A selective assessment of business opportunities in South Africa under the Clean Development Mechanism

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Contents

1. Introduction

This report first summarizes matters related to the Clean Development Mechanism (CDM) in the South African context, considering its current position and its position after 2012. It then discusses South Africa in comparison with Brazil and India, summarized in terms of selected key indicators. CDM projects in Brazil and India, which are further along in terms of project development, are then outlined. Finally the report estimates the costs and benefits of CDM potential in industry through the deployment of energy efficiency measures as well as renewable electricity generation.

2. Some policy issues and considerations

2.1 SA obligations

South Africa has ratified the Kyoto Protocol but has not quantified mitigation commitments, or indeed made any legally binding commitments. Participation in the CDM is entirely voluntary and ratification has not conferred any particular obligations on SA. There are, however, commitments under the Framework Convention on Climate Change, such as the National Communication (including reporting on GHG inventories, adaptation and the mitigation programme).

2.2 Compliance

A compliance system is being set up for Annex 1 parties only. It is highly unlikely that any future developing countries targets will face Annex 1 level stringency levels.

2.3 Enabling environment

The impression is that the Designated National Authority (DNA) may cover two broad roles (see, for example, Winkler et al (2005)): regulatory (sustainable development criteria), and promotional. There is not much action in the latter area now, and the future is unclear. It had been thought that the Department of Trade and Industry (DTI) would take on the promotional role, but there is no obvious output at present. It should be noted that the private sector and parastatals are not doing much to encourage market development, nor is civil society being as active as it could be.

2.4 Post-2012

The situation is highly uncertain, since formal negotiations for post-2012 action were launched only at the Montreal Conference of the Parties serving as the Meeting of the Parties (COP/MOP) in November 2005. The COP/MOP agreed that current caps will continue after 2012. A two-track approach was agreed at Montreal:

- Establish a process to set new Annex 1 targets for a number of years (likely to be at least 5) beyond 2013. The negotiations starting in May 2006 should conclude in 2008 or 2009. Note that there is continuity between the first and second commitment periods – this is an important signal to carbon markets – the second commitment period starts in 2013.
- A 'convention' process, focusing on developing countries, will be followed. It is highly unlikely that developing countries will have Annex 1-type targets, but it is likely that the more advanced developing countries (like SA) will undertake some kind of commitments, though these will be 'softer' than those for Annex 1 to the Kyoto Protocol. The timing of these developing country commitments may be staggered and not necessary start in 2013, as with the Annex 1 countries.

The Montreal meeting also resulted in an agreement to streamline and strengthen the architecture of the CDM for the future. Countries agreed to commit more funds in support of the secretariat.

There is no inside track or special insights available as to how the negotiations will unfold. What is clear is that a political signal has been sent that there will not be a gap between the first and second commitment periods. Apart from that, there is evidence that the CDM market is picking up speed. There is a general sense that the market will continue to grow, increasingly fast, with no obvious volatility or cynical behaviour likely to derail the momentum. The key uncertainty that was removed in Montreal is that a process has started to set new targets for Annex 1 parties. This will set the caps for ‘cap-and-trade’ and also continue demand for Certified Emission Reductions (CERs). Market collapse is extremely unlikely; indeed the chances are that emission reduction targets may be even more ambitious than they are now. The USA has said that it will not undermine the efforts of Protocol parties.

2.5 South African position

South Africa strongly supports a multilateral approach and sees itself possibly taking on something under the Convention, rather than the Protocol.

3. Comparison with Brazil and India

It is generally accepted that in many developing countries climate change remains a marginal issue compared with the pressing matters of food security, poverty, natural resource management, energy access, and urban transport. In South Africa there are additional pressures on government resources because of the need for economic transformation. South Africa, though, is often compared with Brazil and India and we have tried to extract some lessons from their clear success in the CDM field.

3.1 Selected key indicators (as at 24 February 2006)

It was estimated (UNFCCC 2006) that the CDM project pipeline amounted to more than 620 projects world-wide. Of these, 100 are registered and 58 were requesting registration. Table 1 indicates that (a) energy use intensity is comparatively high in South Africa, and that (b) very little has been done to mitigate this via the CDM. On the face of it there seem to be large environmental drivers for CDM projects, and the field is still wide open.

Table 1: Selected indicators

Indicator	*Brazil*	*India*	*South Africa*
Registered projects	14	25	1
Project activities submitted for registration	23	7	1
CERs issued (number of projects)	1	3	0
Issuance requests published	0	1	0
Carbon intensity of electricity production (gCO_2/kWh)	67.1	896.1	848.7
CO_2 intensity of economy (2002) (tCO_2/Mill. Intl. $)	262.6	412.7	817.8
Energy consumption (2002) (t oil equiv/person)	1.1	0.5	2.5

3.2 Development of CDM projects in Brazil and India

We have obtained some insights into the success in these countries through personal contact with local practitioners who have been involved in CDM activities for many years.

3.2.1 Brazil

Many stakeholders from government, academia, and the private sector have been active for many years. Capacity building by universities over the past 10 years is a notable example. Brazil is one of the countries that have attracted a high proportion of foreign investment, and CDM is seen as simply one form of this. In addition, Brazil has many opportunities for landfill and renewable energy projects – the ‘low-hanging fruit’. Ethanol production is widespread and there are also some 400 alcohol distilleries where CDM could be a possibility.

CDM is supported at the highest level in government – the previous president took a personal interest in climate change and the Ministry of Science and Technology is very much in favour of it. The DNA is said to work very well and there are numerous small consultancies looking for opportunities and working on Project Design Documents (PDDs), largely as a result of all the early capacity building.

3.2.2 India

As with Brazil, the point about CDM being a component of foreign direct investment is strongly made. The contributor is quite clear that, if the conditions for inward investment are not good and little new investment is taking place, the opportunities for CDM will also be small: investment is key to CDM, and CDM projects are not likely to be established simply to acquire carbon credits. The point is also made that, even although payment for CERs is only on delivery, the buyer is nevertheless at risk because of onward commitments.

Another major similarity with Brazil is the strong capability of local consultancies. They are seen as being capable of generating opportunities which can intersect with the FDI. (This is in contrast to Thailand, for example, which has relatively high foreign investment but low CDM capability, a poor DNA and, consequently, few CDM projects).

Finally, it is said that India has a good relevant data base with easy access.

3.3 Implications for South Africa

One does not have the impression of government promotion of CDM in South Africa. This is in the context of having a good national energy efficiency strategy document, but little rollout. The relevance here is that, despite often exceedingly good rates of return, energy efficiency proposals are rarely developed. It seems that the South African market is not aware and not concerned.

We believe that Nedbank would have to take awareness-raising upon itself before being able to build a successful CDM business. In this case the bank would need a specialist team able to identify opportunities and engineer viable technical solutions in the first place. Only then could financing be addressed. There are innovative ways of doing this, and the bank would have to be prepared to take on an extended role beyond lending, such as contract energy management. This would be a departure from the normal banking role with prospects as quantified elsewhere in this report.

4. Greenhouse gas mitigation from industrial energy efficiency and renewable electricity generation

The following section gives results of macro-modelling efforts indicating the quantities of CO_2 emissions that can be mitigated from the two largest 'interventions' in the energy sector: the adoption of large-scale industrial energy efficiency and renewable energy. All assumptions are taken from national studies[1] and represent both government's and industry's view of future energy usage, and in turn greenhouse gas (GHG) emissions. The modelling is undertaken using the Long Range Energy Alternatives Planning (LEAP) model (SEIB 2006).

Some important assumptions are that the costs are real, but undiscounted, and that we consider the period 2007-2012 (inclusive) when reporting the cost benefit analysis. This is the period for which CDM is currently active. It is highly likely that mitigation opportunities will exist past this period, and therefore reasonable that the bank consider both the short and longer terms. CERs are assumed to be worth $10 per ton, with an assumed exchange rate of R6 to the dollar. Transaction costs are not included, but similar DSM projects have monitoring and verification costs of less than 10% of the fuel savings.

Firstly, let us consider GHG emissions from the energy sector - which accounts for over 70% of GHG emissions in South Africa, where energy is dominated by coal and therefore CO_2-intensive. In industry, energy – including coal, oil and other fuels, such as synthetic gas – is burned on site. Industry also uses large quantities of electricity. This electricity is generated from coal, and though emissions are not given off at the point of consumption, electricity consumption results in 'indirect emissions' at the power stations.

Figure 1 gives emissions by source for a business-as-usual future, with emphasis on the current CDM period of operation. Figure 2 shows the proportion of emissions by sector in 2005. These emissions are divided into those from the production or 'supply' of energy to sectors that use or

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1 The studies are, for energy efficiency, the Integrated Energy Plan (IEP) of the DME (DME 2003) and Trikam et al. (2003). For the introduction of renewable energy the National Integrated Resource Plan (NIRP 2) developed by the National Electricity Regulator (NER 2004) is used

'demand' energy. Thus sectors are labelled with the prefix 'supply-' or '-demand'. Thus though a demand sector such as industry consumes electricity, the emissions released from generating that electricity are included in the 'supply-electricity' slice of the graph. However, if we were to apportion the emissions from the supply sectors to the sectors which demand the energy, this would be useful for estimating the emissions that could be saved from reducing the demand of energy. Figure 3 apportions energy-related CO_2 emissions to demand sectors for 2005.

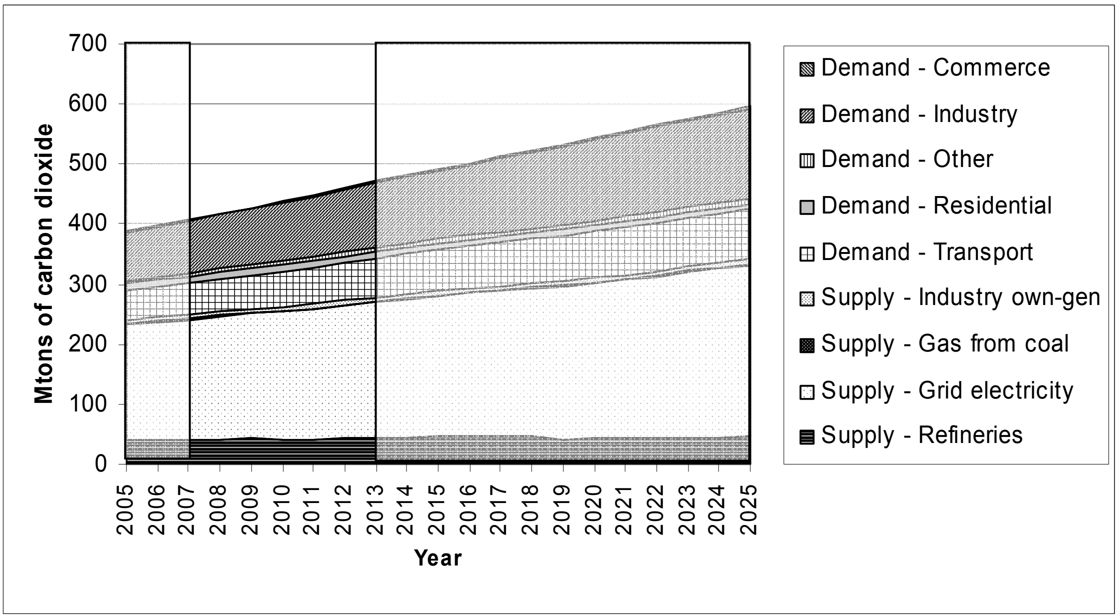


Figure 1: Business as usual emissions from the South African energy sector for a business-as-usual future

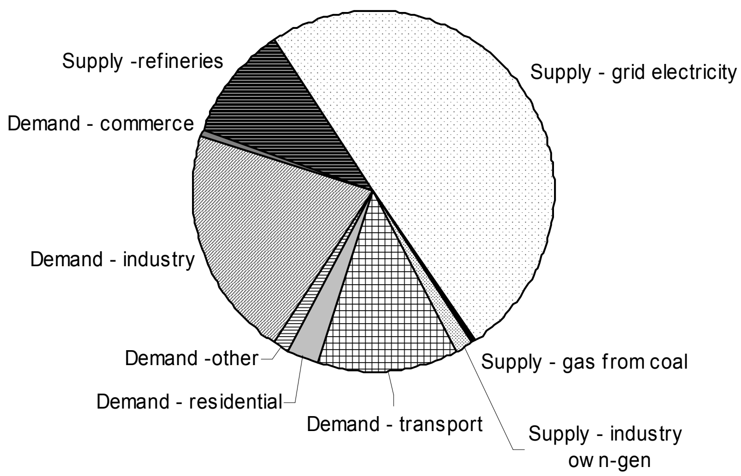
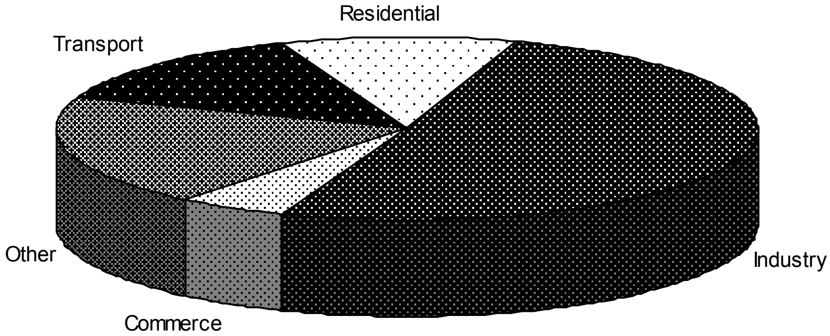


Figure 2: CO_2 emissions by sector in 2005



Note: This assumes that emissions are apportioned proportionally to fuel consumption. For example, industry consumes 67% of electricity generated, and therefore responsible for 67% of their emissions.

Figure 3: CO_2 emissions apportioned to demand sectors for 2005

4.1 Industrial energy efficiency

Our analysis of GHG mitigation begins with industrial energy efficiency. To be energy efficient is to supply a given service, such as lighting, with less energy than business-as-usual. The result is a saving in energy (with associated cost savings) and, if that energy is generated by burning fossil fuels, a saving of CO_2. If electricity is saved, then emissions are reduced indirectly as less coal is burned in power stations. Figure 4 contrasts business-as-usual emissions levels with emissions from a future with a moderate penetration (about 15-40% of the economic technical potential) of energy efficiency in industry.

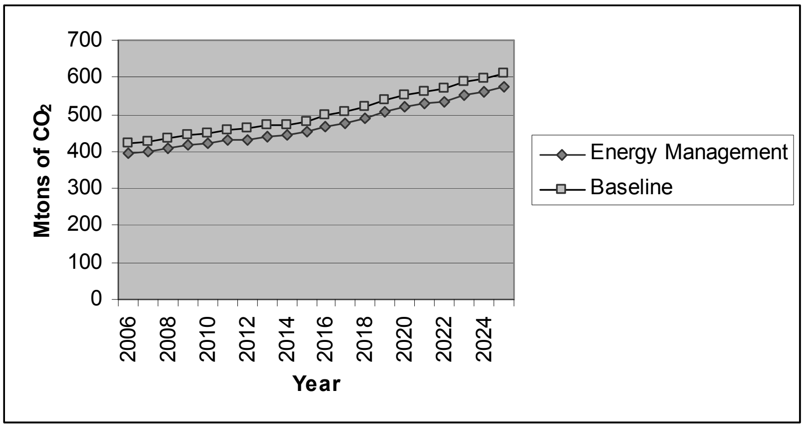


Figure 4: Emissions from 'business as usual' versus 'industrial energy efficiency'

Figure 5 shows emissions savings, and Figure 6 indicates the potential revenue from CERs. Note that other costs or benefits accruing from the energy efficiency measures are not considered.

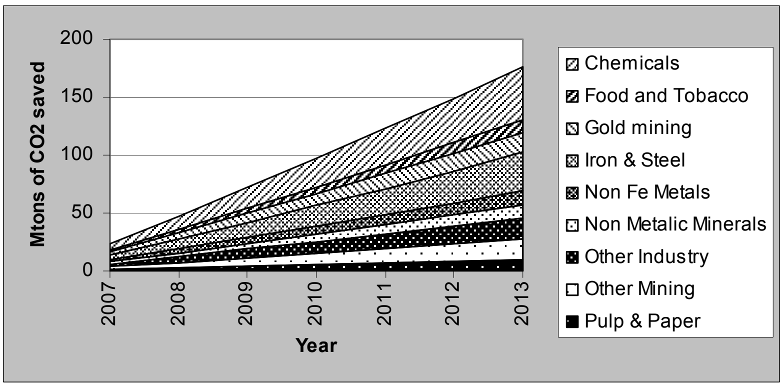


Figure 5: Cumulative emissions savings by energy management in industry

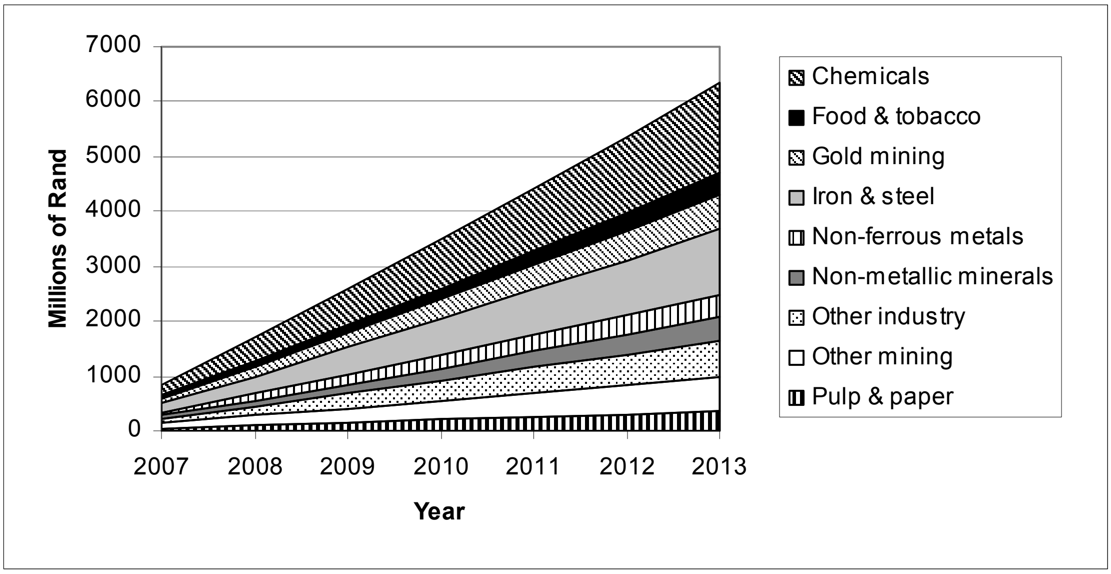


Figure 6: Gross cumulative CER values

4.1.1 The chemical industry

The chemical industry is looked at here as a special example. Figure 7 gives moderate (direct and indirect) emissions savings potentials for the industry that would accrue to energy efficiency measures. Figure 8 shows conservative estimates of the cash flows involved. These are significant, with this subsector accruing close to R1 billion at the end of the period. While CER revenues provide part of the income, most is derived from fuel savings, with some losses due to the extra cost of implementing the energy efficiency measures.

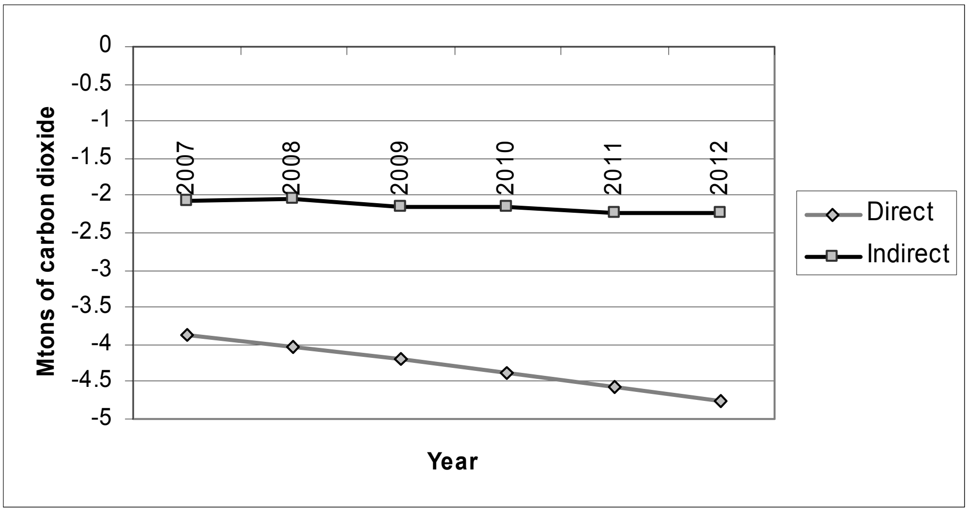


Figure 7: Emissions reduction potentials from the chemicals industry

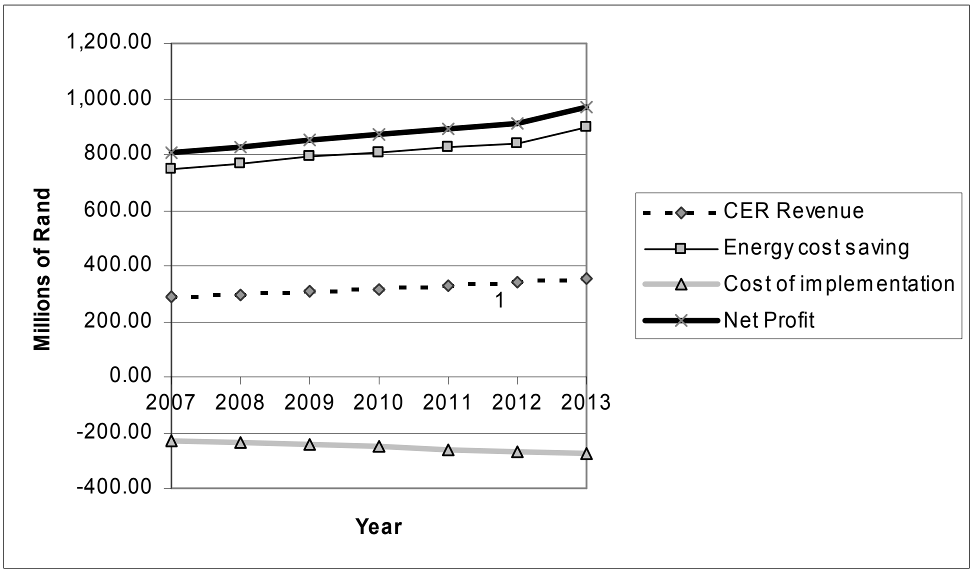


Figure 8: Costs and benefits of energy efficiency in the chemicals industry

4.1.2 Summary of results for industrial energy efficiency

The following two graphs summarise the overall income and potential GHG savings by industry, for selected industries. Figure 9 shows the potential cost of mitigation (the area under the grey line – the assumed price of CERs – indicates profit). In Figure 10 the total cash flows over the period are given. A 'DSM credit' is also included, which is assumed to be the avoided cost of power station construction.

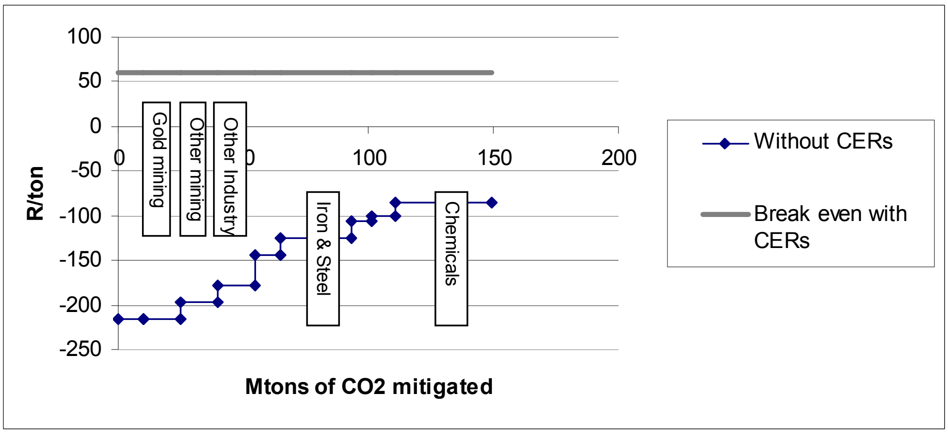


Figure 9: Energy efficiency opportunities, with area under the grey line indicating income

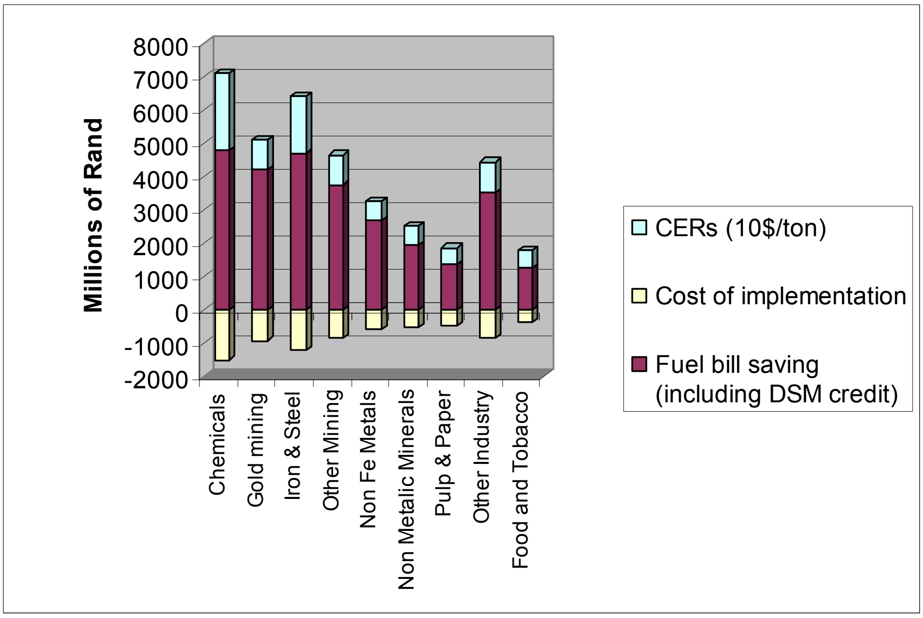


Figure 10: Summary of selected EE cash flows

As electricity is saved, new power station requirements are reduced; an estimate of MW saved is given in Figure 11.

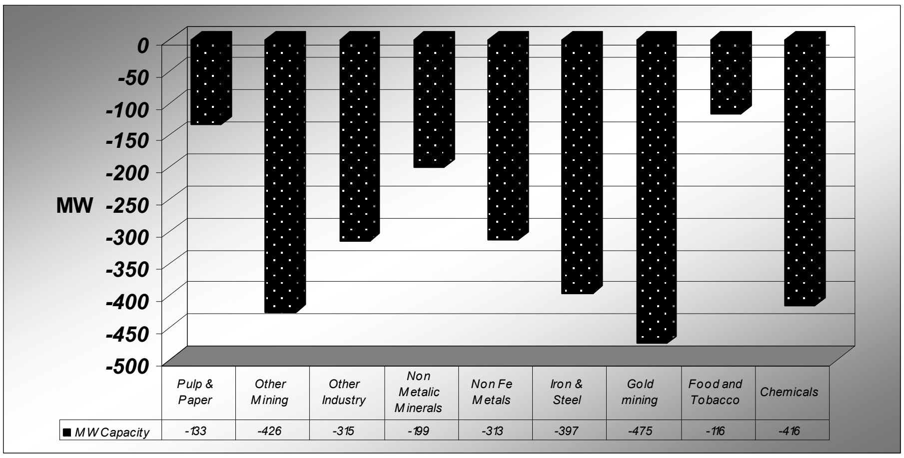


Figure 11: MW saving in the year 2012 from industry

Finally, an estimate is made of the baseline emissions for each industrial sector without any energy efficiency interventions. This graph totals the direct emissions together with an estimate (based on proportional electricity consumption) of indirect emissions from electricity generation.

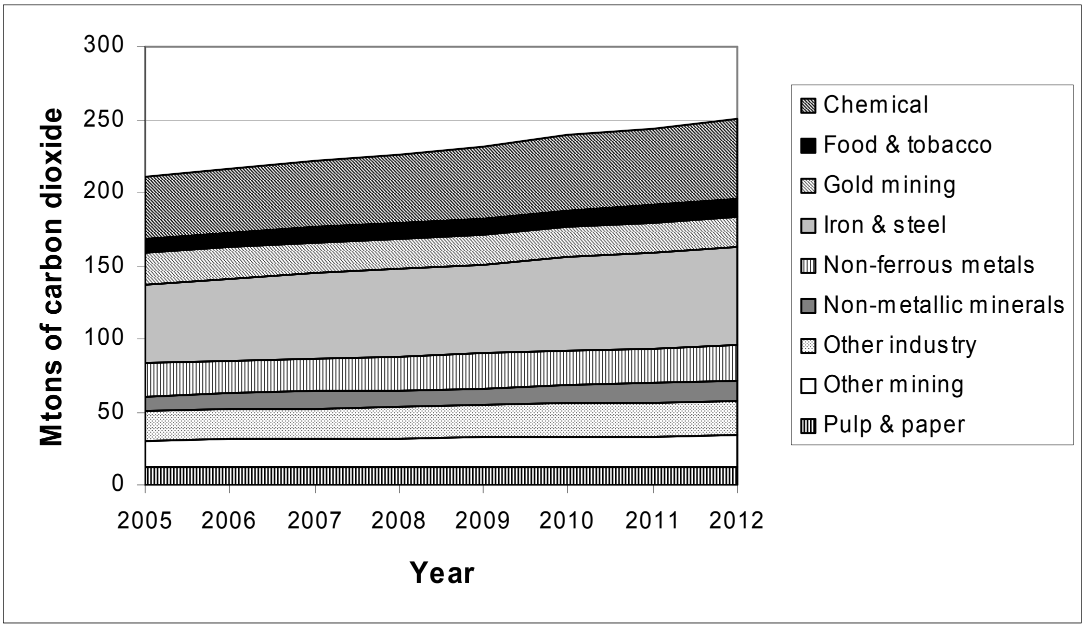


Figure 12: Baseline emissions by industry

4.2 Notes on methodology for energy efficiency costing

In this section, we summarise some aspects of how the energy savings in industry were calculated. Each industry uses fuel for different end uses and in different proportions. An example, of the split of electricity consumption by end use by industry is summarised in table 2 (Howells *in Press*). Examples of the 'end-uses' of electricity include its use in compressors to provide compressed air, in lights for lighting etc.

Table 2: Electricity split into end-use by industry (%)

	Food and beverages	*Textiles*	*Wood and wood products*	*Chemicals*	*Iron and steel*	*Non ferrous metals*	*Rest of basic metals*	*Rest of manufacture*	*Non metallic minerals*	*Gold mining*	*Other mining*
Indirect uses-boiler fuel	2	1	3	1	0	0	0	1	0	0	0
Process heating	4	5	6	3	39	1	17	10	8	2	2
Process cooling and refrigeration	24	7	0	6	1	0	0	5	0	7	7
Compressed air	8	10	38	10	8	0	11	9	14	20	20
Other machine drive	44	50	38	53	40	2	56	47	72	45	45
Electro-chemical processes	0	0	0	18	2	95	17	11	0	0	0
Other process use	0	1	1	0	1	0	0	1	0	10	10
Facility HVAC	8	15	4	4	3	1	0	8	3	8	8
Facility lighting	7	10	7	3	4	1	0	7	3	4	4
Facility support	2	2	1	1	1	0	0	2	0	4	4
Onsite transportation	0	0	0	0	0	0	0	0	0	0	0

Based on audit data, rough estimates of the cost of using energy more efficiently can be made, as in Table 3.

Table 3: Conservative estimates of the cost of using energy more efficiently

Energy efficiency measure	*Life (Years)*	*Percentage of energy saved*	*Payback (Years)*
Electricity saving			
Electrical steam system saving	3	0.2%	0.7
Other thermal savings from electrical based heating	2	1.8%	2.6
Higher efficiency motors	8	3.1%	7.0
Variable speed drives	8	3.1%	5.6
Lighting	5	2.7%	3.6
Compressed air saving	4	4.5%	0.9
Heating ventilating and cooling measures	5	0.9%	2.2
Refrigeration efficiency	5	0.7%	1.4
Coal			
Saving coal though boiler and furnace optimization as well as steam saving	3	15%	1.0
Oil			
Oil saving	3	15%	0.5

In order to derive the percentage of electricity saved, the quantity saved by 'end-use' was calculated for each industry and aggregated. Estimates for the saving possible by end-use are conservative. Values, similar to those used in this report, taken from Howells (*in press*), are given below:

Table 4: DSM interventions and their potential (stand alone) savings by end use

Use of fuel / measure considered	*Steam system*	*Other thermal measures*	*Efficient motors*	*VSDs*	*Efficient lighting*	*Compressed air saving*	*HVAC*	*Refrigeration*	*Load shifting*
Indirect uses-boiler fuel	15%	5%							
Process heating		5%							
Process cooling and refrigeration				10%					20%
Machine drive (inc compressed air)			5%	5%		15%		15%	
Electro-chemical processes									
Other process use									
Facility HVAC			5%	10%			30%		20%
Facility lighting					10%				
Facility support									
Onsite transportation									

4.3 Renewable electricity generation

Electricity generation is responsible for the largest quantity of CO_2 emissions. Forms of generation that are cleaner than coal, such as gas, nuclear and renewables, are mitigation options. This section considers renewable electricity generation, taking as a cue the recent renewable energy target of the DME, and focusing on renewable options that would be needed to meet this. Figure 13 reports emissions expected from a business-as-usual future.

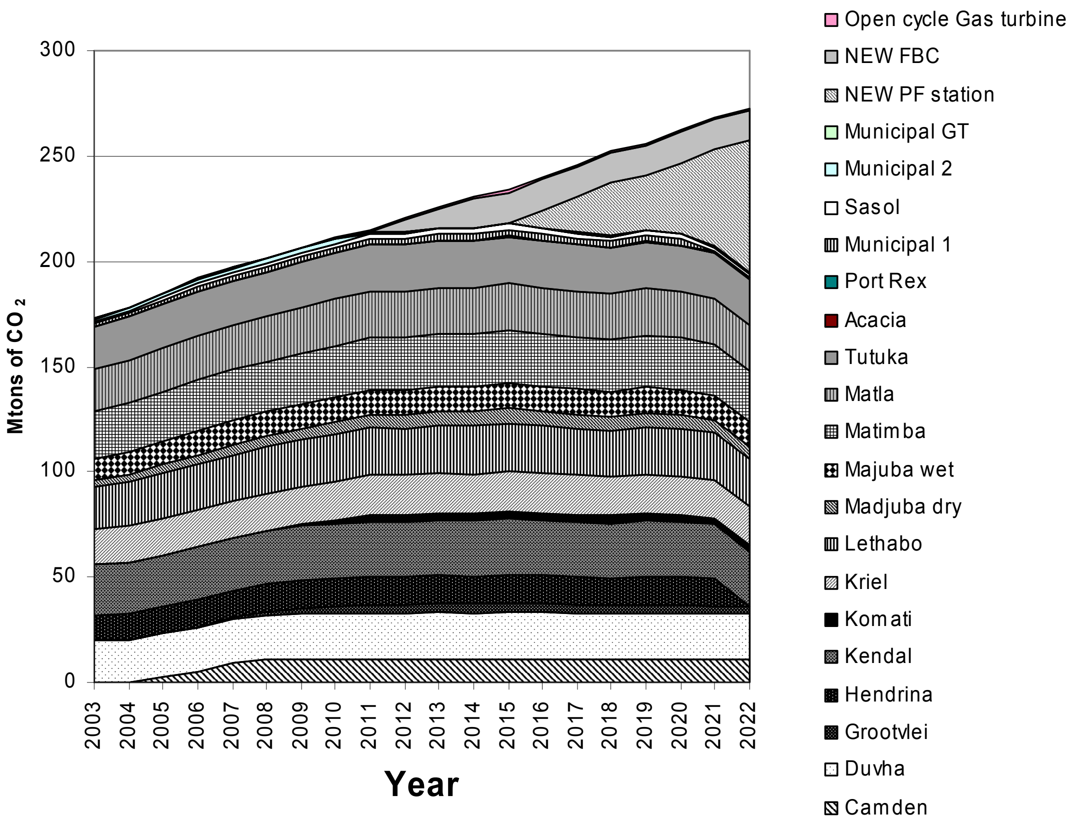
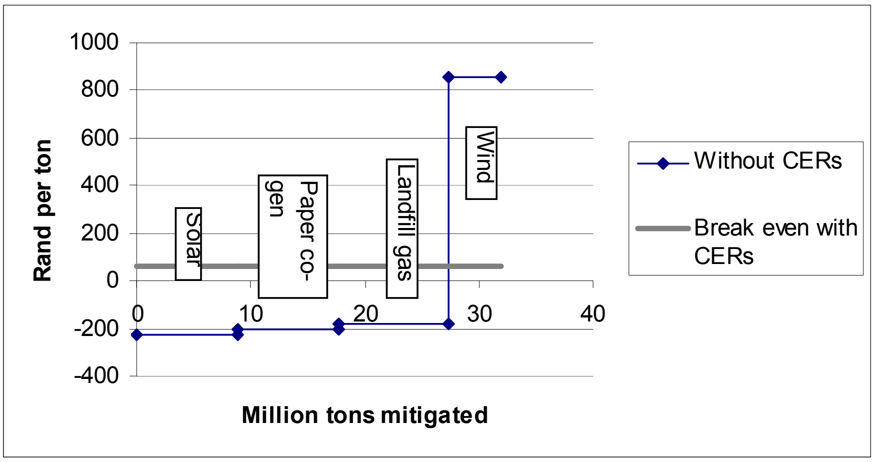


Figure 13: Estimated GHG emissions by power station in South Africa

By implementing the renewable energy target, emissions will be reduced, and these generally at a premium. We report one such case in detail. It should be noted, however, that lower-cost options exist from which CDM projects are being developed in South Africa, including landfill gas and increased electricity generation at pulp and paper mills; these results are reported and summarized in figures 14 and 15. Figure 16 reports the total electricity that may be generated by renewable electricity suppliers were the RE target to be met.



Note: The area under the grey line indicates income

Figure 14: Renewable energy opportunities

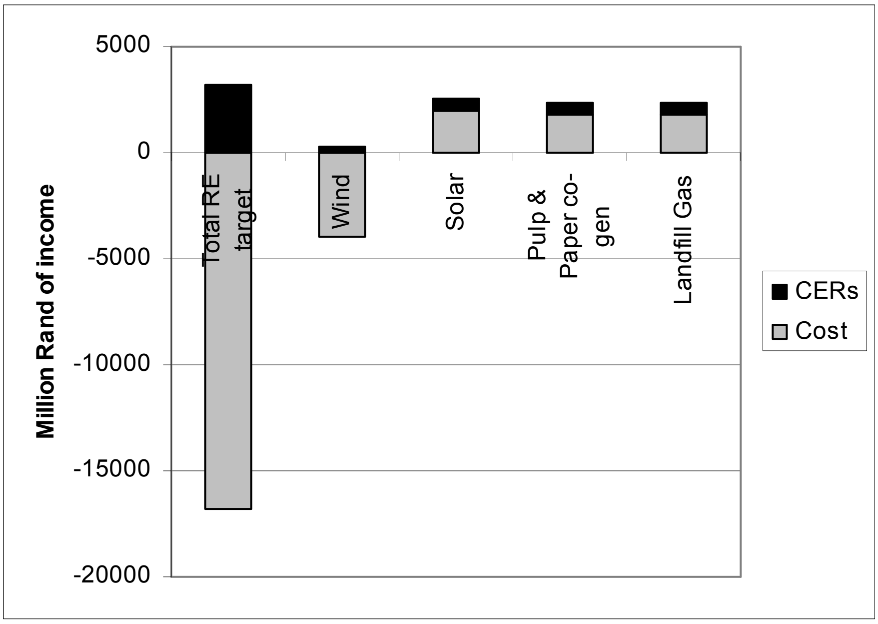


Figure 15: Summary of selected RE cash flows

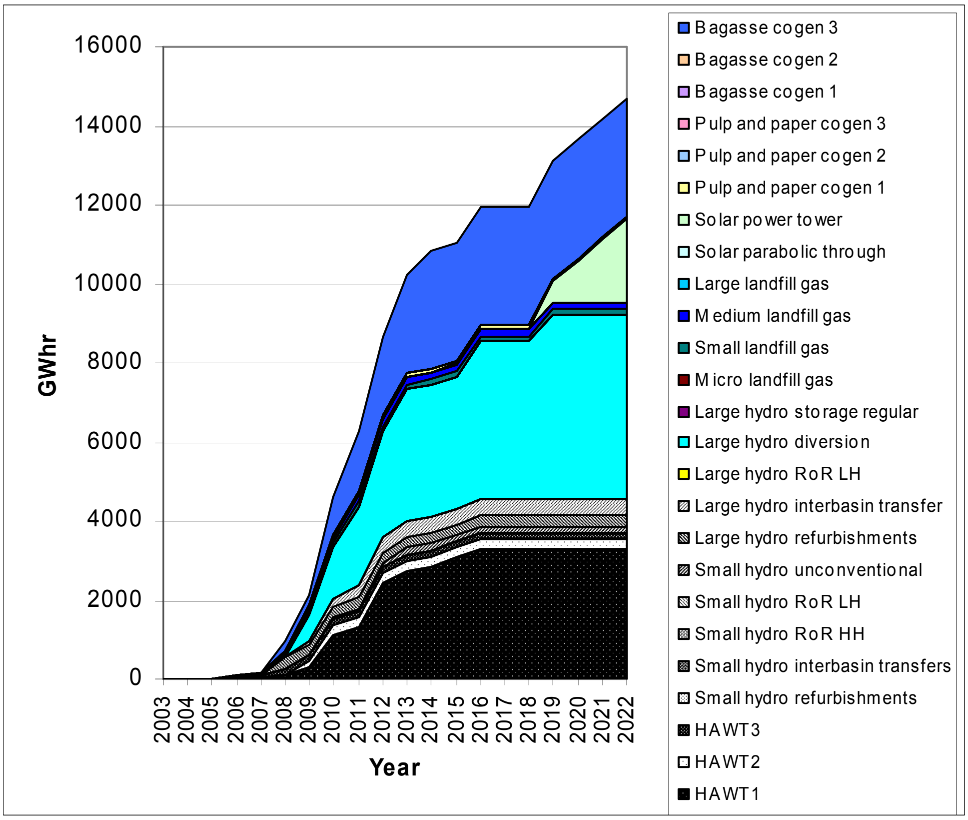


Figure 16: Electricity production by renewable energy technologies to meet proposed DME target

4.3.1 An example: Wind-generated electricity

Figure 17 reports the emissions savings associated with the installation of 1500MW by 2020 of wind turbines, in 2020 close to 10 million tons of CO_2 are mitigated. With a CER price of $10 per ton, this would translate to gross CER income of R600 million in 2020.

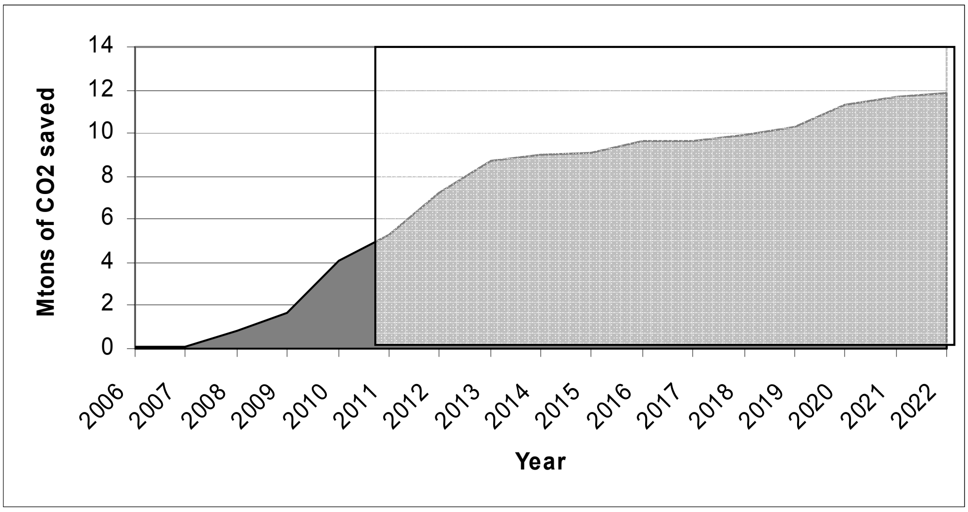


Figure 17: Estimated emissions savings by implementing 1500MW of wind energy in South Africa by 2020

However, when considering the premium to be paid for wind power, CERs would not be sufficient to make the project economically viable. Figure 18 shows the premium required (with no CERs). It can be noted, however, that other government funds are being made available to reach the renewable energy target. This being the case, expensive options such as wind may use CERs to generate extra revenue over and above RE subisidies.

Figure 18: Increased costs associated with the uptake of wind energy

4.4 SF_6 emissions

SF_6 is a compound used in large electrical transformers and switchgear. It has a high global warming potential, but is a relatively small contributor to South Africa's total GHG emissions. SF_6 emissions reduction is not considered here, as specific knowledge of this is held by the electricity supply industry, which is autonomously pursuing it as a potential mitigation option.

4.5 Sequestration (forests)

There is not much opportunity in South Africa, relative to energy projects (see, e.g., Engelbrecht et al. 2004). It may be noted that:

- sequestration is not necessarily permanent – for example, carbon stored in trees could be lost again in forest fires;
- leakage is difficult to assess; and

- cultivating specific species for rapid carbon uptake may adversely affect biodiversity and water requirements.

4.6 South Africa in context

Table 5 summarises South Africa's position relative to other countries in terms of carbon emissions per person in 2000.

Table 5: Global greenhouse gas emissions, 2000
Source: WRI (2006)

Rank	*Country*	*MtC*[a]	*% of regional total*	*Tons C per person*[b]
1	United States	1 891.79	20.62	6.6
2	China	1 355.58	14.77	1.1
3	European Union (15)	1 085.75	11.83	2.9
4	Russian Federation	519.94	5.67	3.6
5	India	506.04	5.51	0.5
6	Japan	364.05	3.97	2.9
7	Germany	265.18	2.89	3.2
8	Brazil	229.54	2.50	1.3
9	Canada	194.75	2.12	6.3
10	United Kingdom	180.58	1.97	3.1
11	Italy	145.95	1.59	2.5
12	Korea (South)	143.41	1.56	3.1
13	Ukraine	142.54	1.55	2.9
14	Mexico	139.42	1.52	1.4
15	France	137.17	1.49	2.3
16	Indonesia	134.95	1.47	0.7
17	Australia	130.42	1.42	6.8
18	Iran	119.74	1.30	1.9
19	South Africa	112.76	1.23	2.6
20	Spain	104.25	1.14	2.6
21	Poland	102.45	1.12	2.7
22	Turkey	98.89	1.08	1.5
23	Saudi Arabia	90	0.98	4.3
24	Argentina	79.08	0.86	2.1
25	Pakistan	77.9	0.85	0.6

Notes:
a) MtC = million metric tonnes of carbon equivalent
b) Tons C = metric tons of carbon equivalent

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