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SUBMISSIONS TO THE DRAFT EIA REPORT FOR THE PROPOSED GAS TO POWER PROJECT AT THE PORT OF SALDANHA BAY

DFFE REF NO: 14/12/16/3/3/2/2006

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Annexure – E expert report of Rocky Mountain Institute

Acronyms
Environmental Authorisation (EA)
Competent Authority (CA)
Draft Environmental Impact Assessment (DEIA)
Climate Change Impact Assessment (CCIA)
Karpowership project)

These submissions are made by Green Connection and Natural Justice in response to the 2022 Draft EIA report published for comment by Karpowership SA (PTY) LTD for the Gas to Power Via Powerships Project (referred to hereafter as the Karpowership project) for the port of Saldanha Bay.

The Green Connection (GC) is a registered non-governmental organisation, that believes economic growth and development, improvement of socio-economic status and conservation of natural resources can only take place within a commonly understood framework of sustainable development. It aims to provide practical support to both the government and non-governmental/civil society sectors, which are an integral part of sustainable development.

Natural Justice: Lawyers for Communities and the Environment (NJ) is a non-profit organization specialising in environmental and human rights law in Africa – with a focus on the pursuit of social and environmental justice for local and indigenous communities.

Natural Justice offers direct support to local and indigenous communities impacted by the ever-increasing demand for land and natural resources. Natural Justice also conducts comprehensive research on environmental and human rights laws, as well as engaging in key national and international processes with, for and alongside indigenous peoples and local communities.

The organization has an interest in this project with regards to how the applicants and environmental assessment practitioner intend to address the impacts, both direct and indirect, that will be brought upon the environment and the local and indigenous peoples and communities who reside along the impacted coasts.

We note that, on 9 December 2022, GC and NJ requested an extension of time for the submission of comments on the three Karpowership applications[1] from 13 December 2022 to

[1] 14/12/16/3/3/2/2007: Draft Environmental Impact Assessment (EIA) Report for the Proposed Gas to Power via Powership Project at the Port of Richards Bay, uMhlathuze Municipality within King Cetshwayo District Municipality, KwaZulu Natal; 14/12/16/3/3/2/2006: Draft Environmental Impact Assessment (EIA) Report for the Proposed Gas to Power Powership Project at the Port of Saldanha Bay, Saldanha Bay Local Municipality, Western Cape; and 14/12/16/3/3/2/2005: Draft Environmental Impact Assessment (EIA) Report for the

15 December 2022. This request was denied. GC and NJ therefore provide these comments within the available time, but reserve our rights to introduce any new grounds of objection at any other stage in the process.

DECISION OF COMPETENT AUTHORITY

The application for environmental authorisation for the 415 MW gas to powership project at the Port of Saldanha was refused for the following reasons (which have been summarized):

a) Applicant failed to comply with section 24(1A)(c) of NEMA in relation to any procedure relating to public consultation and information gathering. The Draft EIAr was subject to public review for less than the statutory 30-day period. Documents were removed from the website and only returned after queries were raised by I and AP's;
b) Failure of the EAP to comply with regulation 23(1)(b) of the EIA regulations 2014 as new information was introduced after the public comment period;
c) Failure to comply with several provisions relating to public participation;
d) Failure to mention all applicable listed activities;
e) Failure to consult occupiers of the site and if applicant is not the owner, then with the person in control of the site;
f) The Marine Ecology specialist study and the estuarine specialise recommended a noise modelling study but none was done;
g) (The conclusion of the SACNASP peer review appears to have been included in error as it relates to Richards Bay.);
h) Most of the specialist studies indicated that there were limits on the studies, for example insufficient time to complete the studies, or the wrong season for the study. These gaps and limitations raise concerns about the adequacy of assessments and validity of the findings. They should have been updated and amended prior to submission for decision making

The competent authority concluded that as a result of significant gaps and limitations the decision maker cannot make an informed decision. In particular:

- Minimum requirements for public participation were not met;
- Actual and potential impacts on the environment and socio-economic conditions could not be evaluated because of a lack of underwater noise impact assessment and the contradictory information provided;
- Effects of activities on the environment could not be evaluated because of one of the major impacts, under water noise was not fully investigated nor were discrepancies between expert reports clarified;

- Hence not possible to determine the significance of potential impacts or consequences for the environment, the effectiveness of mitigation measures or whether the project will constitute a sustainable development; and
- Hence no sufficient, adequate or reliable basis on which the competent authority (CA) can rule in favour of the applicant.

Therefore, environmental authorisation was refused.

APPEAL DECISION AND 2022 FINAL DEIA REPORT

The following is an analysis of the 2022 DEIA report taking into account the record of refusal of the initial application for environmental authorisation, the appeal decision and submissions of the Green Connection, submitted to the initial Draft Environmental Impact Assessment ("EIA") report.

MARINE POLLUTION

1. In its comments on the 2021 DEIA report, Green Connection submitted that the report fails to consider the impacts of marine pollution on the already contaminated Small Bay, on report's incorrect assumption that because effluent from ships is governed by regulation it does not require to be assessed, in an application for environmental authorisation (EA) in terms of section 24 the National Environmental Management Act (NEMA).[2]
2. The issue was not mentioned in the record of refusal by the competent authority (CA).
3. The appeal decision noted in paragraph 2.26 that a holistic consideration of the EA application, for the purpose of the project required it to point out a number of concerns including that:

> "The potential for pollution from shipping (including spent oil and lubricants, paint, solvents and waste detergents, waste from ship maintenance activities, sewage, galley waste, sweepings from hatches and engine rooms, slops from holds and tanks, ballast water, general domestic waste, medicinal/medical waste, spent batteries, discharge of heated water, etc.) as a result of the proposed gas to power process is considered to be high and specific controls will need to be incorporated into the environmental authorisation, if approved."[3]

[2] Act 107 of 1998
[3] Appeal paragraph 2.62.2

This statement is reiterated in the final Marine Ecology, Coastal and Fishers Assessment (Appendix 9 B4 to the 2022 DEIA report) which adds that "potential impacts should not be compromised."[4]

4. The 2022 DEIA report does not analyse the impact of long-term marine pollution, that will inevitably occur in an industrial context, regardless of regulatory controls, nor the cumulative impact thereof on an already polluted marine environment. No assessment of the impact of spills is provided in the 2022 DEIA report. It merely states:

> "In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the MPA and the Langebaan lagoon. The polluter pay principle where Karpowership will be held liable for any clean-up costs associated with an incident". [5]

5. Regarding cumulative impacts the report states:

> "As the project site is located within an existing and operational port, existing and operational facilities include the LPG MBM in Big Bay, Saldanha Steel, Saldanha Bay Iron Ore Terminal and Oil Jetty, Sishen Pier, Sea Harvest and the Oyster Dam. Any development or maintenance activity in the Port of Saldanha (in close proximity to the proposed project) involving the disturbance of sediments, the intake of large volumes of water, the increase in vessel traffic, the occupation of space, along with the proposed Karpowership project, **may have cumulative impacts** on the surrounding marine ecology through increased underwater noise, vessel collision risk, hydrocarbon spill, invasive alien species transfer (via ballast water release), increased pollution of the Saldanha Bay through maintenance and repair activities, and storm water runoff."

6. The final draft EIA report under Impact 7: Impacts of coastal pollution - rates the potential for marine pollution to be high:

> "The potential for pollution from shipping (including spent oil and lubricants, paint, solvents and waste detergents, waste from ship maintenance activities, sewage, galley waste, sweepings from hatches and engine rooms, slops from holds and tanks, ballast water, general domestic waste, medicinal/medical waste, spent batteries, discharge of heated water, etc.) as a result of the proposed gas to power process is considered to be **high** and specific controls are included in the EMPr. "[6]

[4] Specialist study on Marine Ecology and Fisheries October 2022 paragraph 4.5.2

[5] Table 4.21 Lwandle Marine Ecology assessment at page 95

6 Final draft EIA report page 255

This statement is reiterated in the final Marine Ecology, Coastal and Fishers Assessment (Appendix 9 B4 to the 2022 DEIA report) which adds that "potential impacts should not be compromised."[7]

7. The 2022 DEIA report does not analyze the impact of long-term marine pollution, that will inevitably occur in an industrial context, regardless of regulatory controls, nor the cumulative impact thereof on an already polluted marine environment. No assessment of the impact of spills is provided in the 2022 DEIA report. It merely states:

> "In the event of a large-scale marine pollution event, every effort must be made to prevent it reaching and negatively impacting the MPA and the Langebaan lagoon. The polluter pay principle where Karpowership will be held liable for any clean-up costs associated with an incident". [8]

8. Regarding cumulative impacts the report states:

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9. The final draft EIA report under Impact 7: Impacts of coastal pollution - rates the potential for marine pollution to be high:

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[7] Specialist study on Marine Ecology and Fisheries October 2022 paragraph 4.5.2

[8] Table 4.21 Lwandle Marine Ecology assessment at page 95

[9] Final draft EIA report page 255

10. However, the 2022 DEIA report merely repeats what is stated in the 2021 DEIA report that this potential impact can be mitigated by proper pollution management. It does not say what the impacts of a failure to do so would be. Given the long duration of the project, the already polluted receiving marine environment (of both Small and Big Bay) and the nature of the potential marine pollution that can be caused by this project, pollution incidents which might individually appear minor could over time accumulate in impact to a considerable impact. The expert report should have considered and assessed the cumulative impact of a major pollution spill or several long-term spills on the marine environment, but failed to do so. A further failure of the 2022 DEIA report is that marine pollution is not mentioned at all in the section dealing with cumulative impacts. As such there is a failure to comply with the regulatory requirements for impact assessment under the 2014 EIA regulations and therefore authorisation should be refused.
11. Note that the above comments apply to the project even though its preferred location is now in Big Bay.

NOISE IMPACTS

Terrestrial noise

12. Comments by GC on the 2021 DEIA report record that the noise impact assessment is deficient in that it fails to consider cumulative noise impacts and the impacts on people working at the Iron Ore Terminal and surrounding areas and buildings. This issue was not addressed in the record of refusal by the Competent Authority but is mentioned along with other concerns (referred to elsewhere in this submission), in the Appeal decision.[10]

> "2.62.6 The statement that "The operational noise levels of the proposed project exceed the SANS 10103:2008 rating limits for a number of human receptors. The results indicate that from a noise perspective the Big Bay would have less of an impact that the Small Bay site on NSAs in the area. This will result in a High negative significance. The noise impacts associated with the operational activities can be mitigated to be of Medium-Low negative significance after mitigation. The noise impact statement will be the same for

[10] Appeal at paragraph 2.62

both the Small Bay site and the Big Bay site as the night limit at NSA is still exceeded (2021 DEIA report paragraph 84.0n page 183)."

13. It follows from the above that the issue of operational above ground noise needed to be assessed and mitigated for compliance with the 2014 EIA regulations.

14. Noise assessment modelling in the 2021 DEIA report predicted substantial violations of noise standards at a number of points around the bay. The EIA report evaluated nine noise-sensitive areas (NSAs) and modelled ambient noise levels during the operations phase of the project. It should be noted that this is not a temporary issue: A minimum 20-year lifespan is required under the terms of the RMIPPPP,[11] and the powership's operational lifespan is 25 years.

15. These models are based on two possible powership locations; unfortunately, the numbering of these alternatives is not consistent (see 2021 EIAR p42). The preferred location is in Big Bay (white circle), with the alternative location in Small Bay (blue circle).[12]

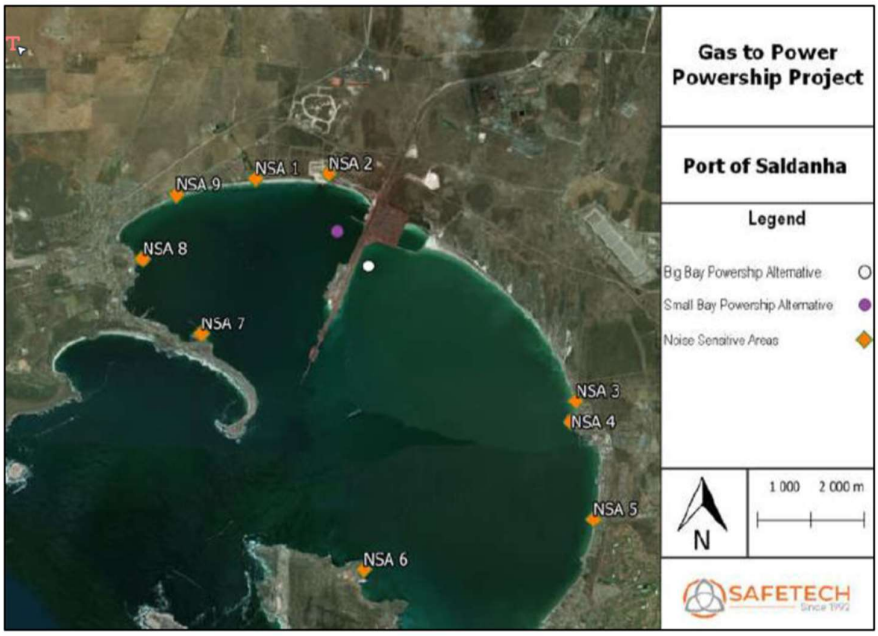

Figure 4-14 Noise Sensitive Areas

[11] Risk Mitigation Independent Power Producer Procurement Programme, issued by the Department of Mineral Resources and Energy.

[12] The original proposal was for the location I n Small Bay, and the Big Bay location was added later.

The modelled noise levels are given in 2021 EIAR Figure 8-5, reproduced below. "Alternative 1" here refers to the Small Bay site, and Alternative 2 refers to the preferred site at Big Bay.

				Small Bay		**Big Bay**	
NSA No.	**SANS 10103:2008 District**	**SANS 10103:2008 Limits dB(A)**		**Alternative 1 Predicted Noise Levels (dB(A))**	**Alternative 1 Comment on results**	**Alternative 2 Predicted Noise Levels (dB(A))**	**Alternative 2 Comment on Results**
		Day	**Night**				
1	Residential	50	40	56.0	Exceeds Day & Night Limits	49.5	Exceeds Day & Night Limit
2	Industrial	70	60	62.2	Exceeds Night Limit	54.2	Within Limits
3	Residential	50	40	0,0	Within Limits	0,0	Within Limits
4	Residential	50	40	0.0	Within Limits	0.0	Within Limits
5	Residential	50	40	0,0	Within Limits	0,0	Within Limits
6	Residential	50	40	22,1	Within Limits	0,0	Within Limits
7	Residential	50	40	40,9	Exceeds Night Limit	41.0	Exceeds Night Limit
8	Residential	50	40	0,0	Within Limits	0,0	Within Limits
9	Residential	50	40	47,8	Exceeds Night Limit	0,0	Within Limits

16. This data clearly indicates exceedances of noise limits at the Industrial site at NSA 2 (approximately the Oil Spill Response Limited facility), the "Residential" NSA site 1 (approximately at Blue Bay Lodge), the "Residential" NSA site 9 at Saldanha Beach, and the "Residential" site NSA 7 approximately at the site of the Small-craft Harbour on the breakwater. (Ambient noise levels below 40 dB(A) are reported as "0.0".) Although the Small Bay location was first proposed, the Big Bay location is now preferred, and due to distance and the presence of the jetty, has somewhat lower noise levels at most NSAs. Still, the noise limits at some points along the shore of Small Bay suffer noise levels exceeding night-time standards and bordering on daytime standards.

17. It should be noted that the term "Residential" is a misnomer, since the noise standard applied here (SANS 10103:2008) has no such category. The relevant categories are "rural", "suburban", and two categories of "urban" (the second having workshops and major roads). The standards here called "residential" are those for the "suburban" category (50 dB(A) day, 40 dB(A) night). From the modelled data at sites NSA 1 and NSA 9, it appears that much of the northwest shore – extending well past the Saldana Beach area in the case of Alternative 1 – will exceed the nightly standards, and some areas will exceed the daytime standard as well. While these appear to be small numbers, a change

of only 3 dB represents a doubling of sound pressure, and a 10 dB change is heard approximately as a doubling of loudness.

18. Importantly, while there are suburban neighbourhoods along this shoreline, the shoreline itself is largely occupied by recreational uses. NSA 9 represents the area of Saldanha Beach and the city-owned Saldanha Holiday Resort, which "prides itself on its beautiful beach which stretches for several kilometers on both sides of the resort." Although the 47.8 dB(A) noise level predicted under Alternative 1 is below the daytime "suburban" limit, it exceeds the 45 dB(A) "rural" daytime standard, which may be more appropriate. The shoreline of Saldanha Bay is a popular destination for national and international visitors, and the many tourist facilities on the beach are not sheltered from ambient noise by homes and other buildings. NSA 1 is the location of Blue Bay Lodge, a popular wedding venue which advertises "undisturbed beaches and quiet surroundings", with ambient noise levels about 56 dB(A) from the Small Bay powership location and almost 50 dB(A) from the preferred Big Bay location.

Impacts of Noise

19. Noise is an important and underappreciated environmental and public health concern. Noise limits and regulations are most commonly designed to reduce exposure to high levels of noise, which can induce hearing loss (especially over extended periods). Beyond hearing loss, however, extended exposure to even moderate levels of noise causes a wide range of problems. In contrast to the direct physical effects that occur at high volumes, "physiological effects of relatively low environmental noise levels primarily occur when the sound level disturbs cognitive functions, causes emotional reactions, or interferes with activities of the individual such as mental tasks, relaxation or sleep."13 These effects may be mediated by disturbance of thought processes, by annoyance or frustration, or as the result of an impact on sleep.[14]

[13] Babisch 2000. Traffic noise and cardiovascular disease : Epidemiological review and synthesis. *Noise and Health* https://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2000;volume=2;issue=8;spage=9;epage=32;aulast=Babisch

[14] Clark and Paunovik. 2018. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Cognition. https://www.mdpi.com/1660-4601/15/2/285/htm

20. Studies of low-to-moderate ambient noise are difficult, but those that have been done show consistent associations with cognitive impairment. A 2021 study by Weuve et al found statistically significant increases in moderate cognitive impairment and Alzheimer's Disease in a population of nearly 8,000 older adults with a mean ambient noise level of only 56.2 dB(A).[15] For perceptual speed in particular, a 10 db(A) increase was equivalent to being about 2 years older. These results are roughly consistent with previous studies of adults. In children, studies have reported significant associations between road traffic noise exposure and national standardized test scores, as well as road traffic noise and measures of attention. These "non-auditory" effects occur even at low levels of exposure; for example, a 2022 meta-analysis identified statistically significant improvements in reading comprehension in quiet classrooms than in noisier ones.[16] Disturbance of sleep is thought to be a particularly important effect of noise on health. As a consequence, the World Health Organization has set a long-goal of 40 dB as a maximum background noise level during sleep. Ambient powership noise would be enough to exceed this goal in several of the NSA locations reported above.

2022 Saldanha DEIA report

- NSA definitions and background for noise assessment: p126 / pdf142
- Terrestrial Noise Impacts: p280 / pdf296

21. The 2022 EIAR dramatically revised the noise assessment, concluding that the impacts would be much less than suggested by the 2021 EIAR. The assessment began with a survey of noise from a similar powership (the Osman Khan at Sekondi-Takoradi, Ghana,), using this as check on the modelled predictions. The resulting models yield lower predicted noise than in the first set of models; the authors argue that "It is thus assumed that the effects of attenuation devices such as silencers etc reduces the noise levels. The desktop modelling results do not fully take into account the attenuation devices."[17] .The

[15] Weuve et al. 2021. Long-term community noise exposure in relation to dementia, cognition, and cognitive decline in older adults. *Alzheimers Dement*
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8720224/pdf/nihms-1762453.pdf
[16] Thompson. 2022. Noise pollution and human cognition: An updated systematic review and meta-analysis of recent evidence. *Environment International*
https://www.sciencedirect.com/science/article/pii/S0160412021005304
[17] 2021 Draft EIAR, Appendix I16.

2022 draft moves the powership to Big Bay, allowing the jetty to provide much-needed buffering for the northwest residential and recreational areas. The result is a much-decreased area of impact, apparently not affecting the northwest coast or the city of Saldanha. (This change does, however, bring the powership much closer to the residential, recreational, and resort areas at Langebaan (NSA 3, 4, and 5).)

22. This dramatic decrease in modelled noise is at odds with the results of 2021, and is hard to explain. The 2021 assessment included modelled noise levels for the Big Bay location as "Alternative 2" (table above). Although these are lower than the Small Bay location, they greatly exceed the night limit at NSA 1 (the Blue Bay Lodge), as well as at NSA 7 (on the breakwater). The much lower overall noise levels represented in the 2022 EIAR are not consistent with this data. Rather than the detailed modelling by NSA presented in the 2021 assessment, the 2022 assessment merely contains the phrase, "the noise impact associated with the operational activities of the proposed Project is predicted to be of Low significance after mitigation at the Port of Saldanha." More detailed modelling is relegated to the appendix. Similarly, the overall metric "Impact on the sense of place experienced by the local community as a result of visual and noise effects that appear during the operational phase" is listed simply as "Low".

23. Dramatically different noise modelling results from the 2021 (left) and 2022 (right) EIARs.

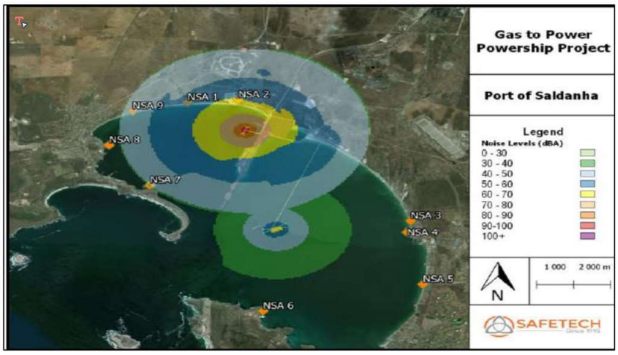

Figure 8-4 Predicted noise levels during the operational phase of the project

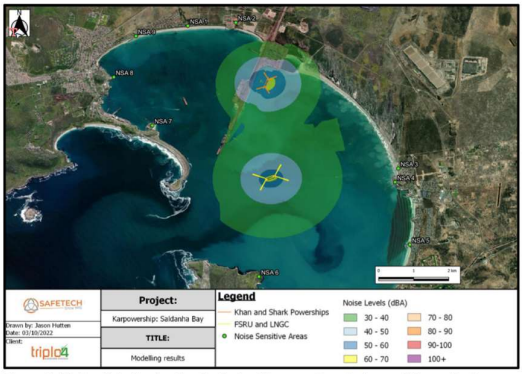

Figure 7-12: Predicted noise levels during the operational phase of the project.

The 2022 revision of noise modelling is described more thoroughly in Appendix 9 C2. The following table (C2 Table 11) compares the predicted noise levels from the 2021 models to the updated predictions from the 2022 models.

Table 11 - Noise Level at receivers during operational phase

NSA No.	SANS 10103:2008 District	SANS 10103:2008 Limits dB(A)		2021 Alternative 2 Predicted Noise Levels dB(A)	2021 Comment on Alternative 2 Results	2022 Updated Predicted Noise Levels dB(A)	2022 Updates Comment on Results
		Day	Night				
1	Residential	50	40	49.5	Exceeds Night Limit	6.6	Within Limits
2	Industrial	70	60	54.2	Within Limits	17.4	Within Limits
3	Residential	50	40	0,0	Within Limits	0,0	Within Limits
4	Residential	50	40	0.0	Within Limits	0,0	Within Limits
5	Residential	50	40	0,0	Within Limits	0,0	Within Limits
6	Residential	50	40	0,0	Within Limits	22.1	Within Limits
7	Residential	50	40	41.0	Exceeds Night Limit	0,0	Within Limits
8	Residential	50	40	0,0	Within Limits	0,0	Within Limits
9	Residential	50	40	0,0	Within Limits	0,0	Within Limits

24. The drop in modelled noise levels from 2021 to 2022 is dramatic, on the order of 40 dB – roughly the difference between a spoken conversation and a jackhammer. The difference between these models is explained as (p24):

- "The 2021 modelling did not take into account the attenuation of the noise by the vessel structure. The sound emissions are thus significantly lower than previously modelled and contained in previous versions of this report."
- "The 2021 survey did not take into account that all of the air intakes are only on one side of the vessel (the port side)."

25. A more likely explanation for a drop in intensity at NSA 1 and NSA 2 is the presence of the jetty, which presumably helps muffle sounds from the powership in Big Bay. Yet the

2021 models also modelled the Big Bay location, and the difference between Big Bay and Small Bay (that is, on either side of the jetty) was only 6-8 dB.

26. Further inquiry into the 2022 models is difficult without completely repeating the modelling process. However, some simple checks can be performed. The base noise level of the powership is not reported in the 2022 EIAR Appendix 9 C2.1, but we can estimate it (as the EIAR does) with the reported data from the similar *Osman Khan* (2022 Draft p281/pdf297):

35m	71.3 dB
50m	70.0 dB
800m	50.0 dB

27. As these measurements were taken on a calm day over open ocean, they would appear to be a good comparison to NSA 6, which is 6.6km across Big Bay but in line-of-sight to the proposed powership location. If we assume that the Saldanha powership is measured at 55.0 dB at 800m (like the *Osman Khan*), and using a simple inverse square law comparison, then at 6600m (NSA 6) we would expect a sound level of 36.7 dB.[18] The predicted value of 22.1 dB (table, above) is about 15 dB lower (equivalent to a 32-fold difference in power).

28. The examples of NSA 1 and NSA 2, which are much closer than NSA 6, may make them a better comparison (although they are on the other side of the jetty from the proposed powership location). Again assuming a powership with the same characteristics (55.0 dB at 800m), then at 2235 m (NSA 2) and 2970 m (NSA 1) we expect 46.1 dB and 43.6 dB, respectively. While these numbers are indeed lower than the original (2021) model predictions of 54.2 dB and 49.5 dB, they are greatly at odds with the 2022 model predictions of 17.4 dB and 6.6 dB.

29. The applicants suggest a number of mitigation strategies to reduce noise impacts, but these strategies are unlikely to have much effect. For example, the first strategy calls on

[18] Sound level at site 2 = Sound level at site 1 - $20*\log_{10}(\text{distance}_2 / \text{distance}_1)$

the operator to "Ensure that all acoustic enclosures or attenuators that are fitted to the vessel are in place during operations." But since these acoustic buffers and attenuators are already in place, this suggestion has no value. The only recommendation likely to have an effect is the suggestion of rotating the ship so the engine air vents point away from sensitive receptors.

30. It follows that the assessment of terrestrial noise appears not to be sufficiently credible to be a basis for decision making and is a fatal flaw.

Underwater noise

31. The GC did not initially comment on underwater noise impacts in response to the 2021 DEIA report, but submitted concerns of small-scale fishers as part of a complaint in terms of section 13 of the 2014 EIA regulations, regarding failure of Triplo 4 to ensure compliance with EIA regulations pertaining to the contents of environmental impact assessment reports.

32. The basis for this complaint was the fact that the practitioners failed to conduct a specialist study of the potential consequences or impacts - on the environment and marine resources of Saldanha Bay - of underwater noise generated by the ships, prior to submission of the final environmental impact assessment report (FEIAR)(GC states that it was particularly concerned about the consequences for small-scale fishers of Saldanha Bay, who depend on a healthy ocean and marine environment for their livelihoods."[19] The complaint therefore encompassed economic and heritage issues as small-scale fishing has been a major component of economic life for indigenous communities since time immemorial. This is recognised in the final draft EIA report:

> "Saldanha Bay supports a strong small-scale fishers' industry that spans several communities in surrounding areas, which provides income, food, and cultural significance to these communities. Any negative impacts to the sector due to the proposed project could have significant socio-economic impacts. To understand how the proposed project may result in socio-economic impacts the Fisheries and Mariculture report by Lwandle and Anchor Environmental Consultants was referenced to unpack the marine impacts, while to understand the positions and concerns of small-scales fishers the

[19] GC complaint dated 31 May 2021 to the DFFE in terms of section 13 of the 2014 EIA regulations.

> engagements undertaken by Steenkamp and Rezaei from Afro Development Planning's resulting Stakeholder Engagement Report are referenced. "[20]

33. The competent authority refused the application for environmental authorisation on a number of grounds, including that the Marine Ecology, Coastal and Fishers Assessment and the estuarine specialist recommended a noise modelling study but none was done. Also, the authority found that there had been a failure of the EAP to comply with regulation 23(1)(b) of the EIA regulations 2014 in that new information was introduced after the public comment period.[21]

34. The appeal confirmed the findings of the decision of the competent authority on the issue of underwater noise impacts and refused the appeal. It acknowledged that noise has an impact on juvenile fish, and fish spawning grounds.

> "It is our view that the potential sensitivity of the fish species and specifically the spawning ground adjacent to the site proposed for the Karpowership Saldanha Bay drives the <u>need for further certainty on this aspect</u>".[22]

The appeal also acknowledges that several fish species and megafauna that are known to occur in Small and Big bays are listed as being threatened by the IUCN list 2020.

> "The white stumpnose and elf both of which use the Bay as a nursery area, are listed as being "vulnerable" as are the smooth hound shark. Heavside's dolphin are listed as being "near threatened". Several sea birds in the area are threatened."[23]

The 2022 DEIA report

35. The 2022 DEIA report, which is based on the 2022 Specialist Study on Marine Ecology and fisheries, is not a basis of decision making, being internally inconsistent and incomplete.

[20] Final draft EIA report page 172

[21] In regard to underwater noise the reports referred in the i2021 DEIA report as: "*GDS R&D Incorporated Noise Study on a Karpowership Noise Emissions (17th April 2021) – supplied by client." And "AB MECHENG Inspection Certificates of Noise Measurements (April 2021) – supplied by client." Were introduced after the initial public comment period,*[21]

[22] Appeal 2.65.3

[23] Id 2.47.6

36. It starts off stating that effects on marine ecology of impacts of cooling water and noise are rated Medium-High without mitigation and with mitigation are reduced to Medium.[24]

37. However in its consideration of impacts on fish and marine mammals the 2022 DEIA is more absolute. It concludes that no significant impacts on fish or marine mammals are predicted as a result of the operation of the Powership in Port of Saldanha as it will not materially change existing underwater noise associated with the port. Hence no additional noise mitigation is deemed necessary, and this project is thus supported from an underwater noise assessment perspective."[25] The report explains this conclusion as follows:[26]

> "The results of the assessment showed that after installing the Powership and an FSRU, even with the Powership operating in excess of the maximum output proposed for the port, the background noise would increase by approximately 9 dB in close proximity to the Powership (approximately 400 m from the ship). This is equivalent to a noise level of 127.6 dB SPLRMS re 1 µPa. This is an above worst-case scenario, since the Powership's maximum contracted capacity is set to 320 MW in Saldanha, whereas this prediction is based on a directly measured 420 MW operation. For context, large cargo vessels were frequently loading or unloading in the Port of Saldanha during the baseline survey and, for example, a bulk carrier typical of the type accessed in the harbour produced

[24] Draft FEIA report Table 0-1-4: Summary of Stakeholder Engagement Activities, page ix

[25] "7.4.9.1.2 Impact of underwater noise on fish
The assessment of underwater noise on fish is simpler than for marine mammals; based on the Guidelines in Popper et al. (2014) (see section 5.2) no weighting is applied or required to calculate the impact thresholds. The exposure criterion for TTS to the most sensitive species of fish is 158 dB SPLRMS, to which a fish must be exposed for 12 hours.
The calculated noise levels in the Port of Saldanha do not reach this threshold in any position. All noise measurements at any range from the Ghanian Powership were at least 10 dB below this value. No risk to fish in the Port of Saldanha is expected as a result of the Powership installation. More information is provided in the marine ecology report Ref. B4, Marine Ecology, Oct 2022.
7.5.9.2 Cumulative Impacts
Based on measurements taken during the baseline monitoring exercise at Port of Saldanha, it is demonstrable that the noise levels shown (that represent the effect of Powership operations) will be exceeded by a transiting container or bulk carrier vessel moving into or out of the port, since noise levels from those existing operations were measured to be higher. The cumulative effect of these passing vessels will be negligible due to their distance from the operational Powership and auxiliary vessels.
7.5.9.3 Specialist Conclusion: Based on this assessment, no significant impacts on fish or marine mammals are predicted as a result of the operation of the Powership in Port of Saldanha as it will not materially change existing underwater noise associated with the port. No additional noise mitigation is deemed necessary, and this project is thus supported from an underwater noise assessment perspective."

[26] Id paragraph 7.5.9

noise levels of 134.6 dB SPLRMS re 1 µPa at 100 m from its side in port, a similar noise level to the Powership at the same distance.

The effect on baseline noise will be negligible where the Powership is operating at a low power, which was found to be typical during the survey of the operational Powership in Ghana.

Predictions of the noise in Small Bay and most of Big Bay will be less than 1 dB above baseline with the Powership operating at maximum power. Outside the Port of Saldanha Bay, no detectable noise contribution is expected."

38. The report then qualifies this conclusion by saying:

> "There is still uncertainty around the extent to which the noise from the FPP will affect fish behaviour and distribution, partly due to gaps in research. <u>As a result, the extent to which fisheries will be affected by the FPP operations is uncertain and the impacts are considered as possible.</u>" [27]

39. The 2022 Specialist Study on Marine Ecology and fisheries highlights the fact that noise pollution could impact adversely on the marine environment, particularly juvenile fish and the ecology on which they depend for development. It states:[28]

> "The proposed FPP facility in the Port of Saldanha Bay is surrounded by important habitats such as Langebaan Lagoon, Malgas, Jutten and Marcus Islands, the subtidal benthic zone and the water body itself. The biota in these areas could be impacted the underwater noise from the vessel operations. **Exposure to noise for a long period of time, such as is expected of the Powership operations, may cause chronic effects, including developmental deficiencies and physiological stress (Popper and Hawkins 2016). These may affect life functions, including individual health and fitness, foraging efficiency, avoidance of predation, swimming energetics and reproductive behaviour (Popper and Hawkins 2016).** However, as stated above, these responses to sound are dependent on the sound qualities.
>
> The most noise-sensitive groups in Saldanha Bay are expected to be mammals and fish. Saldanha Bay acts as an essential nursery habitat for many fish species due to its nutrient-rich waters. Juveniles are considered more susceptible to noise disturbances as they are less mobile, while adult fish (and marine mammals) can move out of affected areas. It is often assumed that animals will avoid disturbing noise. However, territoriality or a response of immobility may

[27] At page 255

[28] Marine Ecology, Coastal and Fishers Assessment at 4.4.4.4

mean that the animal does not move away from the noise source (de Soto 2016)."[29]

40. It follows that the developmental impacts of underwater noise on fish embryos and juvenile fish and the organisms on which they depend for development are still uncertain. This is a matter of concern for small scale fishers who depend on the Saldanha Bay nursery for particularly white stumpnose, for survival.

41. The report also states that the effects on the juvenile stumpnose were not determined and it was suggested that further studies be undertaken to determine the extent to which juvenile white stumpnose inhabit the area of the proposed Powership.

> "Saldanha Bay, and especially the nearshore shallow waters, is an essential nursery habitat for the juveniles of many fish species and any impact on juvenile fish will influence the fisheries they recruit to. As juvenile fish have **less physical capacity to move out of the way of impacts such noise,** discharged warm water, or a water intake pipe, they may be more prone to by impacted by the FPP. Given the current population and low levels of white stumpnose recruitment within Saldanha Bay, efforts should be made to reduce impacts on juvenile white stumpnose. **The extent to which juvenile white stumpnose inhabit the area of the proposed Powership needs to be established. There remains a concern regarding displacement of fish populations occur as a result of impacts arising from Powership operations**. A reduction in the available suitable habitat for juvenile and adult fish may lead to the concentration of fish within heavily fished areas of Saldanha Bay, increasing the risk of over- exploitation by commercial and recreational fisheries."[30]
>
> Although noise from the operational phase is unlikely to cause direct harm to fish, there is still uncertainty around the extent to which the noise from the FPP will affect fish behaviour and distribution, partly due to gaps in research. <u>As a result, the extent to which fisheries will be affected by the FPP operations is uncertain and the impacts are considered as possible</u>. The scoring results in a Medium Overall Environmental Significance, which remains Medium with mitigation. <u>The research gaps in the understanding of the effects of noise on the local fisheries means that the assessment is given a Medium confidence</u>."[31]

42. The report confirms that the white stumpnose is threatened:

[29] id
[30] 7.5.11 at page 254
[31] Id page 255

> "Finally, regarding the breeding of white stumpnose, it is noted that the only area where these fish may be impacted is within the 300m of the Powership 300m of the Powership, where the increased noise may cause juveniles which utilise the area as a nursery to move further away from it. It is important to note that the white stumpnose stock is overexploited in the area and already under pressure, and that juveniles displaced from the Powership site could enter more heavily fished areas (Lwandle & Anchor Environmental Consultants, 2022).[32]

43. This is followed a statement that further research is needed to determine whether the area around the powership is indeed a fish nursery and if so, "adequate mitigation measures" must be put in place. The report concludes by stating:

> "Thus, due to the localised nature of the impact, and the findings of Fisheries and Mariculture specialist there will not be a wider negative impact on the white stumpnose stock beyond a 300m zone around the Powership (Lwandle & Anchor Environmental Consultants, 2022), and therefore no negative socio-economic impacts are anticipated. [33]

44. Effects of noise impacts on ecosystem services and marine biota beyond 400 m was considered to be unlikely although the impacts of increased noise levels due to the FPP are not certain due to the sparse literature on the effect of continuous low-level noise on marine organisms. However, there is evidence that noise of this type has the potential to be harmful or interfere with the ecological functioning of marine biota.

45. The draft final EIA then concludes, without there being thresholds provided in the 2022 Specialist Study on Marine Ecology for marine biota:

> "As the Underwater Noise Assessment (Mason & Midforth 2022) determined, the Powership operations are not anticipated to significantly increase the underwater noise levels in Saldanha Bay. Within 400 m of the Powership there will be an increase in noise of approximately 9 dB but noise levels will not be high enough to cause direct harm to marine fauna, unless they experience prolonged exposure, which is deemed unlikely. Marine fauna may experience masking and behavioural changes within hundreds of metres of the Powership, which could have negative consequences over time.[34]

46. The issue of noise impacts is particularly concerning given the decline in fish stocks and the location of the Powerships close to the shoreline - where juvenile fish species that are more susceptible to noise - are located.

[32] Id page 305
[33] Page 173 final eia report
[34] Draft Final EIA r page 254

Expert reports Dr Michelle FOURNET and Dr Arthur POPPER

Dr Michelle Fournet (ANNEXURE A hereto)

47. We refer to the expert report of Dr Michelle Fournet, concerning the marine noise impacts of the Karpowerships project (the Fournet acoustic report) where the following general findings are made followed by a discussion of a critical flaw in the methodology of assessment and then a comprehensive list of deficiencies in the report.[35]

48. The Fournet acoustic report commences by stating:

> "SUMMARY OF OPINION: The Underwater Noise Assessments and associated Baseline Underwater Noise Reports (studies) failed to adequately demonstrate that noise will not have significant ecological consequences at the three proposed locations. This is in large part due to (1) failure of the studies to consider anthropogenic noise associated with this project as chronic, (2) the failure of the study to adequately assess underwater noise conditions at meaningful temporal scales, and (3) the failure of the studies to consider impacts to the broader marine community, including benthic organisms and invertebrates. As such, the mitigation actions proposed in the associated EIAs are founded on an erroneous assessment of noise impacts, and they fail to meaningfully address the possible or likely impacts of anthropogenic noise associated with the powership projects on the marine environment.
>
> Scientific literature on how marine organisms respond to anthropogenic noise includes behavioral responses, changes in organism presence or absence, physical responses including hearing loss, physiological responses including stress, mortality, and demographic shifts including reduced reproductive success or larval development, and displacement[1]. As such, any proposed activity that is believed to be sound producing may have significant consequences throughout the ecosystem. The studies and technical reports associated with the EIAs did not sufficiently address the impacts of noise to marine organisms found within each region. Instead, the scope of inference for the underwater noise assessment and report was overly narrow, misapplied critical scientific literature, and omitted most of the potential impacts of noise to marine organisms.

[35] ASSEMMENT FOR JUDICIAL REVIEW – ENVIRONMENTAL AUTHORISATION FOR THREE PROPOSED GAS TO POWER POWERSHIP PROJECTS LED BY KARPOWERSHIP SA (PTY) LTD – MARINE ACOUSTIC ECOLOGY EXPERT INPUT Michelle Fournet, M.S., Ph, 2022

Table 1. Potential effects of anthropogenic sound on animals

Effect	Description
Death	Sound exposure results in instantaneous or delayed mortality.
Physical injury & physiological changes	Physical injury results in temporary or permanent impairment of the structure and functioning of some parts of the body. Physiological changes result in increased stress or other effects that can lead to reduced fitness.
Hearing threshold shift	Loss of hearing, temporarily or permanently, results in decreased ability to respond to biologically relevant sounds.
Masking	Noise results in a decrease in detectability of biologically relevant sounds (*e.g.*, sounds of predators and prey, sounds of conspecifics, acoustic cues used for orientation).
Behavioural responses	Behavioural responses include any change in behaviour from small and short-duration movements to changes in migration routes and leaving a feeding or breeding site. Such responses are likely to vary from species to species, depending on numerous factors such as the animals normal behavioural repertoire, motivational state, time of day or year, age of the animal, *etc.* Some changes in behaviour, such as startle reactions, may only be transient and have little consequence for the animal or population.
No obvious behavioural responses	Animals may show transient or no responses, even if they detect the sound (*e.g.*, to a very low-level sound) or habituation may take place. However, even if there is no response, there is always the possibility that physical injury and physiological changes may take place without the animal showing overt changes in behaviour

The above table, taken from Popper and Hawkins, 2019 [16] shows the potential effects of anthropogenic noise on marine animals. Of these, the underwater noise assessment addressed only hearing threshold shifts, despite an extensive body of literature of additional impacts associated with anthropogenic noise. Further, the studies failed to acknowledge in any capacity that the noise produced by the powerships would be long duration (16.5 hours/day over a 20 year period)."

49. The report then identifies a critical flaw in the methodology namely:

"Failure to appropriately interpret the peer reviewed literature when determining impact to marine organisms.

The studies rely heavily on two pieces of peer reviewed literature to support the assertion that noise impacts on cetaceans and fish will be negligible: Southall et al. (2019)[20] and Popper et al. (2014)[21]. However, these studies were misinterpreted and cannot be applied to the current Underwater Assessment Studies. The study authors assert:

"*Any risk to marine mammals or fish, as per the guidelines in Southall et al. (2019) and Popper et al.(2014) respectively, will be negligible. The lower order of effect defined in the guidelines, temporary threshold shift (TTS), would only occur when marine mammals of the most sensitive species (VHF cetaceans, i.e. porpoises) remained within 850 m of the Powerships operating at maximum capacity for a full 24 hours.*"(Underwater Noise Assessments)

However, the study fails to acknowledge the primary caveat included by Southall et al. (2019) which is that the number outlined in that publication only apply to discrete sound exposure. Southall et al. (2019) explicitly states that:

"*The current criteria remain focused on the derivation of auditory weighting and exposure functions for the purpose of evaluating the potential fatiguing effects Marine Mammal Noise Exposure Criteria: Hearing, Weighting Functions, and TTS/PTS Onset 165 of discrete noise exposure (e.g., TTS/PTS).*

These approaches are not applicable in evaluating potential auditory effects of chronic noise exposure over periods of weeks, months, or years." (Southall et al. 2019)[20]

Given that the expected duration of the powership project is estimated at 16.5 hours per day for 20 years, the associated noise should be defined as chronic. Therefore, the values that the authors of the underwater noise studies rely on to assess the impact of anthropogenic noise on hearing do not apply. In the 2019 publication, Southall et al. goes on to state that:

"*As in human noise exposure criteria, [chronic noise] will require different methods and metrics other than the SPL or SEL metrics used here. Separate criteria are needed to evaluate behavioral responses and broader-scale auditory effects (e.g., auditory masking) and physiological effects (e.g., stress responses*)." (Southall et al. 2019)[20]

Despite ample literature describing the need to consider chronic noise impacts and the need to consider effects beyond hearing loss, (e.g., The Effects of Anthropogenic Noise on Animals, 2018 Springer Press)[22–25] the acoustics assessment report fails to consider noise impacts beyond 24 hours in any capacity; this highly significant flaw nullifies any inference based on this report."

50. The Fournet acoustic report then outlines a comprehensive list of other specific deficiencies in the 2022 DEIA report:

    a. Failure to adequately describe the baseline marine soundscape at ecologically relevant timescales and frequencies:
    b. Failure to adequately identify baseline natural soundscape characteristics
    c. Failure to consider the cumulative impacts of chronic noise on marine organisms
    d. Failure to consider impacts of anthropogenic noise on marine life beyond potential hearing loss:
    e. Failure to consider impacts of noise on commercially important species, including commercial fish/invertebrate species and tropic interactions:
    f. Insufficient ambient noise and propagation analysis

51. The report then mentions several SPECIFIC FAILURES/INSUFFICIENCIES ASSOCIATED WITH EIA MITIGATION MEASURES which are set out in the table below in full for ease of reference:

"B. SPECIFIC FAILURES/INSUFFICIENCIES ASSOCIATED WITH EIA MITIGATION MEASURES **Stress**: According to the Impact Management Action section of *Protection of Flora and Fauna* found in each of the EMPRs "*Noise pollution must be minimized to ensure*

faunal inhabitants are not stressed." However, the Underwater Noise Assessments failed to include any quantitative/qualitative assessment or commentary on the role of anthropogenic noise on faunal inhabitant stress. Therefore, it is not possible for this management action to be adequately assessed. Further, the proposed mitigation method, fortnightly awareness training and incident reporting, is insufficient to mitigate noise associated stress on sonic fauna.

Unfounded EIA risk assessments: Because of failures and insufficiencies in the Underwater Noise impact Reports, the EIAs erroneously determined that underwater noise has "No impact". This is not scientifically sound. Further, it is directly contradicted by the results of the marine ecology and marine avifauna report impacts section, which indicates that "The effects on the marine ecology in the receiving water body due to the discharge of cooling water or increased noise and vibration levels" are "Medium-High" before mitigation and remain "Medium" after mitigation.

Similarly, the indication in the Tourism Impacts and Risks section of the EIAs designate the impact of noise on tourism to be low, however no assessment was done on the likely impacts of noise of targeted tourism species including humpback dolphins, penguins, and other marine megafauna. Inversely, the underwater acoustics report relied on the concept that disturbed animals would leave impacted areas in order to minimize noise exposure, which negatively impact tourism operators as animals were displaced from current viewing locations.

Duration: The EIAs lean heavily on the reduction of operational times from 24 hours to 16.5 hours per day. Given the lifespan of the project is predicted at 20 years, this still constitutes chronic ambient noise that radiates throughout the marine environment. No assessment of chronic noise was made to determine long term impacts on marine fauna in the underwater noise assessment. Despite this, in *the scoring table: Impacts of increased noise on the marine ecology* the EIARs indicate that the impact is reversible, despite a lack of research (field or desk) to support the supposition that chronic noise impacts are reversible. Chronic noise impacts have been demonstrated to cause physiological stress, habitat abandonment, reduced foraging effort, hearing loss and potential population declines.[26,27,29–32]

Commercial Fishing Impacts: The RB EIA indicates that "the extent to which fish will be affected [by noise] is unknown" (RB, EIA, Page 303) and that it is possible that "fisheries may experience shifts in the physical distribution of populations of target species" (RB, EIA, Page 303). The following assertion, however, that displacement is only expected to occur over relatively short range is not supported by scientific knowledge and is based on the evaluation in the Underwater Noise Assessment, which failed to consider long term noise impacts. As noted above, even at low levels chronic noise impacts impact catch rates and hearing in many fish species[26,42] According to the most updated literature on the subject:

> "It is not only the level of the sound but also its frequency range, rise time, duration, repetition rate, and a number of other parameters that may be important in determining [noise] effects" – (Hawkins and Popper (2018)[24]

The assertion that made in the RB EIA that "However, overall catches will not necessarily be affected as any displacement would only occur over a relatively short range, expected to be of the order of hundreds of metres." (RB, EIA, Page 303) is unfounded based on existing knowledge of noise impact on fishes.

Impacts to Invertebrates: Both the RB EIA and the NP EIA cite de Soto (2016) when they state that "marine invertebrates may be impacted by underwater noise; however, that evidence is limited (see NP, EIA, Page 286 and RB, EIA Page 242). This is a misrepresentation of the literature. Evidence on the impact of noise on invertebrates is overwhelming, despite the topic being understudies. De Soto 2016 states directly in the abstract of the aforementioned manuscript that "studies show that the noise effects on marine invertebrates range from apparently null to behavioral/physiological responses to mortalities"[35], the literature review goes on to document 10 studies demonstrating behavioral and/or physiological impacts on invertebrates associated with anthropogenic noise, and only two studies demonstrating that invertebrate catch rates were not impact by noise (though these studies include the caveat that additional noise impacts were likely though not measured)[35].

While it was not possible within the scope of this study to assess every ecological citation pertaining to noise, this pattern of downplaying or directly misinterpreting existing scientific literature (as seen above in the case of Southall et al. (2019) and Popper et al. (2014)) were rampant throughout the EIA.

B. GENERAL FAILURES:

The following is a specific list of topics pertaining to acoustic ecology and underwater noise assessments that the Applicant and associated studies failed to adequately address. This list is not comprehensive, but highlights some of the primary failures of the studies and the associated EIAs.

1. Failed to address the impacts of anthropogenic noise on commercially important species. This is significant because a reduction in commercial fish may have economic or cultural consequences.

    a. There is a documented scientific risk to commercial fisheries associated with anthropogenic noise[40,42,43]

2. Failed to address the impact of anthropogenic noise on important prey species. This is significant because the proposed sites are in the near proximity or directly adjacent to Marine Protected Areas (MPAs), National Park, and Critical Biodiversity Areas. Noise may endanger prey species in or *en route* to these areas. This could disrupt the base of the food web and may be ecologically significant throughout trophic levels.

3. Failed to quantify baseline natural sound levels at ecologically relevant timescale or frequency levels at any of the three proposed sites. This is significant because sound is seasonably variable.

    a. The studies rely on less than 48 hours of recordings during periods of moderate to high anthropogenic activities as a baseline. This is not enough time to consider ecological soundscape baselines which are seasonally variable.

4. Failed to adequately quantify naturally occurring contributions to the marine soundscape. The studies defaulted to sound levels of anthropogenically altered soundscapes as the ecological baseline. This is significant because comparing elevated noise associated with the proposed activities to an already elevated soundscape artificially deflates the impact of noise associated with proposed industrial projects and encourages excessive noise contributions to an already stressed ecosystem.

5. Failed to adequately model sound propagation in these regions, despite ample scientific resources in existence to do so. This is significant because in the absence of sound propagation modeling a site-specific noise assessment is not possible and anthropogenic noise may impact protected areas and/or sound sensitive species.

    a. The underwater noise report eschewed actual propagation modeling and instead took 10 second sound samples to demonstrate a lack of impact. This is scientifically unsound and is analogous to taking 10 second snippets of an individual's behavior and claiming to extrapolate their entire life history. Further, no effort was made to consider frequency specific propagation. While not all frequency bands are likely to propagate, no effort was made to determine if biologically significant increases in relevant frequency bands occurred as a function of noise."

6. Failed to assess the risk associated with permanent soundscape alterations due to permanent changes on the seafloor due to construction activities. This is significant because animals use the soundscape as a cue to inform migration, habitat suitability and settlement (i.e., where juvenile animals select to grow and populate).

7. Failed to consider the physiological effects of anthropogenic noise – and stress in particular – on sound sensitive species including marine mammals, invertebrates, and fish. This is significant because the studies failed to consider how biologically critical physiology that is related to the fitness of the individual and overall population may be impacted.

8. Failed to consider the impact of noise on the behavior of protected or sound sensitive species- including marine mammals. Noise can have significant

impacts such as separating cetacean calves from mothers or causing groups of animals, including those that are valuable to tourism, to be displaced.

9. Failed to consider impact of noise on the ecosystem holistically, including a failure to consider the links between trophic levels (e.g., predator and prey), and links between ecosystems and economics (e.g., commercial fish and fisheries). This is significant because it omits some of the largest, though not immediately obvious, potential and cumulative impacts of noise on this ecosystem and the users who rely on it.

10. Failed to incorporate best science into assessment of underwater noise impacts. This is significant because the results of the EIA mitigation efforts are not based on reliable scientific information, and therefore may not adequately protect sensitive ecosystems.

Expert report of Dr Arthur Popper

52. The expertise of Dr Popper has been drawn on extensively in the Marine Ecology expert reports of the 2021 and 2022 DEIA reports. The expert opinion of Dr Popper, after considering the 2022 DEIA, is set out in full in the table below and concludes inter alia that without data on substrate vibration and particle motion, it is impossible to make any predictions as to the potential impacts of the anthropogenic sounds on fishes or aquatic invertebrates. (emphasis added). He concludes that this finding, like the lack of particle motion data, are, in his view major gaps in being able to make any predictions on potential effects on fishes and invertebrates.

53. His report in full is as follows:

COMMENTS SUBMITTED BY DR. ARTHUR N. POPPER ON THE UNDERWATER NOISE ASSESSMENT FOR THE PORT OF SALDANHA, SOUTH AFRICA FOR THE KARPOWERSHIP PROJECT

- With respect to fishes, and perhaps invertebrates, measures only for sound pressure, as done by Subacoustic and reported in Appendix 9 B2 of the Draft

Report on Saldanha Bay[36], are significantly lacking. It is now well understood that all fishes, and likely all invertebrates that hear, use the particle motion component of sound (*e.g*., Nedelec *et al*. 2016, Popper and Hawkins 2018). Some fishes that may be called hearing specialists can detect sound pressure as well as particle motion, but it is likely that most species involved in the region of consideration are not specialists and therefore primarily detect particle motion (*e.g*., Popper *et al.* 2021). This means that any suggestions or criteria (etc.) that are provided only in terms of sound pressure (or SEL, etc.) are likely meaningless, since the fishes will most likely respond to the unmeasured particle motion and not to the sound pressure.

- We and others have now demonstrated that another critical issue is that fishes and invertebrates that live on or close to the seafloor also are likely to detect substrate vibration, (*e.g*., Hawkins *et al*. 2021, Roberts and Howard 2022). Again, there are no measures provided, although it is very likely that the sounds being produced will project into the substrate and travel substantial distances before re-entering the water column.

- My conclusion is that without data on substrate vibration and particle motion, it is impossible to make any predictions as to the potential impacts of the anthropogenic sounds on fishes or aquatic invertebrates. This finding, like the lack of particle motion data, are, in my view, major gaps in being able to make any predictions on potential effects on fishes and invertebrates. I will also add that while particle motion is potentially predicable by knowing sound pressure, this is only the case in very deep (hundreds of meters) and away from boundaries such as the surface of bottom. Thus, in the case in question, actual measures of particle motion must be made. Furthermore, substrate involvement must be measured – it cannot be predicted, and very much depends on the physical characteristics of the substrate, (*e.g*., Lee *et a*l. 2016, Ballard and Lee 2017).

- The argument regarding Temporary Threshold Shift (TTS) is totally irrelevant. I will agree that the likelihood of TTS occurring in the fishes in the area is highly unlikely. But what is highly relevant is that there are increases in the overall increase in sound levels in the area. Such increases are much more likely to result in far more important behavioral and physiological effects such as (but not limited to): animals moving from the local area and leaving breeding or feeding sites; masking of sounds of biological relevance to species such as those used to communicate between animals or the sounds

[36] Tim Mason, Fergus Midforth. 18 October 2022. Underwater noise assessment – Port of Saldanha. Subacoustech Environmental Report No. P292R0803.

of potential predators; and increased stress leading to physiological changes such as in hormonal levels, and numerous other issues. It is also critical to note that without knowing particle motion information and how well fishes and invertebrates make use of particle motion (for which we have minimal data), it is hard to predict what potential effects might be.

- In summary, the overall analysis presented in the project documents with regard to fish have very substantial issues with regard to anthropogenic sound and fishes (and aquatic invertebrates). Clearly, my impression is that the project documents do not reflect recent thinking and knowledge about anthropogenic sound. On the other hand, it is appropriate that the documents use our 2014 guidance and not earlier interim guidance, as used in parts of the US. But it should be noted that in 2014 we clearly pointed out that particle motion is an issue and one that needs to be considered for most fishes.

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The Draft Reports failed to include the issues of particle motion and substrate vibration in their assessment of noise and anthropogenic noise impacts and failed to assess impacts across all life stages of marine species, despite the stated fact that Saldanha Bay serves as a productive nursery habitat for myriad species.[37] Together, these fundamental omissions make the Draft Reports inadequate for the purpose of assessing overall impact of the Karpowership project to marine species.

Discussion

54. The 2022 DEIA report is not a basis for decision making for at least five reasons, and probably many more, arising from the above. Firstly, to maintain that there is a distinction between impacts on fish, on the one the hand, and fish distribution on the other is scientifically unsound and appears to be a device to avoid the inevitable conclusion that the report is making two inconsistent statements about underwater noise impacts on fishing resources. These resources and their sustainability have a material impact on the socio-economic and environmental rights of small-scale fishers.
55. The second basis is that the report recommends further studies in respect of a material issue for impact assessment notwithstanding that the competent authority has told the applicant that it should not recommend any further studies.
56. The third basis is that the report fails to provide certainty on a key issue as recognised in the plan of study[38] and the appeal decision.[39]
57. Further to this ground, the lack of certainty on this crucial issue presented in the final Draft EIA flies in the face of requirements set out on 11 march 2021 by the competent authority when it advised Karpowerships that the final EIA needed to fulfil the following requirements:

    (i) All specialist studies must be final and provide detailed practical mitigation measures for the preferred altemative and recommendations and must not recommend further studies to be completed post EA.

[37] Appeal decision 2.92.5.
[38] See paragraph 50 above

[39] Appeal at paragraph 2.65.3 states "it is our view that the potential sensitivity of the fish species and specifically the spawning ground adjacent to the site proposed for the Karpoweship Saldanha Bay drives the need for further certainty on this aspect".

(ii) Ensure that the issues raised and comments received during circulation of the Draft EIAr from registered I and Ap's and organs of state that have jurisdiction in respect of the proposed activity are adequately addressed in the FEIAr.[40]

These requirements were reiterated in the appeal decision

Appendix 3 to the EIA regulations which deals with the requirements for environmental impact assessment reports states:

> Section 1 (2) states that **the environmental impacts, mitigation and closure outcomes as well as the residual risks of the proposed activity must be set out in the environmental impact assessment report**. (emphasis added)
>
> Section 2 states that the objective of the EIA process is, through a consultative process to
> 2(d) determine the - (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and (ii) degree to which these impacts - (aa) can be reversed; (bb) may cause irreplaceable loss of resources, and (cc) can be avoided, managed or mitigated; (emphasis added)

The plan of study stated that "A specialist study is required to determine the baseline/ status–quo description describing aspects of the marine environment that may be affected by the proposed development and assess the impacts of the project on the marine environment, inclusive of entrainment."

58. Fourthly, as per the Fournet expert acoustic report, the 2022 DEIA expert report on marine impacts fails to appropriately interpret the peer reviewed literature when determining impact to marine organisms.

59. Finally as per the Popper report the 2022 DEIA , concluded that failed to include the issues of particle motion and substrate vibration in their assessment of noise and anthropogenic noise impacts and failed to assess impacts across all life stages of marine species, despite the stated fact that Saldanha Bay serves as a productive nursery habitat for myriad species.[41] Together, these fundamental omissions make the Draft Reports inadequate for the purpose of assessing overall impact of the Karpowership project to marine species.

[40] Appeal decision at paragraph 2.38.2
[41] Appeal decision 2.92.5.

60. Given the above material uncertainties and gaps in knowledge, the EIA is unable to state the environmental impacts, (particularly underwater noise impacts) mitigation and closure outcomes as well as the residual risks of the proposed project as far as the fishing resources on which the small-scale fishers of Saldanha Bay depend are concerned. The concerns of small-scale fishers encompass the entire life cycle of the fish on which they depend and since the above impacts on juvenile fish are not assessed in the final EIA report, the issues raised by fishers have not been addressed.

61. Accordingly, the environmental authorisation should not be granted as the project and its potential serious negative socio-economic impacts on small scale fishers has not been evaluated and mitigated in terms of the regulatory scheme for impact assessments under Section 24 of NEMA.

Impact on cultural practices in regard to fishing

62. It should be noted that small-scale fishers do not only depend on fishing for their livelihoods, but attach significant cultural value to the practice of fishing, and have done so since time immemorial. This is set out more fully in the submission authored by Dr J Sunde, addressed to SLR consulting in regard to the TOTAL Energies EP South Africa Blocks 5, 6 and 7 Draft Environmental Impact Report, and attached to this submission as "Annexure C". [42]

63. Given the shortcomings in public participation in the 2021 DEIA process, this matter was not visited at that stage, but is referred to in the Afro Development report as follows:

> "The potential socio-economic impacts of the proposed project on the fisheries and mariculture sector are of importance given that the fisheries sector supports a large number of small-scale fishers in the area whose livelihood depends on continuing availability of near shore fish stocks. Further, the mariculture industry provides additional employment opportunities in the area, and provides important export income to the country as the sector supplies both the domestic and international market. <u>This industry also provides indigenous peoples access to employment, which is supportive of their cultural and spiritual needs, as access to the sea has</u>

[42] Dated 7 December 2022

been outlined by local traditional leaders as being of cultural and spiritual importance."[43]

"Saldanha Bay supports a strong small-scale fishers' industry that spans several communities in surrounding areas, which provides income, food, and cultural significance to these communities. Any negative impacts to the sector due to the proposed project could have significant socio-economic impacts."[44]

"Finally, it is important to note that the Saldanha Bay has a rich cultural history which has a recorded period of over 400 years from the arrival of European explorers, and an unrecorded history likely spanning far longer from use by indigenous peoples."[45]

The fact that there is still uncertainty over the impacts on the marine and fishing resources of Saldanha Bay, of the Karpowerships project, as set out above results in the fact that the impacts on issues of critical cultural importance remain undetermined, a further fatal flaw.

MAJOR HAZARD INSTALLATION IMPACTS

64. The GC submitted that the assessment of the risks of the project as a major hazard installation is fatally flawed in that the risks of a pipe burst where the pipe traverses land is not considered. Furthermore, the potential cumulative impact of a major accident in the vicinity of large scale planned liquid storage and industrial activity areas is not assessed, notwithstanding the inherently dangerous environment of a port, and the duty to consider all potential impacts.

65. The GC highlighted concerns as to the possible catastrophic consequences of such an accident with the following submission:

"The following image of the crater left by the Tianjin explosion in 2016[46] which killed 173 people and caused $1bn in losses is a sobering reminder of the heightened risk of industrial accidents in ports especially industrially

[43] Afro Development Planning October 2022 - Socio- economic impact assessment report for the proposed power Powership project at the Port of Saldanha Bay, Saldanha Bay Municipality, Western Cape Page 36
[44] Id Page 44
[45] Id Page 55

[46]**Tianjin chemical blast: China jails 49 for disaster Published** 9 November 2016 BBC news- https://www.bbc.com/news/world-asia-china-37927158

orientated parts of ports given that hazardous chemicals for import, export and other uses are often stored there."

66. The 2021 DEIA report, after comments, recommended that the installation be considered a major hazard installation but found the risks mentioned above to be acceptable.[47] It recorded that localized concerns included the fear of a major disaster as a result of an explosion.[48] However it recorded, inconsistently it is submitted, that the significance of such potential impacts to be low, without justification. For example, under Health Impacts, the 2021 DEIA report stated that:

> "The health impacts were addressed within relevant specialists' studies, namely the Air Quality Impact Assessment, the Noise Impact Assessment and the Major Hazardous Risk Assessment. No impacts with high significance were identified. Findings of these studies in terms of impacts and mitigations are discussed in Sections 8.3 and 8.4 of this report." [49]

[47] Summary of risk assessment on page 217

[48] Paragraph 9.2 2021 DEIA at Page 225 –"In addition to these global and national issues, there were also a number of more localised concerns raised pertaining predominantly to the project's compatibility with Port planning and operational activities as well potential adverse impacts on the local estuarine and marine ecology and ambient air quality as well as the fear of a major disaster as a result of an explosion."

[49] 2021 DEIA 8.3.11 Health impact

Rupture of hoses and fire

67. Paragraph 8.4 is headed "Impact Assessment Findings".Under the heading "Risk Assessment"[50] the report concludes:

> "The proposed LNG operations were modelled for this Risk Assessment. The main risk contributing part of the operation is the possible rupture of one of the transfer hoses. The risks were found to be acceptable for the Port and normal Port operations can continue at the other berths while LNG is being offloaded at the facility."

68. Under overall impact assessment the significance of such a rupture after mitigation was found to be very low. Mitigation measures consisted of inspection, good housekeeping and professional installation.[51]

> "The main risk contributing part of the operation is the possible rupture of one of the transfer hoses. This may result in a discharge of LNG into the marine environment due to pipeline bursting leading to a flash and pool fire, a High impact. An accredited installer conducting a pressure test and providing the relevant compliance certificates, as well as inspections on the quality and integrity of the pipeline can mitigate this to a Medium impact. The risks were to found to be acceptable for the Gas to Power Operations."[52]

69. The Quantitative Risk Assessment concludes:

> "No one within the port area is exposed to a risk greater than 1.0e-06 (one in a million) and ship staff is exposed to a risk of no more than 1.0e-05 (one in a hundred thousand). These risks are acceptable for persons operating in a national port."[53]

However, this conclusion seems to explicitly exclude a jet fire occurring from the shear of a portion of the pipeline that is land-based adjacent to the iron ore stockyard, a location where human activities are most likely to damage the pipeline and where humans are most likely to be working or standing close to the pipeline.

70. The risk assessment is therefore incomplete and not a basis for decision making.

[50] id 8.3.14
[51] id Page 179
[52] id 8.4.13.1
[53] Page 58

The risk of a major accident is included under the heading of impact assessment, but the impacts of a major disaster were not assessed. No cumulative impacts were identified for the major hazard risks.[54] The risk assessment undertaken for the 2021 DEIA indicates that it is not an environmental compliance assessment.[55] The approach of treating a risk assessment as an environmental impact assessment in an EIA under NEMA is legally flawed. The response of Triplo4 to GC in regard to its submissions on the initial draft EIA confirms that it took this approach when it stated:

> "The risk of a death to a person along the pipeline is 1.0e—9 (one chance in a billion) which is therefore very low."

71. Even if a risk is low, the cumulative impact may be high, and requires to be assessed under the EIA regulations. It follows that the impacts of a major explosion, which has been identified as a possibility and its cumulative impacts was not assessed.

72. The 2021 DEIA report states:

> "a MHI application will be made to the District Municipality, and be assessed based on their disaster management capacity. This MHI application can only be made upon completion of the EIA process, once the EA has been granted (refer to the Major Hazard Installation Risk Assessment, Appendix I).[56]

However, the above process is not an impact assessment and, in any event, takes place after authorisation is granted.

73. The record of refusal did not mention major hazard installation impacts and the issue was not raised on appeal. However, the appeal decision does make mention of it. It is therefore a matter of importance to the ultimate decision maker and should have been addressed in the Final EIA report, but was not.

[54] 8.4.17.19 Appendix I14 **RISK ASSESSMENT** in terms of **THE MAJOR HAZARD INSTALLATION REGULATIONS**
[55] At page 4 states: The Risk Assessment may not meet the requirements of environmental legislation as it is not intended as an Environmental Risk Assessment.

[56] Page 18

Appeal decision

74. The Appeal decision when considering ground of appeal 2 (lack of a holistic assessment) noted the following as an issue of concern.

> "2. 62 A holistic consideration of the EA application for the proposed Project, and of the appeals, requires that I point out the further concerns that arise in the 2021 DEIA report as follows:
> 2.62.4 the statement that the "Major Hazard Risks assessment established that an in incident involving the Gas to Power Project at the Port of Saldanha Bay could impact on the neighbouring berths. The risks associated with this MHI were found to be acceptable"
> (FEIAr paragraph 8.4.13 on page 176).

2022 DEIA report

75. The report is misleading as to the nature of the assessment done. It states under the heading "Assessment of Potential Impacts" that:

> "Specialist studies were undertaken to investigate key potential direct, indirect and cumulative impacts" on a list of subjects including "major Hazard installation assessment."
> "impacts are acceptable."

76. However as is clear from the above discussion, only a risk assessment was done. No environmentally compliant assessment of impacts was undertaken and no cumulative assessment was done.[57]

77. The 2022 DEIA report, under the heading "impact significance", gives a summary of stakeholder engagement.[58] The summary records under the heading Major Hazard Installation Risk (Section 7.4.20) that "Impacts are acceptable." Pre and post mitigation impacts are indicated as blank. This is contradicted by the statement of the EAP in the initial EIA where it is recorded that there is a fear of a major disaster as a result of an explosion.

> "In addition to these global and national issues, there were also a number of more localised concerns raised pertaining predominantly to the project's

[57] Paragrapg 9 page ix
[58] (Table 0-1-4: Summary of Stakeholder Engagement Activities).

compatibility with Port planning and operational activities as well potential adverse impacts on the local estuarine and marine ecology and ambient air quality as well as the **fear of a major disaster as a result of an explosion.**"[59]

78. Clearly there is no recognition of the concerns raised by GC in this regard. The environmental impact of a major fire as a result of a pipeline leak near to a storage area is not considered despite the fact that it was pertinently raised in the GC submission. The issue is either trivialised in the 2022 DEIA report, or the argument is made that because such incidents are governed by protocols the risk of them happening is unlikely.

79. GC disputes that the impact of a major fire or explosion has been assessed as claimed, in the 2022 D EIA report, and that the impacts of catastrophic incident, no matter the probability of it occurring are acceptable.

> "Major hazards were identified around fire risks associated with gas leaks - which was also found to be normal, and operation can continue with appropriate mitigation and emergency responses. This could also provide opportunity for skills development in the area relating to monitoring and evaluation as well as emergency risk response." [60]
>
> "Impacts of catastrophic accidents on marine ecology and ecosystem services
>
> The introduction of the Powership and FSRU vessels increase the risk of the likelihood of catastrophic accidents occurring. Here, the following were considered to be a catastrophic accident: …
> Explosion/flash fires. …
> Introduction of toxins, biocides or alien species considered extremely harmful to marine ecology.
>
> All these catastrophic events have protocols in place to avoid incidents, therefore the probability and overall significance score for catastrophic accidents in Low. These catastrophic accidents have been assessed **together with the consideration of impacts** on marine ecology and the provision of ecosystem services."[61]

80. It is of critical importance that the impacts of a major explosion as described in the initial submission by GC be assessed, together with the cumulative impacts of such an event and without such an assessment the final EIA report is fatally flawed.

[59] Paragraph 9.2 2021 DEIA at Page 225
[60] Final EIA report page 398
[61] Id page 256

FAILURE TO UPDATE CONCLUSIONS ON MARINE IMPACT OF PIPELINE ROUTING

81. The appeal decision mentioned the importance of limiting impacts on the Saldanha Bay reef habitat:

> "Given that little is known about the reef habitat, some areas may be sensitive and therefore where possible it is recommended that the pipelines should be routed to limit destruction of the habitat (paragraph 3.4.1 on page 29)." [62]

82. The 2022 DEIA report fails to pertinently update its conclusions concerning the impact on marine resources of the FSRU and pipeline construction, (given its amended preferred location), after receiving new information. The report recognises the importance to the sustainability of the marine ecosystem of underwater reefs in Big Bay. However it does not update its recommendations based on findings from the most recent study in this regard, the **SALDANHA BAY SEA BASED AQUACULTURE DEVELOPMENT ZONE SPECIALIST ENVIRONMENTAL MONITORING HARD SUBSTRATE SURVEY August 2022.** (Anchor 2022 Aquaculture report prepared for the Department of Forestry, Fisheries and the Environment), mentioning this report in passing.[63] This report's findings as to the scale of underwater reef in Big Bay indicate that its extent is far larger than initially understood. It also provides a more detailed indication of the location of reefs than had been available hitherto.[64] This information is highly relevant to assessing the impact of the project as a result of its preferred location in Big Bay.

83. The recommendation of the 2022 DEIA report is as follows:

> "The impact of the construction phase on ecosystem services has an Overall Environmental Significance of Low, which is reduced to Very Low if the calcrete

[62] paragraph 2.48.1. The position of the powership was initially proposed at the scoping stage for Small Bay but is now intended to be located in Big Bay

[63] This is not to be confused with another study in 2022 by Anchor, referred to in the report. Anchor, 2022. The State Of Saldanha Bay And Langebaan Lagoon 2020, Technical Report No. Aec 1988/1. 542 Pp.

[64] Anchor 2022 Mariculture report at Executive summary page (ii) "It was suggested that the amount of rocky substratum present in Big Bay was likely significantly more expansive than originally thought and that the full extent of the calcrete platform and the proportion of this habitat type impacted by current and future mariculture activities should be determined."

> reef is avoided, as this is a sensitive habitat that supports the marine ecosystem services."[65]

The Marine expert report likewise reports:

> "Accordingly, the assigned overall environmental significance rating of the effects of construction on marine receptors is Medium-Low without mitigation and Low with mitigation."[66]

84. However the findings of the Anchor 2022 Aquaculture report demonstrate that construction impacts to these reefs cannot be avoided or minimised given the preferred mooring location of the Karpowership FSRU.

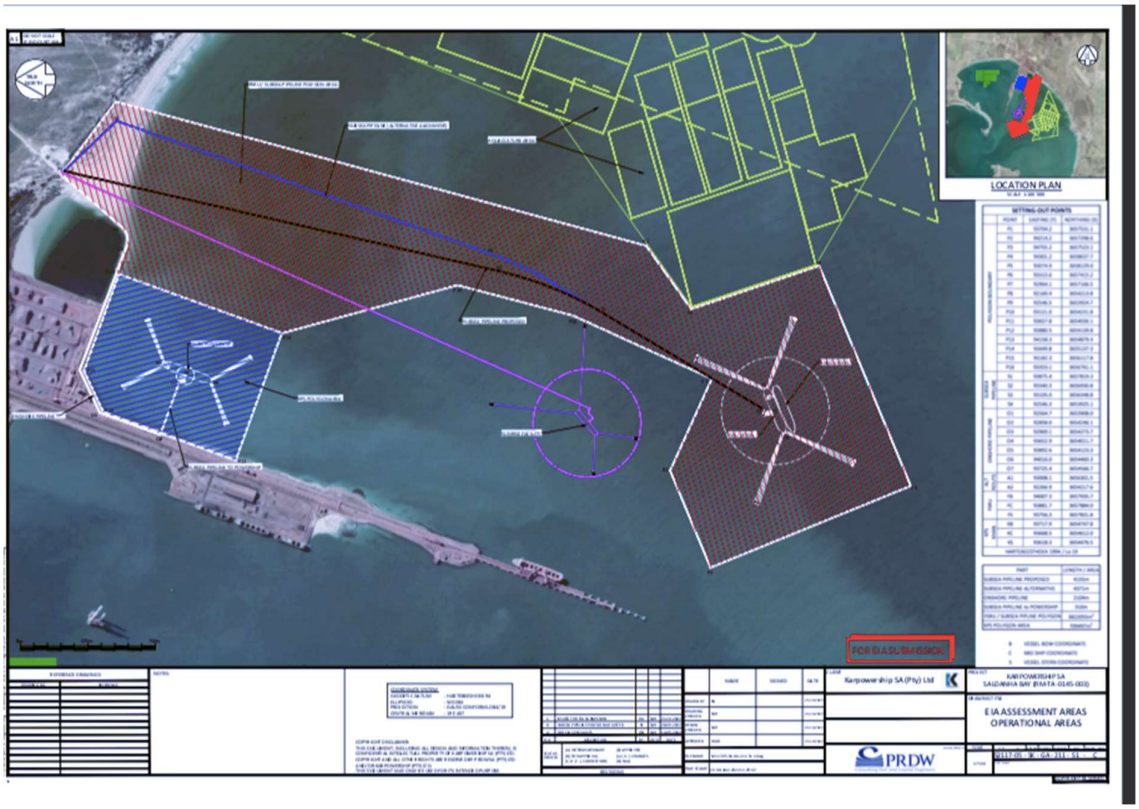
85. The preferred location of the Karpowership FSRU and associated pipelines appears from diagrams in the 2022 DEIA report.[67] Diagrams from the Anchor 2022 Aquaculture report show that this location is in an area where extensive underwater reefs exist, that require protection and that provide important ecosystem and socio-economic benefits. The Anchor 2022 Aquaculture report states that initial estimates of the extent of reefs was probably conservative and more research is required to determine their extent.[68]

86. The 2022 DEIA report is therefore incomplete, and conclusions as to the potential impact of the project inaccurate. The information contained in this research indicates that the final 2022 DEIA report has gaps in knowledge and has failed to assess a significant impact that the project may have on the marine ecosystem. Recommendation of further studies means that the EIA process has not been completed and is against the advice of the department on referred to above[69], and therefore fatally flawed.

PREFERRED LOCATION OF THE PROJECT AND MARINE REEFS

Appendix 1.5 - Preferred Powership and FSRU location _ Gas Pipeline Alternatives.pdf

[65] Final draft EIA report page 255
[66] Marine Ecology, Coastal and Fishers Assessment at page 2, and page 55
[67] Appendix 1.5 - Preferred Powership and FSRU location _ Gas Pipeline Alternatives.pdf
[68] Anchor 2022 Aquaculture report page 6
[69] See paragraph above



Position of underwater reefs per the **SALDANHA BAY SEA BASED AQUACULTURE DEVELOPMENT ZONE SPECIALIST ENVIRONMENTAL MONITORING HARD SUBSTRATE SURVEY August 2022** (Anchor 2022)

The first photograph below indicates the estimated reef areas in yellow and green. The second photograph indicates the finfish precinct in red and the bivalve precinct in yellow. From a comparison with the preferred location diagram above it is clear that the FSRU will be located directly above a hard substrata (reef) and finfish precinct and its pipelines will traverse this reef, as well as a second reef indicated in green, closer to shore. It will cross the finfish and bivalve precincts.

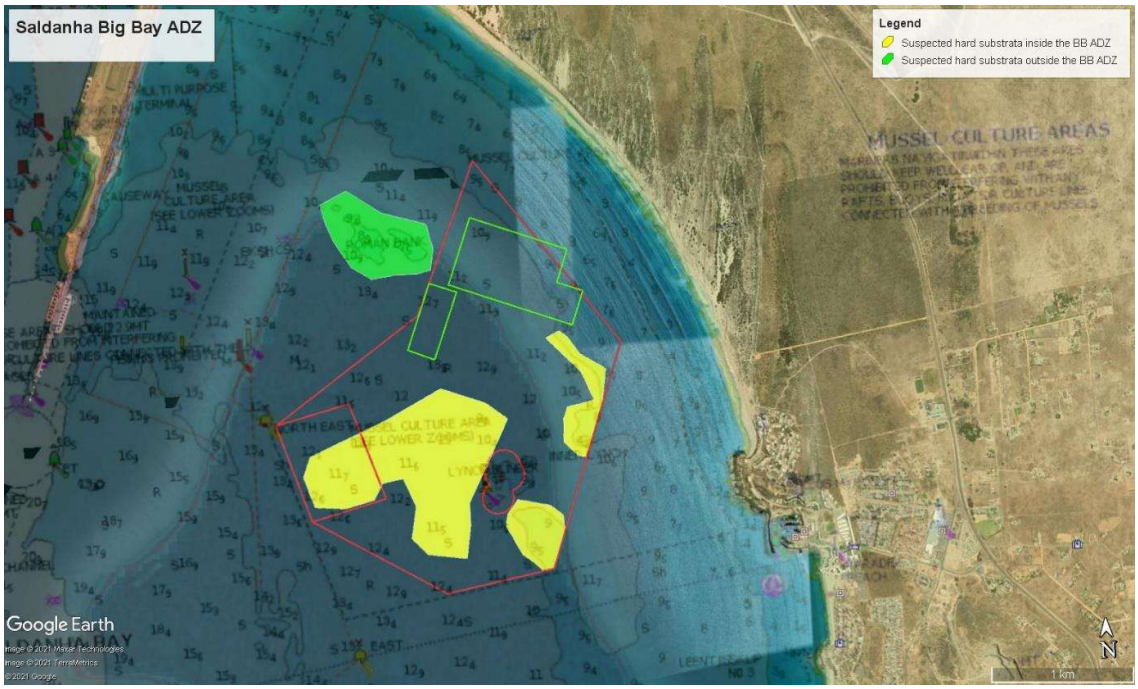
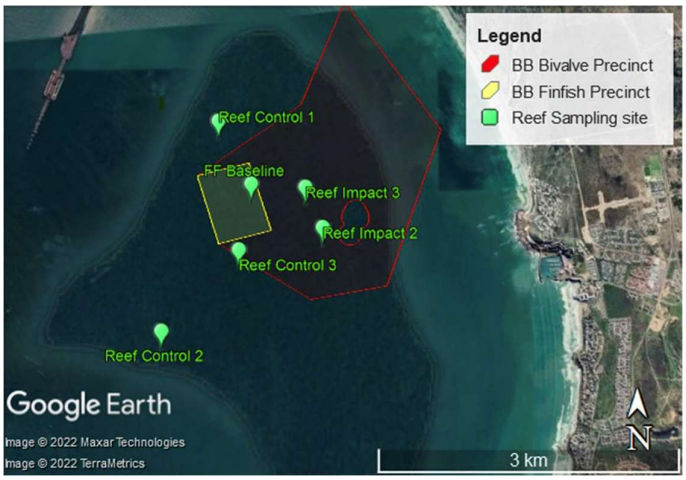
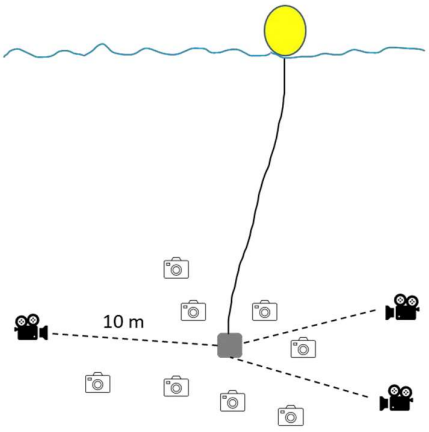


Figure 2. Location of the reef survey sites in Big Bay and diagram of the survey method.





87. The Marine report states that disturbance to benthic and littoral habitats and fauna is an unavoidable consequence of the proposed development. <u>However, disturbance to potentially sensitive habitats should be minimised.</u> Avoidance of destruction of the reef by the laying of pipelines was recommended in the Marine expert report, and is the basis for a recommendation of **low** impact in the final Draft EIA report.

> "An extensive abrasion platform exists throughout much of Big Bay (Flemming 2015). Much of this area may be subject to periodic, natural sand inundation, but some areas of exposed calcrete rock occur. The current extent of the calcrete reef is unknown and there is little information on the type of benthic communities present, although further study has been recommended (Anchor 2020b). The installation of the pipeline will transform the seabed, currently comprising low relief emergent calcrete and sand substrata, by the inclusion of a hard 600 mm diameter linear structure lying on it. The effect route is anticipated to be ~ 2-3 metre wide due to ballast on pipe to ensure stability. The pipeline and ballast are expected to become biofouled with time by sessile organisms and ecological function should be restored.
>
> However, given that little is known about the reef habitat, some areas may be sensitive, and therefore, where possible, it is recommended that the pipeline should be routed to limit destruction of the calcrete reef habitat. [70]

88. The Marine Ecology Expert report refers to the fact that the most recent reef survey has gaps in knowledge and recommends further research in order to determine the best route for the pipeline and to ensure that there are no important potentially sensitive habitats along the pipeline route.

> *4.4.1.2 Mitigation measures*
>
> ……It is recommended that high resolution bathymetry and side scan surveys should be conducted before the gas pipeline is installed to confirm that there are no important, potentially sensitive habitats along the pipeline route. This should expand on and address gaps the recently completed reef survey undertaken by Anchor in 2022. [71]

89. The Anchor 2022 report records the uncertainties regarding the extent of the reefs in its report as follows:

> "it was suggested that the amount of rocky substratum present in Big Bay was likely significantly more expansive than originally thought and that the full extent of the calcrete platform and the proportion of this habitat type impacted by current and future mariculture activities should be determined. (I)[72]

[70] Marine Ecology, Coastal and Fishers Assessment page 54
[71] id Page 56

[72] Anchor 2022 Mariculture report at Executive summary page (ii) – "Due to the fact that the Big Bay ADZ precinct was not surveyed in the recent SANHO data, historical data which appears to have a slightly reduced

ANALYSIS

90. A recommendation that further studies be undertaken is not a mitigation measure, and indicates that the EIA process is as yet incomplete.

91. The Marine Ecology report had initially stated that the extent of the calcrete reefs was largely unknown:[73]

> "Consequently, the present-day extent of the calcrete reef in Big Bay and the benthic assemblages associated with it are not known as it is a largely unstudied habitat within Saldanha Bay (Anchor 2020b - p21)."

92. Importantly the 2022 Anchor Aquaculture research report into the extent of the reef indicates that it is greater than previously known. And also it is now clear that the proposed preferred location of the FSRU directly, or near directly above the reef and finfish precinct means that the pipelines will not be able to avoid traversing at least two reef areas and two marine precincts to a significant extent, all of which are sensitive areas. Based on this research and diagrams above it is submitted that damage to sensitive ecosystems will not be capable of significant mitigation by rerouting of pipelines, and will be more significant than previously considered by the 2021 DEIA report and marine impact assessment.

93. The conclusion of the 2022 DEIA report is that the impact on the reefs is likely to be low. However this is based on it being possible to avoid calcrete reefs as far as possible:

> "If the calcrete reef habitats are avoided as far as possible, lasting damage to the benthic community is predicted to be extremely low due to the very limited spatial scale of disturbance along with low macrofaunal density in the intertidal and likely fairly rapid recovery."[74]

94. The recommendation that such impacts are to be considered low cannot be justified. It is clear from the maps in the Anchor 2022 Aquaculture survey that it will not be possible for the project pipelines to avoid traversing the reefs, and doing so to a significant extent. The reefs are far more extensive than initially thought by the 2021 DEIA and

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reef extent as compared to the SANHO data, was used to calculate the reef area and estimates are likely conservative. "

[73] Page 21

[74] Final Draft EIA report at page 257

their extent is as yet not finally determined and could be larger than initially estimated, when this conclusion was drawn.

95. The scale of the sensitivity of the marine environment and presence of reefs is recommended for further study in the Marine expert report, in order to mitigate impacts, but this means that the impact assessment is as yet incomplete, as potential impacts have not yet been determined with any accuracy on a significant potential aspect of the project. Mitigation is not determinable at this stage. The 2022 DEIA report is therefore not a basis for decision making.

96. Further studies will not address the problem that the location of the FSRU is directly above a reef and its pipelines will traverse two reefs.

97. The Marine report notes the desirability of preventing reef damage and the socio-economic impacts of such damage and suggests for this reason that it should be avoided:

> "Construction phase impacts
>
> The pipeline is anticipated to cross some areas of exposed calcrete reef, unless intentionally avoided as suggested in the mitigation measures for Impact 1, Section 4.4.1.2. While little is known about the reef, it may be a sensitive habitat and is likely to support a much higher faunal diversity than the surrounding area, making it potentially valuable habitat for the species fished in the Bay. Construction impacts on the reef could impact the local fisheries, and so should be avoided."[75]

98. When assessing the significance of impacts of the construction phase the Marine Ecology report once again highlights the potential negative consequences of damage to the calcrete reef and the economic consequences thereof:

> ***"4.4.5.2 Assessment of significance: construction phase***
>
> The scoring of the assessment of the construction phase impacts on the ecosystem services is provided in Table 4-15. Overall, the severity of the construction phase impacts, without avoidance of the calcrete reef, are anticipated to be slightly harmful, as the reef is valuable biological habitat. Given the productivity and importance of Saldanha Bay as nursery habitat, it is likely that the reef is important habitat for many marine species and so any removal of this habitat could have negative consequences for the provisioning

[75] Marine Ecology, Coastal and Fishers Assessment page 84

of ecosystem services. If the suggested mitigation measures are followed, the severity and probability of the impacts will be lower (as shown in Table 4-16)."

99. The Anchor 2022 Aquaculture Survey mentions that development of mariculture in this area has been evaluated and considered inadvisable. The same should apply to the Karpowerships project given that it will damage and destroy sensitive marine environments on which the fishing economy of Saldanha Bay depends:

> "The pilot phase within the bay was recently concluded and all finfish cages removed from the bay. Therefore, there is presently not active finfish mariculture in the Saldanha Bay ADZ and none planned for the foreseeable future. This is likely due to the fact that it has been determined that the majority of the sea floor below the designated Finfish area is covered by reef (~79.9%) suggesting that development of the finfish area within Big Bay is not advised. [76]

100. The draft final EIA is therefore incomplete, inaccurate and is not a basis for decision making

INTEGRATED COASTAL MANAGEMENT

101. The DEIA report fails entirely to consider the requirements of section 63 of the National Environmental Management: Integrated Coastal Management Act, 24 of 2008 ("NEM:ICMA"). Section 63 sets out the factors relevant to environmental authorisation for coastal activities. It further fails to recognise the interests of the whole community, or assess how the interests of the whole community are impacted by the proposal.[77]

102. This is a fatal flaw.

[76] Id 39

[77] **"interests of the whole community"** means the collective interests of the community determined by—
(*a*) prioritising the collective interests in coastal public property of all persons living in the Republic over the interests of a particular group or sector of society;
(*b*) adopting a long-term perspective that takes into account the interests of future generations in inheriting coastal public property and a coastal environment characterised by healthy and productive ecosystems and economic activities that are ecologically and socially sustainable; and
(*c*) taking into account the interests of other living organisms that are dependent on the coastal environment.

CLIMATE CHANGE

103. The Minister's appeal decision on the 2021 Saldanha Bay Karpowerships DEIA report points to several flaws in the proponent's original Climate Change Impact Assessment (CCIA) and integration of climate change into the EIAr. The appeal decision referred to the 2017 judgment in the case of *Earthlife Africa Johannesburg v the Minister of Environmental Affairs* 201[2] All SA 519 (GP) (*Earthlife/Thabametsi* judgement) and confirmed that:

> "a Climate Change Impact Assessment (CCIA) is a necessary component of an EIA process for projects with climate impacts. The Court confirmed the need for a CIA that is much broader than a mere assessment of anticipated emissions; and it confirmed the need for a comprehensive assessment, which assesses, inter alia, the impacts of climate change on the proposed project itself, and the ways in which the project might aggravate the impacts of climate change in the area. The Court concluded that "without a full assessment of the climate change impact of the project, there was no rational basis for the Chief Director to endorse these baseless assertions". [78]

104. The appeal decision found that the CCIA in the 2012 DEIAR did not comply with the requirement as the proponent's CCIA was instead mainly concerned with the contribution of the proposed Project's GHG emissions towards climate change (2021 EIA 8.48 on pages 161 to 163). However it accepted the finding that the impacts is rated as high negative significance and "cannot be mitigated below a high negative rating 2021 DEIA report paragraph 8.4.14.1. on page 179"[79]

105. The Minister found fault in the proponent's failure to make an effort at such mitigation, concluding that mitigation measures for the greenhouse gas (GHG) impacts of the powerships are "entirely undeveloped and inadequate" In particular, the proponent failed to include a plan for how to implement carbon capture and storage (CCS), despite including CCS as an identified mitigation measure (2.61.2). The CCIA should have included the full lifecycle emissions of the Karpowership projects, including "gas production, gathering, processing, initial transport, and LNG liquefaction" (2.61.1).

[78] Appeal decision Saldanha Bay KPS 2.59
[79] At 2.60

106. In the revised 2022 DEIA report and CCIA, these deficiencies remain either partially or wholly unaddressed. The CCIA again fails to appropriately assess upstream emissions from the project, does not fulfill the comprehensive assessment required by the *Earthlife/Thabametsi* judgement, and makes no additional effort to mitigate the emissions from the project, found to be of "Very High Significance," which should be considered a fatal and material flaw to the project.

107. In the context of a climate crisis already resulting in significant harm and loss of life across South Africa, a failing electricity system in which consumers are already paying too much for unreliable and dirty energy, and the opportunity to rapidly and more cheaply deploy renewables at scale today, the "Very high" climate impacts of this project, and the failure of its DEIA report and its CCIA to comprehensively consider these impacts, render this project unacceptable for the climate and the people of South Africa.

CLIMATE CONTEXT

108. This following table setting out the climate context frames the urgency of taking decisions about South Africa's energy future that align with 1.5° C and that avoid exacerbating the harms from climate change that South Africa is already experiencing. Critical to making these decisions is a full analysis of every proposed project's climate implications within the EIA process. Unfortunately, as described below, the Karpowerships proposal falls short of such a comprehensive assessment.

GENERAL CONTEXT
It is incontrovertible that we are in a climate crisis which is being caused by human activities that emit carbon dioxide ("CO_2") and other greenhouse gases, including methane (CH_4), into the Earth's atmosphere. As of June 2022, atmospheric CO_2 levels had reached 421 parts per million (ppm), up from 353 ppm in 1990, and 316 ppm in 1960.[80] This represents a 50% increase over pre-industrial levels. Nearly 70% of this CO_2 comes from the burning of fossil fuels. 2021 saw the largest annual increase in atmospheric methane, 17 ppb, since systematic measurements began.[81]

[80] NOAA, Carbon dioxide now more than 50% higher than pre-industrial levels, (June 3, 2022), https://www.noaa.gov/news-release/carbon-dioxide-now-more-than-50-higher-than-pre-industrial-levels.
[81] NOAA, Increase in atmospheric methane set another record during 2021, (April 7, 2022), https://www.noaa.gov/news-release/increase-in-atmospheric-methane-set-another-record-during-2021.

South Africa is party to several international legal instruments aimed at addressing climate change. It has signed and ratified the UNFCCC, acceded to the Kyoto Protocol and signed and ratified the Paris Agreement of 2015. The Paris Agreement commits state parties to limiting the global average increase in temperature to "well below 2°C above pre-industrial levels" and to "pursue efforts to limit the temperature rise to 1.5 ° above pre-industrial levels". 1.5 ° is not an arbitrary number. Global average warming above 1.5 ° C above preindustrial levels will have profoundly harmful impacts on humanity and the planet, including in South Africa. The IPCC, the preeminent body for assessing the science related to climate change, documents and predicts these harms. In 2018, the IPCC prepared a Special Report on the impacts of global warming of 1.5° C above pre-industrial levels.[82] The Summary for Policy Makers published alongside that report explains that surpassing 1.5 °C would lead to irreversible loss of the most fragile ecosystems, and crisis after crisis for the most vulnerable people and societies.[83] The report indicates that" ... *Some of the worst impacts on sustainable development are expected to be felt among agricultural and coastal dependent livelihoods indigenous people, children and the elderly, poor labourers, poor urban dwellers in African Cities ... "*[84]

The Summary for Policy Makers of the "Physical Science Basis" Working Group of the IPCC's Sixth Assessment (2021), meanwhile, clearly establishes that each incremental increase in global average temperature comes with more substantial impacts. In other words, every fraction of a degree makes a difference to the ultimate health and survival of humanity and the beings with whom we share this planet. There is therefore wide consensus that urgent action is necessary in the next decade to limit global warming to 1.5° C. In the IPCC's Sixth Assessment, it was concluded that to limit warming to 1.5 ° C, emissions will need to peak between 2020 and 2025 and countries must halve CO2 emissions within the next decade and achieve net zero CO2 emissions around 2050. To date, the global community has fallen short of reaching this goal and emissions have continued to rise each decade. According to the UN Emissions Gap Report of 2020, the world is currently heading for at least a global average 3 ° C of warming by 2100.

The IPCC's Sixth Assessment further concludes that projected cumulative future CO_2 emissions over the lifetime of existing and currently planned fossil fuel infrastructure, including gas, without additional abatement (measures to prevent their emissions entering into the atmosphere) puts the planet on a pathway roughly aligned with 2°C average global temperature increase. Construction of further fossil fuel infrastructure would worsen this outlook. In short, there is wide consensus that urgent action is necessary in the next decade to limit global warming to 1.5°C and that there is no atmospheric space left for new fossil-fuel emissions.

South Africa has already experienced more warming than the rest of the world. From 1931 to 2015, western parts of South Africa, "including much of the Western and

[82] IPCC, *Summary for Policymakers: Global Warming of 1.5 ° C*, p. 5 and 9, (2018), https://www.ipcc.ch/sr15/chapter/spm/.
[83] IPCC, *Summary for Policymakers: Global Warming of 1.5 ° C*, (2018), https://www.ipcc.ch/sr15/chapter/spm/.
[84] IPCC, *Global Warming of 1.5 ° C*, p. 244 and 227, (2018), https://www.ipcc.ch/sr15/.

Northern Cape, and also in the east over Gauteng, Limpopo and the east coast of KwaZulu-Natal," warmed by "2°C/century or even higher – in the order of twice the global rate of temperature increase."[85] This trend is predicted to continue, with resulting increases in extreme heat waves[86], drought[87], water and food insecurity[88], wildfires[89], storms and flooding[90], sea level[91], and vector borne diseases[92] already underway.

Despite its particular vulnerabilities to climate change, South Africa is already lagging behind in the global effort to address climate change. The Climate Action Tracker (CAT), which takes the current government action and policies into account, rates South Africa's proposed actions and policies under the Paris Agreement as " insufficient".[93] The CAT states that South Africa's climate commitment in 2030 will fail to limit its warming to 1.5° C as required under the Paris Agreement. South Africa's climate commitment is not in line with a "fair" approach to the Paris Agreement's 1.5° C limit. [94]

[85] Republic of South Africa, Department of Environmental Affairs, *South Africa's Third National Communication under the United Nations Framework Convention on Climate Change* at 12 (March 2018), https://unfccc.int/sites/default/files/resource/South%20African%20TNC%20Report%20%20to%20the%20UNFCCC_31%20Aug.pdf.

[86] Innocent Mbokodo et al., *Heatwaves in the Future Warmer Climate of South Africa*, 11 Atmosphere (3 July 2020), https://res.mdpi.com/d_attachment/atmosphere/atmosphere-11-00712/article_deploy/atmosphere-11-00712.pdf

[87] The SPEI measures precipitation minus potential evapotranspiration. *Id*.

[88] ASSAf Report, page 15.

[89] Nick Watts et al., *The 2020 report of The* Lancet *Countdown on health and climate change: responding to converging crises* at 9 (02 December 2020), https://www.thelancet.com/action/showPdf?pii=S0140-6736%2820%2932290-X.

[90] Elizabeth J. Kendon et al., *Enhanced future changes in wet and dry extremes over Africa at convection-permitting scale*, 10 Nature Communications (23 April 2019), https://www.nature.com/articles/s41467-019-09776-9#Fig2.

[91] Climate Central, Surging Seas Risk Zone *Map* (2019), https://ss2.climatecentral.org/#globalwarning.

[92] S.J. Ryan et al., *Global expansion and redistribution of Aedes-borne virus transmission risk with climate change*, PLoS Neglected Tropical Diseases (28 March 2019), https://journals.plos.org/plosntds/article?id=10.1371/journal.pntd.0007213; S. J. Ryan et al., *Warming temperatures could expose more than 1.3 billion new people to Zika virus risk by 2050*, Global Change Biology (09 October 2020), https://onlinelibrary.wiley.com/doi/10.1111/gcb.15384; S. J. Ryan et al., *Shifting transmission risk for malaria in Africa with climate change: a framework for planning and intervention*, 19 Malaria Journal (01 May 2020), https://malariajournal.biomedcentral.com/articles/10.1186/s12936-020-03224-6.

[93] Climate Action Tracker, *Climate Action Tracker Country Summary: South Africa*, (Oct. 28, 2022) https://climateactiontracker.org/countries/south-africa/.

[94] Climate Action Tracker, *Climate Action Tracker Country Summary: South Africa*, (Oct. 28, 2022) https://climateactiontracker.org/countries/south-africa/.

The CCIA's high level of greenhouse gas emissions constitute a fatal flaw

109. The project will emit 22 million tons of CO_2e over its lifetime if it runs at 100% of the contracted capacity. It states:

> "We note that the RMIPPP RfP states that the power from the plant must be dispatchable at required of the grid operator and requires that the plant bid into this program must be capable of stable operation at 25% of the contacted capacity. Should the plant run at this level, the total emissions of the plant over its lifetime will be 5.5 million tons CO_2e."[95]
>
> Avoided emissions have been calculated based on the current Eskom emission rates[4] of 1.04 tCO_2e /MWh and production of electrical power from the Karpowership at 0.513 tCO_2e /MWh.
>
> **5.1.2 Impact Assessment**
>
> The proposed Karpowership Project would result in approximately 1.1 million tCO_2e/annum and 22 million tCO_2e over the PPA duration assuming that the project operates 16.5hours per day per year. This falls within the medium intensity as assessed against the thresholds in section 3.1.5. The emissions from the Project would have a negative climate change impact."

110. We cannot verify if this is an accurate number, however, because the assumptions and methodologies used in making this calculation is not detailed enough. Nonetheless, this is equivalent to about 0.33% of what the Carbon Action Tracker considers to be South Africa's fair share annual emissions rate of 347.78 $MTCO_2e$ by 2030,[96] and around 0.3% of South Africa's latest 2030 NDC target (insufficient for achieving 1.5° C) of 366 $MTCO_2e$ annually.[97]

111. In the original FEIAr, the specialists developing the CCIA calculated that the project would emit 656,710 tCO_2e annually, in contrast to the 1,1 million tCO_2e calculated in the new CCIA. However, the first CCIA concluded that the project, would have a "very high

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[95] Initial savings page 22 2021 DEIA

[96] Climate Action Tracker, *CAT Assessment Data ZAF,* https://climateactiontracker.org/documents/995/202210_CAT_AssessmentData_ZAF.xlsx/.

[97] Climate Action Tracker, *Climate Action Tracker Country Paris Agreement Targets: South Africa* https://climateactiontracker.org/countries/south-africa/targets/.

impact,"[98] while the CCIA presently under consideration decided that the project emissions, while having substantially greater annual and total emissions than previously estimated, would be categorized only to have a high impact " (p. 52 and 25). The reason for this backtracking is because the new CCIA arbitrary changed the threshold limit for what should be considered "very high", impact level. (see Figure 1 and 2). While the previous CCIA used 10 M tCO2e lifetime emissions for its "very high impact" threshold, the new CCIA used 15 M tCO2e *annual* emissions for its "very high impact" threshold. The new "very high" impact threshold was determined, according to the specialists, based on the annual emissions of a coal fired power plant of 2900 MW, calculated to be 15 MtCO2e.

112. It appears that in the current CCIA, the specialist adjusted the threshold level to prevent the project from being considered to have a very high GHG emissions impact without abatement, which would have rendered it fatally flawed. In other words, it appears that the new CCIA has moved the goalpost to offer an advantage for its climate change assessment.

Figure 1. Climate change impact criteria used in first CCIA[99] (represents *total emissions* over lifetime of project)

	GHG emissions generated (tCO2e)		**Percentage of South Africa's carbon budget used over the life of the project**	
GHG impact rating as a % of SA's carbon	**Lower limit**	**Upper limit**	**Lower limit**	**Upper limit**
Low	0 tCO2e	10 000 tCO2e	0%	0.000227%
Medium	10 001 tCO2e	1 000 000 tCO2e	0.000227%	0.0227%
High	1 000 001 tCO2e	10 000 000 tCO2e	0.0227%	0.227%
Very High	10 000 001 tCO2e	+	> 0.227%	

Table 9: Impact category thresholds used to determine the magnitude of the impact of the project on climate change.

	Amount of GHG emissions	**Relative to Low Emission NDC Carbon Budget**

[98] 2021 DEIA report CCIA report, April 2022, p. 47.
[99] 2021 DEIA report CCIA report, April 2022, p. 47.

GHG impact rating as a % of SA's carbon	Lower limit (tCO2e)	Upper limit (tCO2e)	Lower limit (tCO2e)	Upper limit (tCO2e)
Low	-	30 000	0.000000%	0.00039%
Medium	30 001	1 500 000	0.00039%	0.019%
High	1 500 001	15 000 000	0.019%	0.193%
Very High	15 000 001	+	> 0.193%	

113. We assert that this is an inappropriate attempt to manipulate the study outcomes. Selecting an incredibly massive coal plant to set the threshold for very high emissions skews the interpretation of the figures. Using massive coal fired power plants (much larger than most in South Africa) as the metric against which climate impacts of new energy projects are evaluated would allow even large new coal plants to have less than very high impacts. This is misaligned with South Africa's overall climate ambitions and the urgency of the climate crisis for the country.
114. Looked at objectively, the lock-in of emissions of this scale through South Africa's peak, plateau, and decline mitigation phases will be a barrier to it achieving its climate goals. These emissions alone, without a clear plan for abatement, should, then, constitute a fatal flaw in the project.

Further inadequacies of the DEIA report's climate assessment

115. The 2022 DEIA report and its CCIA fall short of representing a comprehensive climate assessment, required by the *Earthlife/Thabametsi* judgement and reiterated in the Minister's appeal decision, in several respects.

a) CCIA greenhouse gas assessment is incomplete:

116. The primary emphasis of the revised CCIA remains the greenhouse gas emissions associated with the project. These calculations lack detail and underestimate the true emissions of the project.

Upstream and fugitive emission accounting inadequacies

117. The greenhouse gas analysis included several categories of upstream emissions – more than the original EIAr - including the transport of natural gas to the port from within the country, and the production of natural gas, which together accounted for nearly 100,000 t CO2e/year. The precise assumptions behind the emissions calculations, including how fugitive methane emissions in various phases of the gas lifecycle are accounted for, are also lacking in the CCIA, making it difficult to ascertain whether the specialists assessed the universe of emissions from the natural gas lifecycle appropriately.

Questionable assumptions about run times of the powerships and associated emissions

118. The CCIA assumes that the powerships will run for at maximum 16.5 hours per day, as per the constraints of the RFP (CCIA p. 48). This is repeatedly explained to be a "worst case scenario", simply because the RFP was for dispatchable power and specified that the project "be able to operate between 05h00 and 21h30"(CCIA p. 58). However, nowhere is it stated in the RFP or in the DEIA report documents that the plant will *only be allowed* to run at these hours. Those familiar with energy markets know that resources can be run for more time than was originally specified in their procurement process – such as is the case with diesel "peakers" across South Africa today. It is not unreasonable to assume that the plants could be called on to run in more of a baseload capacity, in which case, the 16.5 hours a day, 450 MW limit may very well *not* be the worst-case emissions scenario.
119. There are indications elsewhere in the DEIA report that the plants will run at or above the presumed "worst-case." The project documents assume that an LNG carrier will bring LNG to the FSRU between every 20 to 30 days (2022 DEIA report p. 412), which would represent between approximately 12 and 18 vessels per year. The Marine Traffic Assessment (Appendix 10) states that the "average parcel size" of these vessels will be 100,000 m3 (Marine Traffic Assessment p. 14). If the plant were run at supposedly "worst-case scenario" levels year-round, a maximum of 10 of these 100,000 m3 LNG carriers would be needed to supply the facility, based on the information provided in the CCIA about the powerships' engine efficiencies. Thus, if between 12 and 18 ships of 100,000 m3 of LNG (in reality, a relatively small LNG carrier) are arriving at the port

annually, this would mean that the plants would be running at higher capacity and/or for longer every day than the "worst-case" 450 MW, 16.5-hour days.

120. There are other efficiencies to running the plants more frequently that also might encourage that, including simple mechanical efficiencies, as referenced in the 2021 DEIA report: "From an emissions perspective, the Powership performs most efficiently when operating at full capacity."[100] Additionally, LNG is generally cheaper, and easier to procure, when purchased under long-term contracts that guarantee a supplier a steady customer. Thus, purchasing LNG for intermittent use is far more expensive and uncertain, meaning that there are incentives for the buyer to know exactly how much they will use and use it.

121. All of these factors suggest that the supposed "worst-case scenario" laid out in the CCIA may in fact be the most predictable scenario, or even more optimistic than other very likely scenarios. This would mean not just more direct emissions from the project itself, but also more upstream emissions, as more gas will need to be produced, processed, and transported. As such, emissions over the lifetime from the project would likely exceed 30.7 Mt CO2e.

Failure to correctly account for global warming potential of methane

122. The revised CCIA uses the global warming potentials (GWPs) of methane from the 2006 IPCC report (23), rather than the most recent IPCC report, which finds that the 100-year GWP of methane is 29.8.[101] This means that the methane leakage estimates included in the CCIA are converted to CO_2 equivalent (CO_2e) at a rate lower than the latest science supports. In addition, the specialists dismiss the use of the 20-year GWP (82.5), rather than the 100-year GWP (29.8) for methane, even though the growing scientific consensus around climate tipping points suggest that a 20-year GWP is more relevant.[102]

[100] Richards Bay 2022 DEIA report CCIA April 2022, p. 51.
[101] IPCC, *AR6 - Climate Change 2021, The Physical Science Basis - Chapter 7*, p. 1017, (August 2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Chapter07.pdf.
[102] E.g. IGSD and CHRE, The Need for Fast Near-Term Climate Mitigation to Slow Feedbacks and Avoid Tipping Points Critical Role of Short-lived Super Climate Pollutants To Address the Climate Emergency, (2022), https://www.igsd.org/wp-content/uploads/2020/09/Science-Supporting-Need-for-Fast-Near-Term-Climate-Mitigation-Sept2020.pdf.

Unfounded statements about emissions avoided and positive impacts

123. Despite the very high emissions from the project, the DEIA report climate change impacts section wishfully concludes, "When considering all impacts related to the project, it can be considered to have a low positive impact. Despite having a high intensity impact from operational emissions, the project enables significant reductions through avoided emissions and enabled renewables. Furthermore, it allows for economic development to occur by providing dispatchable power onto the grid which is critical for the economy" (DEIA report p. 383, 405).
124. There is no data provided to back up this conclusion in the CCIA. Instead, the CCIA includes vague assertions that the project "can offer load following capability to stabilise additional renewable energy capacity until sufficient battery storage is added to the grid" (CCIA p. 48). However, there is no assessment of the capability of battery, and other forms of storage, to play that role today, other than reference to two of the hundreds of grid-stabilizing battery projects in operation around the world today (CCIA p. 52). To the contrary, as we have noted in the section on need and desirability, renewable energy alternatives could meet South Africa's immediate energy requirements, and the failure of the DEIA report to assess renewable sources as an alternative is a material flaw.
125. The CCIA also assumes that the gas will necessarily be a replacement for coal and diesel (CCIA p. 52). Its avoided emissions analysis suggests that the project will avoid 12 million tCO2e between 2023 and 2030, under the assumption that the gas will entirely replace coal coming offline (CCIA p. 52-53). However, the CCIA does not offer any basis for this substitution. Our comments have presented expert evidence refuting this assumption.
126. All of these assertions are also framed in the optimistic statement, "if/when the Eskom generation crisis is solved, and the use for power from this project is decreased due to the addition of more generation capacity to the grid, this project may be requested to dispatch less power, and the emission from the project will be reduced" (CCIA p. 47). While the resolution of the Eskom power crisis and the lowered dependence on fossil fuels would indeed be a positive outcome, the 20-year power purchase agreement (PPA) for the project, and the nature of long-term LNG contracts mean that there will be strong incentives to keep the ships running more, rather than using them to dispatch

occasional power at critical times as a peaker might. As a recent Meridian Economics report explains, "Peaking plant fuel offtake is both variable and unpredictable and increasingly will be characterised by long periods of minimal or zero usage as renewables and battery storage provide for daily demand cycles. LNG contract norms require predictable, steady offtake fed by scheduled replenishment vessels with take-or-pay terms. Erratic usage as characterised by peaking plant needs is fundamentally incompatible with these norms, requiring LNG usage to be limited to what will definitely be needed between replenishment cycles."[103] Thus, the physics and markets of gas make this optimistic downward dispatching scenario unlikely.

b) *Inadequacy of greenhouse gas emission mitigation measures*

127. The greenhouse gas emission mitigation measures proposed in the CCIA have not improved since the 2021 DEIA report. The first of three options proposed is to reduce the duration of the PPA. While this would be desirable, the CCIA notes "this measure may affect the financial viability for the project," and therefore seems to write it off (CCIA p. 53). The second proposed mitigation measure is that Eskom does not dispatch the power from the ships, which again would be desirable but also unlikely if the project goes ahead (CCIA p. 53). Finally, the CCIA states that green hydrogen could be used in the future, but that this is not considered economically viable right now (CCIA p. 53). While, again, this might be desirable, there is no evidence provided that the turbines could run on 100% green hydrogen, and the lack of economic viability currently makes it unlikely to serve as a real solution. Thus, all three mitigation measures proposed are unlikely to occur, and should not be considered to mitigate any of the greenhouse gases from the project.
128. The only measure in the EMPr that includes reference to climate change mitigation is that the project should include,

"i) GHG emissions meters to ensure efficiency and safety; ii) gas leak detectors so that fuel can be immediately isolated and shut off, the leak identified, and the necessary

[103] E.g. A. Roff *et al*., *Hot Air About Gas*, Meridian Economics, (June 2022)

repairs or replacements made" (EMPr p. 168/pdf179). These basic control measures *must* be included in the project and is not a meaningful mitigation measure to reduce emissions.

129. Therefore, no meaningful or likely greenhouse gas mitigation measures such as CCS are included in the design of the project, much less proposed within the CCIA. Thus, the new CCIA does not address the Minister's finding in the appeal decision that mitigation measures are "entirely undeveloped and inadequate (Appeal decision, 2.70.2).

c) Inadequacy of comprehensive assessment of climate change

130. In addition to assessing the greenhouse gas emissions of the project, the *Earthlife/Thabametsi* judgement requires that the CCIA include a comprehensive assessment of the project's interaction with climate change, including an assessment of climate change on the project itself, and the ways in which the project might aggravate the impacts of climate change in the area. The Minister's appeal decision found fault with the proponent's original CCIA because it was instead mainly concerned with the contribution of the proposed Project's GHG emissions towards climate change (2.69). The new CCIA, while including more information about the likely impacts of climate change in the project area and the general social context of the area, fails to meet the *Earthlife/Thabametsi* standard in several respects.

131. First, the DEIA report states that the project has considered climate change in its designs and is unlikely to be impacted by it (p. 350), but it does not explain what these designs include, beyond the ships being in a relatively sheltered port area. Nor does it explain how the project will manage the risks to its operations described in the CCIA. These risks include, among others, rising sea temperatures affecting the cooling mechanism of the ship, and rising sea levels combined with storm surges and more intense tropical cyclones causing severe damage and flooding to pipelines, the transmission line, and the ships themselves (p. 55-57). The only suggestion the CCIA poses for reducing harms from these impacts is "regular maintenance of port infrastructure is crucial for reducing these risks and impacts" (p. 57).

132. The DEIA report also fails to consider how the project might aggravate the impacts of climate change in the area, both on people and ecosystems. That is, impacts of the project beyond its GHG emissions may operate as a threat multiplier, either reducing the resilience of community members to climate change, or exacerbating their challenges that climate change is making worse. For example, small-scale fishers may already be struggling with catches because of warming waters affecting fish breeding and fitness, while the project's noise and vibrations, thermal plumes, and impacts to mangroves and estuaries may further reduce fish breeding and juvenile success. Importantly, Saldanha Bay is home to several nurseries for threatened species of fish
133. For example, coastal environments (e.g., lagoons, estuaries, swamp forests etc.) provides sanctuary for juvenile marine (fish and crustaceans) and supports a wide range of species within the region (e.g., Heaviside and Dusky dolphins, African penguin, various types of sterns-e.g., bank, stern and crowned, smooth-hound shark etc.).
134. While the CCIA does acknowledge that climate change may result vulnerabilities and challenges for people of the region (p.59- 63), it does not describe how the project will interact with and potentially exacerbate these vulnerabilities.
135. The CCIA also fails to address the project's impact on the natural resources that have an ability to either mitigate climate change and/or reduce vulnerability to climate change, such as seagrass, coral, dunes, and estuarine salt marshes. These ecosystems buffer against extreme weather events such as storms, rough seas, and/or flooding. Reefs, seagrass, and salt marshes are particularly important as they absorb large amounts of carbon from the atmosphere, thereby acting as carbon sinks.[104] The impacts of the project on these critical ecosystems and their intersection with climate change were not addressed in the CCIA. Again, especially given that the CCIA acknowledges that climate change itself could contribute to the degradation of these critical ecosystems (p. 63), this is an important gap.
136. Finally, while the CCIA describes how climate change will exacerbate local vulnerabilities, the proposals for how the project could reduce these vulnerabilities are vague and inadequate. The DEIA suggests only that, "There is also potential for Karpowership SA to identify related specific community needs which they can invest in

[104] NOAA, *What is Blue Carbon?,* https://oceanservice.noaa.gov/facts/bluecarbon.html.

through CSI projects" (p. 351). The CCIA also points to a possible role for early warning systems and community preparedness programmes in dealing with severe weather, though the role for Karpowerships is unclear. The CCIA merely suggests that such programmes "could be aligned with corporate social investment of the Karpowership project" (p. 351).

137. In summary, in its totality, then, the CCIA and the integration of climate change impacts and interactions into the DEIA report fail to address all of the concerns raised by the Minister about climate change in her appeal decision, and cannot be considered to have addressed the requirements of the *Earthlife/Thabametsi* judgement.

AIR QUALITY

138. Areas of South Africa with higher levels of ambient SO2, NO2, and PM10 create "hotspots" where there are serious air quality issues. These are mainly caused by the burning of fossil fuels near residential areas, as well as from industrial and power generation sources.

139. The following pollutants pose a serious threat to public health: particulate matter (PM), carbon monoxide (CO), ozone (O3), and nitrogen dioxide (NO2) and sulphur dioxide (SO2). Saldanha Bay is vulnerable to negative air quality impacts from these pollutants, which can be linked to industrial activities already present in the area, and may be worsened by the Karpowership project.

PUBLIC PARTICIPATION PROCESS

140. In the Karpowership Saldanha Bay Appeal Decision, the Minister noted that she "must emphasize that meeting a minimum 'threshold' for public participation does not establish an entitlement to the granting of an EA."[105] She went on to explain that there is no 'minimum threshold' for public participation, and that the legislative framework provides for meaningful public participation.[106] The Minister also noted that the procedural unfairness of an inadequate public participation process cannot be cured after the fact.[107]

[105] Karpowership Saldanha Bay Appeal Decision at para. 2.98.
[106] Karpowership Saldanha Bay Appeal Decision at para. 2.100
[107] Karpowership Saldanha Bay Appeal Decision at para. 2.106

141. Although the EAP had an opportunity to revise the public participation process and address outstanding issues, meaningful public participation was not achieved.

142. For example, a Natural Justice staff member attended the public meeting on 21 November 2022 at the Community Hall, who reports:

- that the tense and intimidatory environment was not conducive to meaningful participation;
- that the meeting was conducted in English, despite the very many participants who do not speak English as their first language;
- that the session for questions and answers was inconducive to constructive and meaningful engagement, with intimidation tactics employed by many participants to silence others;
- that the Black Business Alliance WC and their partners were provided with an extended opportunity at the podium to muster support and request participants to pledge their (blind) support for the project;
- that many participants raised their hands with questions, but were not provided with an opportunity to speak.;
- that despite an undertaking to do so, participants were not provided with the requested link to the online meeting so that they could access the presentations;
- that it was questioned by the facilitator at one stage whether it was necessary to present the climate and environmental impact findings.

143. Furthermore, we understand that none of the persons who attended the small-scale fishers meeting on 3 October were actually small-scale fishers. It cannot be said that small-scale fishers have been meaningfully consulted. Given also that the small-scale fishing permits allow the fishers to fish up to the iron ore area (possibly a preferred location), this is a fatal flaw.

NEED AND DESIRABILITY

144. In her appeal decision on the Karpowership Saldanha Bay project, the Minister reiterated that, "[w]hile another government department may decide the 'need and desirability' of a project from their planning perspective," "proposed activities are to be considered *needed and desired* from an EIA perspective, in particular, whether that

option provides the most benefit, and causes the least damage to the environment as a whole, at a cost acceptable to society, in the long-term as well as in the short-term."[108]

145. In denying the powership's environmental authorisation, the Minister found that the potential environmental harms of the project were too high, no matter how important the project claimed to be for alleviating the energy crisis. The Minister stated: "The alleviation of the current energy crisis may be vital, but this does not mean that it must be achieved by this specific project, nor does it follow that there is now a license to ignore all relevant environmental considerations."[109] The Minister also listed a litany of environmental harms from the powership to justify her decision, including an increase in greenhouse gas emissions, harm to marine organisms from underwater noise, threats to the highly sensitive estuarine habitats and organisms, including mangroves, and many more.

146. None of these harms have disappeared just because the applicant has prepared an updated environmental assessment. In fact, the project is exactly the same. Although the updated DEIA report has added more text to justify the powership's need and desirability, including various reports discussing the shortcomings of renewable energy and the benefits of gas to meet the energy crisis, these updates do not address the core of the Minister's concerns that the environmental and social harms of the project are just too high. As we have addressed throughout our comments, the potential harms to the marine ecosystem in and around Saldanha Bay, the climate and noise harms, and the potential harm to the livelihoods of fishing communities are serious and undeniable, no matter how many additional flawed specialist reports the applicant presents.

147. Unfortunately, the updated DEIR still does not honestly assess renewable energy alternatives that are cost-effective and proven to provide the electricity needs of South Africa. Instead, the DEIR falls back on a misguided narrative that renewable energy is substantially more costly than gas from the powerships, that renewable energy cannot meet the energy demands of the grid, and that the use of gas has negligible climate impacts and is consistent with the goals of the Paris Agreement to limit global warming to under 1.5 degrees. As we explain below, this narrative is false, relies on

[108] Karpowership Saldanha Bay Appeal Decision at para. 2.18; DEA (2017), *Guideline on Need and Desirability* at 10, Department of Environmental Affairs (DEA), Pretoria, South Africa.
[109] Appeal Decision at para. 2.22.

fundamentally flawed analysis, and should not support any assessment of the need and desirability of this project.

COST

148. In support of the cost-effectiveness of the Karpowership projects, the applicant appended a report by Political Economy Southern Africa (PESA) (Appendix 8.1) on the role of gas in a just energy transition to its DEIR. PESA's main finding is that "The Karpowership projects despite their shortcomings, are the quickest way to provide South Africa with the much-needed dispatchable power.[110]

149. In reaching this finding, PESA dismisses several reports by Meridian Economics and Meridian and CSIR, including Meridian's report titled "Resolving the Power Crisis Part A: Insights from 2021 - SA's Worst Load Shedding Year So Far",[111] which found through modelling that 96.5% of loadshedding in 2021 could have been avoided through the direct impacts and knock-on impacts of adding 5GW of renewables,[112] with battery storage and demand response meeting the remaining supply gap.[113]

150. In challenging the Meridian report's conclusion that "an additional 5GW of wind and solar would have allowed Eskom to eliminate 96.5% of loadshedding in 2021,"[114] PESA asserts that "the [Meridian] report does not make any consideration or reference to assumptions about the storage capacity and climate conditions required to produce the optimal amount of electricity from the additional 5GW in renewables."[115] This assertion is incorrect. Meridian found that 5GW of wind and solar alone could have eliminated 96.5% of loadshedding in 2021—even before installing additional battery storage. The needed "climate conditions" were also considered because Meridian assumed that the

[110] DEIR, Appendix 8.1 at 36.
[111] DEIR, Appendix 8.1 at 20.
[112] Meridian Economics, *Resolving the Power Crisis Part A: Insights from 2021 – SA's Worst Load Shedding Year So Far* at iii (June 2022), https://meridianeconomics.co.za/wp-content/uploads/2022/06/Resolving-Load-Shedding-Part-A-2021-analysis-01.pdf.
[113] Resolving the Power Crisis Part A at iii.
[114] DEIR, Appendix 8.1 at 20.
[115] DEIR, Appendix 8.1 at 20-21.

new renewable energy capacity "would have the same hourly generation profile" as existing renewable capacity.[116]

151. PESA also asserts that Meridian's and other studies that compare the least cost energy between renewables and gas are inappropriate because "they leave out the cost of service from the tariff …, [which] includes frequency and voltage control, transmission, synchronous power, dispatched ramping, system balancing and last mile connections. ... Moreover, these types of studies make factually inaccurate comparison between the cost of gas-to-power (which includes the total cost of evacuation and distribution) against the incomplete estimations about the cost of renewables".[117] PESA, though, does not itself submit its own cost calculations.[118] Instead, PESA submits that *"[t]he closest the system costs have been reflected was with the RMIPPPP tariffs, which included energy, dispatchability, voltage stability and storage costs*."[119] PESA's arguments are fundamentally flawed.

152. For example, Meridian and CSIR's July 2020 report on different CO_2 emissions scenarios for South Africa ("CSIR & Meridian Report") found that a least-cost scenario for the South African electricity sector involves rapidly expanding wind and solar power in the near term, with 90% renewable uptake in the grid by 2050.[120] The modelling *does* incorporate costs of service based on the parameters of the IRP2019 model, but reflects updated demand, existing fleet performance, and technology costs, and assumes "no carbon emissions constraint, no forced-in new-build technologies, and no annual new-build constraints on any technologies."[121] The renewables pricing assumptions in the

[116] Resolving the Power Crisis Part A at 5.
[117] DEIR, Appendix 8.1 at 20.
[118] DEIR, Appendix 8.1 at 21.
[119] DEIR, Appendix 8.1 at 21.
[120] CSIR and Meridian Economics, 22 July 2020, *Systems analysis to support increasingly ambitious CO2 emissions scenarios in the South African electricity system* (CSIR & Meridian Report) https://researchspace.csir.co.za/dspace/bitstream/handle/10204/11483/Wright_2020_edited.pdf?sequence=7&isAllowed=y .
[121] CSIR & Meridian Report at 60. PESA acknowledges that it makes sense for the IRP2019—a system-wide plan—to "include a multitude of parameters such as system and transmission constraints, load following, dispatch costs and energy costs."[121]

Resolving the Crisis report are also based on actual bid prices from the Renewable Energy Independent Power Producer Programme, accounting for inflation.[122]

153. PESA's reliance on the RMIPPPP as the best existing standard for determining technology costs is also misplaced and unsurprising, given that the restrictions imposed in the request for proposals made gas projects "seemingly, but erroneously, cost-competitive."[123] Clyde Mallinson's techno-economic evaluation of the RMIPPPP from 21 August 2021,[124] attached here as Annexure D, identifies several design flaws in the request for proposals which resulted in bid tariffs that are untethered to the realities of an electricity system and do not reflect true technology costs. Mallinson explains that the "restrictions, terms and conditions" of the RFP process "have little to no impact on gas-dominated projects," but they raise the bid tariffs for renewable energy "on average by more than 50%."[125] In particular, the prohibition on storing energy outside the dispatch window and requirement that energy storage systems be co-located with the renewable generation capacity "result in the need to unnecessarily oversize[] storage systems, increasing the costs for renewable projects and thus increasing the tariffs that were bid."[126] Mallinson's analysis reveals that a "full systems approach" to the request for proposals where "projects were fully integrated with existing Eskom storage assets," evaluated in the context of their interaction with other generation assets, and free from arbitrary restraints, would have resulted in tariffs that were "less than one half of the [] Karpowership [bid] tariffs."[127] Notably, the "optimal full system integrated [request for proposals] would have no gas."[128]

154. PESA also takes issue with another Meridian report called "Hot Air About Gas: An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa," in which Meridian found that "[f]orcing large-scale gas use into the power generation portfolio in South Africa instead of the much smaller alternative peaking role

[122] Resolving the Power Crisis Part A at 33.
[123] Clyde Mallinson, The South African Risk Mitigation Power Producers Procurement Programme (RM4P): A techno-economic evaluation of the underlying design of the request for proposals (RFP) and the resultant impact on the outcomes of the RM4P at 1 (27 Aug. 2021) ("Annexure D").
[124] This report was submitted to the National Energy Regulator of South Africa by the Centre for Environmental Rights as further support for why the Karpowership projects should not receive electricity generation licenses.
[125] Annexure D – Clyde Mallinson RMI4P Report at 4.
[126] Annexure D – Clyde Mallinson RMI4P Report at 7.
[127] Annexure D – Clyde Mallinson RMI4P Report at 12.
[128] Annexure D – Clyde Mallinson RMI4P Report at 12.

to support renewables will increase the cost of the electricity generated by more than 40%."[129] Rather than dispute the validity of this conclusion, PESA instead argues that "this is not the immediate trade-off given [South Africa's] need to expeditiously resolve the intensifying energy crisis, which needs a solution now and not a decade in the future."[130] Yet, South Africa need not make this trade-off at all, as the next section on alternatives explains, because renewable can provide an immediate solution to the energy crisis.

ALTERNATIVES

155. In her appeal decision on the Karpowership Saldanha Bay project, the Minister noted that "[t]he alleviation of the current energy crisis may be vital, but this does not mean that it must be achieved by this specific project, nor does it follow that there is now a license to ignore all relevant environmental considerations."[131] In fact, the objective of addressing this crisis can be better met through focusing on adding renewable energy capacity to South Africa's grid. Yet, as with the original EIA, Karpowership's current 2022 DEIA report fails to assess renewable energy options in its alternatives analysis, even though expert reports submitted in response to the original EIA and recent analyses demonstrate renewables are viable options that would result in the same, if not more, benefits than the Karpowership projects. Besides site, layout, and no-go alternatives,[132] Karpowership only discusses the possibility of using hydrogen gas to power and reserves an assessment of it for "an appropriate time when the feasibility of hydrogen fuelled power generation has sufficiently matured."[133] There is no excuse for the DEIA report's failure to consider alternatives.
156. Other renewable energy options, such as wind and solar, are feasible, affordable, and preferred alternatives. Meridian's report on resolving the power crisis demonstrates that the addition of renewable energy would have eliminated almost all the loadshedding in 2021, without any help from new gas resources. The CSIR & Meridian

[129] DEIR, Appendix 8.1 at 5; Meridian Economics, *Hot Air About Gas: An Economic Analysis of the Scope and Role for Gas-Fired Power Generation in South Africa* at 49 (June 2022), https://meridianeconomics.co.za/wp-content/uploads/2022/06/Hot-Air-About-Gas.pdf.
[130] DEIR, Appendix 8.1 at 5.
[131] Karpowership Saldanha Bay Appeal Decision at para. 2.22.
[132] 2022 DEIR at 425 -428
[133] 2022 DEIR at 81.

Report found that "[p]eaking requirements can be provided by liquid fuels for at least the next 10 years in all scenarios," and South Africa "can wait for 10 – 15 years" before making a decision to "expand gas infrastructure to support the power sector."[134] Rocky Mountain Institute's expert report[135] evaluating the CSIR & Meridian Report and applying its findings to the Karpowership projects, included here as Annexure E, concludes that the Karpowerships "would come online as much as a decade prior to the planned need for any type of new high utilization energy capacity" and thus "represent an unneeded and uneconomic addition to [South Africa's] electricity system" for "over half of their operational life."[136]

157. In support of a larger role for gas despite studies like the CSIR & Meridian Report, Karpowership submits several industry publications in Appendix 8.5, none of which are specific to South Africa except a paper by Wärtsilä Energy,[137] the developer of the Powerships' gas engines and hardly an independent expert in this matter, concludes that the optimal capacity mix (its "Perfect World" scenario[138]) for South Africa "requires the addition of 9 GW of flexible gas, 7 GW of energy storage systems, and 40 GW of combined wind and PV by 2032."[139] According to Wärtsilä, the 9 GW of flexible gas required is best provided through Internal Combustion Engines (ICE) rather than Combined Cycle Gas Turbines (CCGT), which "only make a small appearance with 670 MW in Perfect World in 2025 and 280 MW in 2028."[140]

158. However, Wärtsilä methodology or data is often not disclosed and its conclusions are made without considering important information. For example, for its estimates on the costs of ICE, Wärtsilä relies on "internal" references, experience, and observations, data which cannot be verified independently.[141] Wärtsilä identifies what it calls critical gaps in information that it did not consider, such as the need for "[i]nvestigating the degree

[134] Meridian Economics, 2020, *A Vital Ambition: Determining the cost of additional CO2 emission mitigation in the SA electricity System* at 59, https://meridianeconomics.co.za/wp-content/uploads/2020/07/Ambition.pdf.
[135] This report was attached to groundWork's responding statement in the EA appeal as AJ1.
[136] Annexure E – RMI Report at 12.
[137] Wärtsilä Energy (2022), *Flexible Gas: An Enabler of South Africa's Energy* included in Appendix 8.5
[138] Wärtsilä describes this scenario as one where it "[a]llow[ed] the model to determine the optimal capacity mix without imposing any of the known new capacity addition opportunities and/or restrictions." Wärtsilä Energy (2022), *Flexible Gas* at 6.
[139] Flexible Gas at 2.
[140] Flexible Gas at 10.
[141] *Flexible Gas*, Attachment 1 – Key Inputs and Scenarios.

of flexibility and integrating any supply constraints which mimic real-life limitations one may encounter when considering the LNG supply chain and/or other gas supply options."[142] Meridian, however, has considered such a constraint in its report "Hot Air About Gas," where it cautioned that importing fuel exposes South Africa's power prices to "the vagaries of the exchange rate and the global gas market," which "result in price shocks that usually entail a combination of energy price changes and currency weakening."[143] Wärtsilä also mentions that it compared system costs across its different scenarios, but it is unclear what data it used or how it quantified them.[144] Even if Wärtsilä's Perfect World scenario correctly identified the optimal energy mix for South Africa, it does not support the Karpowerships. The combined capacities of all three Karpowership projects (1,220 MW) greatly exceed both the CCGT allocations for 2025 and 2028 in Wärtsilä's Perfect World scenario identified above.

159. The DEIA report also vaguely refers without any citations to "models developed by the CSIR" that "proposes that gas-powered electricity should have an installed capacity of approximately 6GW by 2030 and 14GW by 2050" and "more than 70% of the energy mix should be renewable energy by 2050 to be cost-optimal".[145] It is impossible to verify what CSIR model the DEIA report references without citations, however, the most

[142] Flexible Gas at 26.
[143] Hot Air About Gas at 41, 46.
[144] Flexible Gas at 16.
[145] DEIR at 362 ("Models developed by the CSIR indicate how an increase in flexibility of the grid would occur with increased gas technology uptake. In their modelling on least-cost renewable energy uptake scenarios, more than 70% of the energy mix should be renewable energy by 2050 to be cost-optimal.").

recent modelling by CSIR in 2020 found very different requirements for gas.[146] In particular:

1. A least cost model for South Africa's electricity grid would be composed of 90% renewable capacity by 2050.
2. Such a grid would be complemented by small quantities of storage capacity and gas fuelled generation capacity.
3. Under this model, there is no need for new gas generation capacity within the next decade as peaking capacity can be provided by existing diesel fuelled generation capacity until then.
4. There is no need for new combined cycle gas capacity in the next decade, and no need for 3 GW of such capacity until 2041. Gas and peaking resources contribute just 1.1% of total electricity generation in 2025, and 2.4% by 2035.
5. South Africa would be better served by focusing on investment in infrastructure to enable a 21st century electricity system, which CSIR/Meridian's findings and global trends show to be largely renewable.

160. Finally, no-go alternative analysis assumes that renewable projects would not replace the Karpowership projects in filling the short-term electricity supply gap. This assumption allows the DEIA report to list a slew of unwanted consequences, including "[c]limate change and air quality impacts due to reliance on coal based power generation," "[n]o additional dispatchable power," and a missed opportunity to "pave the way to a just transition."[147] However, as described above, renewable energy projects would meet any gap left by the Karpowerships and could provide needed electricity along with the environmental and socioeconomic benefits Karpowership claims would be lost if the projects do not go ahead, all without exacerbating climate change.

SOCIO-ECONOMIC IMPACTS

161. The Minister's appeal decision denying the Karpowerships environmental authorisation was extremely critical of the Socio-Economic Impact Assessment report

[146] CSIR and Meridian Economics, 22 July 2020, Systems analysis to support increasingly ambitious CO2 emissions scenarios in the South African electricity system.
[147] DEIR at 341

for the project, finding that it had fatal gaps, limitations, and inconsistencies (para 2.119.2). The Minister stated that "neither socio-economic needs nor procurement considerations can elevate the recommendation in a Socio-Economic Impact Assessment report above the holistic consideration of the actual and potential risks, and impacts on the geographical, physical, biological, social, economic, and cultural aspects of the environment." (para 2.11.4)

162. The Minister found that the Socio-Economic Impact Assessment report "did not include an analysis of the actual and potential risks and impacts," based on the following:

> "2.45.1 The local economy base for fishing in Saldanha was not assessed- the author thereof was not even aware of the details of the approximate number of small-scale fishers, where they dock, or where and what they fish.
> 2.45.2 Local fishermen expressed their worries about the impact of the proposed Project on the fish and on fishermen in general, given that fishing is their only form of livelihood. Saldanha Costal Connection representing small scale fishermen indicated that the fishermen use the Port because they (fishermen) utilise very small vessels that cannot go out further to sea. They ae therefore worried about their fish stocks.
> …
> 2.45.4 The socio-economic assessment did not assess all the sensitivities on fish and marine life in the area."

163. The Minister elaborated further, stating that the "actual and potential impacts on the environment, as well as the socioeconomic conditions, particularly in relation to small-scale fisheries, could not be determined due to gaps and inconsistencies in the various reports submitted" (para. 2.121). In particular, the Minister singled out a lack of information in the Underwater Noise Impact; the Marine and Ecology Study, and the Estuarine Impact Report.

The 2022 DEIA report

164. The report found several potential negative impacts. With respect to potential impacts on fisheries, the Socio-Economic report found that:

> "Based on [the] findings by Lwandle and Anchor Environmental Consultants (2022), and Mason and Midforth (2022) there will be a negligible to limited negative impact on marine species within the Bay

> of Saldanha, which will not disrupt ecological functioning, and the project site will return to normal functioning after the project has ended. This indicates that there will be no negative socio-economic impacts as a result of the project, given that there will be no harmful impacts on local biodiversity, the fisheries, or mariculture industry. This is, however, contingent on there being a limited impact on juvenile fish species, which if forced into heavily fished areas in large quantities, could have a negative impact on the livelihoods of small-scale fishers, and in turn a negative socio-economic impact". (p. 42)

165. The findings on small-scale fishers are also informed by a report compiled by Afro Development Planning summarising discussions it organized with small-scale fishers associated with the Port of Saldanha. It concluded that "Overall, no significant impact directly associated with small-scale fishing activities were noted. This is attributed to the fact that fishing is not taking place in the Port. The port is an industrial zone, for which the small-scale fishing cooperatives are not registered to fish in. Fishing is taking place in the lagoon and along the coastline."[148]

> "It is firstly important to note that all fishing activities raised during the stakeholder engagement were located outside of the Port, none were identified in the project area, and small-scale fishing cooperatives are not registered to fish in the Port as it is an industrial zone, with the majority of fishing identified as taking place in the lagoon and along the coastline (Steenkamp & Rezaei, 2022). Thus, the designated project site will not directly interfere with small- scale fishers by taking up the area where they can fish." [149]

166. However, as we describe further below, the findings of this report should be disregarded because of flaws in its methodology.

167. With respect to the potential underwater noise impacts, the report found:

> "Based on these findings, Lwandle and Anchor Environmental Consultants (2022) find that the noise levels produced during the operations phase will not cause direct harm to marine organisms based off the current scientific understanding, although some biological functions could be disturbed. Within a 100m from the ship, marine organisms will experience increased levels of noise above the general background noise, but this will be similar to noise levels experienced when the same distance away from cargo ships entering the port

[148] Afro Development Planning Supplementary report to: Socio- economic impact assessment report for the proposed power Powership project at the Port of Saldanha Bay, Saldanha Bay Municipality, Western Cape Report at page 47

[149] Id Page 45

> (Lwandle & Anchor Environmental Consultants, 2022). These noise levels will however be continuous for 16.5 hours, which could interfere with ecologically relevant sounds and as such have negative impacts overtime, however sound-sensitive organisms would need to stay within tens of meters of the Powership for 24 hours to experience a temporary reduction in hearing acuity (Lwandle & Anchor Environmental Consultants, 2022). As such the severity of the impact is found to be site specific with wider natural processes and functions slightly altered, and limited to within the broader Port, however as the duration is 2 to 20 years and with a frequency of daily or hourly and probability of 5-25% chance of occurring, the overall environmental significance is medium-high without mitigation, and medium with mitigation (Lwandle & Anchor Environmental Consultants, 2022)."[150]

168. The Report also concludes the following from the discharge of cooling water:

> Thus, impacts will remain site specific with negligible intensity, and natural functions will remain unaltered beyond the ZID, with no irreplaceable loss of marine fauna or flora expected in either region. (Lwandle & Anchor Environmental Consultants, 2022). However, the impact is scored as being medium-high, and medium with mitigation, due to the extended duration, frequency, and probability of the impact, but with a low severity and spatial scale (Lwandle & Anchor Environmental Consultants, 2022).[151]

169. With respect to climate change, the socio-economic report notes amazingly that the benefits of the project would be positive. It relies on the climate change specialist report by Promethium Carbon to conclude:

> "Considering the assessment by Promethium Carbon (2022b), which contextualises the project's GHG emissions in comparison to the direct avoidance of GHG and particulate emissions from coal and diesel fired plants, and the indirect avoidance of emissions by enabling a greater development of renewable energy sources, the socio-economic impacts are expected to be positive." [152]

170. In terms of other positive benefits, the socio-economic report points out in several places the necessity of the powerships to provide electricity to the grid during an energy crisis, and also that the powerships "will allow Eskom to reduce their use of diesel-fired OCGT, which will reduce the cost of electricity, as it is around half the price which Eskom

[150] Id page 41
[151] page 40
[152] Page 53

pays per kWh to run diesel-fired OCGT (702, 2021; own calculation based on Karpowership proprietary data)."[153]

171. Below we identify major shortcomings, gaps, limitations, and inconsistencies in 2022 Socio-Economic Impact Assessment report, and consequently the 2022 DEIA report that relies on its findings.

Discussion

172. A socio-economic assessment must identify and weigh all the negative and positive socio-economic impacts for its findings to be credible. As the Minister has suggested, a socio-economic impact assessment is only as good as the underlying specialist studies on which it relies for its assessment of negative impacts and risks. All the major shortcomings in the 2022 DEIA report and its specialist studies that are identified in the comments above also are relevant when considering the adequacy of the socio-economic impact assessment for the powership.

173. For example, the noise analysis has substantial flaws, and cannot be relied on to understand potential impacts to marine organisms and the fishing communities that rely on healthy marine ecosystem for their livelihoods (i.e., the small-scale fishers and tourism industry). As Dr. Fournet noted[154]:

> "this is in large part due to (1) the failure of the studies to acknowledge that the anthropogenic noise associated with this project as chronic, (2) the failure of the study to adequately assess Underwater Noise conditions at meaningful temporal scales, and (3) the failure of the studies to consider impacts to the broader marine community, including benthic organisms and invertebrates." As such, the mitigation actions proposed in the associated DEIA reports are founded on an erroneous assessment of noise impacts, and they fail to meaningfully address the possible or likely impacts of anthropogenic noise to the marine environment associated with the powership projects.

174. The conclusions with respect to small-scale fishers are also not credible and is largely based on the report prepared by Afro Development Planning, and the materially deficient noise impact assessment report, discussed above, which failed to adequately assess potential impacts on marine organisms. It is unclear how or whether Afro

[153] Page 33
[154] Annexure A

Development's meeting participants truly represented communities that engage in fishing around Saldanha Bay and the region (versus other economic interests). However, Afro Development noted:

> "Some concern was shown by those present at the meeting regarding the poor representation of fishers from the area. … The poor representation of small-scale fishers could have been attributed to a snoek run which was taking place at the time of the meetings." It also noted that "at the time of this engagement many of the specialist studies were still being undertaken. Therefore, specialist findings could not be conveyed to the attendees."[155]

This means, that even though the applicant attempted to hold a meeting with certain individuals it identified as "representing" the small-scale fisher communities, it could not convey any information about potential impacts to them. For these reasons alone, Afro Development, the Socio-Economic Impact Assessment report, and the 2022 DEIA report cannot credibly rely on any information or findings from the meeting to assess potential impacts on fishers.

175. Furthermore, the conclusion of the Afro Development Planning report, and by virtue the socio-economic report, that there would be no impacts to fishers because they do not fish in the port is spurious and misses the point entirely. In other words, the report did not assess or consider potential impacts to fishers outside the harbour in making its findings. This misses the point, since, the loss of juvenile fish and crustaceans (due to underwater noise, temperature increase due to climate change, discharge of heated water by the Powership, and other reasons), may ultimately impact the spawning of fish and the crustacean populations; and in turn, the economics and livelihoods for all local fishermen in the region, not just fishermen within the port.

176. At the same time, the stated need and desirability for the project continues to overstate the necessity of the Karpowerships to address the current energy crisis and its benefit to the local economy. With respect to the need and desirability of the project we refer to our comments above. Gas is not a necessary transition fuel in South Africa and has tremendous climate impacts; renewable energy is economically competitive, has substantially fewer climate impacts, and can meet South Africa's immediate energy

[155] Afro report pages 2 and 6

needs. Moreover, the way that the RMIPPPP request for proposals was designed resulted in bid tariffs that are untethered to the realities of an electricity system and do not reflect true technology costs. A properly designed request for proposals would have resulted in renewable energy tariffs that were substantially less than the Karpowership bid tariffs.

177. The fact that the socio-economic report, relying on Promethium Carbon's climate change impact assessment (CCIA), characterized the climate impacts of the project as positive is cause alone to question the credibility of the entire socio-economic report. We again refer our comments above, which note numerous flaws and deficiencies in a near identical CCIA by Promethium Carbon prepared for the Karpowership in Richards Bay. Promethium's CCIA, like the initial one found to be deficient, fails to appropriately assess upstream emissions from the project, does not fulfil the comprehensive assessment required by the *Earthlife/Thabametsi* judgment, and makes no additional effort to mitigate the emissions from the project, found to be of "Very High Significance," which should be considered a fatal and material flaw to the project. No reasonable expert could characterize the climate change impacts of the project as positive.

178. The issue of loss of cultural heritage and socio- economic impacts is dealt with under the submissions above on underwater noise and threats to fishing resources and should be read into these comments on socio economic impacts.

179. In summary, the result of this faulty analysis is that the Socio-Economic Impact Assessment report and the 2022 DEIA report downplay the negative impacts from the project, while overplaying the benefits of the project (it is astonishing that it has characterized the climate impacts of the project as positive). This renders the findings in the assessment spurious and not a basis for decision making.

EMPLOYMENT

180. The 2022 DEIA report has not evaluated the potential loss of employment that could result from depletion of fishing resources over the 20-year period caused by the Karpowerships.

181. Construction phase

The figures given for employment opportunities that the project will create appear to be inflated (with indirect and induced jobs) and inconsistent with an application to NERSA[156] that gives far lower figures and does not include indirect employment. Figures of direct jobs in construction and operation under the 2022 DEIA are 334 and 142 respectively but rising to 1525 and 240 with indirect jobs. The NERSA application gives construction and operation jobs as 312 and 175 respectively.

2022 DEIA report employment figures

Construction phase

Table 7-43: Breakdown of estimated Full Time Equivalent employment positions during the construction phase

Effect	Employment (FTE)
Direct	334
Indirect	677
Induced	514
Total	1525

Contribution to income

Table 7-46: Estimated Household Revenue Created during Construction

Indicator	Value
Direct	

[156] APPLICATION FOR AN ELECTRICITY GENERATION LICENCE IN TERMS OF THE ELECTRICITY REGULATION ACT, 2006 (ACT NO. 4 OF 2006). Karpowership SA Saldanha Bay (RF) Proprietary Limited

	R41.797 million
Indirect	R72.925 million
Induced	R55.326 million
Total	R170.049 million

Operations phase

Table 7-54: Estimated Full Time Equivalent positions to be created during operations

Effect	Employment (FTE)
Direct	142

Indirect	46
Induced	51
Total	240

NERSA APPLICATION

Construction phase jobs

	Saldanha		
Job Creation	**No. of Jobs**	**Person Months**	**%**
RSA Based Employees	312	4002	
Citizens	274	3407	85.1%
Black Employees	205	2423	61%
Citizens from Local Communities	133	1513	37.8%
Skilled Black Employees	98	1122	28%

NERSA APPLICATION

Operations phase jobs

Job Creation	No. of Jobs	Person Months	%
RSA Based Employees	175	34160	
Citizens	119	24560	71.90%
Black Employees	98	20000	58.50%
Citizens from Local Communities	56	10880	31.90%
Skilled Black / Women Employees	48	8800	25.80%
Critical Powership Positions	**Qualifications**	**Experience**	**Certificates**
Plant Manager	•Graduated from Business Administration, Economy or engineering related departments of prominent universities •Advanced level of English •Excellent computer skills •Ability to think on operational, strategic as well tactical basis •Ability to work people from various cultures •Strong planning and budgetary skills; excellent	•Minimum 8 years or more experience at least five years having served in similar role preferably in an international environment. •Experience in Energy sector	•Seamen Certificate •Designed Du80es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Engine Room Watchkeeping Certificate

	communication and personnel skills; demonstrated leadership ability with non-exempt operating organization		
Assistant Plant Manager	•Bachelor's degree in Mechanical or Marine Engineering •Upper Intermediate of English •Excellent computer skills •Ability to think on operational, strategic as well tactical basis •Ability to work people from various cultures	•Minimum 6 years of experience in Plant Management •Marine experience in technical levels •Powership Experience	•Seamen Certificate •Designed Du81es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Engine Room Watchkeeping Certificate
Deck Officer	•Bachelor's degree in Marine (deck) •Upper Intermediate of English •Good computer Skills •Ability to work people from various cultures	•Minimum 4 years of experience •Experience in Ship Management	•Seamen Certificate •Designed Du81es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Oceangoing Bachelor Master or Deck Office •Navigational Watchkeeping Certificate
Shift Supervisor	•Bachelor's degree in Mechanical Engineering •Intermediate English level	•Minimum 5-8 years of experience in Ship Management	•Seamen Certificate •Designed Du81es Certificate

			•Related Familiarization Certificate •Security Awareness Certificate •Engine Room Watchkeeping Certificate •High Voltage Educa82on •Engine Resource Management Certificate
Shift Engineer	•Bachelor's degree in Mechanical Engineering •Intermediate English level	•Minimum 3-5 years of experience in Ship Management	•Seamen Certificate •Designed Duties Certificate •Related Familiarization Certificate •Security Awareness Certificate •Engine Room Watchkeeping Certificate •Bridge Resource Management Certificate •Engine Resource Management Certificate
Chemist	•Bachelor's Degree in Chemistry •Scientific, numerical and technical skills •Intermediate level of English	•Minimum 3-5 years of experience in the field •Experience in Chemistry marine sector	•Seamen Certificate

Mechanical Maintenance Engineer	•Bachelor's degree in Mechanical or Marine Engineering •Intermediate English level	•Minimum 3-5 years of experience in Ship Management	•Seamen Certificate •Designed Du83es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Engine Room Watchkeeping Certificate •Engine Resource Management Certificate
Electrical Technician	•Degree in Technical High school or Engineering •Intermediate English level	•Minimum 3-5 years of experience •Experience in Opera83on & Maintenance in Marine sector	•Seamen Certificate •Designed Du83es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Navigational Watchkeeping Certificate
Electrical Engineer	•Bachelor's degree in Electrical Engineering •Upper Intermediate English level	•Minimum 3-5 years of experience in Power Plants	•Seamen Certificate •Designed Du83es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Engine Room Watchkeeping

			Certificate •Navigational Watchkeeping Certificate
Health Officer	•Bachelor's degree •Ability to explain environmental health laws and procedures •Upper Intermediate of English	•Minimum 3 years of experience	•Health Officer Certification
HSE Specialist	•Bachelor's degree in Engineering or Technical Sciences Departments •Upper Intermediate of English	•Required minimum 4 years of HSE experience in marine business	•Certification from Ministry of Labor on Health & Safety •NEBOSH (is a plus)
Analysis and Reporting Assistant Manager	•Bachelor's degree in Mechanical Engineering •Upper Intermediate of English •Strong MS Office application skills	•Minimum 3-5 years of experience in Power Plants •SAP Knowledge is a must	•SAP Certificate
Administrative Affairs Assistant Manager	•Bachelor’s Degree •Upper Intermediate level of English	•Minimum 3-4 Years of experience	•Seamen Certificate •Designed Du84es Certificate •Related Familiarization Certificate •Security Awareness Certificate •Oceangoing Bachelor Master or Deck Office •Navigational

			Watchkeeping Certificate

Current jobs that would be threatened by the Karpowership project:

182. By way of comparison, in the aquaculture sector, 663 people are directly employed, with 570 (86%) permanent[157]. Karpowership does not provide any indication if women will be employed but 55% of employees in aquaculture are women. Karpowership's NERSA application has a category of construction jobs which indicate that 98 skilled black employees and that category could include women. There are no guarantees. In direct comparison, Karpowership claims it will employ 133 local citizens whereas the AQZ already employs 663 people.
183. In terms of total job-months over a twenty-year period, the ADZ will provide 159120 job-months while over a twenty-year period, Karpowership will total 34160. In terms of skills level, 80% or 530 jobs of ADZ jobs are semi-skilled, whereas for Karpowership, only 4 jobs are categorised as semi-skilled or unskilled. It is not suggested that these jobs would be threatened by the Karpowership project.
184. However, in the small-scale fisheries sector, there are 117 permit holders (55 SSF, 6 fishers (plus 6 crew) commercial net-fishers, 10 line fish rights holders (with 5 crew per boat = 50 livelihoods) in the Saldanha area, all of whose livelihoods could be threatened by the Karpowerships projects158. According to the local fishers, they work 20 days a month for three quarters of the year and only 4 to 12 days a month in the winter. That is a further 14040 job months. The small-scale fishers also contribute to the local economy, for example, a further 30 direct jobs are created in a small business repairing the fishing nets of the SSF boats, and the boats use about R500 fuel per fishing day.

[157] DFFE - Saldanha Bay open day presentation – DFFE World ocean day presentation of the Saldanha
[158] Data to be supplied

185. The processing of the snoek in the season provides livelihoods to another 40 women. In summary, the entry of the Karpowerships could undermine and potentially destroy more than 170 000job months while only creating about 34 000 job months.

186. The table below summarises the current livelihoods that could be compromised if Karpowership goes ahead. This impact was not assessed in the Socio-Economic impact assessment.

	Direct local jobs	job months/20 yrs
ADZ	663	159120
SSF fishers	117	15694
current job-months total		174814
Karpowership	133	34160

NO GO OPTION AND BEST PRACTICABLE ENVIRONMENTAL OPTION

187. The GC submitted to the 2021 DEIA report that the analysis of the no-go option was defective. Given the deficiencies in the EIA it was not capable of properly assessing the no-go option and the best practicable environmental option. It was also submitted that the analysis of the no-go option fails meet the requirements for such assessments set out in National as well as Western Cape Provincial guidelines, with the result that there is not only a fatal deficiency in the report but the decision maker is also as a consequence unable to apply its mind to all relevant considerations when considering the EIA, including the best practicable environmental option.

188. The record of refusal did not mention the no go option and the issue was not discussed in the appeal decision.

The 2022 DEIA report

189. The report states that the negative environmental impacts of the project have been found to be minimal. Against this the socio-economic benefits of securing the electricity

supply far outweigh the negative impacts and the no go option is not therefore recommended. However the deficiencies in the analysis of environmental impacts and their impacts on the socio economic conditions of small scale fishers and beyond mean that at this stage an analysis of the no-go option is still not possible.

190. The 2014 EIA regulations require the assessment of the no-go option and therefore the draft final EIA report as it currently stands is incomplete and is not a basis for decision making.

On the basis of the above submissions, we request that the application for environmental authorisation be refused.

Annexure A

MARINE ACOUSTIC ECOLOGY EXPERT COMMENTS ON DRAFT ENVIRONMENTAL AUTHORISATION FOR THREE PROPOSED GAS-TO-POWER POWERSHIP PROJECTS LED BY KARPOWERSHIP SA (PTY) LTD –

Dr. Michelle Fournet, M.S., PhD

OVERVIEW: This report contains an expert opinion assessing the scientific soundness of documents and proposed management/mitigation actions relating to three Gas to Power - Powership Projects led by Karpowership SA (PTY) Ltd. The proposed project locations include: (1) Port of Ngqura (on the Southeastern side of South Africa), (2) Richards Bay (near Durban), and (3) in Saldanha Bay (near Cape Town on the West Coast of South Africa). The projects involve the generation of electricity by means of mobile powerships to be berthed in the marine environment. Additional components of the projects that will interact most directly with marine ecosystems include Floating Storage and Regasification Units (FSRU), gas pipelines, and Liquid Natural Gas Carriers (LNGC). Specifically, this report is concerned with whether the draft underwater noise assessments and background reports (hereafter 'the studies') and the associated draft Environmental Impact Assessment reports (DEIArs) and Environmental Management Program reports (EMPrs) adequately assessed the environmental impact of anthropogenic noise and vibrations associated with the proposed projects and associated activities. Anthropogenic noise will be broadly addressed, with specific emphasis on suitability of the studies and DEIArs to address impacts to the marine environment. Particular reference will also be made to acoustics-relevant findings made by decisionmakers in the Records of Refusal and subsequent appeal decision issued by the Department of Forestry, Fisheries, and the Environment of the Republic of South Africa after Karpowership's first application for environmental authorization for the same projects at each location.

These projects collectively compare acoustic measurements made at each location with a single technical study to predict possible noise levels emanating from the powership. All three DEIArs and studies repeat language, indicate similar mitigation strategies, and rely on the same scientific and technical references. As such, this report will address the three independent locales and the associated studies and DEIArs collectively, noting differences in the ecology of the three regions as needed.

This report comments specifically on the following documents and appendices:

1. DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT: The Proposed Gas to Power Powership Project at the Port of Saldanha Bay and associated evacuation route within Saldanha Bay Local Municipality, West Coast District, Western Cape. DFFE REF NO: 14/12/16/3/3/2/2006
    1. Appendix 6: DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR) FOR THE PROPOSED GAS TO POWER VIA POWERSHIP PROJECT AT PORT OF SALDANHA BAY AND ASSOCIATED EVACUATION ROUTE WITHIN SALDANHA BAY LOCAL AND WEST COAST DISTRICT MUNICIPALITIES, WESTERN CAPE. DFFE REF NO: 14/12/16/3/3/2/2006

2. Appendix 9 B-2: Baseline Underwater Noise Assessment
3. Appendix 9 B-1: Underwater Noise Assessment

2. DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT: Proposed Gas to Power via Powership Project at Port of Richards Bay, uMhlathuze Local Municipality, KwaZulu-Natal DFFE REF NO: 14/12/16/3/3/2/2007
    1. Appendix 6: DRAFT ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR) FOR THE PROPOSED GAS TO POWER VIA POWERSHIP PROJECT AT THE PORT OF RICHARDS BAY AND ASSOCIATED EVACUATION ROUTE WITHIN UMHLATHUZE LOCAL MUNICIPALITY, KING CETSHWAYO DISTRICT, KWAZULU-NATAL DFFE REF NO: 14/12/16/3/3/2/2007
    2. Appendix 9 B-2: Baseline Underwater Noise Assessment
    3. Appendix 9 B-1: Underwater Noise Assessment

3. DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT: The Proposed Gas to Power Powership Project at the Port of Ngqura within the Coega SEZ, Nelson Mandela Bay Metropolitan Municipality, Eastern Cape DFFE REF NO: 14/12/16/3/3/2/2005
    1. Appendix 6: ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR) FOR THE GAS TO POWER VIA POWERSHIP PROJECT AT PORT OF NGQURA AT NELSON MANDELA BAY METROPOLITAN MUNICIPALITY, EASTERN CAPE. DFFE REF NO: 14/12/16/3/3/2/2005
    2. Appendix 9 B-2: Baseline Underwater Noise Assessment
    3. Appendix 9 B-1: Underwater Noise Assessment

Abbreviations will be used when referencing sites, studies, and the DEIArs and EMPrs. References to the project at Port of Richards Bay, uMhlathuze Local Municipality, KwaZulu-Natal will be indicated with RB, the project at Port of Ngqura within the Coega SEZ, Nelson Mandela Bay Metropolitan Municipality, Eastern Cape will be indicated with PN, and the project at the Port of Saldanha Bay, Saldanha Local Municipality, Western Cape will be indicated with PS.

SUMMARY OF OPINION: The Underwater Noise Assessments and associated Baseline Underwater Noise Reports (studies) failed to adequately demonstrate that noise will not have significant ecological consequences at the three proposed locations. This is in large part due to (1) the failure of the studies to acknowledge the anthropogenic noise associated with this project as chronic, (2) the failure of the study to adequately assess underwater noise conditions at meaningful temporal scales, and (3) the failure of the studies to consider impacts to the broader marine community, including benthic organisms and invertebrates. As such, the mitigation actions proposed in the associated DEIArs are founded on an erroneous assessment of noise impacts, and they fail to meaningfully address the possible or likely impacts of anthropogenic noise to the marine environment associated with the powership projects.[1]

[1] Powership projects here are defined as powership operations including the FSRU and LNGC.

I have structured my analysis within the following sections:

A. GENERAL INTRODUCTION TO ANTHROPOGENIC NOISE IN THE MARINE ENVIRONMENT
B. RELEVANT DEFINITIONS AND EXPLANATIONS
C. TECHNICAL FAILURES AND INSUFFICIENCIES ASSOCIATED WITH ACOUSTICS STUDIES
D. SPECIFIC FAILURES AND INSUFFICIENCIES ASSOCIATED WITH DEIAr ASSESSMENTS AND MITIGATION MEASURES
E. SUMMARY OF MAJOR FAILINGS OF THE UNDERWATER NOISE ASSESSMENTS AND ASSOCIATED EIARS AND EMPRS

A. GENERAL INTRODUCTION TO ANTHROPOGENIC NOISE IN THE MARINE ENVIRONMENT

Anthropogenic noise is sound produced by human activities, including infrasonic (below the range of human hearing) vibrations, and ultrasonic (above the range of human hearing) vibrations, and sound audible to the human ear. It poses a well-established threat to many types of organisms[1] that rely on sound for vital life functions including foraging, breeding, travelling, and socializing [2–8]. This threat is particularly pronounced in marine ecosystems where sound can travel great distances with little loss of energy and where - in the absence of human activities - many if not most marine species evolved to rely on sound as their most important sense [9,10]. Among its impacts, anthropogenic noise has been documented to limit acoustic communication, displace organisms, elicit changes in foraging behavior, alter predator-prey dynamics, induce physiological stress, and/or result in physical damage or death [2–4,10–16].

Assessing the impacts of anthropogenic noise is a complex field of study requiring the integration of ecology, resource management, and physics. Compared to marine biology, oceanography, or fisheries ecology, acoustics is a relatively new field of study that is not regularly incorporated into traditional academic coursework, and therefore a comprehensive impact assessment that includes an investigation into the impacts of noise should include a bioacoustician on the assessment team with deep knowledge of both the physics of sound as well as the impacts of noise on ecology. Because the properties of sound underwater vary significantly from the properties of sound in air or through land, a specialist is needed to assess underwater noise impacts on both the environment and ecology. Because regions and ecosystems are site specific and unique, assessments must be made relevant to a specific location.

For most marine organisms, sound is critical to life function. Social cetaceans and seabirds including whales, dolphins, and penguins rely on sound for communication, foraging, and pod cohesion [17]. Bottom-dwelling animals, fishes, and invertebrates also rely on or respond to sound in their environment. For example, larval invertebrates and fishes use sound to know when and where to leave their open water life stage and settle into adulthood [18,19]. Scientific literature on how marine organisms respond to anthropogenic noise includes behavioral responses, changes in organism presence or absence, physical responses including hearing loss, physiological responses including stress, mortality, and demographic shifts including reduced reproductive

success or larval development, and displacement[20–22]. As such, any proposed activity that is believed to be sound producing may have significant consequences throughout the ecosystem.

B. RELEVANT DEFINITIONS AND EXPLANATIONS

1. Characterizing Sounds

When determining the impacts of noise on an organism or an ecosystem, the noise must first be characterized. Noise is broadly characterized according to the following:

- Duration: how long each signal lasts
- Frequency (or pitch): how high, low, or broadband (ranging simultaneously high and low) a sound is
- Pulsivity: whether a sound is impulsive (like a series of bangs from fireworks) or continuous (like traffic noise)
- Chronic versus discrete: Does the noise occur in a single short time period (like a jackhammer outside of an apartment window for a morning) or does it persist over long time periods (like an apartment which abuts a train track with trains passing by every day for many years).

Inappropriately characterizing noise has severe implications on individuals or organisms, and improper characterization can hide ecological impacts that may be significant. For example:

- Duration: It would be misleading to characterizing the duration of a fireworks display that took place from 7pm until 11pm as having an average duration of 1.1 seconds (the length of time of a single firework).
- Frequency: It would be misleading to say that simultaneously blowing 10,000 dog whistles (which are too high pitched for humans hear) would not impact a mother dog and her pups that were feeding 1 meter from the whistle blowers, simply because it doesn't substantially contribute to overall low frequency sound levels.
- Pulsivity: It would be misleading to say that animals were capable of adjusting the timing of their calls to vocalize in between sound signals, if the sounds were continuous and there was no break between sounds.
- Chronic vs. discrete: It would be misleading to say that the sound of a jackhammer outside of a bedroom window would have negligible effects on the apartment residents because it only occurred for three hours, when in reality the sound of the jackhammer occurred for three hours every day at 3am for 20 years.

The major flaws associated with how the noise was characterized in the acoustics studies and the associated assessments can be directly related to (1) mischaracterization of chronic noise as discrete, and (2) lack of characterization of noise frequency and related impacts.

The acoustic studies only considered the impact of discrete, continuous noise (noise that continues for approximately 16.5 hours for a single day) on the broadband noise levels (high and low pitch) of an already impacted ecosystem. The reality is that the powership projects will generate chronic continuous noise that is likely to significantly elevate ambient sound levels in the low and mid-frequency ranges that matter most to most marine mammals, fish and invertebrates.

2. Determining Ecological Baselines

In order to determine if elevated noise levels will impact an ecosystem, it is necessary to first understand what the environment sounds like in the absence of human impacts. This process is expressed as "determining the baseline". The ecological baseline is defined as the ecological value of a site before anthropogenic disturbance. The following elements make up an acoustic baseline:

- Ambient sound levels in the absence of human disturbance
- Ambient sound levels measured in ecologically relevant frequency (pitch) bands
- Temporal patterns of natural sound at diel (daily) and seasonal scales

The absence or mischaracterization of any of the aforementioned baseline soundscape elements may have significant implications for ecological interpretation, and may lead to ecological weakening, or demise. For example:

- Erroneously assigning acoustic baselines: An urban task force is asked to determine whether traffic noise is elevating the foraging habitat of a rare bird in an urban park. The task force measures ambient noise levels when only a tractor trailer truck is driving alongside the park and then measures again during moderate traffic flow. Using the period with the tractor trailer truck as the acoustic baseline, the task force determines that noise has no impact since noise levels were equivalent between the two periods. A second task force challenges the results, and compares a traffic free recording (made on a Sunday morning at 9am) with a traffic-full recording (made on a Monday morning during 9am rush hour) and documents a 300% increase in ambient noise. In this case, there is a clear increase in ambient noise associate with traffic that would have been missed if the acoustic baseline has been mischaracterized.

- Erroneously omitting frequency analysis: The same task force is asked to assess whether the installation of new power lines will negatively interfere with bat echolocation, which occur in the ultrasonic frequency ranges (above the range of human hearing, or >20 kHz). They take measurements and then report that the average sound levels between 1kHz and 30 kHz are higher with the power lines present than without the power lines present, but only by a small amount. In reality, however, the noise levels in the bats hearing and communication range are more than 400% higher when the power lines are turned on, while noise levels in the low frequency range do not change. By averaging the high and low frequency ranges, the task force erroneously concludes that the elevation in noise levels is not ecologically meaningful. In practice noise levels at high frequencies with the addition of power lines are loud enough to cause hearing loss in bats.

- Erroneously omitting temporal patterns of sound sources: A contractor is tasked with quantifying a baseline soundscape. They make recordings for 10-seconds an hour in a habitat for one day in the autumn, outside the typical season when animals in this region are mating and migrating. As a result, the sound of migration and breeding animals is not included in the contractors' report. The contractor erroneously reports that there are no mating or migrating signals in this soundscape, and concludes that elevating noise levels won't have an impact on these sounds. However, for several months every year migrating and mating animals are acoustically present -- the contractors study simply did not record them.

These examples are directly analogous to the major flaws in the way the studies assess the baseline soundscape, which include (1) failure to document noise levels in the absence of anthropogenic noise, (2) failure to examine noise in relevant bandwidths, instead opting to average noise levels across broad bands in order to minimize relevant shifts in noise, and (3) failure to account for diel and seasonal variability in the natural soundscape that would reveal ecologically important sounds.

The acoustic studies considered noise levels containing vessels and other anthropogenic noise sources as the ecological baseline. The difference in noise levels between the undisturbed periods (no anthropogenic noise) and the predicted values (powership noise present) is as much as 40 dB (see baseline sounds in figures below and predicted values in the Underwater Noise Assessments); a 40 dB increase in noise is approximately the difference between a listening to a music on headphones on volume 5 out of 10, and a jet engine running 100 feet away – that is, a 1000-times increase in loudness.

C. TECHNICAL FAILURES AND INSUFFICIENCIES ASSOCIATED WITH ACOUSTICS STUDIES

The studies and technical reports associated with the DEIArs for the powership projects did not sufficiently address the impacts of noise to marine organisms found in and around each project site. Instead, the underwater noise assessments and reports were overly narrow, technically misleading, and minimized impacts to the marine environment through the omission of analyses. The studies misapplied critical scientific literature including noise thresholds and omitted most of the potential impacts of noise to marine organisms.

Further, and importantly, the studies failed to acknowledge in any capacity that the noise produced by the powerships would be long duration (16.5 hours/day over a 20-year period) and thus result in chronic noise impacts. As a result of these serious flaws, the Underwater Noise Assessment almost certainly underestimated the impacts of anthropogenic noise on the marine ecosystem.

These are two key examples among many demonstrating the insufficiency of the Underwater Noise Assessment, upon which an erroneous impact assessment and mitigation measures were then based. The following are the primary failures/insufficiencies of the underwater acoustics assessments and associated reports. These failures were consistent between the three proposed powership locations.

1. Failure to consider chronic noise impacts when determining impact to marine organisms *CRITICAL FAILURE*

The studies rely heavily on two pieces of peer-reviewed literature to support the assertion that noise impacts on cetaceans and fish will be negligible: Southall et al. (2019)[23] and Popper et al. (2014)[24]. However, this literature was misinterpreted because it was not intended to be used for assessing chronic noise exposure—like the kind of noise expected from the powerships—and

therefore cannot be applied to the current Underwater Assessment Studies. The assessment authors assert:

> "*Any risk to marine mammals or fish, as per the guidelines in Southall et al. (2019) and Popper et al.(2014) respectively, will be negligible. The lower order of effect defined in the guidelines, temporary threshold shift (TTS), would only occur when marine mammals of the most sensitive species (VHF cetaceans, i.e. porpoises) remained within 850 m of the Powerships operating at maximum capacity for a full 24 hours.*" (Underwater Noise Assessments)

However, the assessment fails to acknowledge the primary caveat included by Southall et al. (2019) which is that the number outlined in that publication **only applies to discrete sound exposure**. Southall et al. (2019) explicitly states that:

> "*The current criteria remain focused on the derivation of auditory weighting and exposure functions for the purpose of evaluating the potential fatiguing effects Marine Mammal Noise Exposure Criteria: Hearing, Weighting Functions, and TTS/PTS Onset 165 of discrete noise exposure (e.g., TTS/PTS).* ***These approaches are not applicable in evaluating potential auditory effects of chronic noise exposure over periods of weeks, months, or years****."* (Southall et al. 2019)[23]

Given that the expected duration of the powership project is estimated at 16.5 hours per day for 20 years, the associated noise should be defined as chronic (see definition on chronic noise in definitions section above). Noise that continues daily for 16.5 hours for a 20-year duration will undoubtedly impact marine organisms that evolved to rely on sound in an environment free entirely from anthropogenic noise. Given that the noise proposed by the powership activities will continue for decades, the values that the authors of the underwater noise studies rely on to assess the impact of anthropogenic noise on hearing do not apply. The values used in the report can be applied **only to short-term noise exposure.** In the 2019 publication, Southall et al. goes on to state that:

> "*As in human noise exposure criteria, [chronic noise] will require different methods and metrics other than the SPL or SEL metrics used here.* ***Separate criteria are needed to evaluate behavioral responses and broader-scale auditory effects (e.g., auditory masking) and physiological effects (e.g., stress responses).***" (Southall et al. 2019)[23]

Despite this caveat, the studies inappropriately apply the values from Southall et al. (2019) to determine that hearing loss will be negligible. This is not scientifically sound.

The same mistake is made when referring to Popper et al. (2014). The original caption to the exact table included used within the assessment studies to make this determination (Popper et al. (2014) includes the following caveat:

> "*As discussed in the text, there are no data on exposure or received levels that enable guideline numbers to be provided*" (Table Caption, Popper et al. 2014)[24]

The above caveat indicates that it is not possible to include guideline numbers (i.e., threshold decibel levels at which a given response would occur) for fish exposed to chronic anthropogenic noise. Despite this, the study authors rely on this publication and this table as a guide to determine that there is no impact of chronic noise to fish anyway. This is a critical error.

Table 2. Summary of the qualitative effects on fish from continuous noise, from Popper et al. (2014)

(N = Near-field; I = Intermediate-field; F = Far-field)

Type of animal	Mortality and potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking[4]	
Fish: no swim bladder	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder is not involved in hearing	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involved in hearing	(N) Low (I) Low (F) Low	See Table 5-3	See Table 5-3	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Sea turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low
Eggs and larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low

[4] Masking is the inability of a species to hear a sound due to the relatively high level of another noise source.

Despite ample literature describing the need to consider chronic noise impacts and the need to consider effects beyond hearing loss, (e.g., The Effects of Anthropogenic Noise on Animals, 2018 Springer Press and others)[21,22,25,26] the Underwater Noise Assessments and Baseline Underwater Noise Reports fail to consider noise impacts beyond a 24-hour period in any capacity. The scientific assumptions made by the studies are only supported if the powerships run for a single day for the entire project duration. This highly significant flaw nullifies any inference based on these studies.

The failure to consider chronic noise is a significant and fatal flaw of the underwater noise assessment for several reasons. First, the study claimed negligible impact of hearing thresholds in marine fishes based on predicted noise values; however, it is known that chronic low intensity noise with values similar to those predicted by the noise report can cause significant reductions in the hearing capabilities of teleost fishes[27]. For example, one study found that the distance at which fish could acoustically detect reef sounds critical to their survival was reduced by half after being exposed to two-weeks of low-intensity noise at 120 dB re 1µPa (lower than predicted noise around the powership projects based on the studies).[27]

A reduction in hearing thresholds in ecologically or commercially important fish and invertebrates in these regions could have significant implications for commercial fishing. Larval

fish and invertebrates use sound to find nursery grounds, and to determine where to settle (where to take up residence for the growth portion of development). Reduced hearing capacity in fish and benthic organisms will make it difficult or impossible for these organisms to acoustically detect appropriate habitats. Failure to find the appropriate juvenile habitat results in death of larval and juvenile organisms. As a result, deafening will drive the decline of both the abundance and biodiversity of organisms that rely on sensitive areas like estuaries and mangroves.

In marine mammals, chronic noise is associated with elevated stress levels[12], various internal and external organ injuries[20], long term displacement from breeding and foraging regions[28,29], shifts in migratory pathways[30,31], and permanent hearing loss[32]. None of the underwater noise assessment studies considered these chronic noise exposure risks, despite the vulnerability of high frequency cetaceans in the area. Of particular note is the presence of humpback dolphins (*Steno plumbea*) in the RB region and humpback whales in the PS region. As noise sensitive cetaceans, humpback dolphins and humpback whales are highly likely to be disturbed by the impacts of chronic noise, including by experiencing chronic stress, possible reduction in reproductive capability, hearing loss, reduced immune function, displacement, and/or shifts in migration. The studies failed to consider these and other chronic impacts of noise on humpback dolphins and humpback whales. Disturbance to these charismatic cetaceans would also negatively impact the tourism industries in these regions.

This complete omission of a chronic noise assessment is particularly significant, as the inadequate assessment of noise impacts of critically endangered species, including humpback dolphins, was directly stated in the DEIAr Refusal and Appeal Denial document. I am of the strong opinion, that the revised DEIArs and the associated studies remain fatally deficient in the assessment of noise impacts on this and other vulnerable species, particularly due to their failure to consider chronic noise exposure.

2. **Failure to consider impacts of anthropogenic noise on marine life beyond potential hearing loss:**

The studies state directly that sound impacts on marine organisms extend beyond acute hearing loss: "*The main adverse impacts of underwater sound on marine species can be broadly summarised as… auditory injury (either permanent or temporary); and disturbance"* (Underwater Noise Assessments). Beyond this statement, however, the studies fail to address organismal disturbance of underwater noise other than hearing loss, despite the prominence of the topic in the scientific literature and the noise recommendation guidelines that the underwater noise assessments rely on[23,24].

Indeed, according to the studies, the noise associated with the powerships is negligible and "*No risk to fish in the Port of Richards Bay is expected as a result of underwater noise from the Powership installation."* (Underwater Noise Assessment, Richards Bay). The underwater acoustics studies for the Port of Ngqura and Saldanha Bay reach the same conclusion (Appendix 9 B2 p. 21 for each). Yet in reaching this conclusion, the studies have failed to assess the full range of relevant harms from the acoustic impacts of the powerships, categorizing harm only as hearing loss and failing to consider behavioral effects resulting from masking (defined as when a loud sound drowns out a softer sound or when noise is at the same frequency as a sound signal).

Table 1, below, taken from Popper and Hawkins, 2019 [16] shows some of the many potential effects of anthropogenic noise on marine animals. Of these, the underwater noise assessment addressed only hearing threshold shifts, despite an extensive body of literature of additional impacts associated with anthropogenic noise.

Effect	Description
Death	Sound exposure results in instantaneous or delayed mortality.
Physical injury & physiological changes	Physical injury results in temporary or permanent impairment of the structure and functioning of some parts of the body. Physiological changes result in increased stress or other effects that can lead to reduced fitness.
Hearing threshold shift	Loss of hearing, temporarily or permanently, results in decreased ability to respond to biologically relevant sounds.
Masking	Noise results in a decrease in detectability of biologically relevant sounds (*e.g.*, sounds of predators and prey, sounds of conspecifics, acoustic cues used for orientation).
Behavioural responses	Behavioural responses include any change in behaviour from small and short-duration movements to changes in migration routes and leaving a feeding or breeding site. Such responses are likely to vary from species to species, depending on numerous factors such as the animals normal behavioural repertoire, motivational state, time of day or year, age of the animal, *etc*. Some changes in behaviour, such as startle reactions, may only be transient and have little consequence for the animal or population.
No obvious behavioural responses	Animals may show transient or no responses, even if they detect the sound (*e.g.*, to a very low-level sound) or habituation may take place. However, even if there is no response, there is always the possibility that physical injury and physiological changes may take place without the animal showing overt changes in behaviour

Table 1. Potential effects of anthropogenic sound on animals, from Popper and Hawkins (2019)

None of many behavioral responses to masking were considered in the studies despite masking having important impacts for marine mammals, sea birds including the endangered African penguins, economically and ecologically important fish species, pelagic plankton, and invertebrates. Among these responses, ambient noise results in the cessation of feeding in multiple cetacean species [14,33], the cessation of foraging activity in invertebrates and fishes [8,34,35], and the cessation of egg laying and reproduction in invertebrate and fish species[26,16], and likely has similar negative consequences for diving birds that rely on sound for vital life function. These biologically critical behaviors are as important to the fitness of the individual as to the health of the populations and have not been adequately assessed in the studies (marine mammals and fish), or indeed considered at all (invertebrates, African penguins).

This failure of the studies and the DEIArs to specifically consider the ecological impacts of masking resulting from the projects' noise is particularly odd considering that the studies' own table (see Table 2 below) shows that the risk of masking and behavioral responses as a result of the projects is moderate to high. Despite this acknowledgment, and with no evidence, the studies consider the threat to be unsubstantiated.

As a result of these failings, the studies' conclusion that "*no significant disturbance effect to marine mammals as a result of underwater noise outside of the normal operational port noise is anticipated"*(Underwater Noise Assessments) cannot be justified, as it is not supported by the data provided in the assessment itself, or by the existing body of science pertaining to noise impacts on marine species. The fact that the DEIArs and EMPrs in turn fail to provide appropriate mitigation measures to avoid acoustic masking makes this lack of analysis of behavioral effects a fatal flaw in the studies.

3. **Failure to adequately monitor and describe the baseline marine soundscape at ecologically relevant timescales, including to assess seasonality:**

The acoustics studies quantified ambient baseline noise levels at two temporal timescales: 10-second spot recordings were made at multiple locations throughout each region, and a 48-hour continuous recording was made at one location in each region. All recordings were made in the month of either October or November, depending on the locale. This is insufficient to adequately describe the baseline natural soundscape. Sound is temporally variable as animals and environmental conditions shift in response to seasons, time of day, day of the week, and human activities. Ambient noise conditions in November will not be indicative of ambient noise conditions at other times of the year, missing significant sound sources that occur in autumn, summer, and winter. For example, mating is facilitated acoustically for most vertebrate and all known marine mammals. Mating occurs at specific seasons, and not exclusively in November. Similarly, commercial activity varies based on day of the week. Recordings made on Sunday mornings will not be indicative of sound levels during peak commercial activities during the week.

Moreover, this sampling design is woefully lacking. It is akin to monitoring weather at a single location over two days and claiming to have a comprehensive understanding of climate at that location. The 'long-term' monitoring that took place over only a 48-hour time period represents only approximately 0.05% of a complete annual cycle. Noise samples that were said to be indicative of regional ambient sound through each region spanned only 3 repetitions of 10-seconds each (*Background Noise Monitoring Reports*). As such each location was only acoustically monitored for a total of 6.5 minutes. Given that the powership project is expected to span 20 years, and to be operational for 16.5 hours per day, it is impossible that noise values collected over a 6.5-minute span in the month of November provide enough detail to make an adequate assessment to determine noise impacts on the marine system. Sound changes based on time of day, season, and ecological activity. Many signals only occur during specific seasons (e.g., mating, migration) that would not have been captured in such a short duration. Similarly, no effort was made to determine if these very limited samples were indicative of average anthropogenic noise contributions in this region, or if these samples were anomalously high or low. From the scientific methods perspective, this is an embarrassingly low duration sample size to be used to predict impacts that will span decades. Despite this, it was these 10-second spot

values that were used to determine both propagation and likely noise impacts spanning the 20-year project period.

4. **Failure to adequately characterize the existing soundscape**

The studies provided insufficient detail on the context of current sound in the project locations to understand the ecologically relevant impacts of adding the ships into those soundscapes. For example, there was no declaration made of what vessels or anthropogenic sources were present throughout the spot sampling.

Additionally, no effort was made to quantify the total hours per day that anthropogenic noise would contribute to the soundscape should the powership project be approved. The reports indicate that noise contributions will be limited because powership operations will not exceed 16.5 hours a day; however, the report failed to indicate how many hours per day the area is already anthropogenically altered. The addition of 16.5 hours a day of noise in these regions may result in continuous chronic noise in the project regions. This consideration – that an additional 16.5 hours may be a dramatic increase in the temporal noise budget resulting in continuous anthropogenic noise – was not included in the studies or the DEIArs.

Lastly, by the studies' own admission, the ambient noise levels reported during the 48-hour continuous sampling was likely artificially inflated by the mooring system used for the hydrophone. For example, the Baseline Noise Report from PS states that *"Slightly higher noise levels are to be expected using a surface-suspended hydrophone at mid-water, which increases the noise at low frequency and influences the overall noise level"* (Baseline Noise Report, PS, Page 9). These "slightly higher" levels are in fact 6-7 dB which is twice as loud or more than naturally occurring levels, so is in fact a substantial increase in noise. No effort was made to correct these values to accurately reflect the soundscape.

5. **Failure to adequately monitor and describe the baseline marine soundscape at ecologically relevant frequencies:**

Though the studies state that different animals are sensitive to noise in different frequency bands (see *Table -1 Underwater Noise Assessment*, Richards Bay, for an example), they failed to adequately consider the role of noise frequency (pitch), including by leaving it out of their modeling of noise increases. The aggregation of noise across very wide bands, as the studies did, is insufficient to assess noise impacts on marine organisms with specific hearing tolerances and ranges. This means that sound from the projects in frequency ranges that are ecologically relevant for specific species may have been ignored because they were washed out via averaging across too large a frequency range. Given the harms that could result to specific marine species as a result of sound in particular frequency ranges, even where that sound may be lower in decibels than the total sound of the project, this is a major deficit.

Without looking at the primary data directly, which was not provided in the assessments, it is not possible to infer whether there was a significant increase in ambient noise in ecologically relevant bands. However, it is both possible and likely that given the very wide bandwidth over which noise was calculated (1 Hz – 32 kHz) that ecologically significant increases in ambient

noise occurred in certain bandwidths but would have been 'averaged out' when considering noise across such a wide spectrum. This sort of averaging therefore erases ecologically significant information.

Fish, baleen whales, birds (including penguins which are exposed to underwater noise), and sea turtles will be sensitive to low and mid-frequency ambient noise. Though the studies failed to report band-specific ambient noise levels, the powership is likely to dramatically increase noise in these bands, while the higher frequencies may remain less impacted. Looking at the plots that show loudness as a function of pitch included in each Baseline Noise Report, this becomes much more obvious. Noise levels are consistently higher in the low-mid frequency ranges, but less so at high frequency (See Figures 1-3, below).

Standard soundscape analyses by default include examination of ambient sound across multiple frequency bands known as decidecade bands (also known as one-third-octave bands) to ensure adequate assessment of noise across the range of hearing of marine organisms. This allows the ecological significance of the sound to be assessed relative to the hearing level of the marine organisms at risk. The omission of such a frequency-specific analysis in the case of the powerships studies is misleading, as it minimizes noise impacts in the frequency bands most likely to disturb marine organisms. Because the noise levels reported were aggregated over a very wide frequency range (up to 32 kHz, well beyond human hearing) the noise is weighted toward frequencies that are higher than most marine organisms would biologically perceive. Noise levels should have instead been reported in decidecade (also known as one-third-octave bands) levels.

6. Failure to adequately identify baseline natural soundscape characteristics

Considering that one of the goals of the Underwater Noise Reports was to "*Conduct a study of the existing underwater noise soundscape (baseline)"* it is essential to include whether the noise present is the actual baseline (naturally occurring) or anthropogenically altered. Using 10-second samples of an existing disturbed state (vessel noise) as the baseline and comparing this with a predicted disturbed state (powership noise), erroneously suggests that there is 'no impact'in noise levels once the powership is operational. In reality, the studies show as much as a 40 dB difference in ambient sound levels between periods when there are no vessels present (the natural baseline), and predicted values associated with powership operations. A 40 dB increase in noise is translated as being 10,000 times louder. Without a doubt, the powerships causing the environment to be 10,000 times louder will have significant negative impacts on the marine environment.

In several cases, it was clear that the spot samples were made during periods of high noise. Per the example in the introduction, this would be akin to taking ones temperature when one already had a fever. For example, the RB spot samples were loudest near cargo ships (*RB, Baseline Underwater Noise Report*), yet these values were erronesouly used to represent the natural occuring soudscape against which disturbance was assessed. By looking at the data included in the reports, it becomes clear that the altered soundscape, instead of the natural baseline soundscape was incorrectly used to infer that the powership would have no impact. Looking at Figures 1, 2, and 3 below you can see that in the absence of vessels, the naturally occuring

soundscape is much lower. However, the spot samples similar to the higher levels shown in the figures were those used to model impact (*Underwater Assessments)*

The importance of frequency defintion in comparing baselines and altered soundscapes becomes clear when looking at these same plots, which compare quiet and noisy periods based on sound frequency (a.k.a. pitch). In these plots one can see that there are significant increases in ambient noise levels at all frequency ranges associated with anthropogenic noise, but that noise doesn't elevate equally across pitch. The plots in each study demonstrate that noise levels in ecologically relevant bandwidths (i.e., low frequency sound that would impact most cetaceans, fish, turtles, and invertebrates) increase as much as 38 dB in PN, 10 dB in RB, and 25 dB in PS when a vessel passes above periods of relative quiet. The plots, which appear in the Baseline Noise Reports but are not included in the Underwater Noise Assessments, demonstrate the dramatic increase in noise in ecologically relevant frequencies associated with specific additions of anthropogenic activities in these regions. The relatively noise-free periods (the lower lines on the graphs) should be considered the natural ecological baseline; this was not the case for the studies, which used the average ambient noise level as the baseline. Noting the variability in noise periods, one

can see how averaging noise levels across the frequency bands would have a ‘leveling’ effect on overall noise.

When the studies claim that a baseline is “natural” when it is in fact inflated due to the presence of vessels and associated activities, this has the effect of minimizing our perception of the noise impacts associated with the powership projects. This is problematic because the increases in sound associated with the project are in fact quite significant. Reminding the reader that decibels are logarithmic, **a 10 dB increase in ambient noise is indicactive of noise levels that are 10 times the intensity, while a 30 increase is 1000 times the sound intensity**. The increases in the soundscape generated by the powerships are therefore without a doubt ecologically meaningful.

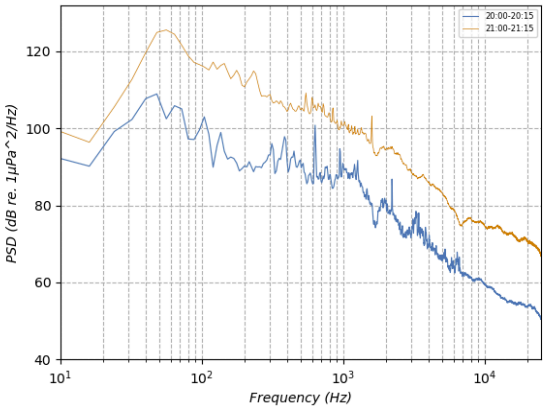

Figure 1- Narrow band frequency plot of a 15-minute sample taken from Richards Bay (Background Noise Monitoring). Yellow line indicates noise levels during a vessel passage, blue line indicates natural sound levels.

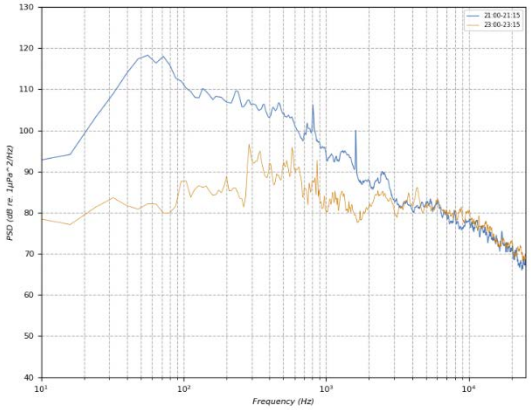

Figure 2- Narrow band frequency plot of a 15-minute sample taken from Port of Ngqura (Background Noise Monitoring). Blue line indicates noise levels during a vessel passage, Yellow line indicates natural sound levels

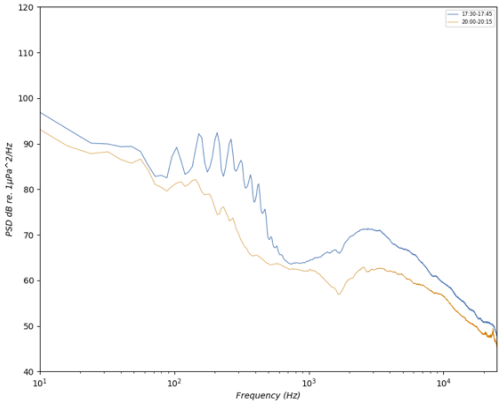

Figure 3- Narrow band frequency plot of a 15-minute sample taken from Port of Saldanha (Background Noise Monitoring). Blue line indicates noise levels during a vessel passage, Yellow line indicates natural sound levels

7. **Failure to consider impacts of noise on ecologically and commercially important species, including commercial fish/invertebrate species and trophic interactions:**

No specific analyses were conducted on the impact of underwater noise on ecologically or economically important species (see Underwater Acoustics Assessments and Baseline Acoustics Reports). Dedicated investigation of the impact of noise on sound sensitive marine species, including marine mammals, commercial fish and invertebrate species, and diving sea birds in particular did not occur. This means that socioeconomic and ecology assessments of the projects could not properly integrate the impacts of underwater noise from the projects, and therefore that the DEIAr had gaps and imbalances as a result.

Anthropogenic noise from various sources (powership operations, vessels, construction), has the potential to negatively impact species important for both small and large scale fisheries, as well as important prey species for birds, marine mammals, turtles and pelagic fishes [36]. Fishes respond to anthropogenic noise in several ways that reduce their fitness. For example, noise reduces their anti-predator response, leaving individuals at higher risk of being eaten. Acoustic masking of breeding sounds can also impact species at the population level, leading to reduced breeding success [8,34,37], temporary or permanent hearing loss, stress [38], and direct or indirect death in fishes and invertebrates[39]. In addition, and more problematic for fisherpeople than for fish, research shows that anthropogenic noise can negatively impact commercial catch rates in teleost fishes. [26,40]

The failure of the studies to include impacts of noise on prey species and fish species important for subsistence and commercial fisheries is particularly problematic given that all of the proposed sites of the powerships contains nursery areas, refuge areas and food sources for numerous marine biota, some of which are commercially important. The sites also all contain multiple sound sensitive marine organisms (including but not limited to pacific humpback dolphins (*Sousa plumbea*) in RB; humpback whales (*Megaptera novaeangliae*) in PS, juvenile fish in PN).

Anthropogenic noise from the operations site may inhibit settlement (habitat selection) and recruitment of fishes and invertebrates in nearby protected or sensitive areas, and thus impact their predators. Broadly, the regions adjacent to the proposed activities, including protected areas, aquaculture sites, national parks, and Critical Biodiversity Areas, may experience long duration (chronic) noise from vessels, powership operations, and/or construction that cause physiological and/or behavioral responses. These important zones include, among others, the *West Coast National Park Marine Protected Area (MPA) Network* which is within 5 km of the PS project site, *Addo National Park Marine Protected Area* which is less than 5 km from the PN site, and multiple *Critical Biodiversity Areas* which overlap (i.e. 0 km distance) with the proposed project site in RB. These noise impacts from the projects present ecologically and economically significant risks to pelagic fishes, lower trophic level bait fish, and invertebrate prey species. A reduction in prey may have fitness consequences for predators, including marine mammals. A reduction in commercial fish may have economic consequences for communities. Moreover, many migratory organisms that seek refuge in protected areas will also have to transit through the operation site in order to reach these protected regions, which may also affect them and in turn the tourism that depends on them.

The DEIArs highlighted the presence and value of invertebrates as a food source around the project areas, despite the studies' failure to address the impacts of noise to these species. Research demonstrates that anthropogenic noise can have acute effects on invertebrates including immobilization, cessation of eating, mating, or egg laying, and changes in swimming behavior.[35] Moreover, many larval invertebrates, as well as corals, shellfish, crustacean species, and fish, rely on sound to facilitate settlement (the act by which larval animals transition from their pelagic 'drifting' phase, to permanent locations[27,29-30]). Acoustic masking of habitat sounds may prevent important structure-building organisms from locating suitable habitat. As invertebrates are commercially important and are a critical food sources for marine mammals in South African waters [41], any negative impacts to this food source would have implications for megafauna, many of which have a year-round presence near the proposed activities.

In sum, the studies failed to investigate potential impacts of increased underwater sound on trophic interactions and marine organisms broadly, and failed to assess the commercial and ecological harms that project noise would be likely to cause.

8. Lack of site-specific sound propagation analysis

Sound propagation in the marine environment is highly context-dependent. Low frequency sound travels at a different speed and with a different level of interference than high frequency sound. In shallow water environments, and those with many bathymetric features (i.e. varied depths and seafloor types) – as is the case in the proposed powership sites – sound propagation can be complex and result in pockets of high amplification zones, and areas of sound shadows. Despite the highly site-specific nature of sound, no effort was made to adequately measure how sound will move through the specific environments surrounding the projects, and no effort was made to consider the differences in how sound travels as a function of frequency.

One of the largest oversights of the acoustics studies was the lack of acknowledgement that frequency (also known as pitch) plays in both the physics of sound and the biological impacts of sound. Failure to model how sound at different pitches propagates through the marine environment, amounts to continued ignorance of how far and at what distance sound will travel, and how far the impact will reach. Further, because the authors of the studies aggregated sound levels across very wide bandwidths, as discussed above, accurate biologically relevant propagation cannot be inferred based on their report.

While it is likely that the presence of the breakwaters minimizes sound transmission beyond these features, not enough information was provided in the report to determine if this is accurate because a full frequency specific propagation study did not take place. Full propagation modeling, that accounts for frequency-specific sounds is essential for determining impacts. This is a failure throughout the studies.

In Coega specifically, the inadequate soundscape characterization used to determine that noise levels at Jahleel Island would not be impacted because the island is 1000 m beyond the powership is erroneous. Audibility is determined by the loudness of a signal above the background sound levels. True background sound levels were not measured for this region and propagation not adequately modeled, therefore audibility cannot be assessed. Similarly, low frequency sound and high frequency sound do not travel the same in the marine environment. No

attempt was made to model noise levels in critical habitats in ecologically relevant frequency bands. The averaging effect (mentioned throughout) would minimize potentially high sound levels in relevant bands that likely would extend well beyond 1000 m from the powership.

Additionally, alterations to the seafloor associated with construction may permanently change how sound travels in these locales. Alterations to the seafloor result in changed bathymetry and subsea substrate density, which impacts how sound travels[47]. Substrate changes may result in a shift in the quality of sound and distance sound is capable of traveling, and thus alter how natural sounds are perceived by marine organisms in this region. As noted elsewhere, this shift would be meaningful to marine organisms, as they use sound as a cue to inform migration [16,37], habitat suitability and settlement (i.e. where juvenile animals select to grow and populate) [35,36,38]. Sound propagation modeling should therefore be used to assess the risk associated with permanent soundscape alteration.

D. SPECIFIC FAILURES AND INSUFFICIENCIES ASSOCIATED WITH DEIAr ASSESSMENTS AND MITIGATION MEASURES

Stress: According to the Impact Management Action section of *Protection of Flora and Fauna* found in each of the EMPrs "*Noise pollution must be minimized to ensure faunal inhabitants are not stressed*." However, the Underwater Noise Assessments failed to include any quantitative or qualitative assessment methods, or commentary on the role of anthropogenic noise on faunal inhabitant stress. Therefore, it is not possible for this management action to be adequately assessed. Further, the proposed mitigation method, fortnightly awareness training and incident reporting, is insufficient to mitigate noise-driven stress on sonic fauna.

Unfounded DEIAr risk assessments: Because of failures and insufficiencies in the Underwater Noise Assessments, the DEIArs erroneously determined that underwater noise has "No impact". This is not scientifically sound. Further, it is directly contradicted by the results of the marine ecology and marine avifauna report impacts sections, which conclude that "The effects on the marine ecology in the receiving water body due to … increased noise and vibration levels" are "Medium-High" before mitigation and remain "Medium" after mitigation.

Contradictions also exist between the Tourism Impacts and Risks sections of the DEIArs and the Underwater Noise Assessments. The former designates the impact of noise on tourism to be low, without any assessment of the likely impacts of noise on targeted tourism species including humpback dolphins, penguins, and other marine megafauna. In contrast, the Underwater Noise Assessments suggested that disturbed animals would leave impacted areas in order to minimize noise exposure, which would negatively impact tourism operators as animals were displaced from current viewing locations.

Duration: The DEIArs and EMPrs lean heavily on the reduction of operational times from 24 hours to 16.5 hours per day. Given the lifespan of the project is predicted at 20 years, 16.5 hour run times per day still constitute chronic ambient noise that radiates throughout the marine environment. No assessment of chronic noise was made to determine long term impacts on marine fauna in the underwater noise assessment. Despite this, in the scoring table, *Impacts of*

increased noise on the marine ecology, the DEIArs indicate that any impacts are reversible. There is no research (field or desk) to support the supposition that chronic noise impacts such as those that would be generated by running the powerships 16.5 hours per day are reversible. As noted above, chronic noise impacts have been demonstrated to cause physiological stress, habitat abandonment, reduced foraging effort, hearing loss and potential population declines.[20,27,29–32]

Fishing Impacts: The RB DEIAr indicates that "the extent to which fish will be affected [by noise] is unknown" (RB, DEIAr, Page 303) and that it is possible that "fisheries may experience shifts in the physical distribution of populations of target species" (RB, DEIAr, Page 303). The report goes on to state that "overall catches will not necessarily be affected as any displacement would only occur over a relatively short range, expected to be of the order of hundreds of metres." (RB, DEIAr, Page 303) This conclusion that displacement is only expected to occur over a relatively short range is not supported by scientific knowledge, and is based on the faulty evaluation in the Underwater Noise Assessment, which failed to consider long-term noise impacts. As noted above, even low level chronic noise impacts catch rates and hearing in many fish species[27,42] According to the most updated literature on the subject:

> "*It is not only the level of the sound but also its frequency range, rise time, duration, repetition rate, and a number of other parameters that may be important in determining [noise] effects*" – (Hawkins and Popper (2018)[22]

The DEIArs'conclusion that commercial fisheries will go relatively unaffected by the projects is therefore unfounded, according to existing knowledge of noise impact on fishes.

Impacts to Invertebrates: Both the RB DEIAr and the NP DEIAr cite de Soto (2016) when they state that "marine invertebrates may be impacted by underwater noise; however, that evidence is limited (see NP, DEIAr, Page 286 and RB, DEIAr Page 242). This is a misrepresentation of the literature. Evidence on the impact of noise on invertebrates is overwhelming, despite the topic being understudied. De Soto 2016 states directly in the abstract of the aforementioned manuscript that "studies show that the noise effects on marine invertebrates range from apparently null to behavioral/physiological responses to mortalities"[35]. The de Soto literature review goes on to document 10 studies demonstrating behavioral and/or physiological impacts on invertebrates associated with anthropogenic noise, and only two studies demonstrating that invertebrate catch rates were not impacted by noise (though these studies include the caveat that additional noise impacts were likely, though not measured)[35].

While it was not possible within the scope of this report to assess every ecological citation pertaining to noise, this pattern of downplaying or directly misinterpreting existing scientific literature (as seen above in the case of Southall et al. (2019) and Popper et al. (2014)) were rampant throughout the DEIAr and associated studies.

Incorporating Uncertainty: Both the studies and the DEIAr failed to account for reasonable uncertainty or to propose effective long term mitigation. The lack of concrete data on noise impacts, does not justify a failure to propose mitigation measures. Many significant risks to marine fauna associated with anthropogenic noise likely exist, but have not yet been thoroughly described. Section 2 of the International Whaling Commission's (IWC) Resolution 2018-4,

Resolution on Anthropogenic and Underwater Noise states that the Commission, "*Further agree that, in line with the precautionary approach, the lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to address the effects of underwater noise (or other potential threats).*"

Spoken plainly, a lack of information is not grounds for ignoring the potential threats of anthropogenic noise when cost effective solutions are available. In the case of the proposed projects there is evidence from the literature that anthropogenic noise causes a significant biological threat to marine organisms throughout trophic levels (benthic fauna, fish, marine mammals, sea birds, sea turtles). A lack of research in this exact locale on these specific faunal communities is not grounds for ignoring potential noise impacts. Rather, it is a greater indication of the need for baseline research and in this region prior to development, and a need for careful mitigation measures.

Monitoring and mitigation should be done year-round to identify noise-sensitive species if/when they arrive so that construction activities and associated project operations can be paused. A firm commitment to noise mitigation throughout the 20-year life of the project is essential. This includes establishing maximum noise thresholds that are frequency dependent and that incorporate duration, and concrete mitigation strategies for how the Applicant will respond when noise thresholds and duration thresholds are approached and met.

E. SUMMARY OF MAJOR FAILINGS OF THE UNDERWATER NOISE ASSESSMENTS AND ASSOCIATED EIARS AND EMPRS

The following list summarizes the primary failings of the Underwater Noise Assessment studies and associated DEIArs and EMPrs. This list is not comprehensive, but highlights some of the primary failures of the underwater noise studies and their associated DEIArs.

1. Failed to address the impacts of anthropogenic noise on small scale and commercially important species. This is significant because a reduction in commercial fish may have economic and cultural consequences.

   There is a documented scientific risk to commercial fisheries associated with anthropogenic noise[40,42,43].

2. Failed to address the impact of anthropogenic noise on important prey species. This is significant because the proposed sites are in close proximity or directly adjacent to Marine Protected Areas (MPAs), National Park, and Critical Biodiversity Areas. Noise may endanger prey species in or *en route* to these areas. This could disrupt the base of the food web and may be ecologically significant throughout trophic levels.

3. Failed to quantify baseline natural sound levels at ecologically relevant timescale or frequency levels at any of the three proposed sites. This is significant because sound is seasonably variable.

The studies rely on less than 48 hours of recordings during periods of moderate to high anthropogenic activities as a baseline. This is not enough time to consider ecological soundscape baselines which are seasonally variable, or to consider seasonally variable migration and breeding practices that are reliant on sound.

4. Failed to adequately quantify naturally occurring contributions to the marine soundscape and compare the addition of the powerships project and all other industrial noise in the bay or port to this baseline. The studies defaulted to sound levels of anthropogenically altered soundscapes as the ecological baseline. This is significant because comparing elevated noise associated with the proposed activities to an already elevated soundscape artificially deflates the impact of noise associated with proposed industrial projects and encourages excessive noise contributions to an already stressed ecosystem.

   The need for a baseline is analogous to knowing a person's basal body temperature. Because we know that human bodies have baseline temperatures of 98.6 degrees, we can understand that someone with a temperature of 103 degrees has a significant fever and is sick. If we wrongly assume based on taking someone's temperature when they are already sick that they have a baseline of 102 degrees, then we may wrongly ignore the threat of a fever at 103 degrees.

5. Failed to adequately model sound propagation in the project zones, despite ample scientific resources in existence to do so. This is significant because in the absence of sound propagation modeling a site-specific noise assessment is not possible and anthropogenic noise may impact protected areas and/or sound sensitive species.

   The underwater noise report eschewed actual propagation modeling and instead took 10-second sound samples to demonstrate a lack of impact. This is scientifically unsound and is analogous to taking 10-second snippets of an individual's behavior and claiming to extrapolate their entire life history. Further, no effort was made to consider frequency specific propagation. While not all frequency bands are likely to propagate, no effort was made to determine if biologically significant increases in relevant frequency bands occurred as a function of noise.

6. Failed to assess the risk associated with permanent soundscape alterations due to permanent changes on the seafloor due to construction activities. This is significant because animals use the soundscape as a cue to inform migration, habitat suitability and settlement (i.e., where juvenile animals select to grow and populate).

7. Failed to consider the physiological effects of anthropogenic noise – and stress in particular – on sound sensitive species including marine mammals, diving seabirds, invertebrates, and fish. This is significant because the studies failed to consider how biologically critical physiology that is related to the fitness of the individual and overall population may be impacted.

8. Failed to consider the impact of noise on the behavior of protected or sound sensitive species- including marine mammals. Noise can have significant impacts such as reducing

foraging efforts in cetaceans, separating cetacean calves from mothers or causing groups of animals, including those that are valuable to tourism, to be displaced.

9. Failed to consider impact of noise on the ecosystem holistically, including a failure to consider the links between trophic levels (e.g., predator and prey), and links between ecosystems and economics (e.g., commercial fish and fisheries). This is significant because it omits some of the largest, though not immediately obvious, potential and cumulative impacts of noise on this ecosystem and the users who rely on it.

10. Failed to incorporate best science into assessment of underwater noise impacts. This is significant because the results of the DEIAr mitigation efforts are not based on reliable scientific information, and therefore may not adequately protect sensitive ecosystems.

For all of these reasons, the Underwater Noise Assessments and associated Baseline Underwater Noise Reports (studies) failed to adequately demonstrate that noise will not have significant ecological consequences at the three proposed locations. As such, the impacts assessment and mitigation actions proposed in the associated DEIArs are founded on an erroneous assessment of noise impacts, and fail to meaningfully address the possible or likely impacts of anthropogenic noise to the marine environment associated with the powership projects.

EXPERTISE:

I am the Associate Director for Education for the Center for Acoustics Research and Engagement at the University of New Hampshire and the director of the Sound Science Research Collective. I spent four years as a postdoctoral research associate at the Cornell University K. Lisa Yang Center for Conservation Bioacoustics where I used bioacoustics to study human impacts on marine organisms. I have a PhD in Wildlife Sciences from the department of Fisheries, Wildlife, and Conservation at Oregon State University with a specialization in marine bioacoustics and underwater noise. I have a MS in Marine Resource Management from the College of Earth Ocean and Atmospheric Sciences at Oregon State University. My MS thesis focused on marine mammal bioacoustics and communication; my dissertation research investigated the impact of vessel noise on marine mammals. I am an author on 16 peer-reviewed bioacoustic research articles on taxa ranging from humpback whales and harbor seals to toadfish and barnacles. I have a decade of experience conducting marine bioacoustics research.

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Annexure B

Additional Noise Comments on the:

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORTS FOR THREE PROPOSED GAS TO POWER POWERSHIP PROJECTS LED BY KARPOWERSHIP SA (PTY) LTD

Reviewed for
Attorney Angela Andrews

Compiled by
Dr. Heidi W. Weiskel
Environmental Law Alliance Worldwide (ELAW)
Eugene, OR 97401

Expert contributions from
Dr. Arthur N. Popper
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Silver Spring, MD 20906

11 December 2022

This memo includes comments on the noise impacts on marine species for the Gas to Power Powership Projects being proposed by Karpowership SA (PTY) Ltd and an overview assessment of the Draft Environmental Impact Assessment Reports' (Draft Reports) treatment of the issue of anthropogenic noise in the marine environment. The powerships would be located in 1) The Port of Nqura, (2) Richards Bay, and (3) Saldanha Bay, South Africa.

Overall, the experts who have reviewed the documents determine that anthropogenic noise impacts in the marine environment were not adequately addressed and that proper mitigations were not recommended. ELAW solicited Dr. Popper's opinion, as his work is cited frequently in the Draft Reports and the Appendices. Dr. Popper had a brief opportunity to assess a subset of the project documents. He contributed the comments below.

COMMENTS SUBMITTED BY DR. ARTHUR N. POPPER ON THE UNDERWATER NOISE ASSESSMENT FOR THE PORT OF SALDANHA, SOUTH AFRICA FOR THE KARPOWERSHIP PROJECT

- With respect to fishes, and perhaps invertebrates, measures only for sound pressure, as done by Subacoustic and reported in Appendix 9 B2 of the Draft Report on Saldanha Bay[1], are significantly lacking. It is now well understood that all fishes, and likely all invertebrates that hear, use the particle motion component of sound (*e.g*., Nedelec *et al*. 2016, Popper and Hawkins 2018). Some fishes that may be called hearing specialists can detect sound pressure as well as particle motion, but it is likely that most species involved in the region of consideration are not specialists and therefore primarily detect particle motion (*e.g*., Popper *et al.* 2021). This means that any suggestions or criteria (etc.) that are provided only in terms of sound pressure (or SEL, etc.) are likely meaningless, since the fishes will most likely respond to the unmeasured particle motion and not to the sound pressure.

- We and others have now demonstrated that another critical issue is that fishes and invertebrates that live on or close to the seafloor also are likely to detect substrate vibration, (*e.g*., Hawkins *et al*. 2021, Roberts and Howard 2022). Again, there are no

[1] Tim Mason, Fergus Midforth. 18 October 2022. Underwater noise assessment – Port of Saldanha. Subacoustech Environmental Report No. P292R0803.

measures provided, although it is very likely that the sounds being produced will project into the substrate and travel substantial distances before re-entering the water column.

- My conclusion is that without data on substrate vibration and particle motion, it is impossible to make any predictions as to the potential impacts of the anthropogenic sounds on fishes or aquatic invertebrates. This finding, like the lack of particle motion data, are, in my view, major gaps in being able to make any predictions on potential effects on fishes and invertebrates. I will also add that while particle motion is potentially predicable by knowing sound pressure, this is only the case in very deep (hundreds of meters) and away from boundaries such as the surface of bottom. Thus, in the case in question, actual measures of particle motion must be made. Furthermore, substrate involvement must be measured – it cannot be predicted, and very much depends on the physical characteristics of the substrate, (*e.g.*, Lee *et a*l. 2016, Ballard and Lee 2017).

- The argument regarding Temporary Threshold Shift (TTS) is totally irrelevant. I will agree that the likelihood of TTS occurring in the fishes in the area is highly unlikely. But what is highly relevant is that there are increases in the overall increase in sound levels in the area. Such increases are much more likely to result in far more important behavioral and physiological effects such as (but not limited to): animals moving from the local area and leaving breeding or feeding sites; masking of sounds of biological relevance to species such as those used to communicate between animals or the sounds of potential predators; and increased stress leading to physiological changes such as in hormonal levels, and numerous other issues. It is also critical to note that without knowing particle motion information and how well fishes and invertebrates make use of particle motion (for which we have minimal data), it is hard to predict what potential effects might be.

- In summary, the overall analysis presented in the project documents with regard to fish have very substantial issues with regard to anthropogenic sound and fishes (and aquatic invertebrates). Clearly, my impression is that the project documents do not reflect recent thinking and knowledge about anthropogenic sound. On the other hand, it is appropriate that the documents use our 2014 guidance and not earlier interim guidance, as used in parts of the US. But it should be noted that in 2014 we clearly pointed out that particle motion is an issue and one that needs to be considered for most fishes.

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Roberts, L., and Howard, D. R. 2022. Substrate-borne vibrational noise in the anthropocene: From land to sea. In P. S. M. Hill, V. Mazzoni, N. Stritih-Peljhan, M. Virant-Doberlet and A. Wessel (Eds.), Biotremology: Physiology, Ecology, and Evolution Springer International Publishing. Cham pp. 123-155.

The Draft Reports failed to include the issues of particle motion and substrate vibration in their assessment of noise and anthropogenic noise impacts and failed to assess impacts across all life stages of marine species, despite the stated fact that Saldanha Bay serves as a productive nursery habitat for myriad species.[2] Together, these fundamental omissions make the Draft Reports inadequate for the purpose of assessing overall impact of the Karpowership project to marine species.

[2] Appeal decision 2.92.5.

Annexure C

Dr Jackie Sunde

One Ocean Hub Small-scale Fisheries Research Team,

University of Cape Town

For attention: SLR Consulting

By Email: TEEPSA-567@slrconsulting.com

Date 7 December 2022

Re: Submission on the TOTAL Energies EP South Africa Blocks 5, 6 and 7 Draft Environmental Impact Report

Introduction

I make this submission as a member of the One Ocean Hub Small-Scale Fisheries Research Group, University of Cape Town. I have been conducting research on small-scale fisheries governance and management with small-scale fishing communities in South Africa for over two decades. For the past three years I have conducted research on the coastal and off-shore mining applications and authorizations and their impacts on small-scale and coastal fishing communities of South.

This proposed project application for environmental authorization to undertake exploration well drilling in Block 5/6/7 off the South West and West coast of South Africa. At its closest point the application area is only 60 km from the shoreline of the Cape of Good Hope, commonly referred to as Cape Point at the end of the Cape Peninsula. It straddles key spawning and migration routes for a number of fish and marine mammals and lies adjacent to the area known by generations of fishers as the heart of the fishing industry in South Africa.

I oppose this application for an environmental authorization for exploratory drilling and regard the public participation process and EIR as inadequate and **request that it be rejected on the following grounds:**

1. **Absence of an over-arching systematic, strategic planning and assessment framework**

To date the Marine Spatial Plan for this region has yet to be developed in accordance with the Marine Spatial Planning Act of 2019 which came into effect on the 1 April 2022. There is as yet no over—arching planning framework for this region of the Western Cape ocean and coast. We believe that any granting of environmental authorizations for oil and gas exploration in this context is illegal. This is contrary not only to the MSP Act but also importantly to the National Development Plan (NDP) which proposes that Strategic Environmental Assessments (SEA) must be conducted in order to plan for sustainable use of the ocean environment. This balanced, systematic planning is required in order to fulfil Section 24 of the Constitution which requires that the government's mandate to secure the right to a healthy environment and protect the marine environment is balanced with the need for sustainable social and economic development. The delegated decision-making authority is not able to do this balancing act in the absence of the necessary guiding strategic environmental assessment that is intended to serve as a framework to guide decision-making

on applications for authorizations such as this one. We argue that the decision-making authority must consider the applicable legal and policy frameworks, including the MSP Act, in order to make a decision and that the necessary planning processes prescribed by the MSP Act are not yet in place to enable a decision of this nature.

2. Need and Desirability

The NEMA EIA Regulations require that the need and desirability of an activity be considered in the Scoping Report. The Scoping Report and this Draft EIR fail to adequately assess the need and desirability of the project, in the context of the current climate emergency and available scientific evidence, save arguing that the project aims to identify oil and gas resources to be used in energy production. It limits its discussion to the exploration activities and does not adequately describe the need or desirability for an energy project of this nature or its potential climate change impacts. It arrogantly ignores the recent Makhanda High Court decision in the case now referred to as the Wild Coast Shell decision, where a full bench stated in its judgement that this issue, and in particular, in relation to climate change and impacts such as those on food security, a comprehensive assessment of the need and desirability of such a project is required as each stage in the process is linked. Quoting the Save the Vaal case, the judges made it clear that there is a clear obligation on behalf of the parties to discuss the need and desirability of the whole, long term aims of the project, and the EIR cannot limit itself to the exploration activities only and ignore the longer term intentions of the project in the context of South Africa's and the international carbon emissions reduction commitments. I note that SLR has chosen to interpret the law differently and not follow this judgement. In the context of the current climate crisis this division between exploration and production is an illusory one. This country cannot afford to ignore the very real interlinkages between these two stages and currently best available evidence, confirmed by two courts, is that these processes must be considered together. This report fails to do this.

Most importantly it is noted that whilst the report argues that government policy is in support of the use of gas as a transition fuel and hence argues that off shore exploration for oil and gas should continue, the report does conclude that the use of fossil fuels is however

"*not aligned with other national and international agreements, laws, policies and plans, which identify the need to reduce the reliance on fossil fuels and for the global community, including SA, to reduce its GHG emissions and meet international law obligations and commitments*".

The South African Constitution obliges our courts to consider international law where relevant. In this instance, for South Africa to risk the health and well-being of the ocean commons and knowingly follow a path that will push up its GHG emissions in contravention of numerous commitments goes against our Constitution, the ethical principles underpinning indigenous San communities of the Cape, the principles guiding our National Environmental Management Act, our Marine Living Resources Act and all common sense.

3. Impact of an Oil spill

The risk of an oil spill that would have huge ecological, social, economic and cultural impacts is acknowledged in the EIR that states that

"[o]ffshore drilling operations carry an inherent risk of oil entering the marine environment as a consequence of an unplanned oil spill event. The greatest environmental threat from offshore drilling operations, although unlikely, is the risk of a major spill of crude oil/condensate occurring from a well blow-out."

The modelling undertaken as part of the OSM as well as the expert marine ecology and fisheries reports indicates that it is likely that a well blowout would result in oil reaching the South African coastline quickly, depending on wind and currents, and may even reach as far as Namibia and would have significant impacts.
The Marine Ecology report also highlights the risk of a major spill, stating that: "the greatest environmental threat from offshore drilling operations is the risk of a major spill of crude oil occurring either from a blow-out or loss of well control. A blow-out is the uncontrolled release of crude oil and/or natural gas from a well after pressure control systems have failed'. 13 The report warns that 'oil spilled in the marine environment would have an immediate detrimental effect on water quality, with the toxic effects potentially resulting in mortality (e.g. suffocation and poisoning) of marine fauna or affecting faunal health (e.g. respiratory damage). If the spill reaches the coast, it can result in the smothering of sensitive coastal habitats'. Importantly, the report goes on to point out that although the AOI is 'located in the marine environment, far removed from coastal MPAs and any sensitive coastal receptors (e.g. key faunal breeding/feeding areas, bird or seal colonies and nursery areas for commercial fish stocks), a large spill could still directly affect these sensitive coastal receptors, as well as migratory pelagic species transiting through the drill area".

The overall sensitivity of marine ecology/environment to a large oil spill is considered VERY HIGH and this calls for a precautionary approach.

The EIR indicates that plankton is particularly abundant in the shelf waters off the West Coast, being associated with the upwelling characteristic of the region. This includes phytoplankton (the principle primary producers), zooplankton and ichthyoplankton (fish eggs and larvae). Major fish spawning areas (including for hake, snoek, sardine and anchovies) are adjacent to and slightly overlapping the area. These species, in particular snoek, are critical for livelihoods and food security. In addition, snoek has considerable cultural importance. Impacts from an oil spill could be devastating for thousands of fishers if snoek spawning was impacted by an oil spill. The Marine Ecology expert report indicates further that the embryonic and larval life stages of fish show acute toxicity to PAHs, even at low concentrations, although effects vary depending on the species and the extent of exposure.

The Fisheries Impact Assessment report indicates that there are several possible direct and secondary impacts of hydrocarbon spills on fisheries, namely:

- Oil contamination of mobile finfish species, in particular of juveniles in nursery areas could result in displacement of species from normal feeding and protective areas as well as possible physical contamination and/or physiological effects such as clogging of gills, both of which would lead to fish mortality;

- Oiling of sessile or sedentary species would result in physical clogging on individuals, disturbance and or removal of habitat for these species and gill clogging for filter feeding species such as mussels, all of which is likely to result in mortality;

- Oiling of passively drifting spawn products (eggs and larvae) would result in their contamination and mortality (the extent of mortality would depend on the nature and extent of the contaminants) leading to reduced recruitment and loss of stock;

- Exclusion of fisheries from areas that may be polluted or closed to fishing due to contamination of sea water by the oil or for example the chemicals used for cleaning oil spills; and

- Gear damage due to oil contamination.

It is noted that the Fisheries Report states that the inshore area of the Agulhas Bank serves as an important nursery area for numerous linefish species, a significant proportion of which originate from spawning grounds along the east coast, as adults undertake spawning migrations along the South Coast into KwaZulu-Natal waters… The eggs and larvae are subsequently dispersed southwards by the Agulhas Current, with juveniles using the inshore Agulhas Bank as nursery grounds. As is evident above, off the South Coast spawning areas are mostly located inshore (that is on the shelf from the coastline to approximately the 200 m depth contour). The coastal bays and estuarine environments are critical nursery areas for many of the fish stocks on which the various commercial fisheries are based. In particular, the small pelagic species of anchovy, sardine, red-eye round herring and juvenile horse mackerel and numerous linefish and demersal species are found in these protected areas in their juvenile stages. Any contamination of these areas would result in mortality of icthyoplankton and impact in the short term on recruitment of species to the demersal trawl sectors, demersal longline, small pelagic purse-seine, midwater trawl, linefish and squid jig sectors.

The eggs and larvae are also carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Following spawning, the eggs and larvae of snoek are transported to inshore (<150m) nursery grounds north of north of Cape Columbine and east of Danger Point, where the juveniles remain until maturity. This report confirms that there is, therefore, some overlap of Block 5/6/7 with the northward egg and larval drift of commercially important species, and the return migration of recruits.

Thus, ichthyoplankton abundance in the inshore portion of the Area of Interest is likely to be seasonally high, particularly in late winter and early spring. The embryonic and larval life stages of fish, however, show acute toxicity to PAHs, even at low concentrations, although effects vary depending on the species and the extent of exposure. In the context of the detrimental effect on icthyoplankton (spawn products) on recruitment to fisheries, all affected fishing sectors are considered to be vulnerable to unplanned and uncontrolled major events and are rated as HIGH sensitivity.

This issue is not adequately addressed in the report which does not acknowledge that the line fish sector will be impacted by the activity. In the absence of adequate evidence of the impact

of such an activity on these species, coupled with the level of risk of a major oil spill, a precautionary approach should be adopted and this activity should not go ahead.

4. Failure to adequately assess, understand and describe the receiving environment, in particular, failure to adequately assess the cultural impact of the project on fisheries and fisher communities in the Cultural Heritage Impact Assessment Report (CHIA)

4.1 Introduction

The Report on the Impact Assessment of Cultural Heritage (CHIA) as a component of the Environmental Impact Assessment Report (EIR), presents a very partial and inadequate assessment of the cultural basis of the receiving environment for this project from a fisheries perspective. An assessment of cultural impact on Khoisan indigenous peoples is one necessary component of a cultural impact assessment and Boswell's CHIA (2022) addresses this to some extent but this is insufficient to cover the fisheries cultural component which is critical for this EIA.

The greater Cape of Good Hope seascape is an extensive cultural-ecological area of deep significance to the people of South Africa. It is a waterbody of cultural significance to fishers and fisher communities in terms of the National Heritage Resources Act Section 3. It is a site of significance and is the subject of many fishers' oral histories. It is located at the tip of the Cape Peninsula and is simultaneously a cultural and ecological symbol of South Africa's place in the world – at the Southern most tip of the African continent, at the place where two of the most important oceans meet. This place of coming together of two important ocean currents creates a unique biodiversity hotspot as it is known as a transition area. It is the location of the meeting of the indigenous peoples of Southern Africa with the colonial nations who occupied the Cape. The unique Cape Peninsula that has survived and its surrounding Bays – Table Bay, Camps Bay, Hout Bay, False Bay, Kalk Bay, Gordon's Bay as well as the embayments further south, Betty's Bay, Walker Bay, Gansbaai and Struis Baai are all sites of great historical and cultural significance for generations of South Africans. This is a seascape that holds the memories of thousands of seafarers, slaves and fishers. It is part of the living cultural home to many indigenous and local fishers whose cultural identities as fishers have been born within and shaped by these waters and the adjacent coastline. For generations of fishers working on these waters and along this coast their whole lives, the ocean around the Cape Peninsula is a contiguous part of their everyday material world. This includes the different indigenous peoples of the Cape who make up several groupings as well as the thousands of fishers who have worked in the fisheries sector, including both the commercial and the small-scale, artisanal and subsistence sectors. Whilst many of these fishers do claim Khoisan indigenous status, many do not however they do articulate their powerful cultural identity as fisher people. An assessment of cultural impact on Khoisan indigenous peoples is one necessary component of a cultural impact assessment but as stated above, this is insufficient to cover the fisheries cultural component which is critical for this EIA.

Understanding the importance of the ocean as a space of living cultural value as well as the value of cultural ecosystem services is in its infancy internationally but the need to assess these cultural values has been recognized. As noted by Wouter (2022), "in terms of Section 3(3) of the NHRA, the cultural and living heritage associated with the communities and indigenous people along the southwestern and west coast of South Africa holds heritage

significance. It is part of the national estate and holds importance as a way of life for small-scale fishers and Khoisan descendants alike. The physical and spiritual interaction with the ocean and the shorelines through millennia resulted in a maritimity that developed into the cultural fabric as they experience it today"[1].

The living cultural heritages of the fisher peoples of this region are still in the process of being documented, assessed and recognized in South Africa. Although ocean and coastal cultural heritage lags behind the recognition of land-based cultural heritage, and maritime heritage has not gained the attention it requires, it is now an area of intense research and documentation.

Most regrettably, the Impact Assessment Report on Cultural Heritage for the Total Energies fails to understand this broader fishery cultural heritage and focuses more narrowly on the ancestral and ritual practices and relationships that Khoisan peoples have to the sea. Although it acknowledges that heritage is both legacy and living cultural practice it does not describe the fisheries component of living cultural practices in the receiving environment or investigate this issue in any depth. Although it does state the following:

"*5.3.18 Some of the groups encountered, such as Small-scale Fishers (SSF), demonstrated greater cultural proximity to the ocean and coast. Thus, they personalised the ocean and coasts more, recognised the agency of the sea itself and the social personalities of marine life. They also more keenly noted human-ocean symbiosis, the reliance of humans on the sea not only for subsistence but for sensory experience and holistic existence. In this regard, SSF have a cultural heritage relationship with the sea. Their connection with the sea and coast is not just about subsistence or commercial use of the sea*" (pp 37).

Regrettably these observations are then not followed up and considered from the perspective of impact on this 'cultural heritage relationship' and the baseline environment section does not elaborate on these observations.

4.**2 Key cultural heritage components not addressed in the report**

Key components that are not addressed at all or addressed inadequately include:

- The role of the ocean and marine resources in constituting cultural identities of fisher people and fisher communities ;
- The systems of local knowledge that are part of cultural systems: The systems of fisher local ecological knowledge of the ocean and marine environment that constitute part of their culture and are key for biodiversity management and protection, particularly in times of environmental and climate change;
- Cultural and customary practices specific to fisher people: The cultural and customary practices of specific fisher communities that have become expressions of their culture;
- Fishers' sense of place which straddles both coastal land and sea and how continuity of this sense would be impacted by the proposed activity;
- Fisher-centred cultural ecosystem values: Some of the distinctive fisheries related cultural ecosystem values that are used by other sectors such as tourism and the real estate sector to articulate the value of their unique Cape brand;

[1] Wouter Fourie, TGS Heritage Assessment Report. PGS Heritages 2022.

Examples of these are presented below in Section 4.4 to illustrate the gaps in the Cultural Impact Assessment report (Boswell 2022).

4.3 Methodology

The Report (Boswell 2022:11) states that the "CHIA report uses anthropological research methods, including fieldwork, to define the receptors, their sensitivity to specific impacts existing, cumulative observable impacts in the sites". No where does it clearly explain how fisher culture is regarded as a 'receptor' or how impacts on fishers' ability to access marine resources as the material basis of their culture, are being assessed in the report.

The Report fails to identify the number of men and women fishers that were interviewed and whether or not an adequate representation of fishers across the different fisheries sectors was included in the report. It merely states rather vaguely that

"*The research also included interviews with participants and observations in coastal locales, where relevant activities are taking place, such as swimming, surfing, kite surfing, sailing and beach walking; and where there were local businesses and effort to leverage subsistence from the sea (i.e., fishing)*".

Considering that this project had already identified key fisheries that the activity would have an impact on for eg, demersal trawl and tuna-pole, as well as the fact that the risk of an oil spill would impact all fishing and harvesting of marine resources, it is surprising that the cultural heritage of fisheries was not investigated in any depth. The Report fails to cite any literature on the cultural identities, knowledge systems, values, customs and customary practices of current fishers or fisheries sectors that is of relevance to an assessment of the impact of the activity on fishers living cultural heritage.

The Report does not distinguish different cultural and customary systems amongst different groups of fishers yet this is an important feature in the literature on different fisheries. For example, the literature on the histories of beach-seine (trek-net) fisheries in the Cape highlight the fact that these fishers evolved a rich system of local laws to manage their interactions in False Bay and the Van Breda court judgement recognized these as local law (van Breda). The Langebaan traditional net fishers developed a similar system of customary practices that they regarded as their local system of customary law (Sunde 2014).

The report only mentions interviewing fishers in Paternoster, but quotes from only one individual fisher and one fisher woman who works as a fish clearner in Kalk Bay. Notably it fails to comment on the extensive local ecological knowledge that women vlekkers have and the integral nature of this knowledge to their cultural identity. It makes very fleeting reference to having conducted fieldwork during the SSF west coast rock lobster season however the report fails to indicate if it interviewed any traditional line fishers and other key fisher groups with distinctive cultural identities. In section 4.9 it states that fieldwork coincided with the closing of the crayfish season but this was only the closing season of crayfish for some fishers – the commercial crayfish season continues until June and this year was extended to August. The fact that the field work coincided with the onset of the snoek season is not noted and the impact that this would have had on the availability of the fishers for interviews is not noted.

4.4 Key gaps in the report

4.4.1 The role of the ocean in constituting cultural identities of fisher peoples: The ocean and marine resources are inextricably woven into the cultural identity of fisher people and fisher communities. This central role that the ocean and access to and use of marine resources plays in the cultural identities of fisher and coastal communities around the world has been recognized by the United Nations. In 2010 the UN Economic and Social Council noted that

" For indigenous peoples living along coastlines, fishing and other uses of the ocean have been their main livelihood and the material basis for their culture" and "The use of the ocean through centuries, especially the near coastal waters with adjoining bodies such as bays, estuaries and fiords, has had an instrumental effect in creating various coastal indigenous peoples' cultures" (United Nations E/C.19/2010/2).

This recognition has found effect in both international law instruments such as the UN Declaration on the Rights of Indigenous Peoples. Extensive anthropological scholarship, coupled with the advocacy statements and writings of traditional and indigenous fisher groups has documented the ways in which access to and use of natural resources, in this instance, marine and coastal resources, forms the material basis of the culture of fisher groups around the world. This interdependency has also been recognized by the Convention on Biological Diversity in a series of decisions of the Conference of Parties, the Special Rapporteur on Human Rights and the Environment amongst others. The significance of continuity in access to the resources that forms the basis of their culture and the health and wellbeing of these natural resources and ecosystems as part of this culture, their knowledge system, their customary practices and for some, customary systems of law, has been acknowledged through the more recent work of the Convention on Biological Diversity Conference of Parties in several instruments. For example, the CBD Tkarihwaié:ri Code of Ethical Conduct to Ensure Respect for the Cultural and Intellectual Heritage of Indigenous and Local Communities Relevant to the Conservation and Sustainable Use of Biological Diversity ("Code of Conduct") highlights the importance of indigenous and local custodianship, and recognizes the holistic interconnectedness of humanity with ecosystems that is embedded in their customary rules as well as cultures, spiritual beliefs and customary practices (including linguistic diversity), and recognises these as key to the conservation and sustainable use of biodiversity.

Perhaps the strongest evidence for this issue comes from the affidavit of a fisherman, the first Applicant in the SEARCHER case heard in the High Court in February 2022 concerning an application for oil and gas exploration.

> *"The cultural history of the West Coast carries the memories of the earliest occupation of our country, of the French occupation of the islands off the West Coast and their taking of our fish, our sea birds, our guano. Of the Cape's dependence on our forefathers to provide fish to feed the workers growing wheat and livestock, of the multitude of snoek sent to Mauritius as 'rantsoenvis' for the slaves working the sugar cane fields of*

that country. So important and so rich is this link between the provision of snoek to the people of Mauritius, that to this day, the Mauritian's celebrate a fish festival to remember this tradition and their historical dependence on the local fishers of the Cape.

This is the cultural heritage of the West Coast. This is my cultural heritage. I was born in 1978 into a family of proud fishermen and women. I am a fourth generation fisher of this West Coast. My maternal grandfather's family originated in Mamre. My maternal grandmother's family lived near the sea in Green Point, near Roggebaai where the fishing boats come in but then they were forcibly removed by the Group Area's Act away from the sea to the Cape Flats. My grandmother's family are descendants of this mix of Khoisan and Malay early inhabitants and workers of this coastline.

My great grandfather and great uncles used to travel by ox-wagon and later by donkey along the gravel road from Mamre to the coast at Ganzekraal to catch fish. My uncles and cousins settled along this coastline. The catching of fish is a part of my cultural heritage. It is how my forefathers and mothers survived. It is in our blood, in our genes.

My grandfather and uncles taught me to fish and to harvest a wide range of marine resources along this coast including lobster, abalone, limpets, black and white mussels. They taught me to jive for mussels in the sand along these shores, a tradition that many young children from the West Coast fishing villages learnt, as they learnt to dive for lobster and to throw in a line for a fish.
I remember catching my first lobster on my own when I was 5 or 6 years old. I recall my Grandfather making me put it back and telling me that the shell was too soft, that it was a female lobster carrying eggs and that we could not eat this particular lobster as we needed it to give birth to many more lobsters. This was how I was taught from a young age to care for the marine resources of the West Coast. The descendants of these early fishers have been and continue to be the real guardians of our marine resources, despite being forcibly removed from the sea during the apartheid years and often prevented from fishing in areas that were designated as 'for whites only' during apartheid.

I grew up in a family of fishermen who caught snoek and fisher women who harvested a range of inter-tidal resources, cleaned fish and 'vlekked snoek. My mother and grandmother made 'ingelaaide' snoek for us at Easter, a very special West Coast tradition that is still practiced today. Easter is a time for eating fish, and the West Coast is famous for the many traditional fish recipes. In our family we ate a lot of these traditional fish dishes. Curried fish is still sought after and sold by leading supermarkets throughout South Africa at Easter, as this cultural tradition continues.
I grew up believing that the sea must be respected and that it was part of us. At the start of the fishing season a church service would be held in each of the fishing villages along the coastline, blessing the village boats and asking that God would watch over the fishermen. I grew up knowing that the communities of the West Coast depended on the sea for their lives and livelihoods and that the sea and fishing was what made us who we are, as people of the West Coast" (Christian Adams in Christian Adams and Others versus the Minister and Others 2022).

It is hard to imagine that the Cultural Heritage Impact Assessment for TOTAL Energies failed to read or reference these court papers that were in the public domain and available to the consultants yet the TOTAL CHIA report fails in its entirety to engage with this specific aspect of the importance of the ocean for fishers' cultural identity. The importance of the ocean as the material basis of their culture is expressed by several of the applicants in this case. It is also closely linked to their access to the species, snoek or *Thyrites atun*, specifically.

This issue of the mutual constitution of the fisher identity and the ocean is skillfully expressed by Marieke Norton (2013)[2]. "*The Cape Snoek, or Thyrsites atun, is a species of fish that has a significant presence in the history of the Western Cape and the development of Cape Town. The snoek is a lively creature that is historically, culturally, economically, and ecologically active in the Western Cape. I argue that in the case of the Cape snoek, the fish and the Cape are performed together; through acts of differentiation, they mutually constitute one another*" (Norton 2013:31).

Norton's very insightful interpretation of the many ways in which snoek is enacted is particularly pertinent for this assessment of living culture because it highlights how fishers' knowledge is embedded in their cultural practices and ways of knowing snoek (marine resources). It is in this intertwining of the social and ecological that snoek and fisher identity and culture are mutually constituted.

This relationship between ocean resources (here the example is snoek) and fisher identity is a living cultural process. To risk what constitutes this process, risks undermining the cultural identity of West Coast fishers. It is this risk that the cultural heritage assessment fails to recognize or assess.

Norton argues that the act of constitution "is mutual and it transgresses the boundary of the nature–culture or subject–object divide. By investigating the history of the snoek, and paying attention to how we construct the idea of it, we are also paying attention to how what we say about snoek says something about us" (Norton 2013: 32). This speaks to the world view and ontology of the fishers who recognise that causing harm to the snoek will cause them harm. This was the insight that Judge Thulare recognised in the fishers' affidavits – that harm to living marine resources is harm to the fishers. This case found in favour of the fishers. This understanding is not addressed in the Cultural Heritage Assessment Report.

4**.4.2 The systems of local knowledge that are part of cultural systems:** The systems of fisher local ecological knowledge of the ocean and marine environment that constitute part of their culture and are key for biodiversity management and protection, particularly in times of environmental and climate change, are not addressed in the report (See for example Duggan et al 2014, Thinking like a fish)[3]. If the fishers' access to fish and to the marine environment is at risk, threatened or impacted by a planned or unplanned event this will impact their knowledge system which is part of their culture. The CHIA fails to describe these knowledge systems or at least provide some examples and does not assess this risk. The knowledge systems of different fisher groups differ however there are certain commonalities that can be

[2] Norton, Marieke The Life and Times of Snoek Ecology and Society, 18 (4) 2013. DOI:10.5751/ES-05866-180432

[33] Duggan, G.L., Green, L.J. & Jarre, A. 'Thinking like a fish': adaptive strategies for coping with vulnerability and variability emerging from a relational engagement with kob. *Maritime Studies* **13**, 4 (2014). https://doi.org/10.1186/2212-9790-13-4

seen across systems and have been well documented in the international literature (Berkes et al 2015).

4.4.3 **Cultural and customary practices specific to fisher people:**

The cultural and customary practices of specific fisher communities that have become expressions of their culture see for example Dennis (2010) on Arniston, Hauk (2010), Williams (2013) on Olifantsriver and de Greef (2015) in relation to Hout Bay or Sunde (2014) with respect to the fishers of Langebaan Lagoon are not identified as cultural heritage. There are numerous other studies comprising peer reviewed literature and student Phd theses that cover the cultural histories and customary practices of the fisheries of the Western Cape however none of these are referenced.

4.4.4 Fishers' sense of place which straddles both coastal land and sea:

The 11 fisher affidavits in the litigation against Searcher in the High Court as well as extensive national and international literature provides extensive evidence of this sense of place and what it means from a fisher perspective but save a reference towards the end of the report, not in the baseline environment section, the CHIA does not explore this or cite this scholarship or try and engage with the challenges of assessing the cultural ecosystem values attached to this from a fisher perspective, only from an indigenous person's perspective. This issue has distinctive importance for fishers, and their culture and livelihoods and needs to be engaged as an issue on its own.

4.4.5 Fisher-centred cultural ecosystem values:

Some of the distinctive fisheries related cultural ecosystem values are used by other sectors such as tourism and the real estate sector to articulate the value of their unique Cape brand. The report touches on the ocean's value from a tourism and recreational perspective but does not address the fisheries-related cultural ecosystem values that are relied upon by other sectors. Should these fisheries be at risk or impacted this would have a knock on effect on these other sectors.

4.4.5 Important fisher cultural sites that have been recognized by SA Heritage Association as Heritage sites because of their value as sites of fisheries heritage such as Kassies Baai etc specifically are not mentioned at all in the report. It is necessary to document these as part of the baseline report so that should there be impacts these can be properly assessed.

4.5 Impact assessment

This section of the CHIA report identifies numerous impacts. For example: it states

7.1.1 Northern Belt Coast (NBC) (Alexander Bay to Hondeklipbaai).

"It is assessed that there will be impacts of operations for these areas". However it does not relate this statement specifically to cultural impacts on fishers. However, the author believes that 'there will be impacts' and appears to suggest that these will impact small-scale fishers.

"*for example, normal operations may affect marine life on which the small-scale fishers depend for their livelihood and normal operations may affect tourism receipts in the area since normal operations may pollute beaches and sea. Furthermore, since the coastal towns in this area have existing impacts in commercial port activity and offshore operations in the form of diamond mining and commercial fishing. In this regard, communities are already experiencing potentially adverse effects on the ocean and sea. However, awareness and experience of the potential impacts of pollution in the sea (i.e., via observation of dwindling fish stocks and poorer quality of fish stocks) and awareness of its impacts on spiritual relations with nature, now mean that communities are less accepting of these impacts on the ocean*"(Boswell CHIA 2022:45). Given that this Northern Belt if furthest away from the identified application area, it can be assumed then that 'there will be impacts' such as those mentioned by the CHIA in all the other areas.

7.12 Western Cape Coast (i.e., Doringbay to Langebaan and including False Bay). It would appear that the author does not realise that this section of the coast is closest to the impact site? In addition, she does not realise that from a fisher perspective, these towns are historical fishing villages and towns and are of critical importance to the fishers' cultural history? For example, Kalk Bay is recognised as a historical fishing village. The author shows little understanding of the importance of these towns for both the commercial and the small-scale fisheries sector as she describes them in the following way:

"*These coastal towns are used for leisure, tourism, subsistence fishing and spiritual/ancestral rituals*".

"*The residents encountered expressed a rich intangible cultural heritage, including ancestral veneration rites that include the sea, as well as deep beliefs regarding the ocean as a living thing, with whom humans must develop a symbiotic and sustainable relationship"* (page 46).

It remains unclear as to whether or not she has assessed the cultural heritage and living cultural value of these heritage sites and considered the impact on them from a fisheries cultural perspective. There is no indication of this.

7.12. South Cape Coast and Eastern Cape (from Struisbay to Algoa Bay). It is unclear as to why the CHIA report divides the coast in this manner given the locality of the application site and the potential impacts and it raises concern that the author has not fully appraised the cultural IMPACTS of this project according to the actual likelihood of impacts on these fisheries communities. The report does not make any attempt to link the impact assessment to the ecosystemic interactions with culture for each of the identified communities. However, it is noted that it is the CHIA author's opinion that

"*It is assessed that potential impacts <u>may be high to very high</u> (my emphasis) for these sites because there are multiple uses and users of the coastline and there are many sites of archaeological and cultural significance, sites of value not only to South Africa but the world*."

If these are the criteria that she is using to assign her ratings as high to very high – namely 'because there are multiple uses and users of the coastline and there are many sites of archaeological and cultural significance', then it would be appropriate for her to have assessed the 'uses and users of the coastline' in each of the above mentioned areas. <u>This is a fatal flaw in this heritage assessment</u>. It is clear that this rating of high to very high is arbitrary and not based on a systematic, real assessment of uses and users and sites of significance.

Had the Expert assessed the cultural heritage sites and “many sites of archaeological and cultural significance” of the West coast she would have surely mentioned the following amongst others:

The extensive archaeological evidence that the coastal groups of Khoikhoi entered the West Coast region over 2000 years ago and relied on marine resources such as seals, whale meat and shellfish in the Saldanha Bay region of Kasteelberg ((Smith, 1987, Sealy and Yates 1994; Henshilwood, 1996; Avery, 1975; Schweitzer, 1979; Deacon et al., 1978) and in the St Helena Bay region important sites for the local fisher community include the fish traps at Wilde Varkvlei and the sacred site at Slipper Bay which is regarded as a special site for the indigenous peoples of the region. It is known as a place “ where whales often strand themselves along the shore are known as 'cetacean traps'. These are areas where minima in the earth's magnetic field cross the shoreline, and where there are offshore reefs.” (http://www.sawestcoast.com/history.html). Kasteelberg, is an open-air archaeological site located 4km from the coast. It provides evidence of occupation by herders between 1800 and 1600 years ago (Klein, 1986). The occupants of the site focused on harvesting seals and the presence of sheep bones also indicated that the inhabitants were most likely herding domestic stock (Klein, 1986; Smith, 2006 in Wouter 2022). Wouter (2022) also notes that St Helena Bay is also significant for the written records that reveal that in 1497, the GuriQua and the San (SonQua) witnessed the arrival and departure of Vasco da Gama in St Helena Bay (Raven-Hart, 1967; Axelson,1998). Would these important heritage sites not also merit the author awarding them “ high to very high” impact?

The coast and area around Langebaan Lagoon is famous for the finding of Eve’s footprint but this is not mentioned in the report, nor are the many other important sites up the west coast between Langebaan and Doringbaai, such as the particularly important archeological site at Elands Bay.

Historian van Sittert has documented in detail the history of the establishment of many of the fishing villages up the West Coast and near the Berg River in particular. He notes that “After the emancipation of slaves, new laws were introduced to control both the freedom of movement and independent livelihoods of people who did not own land. This forced fishermen on the West Coast “to either develop artisanal skills, become wage labourers or squat on coastal government land to eke out a living from small scale production and seasonal work” (Van Sittert 1992: 12-14). His has written a detailed historical account of the establishment of the fishing industry in St Helena Bay and the cultural value of snoek in the exchange between Mauritius and South Africa. There is extensive historical material in Kalk Bay that has been recognised for its heritage value that relates to the cultural heritage of the fisher community (Kwaai 2021) as there is in Kassies Baai which was recognised by the SAHRA as a fisher village.

It is not clear why the author of the CHIA has only indicated sensitive receptor sites in a few of the fishing villages where there is both archeological and living cultural heritage evident. In Section 7.1.4 she states

“there are multiple, sensitive receptors (i.e., sites) in these areas, as well as regular use of the sea and coast for cultural heritage use – ancestral veneration, spiritual uses of the sea, leisured use of the sea and gendered cultural use of the sea. The higher the cultural value of the receptors, the higher the sensitivity of the receptor. Thus, there are highly valuable

archaeological sites in St Helena Bay, Langebaan, Plettenberg Bay, Knysna and in Tsitsikamma" (Boswell 2022: 46). It is noticeable that she does not include fisheries or specific fisheries cultural heritage sites. Further in the report she makes fleeting reference to Kalk Bay but again this is not in relation to a discussion on fishers' cultural heritage. In the discussion on indirect impacts the report makes fleeting reference to fishing but not in terms of the impact of the drilling activities on fisheries as a livelihood or cultural practice. This statement says

"Certain stakeholder groups are directly reliant on the ocean and coast for their livelihood and have cultivated a range of culturally significant practices with the sea and coast (e.g. use of the sea-based activities of fishing and shellfish harvesting for the positive socialization of impoverished boys and men in Paternoster and Steenberg Cove in the Western Cape)". The report then does acknowledge in this latter section that "Interviews with SSF communities also revealed that fishing is not just a livelihoods issue, fishing and crayfish harvesting for example advance sociality and a particular 'way' of life, meaning, it is key to cultural life and practice. The activities of fishing involve working in a socially meaningful site (having access to specific sites at sea), being part of a social group of fishers, having social boundaries and cultural processes of adaptation within this group (i.e., going from collecting bait to eventually being trusted with a boat), bringing fish home for culturally and socially meaningful meals Thus for SSF, fishing is also ICH." (page50).

It is not clear why these practices were not detailed in the section of the report identifying and describing the baseline environment and receptors. Nor does the report go on and assess the impact of the activities on this intangible heritage. This is a fatal flaw of the report as the report is not clear where this intangible cultural heritage was identified and assessed.

The significance of this failure is noted when considering the UNESCO Convention for the Safeguarding of Cultural Heritage.

Wouter (2022) highlights this effort to safeguard Intangible heritage by UNESCO and its member states through the Convention for the Safeguarding of the Intangible Cultural Heritage (ICHC).

He presents the following section extracted from a UNESCO webpage that explains the importance of Intangible Heritage:

"While fragile, intangible cultural heritage is an important factor in maintaining cultural diversity in the face of growing globalization. An understanding of the intangible cultural heritage of different communities helps with intercultural dialogue and encourages mutual respect for other ways of life. The importance of intangible cultural heritage is not the cultural manifestation itself but rather the wealth of knowledge and skills that is transmitted through it from one generation to the next.

The social and economic value of this transmission of knowledge is relevant for minority groups and for mainstream social groups within a State, and is as important for developing States as for developed ones. Intangible heritage is: ▪

Traditional, contemporary, and living at the same time: intangible cultural heritage does not only represent inherited traditions from the past but also contemporary rural and urban practices in which diverse cultural groups take part. ▪

Inclusive: we may share expressions of intangible cultural heritage that are similar to those practised by others. Whether they are from the neighbouring village, from a city on the opposite side of the world, or have been adapted by peoples who have migrated and settled in a different region, they all are intangible cultural heritage: they have been passed from one generation to another, have evolved in response to their environments and they contribute to giving us a sense of identity and continuity, providing a link from our past, through the present, and into our future.

Intangible cultural heritage does not give rise to questions of whether or not certain practices are specific to a culture. It contributes to social cohesion, encouraging a sense of identity and responsibility which helps individuals to feel part of one or different communities and to feel part of society at large. ▪

Representative: intangible cultural heritage is not merely valued as a cultural good, on a comparative basis, for its exclusivity or its exceptional value. It thrives on its basis in communities and depends on those whose knowledge of traditions, skills and customs are passed on to the rest of the community, from generation to generation, or to other communities.

Community-based: intangible cultural heritage can only be heritage when it is recognized as such by the communities, groups or individuals that create, maintain, and transmit it – without their recognition, nobody else can decide for them that a given expression or practice is their heritage (Report from meeting to define Intangible Cultural Heritage, Piedmont (Italy), March 2001 (https://ich.unesco.org/doc/src/00077-EN.pdf, accessed 22 July 2022) drawn from Wouter 2022:27)."

Wouter using this framework notes that "marine-related intangible cultural heritage and people's connection to the ocean is relevant. This type of heritage incorporates the unique ethos and identity of specific places linked with fishing villages; oral history; popular memory; cultural traditions; indigenous knowledge systems, rituals, beliefs, and practices (e.g., fishing techniques) associated with the ocean" and concludes the following in relation to the West Coast fisher cultural heritage:

"Community identity and culture are thus strongly linked to the ocean and what it can provide, physically and spiritually. Communities have coexisted with the ocean for generations. This existence has created a culture and heritage that defines their way of living, community, and kinship unique to the West Coast of South Africa. Cook (2001) describes this as maritimity, a process whereby the sum of cultural adaptations made by coastal populations becomes imbued with meaning and culture. This is evident in community structures, cultural events, and seasonal activities. Their culture and heritage historically had a physical manifestation in village layouts, boat building and the unique west coast architectural vernacular. This vernacular was appropriated by the rich to develop quasi-cultural village expressions in the modern expansions of West Coast towns such as Paternoster" (Wouter 2022).

He further states "Considering the Article 8(j) and 10(c) Convention on Biological Diversity (29 December 1993), of which South Africa has been a signatory since 1995, the need to "…respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval

and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices'" must be considered within the available South African legislation. As such, the NHRA (section 3) (2)) considers heritage resources that are part of the national estate to include: ▪ "places to which oral traditions are attached or which are associated with living heritage: ▪ Or as per subsection 3, has cultural significance or other special values because of – a) its importance in the community or pattern of South Africa's history; b) its possession of uncommon, rare or endangered aspects of South Africa's natural or cultural heritage; c) its potential to yield information that will contribute to an understanding of South Africa's natural or cultural heritage; d) its importance in demonstrating the principal characteristics of a particular class of South Africa's natural or cultural places or objects; e) its importance in exhibiting particular aesthetic characteristics valued by a community or cultural group; f) its importance in demonstrating a high degree of creative or technical achievement at a particular period; g) its strong or special association with a particular community or cultural group for social, cultural or spiritual reasons; h) its strong or special association with the life or work of a person, group or organisation of importance in the history of South Africa.

As with Smith (2015), Loulanksi (2006), and Ndoro (2105) emphasised that culture is more than just the tangible but is also shared beliefs, values, language, traditions, functionality, meaning and community connections. Considering the various values and heritage significance as listed in section 3(3) of the NHRA, the cultural and living heritage associated with the communities and indigenous people along the southwestern and west coast of South Africa holds heritage significance. It is part of the national estate and holds importance as a way of life for small-scale fishers and Khoisan descendants alike" (Wouter 2022).

4.6 Sensitivity of Receptors

In section 7.2.5 the report outlines the methodology used for assessing sensitivity of receptors

The report states that

"The sensitivity of a receptor is defined on a scale of Very Low, Low, Medium, High or Very High guided by the definitions in the Scoping Report. <u>These are derived from the baseline information (my emphasis). Of concern is the fact that the baseline information did not identify the living cultural heritage and intangible heritage of fisheries and fisher communities.</u>

The report states that "Receptors are also differentially affected by seasonal factors" but this is not explained at all.

Under normal operations the:

• *Ancestry / spirituality receptor sensitivity is medium to high (as it can be mitigated with timely, sustained and relevant healer-diviner and First Peoples' Chief interventions). This receptor is not affected by seasonal factors, as ritual processes take place all year round. Rituals are performed according to community or individual needs.*

• Archaeology/Tangible heritage receptor sensitivity is medium to low (as many sites are onshore and can be mitigated via avoidance of these areas where there are vulnerable archaeological sites). This receptor is not affected by seasons.

• Sense of Place receptor sensitivity is medium because normal operations, well managed activities will not affect the sense of place. This receptor is not affected by seasons.

• Livelihoods receptor sensitivity is high because coastal communities in all the sites potentially affected by normal operations in Block 5/6/7 directly depend on fish and crayfish for subsistence. This receptor is also affected by seasons, as winter brings particular weather conditions which affect SSF use of the sea. Relatedly, socioeconomic uses of the sea (i.e., seaside restaurants, sporting use of the sea, swimming) may be reduced during winter.

• Natural heritage receptor sensitivity is high, since natural and cultural heritages are interdependent. Any pollution or other form of negative impact on the sea, arising during normal operations may impact on natural phenomena (i.e., fish, shellfish, fynbos, mangroves, penguins, beach), these in turn may form part of cultural heritage practices. This receptor is not affected by seasons".

• Health receptor sensitivity is medium under normal operations, as operations take place far from sahore. However, it is not low sensitivity because the project vessels might affect health uses of the sea. i.e., the water is no longer perceived as pristine enough for bathing etcetera. This receptor is not affected by seasons. •

"To summarize: combined and prior to pre-mitigation efforts, the overall sensitivity of receptors to normal exploration drilling operations is assessed to be medium" (CHIA 2022).

It is not clear if the Report is suggesting that all fisher intangible cultural heritage would fall under 'natural heritage receptor' and then sensitivity to all would be high? It is not clear why the category of natural receptor would not be impacted by seasons as fishers' cultural practices and customs are also linked to certain species that are seasonal. The report lacks clarity and consistency. It is also factually incorrect. It states that "*Livelihoods receptor sensitivity is high because coastal communities in all the sites potentially affected by normal operations in Block 5/6/7 directly depend on fish and crayfish for subsistence."* This is not correct. The term 'subsistence' was removed from the Marine Living Resources Act of 1998 in 2014. They depend on marine resources for their livelihoods, food security and cultural identities, not for 'subsistence'. Does the level of dependence on a resource change the rating of the impact? This is not clear from the report at all. Would the impact on the cultural heritage of a tuna-pole fisher who is likely to be very directly impacted by the actual activity as per the EIR be more than other fishers? How has the report assessed the indirect impact of fishers who depend on a species such as snoek whose spawning maybe impacted by the activity as the spawning route lies in and adjacent to the area where the activity will take place?

This section of the report states "*This receptor is also affected by seasons, as winter brings particular weather conditions which affect SSF use of the sea*". This statement shows a lack of information on the part of the researchers and a general statement like this undermines the value of an assessment of a cultural identity and activity such as fishing. Any line fisher from the West Coast will tell you that the autumn and winter is the season for snoek fishing and fishers migrate up and down the coast chasing the snoek. The affidavits presented in the

SEARCHER case provided evidence of this. During this season small-scale fishers will travel extensive distances off-shore to catch snoek and also migrate to Cape Town to fish for snoek off Cape Point from Millars, thereby potentially increasing their risk as they fish closer to the area where the activity will take place.

The final assessment of the CHIA Report is that

"*The potential impact of normal operations on receptors noted above and prior to mitigation is considered to be of high intensity, short-term duration (3-4 months per well) and regional extent. Thus, the magnitude (or consequence) is considered to be medium. Appropriate and substantive public participation efforts in the pre-mitigation phase can reduce the intensity of impact" and goes on to state that "Consistent and substantive effort to include indigenous people and their input in the processes associated with normal operations will lessen the magnitude of impact*".

This CHIA Reports final assessment and findings are non-sensical from the perspective of its assessment that "public participation efforts can reduce the intensity of impact". What is it that public participation can do to reduce the intensity of the impact? The report fails to demonstrate the link between the content of public participation and impact. It raises grave concern that the report has not understood the ontology of the living cultural heritage of the communities on the west coast and that the report misunderstands the epistemology and ontology of the world view of many of the indigenous coastal dwellers.

The Constitution protects the right to culture. If fishing and fisheries is the material basis of fishers' right to culture how will more public participation protect their right to culture?

4.7 CHIA Mitigation approach and measures

Section 7.2.7 outlines the CHIA Identification of Mitigation Measures. This section includes

> *Classification 1 Implement a comprehensive, consistent and regular consultation with indigenous groupings and leadership, as well as those who fall outside this category. The aim of such engagement should ensure open communication, direct communication and consistent communication with stakeholders that may be affected by operations. Also refer to Section 7.8.1 to 7.8.6 for further detail on the recommended consultation.*
>
> *2 Based on the outcome of the consultation process, implement where necessary, a ritual event/s that permits engagement with ancestral spirits and nature to alleviate potential and future negative impacts of non-consultation and poor cultural/nature respect.*
>
> *3 Implement a gender sensitive ritual event in each region that recognizes gendered coastal cultural heritage to permit all genders to articulate their cultural relation with the sea and coast*
>
> *3.Establish a functional grievance mechanism that allows stakeholders to register specific grievances related to operations, by ensuring they are informed about the process and that resources are mobilised to manage the resolution of all grievances, in accordance with the Grievance Management procedure. Abate on site*

4. Adjust the well location to avoid any shipwrecks identified in predrilling ROV surveys Abat

This section fails to include a mitigation measure to address fishers' cultural identity and the impacts on their customary practices and systems. Most concerning is the fact that the Report appears to misunderstand the embedded, relational ontology underpinning fishers and indigenous coastal peoples' relationship with the ocean. It erroneously assumes that a ritual will pacify them and their ancestors – failing to understand the role that the ancestors play in the living customary law of many indigenous peoples and also failing to understand fishers' belief in the interconnectedness of the ocean ecosystem and their place in it. It is apparent that the author did not read the Expert Statements from Thando May and Helen Bernard in the SHELL case or hear the pleas in the affidavits of the fishers in the Searcher case. The suggested mitigation measure no. 2 is shocking to a person who has worked with indigenous and local coastal fishers for two decades and who has heard them repeatedly state their belief in their ancestors, the values of their systems of living customary law and the need to care for nature as a living being and the next generation as the principles that run through these systems. These communities are not saying no to oil and gas on a whim. They are not doing it out of ignorance. They are doing it based on centuries old wisdom and connectedness to the ways of their ancestors and the ways of the ocean.

The report itself states on page 46 that "*The residents encountered expressed a rich intangible cultural heritage, including ancestral veneration rites that include the sea, as well as deep beliefs regarding the ocean as a living thing, with whom humans must develop a symbiotic and sustainable relationship"* (page 46). It is not clear on what basis the report proposes a ritual as a mitigation measure when residents regard the ocean as a living being.

Irrespective of what the author of the report actually meant by this sentence "*Based on the outcome of the consultation process, implement where necessary, a ritual event/s that permits engagement with ancestral spirits and nature to alleviate potential and future negative impacts of non-consultation and poor cultural/nature respect, "* this sentence lacks clarity of intent and does provide the reader with information enabling the reader to understand the link between the proposed mitigation measure, a specific potential 'harm' and the intended avoidance or minimisation of that harm. Why is the responsibility for alleviating potential and future negative impacts placed on the ancestors? The sentence reads that the purpose of engaging with the ancestors is to 'alleviate potential and future negative impacts". If there are potential and future negative impacts' the nature of these need to be identified and addressed by the applicants surely? It is not the responsibility of the ancestors to alleviate these impacts, particularly in a context where they have made their concerns clear prior to these negative impacts and harms being done.

The CHIA fails to adequately understand the nature of fisheries in South Africa and the cultural heritage both tangible and intangible applicable to fishers. It fails to adequately describe the baseline environment, identify receptors, assess potential impacts and rate these impacts.

5 Public participation process was not adequate

Small-scale, traditional, artisanal fishers as well as fishers involved in the commercial fisheries sector, such as commercial line fishers, net fishers and many others have not been adequately targeted through the public participation process. There are 56 interim relief (small-scale) fisher communities in the Western Cape alone (Annexure 1 DFFE 2022), that fall within the range of impact of this project. The public meetings were held in various centres but given the high cost of fuel fishers do not have the means to travel to these centres. Attendance at these meetings was very poor. In addition, the meetings coincided with the snoek season and meant that many fishers were not available to attend these meetings. Several of the communities in and around the metro in Cape Town are isiXhosa speaking communities and these communities were not targeted by the public participation process. See Annexure 1 attached. For this reason the application for environmental authorization based on this report should be denied.

6 Failure to adopt an ecosystems-based approach to the assessment and identify the potential impact on the small-scale fisheries

The EIR fails to adopt an ecoystems-based approach to the assessment of impact of the proposed activity. Instead it restricts itself to a narrow focus on 'fisheries' and 'species', rather than understanding the linkages and inter-dependencies between the two. This is most apparent in the way in which the Fisheries Expert Report and the Marine Ecology Report identify which sectors of the fisheries will be impacted. The demersal sector, longline sector and tuna-pole sector are identified on a spatial basis. However the ocean ecosystem and fishers cultural, social and economic identities in relation to this ecosystem are not limited to the fishers' spatial location in the actual area of impact. Equally important is the possibility that the species that they depend upon will be impacted by the drilling activity in the area of impact. Hence the fact that the report indicates that

"*The eggs and larvae are also carried around Cape Point and up the coast in northward flowing surface waters. At the start of winter every year, the juveniles recruit in large numbers into coastal waters across broad stretches of the shelf between the Orange River and Cape Columbine to utilise the shallow shelf region as nursery grounds before gradually moving southwards in the inshore southerly flowing surface current, towards the major spawning grounds east of Cape Point. Following spawning, the eggs and larvae of snoek are transported to inshore (<150m) nursery grounds north of north of Cape Columbine and east of Danger Point, where the juveniles remain until maturity. <u>There is, therefore, some overlap of Block 5/6/7 with the northward egg and larval drift of commercially important species, and the return migration of recruits. The map included in the EIR clearly indicates the potential overlap with snoek spawning routes.</u>*

Given the significance of snoek to the small-scale fishers and traditional line fishers (DFFE 2017, DFFE 2022), this impact requires much closer assessment both by the Fisheries Expert and in the socio-economic impact assessment. The reliance on snoek needs further detailed research before this can be accepted as an adequate understanding of the receiving environment. For this and all the above-stated reasons it is requested that this EIR be

withdrawn and the decision-maker should not permit this environmental authorization due to the gaps in this report.

Submission made by Dr Jackie Sunde

Signed:

7 December 2022

Annexure D

The South African Risk Mitigation Power Producers Procurement Programme (RM4P):

A techno-economic evaluation of the underlying design of the request for proposals (RFP) and the resultant impact on the outcomes of the RM4P

Clyde Mallinson

27 August 2021

Executive Summary

The risk mitigation power producer procurement programme (RM4P) that was launched in December 2019, made use of a gas-dominated procurement process that rendered the request for proposals at best awkward, at worst fatally flawed.

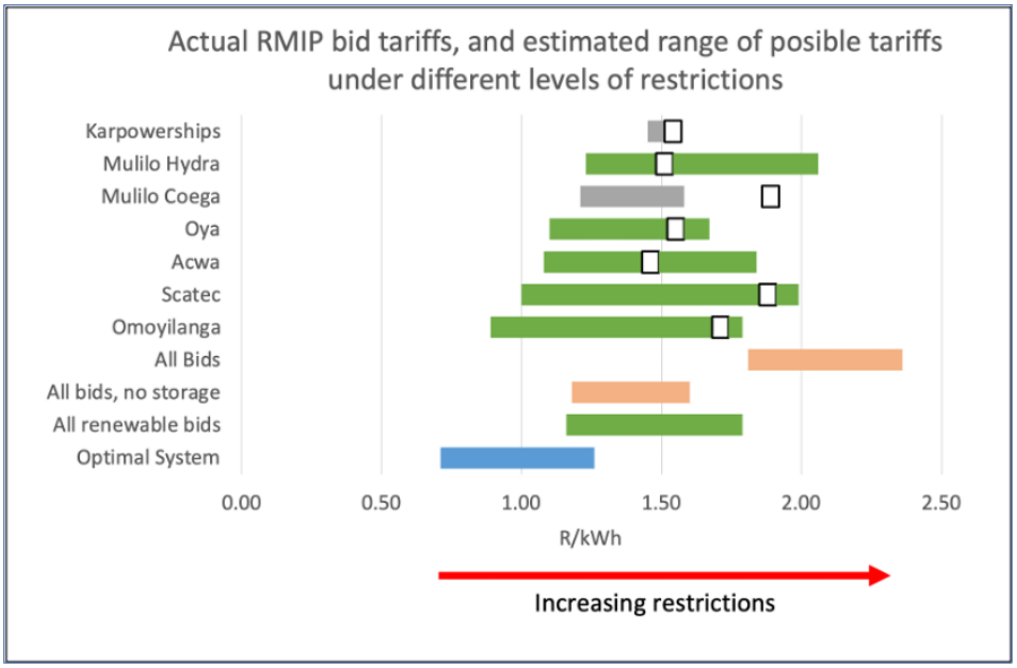
A delayed submission deadline, 24 briefing notes between issue date and final submission deadline, hundreds of clarification questions, and multiple rule changes mid-process, attest to
this.

Unsurprisingly, many of the rules, restrictions, terms, and conditions of the RFP, such as not being allowed to charge from the grid at night, or not allowing shared storage usage among facilities, have little to no impact on gas-dominated projects, such as the three Karpowership projects. This is not so for projects dominated by solar photovoltaic (PV), wind, and energy storage systems (ESS). The combined restrictions imposed by the RFP serve to increase bid tariffs for renewable projects by more than 50%. This in turn renders gas-dominated projects as seemingly, but erroneously, cost-competitive.

Modelling clearly indicates that if the RM4P was aligned to the current and future renewable energy independent procurement programme (REI4P) bid windows, and optimally integrated with all of the existing grid and storage assets, it would be possible to more than halve the tariffs, thus saving Eskom, and ultimately the South African electricity consumer, eight billion rand (R8b) per year, or one hundred and sixty billion rand over the term of the power purchase agreements.

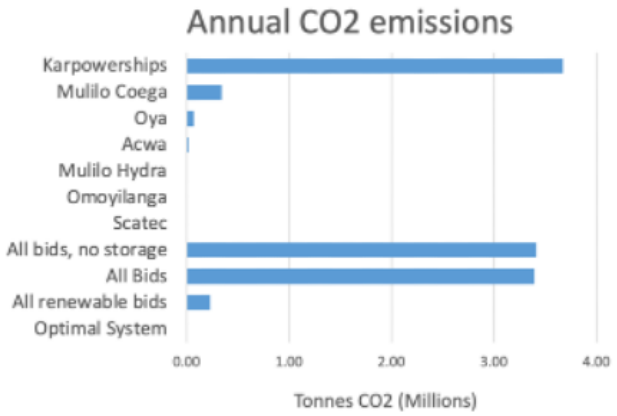
> R 160,000,000,000 saving possible

The impact of a truly technology agnostic procurement process, is neatly summarised in the bar chart below. For a full explanation, see page 15



The recommended modified procurement process renders all gas-dominated projects, including the three Karpowership projects, as redundant, purely based on price. If we add in carbon emissions, environmental impacts, health risks, gas price and exchange rate risk, it is no contest.

The current preferred bidder projects collectively produce over four million tonnes of CO_2 emissions annually, or eighty million tonnes over the duration of the PPAs. Of this, the three Karpowership projects contribute 90% of the total, as shown in the bar chart below.



A revised, flexible risk mitigation procurement process is recommended that is based on locality-adjusted feed in tariffs for PV and wind, and a lease-based energy storage system (ESS) procurement process, where ESSs are allowed to be strategically placed on both the transmission, and the distribution grids, including municipal distribution grids, and are under the control of the systems operator.

A premium would be placed on time to commercial operation date (COD), with incentives for early COD, and penalties for late COD, thus adding new generation capacity to the system in the shortest possible time, noting that more than 600 days have lapsed since the RM4P was first initiated.

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1. Introduction

a. Background

Stage six load-shedding was implemented in South Africa in early December 2019, as planned and unplanned outages at the Eskom coal-fired power fleet reached record highs. The stalling of the process to procure new generation capacity, with the last official round of the renewable energy independent power producers procurement programme (REIPPPP) in 2014, had placed the whole system in a precarious, near permanent state of supply shortage.

b. Justification for this techno-economic report

Based on the lack of clarity in the RFP, especially as regards the technical and financial elements of the programme, it was deemed appropriate to undertake a detailed techno-economic evaluation of the impact of the gas-orientated rules and restrictions so prevalent in the RFP documentation. Assessment of the RFP indicates that the document was in all likelihood designed for a gas procurement programme that was altered and modified in an attempt to claim a "technology agnostic" process. One of the key results is that the terms and conditions of the RFP (rules) have a disproportional negative effect on wind, solar, and storage hybrid projects as opposed to gas-dominated, and especially gas-only projects, typified by the three Karpowership projects, at Richards Bay, Coega and Saldana Bay.

The effect of this is that although the RFP allowed for any kind of technology-mix solution (technology agnostic), the impact of the rules and regulations were anything but technology agnostic, and they have very different impacts on the different technologies The unnecessarily high tariffs of the winning storage-backed wind and solar projects serve to underscore this assertion.

Unsurprisingly, many of the restrictions, terms and conditions of the RFP have little to no impact on gas-dominated projects. This is not the case for projects dominated by solar photovoltaics (PV), wind, and energy storage systems (ESS). The combined terms and conditions imposed by the RFP serve to increase bid tariffs for renewable-dominated projects on average by more than 50%. This in turn renders gas-dominated projects, exemplified by the three Karpowership projects, as seemingly, but erroneously, cost-competive.

In addition, as per the rules of the RFP, projects are treated as individul islanded generators, and are prohibited from communicating and working in concert with each other via the national transmission and distribution grid. Worse still, none of the projects are able to interface intelligently with existing underutilised utility assets, such as Eskom's large pumped-hydro storage fleet.

The RM4P is itself treated in isolation, with little or no cognisance of coupling the programme with the already announced new bid windows five and six of the renewable energy independent procurement programme (REIPPPP). Although the RM4P was treated as a separate emergency procurement programme, an opportunity to link it seamlessly with known future procurement rounds, so as the REI4P was missed. If this full system coupled approach were adopted, tariffs as low as forty percent of the

average winning tariffs in the RM4P are achievable, with the requisite security of supply of 2 000MW between 05h00 and 21h30 available as an inexpensive by-product. Ancillary services required in the RMI4P would also be met, and in fact exceeded.

c. Goals

There are three primary goals of this techno-economic evaluation:

i. Assessment of desirability of winning projects

In order to assess the desirability of the winning projects, five key areas were examined:

1. Cost

Cost, as expressed by the final equivalent bid tariff, is clearly one of the key criteria. For example for the national energy regulator of South Africa, NERSA, to even consider issuing generation licenses to projects, they need to be satisfied that the tariffs provide value for money, and that they are the best options when compared to plausible alternatives. This study will focus on confirming the tariffs of winning projects under the restrictive rules and conditions of the RFP, and then calculate what the tariffs could be if the rules and regulations were adjusted to be truly technology agnostic.

2. Reliability

Reliability, as expressed in the ability of projects to deliver or dispatch electricity as required by the system operator, within the delivery time window from 05h00 to 21h30 each day, is treated as non-negotiable. The techno-economic modelling undertaken uses the 2019 annual hourly data set and portrays wind and solar PV output from actual projects, albeit averaged across multiple sites.

The reliability goal was to test the ability of the various combinations of wind, solar, storage and gas/diesel making up the renewable dominated projects, to meet any dispatch requirement for more than 95% of the time within the dispatch window.

3. Flexibility

The goal as regards flexibility of the different projects to meet the RFP requirements was to model how the gas-dominated rules and regulations impact on the flexibility of renewable-dominated projects. Additionally, modelling would indicate the impact on flexibility if projects were permitted to interface with each other via the connectivity afforded by the grid. A further aim was to extend this to interaction with the full existing Eskom system, and quantify the impact that this additional flexibility would have on reliability as well as on cost.

4. Energy independence

It was deemed important to establish the full extent to which projects could offer energy independence, especially independence from risks associated with exposure to fluctuating gas prices, and dollar rand exchange rates.

5. Greenhouse gas emissions

A key goal of the techno-economic analysis is to establish the carbon emission profiles of all of the winning projects. Secondly, to establish how the emissions from the RM4P projects could be reduced by simple adjustments to the rules and regulations of the RFP to be more accommodating to all technologies, in other words, to make the rules and regulations technology agnostic.

ii. RMPP procurement process

The second goal of this report is to show how the structure of the RM4P led to the selection of preferred bidders, including all three of the Karpowership projects, that were not cost effective, offered poor value for money, and had undesirable outcomes, including unacceptable levels of greenhouse gas emissions, and other forms of environmental impacts.

iii. Alternative procurement programmes

The third goal is to outline possible alternative procurement strategies and programmes and that would seek to increase integration with the existing electricity supply, transmission and distribution system, as well as interface with existing, and underutilised storage assets. In addition, the impacts that a system integrated approach would have on costs (tariffs), and well as on reliability and emissions reductions will be established.

2. Summary of RMPP procurement process

a. Key features and rules of the procurement process

i. Project size

The RM4P sought to procure 2000 MW of dispatchable power between 05h00 and 21h30 each day. Projects were to be between 50 MW and 450 MW of contracted capacity. These size limits were reasonable, and ensured that there would be at least five, and not more than twenty eventual winning projects. As it turned out, there were a total of eleven preferred bidders.

An argument could be made that the upper size limit of 450 MW was specifically chosen, in order to accommodate large gas projects, such as , such as the Karpowerships, or indeed, land-based gas projects. Few wind, solar, and storage hybrid projects would be able to compete at the 450 MW scale simply due to the fact that most environmental impact assessments for solar PV were limited to smaller sizes of 100 MW, and wind projects to 150 MW, in line with the maximum allowable project sizes in all previous REIPPPP bid windows.

ii. Project dispatch rules

The rule that projects were to be fully dispatchable in the RFP-designated 05h00 to 21h30 time window was extremely easy to adhere to for gas-only projects, such as the Karpowerships, or gas-dominated projects, such as the Total Mulilo Coega project, where the declared dispatchable facility was gas-only. The dispatch rules were able to be met by renewable-dominated projects by the addition of suitably-sized energy storage systems (ESS). We will see however, that the combination of rules vi and vii result in the need to unnecessarily oversized storage systems, increasing the costs for renewable projects and thus increasing the tariffs that were bid.

> "Dispatch" means the right of the Buyer, subject to the Codes and the standards of a Reasonable and Prudent Operator, to issue a Dispatch Instruction to the Seller in order to schedule, coordinate and manage the flow of Energy Output of a Dispatchable Facility including to Start-Up, commence, increase, decrease, shut-down or cease delivery of the Energy Output of a Dispatchable Facility;
>
> "Dispatchable Facility" means a Facility or a Project that is capable of being Dispatched and is operated on such basis and can be used or called upon on demand and Dispatched at the request of System Operator for one hundred percent (100%) of the Contracted Capacity over the full duration of the Dispatchable Period while meeting all the technical performance requirements stipulated in Schedule 11 (Performance Requirements) for normal operation and for the provision of the Ancillary Services.

iii. Multiple facility rules

Projects were allowed to comprise multiple facilities, grouped together as a single project, and contracting for a single MW amount. A single project could comprise multiple facilities, that when grouped together, could constitute a single dispatchable project, although none of the individual facilities would be considered dispatchable.

The Omoyilanga project is the only example of such a project, comprising a wind-storage diesel ICE facility, and a separate PV, storage and diesel ICE facility, neither of which is individually dispatchable. Facilities grouped together to constitute a single dispatchable project, are then subject to the system operator rules regarding dispatch instructions (see for example iv, Mingen rules).

In the case of a project comprising a dispatchable facility, and a separate non-dispatchable facility, such as the Total Mulilo Coega project, the fully dispatchable LNG facility is subject to system operator dispatch instructions, whereas the solar PV non-dispatchable facility is not subject to system operator dispatch instructions.

> "**Non-Dispatchable Facility**" means a Facility that the Buyer or its delegated alternative has no contractual right to influence the Dispatch of under normal operating conditions or a Facility which has no or limited ability to respond to a Dispatch Instruction;

iv. Project minimum generation (Mingen) rules

For dispatchable facilities or projects, the system operator can issue dispatch instructions at any time, to suit system needs. The instruction may be to supply the full contracted capacity for the entire duration of the dispatch window, or, as per the Mingen rules, to supply only 25% of contracted capacity on instruction. This is clearly easily complied to by gas-engine projects, when units can easily be shut down or fired up to meet dispatch instructions.

However, for storage-supported renewable dominated projects that are deemed dispatchable, a Mingen instruction is literally an instruction to curtail output. Given that the sunshine and wind cannot be switched off at will, if all on-site storage systems were already fully charged, then the surplus wind and solar would need to be curtailed, in order not to exceed the 25% output instruction. This is easily accomplished via inverter instruction, and excess wind and or solar output is then simply wasted. All of the renewable-dominated project owners will have taken a view (different from project-to-project) on the likely curtailment that would be requested, and increased their bid tariffs accordingly.

It should be noted that all of the renewable dominated projects would be curtailing output even when called upon to dispatch at the maximum contracted capacity (Maxgen). This would mainly be in the summer months, as systems will have been sized to provide contracted capacity during the winter months, and would therefore generate excess for much of the year. Any Mingen dispatch instruction would significantly add to the amount that would need to be curtailed.

v. Minimum annual contracted capacity

The RFP stipulates that a minimum annual amount of energy will be purchased, or deemed to have been purchased, from each project, irrespective of the actual dispatch instructions from the system operator. This minimum quantity of annual energy is calculated at an annual capacity factor of 50% of the full contracted amount. This in turn translates to the buyer (Eskom) contracting to purchase at least 72.73% of the theoretical maximum output possible in the 16.5 hour dispatch window.

One of the outcomes of the rules of the RFP is thus that what are to all intents and purposes emergency supply gas peaking plants, such as the Karpowerships, will be operating at a minimum capacity factor of 50%, which is more in line with combined cycle gas turbines. Open cycle gas turbines (OCGTs), or reciprocating gas engines, are typically operated at no more than 10% annual capacity factors.

The three Karpowership projects represent 62% of the total RM4PP contracted capacity, and will generate a similar percentage of the total output of the combined projects. This is totally out of kilter with normal operating specifications of OCGTs or reciprocating gas engines. Athough the Karpowerships make use of some heat recovery from the reciprocating engines, they are by no means fully comparable to combined cycle gas turbine plants.

Take for example the Eskom fleet. The Eskom OCGT fleet, together with private IPP OCGTs, constitute 3GW, or about 7 percent of total installed generation capacity in South Africa. In 2019, the OCGT fleet operated at an 8% capacity factor, and supplied

less than 1% of the annual output, at just over 2 TWh. This represents one third of the minimum contracted annual output of 6 TWh attributable to the three Karpowership projects.

vi. Grid integration rules

The question of being allowed to charge energy storage systems from the grid outside of the dispatch window was one of the most frequently asked clarification questions, and the answer was always, no, with the following stock answer:

> "The supply of electrical energy to the Seller by the Buyer or from the system is prohibited for the purposes of storing energy in an electrical energy storage facility."

This rule has no impact whatsoever on gas-engine projects, but results in storage-backed renewable projects needing to increase the installed storage duration hours, and therefore unnecessarily increases costs as reflected by bid tariffs.

The buyer in this case, Eskom, generally has surplus electricity available at night, and would benefit from the sale of this surplus. In addition this would significantly lower the tariffs bid by the project. The rule is therefore doubly irrational.

vii. Placement of energy storage systems

RFP rules dictate that any energy storage systems (ESS) must be co-located with either wind or solar generation capacity. However, if ESS are placed at key locations on the transmission or distribution grids, they are able to perform additional services over and above simply acting as storage devices. For example, at peak times of day, electricity transmission volumes are often constrained at bottleneck points, and insufficient electricity is able to be fed to certain areas. Storage devices correctly located can allow for charging of the devices at off-peak times, and then discharging to those areas at peak times to overcome upstream flow constraints.

vi. Local content rules

Local content rules for PV plants for instance dictate that a certain percentage of local content must be used. Local manufacture of PV panels, and inverters has declined over the past few years due to policy uncertainty negatively affecting local demand. Many potential RFP respondents chose not to bid, as the remaining local manufacturing capacity placed an effective cap on the number of solar bidders that stood a chance to be compliant with respect to local content requirements.

In the case of Karpowership, there was no chance of the any of the three projects achieving local content requirements. The local content requirements were then waived for Karpowership on the grounds that South Africa didn't have any local manufacturing capacity to build gas reciprocating engines.

b. Effects of the procurement rules

From the modelling undertaken as the core of this techno-economic evaluation, the cumulative effect of the RFP gas-oriented rules and regulations has resulted in substantial inefficiencies in the winning renewable-dominated projects. This has resulted in bid tariffs that are much higher than they need to be. These tariffs decrease substantially as the layers of unnecessary rules and regulations are stripped away.

The details of the impact of the procurement rules will be covered in section 4 that deals with the results of the modelling.

c. Risks specific to gas (LNG) generated electricity

It is notable that many of the rules and restrictions of the RFP that so negatively impact and increase the tariffs of renewable-dominated projects, have little to no effect on gas-dominated projects, rendering these projects as seemingly competitive.

There are however, certain rules to the RFP that have no effect on renewable-dominated projects, and no effect on gas-dominated projects, and yet expose the buyer, Eskom, and thus the South African electricity consumer, to unacceptable levels of risk and uncertainty.

Specifically, the fuel cost for projects requiring fuel, such as LNG, LPG, or diesel, is treated in the tariff calculations as a pass-through cost to the buyer. The buyer, in this case Eskom, is therefore fully exposed to the risk and price volatility of the global oil and gas markets. In addition, these products are all dollar denominated, so there is additional currency exchange risk on top of commodity price risk. One need only reflect on the recent fuel price increases to understand that the tariffs for the gas-dominated projects, as reflected at the time of the winning bidder announcement, have in all likelihood already increased, based on global LNG price increases.

One could argue that prices and exchange rates may in fact move in favour of lowering the tariffs of gas-dominated projects. Although this may conceivably happen, why take the risk when there are alternatives that are not exposed to price and exchange rate fluctuations?

3. Modelling methodology

A self-built, tested and robust model that makes use of 2019 South African hourly generation and demand data was modified and used to evaluate each of the projects with respect to energy mix make up and contracted amount. The demand profile was set up to reflect the fully contracted demand for each project, for the dispatch window from 05h00 to 21h30 for each day of the year. The data set includes all wind and solar output from existing projects connected to the grid as of 2019. Output data for wind and solar is normalised to 1MW, and then scaled appropriately for each of the projects.

In projects with storage, excess wind and/or solar is used to charge up the storage, limited to the specific charging capacity of the storage system. Once the storage device is fully charged, based on the hours of storage available, any additional excess requires curtailment, and is effectively wasted.

Visual output showing the full demand profile, and well as how the projects meet the demand profile, is generated for the full year. A subset of this full output is shown for each of the projects for a typical week in March, in Figure 1. Any portion of output above the contracted demand dispatch window that is coloured brown, depicts storage charging. Generation above the dispatch window that is not brown, depicts "wasted excess" and would require curtailment.

The model is used to verify the ability of projects to meet the 05h00 to 21h30 dispatch window at the necessary level of reliability. It automatically calculates the contributions from each energy generation source, how much if any excess is produced, and estimates an indicative average tariff, based on a weighted average modified form of levelised cost for each of the technologies.

Input assumptions for the model for capital costs, operating costs, and weighted average cost of capital, and debt tenor terms are recorded in Appendix A. Importantly, all of the same input assumptions are used for all of the projects. Although actual details for each project will clearly differ, the model allows for a robust high-level ranking of the projects, and also allows for ascertaining the effects of different RFP rules on each of the projects. These relative effects are due only to rule changes, and not to any of the other assumptions, which remain unchanged. As such, focus should be on the range of tariffs under different rule scenarios, more so than the actual tariff values.

In addition to modelling all of the winning projects, an additional four scenarios were modelled, and the model demand and energy mix profiles are shown in Figure 2.

- All of the winning projects grouped together as one large project;
- All of the winning projects grouped together as before as one large project, but with all of the storage capacity removed;
- All of the projects with a renewable component grouped together. This included all of the projects other than the three Karpower projects; and
- An illustrative full system approach large project, effectively replacing the Karpowership projects, and capable of delivering 2000 MW as per the RFP dispatch rules.

4. Results of modelling

a. Summary of key findings

The key findings from the results of the techno-economic modelling are as follows:

- Small changes to the rules and regulations of the RFP, such as allowing full system integration and night-time storage charging, result in a 35% decrease in the weighted average tariffs of all of the projects with a renewable component. The weighted average tariff drops from R1.70/kWh to R1.10/kWh;

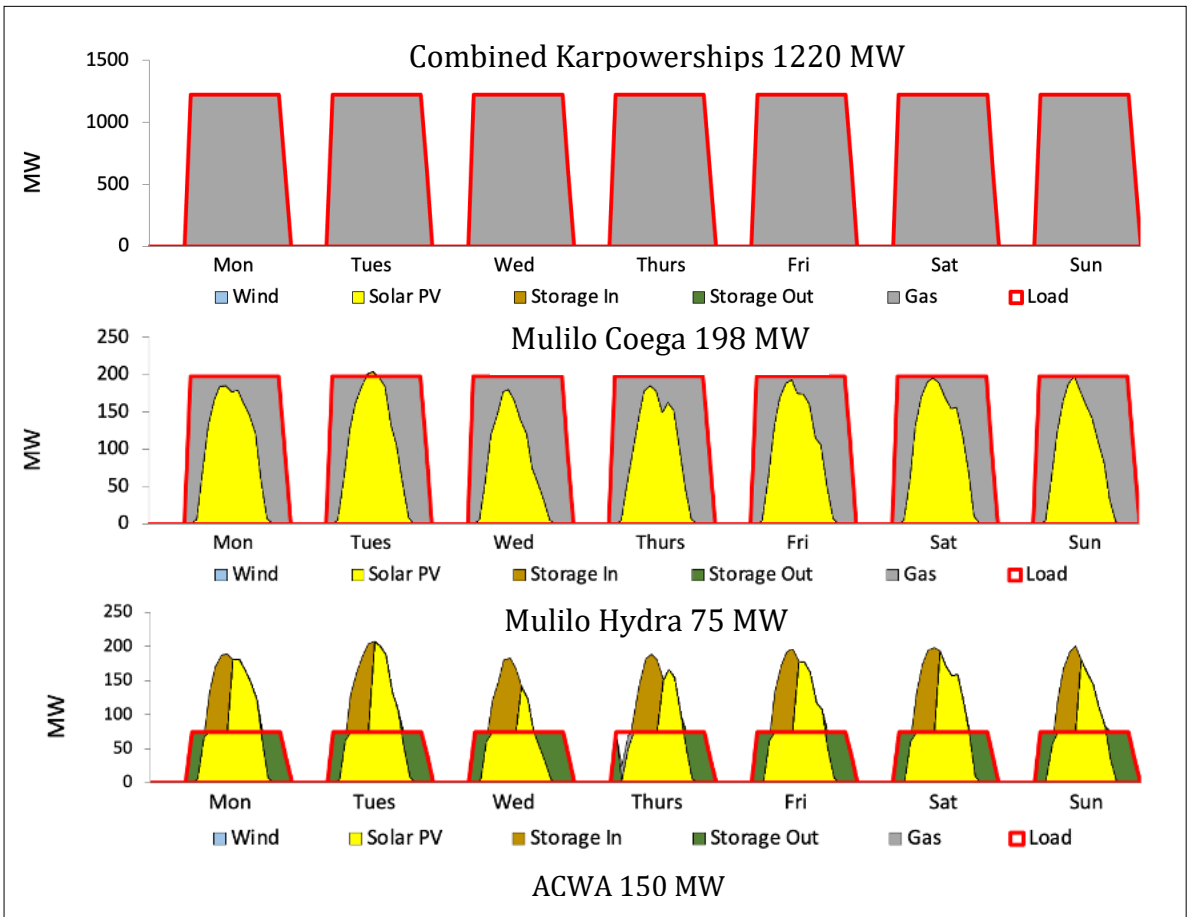
- The same changes have a minimal effect of the weighted average tariff for the three Karpowership projects. The tariff drops from R1.54/kWh, to R1.45/kWh, a decrease of 6%;

- The weighted average tariff of all of projects, excluding the Karpowership projects, is thus 25% less expensive than the Karpowership weighted average tariff, or R0.35/kWh less expensive;

- If the RFP was designed using a full systems approach, and projects were fully integrated with existing Eskom storage assets, the tariff for an optimal system procurement programme would be as low as R0.72/kWh, or less than one half of the current Karpowership tariffs;

- An optimal full system integrated RFP would have no gas, and thus zero carbon emissions, as opposed to the current winning bidders that will produce in excess of 4 million tonnes of greenhouse gas emission per year (not including methane emissions from the production and transport of the gas), of which 90% will come from the three Karpowership projects;

- A particularly interesting albeit bizarre result was found when all of the projects were grouped together as one single large project, as depicted in the top image in Figure 2. It was found that the grouped projects would not be able to meet the maximum dispatch instruction for 1996 MW unless the storage systems were regularly partially charged at night with output from the gas-generated electricity.



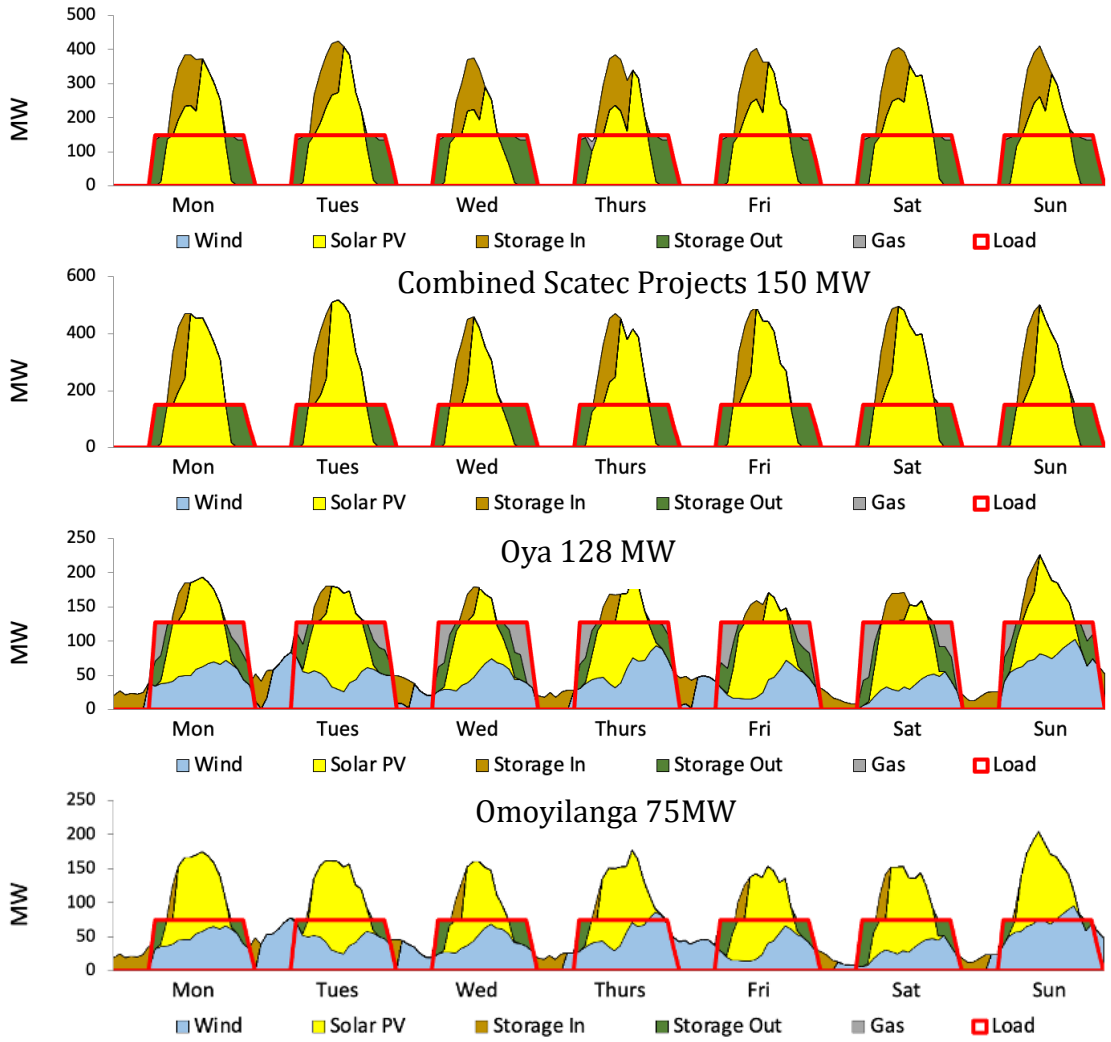
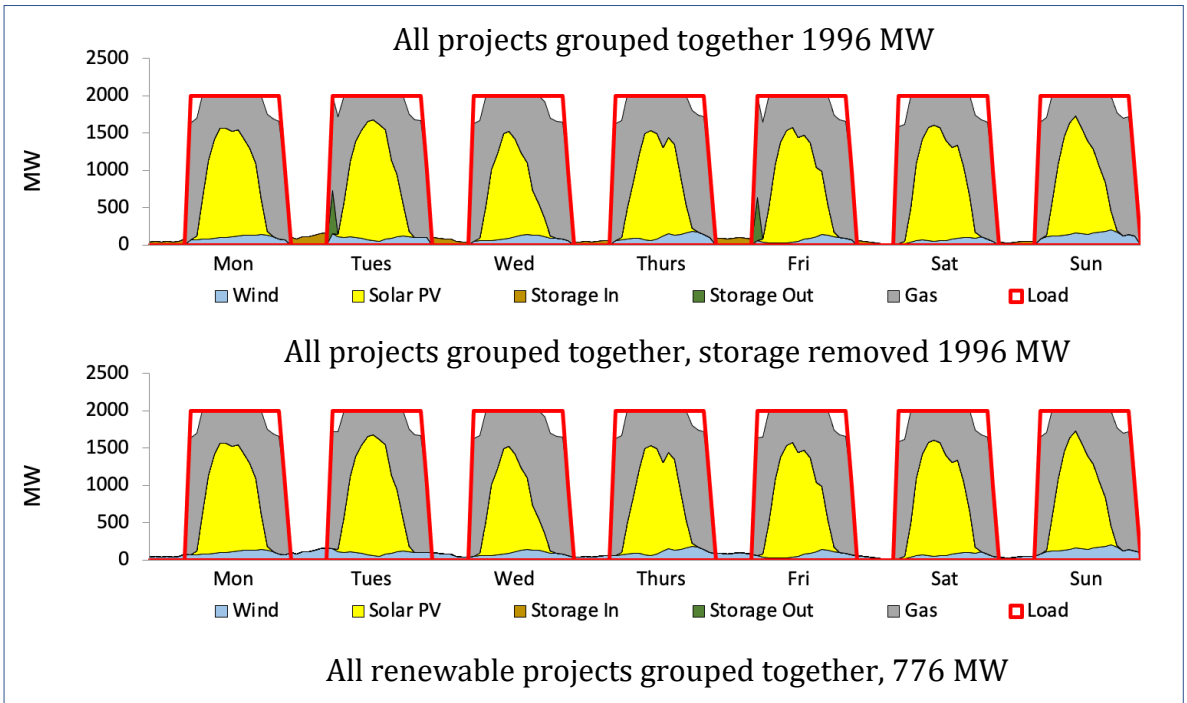


Figure 1. Dispatch window load profiles and contracted amounts in MW for winning bidder projects in the RM4P. The plots show the contributions from the energy mix make up for each project. Actual normalised solar and wind data is used, and a week in March 2019 is depicted as an example. Note that Y-axis scales differ.



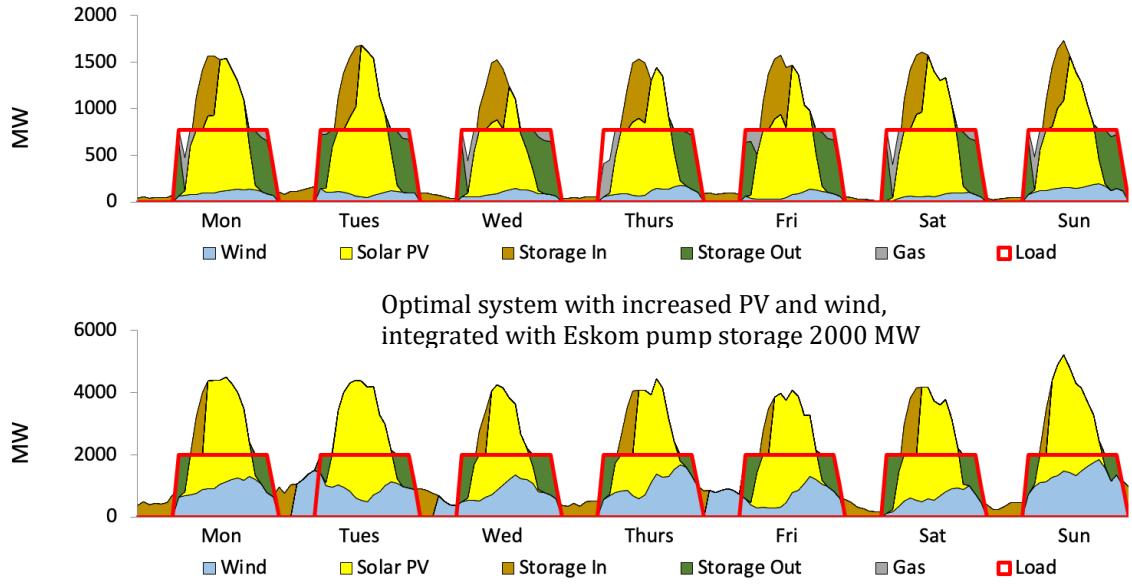


Figure 2. Dispatch window load profiles and contracted amounts in MW for the four additional scenarios that were modelled. The plots show the contributions from the energy mix make up for each project. Actual normalised data is used, and a week in March 2019 is depicted as an example.

This inability to meet the full dispatch requirement in the early morning, and evening, shows as white gaps in Figure 2. Only a very small percentage of the combined storage capacity would thus ever be used. The reason for this is that the maximum combined solar and wind output from the grouped projects never exceeds 1996 MW. As we all know, one can only store if you have an excess. For this reason, a grouped model without any storage was modelled for a comparison, and the calculated tariff dropped from R1,81/kWh, to R1.18/kWh, with little impact on system reliability.

b. Details of key findings

1. Cost

The impact of relaxing rules and restrictions to the RFP that are clearly designed for gas projects is dramatic. The results are recorded in Table 1, and shown in Figure 3. The different tariffs are shown based on different output assumptions (Mingen, Maxgen and Avegen), as well as when all excess generation is allowed to be sold, and not curtailed.

Weighted average tariffs as bid for the Karpowership projects, as well as the estimated tariff possible in a full system integrated procurement process are circled in red in Table 1.

Table 1. Modelling results for each of the winning RM4P winning bids. The Karpowership and Scatec projects are grouped together as single bids. In addition, results are shown of all bids grouped together, with and without storage components, as well as for all renewable bids, and for an optimal system scenario. Winning bid tariffs are only shown for actual projects, not the different combination scenarios.

		Actual R/kWh	As per model estimates R/kWh			
Winning bidders	Size MW	Bid	Mingen (73%)	Maxgen (95%)	Avegen (84%)	Excess sold
Karpowerships	1220	1.54	1.53	1.45	1.48	1.45
Mulilo Hydra	75	1.52	2.06	1.58	1.79	1.23
Mulilo Coega	198	1.89	1.58	1.21	1.37	1.21
Oya	128	1.55	1.67	1.29	1.45	1.10
Acwa	150	1.46	1.84	1.41	1.60	1.08
Scatec	150	1.88	1.99	1.53	1.73	1.00
Omoyilanga	75	1.72	1.79	1.37	1.55	0.89
All Bids	1996		2.36	1.81	2.05	1.81
All bids, no storage	1996		1.60	1.23	1.39	1.18
All renewable bids	776		1.79	1.37	1.55	1.16
Optimal System	2000		1.26	0.97	1.09	0.71

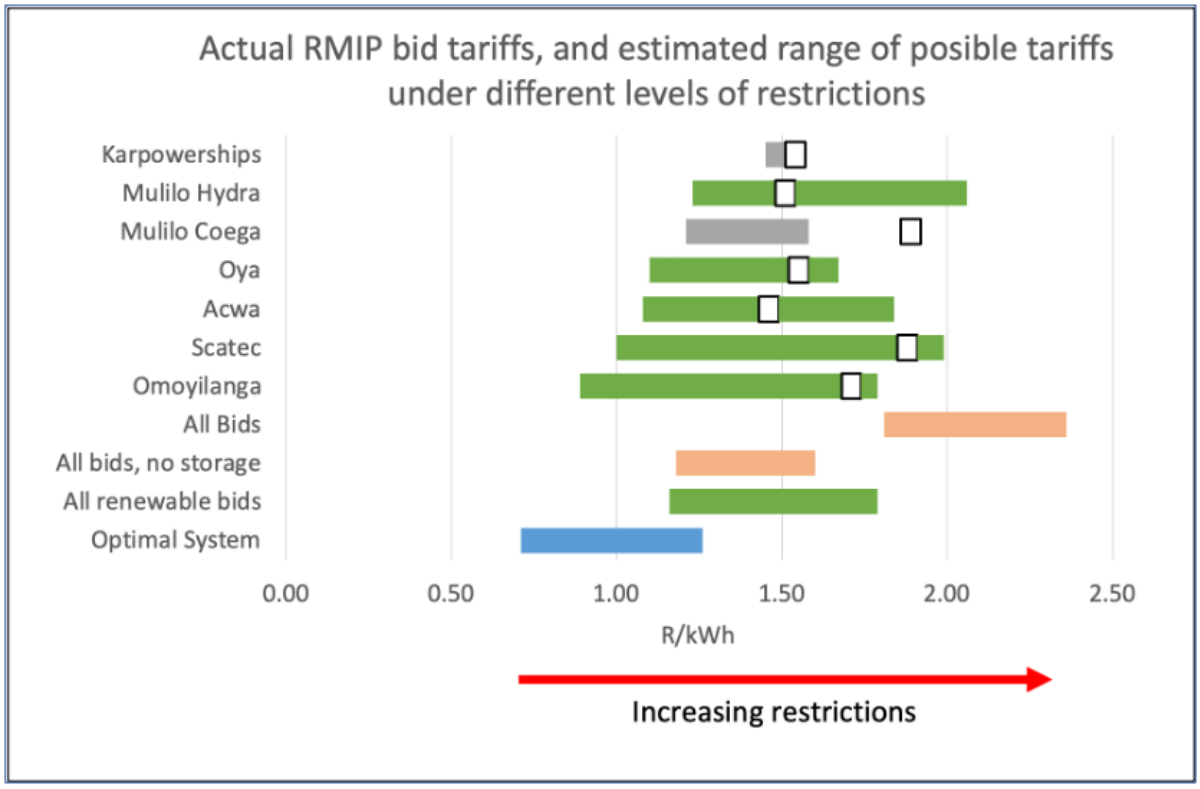


Figure 3. Estimated and actual bid tariffs for the winning RM4P projects. The black outlined small white squares are the actual bid tariffs. The bars depict the range of modelled tariffs, with increasing RFP restrictions. The left edge of each bar indicates the lowest estimated tariff, and the right hand side the maximum estimated tariff.

All of the estimated project tariffs from the modelling show a range of possible tariff rates that include the actual bid tariffs, except for The Mulilo Coega project.

The Mulilo Hydra project, is the only project with a bid tariff to the left of the centre of the estimated range. The Acwa project bid tariff is located in the centre of the range, and all of the other project bid tariffs are close to the top of the range, indicating the expectation from the project owners that average annual output requested by the system operator would be close to the minimum allowable quantum (Mingen rules).

Further analysis of the winning project bid tariffs appears warranted, but is beyond the scope of this report, and not material to the conclusions that are drawn from an analysis of the trends that are so apparent in the results.

It is however worth drawing attention to the “all bids’ and “all bids no storage” results, mentioned in the results summary, shown clearly in Figure 3, and once again illustrating

the imbalance in the collective makeup of the winning bids, exemplified by the Karpowerships providing 62% of the total capacity and output.

2. Reliability

Using the generation mixes from the actual winning projects, it was possible during the modelling to estimate reliability, albeit using generic wind and solar output data, as actual data for the individual projects was not available.

Based on this data used, the projects modelled all indicated that they would be able to reliably meet system operator dispatch instructions for at least 95% of the time, well within acceptable limits.

Figure 4 shows the installed capacity mix as a percentage of total capacity for each of the projects, and for the four modelled scenarios. It also shows the generation output ratios for each of projects, and the four scenarios. Notice how the All Bids scenario has a fairly large installed storage capacity, but the modelled output results show almost no contribution from storage, for reasons previously discussed.

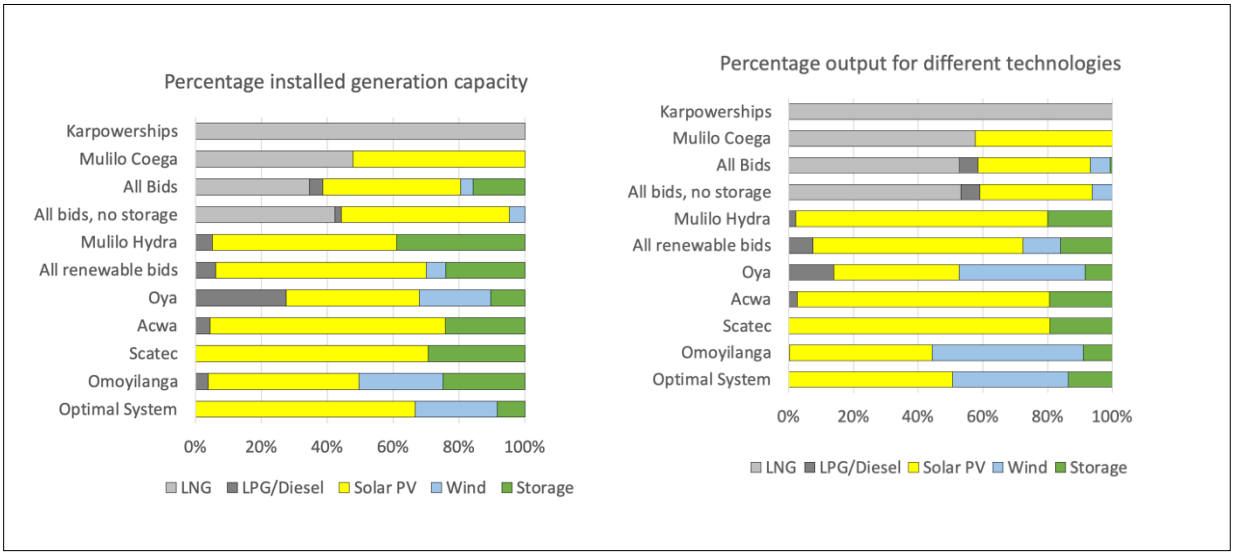


Figure 4. Installed generation capacity ratios for different technologies, and modelled output ratios for each technology for the winning projects, as well as the four scenarios including the optimal system scenario.

3. Flexibility

The modelling results confirm that all of the projects provide the requisite flexibility to be able to meet the rules and regulations of the RFP. However, modelling also shows conclusively that a relaxation of the gas-orientated rules and regulations would have a significant impact on the renewable-dominated projects. If they were allowed to interface with each other, and integrate with underutilised Eskom storage assets, the flexibility of the whole system would increase, and with it, there would be a significant reduction in tariffs, potentially by as much as 50% in a fully integrated systems approach to an alternative, amended RFP.

On the matter of flexibility, we should be increasing flexibility in our procurement approach, especially for so-called emergency procurement. More than 600 days have already passed since the initial launch of the risk mitigation procurement programme,

back in December 2019, and not one project has reached financial close, let alone started actual construction.

Nothing highlights this lack of procurement flexibility more so than the fact that a minimum of 25%, and as much as 50% of all solar- and wind-generated electricity, in the RM4P stands to be curtailed (Figure 5), increasing tariffs by as much as 50%. At the same time, bid window 5 of the REIPPPP closed just this week, and the aim is to procure wind and solar on a take-or-pay basis. Not only is the approach inflexible, but it is demonstrably irrational.

4. Energy independence

As things stand, if the projects go ahead in their current form, and at the current tariffs, 62% of the total output, and a similar amount of the total payments will accrue to the three Karpowership projects. This is the current reality, no modelling required. This means that a disproportionately high level of energy dependence will rest with the three Karpowership projects. This high ratio of gas to renewable projects is totally unbalanced. For example, when compared to the ratio of gas to renewables in the integrated resource plan (IRP_2019), where gas represents less than 15% of wind and solar PV combined. This is once again a reflection of the RFP rules and regulations written to accommodate large gas projects, at seemingly competitive prices.

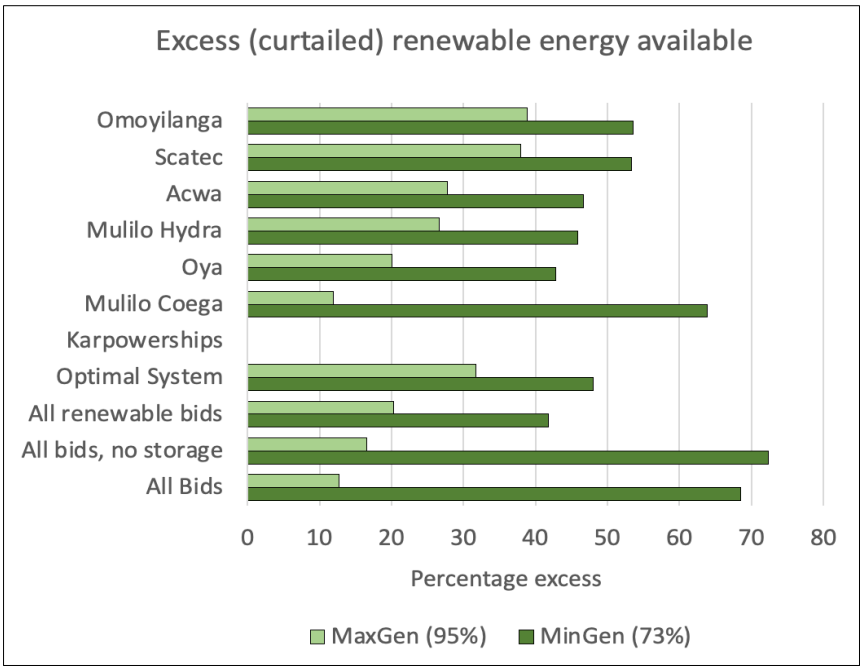


Figure 5. Percentage output requiring curtailment under Maxgen and Mingen operational assumptions

In addition, the bulk of the payments made will flow out of the country, and impact negatively on the sovereign trade balance. It will have the effect of increasing our energy dependence on fuel imports.

Maximum energy independence can be achieved by an efficient and optimal utilisation of our abundant natural resources of wind and sunshine.

5. Greenhouse gas emissions (excluding upstream production and transportation methane leaks)

Greenhouse gas emissions were estimated from the model outputs that reflect the contribution of each technology to the annual output for each project. CO_2 emission intensity per kWh, as well as annual CO_2 emissions for each of the projects and scenarios are shown in Figure 6.

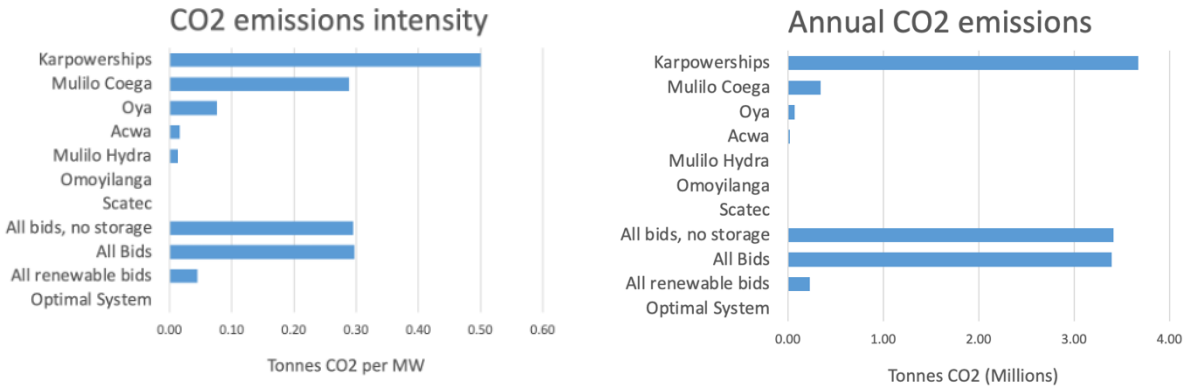


Figure 6. Project CO_2 emissions intensity and modelled annual output.

Combined annual emissions of just over 4 million tonnes of CO_2 are dominated by the three Karpowership projects, making up more than 90% of the total. No estimate has been made of additional emissions linked to the LNG supply chain, although recent information gathered by satellite indicate that methane emissions have been systematically underestimated and under-declared by oil and gas companies.

5. Conclusions

Techno-economic evaluation of the results of RM4P, as per the RFP rules, clearly indicate that the procurement process was designed with gas-procurement in mind. Some of the conclusions that can be drawn are as follows:

- The strict regulations regarding grid or system usage/interfacing have no impact on gas-only projects, such as the Karpowerships. Gas-dominated projects have no need to draw electricity from the grid outside of the designated time window (05h00 - 21h30), and are thus unaffected by this restriction;

- The same regulations, when applied to renewable-dominated projects, have a disproportionate effect, and lead to average tariff increases of over 50%;

- The fact that projects with storage are not allowed to charge the storage at night from the grid, even when there is spare generation capacity, results in the oversizing of storage systems by a factor of almost two, significantly increasing tariff levels;

- The minimum generation (Mingen) rule that can be imposed at any time by the system operator, has a minimal effect on gas projects, and a very large effect on renewable-dominated projects;

- Gas-dominated projects are not negatively affected by operating in isolation. There are no differences if these projects operate individually, or in combinations with each other;

- By contrast, renewable-dominated projects perform poorly in isolation, and far more effectively in concert. Operating in concert, via grid interaction, and full system integration, is however prohibited by the rules of the RFP;

- The rules of the RFP lead to some absurd outcomes. For example, if one models the output of all of the projects grouped together as one large project, as in "All Bids", only a tiny fraction of the 2 860MWh of combined storage duration - from the bids that include storage - is ever utilised, for storage of excess wind outside of the dispatch window. The reason for this is that the combined PV and wind in this hypothetical single large project never exceeds the 1996 MW output requirement. It only makes sense to store surplus PV and wind, and there isn't any surplus during the dispatch window, unless of course Mingen restrictions are put in place;

- Small changes in the RFP rules would significantly reduce the tariffs offered by renewable-denominated projects, thereby rendering gas-dominated projects non-competitive; and

- The "Optimal System" that was modelled has zero gas, 4 000MW of PV, 1 500 MW of wind, and 1 000MWh of storage. It is fully integrated with existing underutilised Eskom System assets, such as the Eskom Pumped-hydro storage facilities. This quantum of PV, wind and storage is similar to the sum of the PV, wind and storage from the RM4P bids, and bid window 5 of the REIPPPP. These two separate procurement programmes could easily be combined as a single, two-stage procurement programme. A sensible grouping of these two procurement efforts would lower the average RM4P bid tariff from R1.60/kWh to R0.72/kWh. This presents a compelling case of value for money, in addition to having zero carbon emissions.

6. Recommendations: an alternate procurement process

It is recommended that the IPP office reassess the rules and regulations of the RM4P as embedded in the RFP. Recognising that speed to achieve commercial operation is of the essence, the following is but one possible new scheme for emergency power procurement:

- Accept that the RM4P process should not be treated in isolation to new REIPPPP bid windows;

- Ensure that full use is made of the utility of the grid, and the existing, yet underutilised Eskom storage assets;

- Allow night-time storage from the grid, when surplus generation capacity is available;
- Aim to procure PV, wind, and storage separately, and in the proportions indicated by the optimal system scenario: namely 4 units of PV, to 1.5 units of wind, to one unit of storage;
- Offer adjusted feed-in tariffs for wind and solar, based on location, and speed to commercial operation date (COD);
- Offer incentives for early COD, and apply penalties for late COD;
- Enter into long-term lease agreements with energy storage system suppliers, as they are not net generators, and PPAs based on kWh produced make little sense; and
- Allow energy storage systems to be located in the most strategic and beneficial locations, including within municipal distribution networks, where they can provide multiple or stacked services, especially when under full control of the system operator.

Appendix A: Model input assumptions

	Solar PV	Wind	Storage power	Storage Energy	Gas engine
Capital expenditure ($/kW)	625	1100	300	160/kWh	700
Operating expenditure (% of Capex)	1.6%	2.5%	2%	2%	2%
Fuel costs ($/kWh)	-	-	-	-	0.08
Debt %	100%	100%	100%	100%	100%
Debt term (Years)	15	15	15	15	15
Debt interest rate %	8%	8%	8%	8%	8%
Capacity factor	27.21%	41.10%	-	-	-

Annexure E

Assessment of the Need for the proposed Karpowership Power Plant projects ("the projects") located at the Port of Saldhana Bay (Western Cape), Port of Ngqura (Eastern Cape) and Richards Bay (KwaZulu Natal).

Mark Dyson (Principal), Sakhi Shah (Associate), James Sherwood (Principal)—Rocky Mountain Institute (RMI)

27 July 2021

Executive summary

Assessment of a power system study by Meridian Economics confirms the least-cost path for South Africa involves heavy renewable build out and limited new gas capacity for the next decade.

A recent assessment by Meridian Economics and CSIR (hereinafter, the "Meridian study"), of the South African electric power system clearly shows that the least-cost scenario for the grid involves rapidly building large amounts of wind and solar generation in the near term. A small amount of gas generation may be added to the grid for flexibility, but until the mid 2030's the only need is for "peaking" capacity that is used very infrequently (~2% of its availability). Until then, diesel can continue to be used by existing generators to meet reliability needs during limited hours of peak electricity demand. This least-cost pathway avoids building expensive gas infrastructure unless and until the need arises and is economically justified, avoiding locking-in of long-term fuel cost commitments prematurely and perhaps unnecessarily.

The Meridian and CSIR study's least-cost pathway also includes battery and pumped hydro storage being built to provide flexibility during hours when there is low renewable generation. Building new coal, nuclear, or hydro is not in line with a least-cost optimization due to high costs. Coal plants are operated at low levels and gradually closed. RMI reviewed the Meridian study and validated its approach, as discussed in this document.

The proposed Karpowership projects are not in line with a least-cost pathway.

Powerships are ship or barge mounted, fully integrated floating gas power plants.[i] Three of the powerships from the Turkish company Karpowership (the "Karpowerships") have been selected to provide emergency power generation under South Africa's Risk Mitigation Independent Power Producer Procurement Programme (RMI4P), which requires selected projects to reach commercial operation as soon as possible and not later than December 2022.[ii] Our understanding is that the three Karpowerships will enter into a 20-year power purchase agreement with the government and together provide 1200MW of gas-based capacity to the grid (out of the total 2000 MW RMI4P procurement round).[iii] The Karpowerships operate natural-gas fueled combined cycle thermal generation and heat recovery steam turbines.[iv]

Applying the Meridian study's analysis to the proposed Karpowership projects show that 1.2 GW (i.e., 1200 MW) of new gas power ships is neither timely nor economically optimal in the next decade. The study's findings suggest that the Karpowerships' 20-year lifespan risk them becoming a burden to South African electricity customers, and is inconsistent with a least-cost investment plan for the nation. Per the Meridian study, South Africa would be better served by focusing on investment in infrastructure to enable a 21st century electricity system, which Meridian's findings and global trends show to be largely renewable.

We agree with Meridian's conclusion that gas is not needed in South Africa for "mid-merit" generation until the mid 2030s for the following reasons:

1. Meridian's analysis finds no need for new gas capacity operating at high utilization levels in the next decade;
2. Meridian's analysis finds that electricity generation, in terms of kilowatt-hours, should be almost entirely be met by non-gas resources and that meeting peaking generation needs with new gas capacity in the near-term is not least-cost;
3. We caution that these results imply that if the Karpowerships are commissioned they may create an economic burden for ratepayers;
4. The RMI4P Request for Proposals did not adhere to international best practices and thus was likely biased in favor of fossil fuel projects.

Consistent with the findings of Meridian's study that commissioning of new mid-merit gas capacity at this time is both unnecessary and not the least-cost option for South Africa, we recommend postponing consideration of investment in the Karpowerships.

If the Karpowerships are commissioned they would come online by 2022, as much as thirteen years prior to the economically optimal addition of any type of new non-peaking gas capacity. This would mean that for over half of their operational life, they would represent an uneconomic and unnecessary addition to South Africa's electricity system.

The Meridian study states that the best use of investment is to immediately start to build renewables in areas with existing transmission capacity whilst in parallel building out transmission infrastructure to accommodate additional renewables in future years.

This would be consistent with the transition being made by many other historically fossil-heavy grids, and the International Energy Agency (IEA) reports that from 2019–2020 investment in renewables outpaced fossil plants by 250% globally. Based on the study's results, we agree with this recommendation and emphasize that investing in the proposed Karpowerships will be more expensive for South African electricity customers than investing in new wind and solar and is not required for reliable electricity generation.

Introduction

Meridian Economics, a South African advisory group and think tank, in collaboration with the Council for Scientific and Industrial Research (CSIR), published a study and technical report in July 2020, *Systems analysis to support increasingly ambitious CO_2 emissions scenarios in the South African electricity system*. Meridian states that the study was independently conceived and produced by Meridian and CSIR, and was funded by philanthropic sources. The Meridian study evaluates the optimal development of South Africa's electricity system, showing different pathways that both minimize customer costs and meet increasingly ambitious CO_2 emissions reduction scenarios. The Meridian study provides crucial insight into the costs and benefits of various investment strategies that are directly relevant to the proposed Karpowerships.[v]

In this declaration, we review the scope and credibility of the Meridian study's methodology in terms of current best practice, and place its findings in the context of the proposed Karpowerships.

This declaration addresses investment in electricity generation plants within the wider context of the grid

The electric power system in the Republic of South Africa (RSA) is a network of resources that provides electricity to consumers and businesses. At a high level, the grid consists of:

1. Generating stations that produce electric power. These can be fossil fuel powered (coal, gas, oil and diesel) or they can be renewable resources such as solar, wind or hydro.
2. Energy storage which stores excess electricity generated and provides power when there is a lack of electricity being generated.
3. Electrical substations that convert electricity into high voltage for long distance transmission or low voltage for distribution to customers.
4. High voltage transmission lines that carry electric power from generating stations over long distances.
5. Lower-voltage distribution lines that deliver electric power at a local level and to individual customers.

Generation capacity is generally defined in terms of power, with units of watts (W), kilowatts (kW or 10^3 W), megawatts (MW or 10^6 W), and gigawatts (GW or 10^9 W). Electricity generated is defined in corresponding units of energy, watt-hours (Wh) through gigawatt-hours (GWh), which are equivalent to producing that amount of power for one hour.

Utilities globally are shifting their approach to grid planning

Descriptors for generation plants are evolving

Generation plants have historically been characterized as “baseload”, “peaking”, and “mid-merit”. We define these terms below, but then explain how they are antiquated, do not address actual electricity system values or services in a modern grid, and do not correspond with economic or reliability considerations.

- **“Baseload” power plants:** Historically, coal and nuclear were seen as essential to supply electricity since there were few alternatives. These plants tend to run at maximum levels, generally only shut down for maintenance and do not change their output quickly. The term “baseload” refers to the minimum level of demand on an electrical grid, and this demand was generally met using coal or nuclear energy, hence these power plants were referred to as “baseload plants”.
- **“Peaking” power plants**: Peaking generators are those that are needed and/or used only during periods of peak demand, when there is much higher demand than usual. For example, peaking plants often run on hot summer afternoons when air conditioning demand is greatest. This type of seasonal peak load has historically been met with gas and hydro plants, which were either more expensive or have less energy availability than coal and nuclear plants. More recently, energy storage technologies including batteries have effectively competed with gas plants to provide peaking power in many global power markets.
- **“Mid-merit” power plants:** To meet fluctuating levels of electricity demand throughout the day and over the course of the year, between the levels at which “baseload” and “peaking” plants tend to operate, utilities have historically used “mid-merit” plants (e.g., gas, diesel or hydro plants) which can easily adjust their output to match changing demand.

Though useful in characterizing the grid operations and planning paradigms for 20th Century electricity systems, these terms are rapidly losing relevance in modern grids where emerging technology, especially variable renewable energy resources (e.g., wind and solar) as well as energy storage, are proving their ability to meet reliability needs at least cost without falling neatly into these historical categories of resources.

In particular, the term “baseload” is a misnomer. There is no technical requirement in electricity systems for large plants that operate inflexibly – plants that cannot vary their output easily or suffer losses in efficiency and competitiveness if they do. There is a need for sufficient capacity

in a system that is able to meet peak demand and a reserve margin. However, this can be supplied from a diversified and complementary set of resources, which is different from large plants that run continuously as “baseload” generators.

Specifically, geographically dispersed renewable generation can provide consistent energy production to meet baseload requirements and can also be curtailed to meet fluctuating demand levels. Energy storage can also be used to accommodate fluctuating demand and to meet peak loads.

Renewables can increasingly provide services that have historically been met by fossil plants

Many leading global utilities have shifted their approach to resource planning, and in doing so have found that emerging technologies, and specifically wind, solar, and storage, can provide the same sort of grid services that were provided by “baseload,” “peaking,” and “mid-merit” power plants in the 20th Century:

1. The world’s largest auction for renewables and storage took place in India in 2020 for 1.2 GW of capacity. The requirement was for energy during morning and evening hours which is traditionally met by “mid-merit” generators. Successful bids were comprised of renewables, battery storage, and pumped hydro storage. One of the bids, by ReNew Power, set a world record for the lowest priced renewables plus battery storage capacity, with this and other recent renewable tenders being cheaper than energy from coal in India.[vi]
2. A 350 MW pumped hydro storage plant in Morocco is being constructed and planned to be completed in 2022. It will be coupled with existing wind generation to meet demand during peak hours, otherwise provided by “peaker” plants.[vii]
3. In the Atacama Desert in Chile, the planned Valhalla project will use a 600 MW solar PV farm coupled with a 300 MW pumped hydro storage plant to provide continuous power to meet load, thus avoiding the need to build a “baseload” plant.[viii]
4. In Thailand, the 500 MW Lam Ta Khong pumped hydro storage facility built in 2004 replaced older peaker plants which ran on oil, to provide energy during periods of high demand.[ix]
5. In Colorado, USA, the largest utility in the state (Xcel Energy) is retiring two of its largest coal-fired power plants[x], without direct replacement with new gas-fired power plants. Instead, the utility is replacing these “baseload” plants with a combination of wind, solar, and storage projects, marrying the low-cost energy from wind and solar with flexibility from batteries and the remaining coal and gas fleet to provide both “baseload” and “mid-merit” electricity.
6. In Indiana, USA, one of the state’s largest utilities (NIPSCO), is similarly prioritizing[xi] a transition plan for all of its coal plants, seeking to replace them with very low-cost wind and solar energy, and avoiding any investment in new gas-fired generation. This plan is anticipated to save the utility’s customers USD $4 billion over the lifetime of the renewable projects, relative to continued reliance on coal or investment in new gas-fired power plants.
7. In Oklahoma, USA, a large utility has signed a contract[xii] for a new power plant that includes wind, solar, and storage technologies at a single site, and will provide power to the utility’s customers at a price considerably lower than alternative investment in “peaking” or “mid-merit” gas-fired generation, while maintaining reliability.
8. In North Dakota, USA, a major utility will cease operations of an 1,100 MW coal-fired power plant, replacing its “baseload” power output with electricity from new wind and solar projects[xiii], relying on other existing gas plants as well as a new long-duration energy storage project to balance wind and solar variability.

9. In South Australia, Neoen and Tesla have shown with the Hornsdale Power Reserve[xiv] that large-scale batteries can economically play many of the same roles as “mid-merit” and “peaking” generators, helping to provide critical grid stability services even in times of contingency on their renewables-dominated regional grid.

In general, utilities in leading markets are turning toward modern resource planning approaches that do not rely on legacy generator characterizations to determine investment priorities. For example, even in the United States where gas is available at near-record low global prices in 2021, both utilities in traditionally regulated territories[xv] as well as private investors in restructured markets[xvi] are using modern planning studies to determine that emerging technologies like wind, solar, and storage can be lower-cost solutions than traditional “baseload” and “mid-merit” power plants – and as a result, the level of planned wind, solar, and storage investment is over ~10 times the amount of new gas generation across the country. Globally, the International Energy Agency (IEA) reports that from 2019–2020 investment in renewables outpaced investment in fossil plants by 250%.[xvii]

The study by Meridian Economics credibly assesses grid investment pathways for RSA

The Meridian study is an example of an investment planning or "capacity expansion" model, which seeks to optimize investments over a multi-decade period in generation, storage, and network infrastructure in order to realize least-cost electricity service to customers while maintaining system reliability. The primary focus of the Meridian study is on item (1) of the list on page 2 above – i.e., optimizing investments in different generation resources – but the study also represents the requirements for storage and transmission investments alongside generation investments needed to meet customers' loads.

The study treats electricity generators and grid requirements appropriately

The Meridian study assesses all kinds of power plants and their role in South Africa's least-cost electricity investment plan as part of its analysis, including plants that have historically been characterized as "baseload", "peaking", and "mid-merit." The Meridian study, like most modern electricity planning studies, does not strictly enforce these antiquated categories to define its investment priorities, but rather addresses the problem correctly by modeling solutions that meet specific reliability metrics.

The least-cost pathway found by the study is a mostly renewable grid

Currently, coal is used to produce around 80% of electricity in RSA. 6% is from nuclear, 4% is imported, approximately 1% is from diesel, with the remaining 7% coming from wind, solar and hydro.[1] The study finds that the least-cost optimization chooses a grid mostly comprised of renewables, even though carbon emissions are not constrained in this scenario.

This least-cost option from the Meridian study involves building large amounts of wind and solar, which comprise over 60% of new capacity built by 2050. There is also an increase in battery and pumped hydro storage to provide flexibility since output from wind and solar is variable, making up 10% of new capacity built. The optimization does not choose new coal, nuclear or hydro due to high costs and there is gradual closure of coal and nuclear plants. Finally, gas plants are added to the grid for flexibility, about 17% of new build capacity, but this happens in the mid 2030s (as discussed in more detail below).

The Meridian study finds that gas is optimally used to provide two services to the grid:

1. Peaking capacity needed for periods of high electricity demand, using open-cycle gas turbine plants which can ramp up and down quickly to follow demand changes.
2. More frequently, but at lower output levels, over a few hours when there is insufficient renewable energy generated. This "mid-merit" application uses combined-cycle gas turbine plants which cannot efficiently ramp as quickly.

Notably, the Meridian study does not find a significant role for gas generation in supplying a significant amount of South Africa's electricity needs on a daily basis. Given the higher operating cost of gas generation compared to renewables, gas only accounts for 4% of total energy produced by 2050. The relevance of these findings to the Karpowerships are discussed in more detail later in this document.

[1] An additional 2% is the result of pump load, which is associated with pumped hydro storage losses

The study correctly represents South Africa's planning context and provides useful guidance for near-term investments

The modeling conducted by Meridian Economics shows a least-cost pathway having 90% renewable capacity by 2050. This output is rational and reasonable given new technology costs, technology characteristics, the age of South Africa's coal fleet, and the time scale to make major changes to the grid mix. This pathway aligns with trends seen globally in technology prices and infrastructure investment—for example, 77 countries committed to net zero emissions by 2050 at the 2019 Climate Action Summit[xviii] and a large proportion of these currently have fossil fuel-heavy grids. These countries identified that their optimal electricity system investment pathway would necessarily lead them toward renewables and low-carbon development. Investments in fossil generation plants for electricity have declined globally by approximately 30% since 2010 according to the International Energy Agency[xix], whilst spending on renewables, transmission and distribution has steadily increased.

The Meridian study has a more aggressive renewable strategy than Eskom's 2019 integrated resource plan (IRP), even though they use the same modeling software. However, the 2019 IRP "forces in" coal, hydro, and gas using a 'policy adjustment' and does not have up-to-date renewable cost assumptions.

The model used by the Meridian study optimizes the generation mix through 2050, and the least-cost option is a grid mainly comprised of renewable resources, with some storage and a very small proportion of gas. In the least cost option, peak load requirements can be met by liquid fuels for the next 10 years. This is in the form of existing diesel generators, which provided 1 TWh[xx] of electricity (0.8% of total) in 2019 and are expected to provide 1.4 TWh[xxi] in 2030 (0.4% of total). Gas plants are eventually chosen by the model to meet peak demand requirements; however, they are not needed within the next decade since there is adequate existing liquid fuels capacity in the meantime. Waiting to make this decision allows flexibility, avoiding locking-in to long term fuel cost commitments prematurely.

Given the analysis, cost trends, current infrastructure, and planning context, the conclusions from the study suggest directing energy infrastructure investment into rapidly building renewables and transmission, and to delay building significant gas infrastructure so it is constructed only if and when the needs arise and the costs for potential gas alternatives are better understood. According to a least-cost pathway, with the current low level of renewables and high coal capacity on the grid, there is no need for combined cycle gas capacity, which is used to meet load during hours of insufficient renewable generation. There is also no need for open cycle gas capacity which is used to meet peak demand since there is adequate liquid fuel generation.

The Karpowerships are planned to operate at 50-70% capacity utilization levels[xxii]. Capacity utilization is a measure of a power plant's actual energy generation compared to its theoretical maximum if the plant ran at constant, full output (i.e., its rated capacity multiplied by the number of hours in a year).

The study adheres to international best practices

The Meridian study uses PLEXOS grid modeling software to optimize grid mixes based on different constraints. This is a standard and well-known tool, which was also used by the RSA government to develop the IRP. The model optimizes for generation plants which are least cost to reliably meet demand, choosing grid expansion power plants under different scenario constraints. Demand is met on a seasonal, daily and hourly basis. This ensures that the final grid mix output will be reliable in different seasons, but also that the generation options chosen provide electricity even during hours of peak load.

The expansion plan was then run in more detail to assess how each power plant behaves. This unit level modeling decides the order of dispatch for each plant and specifies when and for how long each plant is required. This detailed modeling ensures that the grid expansion plan meets specific reliability requirements in the minutes to seconds timeframe. It tests that criteria for reliable grid supply are met, including having enough flexible supply. This level of detail also ensures that generator requirements and capabilities are adhered to.

System services for the grid are omitted from the analysis, which include keeping voltage stable and restarting the grid after a system-wide outage. For the level of detail of the analysis and conclusions made, this is reasonable. Including these services would not impact the outcome, since they need to be addressed regardless of which generation plants are built.

Given this level of detail and the long timeframe of the analysis, the conclusions made for the expansion plans are appropriate. Based on comprehensive analysis sizing specific power plants, recommendations were made about the general pathway for the grid to transition from its current coal-heavy state to incorporate more renewables, and the range of years when it makes sense to build gas.

The study uses valid assumptions for capital and operational costs for the different energy resources included in the analysis. These include Eskom's 2019 IRP, Electric Power Research Institute (EPRI) and National Renewable Energy Laboratory (NREL).[2] The assumptions used for reliability requirements including operating reserves which should be maintained to avoid supply shortcomings correspond to Eskom Ancillary Services Technical Requirements.[3] We also reviewed the following benchmarks to ensure estimates in the Meridian study were reasonable:

1. Cost estimates have been benchmarked with the 2020 Bloomberg New Energy Finance Annual Energy Outlook.[xxiii]
2. Solar and wind resource availability taken from CSIR's Wind and Solar PV Resource Aggregation Study for South Africa[xxiv] have been benchmarked with the 2020 Bloomberg New Energy Finance Annual Energy Outlook and with global reanalysis models and satellite observations.[4]

The Meridian study has some limitations, but these do not impact the overall conclusions

The Meridian study's limitations tend to be conservatisms as they pertain to the implied pace of cost-effective decarbonization and the need for new fossil infrastructure. Refining these assumptions and exclusions would likely result in reduced use of fossil-fueled generation in capacity expansion results.

Demand side management measures which reduce the demand for electricity are not included in the study. These include energy efficiency where less energy is used to perform the same task (for example LED lightbulbs) and demand response where utilities pay customers who choose to reduce their electricity usage during periods of peak demand on the grid. These measures would reduce the demand forecasted and improve the economic argument against large fossil infrastructure.

The cost to decommission generation plants at the end of their lifetime is not included in the study. Decommissioning costs for fossil plants are much higher than solar and wind, so

[2] See slide 18 of the Meridian study
[3] See page 31 of the CSIR 2020 Technical report
[4] Modern-Era Retrospective analysis for Research and Applications (MERRA-2) and Surface Solar Radiation Data Set – Heliosat (SARAH) from renewables.ninja website

including this cost would also improve the economic argument against large new fossil infrastructure.

The Meridian study uses the electricity demand growth forecast from the Eskom Medium Term System Adequacy Outlook (MTSAO) until 2024 and then the medium growth scenario from the IRP 2019 to project demand up to 2050. This is because the MTSAO has a slower demand forecast which is more realistic for the immediate future given current trends. However, this electricity demand forecast has high growth compared to other countries with similar economies and development paths. Many Organization for Economic Cooperation and Development (OECD) member countries, such as the United States, United Kingdom, and Japan, have effectively decoupled electricity use from gross domestic product (GDP) growth. In the U.S., for example, growth in electricity consumption flattened beginning in the mid-1990s, while GDP growth continued at historical rates. At the same time, electricity planners have tended to overestimate load growth. RMI analysis in the U.S. has shown that for at least the last decade, planners have, on average, over-forecast electricity demand by one percentage point for each year of their forecast. That over-forecast means that results are more than 10 percent too high looking 10 years out, translating to immense spending on unnecessary power plants.[xxv] Considering these factors, it is likely that—if anything—Meridian's assumptions overestimate future electricity demand in South Africa, and the associated generation capacity needed.[xxvi] [xxvii]

Externalities associated with electricity generation are also not included in the Meridian study. Environmental pollution, health impacts, waste management and site rehabilitation costs are much higher for fossil generation than renewables. Valuing these impacts and including them in the analysis would improve the economic argument against large fossil infrastructure.

Mid-life generator major maintenance and overhauls for all technologies are omitted, though these are generally higher for coal and gas plants over a fixed period of time than for solar and wind.[xxviii] Including these costs would favor the case for renewables over new fossil plants.

The study assumes that coal plants can ramp down to 35% capacity, which helps accommodate new renewable capacity. However, the costs to retrofit the coal plants so they are able to run at this low level relative to current operation have been omitted. The existing coal fleet has aged and has a lower output than planned, with refurbishment costs omitted from the study. The existing Eskom generation plants, which are mostly coal, are expected to be producing energy at 86% of their total capacity but are actually averaging below 70% according to the IRP 2019[xxix]. The combination of refurbishing coal plants to extend their lifetime and retrofitting to run at a low capacity may be prohibitively high. If it is uneconomic to keep existing coal plants online and ramp down to 35% capacity, further analysis may find that it is lower cost to retire coal and replace it with alternative capacity. However, early retirement of coal is unlikely given the IRP 2019 comments on coal which include the following statements: "Eskom's existing generation plant will still dominate the South African electricity installed capacity for the foreseeable future" and "More funding should be targeted at long-term research into clean coal technologies … as these will be essential in ensuring that South Africa continues to exploit its vast, indigenous minerals responsibly and sustainably".

Finally, Meridian's study does not account for the costs of developing and building new gas transport infrastructure. Current gas production and transportation capacity is limited in RSA, and reflecting these costs may reduce the viability of new gas generation that require it.

South Africa's Risk Mitigation Independent Power Producer Procurement Programme

The Karpowerships have been selected to provide emergency power generation under South Africa's Risk Mitigation Independent Power Producer Procurement Programme (RMI4P). The South Africa Department of Mineral Resources and Energy gazetted the RMI4P in July 2020 to meet a short-term energy supply gap of approximately 2000 MW between 2019 and 2022 that was identified in the Integrated Resource Plan 2019.[xxx] The RMI4P also has the objective to alleviate the current electricity supply constraints and reduce the extensive utilization of diesel-based peaking electrical generators.[xxxi]

Our understanding of the RMI4P process is that bidding generation facilities were required to meet the following requirements. First, facilities must provide dispatchable flexible generation and be able to operate between 05:00 and 21:30 daily in response to plant-performance needs of the electricity system operator.[xxxii] Second, bidding facilities must reach commercial operation as soon as possible and connect to the grid by December 2022. Third, facilities must meet minimum thresholds for economic development obligations, including job creation and at least 40% local content (i.e., manufacturing components of the generation facility locally).

On 18 March 2021, the Ministry of Mineral Resources and Energy announced that three Karpowerships were selected as preferred bidders to provide over 1200 MW of emergency power under the RMI4P.[xxxiii] These are located in Richards Bay (450 MW), Saldanha (320 MW), and Coega (450 MW). We understand the Karpowerships applied for and were granted an exemption from the local-content requirement, and that the Department of Mineral Resources would enter into a 20-year power purchase agreement with the Karpowerships.[xxxiv]

Commissioning the Karpowerships is not optimal and is likely to be costlier than other options

The Meridian study clearly shows that the proposed 1.2 GW gas-fired Karpowerships are neither timely nor economically optimal from a system planning perspective. The study's findings suggest that the plants risk becoming a burden to South African electricity customers, and are inconsistent with a least-cost investment plan for the nation. Per the Meridian study, South Africa would be better served by focusing on investment in infrastructure to enable a 21st century electricity system (as noted above, Meridian's findings show this to be largely renewable).

This section explains the analysis supporting these implications by placing the Karpowerships in context of the scenarios analyzed by the Meridian study. The Meridian study offers two variations of conservative power system scenarios: a business as usual (BAU) reference scenario based on Eskom's 2019 IRP and the policy goals it reflects, and a least-cost scenario which optimizes capacity expansion without policy constraints or environmental goals. We focus on these conservative scenarios as they are reflective of RSA's historical policy and planning environment—however, Meridian's climate-oriented scenarios (which limit CO_2 emissions) also find that gas plants like the Karpowerships are not required until the mid 2030s at the earliest.

The proposed Karpowerships are inconsistent with a least-cost grid investment plan for South Africa

The Meridian study clearly shows that the proposed Karpowerships are not consistent with any cost-optimized capacity expansion plan for RSA. Most notably, this is true both for the BAU reference scenario and for the least-cost scenario that Meridian models. Fundamentally: (1) the analysis finds no need for new, high-capacity factor gas plants in the next decade; (2) that electricity generation, in terms of kilowatt-hours, should almost entirely be met by non-gas resources; and (3) if the plant were to be built it may create an economic burden for ratepayers. Furthermore, (4) the RMI4P Request for Proposals did not adhere to international best practices and thus was likely biased in favor of fossil fuel projects.

(1) There is no need for new, high-capacity factor gas plants until at least 2030.

In both Meridian's BAU and least-cost scenarios, two types of gas power generation capacity are included as options: open cycle gas turbines (OCGT) are typically utilized as "peaking" capacity, and combined cycle gas turbines (CCGT) are normally used for mid-merit "energy" applications. In both the BAU and least-cost scenarios, the study finds that the first (and dominant) application of gas capacity is OCGTs for peaking. In contrast, the Karpowerships have CCGT plants. The expected utilization factor for Karpowerships is 50-70%, meaning it will operate more like an energy plant (i.e., baseload or mid-merit) rather than a peaker plant.

Table 1 shows the study's findings related to OCGT and CCGT capacity expansion in the BAU and least-cost scenarios. The BAU scenario finds a need for slightly more than 1.2 GW of new OCGT capacity beginning in 2027, but new CCGT capacity is not needed until 2036. For reference, 3 GW of new generation is equivalent to 2% of RSA's currently installed capacity, per Eskom's 2019 IRP. The least-cost scenario finds similar timelines, with new OCGTs needed for peaking capacity in the mid-2020s but new CCGT capacity is not needed until the 2030s.

Notably, existing OCGT and peaking plants in RSA currently utilize liquid fuels (mostly diesel), rather than gas. According to Meridian, the limited new OCGT capacity shown in the next decade may similarly be most cost-effectively run on liquid fuels, rather than requiring new large-scale gas delivery infrastructure or floating gas plants.

Table 1: Timeline for gas capacity expansion in Meridian's BAU and least-cost scenarios.

Capacity Type	Year Expansion is First Needed	Amount of Capacity First Needed	Year 1.2 GW Cumulative New Capacity Needed
BAU Reference Scenario			
OCGT (Peaking)	2024	1.0 GW	2027
CCGT (Energy)	2036	0.2 GW	2038
Total Combined	*2024*	*1.0 GW*	*2027*
Least-Cost Scenario			
OCGT (Peaking)	2023	1.0 GW	2024
CCGT (Energy)	2030	0.3 GW	2033
Total Combined	*2023*	*1.0 GW*	*2024*

If the Karpowerships are commissioned by 2022 they would come online as much as a decade prior to the planned need for any type of new high utilization energy capacity. This would mean that for over half of their operational life, the Karpowerships would represent an unneeded and uneconomic addition to RSA's electricity system.

Overall, what these results show is that the near-term addition of 1.2 GW of gas power is inconsistent with optimal power system expansion. Mid-merit or baseload capacity in particular is not recommended until the 2030s. From RMI's experience with utility capacity expansion planning, this is a relatively long time horizon, and it is reasonable that in ten years' time technological developments and system changes will result in a different response. In the U.S., for example, many utility resource plans in the early 2010s called for significant gas investment—those same utilities' plans have since evolved to call for mostly solar and wind capacity as a result of falling costs and improved integration strategies, leading to the cancelation of numerous gas plants.[xxxv]

(2) Energy needs can be most cost-effectively met by non-gas resources.

Meridian's results do not show a significant role for gas resources in meeting RSA's energy needs. In the least-cost scenario, gas and peaking resources (new and existing) are expected to contribute just 1.1% of total electricity generation in 2025. By 2035, this grows to just 2.4%.

Table 2 illustrates the expected contribution of new gas-fired capacity by comparing the capacity utilization of OCGT and CCGT plants over time in Meridian's least-cost scenario. Capacity utilization is a measure of a power plant's actual energy generation compared to its theoretical maximum if the plant ran at constant, full output (i.e., its rated capacity multiplied by the number of hours in a year). Meridian finds that OCGTs are only needed to generate less than 3% of their potential output over the course of a year (the handful of hours where demand spikes or there are other capacity shortages). CCGTs, when they come online, are needed for roughly 20% of their available output over the course of the year. For international context, these are relatively low capacity utilization rates—in the U.S., CCGTs averaged a 56% capacity utilization over 2018–2020, while OCGTs averaged 11% over the same period.[xxxvi]

Table 2: Capacity utilization of new gas-fired generation capacity over time in Meridian's least-cost scenario.

	Capacity Utilization		
Capacity Type	**2025**	**2030**	**2035**
Least-Cost Scenario			
New OCGT (Peaking)	1.9%	2.8%	2.5%
New CCGT (Energy)	N/A	20.5%	22.1%
Total Combined	*1.9%*	*4.0%*	*5.8%*

We believe that this low capacity utilization may be particularly important to consider in light of the limited need for new gas capacity explained above. While CCGTs are typically considered to be low-cost sources of power, this assumption is predicated on relatively high levels of capacity utilization. For instance, the international financial advisory and asset management firm Lazard's benchmark Levelized Cost of Energy analysis assumes new-build CCGTs would have a capacity utilization rate of 50–70% for its comparisons.[xxxvii] OCGTs are typically used for peaking and are considered higher cost sources of power, generally running at lower levels of capacity utilization, with Lazard's analysis assuming a new build OCGTs capacity utilization rate of 10%. If the need for gas-fired generation in RSA is further limited, this would compromise the economic efficiency of the Karpowerships plants.

In our opinion, accepting that a gas plant with greater annual energy production will be neither needed nor economically optimal until the 2030s, the Karpowerships do not best serve RSA's needs for the following reasons:

- The financial risk presented by the high costs of gas plants designed for short-term emergency use being locked in for a 20-year period under the power purchase agreement, where excessive costs may be passed on to ratepayers and/or become a financial burden for Eskom.
- Risk of change in design assumptions, as small shifts in expected load, emergency needs, or the costs of other resource options could easily reduce or delay the need for new gas capacity; this would result in under-utilization of the plant and/or unnecessary additional cost to ratepayers.

Alternatively, Meridian's study shows that existing peaking plants, alongside investment in up to 3 GW of OCGT peaking capacity over the next decade, can meet RSA's peak demand requirements. Under Meridian's least-cost scenario, these plants can be run on diesel as has been done historically in existing power plants. This would avoid investment in new gas infrastructure until, if or when the need arises and the economics are justified.

(3) Potential economic burden for ratepayers.

As discussed above, Karpowerships are not an optimal solution for the gap in energy supply, a fact that is reflected in the relatively high contract cost. However, operating Karpowerships as a peaker plant (i.e., at a low capacity utilization level) is also not optimal if the contract structure, requires Eskom to pay for a minimum amount of power regardless of actual need. Our understanding of the contract and rationale is that the Karpowerships were prioritized as an

emergency measure to reduce load shedding, which is inconsistent with a 20-year fixed contract that leaves little room for flexibility as cheaper generation options can be built in the near term.

Given the optimized resource use found in Meridian's study, we can speculate that it is conceivable the Karpowerships would either operate at a lower-than-expected capacity utilization level, or cause other plants to similarly be used at less than their expected capacity utilization level. As noted above, Meridian's least-cost scenario found new and existing gas capacity would optimally provide 1.1% of RSA's electricity generation in 2025. If operated at 60% capacity utilization, the Karpowerships alone would provide 2.4% of total generation in 2025. A gas plant at Richards Bay is also being considered which would provide 4.6% of total generation in 2025 if run at the expected 48% utilization rate. This new gas generation would necessarily displace other sources of power. The fact that the Meridian study's least-cost plan did not prioritize building a more-expensive combined cycle plant running at high utilization rates in this decade, and instead prioritized the more cost-effective option of building less-costly OCGT peaking plants running at low utilization rates to meet near-term capacity needs, supports the argument that early investment in high utilization gas plants to provide energy is not economic.

There is also a material risk that the Karpowerships contract becomes more expensive to continue paying for than new clean energy resources are to build, well before its contract end date. The global benchmark costs of new solar, wind, and battery costs have fallen faster than expected for over a decade, and analysis[xxxviii] in other countries has shown that continued advancement in these technologies – even at a much slower rate of change than experienced since 2010 – will allow combinations of new wind, solar, and storage projects to undercut the operating costs of existing gas-fired generation by the mid-2030s, leading to early retirement and contract termination for gas capacity and significant financial losses.

If Eskom were to enter a 20-year power purchase agreement with the Karpowerships, it would mean that the plants' current costs along with any potential cost increases as noted above would be borne by ratepayers for 20 years. In light of Eskom's financial challenges, it is possible that the RSA government may be required to provide financial support to Eskom, effectively passing any under-recovered Karpowership costs on to all RSA taxpayers.

In order to be consistent with the long term least-cost pathway, Meridian's study shows that investment should be targeted toward renewables and transmission expansion in the near term. Given the lower costs of renewables and the availability of transmission capacity in the near term, renewables should first be built in areas where there is existing transmission capacity. These regions include Mpumalanga and Northern Free-State, where there is well-developed transmission infrastructure and declining coal and gold mining according to the Meridian study. This transmission capacity will increase if coal generation is phased down. In parallel, transmission should be expanded to locations with optimal renewable resource, to support further renewable construction. This will enable a rapid build-out of clean energy infrastructure which meets demand at the lowest cost.

(4) The RMI4P Request for Proposals did not adhere to international best practices and thus was likely biased in favor of fossil fuel projects.

The Request for Proposals (RFP) for RMI4P required bidders to guarantee that their power would "operate from 5h00 to 21h30 so that it can be dispatchable 60% of the day." [xxxix] [xl] In doing so, the RFP required that each bidder, with a stand-alone project, must meet these dispatch requirements to ensure a reliable electricity grid, rather than allowing the projects to rely on the balancing services of the grid. The balancing services of the grid are important not only for variable renewable generation but also for coal, gas and nuclear plants that must be

taken offline for maintenance. With these requirements, the RMI4P precluded the participation of variable renewable options that could not meet these individual bidder dispatch requirements.

This aspect of the design of the RMI4P RFP is inconsistent with best practices for procuring electricity resources. To transition away from aging fossil fuel fleets, incorporate a growing share of renewable energy resources, and achieve climate goals, a procurement process should incorporate an all-source approach that is "agnostic to which supply-side and storage resources will be selected." [xli] It should also achieve a "least-regrets" outcome that accounts for "the changing economics of clean energy and future uncertainty in technology, fuel, and emissions costs," and limits "the financial exposure of captive customers and investors." [xlii]

Procurement structures that narrowly specify individual asset performance do not meet this standard. As demonstrated by industry experience globally, procurement processes that assess potential investment as components of an overall resource portfolio, rather than as "islands" within the grid, tend to produce lower-cost, lower-risk outcomes.[xliii]

In summary, both the RSA-specific results of the Meridian study and international best practices in procurement strongly suggest that without the RMI4P's procurement criteria that assessed potential projects as stand-alone assets rather that components of the broader RSA grid, renewable energy and storage would likely have been a more cost-effective choice than Karpowerships for emergency electricity generation capacity.

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