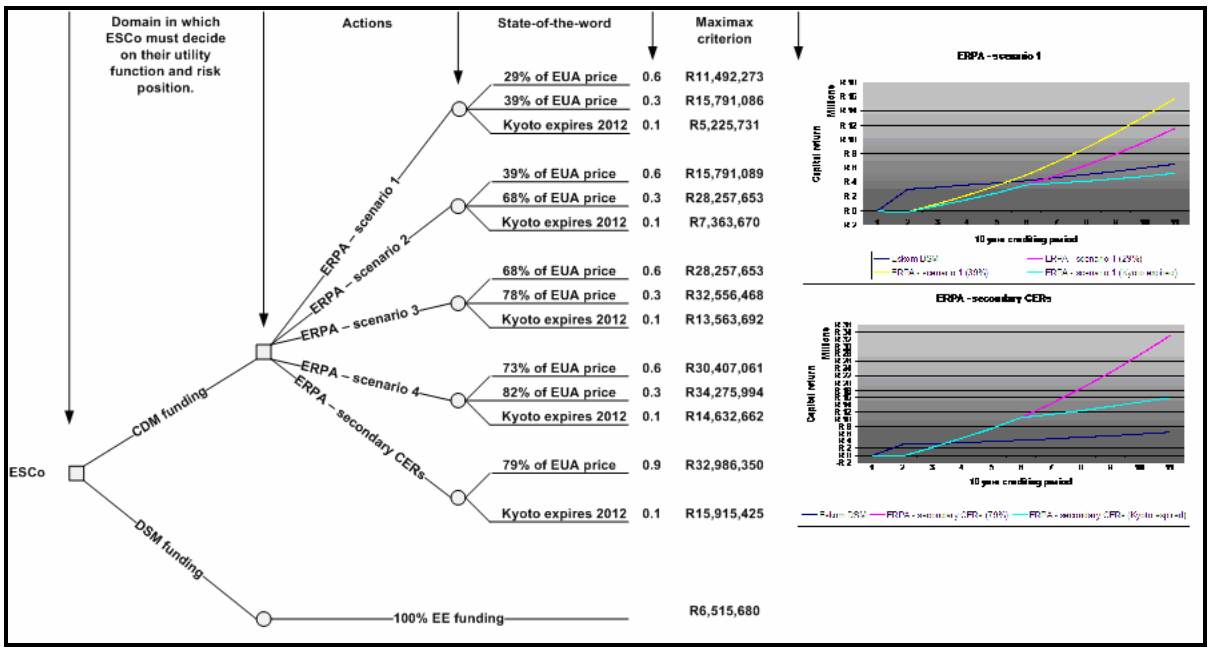
7 Optimal ESCo business strategy and results



This chapter utilises the risk outcome of various attributes identified in Chapter 6 to complete a decision analysis framework. A simple decision tree is designed, showing the maximum capital return for the various scenarios together with the risk position the ESCo assumes.

7.1 Introduction

Within the contexts of this study the energy-efficiency intervention can be implemented using three types of funding methods. Firstly, the client can decide that the return on investment is high enough to justify funding the projects using internal capital. This will eliminate the long wait for the procurement processes of DSM and CDM. From the ESCo's perspective this approach is only discussed briefly because it falls outside the DSM/CDM decision-making domain.

Given the experience of ESCos in the DSM field, it can be assumed that a DSM project submission will be a success. The R/MW value, although not public knowledge, is also firm and guaranteed for a successful implementation. The probability (P) of a successful DSM project activity is P = 1.

CDM, however, has more risks and pitfalls than DSM and a successful implementation cannot always be guaranteed. The discussion in Chapter 6 shows that HVAC International will have a 70% chance of a successful CDM project, that is P=0.7. Even after successful registration of the CERs there is no guarantee of the price that will be paid. The various contracts or ERPAs will be incorporated into expected value and reward calculations.

Only the capital return and registration costs of DSM and CDM can be compared since their project activity expenses are exactly the same. To further simplify the calculations it is assumed that a comparison will only be made after a DSM project has already been determined as feasible.

7.2 Electricity cost-saving benefit analysis

7.2.1 Client savings based on existing tariffs

Eskom's existing electricity rates are amongst the cheapest in the world [6]. This has resulted in a low motivation factor for energy-efficiency projects in the past. It has also been a contributing factor in proving additionality for CDM projects. Kopanang mine, together with most industrial sector clients, uses Eskom's MegaFlex real-time pricing structure.

For a 1.09 MW energy-efficiency saving, based on the MegaFlex profile, Kopanang could expect an operational cost saving of R1,079,593, as shown in Table 21. It is clear from this table that to get the most benefit from MegaFlex, Kopanang should avoid unnecessary use of equipment during this time.

Time	2007-06-01	Winter	2007-08-31	2007-09-01	Summer	2008-05-31	Energy Efficiency (MW)
hh:mm:ss	Weekday	Saturday	Sunday	Weekday	Saturday	Sunday	1.09
00:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
01:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
02:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
03:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
04:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
05:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
06:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
07:00:00	55.3	14.62	7.95	15.69	9.74	6.9	R 83,028
08:00:00	55.3	14.62	7.95	15.69	9.74	6.9	R 83,028
09:00:00	55.3	14.62	7.95	15.69	9.74	6.9	R 83,028
10:00:00	14.62	14.62	7.95	9.74	9.74	6.9	R 41,446
11:00:00	14.62	14.62	7.95	9.74	9.74	6.9	R 41,446
12:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
13:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
14:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
15:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
16:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
17:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
18:00:00	55.3	14.62	7.95	15.69	9.74	6.9	R 83,028
19:00:00	55.3	14.62	7.95	15.69	9.74	6.9	R 83,028
20:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
21:00:00	14.62	7.95	7.95	9.74	6.9	6.9	R 39,288
22:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
23:00:00	7.95	7.95	7.95	6.9	6.9	6.9	R 28,496
							R 1,079,593

Table 21: 1 MW EE cost saving

Assuming that Kopanang mine does not have the technology to implement this project and an ESCo takes on a contractor's position, the expected project cost would be as follows:

- REMS-CARBON (CAPEX) = R2,750,000
- OSIMS (CAPEX) = R1,250,000
- REM-CARBON (Labour) = R2,800,000
- OSIMS (Labour) = R490,000

With a total project activity cost of R7,290,000 and an annual saving of R1,079,593, the Internal Rate of Return (IRR) is only 9%. AngloGold Ashanti's money would be better in the bank, where they could earn more than 10% on a capital investment. This study will assume a 10-year saving or crediting period throughout the calculations, for equal comparison between the various ROIs.

7.2.2 Client savings based on expected tariff increase

South Africans face high electricity price increases after Eskom has drafted a proposal to NERSA for price a increase in 2008/9. Eskom is in the second year of the Multi-Year Price Determination (MYPD) and is facing significant financial challenges for 2008/9, assuming a price increase of 14,2%. Eskom's capacity expansion programme will cost R343bn over the next five years.

From the September 2005 MYPD 1 submission to January 2008, the coal Producer Price Index (PPI) increased from 194 to 259 cent, or 29%, as seen in Figure 83.

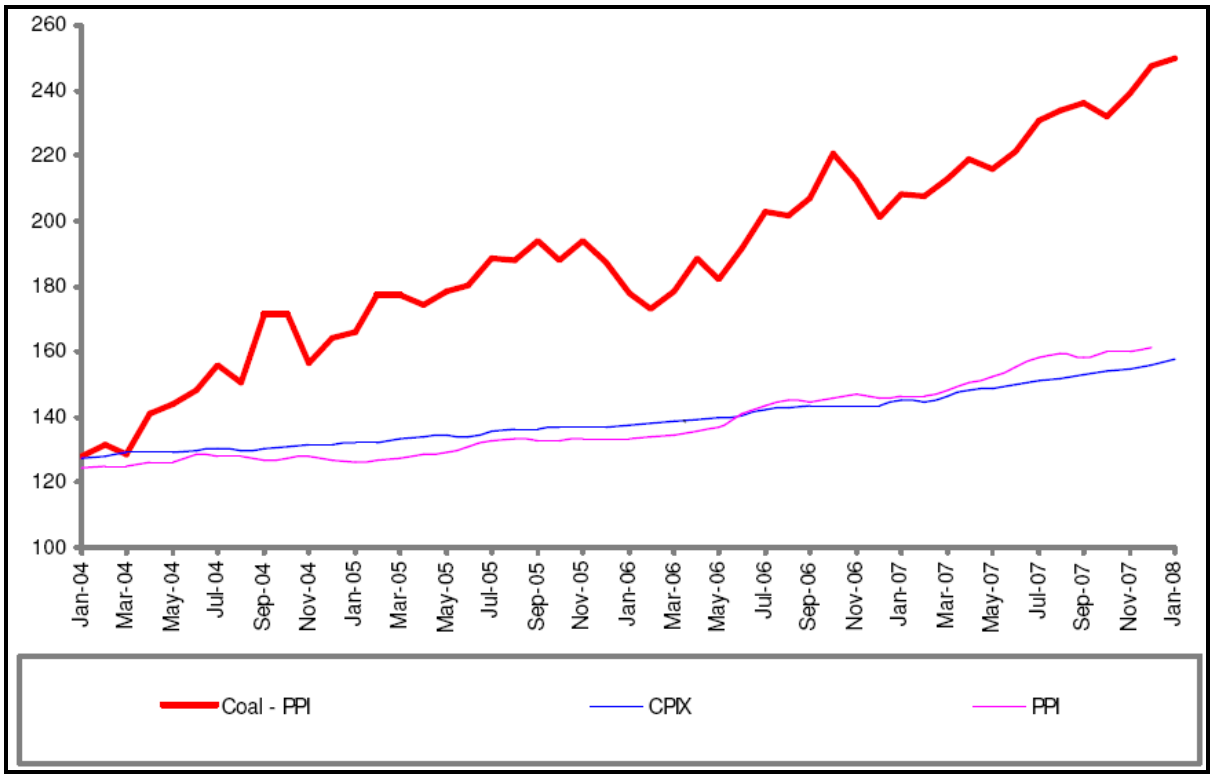


Figure 83: Coal component of PPI between Sep '04 and Jan '08

There are further pressures of increased primary energy costs as well as the requirement to reduce consumption through DSM and power conservation projects. In order to address this crisis, Eskom has recommended a revision of the 14.2% price increase for 2008/9. A 53% real increase or a 60.87% nominal increase is required. If this increase is not approved the tariff increase required for 2009/10 will be almost 100% [1].

With this 60% price increase, Kopanang could annually save R133,773 per hour during the peak periods, by implementing the proposed energy-efficiency intervention of 1.09 MW. Using real-time pricing Eskom attempts to manipulate the client's demand profile to adapt their energy baseline profiles to reduce Eskom's maximum demand. See Figure 84.

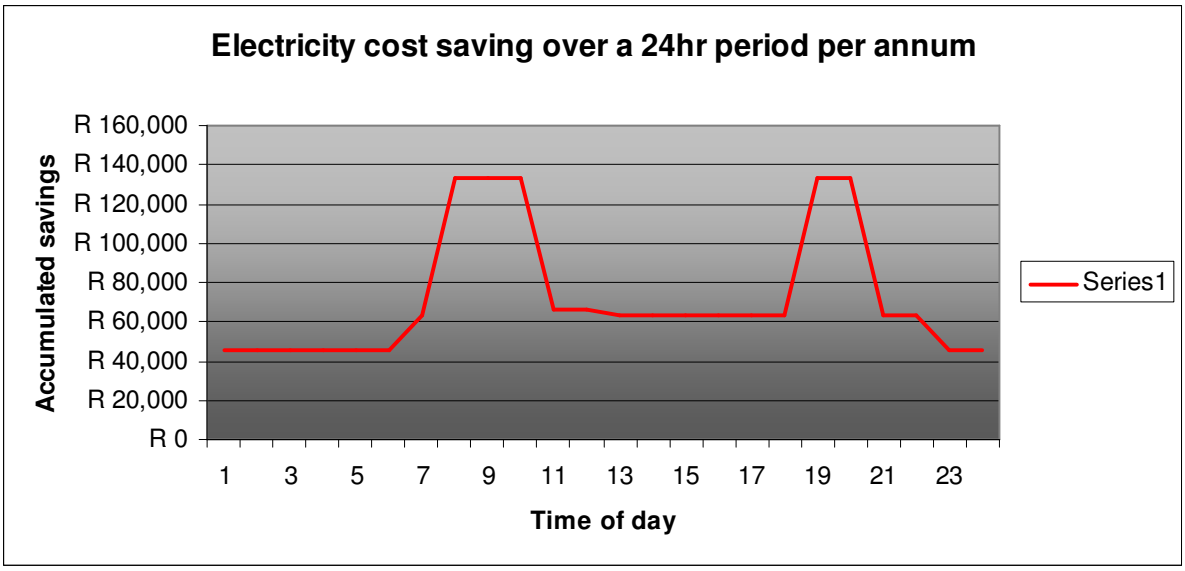


Figure 84: Electricity cost saving over a 24hr period

With a total project activity cost of R7,290,000 and an annual saving of R1,731,871 the IRR is 20%. AngloGold Ashanti's capital would be in a better position if invested in the project, rather than in the bank and will be more in line with AngloGold Ashanti's policies.

Considering that both the standard and increased tariff structures reveal relatively low IRRs, it can be assumed that this project will require additional funding from either DSM or the CDM. Kopanang will still receive the full benefit of the reduced electricity costs which is R1,079,593 based on the existing tariff or R1,731,871 when the proposed tariff increase is implemented.

7.3 The price for energy efficiency

7.3.1 The DSM price

The Rand per megawatt threshold that Eskom will pay for DSM initiatives plays a key role in the feasibility of the project. A reasonable estimate of this value would be to compare the MW targets with Eskom's budget as seen in Table 22.

DEMAND SIDE MANAGEMENT OPERATING EXPENDITURE AND 3 YEAR PLAN										
PROGRAMME AREA	2006/07 Actual		2007/08 Projection		2008/09 Budget Proposal		PLAN			
	Previous Year		Current Year		TOTAL 12 Months		2009/10		2010/11	
	Rm	MW	Rm	MW	Rm	MW	Rm	MW	Rm	MW
TOTAL INCOME										
TOTAL OPERATING EXPENSES		170		400		815		870		915
RESIDENTIAL PROGRAMMES				206		562		735		798
Efficient Lighting (CFLs)				200		484		50		100
Solar Water Heating				6		16		50		100
Shower Aerators				0		5		10		20
Smart Metering				0		20		500		447
Geyser,Pipe Insulation				0		1		50		50
Household Cooking Conversion to Gas				0		36		75		81
ESCO PROJECTS		170		194		238		135		117
Commercial				69		60		35		40
Industrial				87		131		70		57
Redistribution				38		47		30		20
OTHER DSM INITIATIVE EXPENSES										
Awareness and communication (including extensive Residential programme and education programmes) street lights and Gov buildings						15				
Power Alert										
PROGRAMME OVERHEADS										
Department overhead										
Monitor & Evaluation Costs										
NET OPERATING EXPENSES	R 605	170	R 825	400	R 2,453	815		870		915

Table 22: Eskom's DSM plan until 2010/11

The 2008/2009 budget is R2,453 million, with an 815 MW target that gives a R3,009,815/MW saving. Based on the existing 50% energy-efficiency funding policy, ESCos can expect R1.5 million per MW from Eskom. The remaining R1.5 million will have to be recovered from the client. However, BUSA (Business Unit South Africa) recently proposed a 100% energy efficiency funding policy to NERSA [7]. R3mil/MW energy efficiency will be used for the further calculations to stay current with likely national policy changes.

The installation of REMS-CARBON is a very expensive project with a small saving compared to other DSM projects. If Eskom funds the R1.5 million and the mine supplies the remaining funds, the IRR will be 28%. With 100% energy-efficiency funding Kopanang mine could expect an IRR of 42%.

7.3.2 The price for CERs

The price for carbon credits varies globally. The international carbon market is a system with different types of carbon credits commodities that are linked one way or another. CERs are priced according to a variety of factors including risk, contractual issues and fundamentals of supply and demand. The EU ETS accepts project-based credits like CERs. European companies provide demand for CERs, creating a limited correlation between the two.

The price for the most traded carbon contract, the forward delivery of EUAs in December 2008, closed at €23.31 on the European Climate Exchange on Friday, 4 April. Table 23 compares the prevailing market prices for 17 September 2007, according to Point Carbon database of transactions in the EU emissions trading scheme and the Clean Development Mechanism [2].

Contract type	Price or Price range (€/tCO2e) 17 Sep '07	Price or Price range (% of EUA Dec'08 spot)	Price or Price range (€/tCO2e) 4 April '08	Price or price range (ZAR/tCO2e)
EU allowance (EAU) for delivery on 1 December 2008	20.61	100%	23.31	289.04
Secondary CER for delivery on 1 December 2008	16.35	79%	18.49	229.30
Primary ERPA for CERs, category 1	6-8	29% - 39%	6.8 - 9.0	84 - 112
Primary ERPA for CERs, category 2	8-14	39% - 68%	9.0 - 15.8	112 - 196
Primary ERPA for CERs, category 3	14-16	68% - 78%	15.8 - 18.1	196 - 224
Primary ERPA for CERs, category 4	15-17	73% - 82%	17 - 19.2	210 - 238
Primary ERPA for ERUs	5-12	24% - 58%	5.7 - 13.6	70 - 168

Table 23: EUA and CER prices

EUA prices rose almost €1 on the day the 2007 emission data was released, showing that emissions increased by 1% over 2006. This led analysts to conclude that the demand for emission permits would be rising throughout the 2008-2012 second phase period of the EU ETS, given the tighter allocation plans. Forecasts for price levels of €30 to €35 in the next few years have contributed to this bullish trade [3].

Yvo de Boer, executive secretary of the UNFCCC, said in his final statement at the Bali Conference of Parties (COP) that the international carbon market, spawned by the Kyoto Protocol, will continue beyond 2012. The London-based European Climate Exchange (ECX) recorded their first trade of EU allowances for 2013 delivery, at a price of €27.70 on 9 April 2008 [4].

7.4 DSM and CDM cost-benefit analysis

7.4.1 Exclusion of the project implementation cost

The project implementation costs are irrelevant for the purpose of this section. In this section it is assumed that the comparison between the DSM and CDM projects is for existing viable DSM projects. This study will include registration costs, CER issuance costs and the time value of money for the capital returns of the project.

The following variables will be kept firm throughout the calculations:

Variables that are kept constant			
Financial		**Administrative costs**	
Currency (R/€)	R12.40	Validation	R 100,710.00
Interest rate - liability	15%	PDD registration	R 39,100.00
Interest rate - asset	9%	Verification (annual)	R 46,530.00
Technical		Issuance cost per CER	R 0.78
Grid emission factor	1.2 tCO2/MW		

Table 24: Variables that are kept constant throughout the calculations

The CERs price in the ERPA for pre-2012 contracts will be based on the market prices for 17 September 2007. For ERPAs post-2012, the future price of €27.70, as transacted on ECX on 9 April 2008, will be used.

7.4.2 ERPA – scenario 1

The seller does the utmost to deliver a flexible or non-firm volume, while the buyer commits to buy if the seller delivers even if they turn out not to be eligible for CDM. No sanctions will be enforced if non-delivery occurs. The price range can be seen in Table 25.

Contract type	Price or Price range (€/tCO2e) 17 Sep '07	Price or Price range (% of EUA Dec'08 spot)	Price or Price range (€/tCO2e) 4 April '08	Price or price range (ZAR/tCO2e)
EU allowance (EAU) for delivery on 1 December 2008	20.61	100%	23.31	289.04
Primary ERPA for CERs, category 1	6-8	29% - 39%	6.8 - 9.0	84 - 112

Table 25: ERPA - scenario 1

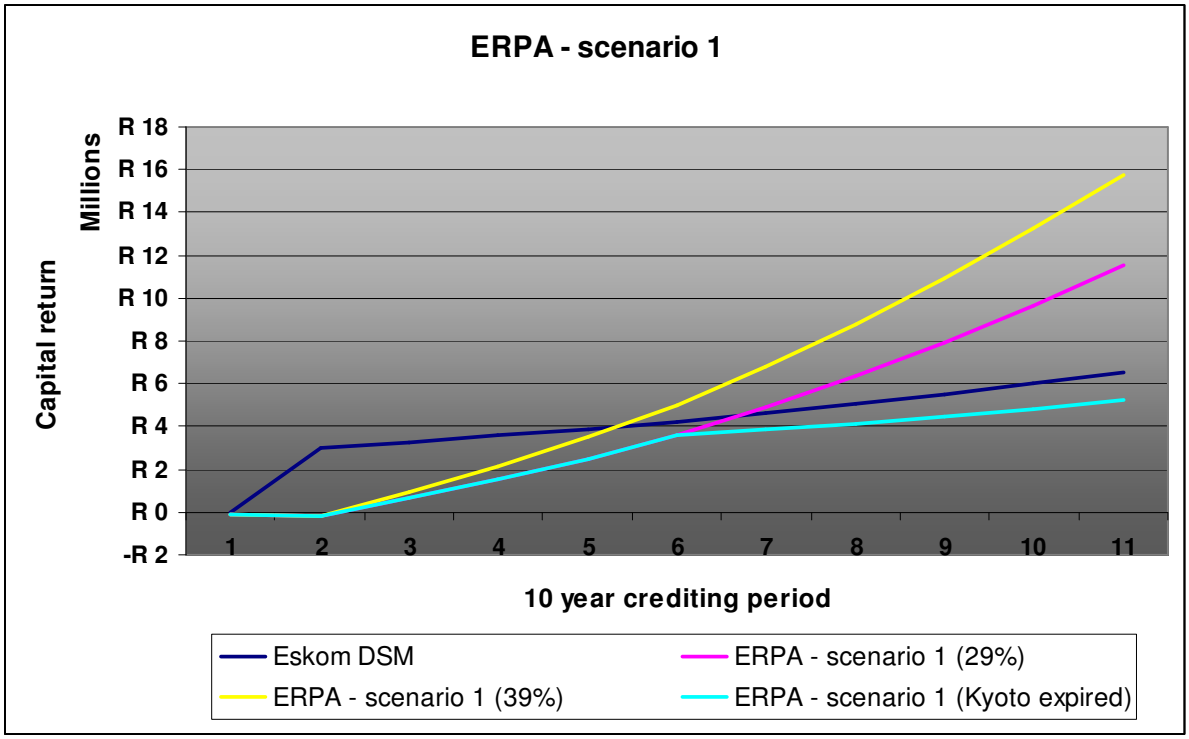


Figure 85: DSM compared to CDM ERPA - scenario 1

The ERPA – scenario 1 assumes the lowest risk position according to Point Carbon. A CER price of only 29% of the value of the EUA and no market after 2012, will result in the only scenario with a smaller capital return than a DSM project as shown in Figure 85.

7.4.3 ERPA – scenario 2

The ERPA – scenario 2 is similar to the ERPA – scenario 1, but the contract is only valid on a set of preconditions (CER contract). No sanctions will be enforced if non-delivery occurs. The price range can be seen in Table 26.

Contract type	Price or Price range (€/tCO2e) 17 Sep '07	Price or Price range (% of EUA Dec'08 spot)	Price or Price range (€/tCO2e) 4 April '08	Price or price range (ZAR/tCO2e)
EU allowance (EAU) for delivery on 1 December 2008	20.61	100%	23.31	289.04
Primary ERPA for CERs, category 2	8-14	39% - 68%	9.0 - 15.8	112 - 196

Table 26: ERPA - scenario 2

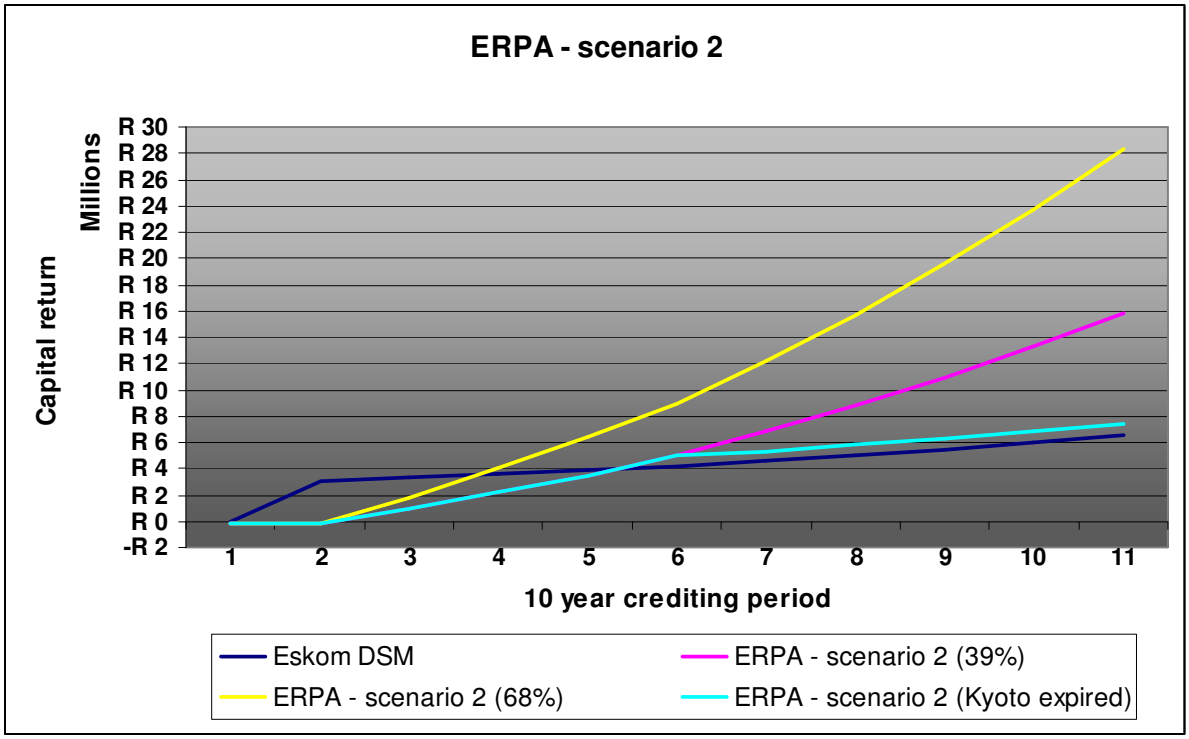


Figure 86: DSM compared to CDM ERPA - scenario 2

Figure 86 shows that even the worst possible outcome for an ERPA – scenario 2, is still more lucrative over a 10-year period than a DSM project of similar MW savings.

7.4.4 ERPA – scenario 3

In an ERPA – scenario 3, the seller commits to deliver a minimum number of CERs. The seller is committed to replace the CERs if the contractual number of CERs is not delivered. The expected price range for this type of ERPA can be seen in Table 27.

Contract type	Price or Price range (€/tCO2e) 17 Sep '07	Price or Price range (% of EUA Dec'08 spot)	Price or Price range (€/tCO2e) 4 April '08	Price or price range (ZAR/tCO2e)
EU allowance (EAU) for delivery on 1 December 2008	20.61	100%	23.31	289.04
Primary ERPA for CERs, category 3	14-16	68% - 78%	15.8 - 18.1	196 - 224

Table 27: ERPA - scenario 3

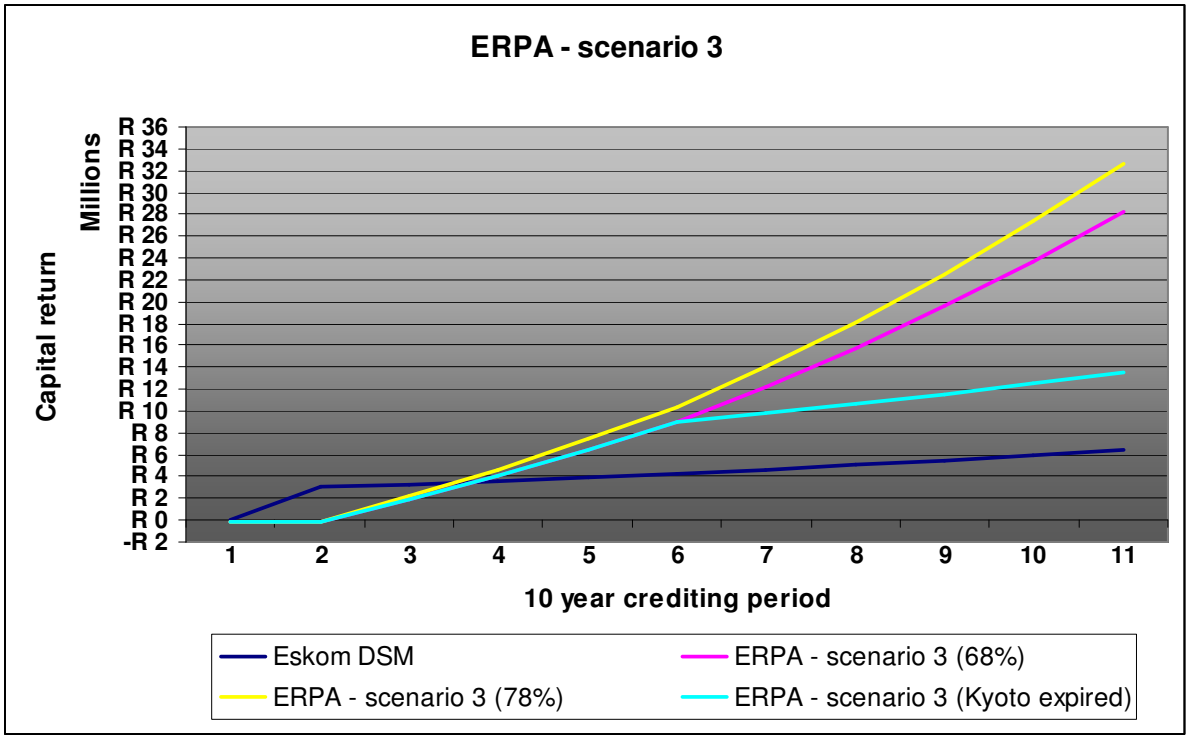


Figure 87: DSM compared to CDM ERPA - scenario 3

Figure 87 shows that all three ERPA outcomes would yield a much better return on investment than DSM. However, these outcomes ignore risk and are the expected maximum capital return.

7.4.5 ERPA – scenario 4

In an ERPA – scenario 4, the seller guarantees to deliver a firm volume. The seller is contractually obligated to compensate the buyer if the agreed number of CERs is not met. The expected price ranges can be seen in Table 28.

Contract type	Price or Price range (€/tCO2e) 17 Sep '07	Price or Price range (% of EUA Dec'08 spot)	Price or Price range (€/tCO2e) 4 April '08	Price or price range (ZAR/tCO2e)
EU allowance (EAU) for delivery on 1 December 2008	20.61	100%	23.31	289.04
Primary ERPA for CERs, category 4	15-17	73% - 82%	17 - 19.2	210 - 238

Table 28: ERPA - scenario 4

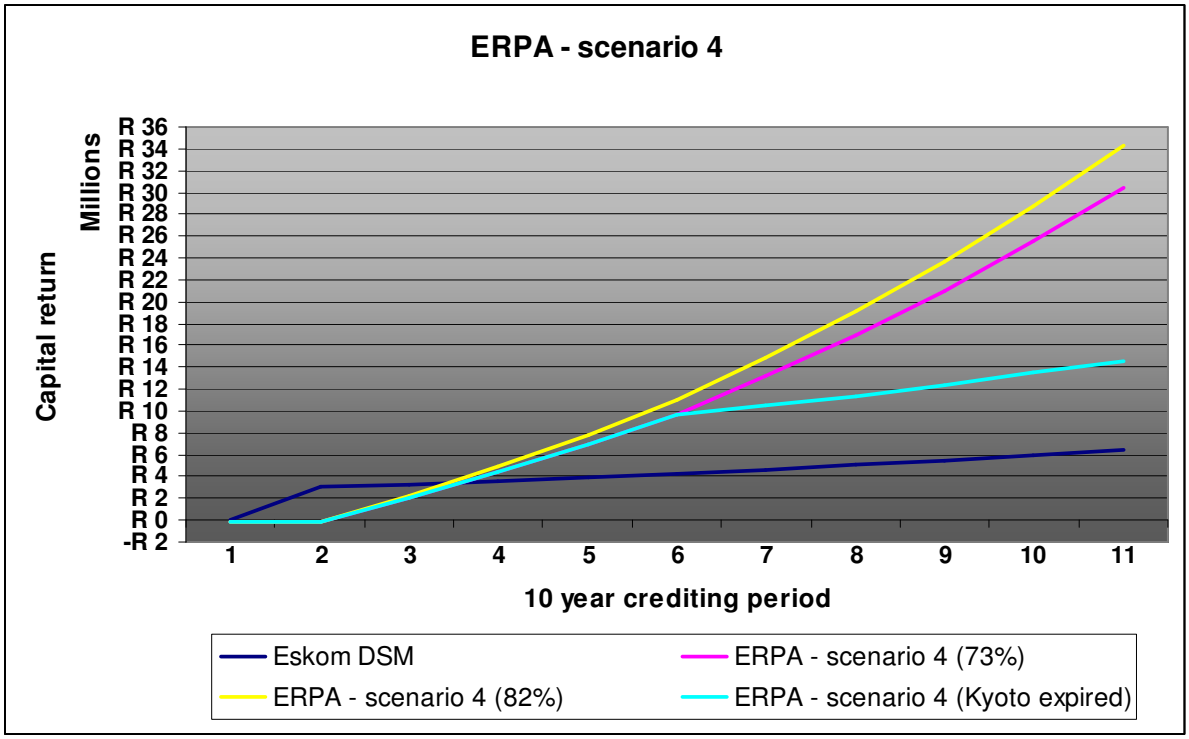


Figure 88: DSM compared to CDM ERPA - scenario 4

The expected return is significantly more than a DSM approach, as shown in Figure 88, but so is the risk.

7.4.6 ERPA – secondary CERs

Secondary CERs have no project risk attached to them, because the credits are already registered at the CDM EB. The buyer pays a high premium for this low-risk commodity as shown in Table 29.

Contract type	Price or Price range (€/tCO2e) 17 Sep '07	Price or Price range (% of EUA Dec'08 spot)	Price or Price range (€/tCO2e) 4 April '08	Price or price range (ZAR/tCO2e)
EU allowance (EAU) for delivery on 1 December 2008	20.61	100%	23.31	289.04
Secondary CER for delivery on 1 December 2008	16.35	79%	18.49	229.30

Table 29: ERPA - secondary CERs

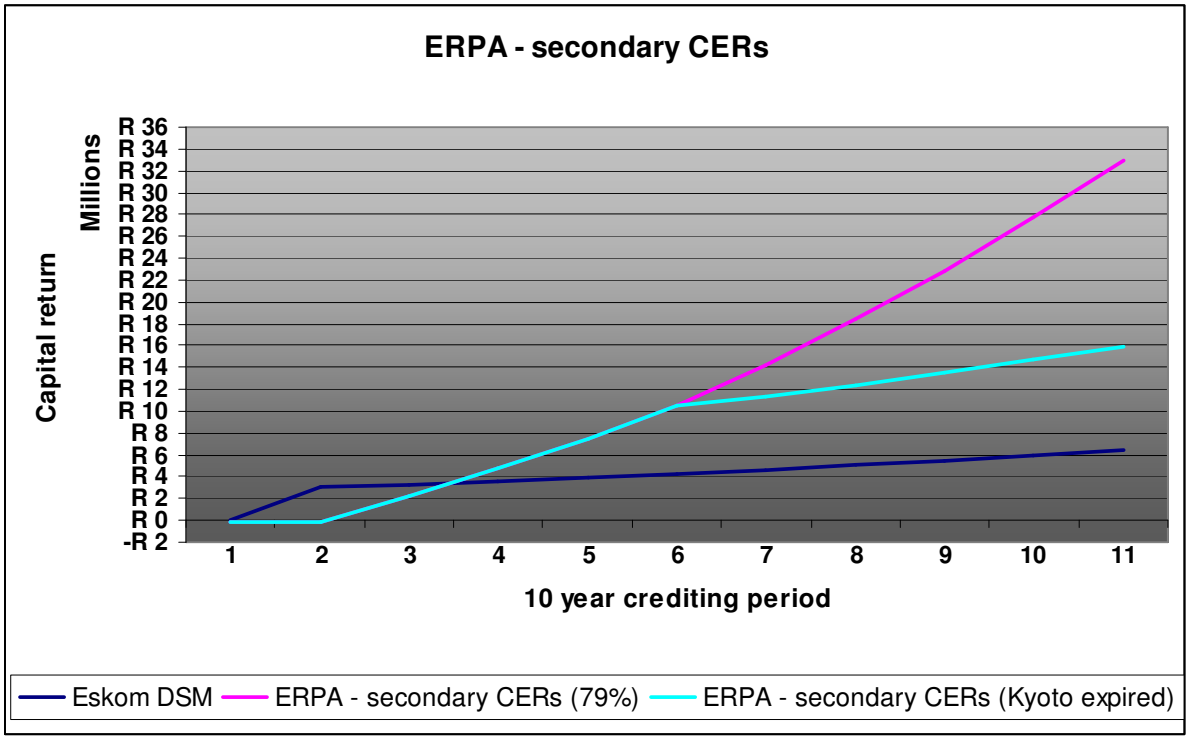


Figure 89: DSM compared to CDM ERPA - secondary CER market

An expected capital return of over R32 million should be realised from this type of project, if the ESCo is prepared to accept all the risks. This is shown in Figure 89.

7.5 Decision-making under uncertainty

7.5.1 The maximax criterion

Section 7.4 calculated the reward for deciding either on DSM funding or alternatively the 5 various CDM ERPA scenarios ignoring the "state of the world". This section makes use of Von Neumann – Morgenstern utility model for uncertainty, and the use of decision trees for making decisions at different points in time.

The expected value criterion chooses the action that yields the largest expected reward (r_{ij}), but ignores the risk position of the ESCo and utility function. For any given scenario the maximum capital return is shown in Figure 90.

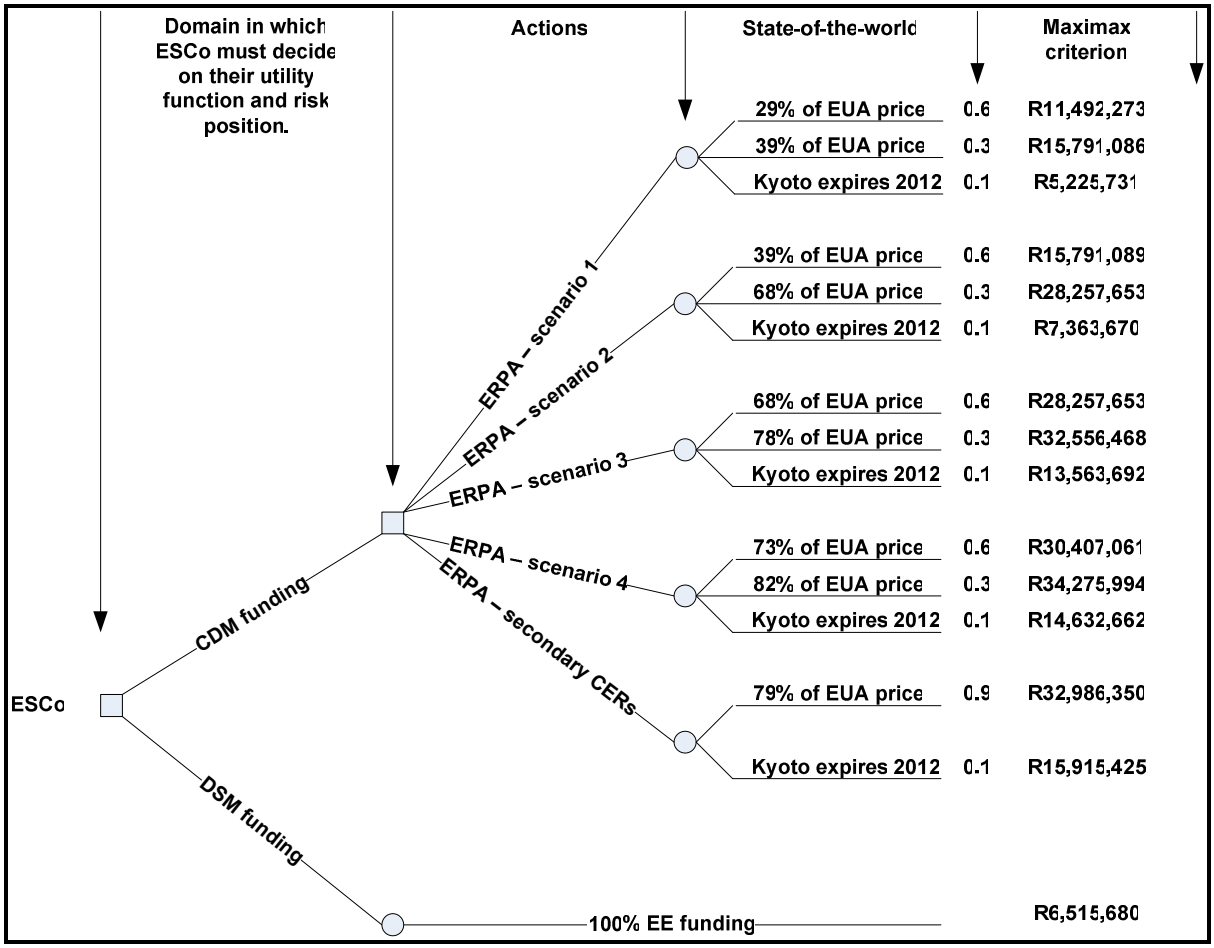


Figure 90: Maximum criterion decision tree

If the decision-maker ignores all risk and uncertainty, the best choice would be to sell all the CERs on the secondary spot market (valued at R32,986,350) or negotiate an ERPA – scenario 4 with a very high primary CER price (valued at R34,275,994). Compared to the DSM maximum criterion worth R6,515,680, the CDM is a much better investment. Unfortunately this is not a true reflection of the reality of the situation and further calculations are required.

7.5.2 The ESCos utility function

The certainty equivalent of the decision between DSM and CDM is denoted as CE(CDM). This is the value such that the ESCo is indifferent between doing a DSM project and receiving CDM funding of CE(CDM) = R 6,515,680. The risk premium (RP) of the decision is written as RP(CDM) = EV(CDM) – CE(CDM), where EV(CDM) is the expected value of the CDM decision [5]. The ESCo's attitude towards risk is:

- Risk-averse if the nondegenerate decision CDM, RP(CDM) > 0;
- Risk-neutral if the nondegenerate decision CDM, RP(CDM) = 0; and
- Risk-seeking if the nondegenerate decision CDM, RP(CDM) < 0

If there is a 70% chance of a successful CDM registration the decision-maker will be indifferent between the following probabilities of a successful ERPA and the guaranteed DSM project:

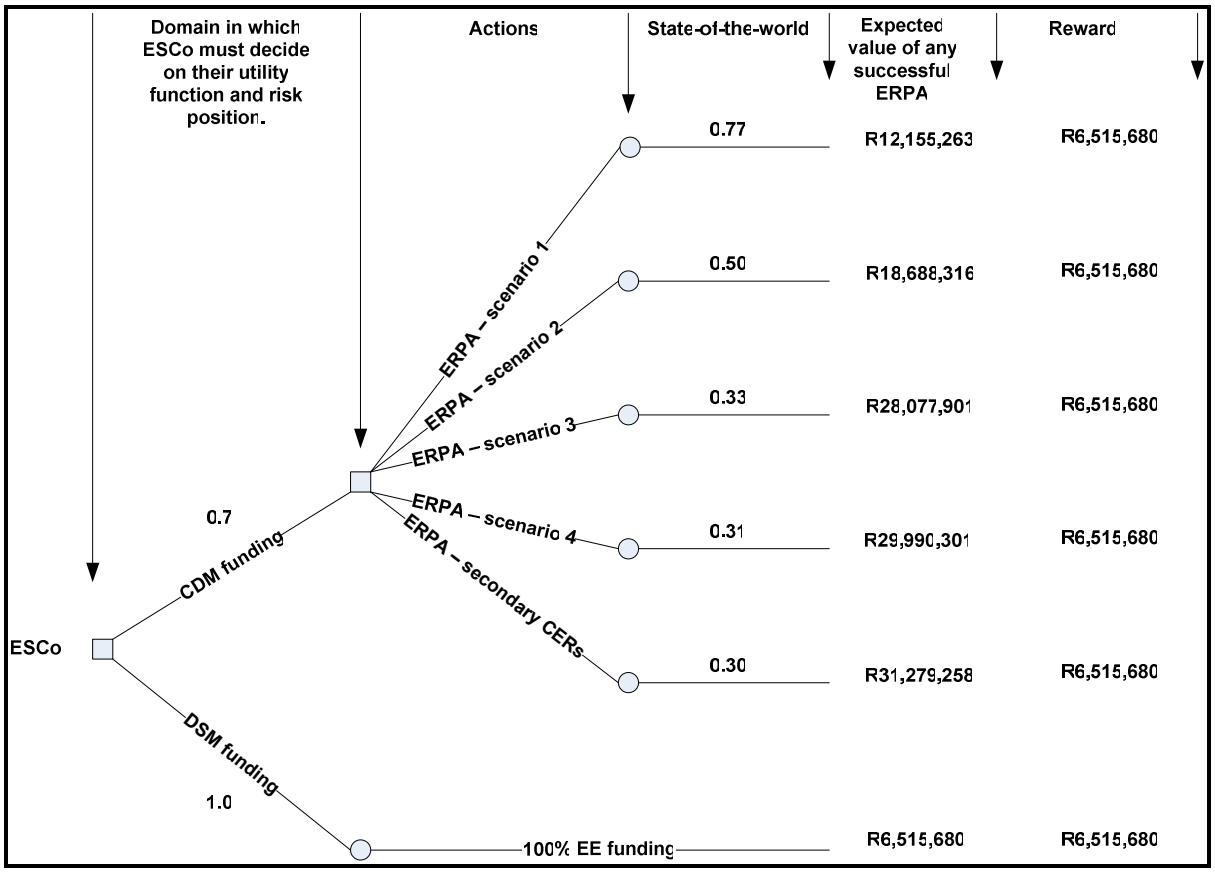


Figure 91: Indifference between CDM and DSM

If there is a 77% chance of negotiating a successful ERPA – scenario 1, the decision-maker would be indifferent between contracting for a DSM or CDM project. For any probability of a successful ERPA – scenario 1 exceeding 77%, the decision-maker would be considered risk-averse. Any probability less than 77% will make the decision-maker / ESCo risk seeking.

If for example, analysis shows that there is only a 10% chance of successfully selling CERs at a maximum price of €16.35 in the secondary market, the expected reward would be R2,189,548. The risk premium is then:

RP(CDM-ERPA-sec.) = EV(CDM-ERPA-sec.) - CE(CDM-ERPA-sec.)

RP(CDM-ERPA-sec.) = R2,189,548 - R6,515,680

RP(CDM-ERPA-sec.) =-R4,326,132

If the ESCo chooses this option under these probabilities they would be considered risk seeking (RP<0) with risk premium or expected risk value of R4,326,132.

Denmark is presently 18 million tons of CO_2e over their Kyoto target, as shown in Chapter 2. The Royal Danish Embassy in South Africa is a keen buyer of CERs to offset their own emission and there is a 90% chance of a successful ERPA – scenario 4 agreement to buy carbon credit for the next 10 years. The risk premium is then:

RP (CDM-ERPA-4) = EV(CDM-ERPA-4) - CE(CDM-ERPA-4)
RP (CDM-ERPA-4) = R18,893,890 – R6,515,680
RP(CDM-ERPA-4) = R12,378,210

If the ESCo chooses this option under these probabilities they would be considered risk averse (RP>0) with a risk premium or expected risk value of R12,378,210.

7.6 Proposed Eskom funding

A reasonable price for Eskom to pay ESCos per MW saving would be of similar value to that which a developer could expect from an ERPA with equivalent risks in implementing a DSM project. The ERPA – scenario 1 holds the least risk for the developer and should be used for comparison. The present value of an ERPA – scenario 1 is R5,596,622, calculated from a future value of R12,155,263 after 10 years.

Figure 92 shows the various capital returns for a high (39% of EUA price) and low (29% of EUA price) CER price and Kyoto expiring, without a follow-up scenario for an ERPA – scenario 1. It also shows the proposed Eskom DSM funding curve. The expected reward based on a 0.3, 0.6 and 0.1 probability respectively, is calculated at R12,155,263. This is the future value that the author proposed Eskom should match for a reasonable DSM EE project.

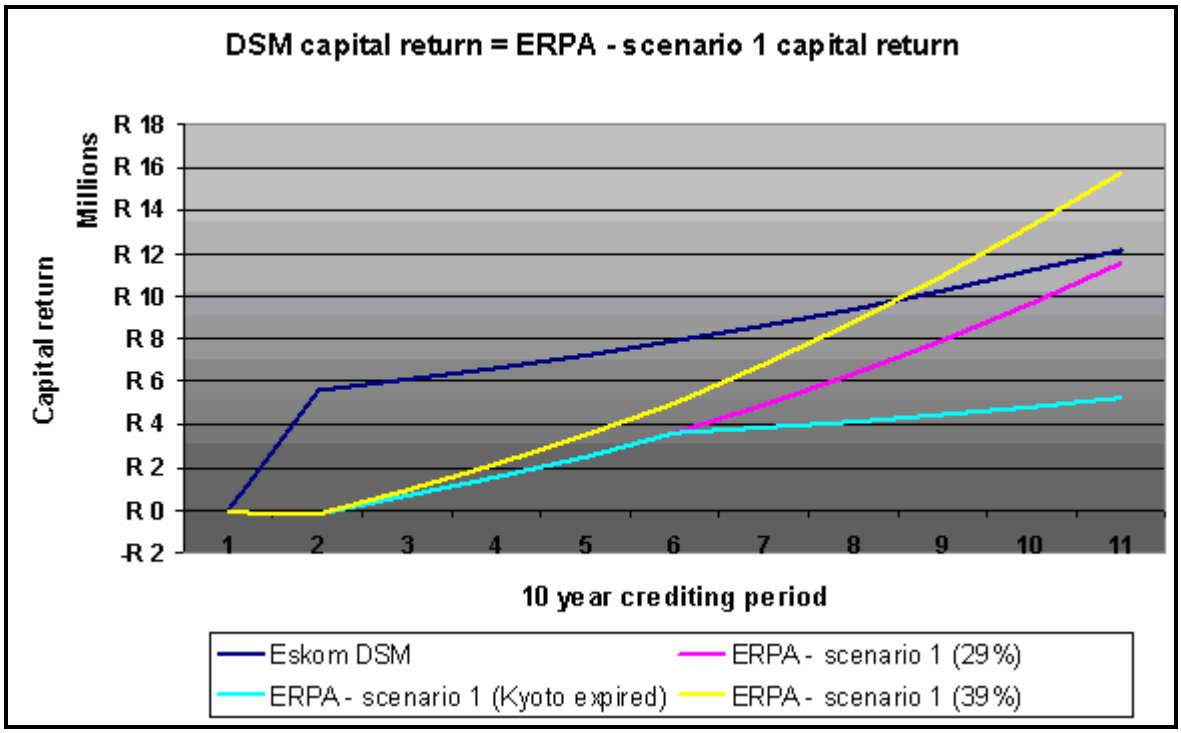


Figure 92: Proposed R/MW Eskom should adopt

A R4 million increase above the existing R1.5 million per megawatt energy-efficiency savings, might appear excessively high but is definitely in line with international markets. Eskom is not only faced with a peak demand challenge but is greatly concerned about the increasing base load demand. It is essential that Eskom increases the R/MW value, to increase the feasibility of more energy-efficiency projects to address this problem.

7.7 Conclusion

The time taken for DSM and CDM registration could cause clients to fund energy-efficiency activities in-house to meet internal targets and policies. If AngloGold Ashanti's Kopanang gold mine decides to implement the proposed project activity they could expect an internal rate of return of 20%. At the time of writing this was based on the assumption that electricity tariffs would increase by 60%. The effective date of this tariff increase, as proposed to NERSA by Eskom, was in fact 1 July 2008.

The existing market environment appears to be very favourable for a CDM project with the CER price steady at €16. A CDM project could yield a capital return as high as R34,275,994 for 1 MW project activity over a 10-year crediting period, provided that accurate information was available. DSM presently offers a R3mil/MW once-off payment worth R6,515,680. Over the same period there is little doubt that a CDM project could deliver more cost savings.

Unfortunately this is based on perfect information and does not reflect the true state of the world, which includes risks as shown in Chapter 6. With the use of a simple decision tree the reward of various ERPA scenarios can be determined and compared to DSM, based on a chosen ESCo risk profile. With a 70% chance of a successful CDM registration and project activity and only a 30% chance of selling into the spot market, the reward equals that of a 100% guaranteed DSM project.

Section 7.6 of this chapter has shown that Eskom should seriously consider the use of the carbon market as a benchmark on how much funding should go towards demand-side energy

efficiency. A reasonable comparison for DSM EE is that of an ERPA – scenario 1 with very little development risk. The outcome of this comparison proposes that Eskom increase their energy-efficiency funding to R5.5 million per megawatt.

7.8 References

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