ENERGY AND COST MODELLING OF WATER RETICULATION SYSTEMS IN DEEP-LEVEL GOLD MINES

by

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SUMMARY

Gold mines in South Africa consume a great proportion of the country's total electricity production. A significant part of this consumption is the electricity used by their water reticulation systems. Low gold prices and other financial pressures are causing gold mines to examine various means of cost saving. Scientific management of the water reticulation systems promises to result in significant cost savings.

By developing mathematical energy conversion models of all major components found in typical water reticulation systems of deep-level gold mines, these systems can be simulated under different operating conditions, configurations and schedules in order to find most efficient combinations. Proper integration of these models ensures that any system simulated produces accurate energy usage data. This data can then be applied to various available electricity tariffs to find the most cost effective.

Modelling the water reticulation systems in deep-level gold mines furthermore provides a tool allowing developers of future installations to experiment with different proposed systems and so take more informed decisions about system configurations and specifically choice of energy recovery systems.

This dissertation includes all methodologies, and mathematical tools used to develop the models. It verifies models generated using actual data obtained from a number of Anglogold gold-producing shafts and demonstrates how the models can be used to reduce electricity costs with examples using actual data.

KEYWORDS

Energy Conversion Modelling, Mining, Pumping, Energy Recovery

OPSOMMING

Suid-Afrika se goudmyne verbruik `n groot gedeelte van die land se totale produksie van elektrisiteit. `n Beduidende gedeelte van hierdie verbruik bestaan uit die elektrisiteit wat deur hulle waterpompstelsels gebruik word. Lae goudpryse en ander finansiële druk noop goudmyne om verskeie metodes van kostebesparing te ondersoek. Beduidende kostebesparing van die waterpompstelsels kan deur wetenskaplike bestuur teweeg gebring word.

Deur wiskundige energie-omsettings modelle van alle hoof komponente wat in tipiese waterpompstelsels in diepvlak goudmyne gevind word te ontwikkel, kan hierdie stelsels onder verskillende werkstoestande, konfigurasies en skedules nageboots word om die mees doeltreffende kombinasies te vind. Behoorlike integrasie van hierdie modelle verseker dat enige nagebootste stelsels akkurate data van energieverbruik lewer. Hierdie data kan dan toegepas word op die verskillende beskikbare elektrisiteitstariewe om die mees koste effektiewe een te vind.

Modellering van die waterpompstelsels in diepvlak goudmyne sal ook ontwikkelaars van toekomstige installasies in staat stel om met verskillende voorgestelde stelsels te eksperimenteer en sodanig besluite wat op beter inligting berus, te neem oor stelsel konfigurasies en spesifiek die keuse van energie-herwiningstelsels.

Hierdie verhandeling sluit alle metodes en wiskundige apparatuur in wat gebruik is om die modelle te ontwikkel. Dit verifiëer ontwikkelde modelle en gebruik werklike data wat verkry is van 'n aantal Anglogold goudproduserende skagte en demonstreer hoe die modelle aangewend kan word om elektrisiteitskoste te verminder deur gebruik te maak van voorbeelde wat op werklike data berus.

SLEUTELWOORDE

Energie-omsettings Modellering, Mynbou, Pomp, Energie herwining

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