultimately, this leads to a more sustainable, reliable, and functional lighting solution at Kusile Power Station.

3.6 Number of Replacement Lights

Light Description	Quantity Estimates
70W LED Bulkhead (Mag44 retrofit panel and modules) Replacement for 100W HPS Bulkhead Light	12000
600x600mm LED Panel Light replacement for 2ft Fluorescent 24W Tubes	3600
150W LED High Bay replacement for 400W High Bay Light	600
280W LED High Bay replacement for 600W High Bay Light	400
5 - 9W LED Bulb replacement for 9W Energy Saving Bulbs	6000
18W LED Tube replacement for 5ft Fluorescent Tubes	250

3.7 Lighting Minimum Requirements

Light Sources to be installed through this project as per the above-mentioned type must ~~be~~ meet the following specifications and it must be noted that all light sources must comply with Schedule B attached in **Appendix A**.

3.7.1 Photometric Requirements

- The light colour shall be “Neutral White” (4000K).
- The colour rendering index shall be equal to or greater than 85.
- The luminaire efficacy shall be equal to or greater than 110 lm/W.
- The luminaire downward light output ratio (LOR) shall be equal to 100%.
- The luminaire shall reach its full brightness instantaneous.
- IES and/or LTD files for use with Relux must be supplied in electronic format.

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3.7.2 Electrical Requirements

- Luminaire input voltage shall be 230V AC $\pm 15\%$.
- Luminaire operating frequency shall be 50Hz $\pm 5\%$.
- Luminaire efficiency shall be equal to or greater than 90%.
- Luminaire power factor shall be equal to or better than 0.95.
- Luminaire total harmonic distortion shall be equal to or less than 20%.
- All LED drivers shall be suitable for operation with the specified rating of the luminaire on a 230 VAC $\pm 10\%$ 50Hz single-phase electrical power supply system.

3.7.3 Mechanical Requirements

- Luminaires shall be constructed from durable lightweight materials and shall be accompanied by comprehensive test reports certifying that the luminaires have successfully passed SANS 475.
- Luminaires shall be supplied complete with control gear and LED module.
- Diffusers / lenses shall not have external prisms that could accumulate dirt and dust, and thus reduce the light output of the luminaires. Diffusers shall be constructed in such a manner that the wall thickness of the material is maintained at a constant thickness, hence preventing the projection of lines of patterns onto the ground level.
- In case where luminaires are fitted with reflectors, the reflector shall be made of high-grade super pure deep anodized aluminium.
- LED drivers shall be fully housed within or fixed onto the body of the luminaire.
- The luminaire dimensions and weight shall be specified.
- The number of modules and LEDs per module shall be specified.
- The operating relative humidity range shall be 10% to 70%.

3.7.4 Guarantees

- Luminaire housing for a minimum period of ten (10) years.
- The electrical components for 30 000 operating hours (five years).
- The LED module for 30 000 operating hours (five years).

3.7.5 Documentation to be submitted.

- The following documentation must be submitted per luminaire offered:
- Proof of compliance to the SANS 60598-1 (by accredited laboratory)
- Proof of compliance to the SANS 475 (by accredited laboratory)
- Proof of compliance to the EN 55015 (by accredited laboratory)

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- Completed technical Schedule B in Appendix 1.
- IES and/or LTD files supplied in electronic format.
- Proposed Relux simulation (electronic .RDF file)
- Photometric test reports per luminaire offered. (by reputable accredited laboratory)
- Luminaire guarantee certificate.
- Certificate indicating lead time for delivery from date of order.
- Luminaire maintenance strategy.
- No luminaire will be approved or tested if these test reports are not provided.

3.8 General Installation Guidelines

3.8.1 Safety Compliance

- Follow all relevant electrical codes and safety regulations during installation.
- Use appropriate personal protective equipment (PPE) and safety measures.

3.8.2 Documentation

- QCP and ITPL to be used for all the station lights and must be submitted to Engineering for review.
- Datasheets,
- Storage, packing and transportation instructions.
- Maintenance manual

3.8.3 Quality Assurance

The quality of the LED lighting installation at Kusile Power Station is critical to the overall success of the project. All LED fixtures must meet or exceed industry standards for energy efficiency, durability, and performance. The selected LED lights should be sourced from reputable manufacturers with proven reliability and compliance with international standards such as SANS, IEC, or equivalent certifications.

All LED lights to be installed must have their samples tested and approved by Eskom Research, Test and Development (RT&D) before they can be accepted for installation at Kusile Power Station.

Throughout the installation process, qualified personnel will ensure that all fixtures are properly mounted, connected, and tested for functionality, brightness, and consistency.

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4. Acceptance

This document has been seen and accepted by:

5. Revisions

Date	Rev.	Compiler	Remarks
October 2024			

6. Development Team

The following people were involved in the development of this document:

7. Acknowledgements

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Appendix A

Schedule B: Technical Particulars of Luminaire Offered

ITEM NO	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
1	Photometric Specifications			
1.1	Colour temperature	K	4000 K (Neutral White)	
1.2	LED luminous flux	lm	Specify	
1.4	Colour rendering index (CRI)		≥ 85	
1.5	Luminaire efficacy	lm/W	≥ 110	
1.5	Light output ratio (LOR)	%	Specify	
1.6	Downward light output ratio (DLOR)	%	≥ 85	
1.7	Time to full brightness	minutes	< 1	
1.8	IES and/or LTD files		Comply	
2	Electrical Specifications			
2.1	Input voltage	VAC	230 ±15%	
2.2	Frequency	Hz	50 ± 5%	
2.3	Input current (maximum)	mA	300-500	
2.4	Efficiency (total LED to total luminaire power consumption)	%	≥ 90	
2.5	Power factor (PF)		≥ 0.95	
2.7	Total Harmonic distortion	%	≤ 20	
2.8	Protection type			
3	Electromagnetic Specifications		As specified	
4	Mechanical Specifications			
4.1	Luminaire design		As specified	
4.2	Luminaire material and SANS 475 compliance		As specified	
4.3	Luminaire and accessories		As specified	
4.4	Diffuser		As specified	
4.5	Reflector material		High-grade super pure deep anodized aluminium	

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ITEM NO	DESCRIPTION	UNIT	SCHEDULE A	SCHEDULE B
4.6	LED Drivers capability		As specified	
4.7	Luminaire dimensions		As specified	
	Height	mm		
	Width	mm		
	Length	mm		
4.8	Luminaire Weight	kg		
5	General Specifications			
5.1	Number of modules			
5.2	Number of LEDs			
5.3	Arrangement (number of LEDs per module)			
5.4	Operating temperature range	°C	-10 to +60	
5.5	Operating humidity range	%RH	10% - 70%	
6	Guarantee			
6.1	Luminaire housing (minimum)	years	10	
6.2	Electrical components (minimum)	hours	30 000	
6.3	LED modules (minimum)	hours	30 000	
6.4	Luminaire replacement in case of sub-standard performance		As specified	
7	Delivery			
7.1	Lead time for delivery from time of order	Calendar days	60	
8	Maintenance strategy			
			Specify	

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