

FINAL REPORT

Peer Review of the Climate Change Study for the Proposed Thabametsi Coal Fired Power Station



EOH Coastal & Environmental Services

25 Tecoma Street, Berea
East London, 5214

Ph: 043-726-7809

E-mail: alan.carter@eoh.com

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1. BACKGROUND

EOH Coastal & Environmental Services (EOH CES) represented by Dr Alan Carter, was appointed to assist the Department of Environmental Affairs (DEA) in peer reviewing the Climate Change Study and Palaeontological Impact Assessment (CCSPIA) report and specialist studies for the proposed Thabametsi Coal Fired Power Station.

Since the climate change component of the CCSPIA for the Thabametsi Coal Fired Power Station was the first of its kind in South Africa, DEA required assistance in assessing the scope and adequacy of such a report. Therefore, the objective of the current engagement was to advise DEA whether the climate change component of the CCSPIA:

- Meets acceptable standards with respect to assessing climate change risks at a project level;
- Adequately identifies and assesses all material climate change risks associated with the proposed Thabametsi project; and
- Makes reasonable recommendations concerning the mitigation of identified risks.

2. APPROACH

The scope of work was informed by the Terms of Reference for the engagement, and based on a meeting with DEA officials in October 2017. The agreed scope of work required a detailed review of the following three documents prepared by Savannah Environmental, the appointed Environmental Assessment Practitioner (EAP) for the project, and by ERM on behalf of Savannah Environmental:

- Savannah Environmental - Climate Change Study and Palaeontological Impact Assessment (CCSPIA) – Final for Public Review (June 2017).
- ERM - Greenhouse Gas Assessment (GGA) for the 1,200 MW Thabametsi Coal-Fired Power Station in Lephalale, Limpopo Province, South Africa (June 2017); and
- ERM - Climate Resilience Assessment (CRA) for the 1,200 MW Thabametsi Coal-Fired Power Station in Lephalale, Limpopo Province, South Africa (June 2017).

The following additional documents were also reviewed:

- Savannah Environmental – Final Climate Change Study and Palaeontological Impact Assessment – Comments & Responses Report (August 2017); and
- ERM – Water Resource Review (WRR) (June 2017).

The comments submitted by Interested and Affected Parties (I&APs) and the Environmental Assessment Practitioner's (EAP) responses provided in the "Comments & Responses Report" were carefully scrutinised in order to gain a clear understanding of the main issues of contention relating to the CCSPIA and the GGA, CRA and WRR specialist studies.

The scope of the current review does not include the palaeontological component of the CCSPIA.

3. RESULTS OF REVIEW

The CCSPIA correctly distinguishes between two key aspects that need to be considered when assessing the climate change risks associated with a project, namely, the:

- Greenhouse gas (GHG) emissions of a project and the contribution to the global accumulation of GHGs in the atmosphere and resulting global warming and climate change, and the identification of opportunities for mitigation; and

- Risks and impacts that the physical manifestations of climate change may have on a project, and the identification of opportunities to mitigate against vulnerabilities through appropriate adaptation measures.

This is reflected in the generation of two reports, each covering the two aspects described above, and the consolidation report in the form of the CCSPIA.

3.1. Greenhouse Gas Assessment (GGA) Report

The GGA report is comprehensive and thorough and is substantially in line with international guidelines and best practice concerning the assessment of GHG emissions at a project level.

Some specific observations on the GGA are provided below:

2. Methodology

Overall, the methodology is appropriate and is consistent with best practice and international guidelines. However, the following issues were identified:

- The methodology identifies that the Social Cost of Carbon (SCC) is a relevant issue. However, the report does not include a complete assessment of these issues due to the inherent high level of uncertainty associated with the quantification of social impacts. There is an undeniable cost to society associated with the high level of GHG emissions for the project, and given the high level of importance attributed to this issue by I&APs, an attempt could have been made to quantify the SCC based on a range of available cost estimates (low to high); and
- The methodology indicates that Scope 3 emissions have been calculated but are excluded from the final numbers in order to be in line with IFC Standards. However, since this information was developed, it could have been included for informational purposes.

3. Baseline description

The baseline description is very thorough and provides a detailed background on the project within the context of South African energy and climate change policy, including IRP2010, CBIPPP, LTMS, NCCRS, etc. and SAs commitments to mitigate against climate change.

The report is also very thorough in providing context concerning the emissions intensity of other coal-fired power plants in South Africa.

The report also correctly attributes a HIGH significance rating to GHG emissions in line with international standards due to the very high emissions levels.

The application of SA energy and climate change policy is a significant issue for I&APs. In this regard, the justification for the proposed power station in the GGA appears to be substantially based on existing adopted South African energy and climate change policy. As a point of departure (in the methodology assumptions), it is stated that: “the study assumes that existing policies and plans for the energy sector and with respect to climate change mitigation will be implemented as described in existing policy documents”. In our opinion, this is not an unreasonable assumption and approach, although it is likely to remain contentious.

In addition to the above, it is assumed that the obligations that will be imposed by the Carbon Tax Bill (2017) will also apply to the Thabametsi power station. While this is not covered in the GGA, it is suggested that it would be prudent to consider the implications of the Bill which will probably come into effect sometime during 2018 as the financial implications could be significant.

4. Impact assessment

The impact assessment information, in the form of GHG emission levels for the various phases and activities associated with the project, is systematic and comprehensive.

Emissions

The following observations were made concerning the calculated GHG emission levels:

- The GHG emission levels reported are reasonable and consistent with the emission levels for other coal-fired power plants of a similar capacity and technology;
- There is no reason to believe that the emissions values are understated;
- All relevant computational factors appear to have been properly considered in the emission calculations, such as activity data, emission factors, load factor, global warming potentials, etc. However, the report does not provide the details of the underlying GHG emissions calculations which would be useful to the users of the report to understand how the emissions were calculated. Consideration should be made for the calculations to be provided.

Impact assessment

The following observations were made concerning the GHG emission impacts:

- The rationale (including the assumptions) for assessing the magnitude of the emissions on a global and National level is informative and appropriate, particularly the information on the contribution of the project to South Africa's overall GHG emission under the peak, plateau, decline (PPD) trajectory;
- The comparison of the project GHG emissions intensity with other technologies is informative and appropriate;
- Although the report indicates that the emission intensity for the project is "within the range for subcritical plants based on IEA analyses", the IEA sets a lower threshold of 0.88 kg CO₂/kWh with no upper threshold. It is suggested that the projected emission intensity of 1.02 kg CO₂/kWh for the Thabametsi power station is relatively high due to various project specific features, such as coal resource, etc.;
- The background on the rationale for choice of technology is informative, such as: local coal resource, specified boiler capacity per the CBIPPP, limited water availability and specified sub-critical technology per the CBIPPP;
- The comparison of the project GHG emissions intensity with other technologies is informative and appropriate, notwithstanding the comments from I&APs which appear to place a great deal of emphasis on the relatively poor emission intensity of the Thabametsi power station compared with other similar but older South African power stations; and
- The rationale for rating the projects emissions as **VERY LARGE** is appropriate. However, the rationale for the overall GHG emissions significance rating of **HIGH (NEGATIVE)** based on the EAPs rating scale, is unclear and seems to be somewhat subjective. It is suggested that this could be elevated to **VERY HIGH (NEGATIVE)** due to high probability and very large emissions, and with limited opportunities for mitigation.

The following additional comments relate to the selection of the subcritical technology, which again, appears to be a significant issue for I&APs:

- Although the report suggests that the less efficient subcritical technology is better suited to small-scale units such as that proposed for the Thabametsi power station, we are aware of other projects where a more efficient 350 MW supercritical boiler technology is being adopted. However, there may be other local factors dictating the selection of the subcritical technology for the Thabametsi power station, such as water resource limitations; and
- The selection of the technology appears to be very much cost driven and dictated by the ceiling price per the CBIPPP specifications.

5. Emissions management measures

The report provides a comprehensive explanation concerning the technology choice and as a consequence the limited mitigation options. It also indicates that emissions can be best managed through maintaining the optimal thermal efficiency and minimising the emissions from the plant and provides examples, including: coal feed variability, coal drying, flue gas heat recovery, etc. These recommendations appear to be reasonable.

The report also recommends the development and implementation of an Energy and Emissions Management Plan and provides reasonable suggestions on the scope of such a plan.

6. Conclusion

The conclusion section confirms that the Thabametsi power station's annual and cumulative GHG emissions will be significant and will have climate change impacts (although not specified, it is assumed HIGH).

3.2. Climate Resilience Assessment (CRA) Report

Similar to the GGA report, the CRA report is comprehensive and thorough and is substantially in line with international guidelines and best practice concerning the assessment of the risks that the local physical manifestations of climate change may pose to a project such as the Thabametsi power station.

2. Methodology

The methodology is appropriate and clearly explains the limitations, particularly the uncertainty relating to predictions of future physical manifestation of climate change impacts such as changes in precipitation patterns, temperature, etc.

3. CRA scope

The report adequately describes the assets and activities directly associated with the project that may be vulnerable to changes in climatic conditions, including:

- Raw materials;
- Access roads;
- Power station equipment;
- Waste storage and disposal;
- Transmission;
- Staff; and
- Local communities of Maropong, Onverwacht and Lephalale.

4. Climate baseline and future climate scenarios

The report provides an appropriate description of the baseline and future climate scenarios associated with climate change that pose a risk to the project, including: extreme temperatures, uncertain precipitation patterns, flooding, droughts, wind speeds, etc.

Concerning future climate scenarios, the report has sourced information from appropriate resources such as the South African Risk and Vulnerability Assessment (SARVA) report amongst others, and reputable local down-scaled projections from the Climate Systems Analysis Group (CSAG).

Concerning extreme weather events, the report describes previous extreme weather events in the Lephalale area which may inform future trends, such as drought, storms, wildfires, etc. It is

particularly worth noting that drought severity in the Lephalale area is rated as Medium to High due to numerous droughts having been experienced in the past.

The report again highlights the uncertainty inherent in the various future climate change prediction models but has adopted a conservative approach by assessing impacts under the high global GHG emissions scenario which would presumably represent the worse-case future climate change scenario.

5. Climate risk identification and prioritization

The report provides an appropriate list of key climate related risks that could impact on the establishment and operation of the Thabametsi power station. These include:

1. Increase in average air temperatures resulting in reduced thermal efficiency of the power station;
2. Increase in peak (maximum) air temperatures resulting in heatwaves and wildfire events;
3. Lower than normal precipitation levels resulting in increased dry spells and droughts;
4. Higher wind speeds and gusts;
5. Flooding events; and
6. Dry spells and drought.

The report provides a comprehensive assessment of the impacts associated with the various climate risks, particularly relating to the risks of decreased precipitation and droughts, and the impacts on the project in terms of access to water for the power plant and other water users (e.g. local communities, farmers, etc.).

The report also highlights the current status of the Mokolo and Crocodile Water Augmentation Project (MCWAP (Phases 1 and 2) and the Water Use Licence Application (WULA) and the implications for the power plant.

It is particularly relevant that the report confirms that the Lepalale area is vulnerable to drought having experienced numerous severe droughts in the past, including most recently in 2015/2016. In addition, the climate change projections for the region indicate a likely increase in dry spells and drought during the dry season from March to August.

Risk assessment and prioritization

The risk assessment is qualitative in nature and the risk assessment prioritization criteria adopted, appear to be appropriate and consistent with best practice.

The analysis of the climate related risks appear to be realistic and reasonable, with the following risks being rated as **HIGH** significance:

- Lower than normal precipitation levels and increased drought resulting in water shortages;
- Lower than normal precipitation levels and increased drought causing water quality issues;
- Flood events causing polluted water overflows; and
- Dry spells and drought events affecting communities and threatening the social licence to operate.

Other risks such as high temperatures, heatwaves, wildfires, high winds, flood events, etc., have been as **LOW to MEDIUM** risk.

6. Adaptation measures

The report identifies appropriate hard (technical) and soft (non-technical) risk management (adaptation) measures, which if effectively implemented, results in only three remaining risks if **HIGH** significance, namely:

Adaptation measures for the remaining **HIGH** priority issues include:

HIGH RISKS	ADAPTATION/MITIGATION
<ul style="list-style-type: none"> Lower than normal precipitation levels and increased drought resulting in water shortages; 	<ul style="list-style-type: none"> Water shortage risks must be monitored and managed on an ongoing basis. Develop a contingency plan for water shortages. Consider covering raw water dam to reduce evaporation. Schedule regular water balance audits.
<ul style="list-style-type: none"> Lower than normal precipitation levels and increased drought causing water quality issues; and 	<ul style="list-style-type: none"> Water quality risks must be monitored and managed on an ongoing basis. Develop a contingency plan for water quality deterioration.
<ul style="list-style-type: none"> Flood events causing polluted water overflows. 	<ul style="list-style-type: none"> Communicate publically the power stations water management policy and report on performance, consumption, etc. Consider contributing to community funds linked to improving water access and infrastructure and participate in community forums to engage with communities on water-related concerns.

The report indicates that the “residual” (post mitigation) risks remain **HIGH** due to the “limited site level control over the broader water risk context”.

It is our opinion, that the outcome of the impact assessment post-mitigation is reasonable and appropriate.

7. Conclusions and recommendations

The report concludes by summing up what has already been described above and suggests that the findings of the CRA should be further investigated and updated as the project progresses.

3.3. Water Resource Review (WRR) Report

The Water Resources Review (WRR) report largely provides a high-levelled review of the current status of the MCWAP Water Supply Scheme and the water supply requirements for the project.

Concerning the impacts of climate change on the MCWAP, the report confirms that although the National Water Resource Strategy (2013) indicates that water planning should take climate change into consideration, it is not yet being implemented. Similarly, the Limpopo Reconciliation Strategy (2017) does not consider climate change in its assessment citing “the impact of climate change on the availability of water is uncertain”.

Overall, the report is informative and concludes that due to the threats relating to water scarcity in the Lephalale area, the power station should plan and select appropriate technologies (including water storage) to ensure that the power plant can operate under more water scarce conditions than currently exist.

3.4. Climate Change Study and Palaeontological Impact Assessment (CCSPIA) Report

The CCSPIA report consolidates the results of the two ERM specialist GGA and CRA reports.

The report highlights the additional information provided in the three ERM reports in response to I&AP comments and provides a concise summary of the findings of the reports, the details of which have already been described above.

An area of concern is that in the overall conclusions on page 32 of the CCSPIA, it states that the findings of the additional studies do not change the overall conclusion of the EIA, and that the overall impact of the project remains at **MEDIUM to LOW** significance. The rationale for reaching this conclusion is unclear when GHG emission risks are **VERY HIGH** and water scarcity risks are **HIGH**.

3.5. Comments and Response Report

The Comments and Response Report provides an analysis of the main issues raised by:

- Centre for Environmental Rights (CER) on behalf of Earthlife Africa; and
- Greenpeace Africa.

The submissions made by I&APs are detailed and comprehensive, particularly those of Earth Life Africa. Our comments on the main issues raised by I&APs is provided below under the same themes presented in the Earth Life Africa submission (as the Greenpeace Africa submission essentially echoes that of Earth Life Africa).

Main I&AP issues	EOH Comment
<p>High GHG emission intensity Mostly covered under points 21-34, including:</p> <ul style="list-style-type: none"> • 25. The exclusion of coal mining emissions from the GGA. • 29. The projects GHG emissions intensity is higher than two of the five Eskom plants scheduled for decommissioning. • 30. Dispute the CCIA's conclusion that the projects GHG emissions are similar or slightly lower than five Eskom plants. • 32. The CFB technology selected for the project will be worse than existing plants and 60% worse than Medupi and Kusile. <p>Also:</p> <ul style="list-style-type: none"> • 18. The emission intensity of 1.23 tCO₂e/MWh is high compared to other technologies, existing SA power stations and globally. 	<p>Concerning the exclusion of GHG emissions associated with the coal mining operations from the GGA, it is our opinion that the response of the EAP is appropriate and that these emissions are outside the GHG emissions boundary and scope of the project in terms of international best practice.</p> <p>The GGA provides detailed and adequate background information concerning the rationale for selecting the subcritical CFB technology (i.e. prescribed by the CBIPPP).</p> <p>The significance of GHG emissions associated with the project as documented in the GGA report are reasonable and are not understated, resulting in an overall HIGH significance rating.</p> <p>However, given that the emissions are VERY LARGE (in line with international guidance), and the "GHG emissions <u>will</u> result from the project" (i.e. high probability), and there are limited opportunities for mitigation, it could</p>

Main I&AP issues	EOH Comment
	be argued that the rating should be classified as being of VERY HIGH overall significance.
<p>Social and environmental costs Mostly covered under points 35 – 46, including:</p> <ul style="list-style-type: none"> • 35. The CCIA does not attempt to quantify the external cost of climate change impacts. • 36. It is important that the social costs are factored into the financial feasibility of the project, in line with NEMA “polluter pays” principle. • 40. There is no legitimate reason why a value cannot be attributed to the GHG emissions from the project. <p>Also:</p> <ul style="list-style-type: none"> • 8.1 In addition to direct emissions and impacts, the CCIA must include: indirect and full lifecycle emissions, cumulative emissions and the environmental and social costs of GHG emissions. • 8.3 The projects GHG emissions will aggravate climate change impacts on the environment and society at National and local scale. GHG emissions will exacerbate project areas vulnerability to climate change. • 10.1 The principle of intergenerational justice should be applied. • 13. The assessment of social and environmental impacts is inadequate. 	<p>This is a valid I&AP concern that possibly has not been adequately addressed in the GGA, which essentially suggests that that inherent uncertainties relating to SCC estimations, precludes such an exercise. While the difficulty of quantifying the SCC is acknowledged, this information would be useful to the Competent Authority. It is suggested that the CCIA could at least have provided a range of estimates.</p> <p>It is worth noting that if one applied the proposed Carbon Tax Bill price of R120 per ton of CO₂e as a surrogate for the SCC over the life time of the project, this would amount to about R30 billion. Other carbon pricing signals could be used such as the average price for various voluntary programmes which is currently about US\$3.0/tCO₂e (about R40/tCO₂e).</p>
<p>Resilience to climate change (mainly water scarcity) Mostly covered under points 47 – 62, including:</p> <ul style="list-style-type: none"> • 48. The precipitation projections are uncertain. • 58. The CCIA predicts that the water availability will look very different 20 – 30 years from now. • 61. The project area already water-scarce and vulnerable to extreme weather events such as droughts and floods. • 62. The CRA does not indicate what will happen if water does run out. • The project contrary to NEMA “risk averse and cautions approach”. <p>Also:</p> <ul style="list-style-type: none"> • 10.3 Water scarcity • 79. High risk of impact of climate change on water scarcity cannot be mitigated. 	<p>This is one of the main I&AP issues and has been comprehensively addressed in the CRA and WRR, providing the Competent Authority with adequate information on which to base a decision. The water scarcity issue has not been downplayed and remains one of the most significant issues, with three issues relating to water scarcity retaining a HIGH significance rating after mitigation.</p> <p>The EAPs response to the question of what will happen if the water runs out, is reasonable.</p> <p>Other water augmentation opportunities such as rain-water harvesting should also be considered.</p>

Main I&AP issues	EOH Comment
<p>Exacerbation of climate change impacts on communities (mainly water scarcity) Mostly covered under points 63 – 72, including:</p> <ul style="list-style-type: none"> • 63. The project will increase surrounding areas vulnerability to climate change (assumed water availability). • 65. The risk of “social licence to operate” (mostly relating to water scarcity) is understated. • 70. The impact on downstream users with less water for communities, farmers and surrounding environment. <p>Also: 79.</p> <ul style="list-style-type: none"> • Very little can be done to mitigate the water scarcity issue. 	<p>The CRA and the WRR jointly provide a comprehensive and detailed analysis of the water issues associated with the project. The CRA applies an appropriate overall HIGH significance rating to three water scarcity related risks, after mitigation.</p>
<p>Inadequate mitigation measures and recommendations Mostly covered under points 73 – 83, including:</p> <ul style="list-style-type: none"> • 73. The CCIA fails to adequately consider the avoidance alternative when NEMA requires a full and objective evaluation of: avoidance, minimization and remediation. • 74. The CCIA proposes weak climate change mitigation measures as it is not possible to adequately mitigate and minimise significant climate change impacts. • 76. The CCIA does not look alternatives nor no-go option • 78. The CCIA proposes mitigation to maintain emissions, not to reduce and does not consider the possibility of alternative locations to reduce emissions. • 79. Very little can be done to mitigate the water scarcity issue. • 81. Due to the high impact rating, application of the precautionary principle, and impacts outweigh benefits, NEMA requires a rejection of the application. <p>Also:</p> <ul style="list-style-type: none"> • 11. Consideration of alternatives. 	<p>The GGA and CRA do not assess alternatives or the no-go option.</p> <p>Given that the application is in response to a specific project scope under the CBIPPP, it could be reasonably argued that there are no reasonable and feasible alternatives.</p> <p>If the project had been in response to a broader energy generation scope (i.e. “not constrained by technology” in terms of the CBIPPP) then the I&AP issue may have more merit.</p> <p>The mitigation measures proposed in the CCSPIA and specialist reports (such as the emissions management measures proposed in the GGA) are reasonable given the technology being assessed.</p>
<p>Lawfulness of authorizing the project Mostly covered under points 84 – 102, including:</p> <ul style="list-style-type: none"> • 85. Suggests conclusions of the CCIA are incorrect and unlawful as it disregards the ERM findings as part of the CCIA (i.e. significant GHG emissions, high climate change risks, and limited mitigation measures to avoid or remedy the significant 	<p>These issues essentially relate to the costs versus the benefits of the proposed Thabametsi project. The CCSPIA and the specialist reports adequately identify and assess the environmental and social risks (except perhaps for the SCC issue outlined above).</p>

Main I&AP issues	EOH Comment
<p>impacts.</p> <ul style="list-style-type: none"> 86. Any benefits heavily outweighed by the harm. 90. IRP2010 cannot be relied on until revised. The CSIR and others have raised concerns and posed objections to new coal in the 2916 IRP update, and there is no need for baseload capacity at the moment. 	<p>We do not have a strong view or opinion concerning whether existing energy policy represents or justifies the overall benefits of the project, or whether anticipated amendment to the IRP2010 should be considered.</p> <p>The decision as to whether the benefits outweigh the costs (harm) lies with the Competent Authority.</p>
<p>Harm outweigh benefits Mostly covered under points 103 – 119, including:</p> <ul style="list-style-type: none"> Any benefits assumed to arise from the project would be completely outweighed by the irreversible and long-term harm caused were the project to go ahead. <p>Also:</p> <ul style="list-style-type: none"> 86. The benefits heavily outweighed by the harm. 	<p>As above</p>
<p>Overall impact rating 17. The CCIA report concludes that the overall impact rating remains MEDIUM TO LOW after considering the HIGH risk ratings of the GGA and CRA, without any justifiable basis.</p>	<p>In our opinion, there is some validity to the issue raised by I&APs concerning the overall rating in the CCSPIA.</p> <p>The HIGH rating of the CRA and HIGH rating of the GGA (or possibly VERY HIGH as suggested above), should not be diluted within an overall rating of MEDIUM to LOW. The rationale for doing so is unclear from the CCSPIA (pg. 32).</p> <p>An overall HIGH significance rating would not necessarily represent a “fatal flaw”, provided that the benefits are justified and can be motivated.</p>

4. CONCLUSIONS

The CCSPIA, GRA and GGA reports are comprehensive documents that adequately assess the climate change risks and impacts associated with the proposed Thabametsi Coal-Fired Power Station. The reports are of a high standard and reflect the application of international guidelines and best practice relating to the two main elements of a project level climate change risk assessment, namely:

- GHG emissions profile (carbon footprint); and
- Climate change risk and vulnerability assessment.

Overall, the assessment of the risks and impacts associated with the GHG emissions and climate change vulnerabilities is systematic, realistic, conservative and not understated, where the most important risks include the:

- Very large GHG emission levels that will contribute significantly to global GHG concentrations and global warming; and
- Vulnerability of communities to the manifestations of a changing climate, particularly changes in precipitation patterns and resultant water scarcity.

The following issues should be considered by DEA following from the current peer review:

- While the **HIGH** significance risk rating for climate resilience according to the GRA is not unreasonable, it is suggested that the significant risk relating to GHG emissions could be **VERY HIGH**.
- The rationale for concluding that the overall impact of the project is **MEDIUM to LOW** when emissions risks are **VERY HIGH** and water scarcity risks are **HIGH**, is unclear and it is suggested that the EAP should clarify their rationale.
- The **VERY HIGH** GHG emissions levels associated with the project implies a high social cost. An attempt could have been made to provide an estimate of the SCC based on a range of values.

The environmental and social costs associated with the proposed Thabametsi Coal-Fired Power Station are HIGH. However, this does not necessarily represent a “fatal flaw” provided that the benefits are justified and can be motivated. In terms of the CCSPIA, the justification for the proposed power station is substantially based on existing adopted South African energy and climate change policy. In our opinion, this is not an unreasonable approach, although it is likely to remain contentious.