

**A UNIQUE ENERGY-EFFICIENCY-INVESTMENT-
DECISION-MODEL FOR ENERGY SERVICES COMPANIES**

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ABSTRACT

- Title:** A unique energy-efficiency-investment-decision-model for energy services companies
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To remain competitive in an environment with limited natural resources and ever-increasing operational costs, energy efficiency cannot be ignored. From this perspective the need for Energy Service Companies (ESCOs) has arisen to address the supply constraint of national utilities and emission reductions faced by governments, to mitigate climate change. This has led to the development of two energy-efficiency finance business applications in South Africa, namely Demand-Side Management (DSM) under Eskom and the Clean Development Mechanism (CDM) under the Kyoto Protocol.

The technologies developed by ESCOs, primarily for DSM energy efficiency projects, can be directly applied to generate Certified Emission Reduction (CERs) units, or carbon credits under the CDM business model. ESCo executives now need to decide which option will be more profitable; a once-off Rand/MW value from Eskom-DSM or an annual return on investment (ROI) from selling CERs over an extended crediting period. With a volatile CER price and bureaucratic registration procedures, it is very important that managers have all the right information at hand before making such decisions.

A unique energy-efficiency investment decision model is developed that incorporates cost benefit analysis, based on the ESCOs chosen risk profile. All attributes to the model of both

DSM and CDM are defined, discussed and quantified into a decision analysis framework that would minimize risk and maximize profit. These attributes include life cycle analysis, technology transfer, cash flow, future CER prices, and associated project and political risks. The literature and background information that builds up to the development of this decision model serves as a complete handbook with guidelines to the South African energy services industry and investors.

This study proposes a new energy-efficiency methodology under the United Nations Framework Convention on Climate Change (UNFCCC) that would increase the amount of CDM energy efficiency projects in South Africa and internationally. The methodology is designed to improve control system efficiency of any large electricity consumer instead of being equipment-specific. This implies that developers can use the same methodology regardless of whether the end-users are clear water pumping systems, compressed air systems, fans etc. This will reduce the cost of registering new methodologies with the UNFCCC and make CDM a more lucrative option to ESCos and other developers.

This new energy-efficiency methodology and finance decision model was used in a case study to test its validity and accuracy. Two supporting technologies, REMS-CARBON and OSIMS, were developed in conjunction with HVAC International and tested at the clear water pumping system of Kopanang gold mine. The results from the case study demonstrated that this model is an acceptable tool in ensuring that ESCos gain maximum benefit from energy efficiency finance initiatives.

Due to the experience gained with the modalities, procedures and pitfalls of DSM and CDM, further suggestions are made for new protocols to follow the Kyoto Protocol post-2012. South Africa and specifically ESCos could be very well positioned in a global “cap-and-trade” future carbon market.

SAMEVATTING

Titel:	‘n Unieke energie-effektiwiteits beleggings model vir energie-dienstemaatskappye
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Om kompetend te bly in ‘n omgewing waar beperkte natuurlike hulpbronne en stygende operasionele koste ‘n groot rol speel, kan energie-effektiwiteitsmetodes nie geïgnoreer word nie. Vanuit hierdie perspektief, kom die noodsaaklikheid vir Energie-dienstemaatskappye (EDM’s) na vore. EDM’s spreek die voorsieningstekort aan wat voortspruit uit die owerhede se pogings om emissies en nasionale elektrisiteitsverbruik te verminder. Dit het gelei tot die ontwikkeling van twee energie-effektiewe besigheidsaanwendings in Suid Afrika, naamlik: Aanvraagbestuur wat deur Eskom bestuur word en Skoon Ontwikkelingsmeganismes (SOM), bestuur deur die Kyoto Protokol.

Die tegnologie wat deur EDM’s ontwikkel word, is hoofsaaklik vir Aanvraagbestuur, waar doeltreffende energie-effektiewe projekte direkte betrekking het op die generering van Gesertifiseerde Emissievermindering (GEV) of koolstofkrediete, onder die vaandel van die SOM besigheidsmodel. EDM topbestuur sal voortaan moet besluit watter opsie meer winsgewend sal wees: ‘n eenmalige Rand/MW waarde van Eskom-Aanvraagbestuur, of ‘n jaarlikse verhaling van beleggings wat voortspruit uit die verkope van SOM oor ‘n gegewe kredietperiode. As gevolg van die skommelende GEV pryse en burokratiese registrasie-prosedures, is dit baie belangrik dat bestuursvlak die korrekte inligting het voor enige besluite van die aard geneem kan word.

‘n Unieke energie-effektiwiteitsbeleggings besluitnemingsmodel is ontwikkel wat die kostevoordeel-analise, gebasseer op die EDM se gekose risiko-profiel inkorporeer. Alle voordele van beide Aanvraagbestuur en SOM word bepaal, bespreek en gekwantifiseer tot ‘n besluitnemingsanalise raamwerk wat risiko verminder en die wins vermeerder. Die voordele hieraan verbonde sluit lewensiklus analyses, tegnologies-uitruiling, kontantvloei, toekomstige GEV pryse, geassosieerde projekte en politiese risiko’s in. Die literatuur en agtergrondsinsigting wat die ontwikkeling van hierdie besluitnemingmodel voortbring, dien as ‘n volledige handleiding met riglyne tot die Suid-Afrikaanse energiediens-industrie en beleggers.

Hierdie studie stel ‘n nuwe energie-effektiwiteitsmetode voor, wat gelei word deur die Verenigde Nasies Raamwerk Konvensie vir Klimaatsveranderinge en wat die hoeveelheid SOM energie-effektiewe projekte in Suid-Afrika en internasionaal sal laat toeneem. Hierdie metode is ontwerp om die beheerstelsel effektiwiteit van enige groot elektrisiteitsverbruiker te verbeter, in plaas daarvan om net op toerusting staat te maak. Dit beteken dat ontwikkelaars dieselfde metode kan gebruik, ongeag of die eindverbruiker skoon water pompstelsels, hoëdruk lugvoorsiening of waaiers is. Dit sal ook die registrasiekoste van nuwe metodes by die VN Raamwerk Konvensie vir Klimaatsveranderinge verminder en verseker dat SOM ‘n baie meer aanloklike en lukratiewe opsie vir EDM’s en ander ontwikkelaars is.

Hierdie nuwe effektiwiteitsenergie-metodologie en finansiële besluitnemingsmodel is in ‘n gevallestudie gebruik om die geloofwaardigheid en akkuraatheid daarvan te toets. Twee ondersteunende tegnologieë, “REMS-CARBON” en “OSIMS” is ontwerp in samewerking met “HVAC International” en getoets by die skoon water pompsisteam van Kopanang goudmyn. Die resultaat van hierdie gevallestudie het gedemonstreer dat hierdie model ‘n aanvaarbare metode is, wat verseker dat EDM’s die maksimum voordeel uit finansiële energie-effektiwiteitsinisiatiewe trek.

Na aanleiding van die ondervinding verwerf met die metodes, prosedures en slaggate van Aanvraagbestuur en SOM, word verdere voorstelle gemaak vir ‘n nuwe protokol wat die Kyoto Protokol na 2012 kan opvolg. EDM’s in veral Suid-Afrika, is in ‘n baie goeie posisie

om voordeel te trek uit 'n toekomstige globale “verminder en verhandel” koolstofkredietmark.

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This thesis was inspired by the tragic loss of a great friend, Raymond Cope, in a hang-gliding accident due to severe turbulence, possibly the effects of human-induced climate change. The only thing that will keep pilots soaring safely and ensure the existence of our environment will be a mind shift towards energy efficiency.

If any of the content is not referenced, or referenced incorrectly, I will correct it immediately on request of the author. Contact Gerhard Bolt at gbolt@rems2.com or +27 12 809 1081

LIST OF ABBREVIATIONS

AAU	Assigned Amount Units
AR4	Fourth Assessment Report by the IPCC
BAU	Business As Usual
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COP	Conference of parties
CER	Certified Emission Reduction
CH ₄	Methane
DNA	Designated National Authority
DME	Department of Minerals and Energy
DOE	Designated Operations Entity
DSM	Demand-Side Management
EC	European Commission
EE	Energy Efficiency
ERPA	Emission Reduction Purchase Agreement
ERU	Emission Reduction Unit
ESCo	Energy Services Company
EU	European Union
EUA	European Union Allowances
EU ETS	European Union Emission Trading Scheme
GHG	Greenhouse gas
GWP	Global warming potential
HFC	Hydro fluorocarbons
IEA	International Energy Agency
IPCC	Inter-governmental Panel on Climate Change
OECD	Organization for Economic Co-operation and Development
OSIMS	On-site information management system

KP	Kyoto Protocol
KPI	Key Performance Indicator
kWh	Kilowatt Hour (Standard unit for electricity consumption)
M&P	Modalities and Procedures
MW	Megawatt
MWh	Megawatt Hour
NAP	National Allocation Plan
NEC	New Engineering Contract
NCF	New Carbon Finance
N_2O	Nitrous oxide
OPC	Object link and embedding for Process Control
PLC	Programmable Logic Controller
PFC	Per fluorocarbons
PPM	Parts per million
QBTU	Quadrillion British Thermal Units
REMS	Real-time energy management system
RTP	Real-time pricing
R/MW	Rand per Megawatt
TAR	Third Assessment Report (by the IPCC)
TOU	Time of use
SCADA	Supervisory Control and Data Acquisition
SF6	Hexafluoride
SRES	Special Report on Emission Scenarios (2000)
UNFCCC	United Nations Framework Convention on Climate Change
YTD	Year to date

TABLE OF CONTENT

ABSTRACT	i
SAMEVATTING	iii
ACKNOWLEDGMENTS	vi
LIST OF ABBREVIATIONS	vii
TABLE OF CONTENT	ix
LIST OF FIGURES	xii
LIST OF TABLES	xvi
1 Energy efficiency – an overview	1
1.1 Introduction.....	2
1.2 Fossil fuels and their anthropogenic effect	4
1.3 Climate change.....	10
1.4 Cost effective initiatives	16
1.5 The South African energy profile	19
1.6 Aims, contributions and outline of this study	26
1.7 Conclusion	32
1.8 References.....	34
2 Energy-efficiency markets and business models	40
2.1 Introduction.....	41
2.2 The Kyoto Protocol and the Clean Development Mechanism (CDM).....	41
2.3 Other carbon markets	49
2.4 Movement in the carbon market	52
2.5 Demand-side Management (DSM) in South Africa	56
2.6 Energy-efficiency funding conflict.....	59
2.7 Conclusion	60
2.8 References.....	61
3 Pre-implementation procedures of DSM and CDM	64

3.1	Introduction.....	65
3.2	The DSM process.....	65
3.3	The CDM process	75
3.4	New generic energy-efficiency methodology	88
3.5	Existing baseline and monitoring methodology	90
3.6	Conclusion	94
3.7	References.....	95
4	ESCo technologies – HVAC International case study	98
4.1	Introduction.....	99
4.2	Real-time Energy Management System (REMS).....	100
4.3	On-site Information Management System (OSIMS)	115
4.4	Development of REMS-CARBON.....	121
4.5	Conclusion	124
4.6	References.....	125
5	Identification and development of a project activity	127
5.1	Introduction.....	128
5.2	Energy efficiency through water supply optimisation	128
5.3	Water usage at Kopanang gold mine	130
5.4	DSM energy-efficiency proposal.....	137
5.5	CDM Project Design Document.....	141
5.6	Conclusion	145
5.7	References.....	146
6	DSM and CDM risks and sensitivity analysis.....	148
6.1	Introduction.....	149
6.2	ESCo risk profile.....	150
6.3	DSM risks	152
6.4	CDM risks.....	154
6.5	Carbon price dynamic risks	162
6.6	Risk assessment	171
6.7	Conclusion	172

6.8	References.....	175
7	Optimal ESCo business strategy and results	176
7.1	Introduction.....	177
7.2	Electricity cost-saving benefit analysis.....	178
7.3	The price for energy efficiency.....	181
7.4	DSM and CDM cost-benefit analysis	184
7.5	Decision-making under uncertainty	190
7.6	Proposed Eskom funding	194
7.7	Conclusion	195
7.8	References.....	196
8	Conclusion and future energy-efficiency protocols.....	197
8.1	Summary	198
8.2	Carbon market position and outlook.....	202
8.3	Conclusion	206
8.4	Recommendations for further work	207
8.5	References.....	209
	Appendix A: A practical DSM project example.....	211
	Appendix B: SSC-CDM-PDD	221

LIST OF FIGURES

Figure 1: Projected primary energy consumption for developing countries [1].....	2
Figure 2: Energy related CO_2 emission by region [3]	3
Figure 3: Proved coal reserves at end 2005 [9].....	5
Figure 4: Proved oil reserves at end 2005 [9].....	6
Figure 5: Proved natural gas reserves at end 2005 [9].....	7
Figure 6: Primary energy consumption per capita [9]	8
Figure 7: GHG emissions by sector [16]	9
Figure 8: Greenhouse gas emissions per capita by country [17]	9
Figure 9: The Greenhouse effect.....	10
Figure 10: Global warming potential of greenhouse gases.....	12
Figure 11: Global and continental temperature change	14
Figure 12: Projected global surface warming	15
Figure 13: Stabilizing wedges to reduce CO_2 emissions [21]	17
Figure 14: Energy resources of South Africa [33].....	20
Figure 15: Installed electricity capacity of South Africa [34]	20
Figure 16: SA's electricity profile showing peak periods [22]	22
Figure 17: Electricity use by sector [37].....	23
Figure 18: DSM energy efficiency [38].....	23
Figure 19: DSM load management	24
Figure 20: Time of use electricity profile	25
Figure 21: Outline of this thesis.....	27
Figure 22: Kyoto Protocol participation - world map.....	42
Figure 23: Members of the European Union [7].....	43
Figure 24: The Clean Development Mechanism	48
Figure 25: Asset classes of CDM projects [14]	49
Figure 26: Project and allowance-based markets.....	54
Figure 27: EUA prices from April 2005 to November 2008 [20]	55
Figure 28: Growth in the CER market.....	55
Figure 29: The DSM process model [16]	56

Figure 30: Eskom's capacity reserve margin [17].....	58
Figure 31: Maximum demand in the industrial sector [1]	66
Figure 32: Parties involved in the DSM process [6].....	69
Figure 33: DSM project process chart [4].....	70
Figure 34: DSM approval process	72
Figure 35: New proposed DSM process	74
Figure 36: DNA project approval procedure [12].....	77
Figure 37: Validation procedure	78
Figure 38: CDM EB procedures for approving methodologies.....	80
Figure 39: Third party verification [14].....	81
Figure 40: CDM project cycle [18].....	83
Figure 41: Summary of CDM registration costs [15]	85
Figure 42: The CDM approval process.....	86
Figure 43: New methodology approval process	87
Figure 44: A typical South African gold mine water pumping system layout	103
Figure 45: REMS-CARBON control philosophy	104
Figure 46: REMS-CARBON systems constraints	105
Figure 47: Control valve layout	106
Figure 48: REMS-CARBON pump station setup.....	107
Figure 49: Schematic control philosophy	108
Figure 50: Hardware system integration.....	109
Figure 51: REMS-CARBON data communication network	111
Figure 52: REMS operating interface	112
Figure 53: REMS simulation tools	113
Figure 54: International definitions for a power station	115
Figure 55: Declining performance of a typical DSM initiative	116
Figure 56: Interconnection of OSIMS and REMS.....	117
Figure 57: MARVIN daily energy profile display.....	118
Figure 58: Historic cumulative DSM performance of 20 projects	120
Figure 59: REMS-CARBON interface	124
Figure 60: Control valve unit with bypass.....	130

Figure 61: Water baseline vs. optimised water baseline.....	131
Figure 62: Energy-efficiency baseline vs. business as usual	132
Figure 63: DSM EE additional to DSM LS	134
Figure 64: Load-shifting at Kopanang gold mine.....	135
Figure 65: Historic performance analysis for Kopanang.....	135
Figure 66: Historic cumulative performance analysis for Kopanang	136
Figure 67: Definition of energy efficiency	142
Figure 68: HVAC International’s delivery performance	151
Figure 69: Eskom DSM approval times.....	152
Figure 70: Accumulated number of 250 methodologies.....	154
Figure 71: Average time for new methodology outcome	155
Figure 72: Number of CDM projects in each category.....	158
Figure 73: Cumulative CERs expected until 2012	158
Figure 74: Type 2 Small-scale CERs issued.....	160
Figure 75: Time lag between public comment and request for registration	161
Figure 76: Time lag from request for registration until registration.....	161
Figure 77: Price spread between EUAs and CERs [5]	164
Figure 78: Short-term price drivers in the EU ETS [8]	167
Figure 79: Public power and heat energy consumption.....	168
Figure 80: Emissions by fuels.....	168
Figure 81: Trading volume for 2007 [6].....	170
Figure 82: ECX CER prices from March to April 2008 [6]	171
Figure 83: Coal component of PPI between Sep '04 and Jan '08.....	180
Figure 84: Electricity cost saving over a 24hr period	181
Figure 85: DSM compared to CDM ERPA - scenario 1	185
Figure 86: DSM compared to CDM ERPA - scenario 2	186
Figure 87: DSM compared to CDM ERPA - scenario 3	187
Figure 88: DSM compared to CDM ERPA - scenario 4	188
Figure 89: DSM compared to CDM ERPA - secondary CER market.....	189
Figure 90: Maximum criterion decision tree	190
Figure 91: Indifference between CDM and DSM.....	192

Figure 92: Proposed R/MW Eskom should adopt	194
Figure 93: ESCo technologies and REMS-CARBON.....	198
Figure 94: DSM and CDM decision tree	198
Figure 95: Investment decision model.....	200
Figure 96: REMS-CARBON at Kopanang gold mine.....	201
Figure 97: Rising oil prices.....	203
Figure 98: Rising EUA prices.....	204
Figure 99: Impact of coal prices on CO_2 and electricity [5].....	205
Figure 100: Basic layout of an underground mine pumping system	213
Figure 101: Baseline data for pumping system.....	215
Figure 102: Intervention electricity baseline	217

LIST OF TABLES

Table 1: Stabilizing wedges to reduce CO_2 emissions	16
Table 2: Real-time electricity pricing	25
Table 3: Emission targets under the Kyoto Protocol	43
Table 4: Over-delivery and shortfall of emission targets [42]	46
Table 5: Carbon market growth in 2006 [47]	52
Table 6: CIBD registration costs [3]	68
Table 7: Small-scale CDM costs for HVACI	84
Table 8: Grid emission factor for Eskom 2007	123
Table 9: Kopanang infrastructure cost	133
Table 10: REMS-CARBON work plan	139
Table 11: OSIMS work plan	140
Table 12: Categories of CDM-SSC project activities [5]	143
Table 13: Eskom's Power Conservation Programme penalty control bands	144
Table 14: Type 2 Small-scale CDM projects activity categories	155
Table 15: 25 South African CDM projects in the pipeline	157
Table 16: CER issuance success	159
Table 17: CER prices on 17 Sep 2007 [5]	164
Table 18: Rating of consequences	171
Table 19: ESCo, DSM and CDM risk assessment	173
Table 20: Summary of the carbon market dynamic [5]	174
Table 21: 1 MW EE cost saving	178
Table 22: Eskom's DSM plan until 2010/11	182
Table 23: EUA and CER prices	183
Table 24: Variables that are kept constant throughout the calculations	184
Table 25: ERPA - scenario 1	185
Table 26: ERPA - scenario 2	186
Table 27: ERPA - scenario 3	187
Table 28: ERPA - scenario 4	188
Table 29: ERPA - secondary CERs	189
Table 30: Electricity consumption during performance assessment	217

Table 31: Impact on electricity consumption..... 218
Table 32: Performance over a 10-month period 218