

DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science to the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination to any other University.

_____ day of _____ 2012

ABSTRACT

Sufficient energy availability and utilization lie at the core of not only the mining industry but also the economic growth of South Africa. The mining industry is one of the major consumers of electricity in South Africa; accounting for approximately 17.4 percent. The focal point of the research project was on New Denmark Colliery; an Anglo American Thermal Coal operation located in the Mpumalanga Province. The main objective of the research project was to analyse energy consumption, economics and management at the mine. The study provides a framework for understanding significant energy uses in a mining operation; electricity costs and some of the mechanisms, tools and initiatives that can be used to manage energy optimally. This provides the mining industry with a platform to become part of the energy solution in South Africa.

The author conducted comparative time series studies to determine energy consumption as a function of production, specific activities at the mine, carbon dioxide emissions, electricity costs; from which the forecasts were made to determine the amount of electricity consumption and costs in the future. It can be submitted from the monthly comparative studies that more electricity is consumed during high demand season (June, July and August); as a result the costs are also very high. It was concluded that mining, ventilation and coal transportation consume relatively more electricity compared to other activities at the mine. It was further submitted that the higher the level of production the higher the quantity of electricity consumption and vice versa.

It was further concluded that although the amount of electricity consumption has been fluctuating over the years, electricity costs have been escalating at an alarming rate due to change in tariff rate, inflation and the structure of the tariff. The cost of power will increase drastically over the next five years, due to uncertainty regarding the magnitude of the pending Eskom tariff increases. It was recommended that mining operations must create energy management models for their mining operations in order to reduce the amount of electricity consumption, minimize the electricity costs and secure long term electricity supply. Models created must be aligned to company vision, organizational structure and also operational practice at the mine.

DEDICATION

This research report is dedicated to my family, Wits School of Mining Engineering and the Mandela Rhodes Foundation; they frequently inspire and empower me to do things I never thought I could.

ACKNOWLEDGEMENT

I wish to express my appreciation to the following organisation and persons who made this project report possible:

1. Dr Hudson Mtegha, my project supervisor for his guidance, encouragement and support.

2. The following company divisions/organizations are gratefully acknowledged for their assistance and provision of data during the course of the study.

- a) Anglo American Energy Department (Global)
- b) Anglo American Global Shared Service
- c) Anglo American Library
- d) Anglo American Thermal Coal Project Services
- e) Anglo Thermal Technical Service
- f) Eskom
- g) New Denmark Colliery (Mining, Finance and Engineering Department)
- h) Goedehoop Colliery (Engineering and Finance Department)

3. My family and friends for encouragement and support during the study.

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LIST OF ACRONYMS/SYMBOLS

AATC	: ANGLO American Thermal Coal
c/kWh	: cents per Kilo watt hours
CO ₂	: Carbon Dioxide
CV	: Calorific Value
DE	: Department of Energy
DME	: Depart of Minerals and Energy
DSM	: Demand Side Management
ECS	: Energy Conservation Scheme
EE	: Energy Efficiency
GHG	: Green House Gases
GW	: Gigawatt
IEP	: Integrated Energy Plan
EIA	: Energy Information Administration
GDP	: Gross Domestic Product
GJ	: Giga Joules
J	: Joules
Kg	: Kilogram
km	: Kilometre
Kt	: Kilotonnes
KV	: Kilo Volts
kW	: Kilo Watt
kWh	: Kilo Watt Hour
kWh/t	: Kilo Watt hours per tone
MD	: Maximum Demand
m	: Metre

m ³	: Meter cube
Mtpa	: Million tonnes per annum
MVA	: Mega Volts Amperes
MW	: Mega Watts
NDC	: New Denmark Colliery
NER	: National Electricity Regulator
NERSA	: National Energy Regulator of South Africa
PCP	: Power Conservation Programme
PV	: Present Value
R	: Rand
R/kWh	: Rand per kilowatt hour
Rmil	: Million Rands
R & D	: Research and Development
RTS	: Return to Service
SA	: South Africa
SAPIA	: South African Petroleum Industry Association
SAPP	: Southern African Power Pool
SO ₂	: Sulphur Dioxide
t	: tones
TWh	: Tera Watt Hour
UNFCCC	: United Nations Framework Convention on Climate Change)
USA	: United States of America
V	: Volts
WEC	: World Energy Council
YTD	: Year to Date

