Multi-project baselines for potential Clean Development Mechanism projects in the electricity sector in South Africa

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1. Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) aims to reduce emissions of greenhouse gases (GHGs) in order to 'prevent dangerous anthropogenic interference with the climate system' and promote sustainable development [(1)]. The Kyoto Protocol, which was adopted in 1997 and appears likely to be ratified by 2002 despite the US withdrawing, aims to provide means to achieve this objective [(2)].

The Clean Development Mechanism (CDM) is one of three 'flexibility mechanisms' in the Protocol, the other two being Joint Implementation (JI) and Emissions Trading (ET). These mechanisms allow flexibility for Annex I Parties (industrialised countries) to achieve reductions by extra-territorial as well as domestic activities. The underlying concept is that trade and transfer of credits will allow emissions reductions at least cost. Since the atmosphere is a global, well-mixed system, it does not matter where greenhouse gas emissions are reduced.

The CDM allows Annex I Parties to meet part of their emissions reductions targets by investing in developing countries. CDM projects must also meet the sustainable development objectives of the developing country. Further criteria are that Parties must participate voluntarily, that emissions reductions are 'real, measurable and long-term', and that they are additional to those that would have occurred anyway. The last requirement makes it essential to define an accurate baseline.

The remaining parts of section 1 outline the theory of baselines, emphasising the balance needed between environmental integrity and reducing transaction costs. Section 2 develops an approach to multi-project baseline for the South African electricity sector, comparing primarily to near future capacity, but also considering recent plants. Five potential CDM projects are briefly characterised in section 3, and compared to the baseline in section 4. Section 5 concludes with a discussion of options and choices for South Africa regarding electricity sector baselines.

1.1 Baselines and additionality

Reductions of GHG emissions must be additional to business-as-usual. If a project would have happened anyway, it should not be a CDM project and receive investment through that mechanism. Once a project has qualified for the CDM and been implemented, the certified emissions reductions need to be calculated. To do so, the difference between the baseline and the project performance needs to be calculated.

Like any projection, baselines depend on assumptions about the future. Key assumptions include the level of economic growth, energy supply and demand, and the emissions assumed as a starting point. Baselines are counterfactual, in the sense that, due to climate change policy, the baseline will never occur.

1.2 Minimising transaction costs while ensuring environmental integrity

The aim of multi-project (or standardised) baselines must be to seek a balance between ensuring environmental integrity and minimising transaction costs. Setting project-by-project baselines would increase the transaction costs of CDM projects and thus reduce the number of projects that attract investment. The experience of the AIJ[1] pilot phase was that baselines are time-consuming and highly subjective. Hence there have been suggestions to standardise baselines across many projects, to set them for particular sectors, or given technologies. Multi-project baselines based on emissions intensity are known as benchmarks.[2] A concern about multi-project baselines is that they might undermine the environmental integrity of the Protocol, in that emissions reductions might be credited that are not 'real'.

Establishing a baseline for a particular activity, sector and/or region potentially simplifies the calculation of emissions reductions. Baselines need to be simple enough to be practical in developing countries. This article considers one approach to multi-project baselines for the electricity generation sector, and the implications for a set of potential CDM projects in South Africa.

Which approach is finally adopted will depend on the international rules set in the UNFCCC negotiating process. Current text (FCCC/CP/2001/CRP.11) suggests that a project-specific approach will initially be followed, with the Executive Board of the CDM developing simplified rules as experience is gained. Project participants are likely to have a choice of baseline methodology.

2. Baselines for South African electricity generation

A key decision in determining baselines is to identify the plants to be included in the baseline. It is the performance of these plants or units that the potential CDM projects will be measured against. Performance is measured in terms of carbon intensity (kg C / kWh).

2.1 Recent or near future plants

One approach is to use data for recently constructed plants, assuming that these represent the best available technology. 'Recent' might mean different lengths of time, perhaps three to five years. An advantage of this approach is that the data for such plants is observable. This does not mean that there is no uncertainty about observed data. However, a forward-looking baseline that includes future plants needs to make additional assumptions about which plants would most likely be built. A forward-looking baseline has the advantage that it can consider new, more efficient technologies. In a context where the sector is changing rapidly, it is more 'realistic' about what new technologies are likely to be used. The reference scenario can therefore be based on recent plants or near future.

In South Africa, the backward-looking approach does not work for practical reasons. Only one power station, Majuba, has been commissioned in the last seven years.[3] Here, four units have become operational between 1996 and 1999, and two more are being constructed during 2000 and 2001. If one uses the 'recent plant' approach, one therefore compares the CDM projects to the performance of a single power station.

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1 Activities Implemented Jointly. The AIJ pilot phase was initiated at the first Conference of the Parties to test the impact of implementing emissions reductions projects in some countries (developing countries or economies in transition) and funded by others without generating credits.

2 See M. Lazarus *et al* (1999) for an evaluation of different approaches to benchmarking, and case studies of Argentina, China, South Africa, Thailand and the United States.

3 The last previous plant was Kendal, whose units were commissioned from 1988-1993 (Eskom 1996).

The slower growth in demand in South Africa in recent years creates some inertia against changes in the capacity mix (3). Opportunities to change the capacity mix towards low-carbon technologies are constrained by the existence of excess capacity and mothballed coal stations. These arguments are specific to the electricity sector in South Africa, and do not imply that other developing countries might not choose recent plant baselines.

A more general point is that forward-looking baselines are open to 'gaming'. Countries have an incentive to choose a reference scenario with high carbon intensity, so that CDM projects will be able to sell more credits. Gaming is also a problem for project-specific baselines. It can be avoided to some extent by including factors that are difficult to change – for example, requiring the projection to be based on published government or utility plans. Setting regional baselines also makes gaming more difficult, as would a system of international review (4). To the extent that gaming cannot be avoided, there is a trade-off between this risk and the risk of free riders against a backward-looking baseline that does not promote the best available technology.

In this analysis, we have therefore chosen a baseline that includes 'near future' plants. These include the two new units of Majuba, the recommissioning of two units in mothballed power stations, the importation of hydro, and a new gas plant. Given the directions set by Eskom's Integrated Electricity Plan 6, one could reasonably expect these units to come on line between 2000 and 2005.

	Majuba Unit 5	*Majuba Unit 6*	*Mothballed coal 1*	*Mothballed coal 2*	*New gas*	*Imported hydro*
Capacity (MW)	713	713	570	870	736	400
Efficiency assumed [4]	34%	34%	30%	30%	55%	
Annual generation (TWh)	0.83	0.83	3.02	4.61	4.13	1.84
Annual fuel use (GJ)						None
Coal	8 685 461	8 685 461	36 252 666	55 333 017		
Natural Gas					27 057 200	
Carbon intensity (kg C / kWh)	0.295	0.295	0.338	0.338	0.100	0.000

Table 1: Key characteristics of a 'near future' baseline plants and units

Sources: Developed from data in NER (5), Eskom (6)

Some key results are compared using the 'recent plant' baseline, that is, considering the Majuba power station only.

2.2 Basis of comparison

Three key decisions are required to calculate the baseline:[5]

[4] When Eskom published annual Electricity Statistics (up to 1996), efficiencies were reported at the plant level. More recent NER and Eskom publications no longer carry this information. In the absence of such data, specifically, we assumed for Majuba specifically that the efficiency of the wet-cooled units was similar to the Eskom weighted average, which include several wet-cooled plants.

[5] These three decisions are analysed here. Lazarus *et al* (1999) note two further methodological issues – the degree of aggregation, and whether a static of dynamic baseline is used.

1. The first decision is which set of plants to include in the reference scenario. For each plant, the essential data is the fuel input (in GJ per year) and the electrical output (in TWh per year). Combining this information with the calorific value of the fuel and its carbon content, we can calculate the carbon intensity. The carbon intensity is measured in mass of carbon per unit of energy produced, e.g. in units of kg C/kWh.
2. The second issue is to which set of plants the potential CDM project should be compared. For example, does a new gas plant need to perform better than the average power station in the whole sector, the average fossil-fuelled plant, or better than other gas-fired plants only?

   These comparisons can be applied to different sub-sets of the plants in the baseline. The project can be compared to other plants using the same fuel (‘fuel-specific’), to all fossil fuel-fired plants (‘all fossil’), or to the whole electricity generation (‘sector-wide’). Obviously, the fuel-specific comparison only works if there is a plant or unit in the baseline using the same fuel as the project.
3. The third decision is whether to compare projects against average, better-than-average or best plants. Once the carbon intensity of the plants in the reference scenario are known, we can construct increasingly stringent benchmarks – a weighted average, 25th percentile, 10th percentile or the best plant. One would expect the carbon intensity required by each of these benchmarks to be lower – in other words, the CDM project will have to show lower carbon intensity than a harder target.

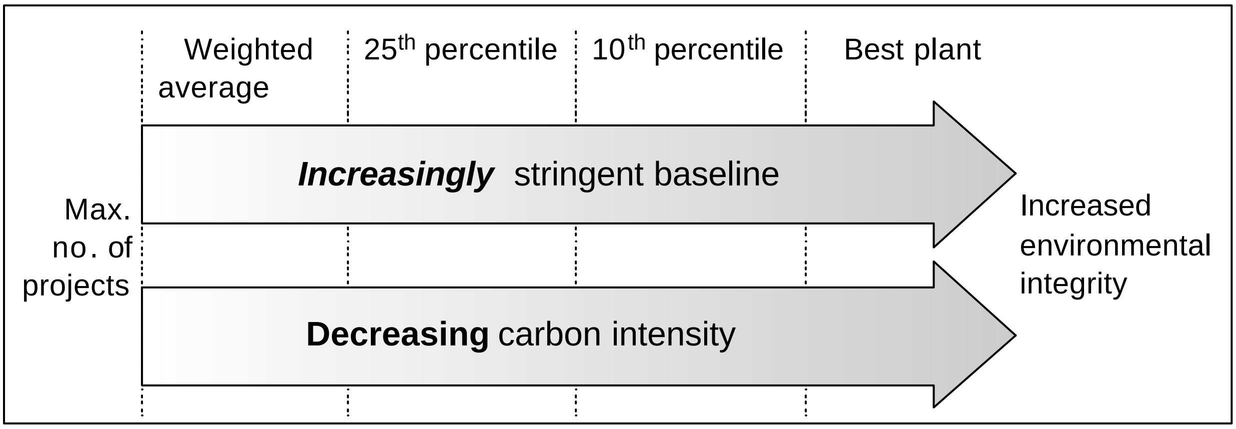

Figure 1: Relative stringency of different benchmarks

Table 2 shows the baseline intensities – both energy and carbon intensity – given the units included in the ‘near future’ baseline. No energy intensity is reported for the sector, since this concept has different meanings for fossil fuel plants and those using renewable energy sources. There is no ‘fuel’ for hydropower, so no fuel-specific intensities are reported. For the purposes of this analysis, we assume that the carbon intensity is zero, although this may well not be the case (7). The carbon intensity for gas is calculated from the fuel input and electrical output of one station only (“new gas” from Table 1). Carbon intensity represents the baseline for CDM projects; energy intensity is reported for information only.

				Weighted average**	Percentile 25%	Percentile 10%	Best plant
Fuel specific	Energy intensity	MJ/kWh	Coal	11.72	10.90	10.46	10.46
			Gas	6.55*	6.55*	6.55*	6.55
	Carbon intensity	Kg C/kWh	Coal	0.330	0.307	0.295	0.295
			Gas	0.100*	0.100*	0.100*	0.100
All fossil	Energy intensity	MJ/kWh		0.259	0.100	0.100	0.100
	Carbon intensity	Kg C/kWh		0.270	0.128	0.100	0.100
Sector wide	Carbon intensity	Kg C/kWh		0.228	0.052	0.000	0.000

Note: * Based on one plant only – see text.

** Weighted average of plants in reference scenario, not all South African plants

Table 2: Energy and carbon intensities for the near future baseline

The benchmarks get more stringent from left to right, as expected. However, the coal-specific carbon intensity is identical whether one uses the 25th percentile, 10th percentile or best plant. This is because several of the coal units included in the baseline have identical performance. Natural gas has much lower carbon intensity than coal – and this constitutes the best plant and 10th percentile for the 'all fossil' comparison. The zero carbon intensity sector-wide reflects the inclusion of imported hydro and the assumption that it is zero-emitting.

The baseline generally gets more stringent as one moves from fuel-specific to 'all fossil' and 'sector-wide' comparisons, as 'all fossil' adds in natural gas, and the sector adds the imported hydro, bringing down the weighted average carbon intensity.

As can be expected, the weighted average carbon-intensity of the plants in the reference scenario selected here is lower at 0.228 kgC/kWh than the average for all plants. Eskom reports that the total electricity produced in 2000 was 189 307 GWh (net) [(9)] and that total carbon dioxide emissions from coal-fired power stations were 161.2 million tons of CO_2 [(9)]. The reported carbon intensity is 0.85 kgC/ kWh [(9)], which converts to 0.232 kg CO_2 / kWh. In other words, the average carbon intensity of the current mix of Eskom plants is less than 2% higher than that of the reference scenario of 'near future' plants.

For gas, the fuel-specific carbon intensity is lower than the all-fossil or sector-wide intensity, which includes more carbon-intensive coal. The weighted average and percentiles for gas are based on one plant only. While it may be more mathematically correct to base such measures on more than the one gas plant included here, the value of the single plant is included across all, as that is what one would compare the project against. Figure 2 illustrates the near future baseline graphically, showing each plant's carbon intensity against its share of generation.

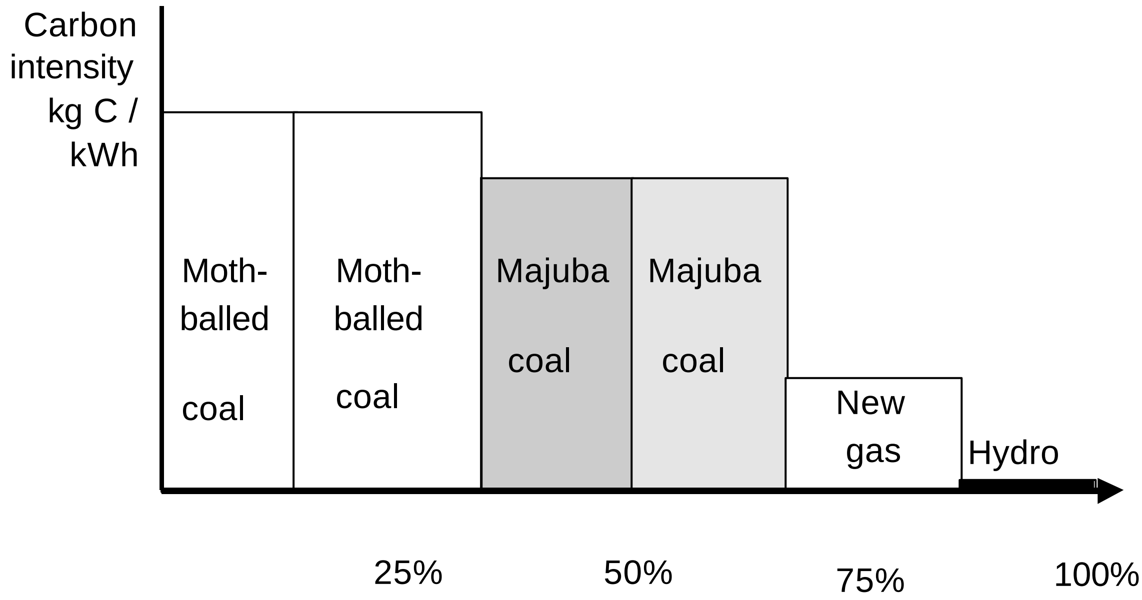

Figure 2: Near future reference scenario carbon intensity (kg CO_2/kWh) against the share of generation (TWh)

3. Potential CDM projects – supply options and demand interventions

A critical methodological choice is which potential CDM projects to include in the analysis. The purpose of this analysis is not to compare different CDM projects, but rather to investigate the impact of different baselines on hypothetical projects in South Africa. To make the analysis worthwhile, the data should be as realistic as possible. For this analysis, we chose diverse projects – some using fossil fuels, others using renewable energy sources, as well as a demand-side intervention and an off-grid project. Including both supply and demand-side options ensures that these interventions are treated equally. These projects include the following:

- The Cape Metropolitan Local Authorities and Shell are investigating the feasibility of importing gas from the Kudu gas fields for three units of 368 MW each [(10)]. New gas-fired power plants are substantially less carbon-intensive than coal-fired plants. Further possibilities being explored are using natural gas from fields off Mozambique and piping gas to Johannesburg and Secunda.
- The Darling wind farm is aiming to install 5 MW for production of electricity for the grid. This independent power producer is the bulk renewable energy project in South Africa, which has progressed the furthest towards implementation [(11)].
- As part of the South African Country Study on Climate Change, the possibility of more efficient, super-critical coal plants was investigated [(12)]. The more efficient use of coal in these plants could reduce greenhouse gas emissions.
- Eskom's Efficient Lighting Initiative aims to install 18 million compact fluorescent lights (CFLs) to reduce energy demand in the residential sector [(13)]. Rather than

increasing supply, this project aims to reduce demand for electricity, and thus avoid emissions.

- Off-grid solar home systems have been used to electrify rural areas unlikely to receive grid electricity. The aim of the programme is to extend this from initial projects to a target market of 350 000 households (14). In comparing this programme to the multi-project baseline, one implicitly assumes that it will displace electricity. It is more likely that paraffin will be displaced for lighting. This trade-off is necessary if one wants to benefit from the simplicity of applying a single baseline to many projects.

This set of CDM projects in no way claims to be comprehensive.[6] We chose a small sample of projects that, in our opinion, are likely early-start CDM projects, are the subject of major pending decisions, or use commercially available technologies. On the basis of the data in Table 3, these five CDM projects were compared to various baselines.

	New gas: Cape Power Project	*Wind energy: Darling*	*New coal: supercritical steam*	*Efficient Lighting Initiative*	*Off-grid solar home systems*
Capacity (MW)	368	5	1 974	1 080 *	17.5
Efficiency assumed	55%	N/a	47%	N/a	N/a
Annual generation (TWh)	2.07	0.00876	10.46	4.00 *	0.02555
Annual fuel use (GJ)		None		None	None
Coal			80 137 473		
Natural Gas	13 528 600				
Carbon intensity (kg C / kWh)	0.100	0.000	0.216	0.000	0.000

* Avoided capacity and generation.

Table 3: Key characteristics of potential CDM projects

Sources: Developed from data in Roggen (10), Howells (12), Karottki & Banks (15), Eskom (13) and Qase (14)

4. Comparing potential projects to baselines

Having identified a 'near future' reference scenario and potential CDM projects, the performance of each project can now be compared to various baselines.

4.1 Decrease in carbon intensity from CDM projects under near future baseline

Table 4 compares the performance of projects against different baselines. It shows by how much the CDM project's intensity *beat* the baseline. A positive number indicates a lower carbon intensity than the baseline; the bigger the number, the better the

[6] Projects that were *not* included in the analysis were the nuclear PBMRs, solar thermal technologies and IGCC new coal. Pebble Bed Modular Reactors are being investigated by Eskom, who are currently conducting an EIA for two pilot plants (110 MW each) at Koeberg. They were not since nuclear technologies are not eligible for CDM investment. Solar thermal technologies for electricity generation are at an early stage of investigation in South Africa. The SA Bulk Renewable Generation (SABRE-Gen) project is conducting feasibility studies and demonstration facilities, but is not as close to implementation as wind. Integrated Gasification Combined Cycle (IGCC) new coal plants may achieve up to 55% efficiency, but are not expected to be implemented before 2025 (Howells 1999).

performance in terms of carbon intensity. Only projects with positive numbers are viable as CDM projects.

	Baseline standard	New gas: Cape Power Project	Wind energy: Darling	New coal: Super-critical steam	Efficient Lighting Initiative	Off-grid Solar Home Systems
Fuel specific	Weighted average	0.000	n/a	0.114	n/a	n/a
	25th percentile	0.000	n/a	0.091	n/a	n/a
	10th percentile	0.000	n/a	0.079	n/a	n/a
	Best plant	0.000	n/a	0.079	n/a	n/a
All fossil	Weighted average	0.159	0.259	0.044	0.259	0.259
	25th percentile	0.000	0.100	-0.116	0.100	0.100
	10th percentile	0.000	0.100	-0.116	0.100	0.100
	Best plant	0.000	0.100	-0.116	0.100	0.100
Sector wide	Weighted average	0.128	0.228	0.012	0.228	0.228
	25th percentile	-0.048	0.052	-0.164	0.052	0.052
	10th percentile	-0.100	0.000	-0.216	0.000	0.000
	Best plant	-0.100	0.000	-0.216	0.000	0.000

Table 4: Decrease in carbon intensity from CDM project against NEAR FUTURE baseline (kg C/kWh)

These results suggest that:

- Fossil fuel CDM projects struggle to beat the baseline if anything other than fossil fuels is included. One can see this trend for new gas and new coal, as one moves from the 'all fossil' to the 'sector-wide' comparison, with the latter including hydro. In short, with a sector-wide comparison, new coal and new gas projects would attract less CDM investment.
- Renewables do well under most comparisons, except plants in the top 10 percent sector-wide,[7] which compares them to zero-emitting imported hydro. Renewables in South Africa probably should be compared to the sector, since they might substitute a wide range of electricity sources, not only coal.
- Gas looks best if you compare it to fossil fuels only, since in South Africa, that means mainly coal. The fuel-specific comparison for gas shows zero improvement in carbon intensity, since units of new gas were included in the baseline, and another, identical unit included as a CDM project. The implication of this choice is that new gas projects would have to do better than ones included in the 'near future' baseline in order to qualify as CDM projects and gain CERs. Thus assumptions about the type of gas plant that would have been built anyway are critical. The broader debate is whether the CDM should be a means to promote gas, given its lower carbon intensity, or whether scarce CDM investment should go to projects, which are not financially viable at current prices.

[7] The fuel-specific comparison does not apply, since no fuel is consumed in the sense that fossil fuels are used.

In the South African context, the sector-wide baseline appears to make the most sense, because the actual electricity displaced by these projects will include the coal, gas and hydropower that would likely come on-line from 2000 to 2005. The CDM projects will not only displace coal power, so that any fossil-fuel projects that want to attract CDM investment have to compete with gas and hydro, as do renewables.

This approach assumes that one is aiming to ensure environmental integrity – that is, that any emissions reductions claimed are real. If the aim was to maximise the number of CERs produced in South Africa, that would imply a different set of choices.

The additional credits from a less stringent baseline can be quite substantial, as shown in the annual emissions reductions in kilotons of carbon in Table 5. These tables reflect the different size of projects, as well as their carbon intensity.

	Baseline standard	*New gas: Cape Power Project*	*Wind energy: Darling*	*New coal: supercritical steam*	*Efficient Lighting Initiative*	*Off-grid solar home systems*
Fuel specific	Weighted average	None	N/a	1 198	N/a	N/a
	25th percentile	None	N/a	954	N/a	N/a
	10th percentile	None	N/a	824	N/a	N/a
	Best plant	None	N/a	824	N/a	N/a
All fossil	Weighted average	329	2	457	1 038	7
	25th percentile	none	1	none	401	3
	10th percentile	0	1	none	401	3
	Best plant	none	1	none	401	3
Sector wide	Weighted average	265	2	130	913	6
	25th percentile	none	0	none	208	1
	10th percentile	none	none	none	none	none
	Best plant	none	none	none	none	none

Table 5: Carbon reductions by project based on NEAR FUTURE baseline (kilotons C/yr)

Of note in these results are the relatively small absolute carbon reductions for the wind energy and off-grid SHS projects. For wind, this is primarily due to the small size of the project (5 MW). Given the good performance of wind on carbon intensity, this points to the need to scale up renewable energy projects.

If better-than-average benchmarks (e.g. 25th percentile) are applied, the fossil fuel CDM projects analysed result in no or relatively small carbon reduction for their size. If one wanted to choose between projects, further analysis would need to take into account both the size of projects and the cost of reduction ($/tC).

We have chosen in this analysis to use a 'near future' set of plants for our baseline, arguing that changes in the electricity sector make this more realistic. Repeating a similar analysis against a 'recent plant' baseline results in fossil-fuel CDM projects gaining more credits [(16)]. A problem is that this approach overstates the real, measurable and long-term reductions” [2] because some emissions would have been reduced anyway due to the expected changes in the electricity sector. These results support our argument that for South Africa, a baseline looking at near future plants is more effective in ensuring environmental integrity.

4.2 Comparing projects against multi-project and project-specific baselines

Can one compare these results to those from project-based baselines? No, complete analysis has been done in this article, but some illustrative example raise further research issues. One available project-specific analysis is for off-grid solar home systems in a rural concession area (50 000 households). The study found a total of 11 500 tons of avoided CO_2 emissions per annum [16]. Converting to the same target market and to carbon, the equivalent reduction calculated by project-based baseline is 22 kilotons of carbon per year. Under the near future baseline, the range is from 0 to 7 ktC/year. However, this comparison does not compare equal quantities, in that the multi-project baseline implicitly assumes that electricity is avoided. In reality, rural South African households would tend to use paraffin or candles for lighting [17].

Another example is an analysis of efficient lighting [18]. Converting to equivalent number of compact fluorescent light bulbs, the study found that 360 ktC/year would be avoided. This is within the range of results in Table 5, from zero to 1 198 ktC, depending on which comparison set and benchmark is used. The fact that this is in the low range is due to different assumptions – the study assumed 3.2 hours of lighting per day, while 6.0 hours were used in the present analysis.

The conclusion from these two examples is that assumptions remain critical. Multi-project baselines, being standardised, can conflate many assumptions in a single number. While that single number provides certainty about the benchmark, subjective elements will always remain in gathering information about the CDM project. So multi-project baselines cannot eliminate all subjectivity from the overall process of determining additionality and calculating CERs.

5. Conclusion

5.1 ‘Near future’ baseline appropriate for South Africa

The analysis of multi-project baselines for the electricity generation sector suggests that a backward-looking baseline looking at recent plants is not appropriate in South Africa, because of the small number of recent plants and changes in new, marginal plants. A comparison to recent plants could work in countries where many plants have been constructed in recent years. This is not the case in South Africa, although it may well be true of other developing countries.

Using a ‘near future’ baseline represents our best estimate of what is likely to happen in the South African electricity sector. Our analysis is based on the assumption that a separate additionality test would screen out projects that do not meet environmental, financial, investment and technological additionality. In this case, the danger that a weighted average ‘near future’ baseline would simply be built and give away many free-rider credits is avoided – such projects are screened out through the additionality test.

The carbon reductions were also compared given a 'recent plant' reference scenario. Given a 'softer' baseline based on the recent plant, the carbon reductions are generally higher. If, however, a stricter baseline is applied, these emissions would not be credited.

If the 'recent plant' benchmark was to be used in South Africa, one would need to go back some 20 years or so to get a reasonably representative baseline. That would defeat the purpose of 'recent plant' baselines, which is to include marginal, relatively efficient technologies. Any backward-looking baseline would have to adjust its analysis to take into account technological change – through a factor for autonomous increases in energy efficiency, for example.

Alternatively, if one wanted an observable baseline, one might extend the analysis to a broader region, to include a sufficient number and diversity of recent plants. Regional analysis makes sense where there are grid connections and trading. Future research could look at such an analysis for the Southern African Power Pool.

5.2 Balancing investment and environmental integrity

Baselines need to strike a balance between ensuring environmental integrity and attracting CDM investment. Two options might be followed by South Africa – to choose a single baseline, or to use different baselines for different projects.

5.2.1 Option A: Choosing a single baseline

Comparing increasingly strict benchmarks, the weighted average, being the 'softest' baseline, allows the largest number of CDM projects to qualify and does reflect the projected mix of the sector. The best plant and 10^{th} percentile benchmarks appear overly restrictive, in that even renewable energy projects show only a marginal improvement in carbon intensity.

The 25^{th} percentile benchmark is an intermediate choice and would still help to provide incentives to introduce advanced technologies. It might be a good choice in the absence of a separate additionality test, since as a better-than-average benchmark, it reduces free-rider credits. If a separate test screens out non-additional projects, there seems little reason not to award credits against the less stringent weighted average benchmark.

The results of section 4.1 showed that the sector-wide baseline appears to make the most sense for the South African context. A single sector-wide benchmark provides a strong incentive to invest in low-carbon technologies. The CDM projects will not only displace coal power. Hence any fossil-fuel projects that want to attract CDM investment have to compete with gas and hydro, as do renewables. More efficient coal plants could still be developed if a weighted average benchmark is used, but the emissions reductions would be relatively small.

One option for South Africa, based on the analysis in this article, would be to use a sector-wide, 25^{th} percentile baseline for all CDM projects in the electricity generation sector.

5.2.2 Option B: Different baselines for different projects

Different CDM projects have specific attributes, and so might be measured against different baselines. One approach is to match projects with the load profile that they would displace. A new super-critical coal plant would be used for baseload, displacing other coal plants. Large new gas plants are also likely to be used for baseload, but can be brought on-line more quickly and hence used for peaking power. Energy efficiency projects displace some average of electricity generation, so that perhaps a weighted average would be appropriate.

Differentiating baselines would allow the test for additionality to be separated from the calculation of CERs. This may be useful, for example, for small-scale renewables and energy efficiency projects. In terms of additionality, these projects could simply be accepted, while their CERs could be calculated against a sector-wide baseline. New coal and gas, by contrast, can be expected to meet a stringent additionality test to qualify for CDM investment, e.g. 10^{th} percentile. However, once such projects have been approved, calculating CERs from a 25^{th} percentile benchmark would make them more attractive to investors, and would also allow some credits to be assigned to the host country.

For this analysis, not enough information was available to explore all the implications of this approach. Further work is required, given that the reference scenario only includes a few near future plants, while load profile is defined in relation to the entire sector, including older plants.

5.3 Choices for South Africa

The advantage of a single baseline is that it is simple, and treats all technologies equally. For the electricity sector, it can include both supply and demand side options. Care must be taken for demand-side projects, that the estimates of avoided generation include avoided transmission and distribution losses. The attraction of different baselines for different CDM projects is that they can more accurately reflect what the project displaces. A single benchmark for the electricity sector is attractively simple. A project-specific approach promises more accuracy in ‘getting the reductions right’, but has higher costs.

This analysis provides initial thoughts towards constructing such baselines. Hopefully it has made a small contribution to outlining possible policy options for South Africa and their implications. A final decision will require further research and a consultative process of decision-making. Particular areas that require further attention include:

- extending the analysis from South Africa to the entire Southern African Power Pool;
- more detailed comparison of multi-project against project-specific baseline, applied to specific projects, which may require additional project-specific studies;
- introducing some dynamics over time to the static analysis presented here;
- considering different types of power stations being displaced, e.g. base-load and peak-load;
- improving data quality, such as coal consumption per power station or unit; and

- considering individual units within power stations, where they differ significantly from one another.

Such research would place South Africa in a better position to choose a baseline methodology. In doing so, it will need to strike a balance between maximising the number of CDM projects and minimising transaction costs on the one hand, and allowing free-riders in the CDM, threatening environmental integrity.

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