


**MEDUPI POWER STATION
ELECTRICAL POWER INSTALLATION (EPI)
PACKAGE P11**

UNIT 6 TURBINE HALL LIGHTING REPORT

Document No	5342.12_001	
Document Rev	Rev 1	
Date of Issue	14 July 2011	
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1. INTRODUCTION

This report outlines a technical assessment of the highbay luminaires offered by two manufacturers, namely: BEKA PTY (LTD) and MAGNITECH PTY (LTD). These luminaires are intended for use in the Unit 6 Turbine Hall at the Medupi Power Station. This revision is in response to Eskom's letter dated 31 May 2011 (SPF No: 257-74113, Transmittal No: 261-13506) which commented on Revision 0 of this document (5342.12_001). See Annexure 4 for Eskom's comment letter. All the technical and financial information presented in this revision of the document is the most recent and up-to-date information provided to SSI by the respective lighting vendors. Consequently, the information included in Revision 1 takes precedent over the information included in Revision 0.

This turbine hall lighting design was prepared by SSI and forwarded to both lighting vendors who were requested to furnish SSI with the following information:

- Independently certified photometric test reports of their 600W HPS highbay complete with a 600W tubular HPS lamp;
- A complete lux level simulation of Unit 6 turbine hall using the following depreciation factors (in accordance with SABS/SANS 10114-1-2005):
 - LLD for HPS: 0.9
 - Ballast Correction: 0.97
 - Lamp Output Correction: 0.95
 - Dust Factor 0.9
 - Total Maintenance Factor: 0.75

and reflectance values:

- Wall Reflectance: 20%
- Floor Reflectance: 10%
- Ceiling Reflectance: 50%
- The light fitting's ballast power

The technical assessment is carried out using this provided information. Further to the technical assessment, a financial evaluation taking into account the life-cycle costing is undertaken. The report closes by recommending a suitable manufacturer as per the undertaken evaluation.

2. LIGHT FITTING SUPPLIERS

Quotations and technical information were obtained from the following two lighting suppliers:

BEKA INDUSTRIAL LIGHTING DIVISION:	MAGNITECH, ILANGA LIGHTING DISTRIBUTION COMPANY
P.O.Box 120 Olifantsfontein, 1665 SOUTH AFRICA Telephone: +27-11-238 0040 Facsimile :+27-11-238 0184 Web Page: www.beka.co.za Contact Person: Paul Nicolai	P.O.Box 34218 Jeppestown, 2043 SOUTH AFRICA Telephone:+27 11 614 4327 Facsimile:+27 11614 5920 Web Page: www.ilanglighting.co.za Contact Person: Jan Henning

3. DESIGN REQUIREMENTS AND PHILOSOPHY

According to Eskom's *Lighting and Small Power Installation Standard 200-11764*, the required lux level in the Turbine Hall at the Medupi Power Station is 300 lux. In order to achieve this requirement, it is proposed to mount 39 x 600W High Pressure Sodium (HPS) highbays (Eskom Code: 2X) to the Turbine Hall roof purlins, approximately 14.5 m above the operating floor (LVL 9.00m). The configuration of these highbays can be seen in Figure 1 below.

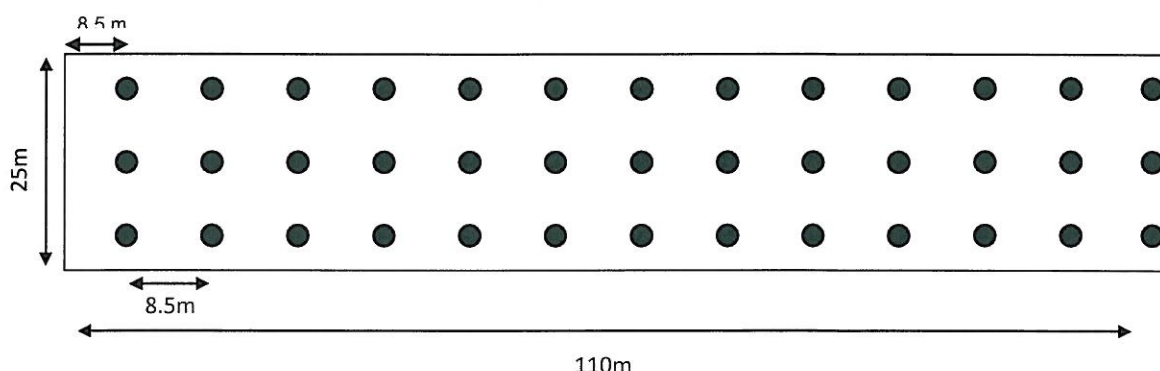


Figure 1: Turbine Hall highbay lighting configuration (not to scale)

4. LUMINAIRE TECHNICAL ASSESSMENT

Table 1 below provides all the relevant technical information for both Magnitech's 600W HPS highbay: **BM3/SAW701 600 HPS**, and Beka's 600W HPS highbay: **Bekabay Techno 600W HPST HO 128mm spacer**.

Supplier	Lamp Rating	Light Output (Lumens)	Power with Ballast	Rated Average Life	Efficacy (lm/W)
Magnitech: BM3/ SAW701 600 HPS	600W	90 000	630W	24 000 h	142.86
Beka: Bekabay Techno 600W HPST HO	600W	90 000	667W	24 000h	134.93

Table 1: Technical Information of Magnitech and Beka Highbays

Note 1: The information provided in Table 1 was provided by the respective lighting suppliers. See Annexure 3.

Note 2: Both lighting manufacturers indicated that the OSRAM super high pressure sodium lamp will be supplied with their respective fitting, resulting in identical values in Table 1.¹

Note 3: The standard electrical definition of efficacy is used, i.e.: the *luminous efficacy of the source*.

5. LUMINAIRE COST COMPARISON

Table 2 below shows the capital costs calculated using the unit price in Actom's Bill of Quantities.

Supplier	No. luminaires	Luminaires+ installation with lamp included (Rands)	Total costs (Rands)
Magnitech: BM3/SAW701 600 HPS	39	R 2 711.25	R 105 738.75
Beka: BekabayTechno 600W HPST HO	39	R 3 179.23	R 123 990.75

Table 2: Capital Costs

6. DESIGN EVALUATION

Table 3 below summarises the simulation results received from the two lighting vendors. (See Annexure 1). Both vendors were approached to provide independently certified photometric data and to use this data in their respective simulations. While both vendors provided this data and the associated simulations (seen in Annexure 1), Magnitech did not provide *independently certified* photometric data. This issue is further addressed in Section 9.1 below.

Supplier	Obtained Average lux level on LVL 9.00m (Operating Floor)
Magnitech: BM3/SAW701 600 HPS	508 lx
Beka: HPS Bekabay Techno 600W HPST HO	465 lx

Table 3: Simulated average illuminance levels from both lighting suppliers

¹ Information confirmed by M. Vigus-Brown from Magnitech (011) 618 -2720 and P. Nicolai from Beka (011) 238-0000

7. POWER COMPARISON

Table 4 provides a summary of the prospective total power consumption for Unit 6 Turbine Hall at the Medupi Power Station.

Supplier	No. luminaires (QTY)	Lamp output power with ballast (W)	Total power consumption (kW)
Magnitech: BM3/SAW701 600 HPS	39	630	24.57
Beka: BekabayTechno 600W HPST HO	39	667	26.01

Table 4: Total Power Consumption Summary

8. FINANCIAL EVALUATION

8.1 Capital cost

From the capital costs shown in Table 2, it is evident that Magnitech's *BM3 SAW701 600 HPS* is offered at a lower price as compared to Beka's *Bekabay Techno 600W HPST HO*

8.2 Operational costs (5 years)

The operational costs consist of Energy Consumption Costs and Lamp Replacement Costs

8.2.1 Energy consumption costs (5 years)

In calculating the energy consumption, the following assumptions are made:

- The lamp will be switched on for 24 hours every day;
- The energy cost is R0.64² / kWh appreciating by an estimated 20% per annum; and
- The maximum demand cost is R100.00 / kVA appreciating by an estimated 20% per annum.

Table 5 presents the Energy Consumption per annum and the Maximum Demand per annum. Table 6 presents the five year Energy Consumption and Maximum Demand costs forecast.

² http://www.eskom.co.za/live/content.php?Category_ID=287

Supplier	Total Power (kW)	Energy annual (kWh)	Max demand annual (kVA)
Magnitech: BM3/SAW701 600 HPS	24.57	215 233.20	294.84
Beka: BekabayTechno 600W HPST HO	26.01	227 873.88	312.16

Table 5: Annual Energy and Maximum Demand Figures

Supplier	5 Year Energy (Rands)	5 Year max demand (Rands)	Total cost (Rands)
Magnitech: BM3/SAW701 600 HPS	R1 018 668.09	R219 408.13	R1 238 076.22
Beka: BekabayTechno 600W HPST HO	R1 078 494.62	R232 294.01	R1 310 788.63

Table 6: Five Year Energy and Maximum Demand Costs

8.2.2 Lamp replacement costs (5 years)

The lamp life offered by both manufacturers is 24 000 hours which translates into a period of 2.74 years assuming the lamps run for 24 hours per day. An assumption is made that all the lamps will be replaced within a 2.5 year period, i.e.: twice in every 5 year cycle. Since Eskom will obtain, fit and maintain the lamps themselves, the lamp replacement costs are not specific to the selected light fitting supplier and will be bought in large batch consignments based on an open tender. However, in order to conduct a full operational cost evaluation, a generic lamp replacement cost value of R 250.00 is used. The cost of this lamp is assumed to escalate by 10% each year. These costs are shown in Table 7 below.

Since the labour rates of Eskom are unknown, they are not included in the operational cost analysis. However, for a more accurate evaluation, this cost should be included

Luminaires (No.)	Lamp cost 2010 (inc VAT) (Rands)	Lamp cost 2015 (Rands)	Total cost 2015 (Rands)
39	R250.00	R366.03	R26 072.48

Table 7: Five Year Lamp Replacement Costs

All calculations for Table 4 to Table 7 can be seen in Annexure 2.

9. DISCUSSION AND RECOMMENDATION

9.1 Technical

From the technical evaluation of both Beka's and Magnitech's fitting's photometric data and simulations, both fittings meet the required average lux levels and are therefore deemed suitable for the Unit 6 Turbine Hall lighting application. However, since only Beka provided SSI with the required *independently certified* photometric data and associated simulations, only the Beka fitting's simulation results can be verified.

9.2 Financial

From Tables 4 to 7 above, it can be seen that Magnitech's light fitting is better priced in terms of Capital, Operational and Lamp Replacement Costs. This is summarized in Table 8 below.

Supplier	Capital cost (Rands)	Operational cost (Rands)	Lamp replacement (Rands)	Total cost in 5 yrs(Rands)
Magnitech: BM3/ SAW701 600 HPS	R 105 738.75	R1 238 076.22	R26 072.48	R1 369 887.45
Beka: Bekabay Techno 600W HPST HO	R123 990.75	R1 310 788.63	R26 072.48	R1 460 862.39

Table 8: Cost Comparison over a Five Year Period

9.3 Recommendation

From the financial analysis included in this report, Magnitech's *BM3/SAW701 600 HPS* fitting presents a more cost effective fitting. However, based on the technical evaluation, since Magnitech did not provide SSI with independently certified photometric data and the associated simulations, we recommend Beka's *Bekabay Techno 600W HPST HO* fitting be used in the Unit 6 Turbine Hall at the Medupi Power Station.