EXPERT CRITIQUE OF CLIMATE CHANGE IMPACT ASSESSMENT FROM TEEPSA's OFFSHORE PRODUCTION RIGHT AND ENVIRONMENTAL AUTHORISATION APPLICATIONS FOR BLOCK 11B/12B, SOUTHERN CAPE COAST, SOUTH AFRICA

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1. Executive Summary

TotalEnergies EP South Africa B.V. (TEEPSA) ("the project proponent") seeks a production right and environmental authorisation to carry out exploration and production activities for gas and gas condensate in Block 11B/12B off the Southern Cape coast of South Africa. Project activities would include the drilling and extraction of gas and gas condensate from up to six appraisal and production wells, drilling and testing of up to four exploration and appraisal wells, construction and decommissioning of the infrastructure needed to carry out these activities, transport of gas and gas condensate via pipelines, processing of gas and gas condensate at the Forced Air (F-A) offshore platform, and all associated vessel movements to realize these activities.

As part of the project's Environmental and Social Impact Assessment (EIA), the project proponent contracted W.. S.. P.. (WSP) to carry out a Climate Change Impact Assessment (CCIA) of these proposed activities. This report critiques the CCIA report. Specifically, the completeness and accuracy of the greenhouse gas (GHG) emissions calculations, the measures stated to mitigate these emissions, and the interpretation of the climate impact of these emissions.

The CCIA reports that the project would produce 1.5 MtCO_2e emissions over its 27-year lifespan. This is a significant underestimate, as the CCIA fails to consider key sources of emissions (listed below) resulting from the project and to use scientifically defensible methods to calculate emissions. The CCIA also understates the climate impact of these GHG emissions, as the CCIA fails to demonstrate how these mitigation measures would be implemented. These weaknesses are elaborated on briefly below and in more detail in individual sections of this report.

- **Overly restrictive scope of GHG emissions**. Potentially important GHG sources missing from the CCIA calculation include:
    - End use of the gas and gas condensate;
    - Leakage and venting of gas from wells, the processing facility, and transport infrastructure;
    - Flaring at well platforms during the drilling, completion and production phases;
    - The existing F-A platform processing facility, which will be refurbished and revived as a result of this project and is an integral part of the proposed project activities;
    - Unplanned events such as well blowouts / explosions;
    - The 6th production well. GHG emissions estimates are calculated for 5 production wells, rather than the maximum likely number of wells (6); and
    - Other existing, approved or proposed oil and gas projects in assessing cumulative impacts.
- **The CCIA fails to use scientifically defensible assumptions in its emissions calculations**. These include:
    - Reliance on outdated (2007) global warming potential (GWP) values[1] that underestimate the climate change impact of emissions relative to contemporary (2021) expert consensus;

[1] CCIA p. 34-35

  - Assumption of a single unrealistically high natural gas processing flaring efficiency (98%)[2]; and
  - Reliance on outdated (2000) and refuted reports in concluding that gas-to-electricity production is far less GHG emissions intensive than coal-to-electricity.
- **The CCIA underestimates the significance of the project's GHG emissions**, resulting from the:
  - Unjustified determination that the "sensitivity of receptors" to climate change is "low"[3]; and
  - Unjustified assumption that mitigation measures would reduce the intensity, magnitude, and significance of the impact of GHG emissions from the project below baseline levels given in the GHG calculation.

The CCIA therefore deviates from best practices and the state-of-science in its GHG emissions calculations and in evaluating the climate impact of these emissions. As such, the CCIA is fundamentally flawed. Corrections to these limitations, and the emissions and significance underestimates that result, must be made for DFFE to make a well-informed decision.

2. Introduction

The report is prepared following review of the CCIA and the full EIA, including the Environmental Management Program, and comparison to of the CCIA to best practice climate assessments, as well as to the requirements for CCIAs in the draft CCIA Guideline[4] and in the *Earthlife Africa Johannesburg v the Minister & Others* judgement ("Thabametsi decision").

The 1.5 MtCO_2e Scope 1 emissions that the CCIA predicts the project will generate over its 27-year lifetime is approximately equivalent to 340,000 gasoline-powered vehicles driven for a year[5]. This has the potential to make a meaningful contribution to climate change. Yet, the emissions resulting from the project would also be far greater than the 1.5 MtCO_2e given in the CCIA, as not all source contributions have been accounted for.

One recurring reason for this underestimation is that the CCIA uses uncertainty as a flawed reasoning to not include important sources of emissions. Instead, the report could have employed best practices to bound the estimate of these emissions from these sources under best and worst case scenarios and included these ranges in the assessment. As such, the CCIA needs to be revised to include estimates for these key sources of emissions so that a decision about the project can be made with more realistic and complete information.

In the sections that follow, the general failings of the CCIA are described.

3. The CCIA omits key sources of emissions

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[2] CCIA p. 37
[3] E.g., CCIA p. 47
[4] https://cer.org.za/wp-content/uploads/2021/06/NEMA-Consultation-on-intention-to-publish-the-National-Guideline-for-consideration-of-climate-change-implications-in-applications-for-enviro-authorisations-AELs-and-waste-managemen-1.pdf.
[5] U.S. EPA, *Greenhouse Gas Equivalencies Calculator*, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator#results.

3.1 End use of the gas and gas condensate

The CCIA does not calculate the likely emissions that would result from the end use of the gas and gas condensate produced. It lists a few of the possible uses of these products, such as electricity production or to generate liquid fuels,[6] but does not calculate emissions from these activities. This is not compliant with the Thabametsi decision that stipulates that the full lifecycle emissions be considered and deviates from the draft CCIA Guidelines to include indirect emissions from the project in CCIAs.[7] These end use activities are a large source of GHGs, due to combustion of carbon leading to formation of the GHG carbon dioxide (CO_2), so would comprise by far the greatest percentage of emissions from the project. Failure to include these in the CCIA makes it impossible to accurately assess the true climate impact of this project.

There is uncertainty in how the gas and gas condensate will ultimately be used and therefore the emissions that would be associated with these uses, but best practice dictates that the CCIA report a range of emissions based on reasonable assumptions. For example, the CCIA could realistically assess the emissions from gas-to-liquids as one scenario and from combined cycle power plants as the other. These estimates would clearly also have to include assumptions about the quantities of gas and gas condensate to be produced by each well. These assumptions are already provided in the CCIA emissions estimates, including in determining the flow of gas and gas condensate to the F-A platform, so this would not add any additional work or uncertainty to the overall CCIA.

The assertion in the CCIA that natural gas use in the electricity sector produces climate benefits is unfounded, as there is no calculation of the emissions or reference to reliable and up-to-date scientific literature to support this claim.

3.2 Leakage and venting of gas from wells, the processing facility, and transport infrastructure

Leakage (fugitive emissions) and purposeful releases (venting) of gas from wells, pipelines, compressors, and other gas production and transportation processes have been increasingly studied in recent years, with almost all of this research concluding that past estimates of these emissions were severely underestimated and that leaked natural gas undermines climate benefits of shifting electricity production from coal to gas.[8] The CCIA only mentions these emissions qualitatively and concludes that "Although such leaks are considered to be minimal, further research needs to be undertaken in order to develop emission factors for this quantification and to obtain cost effective methods to estimate emission measurements for such leaks."[9]

There are many recent sources of scientific research that have measured substantial leakage rates at relevant sites. This growing body of research estimates that fugitive and venting emissions over the lifecycle of fossil gas is typically between 2% and 6.1% of production, resulting in many thousands of

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[6] CCIA p. 44

[7] *Earthlife Africa Johannesburg v the Minister & Others*,

[8] E.g., Lu Shen *et al.*, *Satellite quantification of oil and natural gas methane emissions in the US and Canada including contributions from individual basins*, 22, Atmospheric Chemistry and Physics, 11203–11215 (2022), https://acp.copernicus.org/articles/22/11203/2022/l Thibaud Ehret *et al.*, *Global Tracking and Quantification of Oil and Gas Methane Emissions from Recurrent Sentinel-2 Imagery*, 56, Environ. Sci. Technol., 10517–10529 (2022), https://doi.org/10.1021/acs.est.1c08575; Deborah Gordon *et al.*, *Evaluating net life-cycle greenhouse gas emissions intensities from gas and coal at varying methane leakage rates*, 18, Environ. Res. Lett., 084008 (2023), https://dx.doi.org/10.1088/1748-9326/ace3db.

[9] CCIA p. 43

additional $MtCO_2e$ released into the atmosphere over the project lifespan.[10] Recent papers from the UK and the U.S. show that government inventories substantially underestimate emissions from offshore oil and gas production specifically.[11] The failure of the CCIA to include any calculation and consideration of leaks and venting across the lifecycle of the project is a serious omission that must be rectified to fully comprehend the climate impacts of the project. This should be resolved by providing reasonable bounded GHG emissions estimates from the 2% to 6.1% leakage rate range.

3.3 Flaring at well platforms during the drilling, completion, and production phases

The CCIA also fails to calculate emissions from flaring at the production well platforms over the lifespan of the project. Fossil fuel production wells release gas during well testing and completion, as well as during the much longer production phase for safety or operational reasons that is flared on site.[12] Yet, these emissions are not included in the CCIA production GHG emissions calculations.

3.4 F-A platform processing facility should be considered Scope 1 and be included in the total project contribution to the National Inventory

The F-A platform is a core component of the proposed project, as all the gas and gas condensate produced would pass to it for processing. According to the CCIA, this platform will be refurbished and revived to accommodate the products from these new wells. Given this, emissions from this processing plant should be included as Scope 1 (direct) emissions.

The CCIA repeatedly states that the F-A platform is a separate project and so requires a separate EIA. Given this, the emissions from the F-A platform are not considered in assessing the project contribution to the national inventory. The CCIA calculates lifespan emissions from the F-A platform of 4,049,699 tonnes CO_2e, but categorizes these as Scope 3 (indirect) rather than Scope 1. The approach of categorizing the F-A platform as Scope 3 leads to an underestimate in the total climate impact significance of the project, as a large portion (>4 megatonnes CO_2e) is absent in the total GHG emissions of the project.

Even if the platform emissions continue to be categorized as Scope 3, as is done in the CCIA, these, as with other Scope 3 emissions, should be summed together and used to evaluate the total project contribution

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[10] Alexander Q. Gilbert & Benjamin K. Sovacool, *US liquefied natural gas (LNG) exports: Boom or bust for the global climate?*, 141, Energy, 1671–1680 (2017); Ramón A. Alvarez *et al.*, *Assessment of methane emissions from the U.S. oil and gas supply chain*, , Science, (2018), http://www.sciencemag.org/lookup/doi/10.1126/science.aar7204.; Leslie S. Abrahams *et al.*, *Life cycle greenhouse gas emissions from U.S. liquefied natural gas exports: implications for end uses*, 49, Environ. Sci. Technol., 3237–3245 (2015); DeVynne Farquharson *et al.*, *Beyond global warming potential: a comparative application of climate impact metrics for the life cycle assessment of coal and natural gas based electricity*, 21, J. Ind. Ecol., 857–873 (2017).

[11] Stuart N. Riddick & Denise L. Mauzerall, *Likely substantial underestimation of reported methane emissions from United Kingdom upstream oil and gas activities*, 16, Energy & Environmental Science, 295–304 (2023), https://pubs.rsc.org/en/content/articlelanding/2023/ee/d2ee03072a.; Alan M. Gorchov Negron *et al.*, *Excess methane emissions from shallow water platforms elevate the carbon intensity of US Gulf of Mexico oil and gas production*, 120, Proceedings of the National Academy of Sciences, e2215275120 (2023), https://www.pnas.org/doi/full/10.1073/pnas.2215275120;

[12] U.S. Department of Energy Office of Oil and Natural Gas, Office of Fossil Energy, 2019, *Natural gas flaring and venting: State and federal regulatory overview, trends, and impacts,* p. 1-2, https://www.energy.gov/fecm/articles/natural-gas-flaring-and-venting-regulations-report.

to South Africa's National Inventory. These are additional emissions resulting from the project, regardless of category.

3.5 The CCIA does not consider emissions from events such as a well blowout (Chapter 10 of EIA)

The CCIA acknowledges that "the Project's GHG emissions could increase due to an occurrence of an unplanned event," such as a blowout or explosion, which "can vary in [] severity and consequences."[13] Without any attempt at quantifying the extent of such an increase in GHG emissions, the CCIA then proceeds to note that the Project's "multiple safety systems and redundant measures" will "minimise the risk of accidents or unplanned events."[14] The "Impact Assessment – Unplanned Events" chapter is even more silent on the issue of GHG emissions – it does not contain a single reference to "climate change" or greenhouse gas emissions. Failure to account for potential emissions in the case of an unplanned event, despite conceding that the occurrence of one would increase emissions, makes it impossible for the government to understand the worst-case scenario impacts of the project or assess the efficacy of the systems and measures designed to "minimise" impacts.

3.6 The CCIA does not calculate emissions from the maximum number of wells (6) that might be drilled for production.

The CCIA notes that "[t]he proposed development concept will connect up to 6 wells in the Project Development Area" and summarises production activities as including "[d]rilling and flow test of up to 6 wells."[15] However, in a footnote, the CCIA explains that "five production wells will be drilled in the Production Development Area with the option for a sixth well should it be required"[16] and thus "the greenhouse gas assessment was based on five wells."[17] The CCIA should assess emissions based on the maximum number of likely wells, as TEEPSA will have the option to drill a sixth well without conducting further environmental studies, including assessment of climate impacts.

3.7 Other oil and gas projects underway or under review should be considered within the Cumulative Impacts Assessment

The CCIA falls short on its cumulative impacts assessment by neglecting to consider the GHG emissions of the other oil and gas projects under review or approved to occur in South Africa. Instead, the Cumulative Impacts Assessment only notes existing and proposed projects "within reasonable proximity to the Project" that have or will have an "[e]ffect on air quality/GHG emissions."[18] It even concludes that there are "[n]o cumulative impacts anticipated" from Block 5/6/7 activities because they are "too distant" and "well drilling activities are unlikely to coincide with the production well drilling and construction phases of Block 11B/12B."[19]

The CCIA should consider the cumulative climate impacts of emissions from existing and proposed oil and gas projects, beyond what would be considered within "reasonable proximity" to Block 11B/12B. Unlike conventional air pollutants that have localised impacts, GHGs are long lived (10+ year atmospheric

[13] CCIA, p. 61.
[14] CCIA, p. 61.
[15] CCIA, p. 5.
[16] CCIA, p. 39 n.8.
[17] CCIA, p. 39 n.8.
[18] EIA, p. 521.
[19] EIA, p. 521.

lifetime) and so contribute to global changes in climate. There are many other projects underway or awaiting approval in South African waters, including TEEPSA projects. Without considering all the other oil and gas projects being proposed at exploratory or production phase, the government cannot determine South Africa's maximum likely climate emissions if all these projects were approved to assess whether these projects would impinge upon South Africa's international climate commitments.

4. The CCIA fails to use scientifically defensible assumptions in emissions calculations

4.1 The CCIA relies on outdated (2007) global warming potential (GWP) values that underestimate the climate change impact of emissions relative to contemporary expert consensus

The CCIA GHG emissions calculations use Global Warming Potentials (GWPs) from the IPCC's AR4 2007 report. Methane (CH_4) is the main component (>90%) of fossil gas emitted through leaks and venting throughout the lifespan of the product. The AR4 value for CH_4 used in the CCIA is 25, meaning that, in 2007, it was the scientific consensus that the climate effect of CH_4 was 25-times greater than that of CO_2 over a 100-year timeframe. In the latest (AR6) IPCC report published in 2021, the updated consensus is that the GWP of CH_4 is 29.8 over a 100-year timeframe.[20] A shift to using the 2021 GWPs would increase the CCIA GHG emissions from CH_4 by 19%.

The justification in the CCIA for using AR4 GWP values is "[f]or consistency in comparing the Project's GHG emissions to the National Inventory."[21] The CCIA could have just as easily calculated both estimates to compare to the inventory and to accurately represent the scientific consensus climate impact of the project.

4.2 The CCIA assumes an unrealistically optimistic natural gas processing flaring efficiency

Flaring of gas from test wells and the processing platform are important sources of GHG emissions in the project, generating over 1.10 megatonnes CO_2e as reported in the CCIA Table 6-6 for construction and Table 6-9 for the F-A platform.[22] Additional emissions will come from flaring during the production phase, but this is omitted in the CCIA (see Section 3.3). Gas flaring combusts methane into CO_2 and in so doing reduces the climate impact of the project, as CH_4 is a more potent GHG than CO_2. The efficiency of the combustion of the flares used to burn off this gas therefore has significant implications for the climate impacts of a project.

The CCIA calculations of total emissions from the project assumes a flare combustion efficiency of 98%.[23] This is only achievable under optimal conditions. In reality, including aboard platforms at sea as in this project, flare efficiencies are usually significantly lower than 98%. For example, a recent peer-reviewed study of flares at natural gas wells in the United States found efficiencies of only 90.2-91.8%.[24] This means that much greater quantities of methane, rather than CO_2, are emitted across the lifecycle of the gas than the CCIA currently includes, with the associated higher climate change impacts because of the potency of methane as a greenhouse gas (see Section 4.1). A realistic GHG emissions assessment would therefore

[20] IPCC AR6, 2021, p. 1017.
[21] CCIA, p. 34. Note that the AR6 GWP for N_2O is lower than it was in 2, though (273 v. 298).
[22] CCIA, pp. 41 and 44
[23] CCIA, p. 37
[24] Genevieve Plant *et al.*, *Inefficient and unlit natural gas flares both emit large quantities of methane*, 377, Science, 1566–1571 (2022).

include flare efficiency assumptions in line with recent science, rather than the outdated optimal assumptions employed in this CCIA. At a minimum, the CCIA could include a range of flare efficiency assumptions given the substantial contribution of flaring GHG emissions to total project emissions.

4.3 The CCIA includes an outdated (2000) report to conclude that emissions from gas-to-electricity production chains are far lower than emissions from coal-to-electricity.

To support its assertion that gas "supplies lower carbon intensity power to the electrical grid and supports decarbonisation efforts by displacing higher carbon intense fuel such as coal and diesel,"[25] the CCIA includes a chart from an outdated report by the International Atomic Energy Agency showing, among other things, that the total greenhouse gas emissions from the electricity production chain is lower for gas than for coal.[26] Recent analyses, however, have shown that leakage of the potent GHG CH_4 undermines this claim. For example, a study by energy expert Rocky Mountain Institute and several universities found that although gas emits only half as much carbon dioxide as coal when burned, the lifecycle emissions[27] of carbon dioxide, methane, and sulfur dioxide from gas are comparable to those from coal, even when as little as 0.2% of gas leaks along the supply chain.[28] The assumption of the CCIA that coal is preferable to gas in the electricity sector would require lower gas venting and leakage rates than is actually realized.[29]

5. The CCIA underestimates the significance of the project's contributions to climate change

The CCIA's methodology for assigning significance to the impacts of the project's emissions is flawed, so the climate impact of the project is substantially underestimated.

5.1 The CCIA relies on an unjustified determination that the "sensitivity of receptors" to climate change is "low."

One factor that the CCIA considers when reducing the impact significance of the various phases of the project, including the F-A platform, is the sensitivity of receptors, which it considers to be of low sensitivity. The CCIA explains: "Due to the international scale and infrequent occurrence of the impact, receptors are considered to be of low sensitivity."[30] Beyond this vague and ambiguous statement, the CCIA does not explain how it defined receptors, the location of these receptors, or the method used to determine low sensitivity. Without this information, it is impossible to evaluate the CCIA's claims about receptor sensitivity.

5.2 The CCIA offers vague and unproven mitigation measures that are then claimed to substantially reduce greenhouse gas emissions of the project.

[25] CCIA, p. 44.
[26] CCIA, p. 45.
[27] The authors compared emissions from gas and coal across several stages including "extraction, processing, transport, waste disposal, infrastructure construction and decommissioning, and end use combustion." Deborah Gordon et al., *Evaluating Net Life-Cycle Greenhouse Gas Emissions Intensities from Gas and Coal at Varying Methane Leakage Rates*, Environmental Research Letters (July 17, 2023), https://iopscience.iop.org/article/10.1088/1748-9326/ace3db.
[28] *Id.*
[29] CCIA, pp. 44-45.
[30] CCIA, p. 51.

The CCIA claims that the Scope 1 emissions of the project's exploration and production phases would be of medium significance and that the Scope 3 emissions from the F-A Platform would be of very high significance.[31] The CCIA proposes various mitigation measures that it claims would reduce the Scope 1 emissions to negligible levels and the Scope 3 emissions to medium significance. These include the following project controls:

- TEEPSA will comply with the requirements set out in MARPOL Annex VI Regulation 18 – Fuel Quality.
- Project vessels will be supplied with marine gasoil (MGO) or heavy fuel oil (HFO) with less than 0.5% sulfur (mass).
- Project vessels will be operated and maintained to ensure the efficient consumption of fuel in completion of the required activities.[32]
- Special attention will be paid to the drill unit, pipelaying vessel, support vessels and survey vessel with a Ship Energy Efficiency Management Plan (SEEMP) that complies with the IMO 2022 guidelines.
- TEEPSA will continue to engage with PetroSA regarding the use of good international industry practice in the operation and maintenance of the F-A Platform.

Next, it proposes the following mitigation measures:

- Maintain a record of fuel consumption for monthly submission to TEEPSA for reporting purposes.
- Optimise the operation programme (rotation of the support vessel for example) for the tracking of fuel consumption and other metrics relevant to the quantification of GHGs.[33]
- Optimise helicopter flight paths.
- Optimise well test and monitor the efficiency of the flare programme to reduce burning as much as possible during the test.
- Use a high-efficiency burner for flaring to maximise combustion of the hydrocarbons in order to minimise emissions and hydrocarbon 'drop-out' during well testing.

There are several flaws with the CCIA's approach. First, it does not quantify to what extent any of these measures could actually reduce emissions, so the CCIA's conclusions about residual impacts after mitigation are arbitrary and unsupported by evidence. The mitigation measures proposed are unlikely in practice to reduce emissions beyond what TEEPSA is legally and economically already motivated to do. The pathway from measures to reductions in emissions is also unclear. For example, no clear pathway from record maintenance of fuel consumption to GHG emissions reduction is provided. Finally, some of the project controls proposed, such as high-efficiency burners for flaring, were relied on already in the calculation of the GHG emissions of the project, so it is unclear how these further contribute to reductions beyond baseline GHG emissions that were obtained using these conditions. In summary, the proposed mitigation measures can only be relied on to reduce climate change risk if there is a clear path from action to emissions reductions and these emissions reductions are defensibly quantified.

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[31] CCIA, p. 51. Note that the table on page 53 contradicts this Very High significance rating, rating F-A platform emissions as "High Significance" before mitigation. The source of this this discrepancy is not explained.
[32] CCIA, p. 50-1.
[33] CCIA, p. 51.

5.3 The failure to include the F-A Platform's emissions as Scope 1 emissions leads to an underestimate in overall emissions of the project.

As mentioned already, the CCIA should have included the F-A Platform emissions as Scope 1 emissions or at a minimum have included the platform emissions in the calculation of the project contribution to the National Inventory. Doing so would have increased the total GHG emissions of the project and increased the impact magnitude of the project relative to the National Inventory.

6. Conclusion

Based on the above details, it is evident that the CCIA has substantial gaps and fundamental flaws and so is not a reliable means to assess the climate impacts of the project.