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## Appendix A: A practical DSM project example

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*Appendix A summarises the various activities involved in a DSM project. These activities include the scoping document, measurement and verification reports, baseline calculations and the performance assessment period.*

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## **Introduction**

The mining industry in South Africa has made a substantial contribution towards the success of Eskom's demand-side management (DSM) programme. This contribution comes in the form of projects that are implemented by energy service companies (ESCOs) to shift the load of the underground water pumping systems out of the critical evening peak periods (18h00 to 20h00 on weekdays).

It is the purpose of the underground pumping systems to continuously pump water out of the mine to avoid the flooding of the shafts. There are two major sources of water in a mine. Firstly, chilled water from the mine surface is fed into the mine and is used to cool the underground mining conditions and operations. Secondly, natural occurring ground water collects in the mine. The quantities of water that enter the mining operations from the above sources are often substantial, resulting in pumping systems with large installed capacities. A basic layout of such a pumping system is provided in Figure 100.

The system typically consists of a number of fridge plants and cooling towers on the surface of the mine. These fridge plants provide the function of cooling the water for mining operations below the surface. The water is then fed under gravity to the various reservoirs, mining operations and cooling coils.

This water is then collected, together with the fissure water, on the bottom level in a number of settlers that feed into a large reservoir with a capacity of approximately 9,000 m<sup>3</sup> (75 level dam in Figure 100). From the 75 level reservoir the water is pumped to the 38 level reservoir (5,500 m<sup>3</sup> capacity) with four pumps. The water is then pumped to the surface with five pumps and collects in the surface hot water dam. From here the cycle continues again.

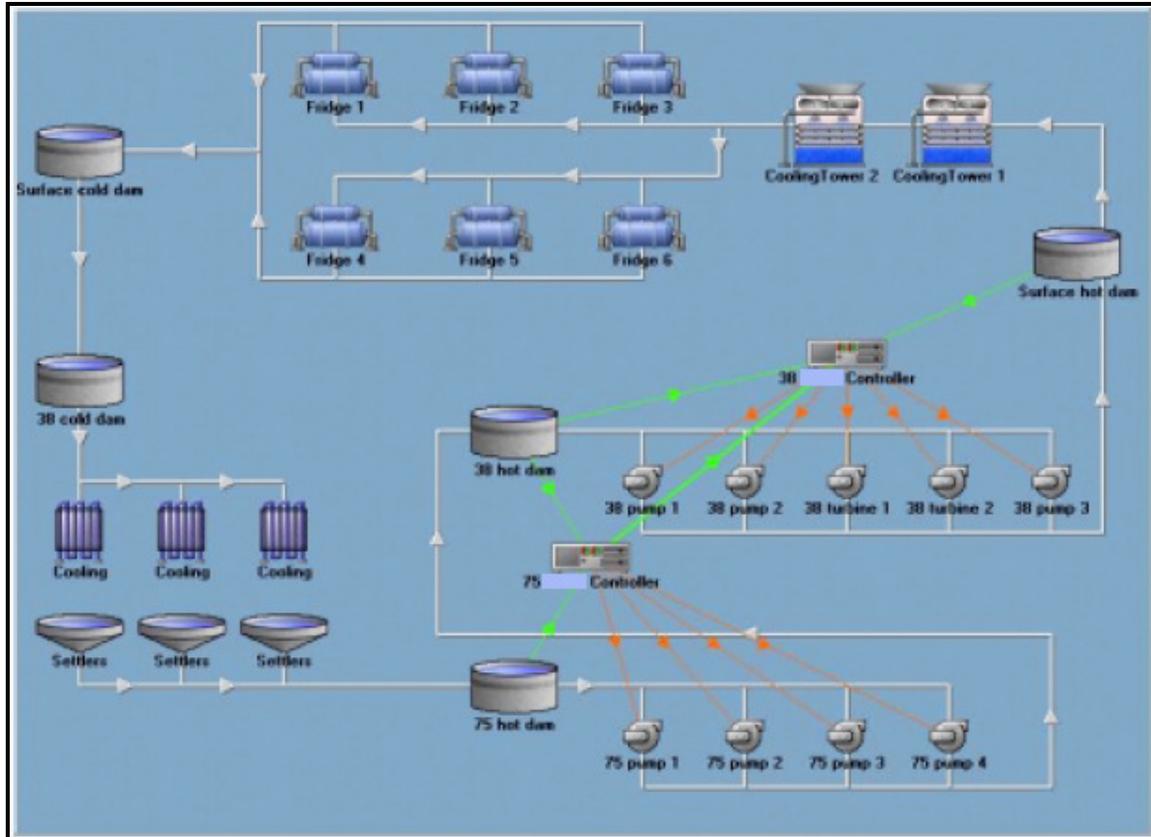


Figure 100: Basic layout of an underground mine pumping system

A typical installed capacity for such a pumping system (including only the pumps) can be as high as 24.0 MW. The targeting of the underground pumping system is an attractive option for DSM activities.

### DSM Activities on the Mine Pumping System

The intelligent and optimised scheduling of the pumping load is one means of obtaining DSM benefits for Eskom. On this project the ESCo proposed a project to the Client and to Eskom where they planned to shift a load of 3.0 MW from the evening peak period (and consequently save the mine R 300,000 in their annual electricity account) to the standard and off-peak time-of-use (TOU) periods. This would be achieved without affecting the mining operations and/or conditions.

The ESCo proposed to achieve this goal through the installation of an automated pump scheduling and control system that utilized the capacity of the various reservoirs to allow for load-shifting. The control system basically operates and prepares the pumping system to ensure that the surface cold water dam is fully charged with chilled water, and that the 75 level dam is empty. This would allow the ESCo to cut back on pumping for the two hours in the evening peak, whilst the cold water dam feeds the mine, and the 75 level dam collects the water.

### **Measurement and Verification**

The M&V team becomes involved in the project once they have been instructed by Eskom DSM. As mentioned, it is the function of M&V to quantify the impacts that result from the DSM intervention and to determine whether the impacts are being sustained over time. The M&V teams function as an independent party within the DSM project environment.

### **M&V Scoping Report**

The first step is to obtain a scope of work planned by the ESCo, and to gather any other relevant information (project location, number of pumps, proposed schedule of implementation, etc.). The pumping systems are also visited and the exact quantity of pumps and their installed ratings are recorded, together with the operational load (if possible). The first deliverable from the M&V team is the M&V scoping report. This report is circulated to all the stakeholders (Eskom, ESCo, mine) to ensure that the scope for the M&V project is correctly assessed.

### **M&V Plan**

The M&V plan is the second deliverable and it outlines the procedures and methodologies that will be followed to perform M&V for the project. The M&V plan also specified the metering activities that will be conducted by the M&V team to obtain data for baseline development, and how data will be obtained after implementation for impact calculations.

Once the M&V plan has been submitted, the M&V will install a metering system on the pumps that records the electrical load of the pumps. In the majority of cases this is however not necessary, since SCADA systems may be present on the mine. If this is the case and the quantity of data is sufficient, the data should be sufficient to develop the M&V baselines. In cases where a SCADA system is not present, manual log sheets with the start/stop times of pump operation may be used together with the measured operational load of the individual pumps.

If this data is also lacking, the M&V team will need to conduct their own measurements. Data for baseline development is required for a period of three months prior to contact between the mine and the ESCo. The result of the above actions is to obtain a total pumping system electricity use profile in 30-minute intervals

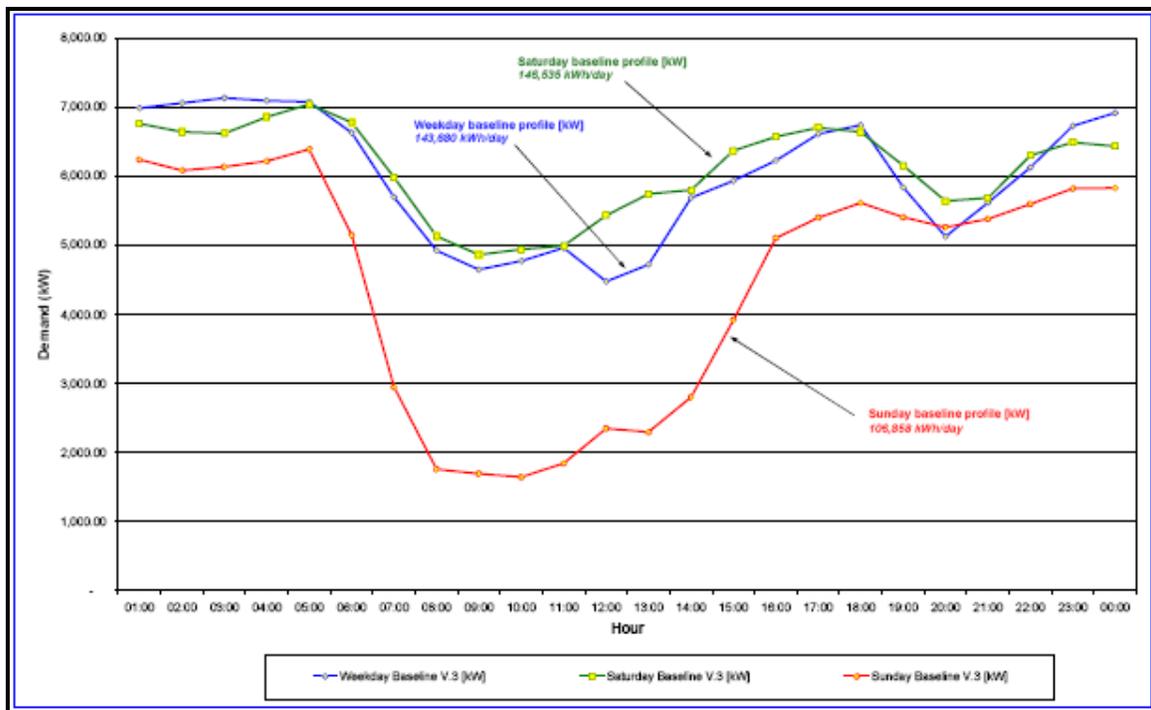


Figure 101: Baseline data for pumping system

### M&V Baseline Report

The M&V baseline is developed from the above data and is calculated for weekdays, Saturdays and Sundays. The Weekday baseline profile is basically the average profile of all

the weekdays present in the data set. The same principle is followed for Saturdays and Sundays. The end result is three baselines, one for Weekdays, one for Saturdays and the last for Sundays. Figure 101 provides the baselines that were developed for the above mine pumping project.

From the baseline profiles in Figure 101 it can clearly be shown that Weekdays and Saturdays have a very similar pumping profile, whilst Sundays are characterized by a much lower pumping profile. Note that the baseline electricity consumption is 143,680 kWh per weekday.

### **Post-Implementation Report**

Upon completion of the project implementation by the ESCo, Eskom will issue a Certificate of Completion. The issuance of this certificate allows the M&V team to conduct a post-implementation site visit. The M&V team needs to verify that all the proposed equipment has been implemented and that any discrepancies between what was done and what was planned are reported in the M&V post-implementation report. This report is also submitted and circulated amongst the project stakeholders.

### **Performance Assessment Reports**

The M&V performance assessment phase also commences once the certificate of completion has been issued. This phase had a duration of 3 months. A M&V performance assessment report is issued for each of these months. This report basically needs to assess whether the project delivered on the promised MW impacts. In the case of the above mine pumping project, the project resulted in 4.07 MW on average over the evening peak periods for the first month.

The second and third months delivered 4.19 MW and 4.29 MW respectively. This clearly shows that the project performed well against its intended DSM target of 3.00 MW. The results of the last month in the performance assessment phase, are summarized in Table 30

provided below. Table 30 clearly shows how the load was shifted from the evening (and the morning peak in this case) to the other time-of-use periods.

Day Type	Weekday (MW)				Saturday (MW)		Sunday
TOU Period	Morning Peak	Weekday Standard	Evening Peak	Weekday Off-Peak	Saturday Standard	Saturday Off-Peak	Sunday Off-Peak
Baseline	4.701	5.627	5.401	6.869	5.227	6.354	4.372
Actual	2.126	6.026	1.114	7.841	2.625	7.439	5.264
Impact	2.575	-0.399	<b>4.287</b>	-0.971	2.602	-1.085	-0.892

Table 30: Electricity consumption during performance assessment

### M&V Performance Tracking

Once the performance assessment phase has been completed, the project responsibility is consequently transferred to the mine (client) to sustain and maintain the project impacts for the duration of the contractual agreement with Eskom DSM. The mine however has a back-to-back agreement with the ESCo to maintain the system. The project enters into the M&V performance tracking phase. During this phase the M&V team generates monthly savings reports which are submitted to all stakeholders.

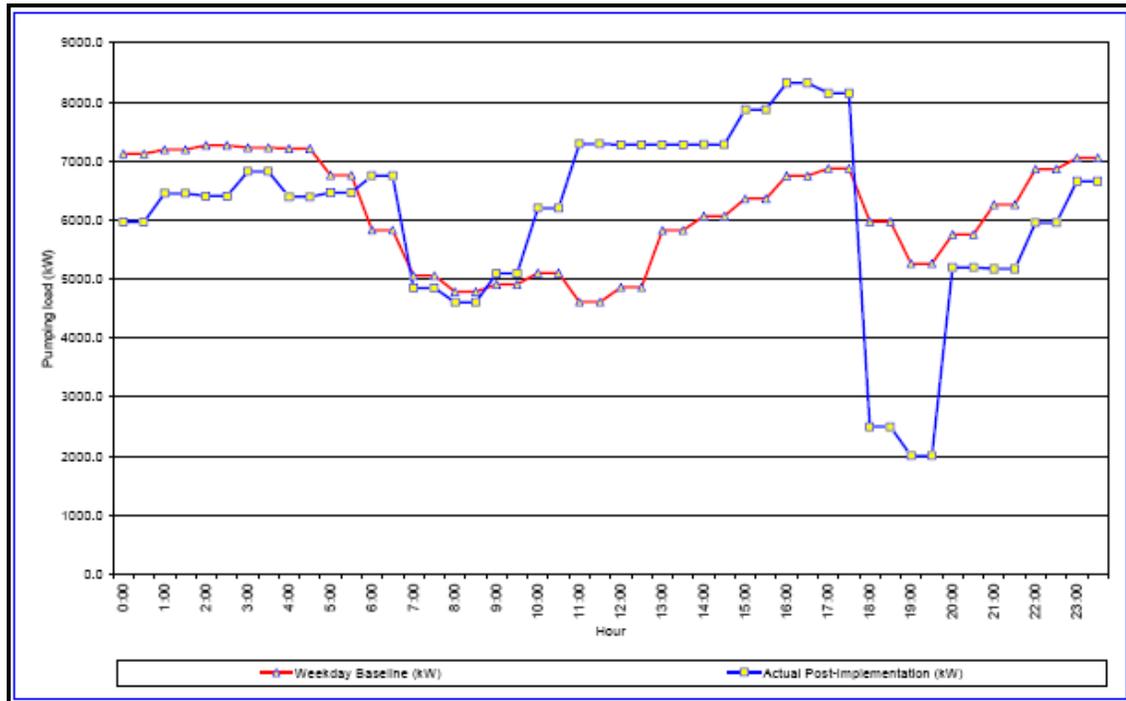


Figure 102: Intervention electricity baseline

Table 31 shows the average impact profiles (Baseline and Post-Implementation) achieved for a month. It can clearly be seen how the ESCo shifted the load from the evening peak (weekdays) to the other TOU periods.

The monthly savings reports are generated by the M&V team for the duration of the contractual agreement with Eskom. These reports also provide the monthly cost implications for the client, together with a range of other relevant impacts.

Day Type	Weekday (MWh)						
TOU Period	Morning Off-peak	Morning Standard	Morning Peak	Midday Standard	Evening Peak	Evening Standard	Evening Off-peak
Baseline	8482.10	1150.94	2896.94	9167.87	2216.18	2373.19	2757.03
Actual	9079.83	1297.90	1169.80	11407.54	643.14	2175.50	3031.06
Impact	-597.73	-146.96	1727.14	-2239.67	1573.04	197.69	-274.03
Day Type	Saturday (MWh)					Sunday (MWh)	
TOU Period	Morning Off-Peak	Morning Standard	Midday Off-peak	Evening Standard	Evening Off-peak	Sunday Off-peak	
Baseline	1912.00	1019.96	1540.82	482.62	1020.80	4967.08	
Actual	2147.89	789.93	1840.50	135.49	1025.53	5243.43	
Impact	-235.90	230.03	-299.68	347.13	-4.73	-276.35	

Table 31: Impact on electricity consumption

Table 31 shows the impact on the electricity consumption results, on which the client’s performance is assessed in terms of penalties and banking. These values are the accumulated values over the complete performance tracking period, which is 10 months in total. Table 32 shows the project’s financial performance over this accumulated 10-month period.

Day Type	Weekdays (Rand)	Saturdays (Rand)	Sundays (Rand)	Total
	Electricity consumed	Electricity consumed	Electricity consumed	Rand
Baseline	R 3,260,705	R 522,922	R 367,623	R 4,151,250
Actual	R 2,837,615	R 494,811	R 390,598	R 3,723,024
Impact	R 423,090	R 28,110	-R 22,974	R 428,226

Table 32: Performance over a 10-month period

### **Baseline periodical recalculation**

No changes are made to the efficiency of the pumping system during the implementation of the pump scheduling DSM projects. The load is simply shifted to other TOU periods. The baselines (weekday, Saturday and Sunday profiles) are recalculated for each day of the month, every time a monthly savings report is developed. The reason for this is that the baseline electricity profiles for the pumping system need to take load growth into account. This will ensure that the baselines are still accurate, even when the mine pumps more water in one month and less in another.

The baselines are recalculated for each day in the period under consideration (when developing the performance assessment and the savings reports) so that the daily total electricity consumption (kWh) of the baseline profile is the same as the daily total electricity consumption (kWh) of the actual day to which it is being compared. The difference between the actual kWh and the baseline kWh will be divided by 24 and added to each hour of the baseline profile. This will result in the baseline shifting up or down (with a constant kW value over all hours of the day) to ensure that the baseline and the actual daily profiles deliver the same daily total electricity consumption (kWh/day).

This recalculation of the baseline became necessary when it became clear that the pumping activities of other mines in close proximity could greatly influence the pumping activities on the project mine and have an influence on the DSM project and its performance. This meant that if the pumping of water increased on the mine, the baseline should reflect it and still give an accurate representation of the DSM impact of the project. The assumption the M&V team makes, when recalculating the baselines in this manner, is that we assume the system efficiencies stay unchanged.

### **DSM Project Impacts**

The project performed well against its intended DSM target, during its M&V performance assessment phase (4.07 MW, 4.19 MW and 4.29 MW for the respective months). This performance was sustained over the project life for the past ten months, since the completion of the M&V performance assessment phase.

The project managed to achieve a load-shift of 3.87 MW on average during the evening peak periods (weekdays), over the total 10-months period. The project also managed to save the mine a total of R 428,000 in avoided electricity costs over this period, which well exceeds the original R 300,000 the ESCo proposed. The project also managed to shift 2.84 MW, on average, from the morning peak period, over the 10-month period.

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## Appendix B: SSC-CDM-PDD

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*Appendix B contains the newly developed Small-Scale CDM-PDD for demand-side energy efficiency management in the industrial sector. The approved baseline and monitoring methodology (AMS-II.C.) for small-scale projects are amended and used in this PDD*

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**CLEAN DEVELOPMENT MECHANISM  
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)  
Version 03 - in effect as of: 28 July 2006**

## **CONTENTS**

- A. General description of project activity
- B. Application of a baseline and monitoring methodology
- C. Duration of the project activity / crediting period
- D. Environmental impacts
- E. Stakeholders' comments

### ***Annexes***

- Annex 1: Contact information on participants in the project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan

**SECTION A. General description of project activity****A.1 Title of the project activity:**

&gt;&gt;

“Demand-side energy efficiency management in the industrial sector” – PDD version 1, 10 January 2008

**A.2. Description of the project activity:**

&gt;&gt;

The project activity aims to implement new technology in the gold mining sector of South Africa to improve the energy efficiency of their clear water pumping systems. This will result in a smaller demand of electricity from the South African grid supplied by Eskom.

Clear water is pumped down the shaft and used for several mining operations. In most mines the actual demand for clear water is not known, not properly defined nor properly managed due to lack of measurement and control infrastructure. This results into excess water being pumped into the shaft even though there is no immediate demand. The redundant water is then pumped back to the surface to prevent flooding.

By implementing HVAC International’s REMS-CARBON technology, installing valves of different levels and automating the pumping systems the running time of the pumps can be reduced. The project activity thus seeks to reduce GHG emissions by explicitly reducing the demand for electricity.

In view of the developer the Project Activity assists South Africa in achieving **sustainable development**, primarily in the following aspects:

- The project directly reduces the amount of electricity needed to pump clear water and hence reduces the demand placed upon the South African national grid. It supports the drive for the industrial demand-side management of energy being pursued by South Africa and Eskom, the national utility;
- The project acts as a clean technology demonstration project, encouraging development of modern and more efficient utilization of electricity throughout South Africa;
- The new technology will create significant employment opportunities and improve skills of the system operators;
- It will lead to the transfer of cutting edge, modern technologies to the mining industry.
- The cost of implementing such technologies is extremely high and not always feasible for the mines. With additional funding the technology installed will increase the expected life of the mine, ensuring employment opportunities and alleviate poverty into the future.

**A.3. Project participants:**

&gt;&gt;

**HVAC International (PTY) Ltd** will act as the project developer and operate as an independent energy efficiency consultant in terms of an agreement between HVAC International and the mine. HVAC International is a very experience ESCo with a very sustainable track record:



Contact information for Project Participants and Party (ies) involved is provided in Annex 1.		
Name of Party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa	AngloGold Ashanti (Pty) Ltd	No
South Africa	Central Energy Fund (CEF) (*)	Yes
South Africa	HVAC International (*) - developer - private entity	Yes
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		
<b>Note:</b> When the PDD is filled in support of a proposed new methodology (from CDM-NM), at least the host Party (ies) and known project participants (e.g. those proposing a new methodology) shall be identified.		

#### A.4. Technical description of the project activity:

##### A.4.1. Location of the project activity:

&gt;&gt;

##### A.4.1.1. Host Party(ies):

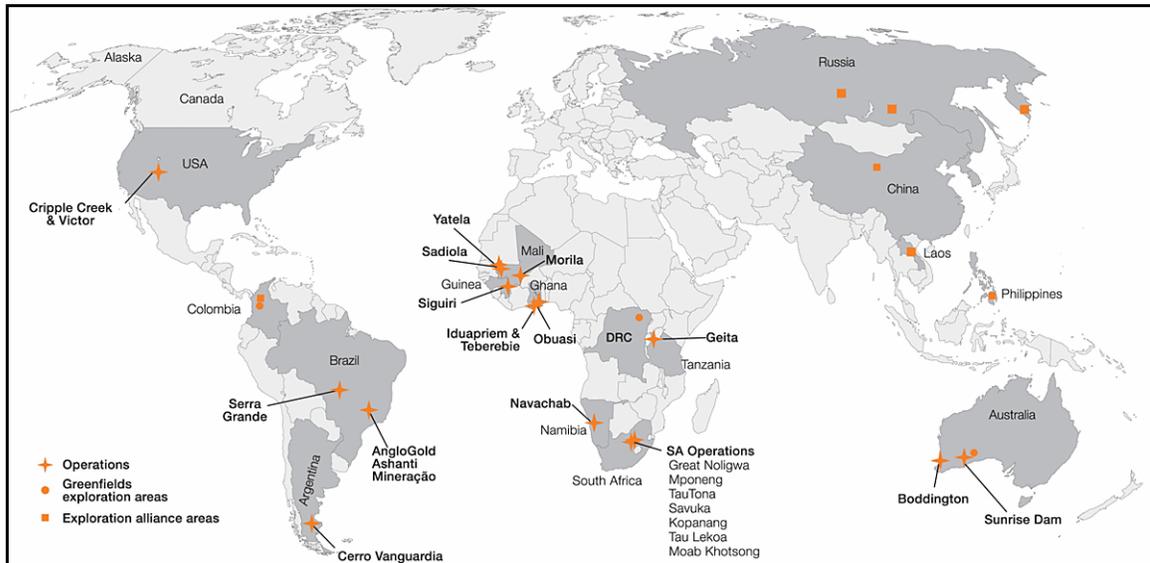
&gt;&gt;

Anglogold Ashanti (Pty) Ltd – Kopanang Gold Mine

AngloGold Ashanti is one of the world's leading gold producers, with a varied portfolio of assets and ore body types in key gold-producing regions around the world. At the end of 2006, the company had 21 operations located in 10 countries (South Africa, Argentina, Australia, Brazil, Ghana, the Republic of Guinea, Mali, Namibia, Tanzania and the United States) on four continents, together with a substantial project pipeline and a focused, global exploration programme.

AngloGold Ashanti produced 5.6Moz of gold in 2006, of which 2.6Moz (46%) came from deep level hard-rock operations in South Africa and the balance of 3Moz (54%) from the shallower and surface operations around the world. Greenfield's exploration is under way in Western Australia, Colombia and the Democratic Republic of Congo (DRC), and through exploration partnerships and joint ventures in Alaska, Russia, China, the Philippines and Laos. The group employed 61,453 people around the world.

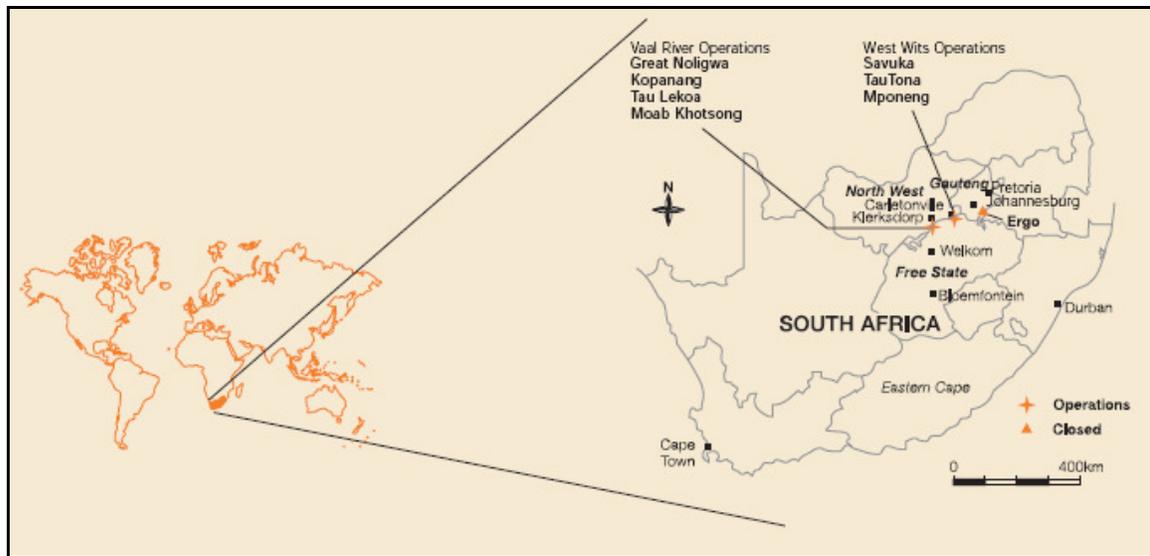
The group's South African operations produced 45% of overall group production in 2006. The Vaal River operations, comprising the Great Nologwa, Kopanang, Tau Lekoa and Moab Khotsong mines produced 1.28Moz. Together these mines employed on average 18,191 people (15,296 employees and 2,895 contractors) during 2006.



**A.4.1.2. Region/State/Province etc.:**

>>

Kopanang gold mine is situated on the Free State side of the Vaal River and adjoins Great Noligwa.



**A.4.1.3. City/Town/Community etc:**

>>

The towns of Orkney and Klerksdorp are closest to Kopanang gold mine and lies just north of the Vaal River, approximately 10km from the mine.

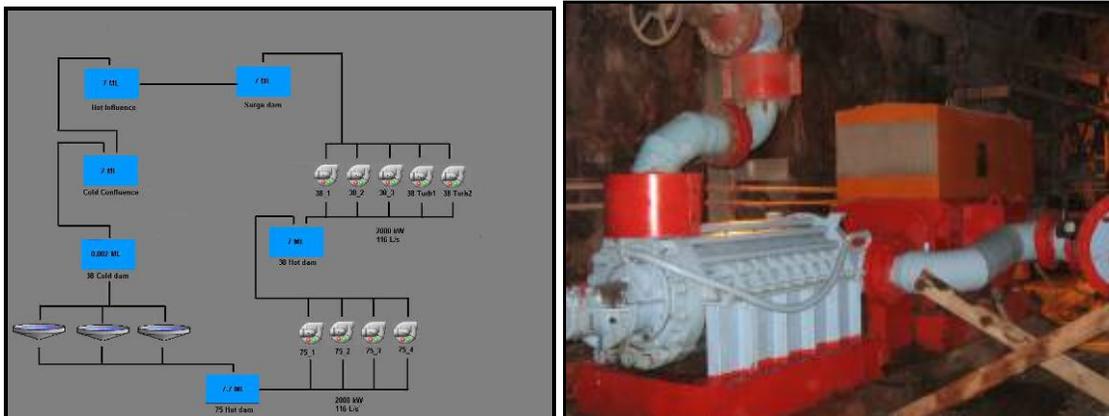
**A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):**

&gt;&gt;

Kopanang gold mine is situated 10km from Orkney (North West Province, South Africa) on the R76. The caption on the left shows the top rigging or winder tower of the mine and the caption on the right shows the SCADA system.



The following is a schematic layout of the clear water pumping system and the physical pumps at Kopanang where the project activities will be implemented:

**A.4.2. Category(ies) of project activity:**

&gt;&gt;

According to the UNFCCC, this project fits into:

TYPE II – ENERGY EFFICIENCY IMPROVEMENT PROJECTS

II.C. Demand-side energy efficiency activities for specific technologies (Version 10)

Sectoral Scope 3 – Energy Demand.

**A.4.3. Technology to be employed by the project activity:**

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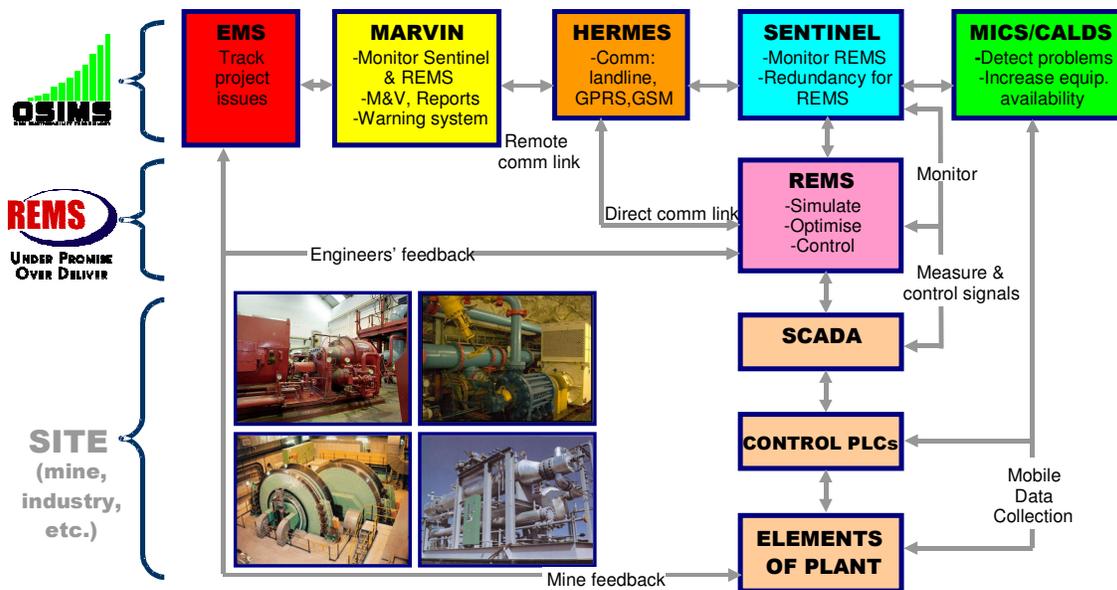
REMS-CARBON (Real-time Energy Management System for Carbon) has been specifically developed by the HVAC International engineering and software teams to manage and control the most efficient method of pumping water.

REMS-CARBON automatically controls the pumps via the SCADA and the PLC's. REMS-CARBON uses all available data like dam levels, flow rates in and out of the dams and installed capacities of the pumps, to optimize the electricity demand.

The control room operator can view the status of the pumping system at any given time and switch to manual use, should some unforeseen situation occur. This will obviously cause a less than optimal pumping solution. HVAC International can also view every mine's status from their monitoring room in Pretoria (Gauteng Province) to ensure that all technologies are working seamlessly.

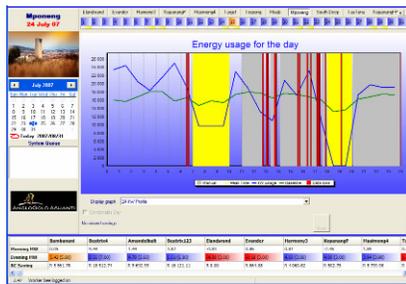
REMS-CARBON generates monitoring and maintenance reports from the mine and automatically emails them to the support team for performance measures through a system called OSIMS (On Site Information Management System).

The figure below shows the layout of the different core OSIMS technologies and how they connect to REMS-CARBON and the mine/industrial system being controlled. The top layer represents OSIMS with REMS-CARBON directly below it. The interconnection with the controlled system elements is shown in the bottom layer.



The following briefly highlights some of the elements in OSIMS.

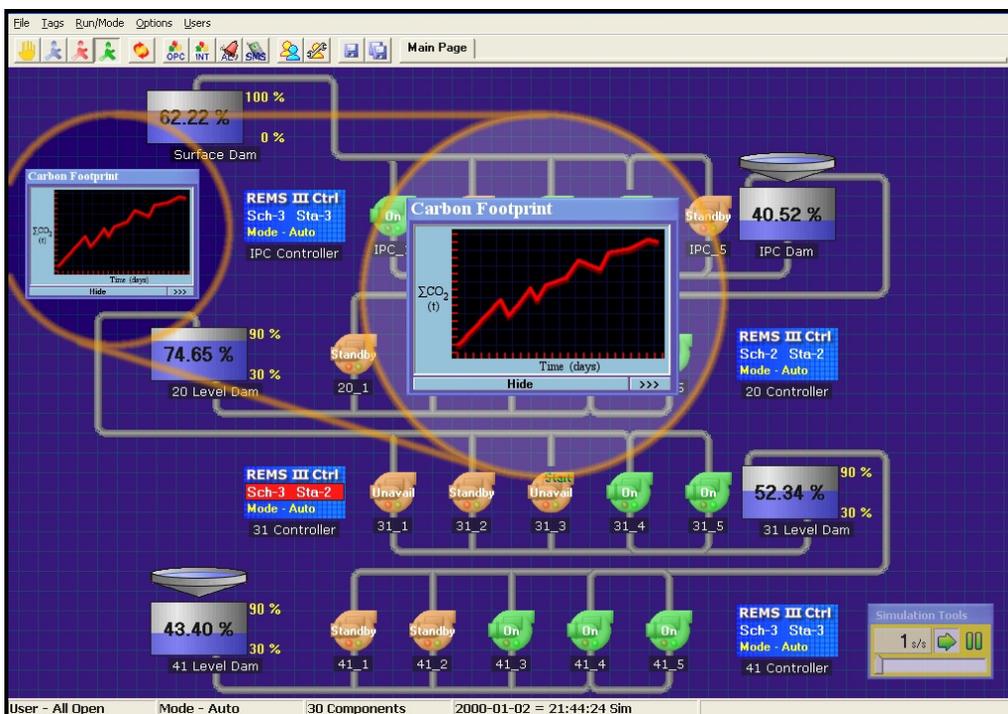
- **Sentinel:** This system monitors REMS, the client's SCADA system and the communication network. If a problem with REMS is detected, Sentinel will take over full control from REMS while at the same time trying to restore REMS. All detected problems are communicated to HVACI's head office (Marvin). Sentinel also backs-up and securely transmits project data to head office.
- **Marvin:** This system, located at HVACI's head office, monitors all the REMS projects. Any problems are immediately reported via SMS and e-mail to the responsible engineers. This minimises the impact on DSM potential of problems on system elements. Furthermore Marvin retrieves, unpacks, verifies, calculates, interprets and archives project data. Marvin performs in-house M&V (Measurement & Verification) functions and generates reports and presentations for Eskom, HVACI and their clients.



Project performance and other information are available online and also via mobile phone to project engineers. The immediate availability of information helps issues to be addressed immediately. Information is the key to the sustainability of DSM projects.

- **HERMES:** Hermes is a triple redundant communication system, developed to ensure that communication between HVACI's head office (Marvin) and DSM site (Sentinel) can take place. Many projects are located at remote sites with limited communication networks. Fixed line, GPRS and GSM technology are utilised. Communication can be forced from both directions.
- **MICS/CALDS:** Is a bouquet of mobile communication devices, used to promote regular equipment checking and maintenance. Poorly maintained equipment is a major problem resulting in equipment failure. This translates to DSM potential being lost and often takes days to recover from after the problem has been fixed. These devices are customised for the specific installation. Sentinel uploads this information for monitoring. The overall maintenance quality of the mine/industry is improved by this system.
- **EMS:** This project management system logs data of all project installations and investigations. The shared information helps HVACI's engineers to effectively address issues on site that may previously have been experienced on other sites. Furthermore EMS helps to keep track of project resources to ensure all project problems are attended to within time and on budget.
- **REMS-CARBON:** The REMS platform is similar to SCADA systems but with additional functionalities, specifically focuses on energy efficiency. REMS-CARBON is capable of simulating, optimising, monitoring and automatic control of clear water pumping systems to reduce running costs and improve energy efficiency. The Kopanang REMS-CARBON interface is presented in the following figure:





**A.4.4 Estimated amount of emission reductions over the chosen crediting period:**

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For a 10 year crediting period the emission reduction will amount to 114,580 tCO<sub>2</sub>e :

Crediting period	Emission reductions (Ton CO <sub>2</sub> e per annum)
1	11,458.08
2	11,458.08
3	11,458.08
4	11,458.08
5	11,458.08
6	11,458.08
7	11,458.08
8	11,458.08
9	11,458.08
10	11,458.08
<b>10</b>	<b>114,580.8</b>

**A.4.5. Public funding of the project activity:**

&gt;&gt;

There is no public funding from an Annex 1 country involved in the project activity and a unilateral approach will be followed.

**SECTION B. Application of a baseline and monitoring methodology****B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:**

&gt;&gt;

AMS-II.C. : Demand-side energy efficiency activities for specific technologies

**B.2 Justification of the choice of the methodology and why it is applicable to the project activity:**

&gt;&gt;

AMS-II.C. comprises activities that encourage the adoption of energy-efficient equipment, lamps, ballasts, refrigerators, motors, fans, air conditioners, appliances, etc. at many sites. These technologies may replace existing equipment or be installed at new sites. In the case of new facilities, the determination of baseline scenario shall be as per the procedures described in the general guidance to SSC methodologies under the section ‘Type II and III Greenfield projects (new facilities)’. The aggregate energy savings by a single project may not exceed the equivalent of 60 GWh per year for electrical end use energy efficiency technologies. For fossil fuel end use energy efficient technologies, the limit is 180 GWh thermal per year in fuel input.

The REMS system optimises the flow of water throughout different levels in the mines. The water pumps are thus controlled more efficiently and will directly result in the pumping of less water. Any additional water will be pumped to the surface so that the demand of water matches the supply equally. This method seeks to reduce GHG emissions by explicitly reducing the amount of electricity consumption from pumping from underground mining levels, without influencing the safety and production aspects of the mine.

The energy efficient project activity at Kopanang mine results in a 1.09MW power saving. The annual saving is:

$$1.09(\text{MW}) \times 24 (\text{hours/day}) \times 365 (\text{days/year}) = \mathbf{9548.4\text{MWh/year}}$$

This project activity classifies as a Small-scale Project Activity (CDM-SSC-PDD) according to the above UNFCCC criteria.

**B.3. Description of the sources and gases included in the project boundary**

&gt;&gt;

All the pumps within the boundary of project activity are connected on the national utility grid – Eskom. The emissions are calculated by multiplying the run-time of the pumps (hours) with their installed capacity (MW) and the grid emission factor. Eskom has calculated their grid emission factor according to the CDM approved consolidated methodology 0002 in their annual report for 2007 to be 1.2kg/kWh.

**B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

&gt;&gt;

The theoretical power required to pump water to the surface is calculated as follows:

$$Power = \rho.Q.g.H$$

Where:

$\rho$  = the density of the fluid in  $kg / m^3$  ;

$Q$  = the flow in  $m^3 / s$  ;

$g$  = gravitational constant; and

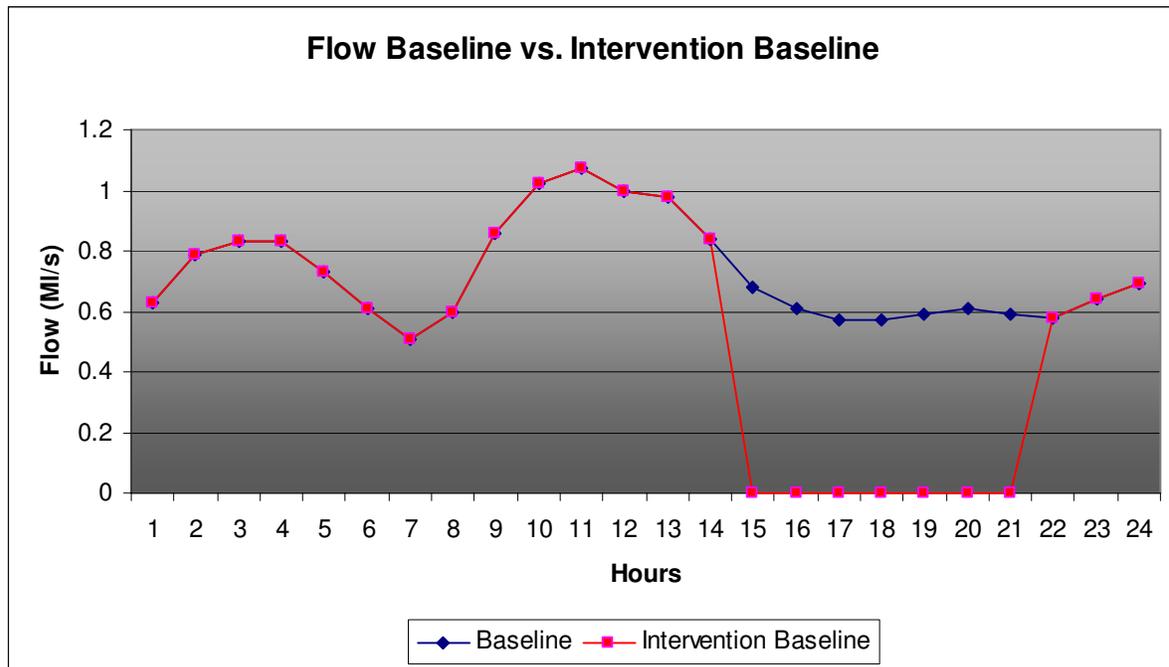
$H$  = height to which the water is pumped.

From this formula it can be seen that, for a given height, a reduction in the amount of water pumped will result in a reduction in power.

The water usage for Kopanang has been obtained for the period of July 2006 to January 2007 and analysed. All data were considered except holidays and days when there was no demand for water with the latter usually due to maintenance.

During the blasting time, which is normally between 14:00 and 20:00, no miners and operators are allowed underground according to the law. This also implies that there will be no demand for water during this period. By strategically placing valves on all the production levels where water is required it was possible to isolate the demand-side for water.

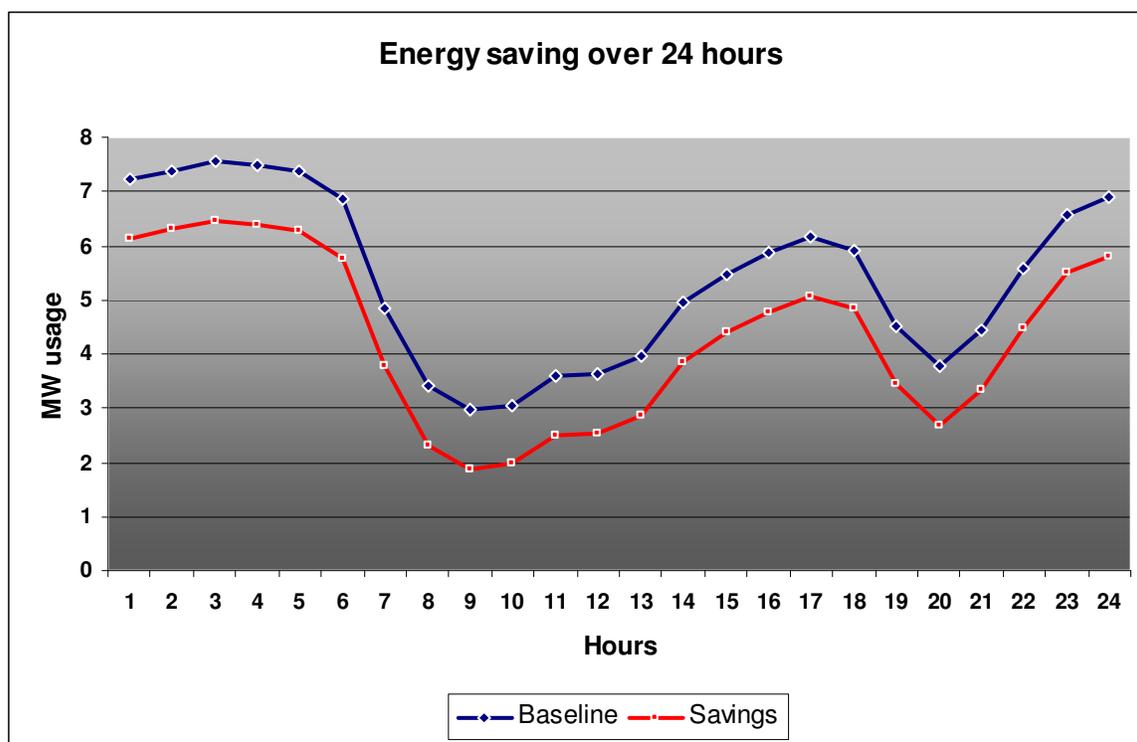
With the installation of REMS-CARBON, the valves can be automatically controlled. During blasting the valves are closed for approximately 6 hours per day, which results in zero flow between 14:00 and 20:00, as seen in the following flow baseline figure. Note that even though the surface valves are completely close at 14:00 there will still be flow into the dams until the pipe columns are completely drained. During the operating hours, the clear water will only be supplied to active mining levels.



*Water baseline vs. optimised water baseline*

To determine the monthly savings, the monthly flow data was evaluated and compared to the historic flow baseline. By comparing the optimised flow data to the water flow baseline, a percentage water saving was obtained. The amount of energy saving as a direct result of less water being pumped out of the system will only be available the following day. Water in the columns, haulages and dams acts as a buffer between the reduced flow of water and the energy saving from pumping. This energy reduction is divided by 24 hours to give a MW saving.

The daily water flow was reduced from 17.43 MI/day to 13.89MI/day resulting in a 20.28% saving in water usage per day. This means that the mine will be capable of reducing the daily energy consumption, with regard to the pumps, with approximately 26.25 MW hours. By dividing this value by 24h, the power demand will be reduced by 1.09 MW per day. The next figure shows the possible reduction in energy consumption.



*Energy efficiency baseline vs. business as usual*

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>**

The realisation of this 1.09MW energy efficiency project would not have taken place without the CDM funding opportunity. One barrier to this project activity is the cheap electricity in South Africa, which has resulted in an energy intensive culture.

**The DSM Fund**

In accordance with the NER Energy Efficiency and Demand-side Management Regulatory Policy as approved by the NER on 25 May 2004, the DSM fund provides subsidies to projects that effect energy efficiency, load-shedding, load-shifting etcetera. The quantum of the subsidy varies according to the type of intervention.

**The DSM fund and Executive Board 16 Annex 3**

As appears from the paragraphs above the DSM fund is thus clearly established through a national policy by a public utility belonging to the South African Government and endorsed by the National Energy Regulator, the over-arching regulatory authority in South Africa. The DSM programme clearly started after 11 November 2001 and is aimed inter alia at financing energy efficiency programs.



The result of the above is that any DSM subsidy granted to a CDM project in South Africa amounts to a type “E-“ policy and has the effect that the subsidy has to be disregarded for purposes of the baseline, that is the baseline should refer to the hypothetical situation where the DSM fund is not in place.

In light of the fact that the Project Activity would in the submission of the developer have been additional even in the absence of Executive Board 16 annex 3(1)(b) and (3), the calculations below are done also to illustrate same.

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%. AnlgoGold Ashanti’s money would be better in the bank, where they could earn more that 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.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

>>

AMS-II.C. comprises activities that encourage the adoption of energy-efficient equipment, lamps, ballasts, refrigerators, motors, fans, air conditioners, appliances, etc. at many sites. This methodology focuses on improving the control system rather than on replacing old equipment regardless of whether the unit delivered is water, air, heat or any other form of electricity consumer.

The energy displaced is still electricity with emission reductions achieved as follows:

$$ER_y = (BE_y - PE_y) - LE_y$$

#### Where:

$ER_y$	emission reductions in year $y$ ( $tCO_2e$ )
$PE_y$	project activity emissions ( $tCO_2e$ )
$LE_y$	leakage emissions in year $y$ ( $tCO_2e$ )

### B.6.2. Data and parameters that are available at validation:

*(Copy this table for each data and parameter)*

<b>Data / Parameter:</b>	<b>Power</b>
Data unit:	MW
Description:	Megawatt installed capacity of individual pumps
Source of data used:	Logged real-time into the client SCADA and REMS-CARBON data logger MARVIN
Value applied:	1.09MW from this project activity
Justification of the choice of data or	Emission reductions are merely calculated by subtracting the emission baseline from the project activity baseline. These baselines are calculated by multiplying



description of measurement methods and procedures actually applied :	the electricity baselines (before and after project activity) with the grid emission factor.
Any comment:	NA

### B.6.3 Ex-ante calculation of emission reductions:

&gt;&gt;

Project total emissions are calculated daily as follows:

$$PE = \sum_i (OH_i) * (RP_i) * (EF)$$

#### Where:

PE	=	Daily Project Emissions in tons CO <sub>2</sub> e
$\sum_i$	=	the sum over the group of “i” devices
OH <sub>i</sub>	=	Daily Operating Hours for device i
RP <sub>i</sub>	=	Rated Power of device i
EF	=	Emissions Factor (measured in kg CO <sub>2</sub> e/kWh)

$\sum_i (OH_i) * (RP_i)$  = Daily total electricity power used on all the clear water pumping systems

#### BASELINE

The energy baseline (EB) is multiplied by a Baseline Carbon Emissions Factor (EF, measured in kg CO<sub>2</sub>e/kWh) for the electricity displaced. Therefore the baseline emissions (BE) are calculated as follows:

$$BE = EB * EF$$

With EF = 1.2 ton CO<sub>2</sub>/MW

Time of day	Electricity baseline EB(MW)	Project baseline EP(MW)	Reduction in electricity baseline	Baseline emissions BE=EB*EF	Project emissions PE=EP*EF	Emission reductions BE-PE	Emission reduction pa tCO <sub>2</sub>
0.00	7.21	6.12	1.09	8.65	7.34	1.31	479.12
1.00	7.39	6.30	1.09	8.87	7.56	1.31	479.11
2.00	7.55	6.46	1.09	9.06	7.75	1.31	479.12
3.00	7.48	6.38	1.09	8.97	7.66	1.31	479.12
4.00	7.36	6.27	1.09	8.84	7.52	1.31	479.12
5.00	6.86	5.76	1.09	8.23	6.92	1.31	479.11
6.00	4.86	3.76	1.09	5.83	4.52	1.31	479.11
7.00	3.40	2.30	1.09	4.08	2.76	1.31	479.12
8.00	2.95	1.86	1.09	3.55	2.23	1.31	479.12
9.00	3.06	1.96	1.09	3.67	2.36	1.31	479.12



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10.00	3.60	2.50	1.09	4.31	3.00	1.31	479.12
11.00	3.62	2.53	1.09	4.34	3.03	1.31	479.12
12.00	3.95	2.86	1.09	4.74	3.43	1.31	479.12
13.00	4.95	3.86	1.09	5.94	4.63	1.31	479.12
14.00	5.48	4.39	1.09	6.58	5.27	1.31	479.11
15.00	5.86	4.77	1.09	7.03	5.72	1.31	479.11
16.00	6.15	5.05	1.09	7.38	6.07	1.31	479.11
17.00	5.92	4.83	1.09	7.10	5.79	1.31	479.12
18.00	4.53	3.44	1.09	5.44	4.12	1.31	479.11
19.00	3.78	2.69	1.09	4.54	3.23	1.31	479.12
20.00	4.44	3.34	1.09	5.32	4.01	1.31	479.11
21.00	5.57	4.48	1.09	6.69	5.37	1.31	479.11
22.00	6.59	5.49	1.09	7.90	6.59	1.31	479.12
23.00	6.90	5.81	1.09	8.28	6.97	1.31	479.11
							<b>11458</b>

**B.6.4 Summary of the ex-ante estimation of emission reductions:**

&gt;&gt;

Emission reduction per annum = 11,458 ton CO<sub>2</sub>e**B.7 Application of the monitoring methodology and description of the monitoring plan:****B.7.1 Data and parameters monitored:***(Copy this table for each data and parameter)*

<b>Data / Parameter:</b>	<b>Power</b>
Data unit:	MW
Description:	Megawatt installed capacity of individual pumps
Source of data to be used:	Logged real-time into the client SCADA and REMS-CARBON data logger MARVIN
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1.09MW from this project activity
Description of measurement methods and procedures to be applied:	Emission reductions are merely calculated by subtracting the emission baseline from the project activity baseline. These baselines are calculated by multiplying the electricity baselines (before and after project activity) with the grid emission factor.



QA/QC procedures to be applied:	NA
Any comment:	NA

### B.7.2 Description of the monitoring plan:

&gt;&gt;

**Source:**

The kWh metering is logged and stored electronically by the SCADA when the pumps are running.

**Monitoring Methodology:**

The monitoring methodology requires monitoring of the following:

- Clear water pumped into and out of the system will need to be metered in litres/second.
- Energy in the form of kWh required to move the water within the boundaries of the system.
- Carbon content of the electricity employed by the clear water pumping system using the grid emission factor.

**Monitoring procedures and allocated responsibilities:**

HVAC International has already established a comprehensive monitoring plan at the gold mines through previous Demand-side Management projects. The monitoring plan consists of the following components:

1. PLC (Programmable Logic Controller) below surface level, extracts data from field instrumentation. (Mine Instrumentation Department)
2. Data uploaded onto SCADA on surface level. (SCADA maintenance is mine's responsibility)
3. REMS 3 continuously extract data from SCADA. Data secured in REMS 3 is only available to HVACI technical support. From this point forward the data becomes HVACI's responsibility.
4. REMS 3 data is sent via e-mail to HVAC head offices on a daily basis. Data gets calculated by an automatic calculator named Marvin and stored in a database.
5. Baseline reporting data is generated and stored in a database for monitoring and verification.

**Maintenance responsibilities:**

1. Clear water pumps are maintained by the mines.
2. Flow meters are serviced by the mine's technical department (mechanical and electrical)
3. PLC and SCADA systems are under technical support from the mines.

This process is continuous for the duration of the project and is in place to make sure the savings are real, measurable and sustainable.

### B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

&gt;&gt;

NA



**SECTION C. Duration of the project activity / crediting period**

**C.1 Duration of the project activity:**

10 years

**C.1.1. Starting date of the project activity:**

>>  
NA

**C.1.2. Expected operational lifetime of the project activity:**

>>  
Life of mine (10 years +)

**C.2 Choice of the crediting period and related information:**

**C.2.1. Renewable crediting period**

**C.2.1.1. Starting date of the first crediting period:**

>>  
NA

**C.2.1.2. Length of the first crediting period:**

>>  
NA

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

>>  
NA

**C.2.2.2. Length:**

>>  
10 years

**SECTION D. Environmental impacts**

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**D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

>>



**environment & tourism**

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Enquiries: J Geeringh

Mr Gerhard Bolt  
HVAC International (Pty) Ltd  
P O Box 2156  
FAIRIE GLEN 4  
0043

Fax: (012) 809 0527

Dear Mr Bolt

**APPLICATION FOR EXEMPTION: PROPOSED CLEAR WATER PUMPING EFFICIENCY IMPROVEMENTS AT ELANDSRAND, KOPANONG AND SOUTH DEEP GOLD MINE – SOUTH AFRICA.**

I hereby acknowledge receipt of your application letter requesting exemption from complying with the Environmental Impact Assessment Regulations, 2006 and the description of the proposed activity dated 27 July 2006 submitted to this department regarding the above-mentioned matter. You have submitted this application in order to comply with the requirements of Government Notice No. R. 385 of 3 July 2006.

The activity you describe is not a listed activity as per GN No. R. 386 or R.387, and you are therefore not required to comply with the said government notices by doing a basic or full scoping / EIA assessment.

Yours sincerely

Ms Pam Yako  
Director – General  
Department of Environmental Affairs and Tourism  
Letter signed by: M Ntene  
Designation: Deputy Director, Env. Impact Mngt

Date: 18/08/2006

Munyaka wa ziko z'nyaka wa Mvundelwano-utshini • UThixo le Nqilwan'izweni netafu'nakashe • Isiteso lemi Gintzi yakur'iganganyo makhawetho  
Mibemulo ya Tshaka & Mibemulo • Departmente: Dimpingwazi an' Tshelomo • Letshamo ya Tshoko lo Shantsho • Leshoko lo Shantsho  
Iigoro ya Tshelomo le Bofu • Umhlanga wa Mibemulo noMvundelwano • Umnyaka Wawawo Nokuqalana

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

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**SECTION E. Stakeholders' comments**

>>NA

**E.1. Brief description how comments by local stakeholders have been invited and compiled:**

>>  
NA

**E.2. Summary of the comments received:**

>>  
NA

**E.3. Report on how due account was taken of any comments received:**

>>  
NA