A CASE FOR HIGH CAPACITY COAL TRUCKS TO REDUCE COSTS AND EMISSIONS AT SOUTH AFRICA'S POWER UTILITY

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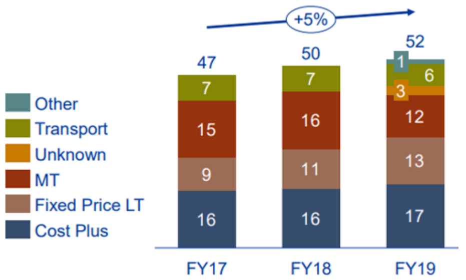
1 INTRODUCTION

South Africa's national power utility, Eskom, is facing several operational and business challenges. The impact of this is evident in the country's ongoing load-shedding programme. Load-shedding reached an unprecedented "Stage 6" in December 2019, meaning that the utility was required to shed 6000 MW of load to protect the grid from collapse. All the while, the utility is under heavy strain to contain costs and increase revenue, while also reducing its environmental impact. At the heart of Eskom's business and impact is coal, with over 90% of its generating capacity relying on the resource [1]. Figure 1 shows a breakdown of the costs of coal for the 2017 financial year, as well as forecasts for 2018 and 2019 [2]. In 2017, 120 million tonnes of coal were purchased and transported, at a total cost of R 47 billion. Transport costs accounted for R 7 billion or about 15% of this. In terms of environmental impact, Eskom has a significant carbon footprint, accounting for about 42% of South Africa's total carbon emissions [3]. Eskom reported that 114 million tonnes of coal was burned in the 2018/19 financial year, resulting in the release of 221 million tonnes of CO_2 [4].



	FY17	FY18	FY19
Coal USO(TWh)	199	201	199
Coal purchased (Mt)	120	125	120
R/t	393	398	430
R/t increase		1%	8%
Coal burn (Rbn)	44	46	49
Coal burn (Mt)	**114**	**116**	**112**

Figure 1: Eskom cost breakdown 2017-19 [2]

Due to the low value, high volume nature of coal, coal-fired stations are mostly strategically located near major coal fields and coal mines, so as to minimise the coal transportation task in terms of cost and time. An illustration of the main North-East South African coal region is shown in Figure 2. Eskom makes use of three transport modes to get coal from source to power station, namely conveyor, rail and road. According to Eskom in 2015, the modal split by tonnes is approximately 60% conveyer, 30% road, and 10% rail [5]. Conveyer transport is by far the cheapest per tonne-km (at around 20% the cost of road transport [6]), rail the next economical, and road haulage the most expensive at approximately R1.18/tonne-km for a fully laden 56-tonne interlink combination at 50% utilisation [7].

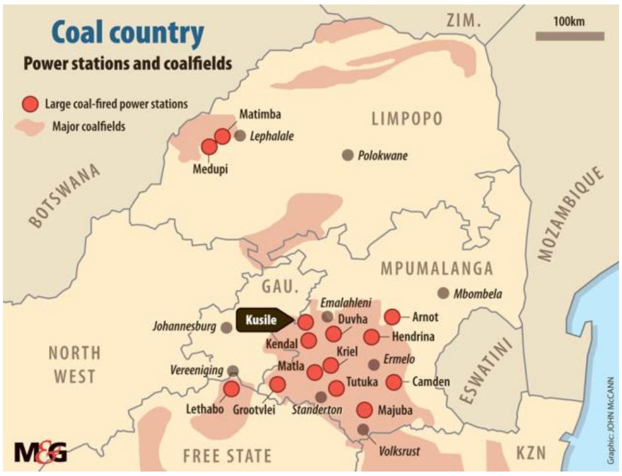


Figure 2: Coal-fired power stations and coal sources in South Africa [8]

In South Africa, the National Department of Transport has supported a special trial of High Capacity Vehicles (HCVs) since 2007. The pilot project is known as the "Smart Truck" or "Performance-Based Standards" (PBS) pilot project, and monitoring data have demonstrated drastic improvements in the efficiency of the operations participating in the trial, with reduced costs, fuel use and emissions per tonne-km, while also improving safety [9]. Within the trial, there are currently 60 PBS truck combinations transporting coal to power stations. Figure 3 shows a comparison of the PBS and "baseline" truck combinations. The baseline trucks are conventional interlink combinations running at the legislated 56-tonne gross mass limit, with tandem axle groups on the trailers, and are 22 m in length. The PBS combination is a 22-meter 74-tonne gross mass interlink operating under permit within the PBS pilot programme, with tridem axles on the trailers to support the additional load without exceeding axle load limits (and hence minimising impact on the road pavement).

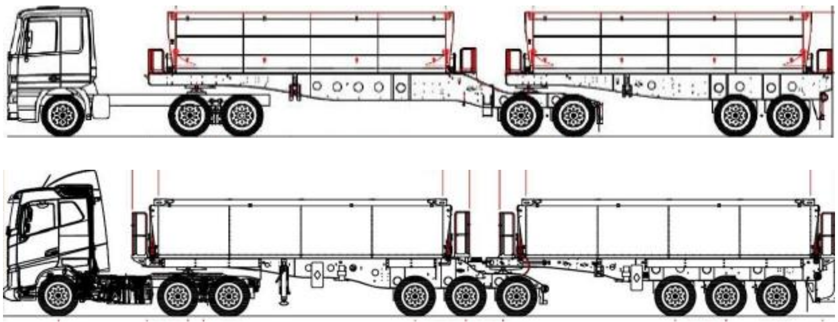


Figure 3: Conventional 56-tonne tandem interlink coal side-tipper (top) and 74-tonne tridem interlink coal side-tipper (below) (both 22 m in length)

2 SUMMARY OF METHODOLOGY AND FINDINGS

We studied monitoring data from the PBS pilot project representing approximately 2.7 million tonnes of coal movement and 6.3 million kms of truck travel. From these data we were able to calculate an overall 15% reduction in fuel use per tonne-km for the 74 tonne PBS truck combinations versus the standard 56 tonne combinations. The data were also used to calculate an average lead distance of 89 km. The lead distance was validated using the University of Stellenbosch's Freight Demand Model, which indicated a comparable figure of 97.5 km, which was used for further analysis.

We then consolidated known and inferred data on tonnes moved in Eskom's 2018/19 financial year, the portion of that moved by road, the cost of this transport per tonne-km, the number of haulage routes, and the calculated lead distance. Combining this with a 15% reduction in fuel use per tonne-km, assuming that fuel accounts for 40% of the transport cost to the operators [10], and assuming that 50% of the transport savings would be passed on the consignee (Eskom) the net potential cost and emissions savings to Eskom were calculated. The results are summarised in Table 1.

Table 1: Cost and emissions savings potential for Eskom's road coal transport

Cost saving potential (annual)	R 122 183 100
Emissions saving potential (TTW) (annual tonnes CO2)	27 957
Emissions saving potential (WTW) (annual tonnes CO2)	34 688
Truck trips saving potential (annual)	303 429

These savings are cause for the state-owned Eskom to strongly consider the promotion of high capacity vehicle transport for its road coal supply operations. The industry has already demonstrated a willingness to pursue this through the PBS pilot project, and, in this example, 50% of the cost savings would be enjoyed by the operators. These figures do not include the additional savings from the reduction in road wear (and associated costs and emissions) from fewer truck trips, and other potential savings from modal shift, which should continue to be encouraged.

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