Hoekplaas Solar PV4 Battery Energy Storage System

Draft Motivational Report in support of a Part 2 Environmental Amendment Application

DEFF Ref Nr: 14/12/16/3/3/2/495

September 2020

Applicant

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LANDSCAPE DYNAMICS

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CHAPTER 1: PROJECT INFORMATION

1.1 Background and Locality

An Environmental Authorisation (EA) was issued for the construction of the **75 MW Hoekplaas Solar PV4 Energy Plant** on the Farm Hoekplaas No 146, in the jurisdiction of the Siyathemba Local Municipality, Northern Cape Province. The site is situated adjacent to the R357, less than 10km south of Copperton and ±50km south-west from Prieska. The approved site is 250 hectares in extent.

The EA was issued on 27 October 2015 with reference number 14/12/16/3/3/2/495. The EA was subsequently amended on 10 October 2014, 25 April 2016, 6 April 2017 and 9 July 2020. The EA is valid for a 3 year period and lapses on 9 July 2023.

It is proposed to amend the project description by adding a Battery Energy Storage System (BESS) to the approved solar photovoltaic energy plant and this application is therefore for a **Part 2 EA Amendment**. This Motivational Report is in support of the EA Amendment Application Form.

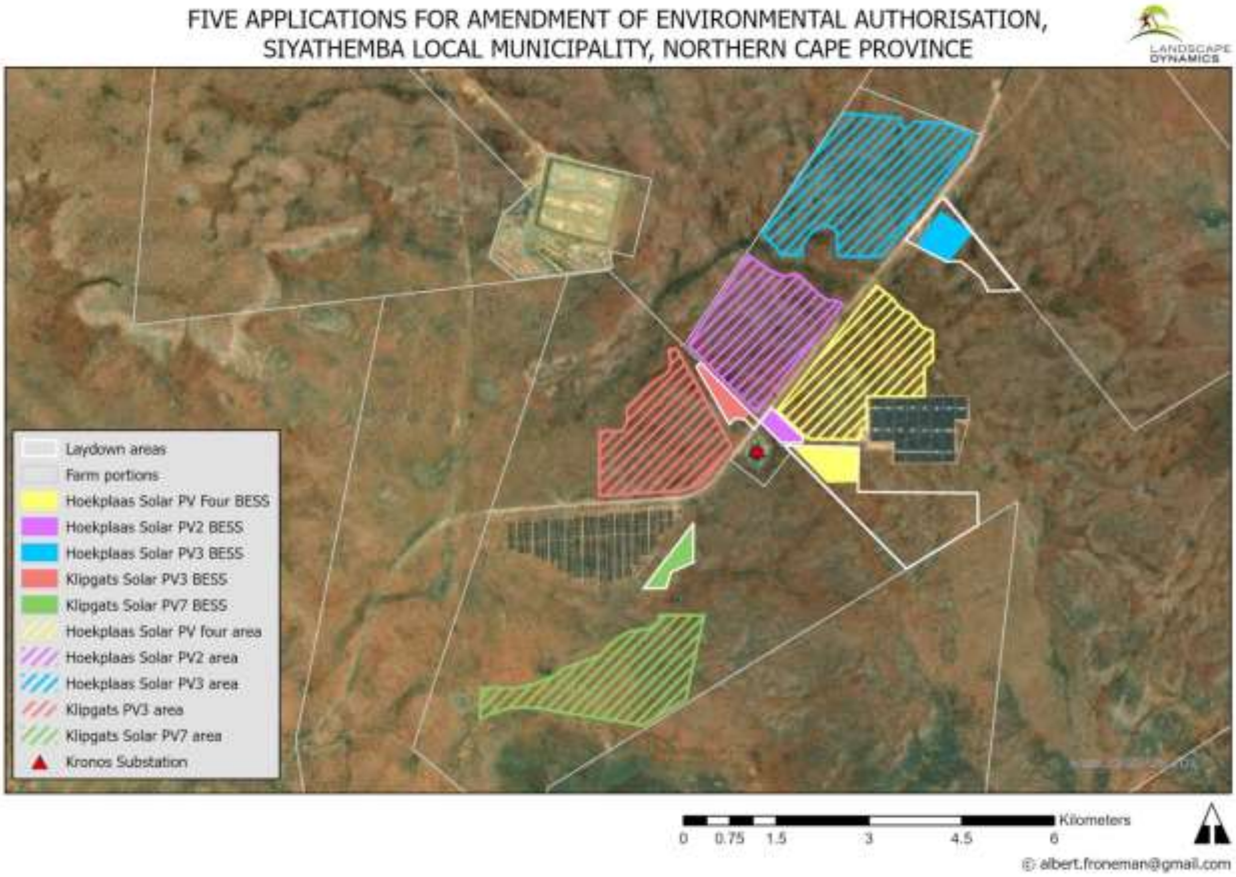
The Department of Environment, Forestry & Fisheries (DEFF) was the Competent Authority (CA) which issued the above-mentioned EA and is therefore also the CA for this application.

Mulilo Renewable Project Developments (Pty) Ltd managed the below-mentioned applications, and received Environmental Authorisations for the following five solar photovoltaic energy generation projects:

Applicant	Property	DEA Ref Nr
Klipgats Solar PV3 (Pty) Ltd	Remainder of Portion 4 of the farm Klipgats Pan No 117	14/12/16/3/3/2/487
Klipgats Solar PV7 (Pty) Ltd	Portion 4 of the farm Klipgats Pan No 117	14/12/16/3/3/2/491
Hoekplaas Solar PV2 (Pty) Ltd	Farm Hoekplaas No 146	14/12/16/3/3/2/493
Hoekplaas Solar PV3 (Pty) Ltd	Farm Hoekplaas No 146	14/12/16/3/3/2/494
Hoekplaas Solar PV Four (Pty) Ltd	Remainder of Farm Hoekplaas No 146	14/12/16/3/3/2/495

The five sites are in close proximity to each other and a BESS will be added to each of the five solar PV plants respectively. **All five BESS sites are situated within the approved laydown areas of the five solar projects that were assessed and approved as part of each project's current EA.**

The position of the sites in relation to each other can be seen on the map below.



1.2 Legal requirement

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National Environmental Management Act (Act 107 of 1998)

This application is done in terms of the National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA) and the Environmental Impact Assessment Regulations published in Government Notice No R982, December 2014, as amended.

Applicable to this EA Amendment application is Section 31 of NEMA, which states that an Environmental Authorisation may be amended if the amendment will result in a change to the scope of a valid environmental authorisation where such change will result in *an increased level or change in the nature of impact* where such level or change in nature of impact was not
(a) assessed and included in the initial application for environmental authorisation; or
(b) taken into consideration in the initial environmental authorisation;
and the change does not, on its own, constitute a listed or specified activity.

NEMA Listed Activities

An EA can only be amended if the proposed development does not trigger any new listed activities, in other words if all applicable NEMA listed activities has been appropriately assessed.

In the case of this project, the following applies:

The EIA commenced under the **2010 Environmental Impact Assessment Regulations** and the EA was issued under the 2010 Regulations, in other words before the Regulations were amended in 2014. The following listed activities were authorised:

2010 EIA REGULATIONS

Government Notice R544: Listing Notice 1

- Activity Nr 10: Construction of infrastructure for the distribution of electricity with a capacity of 33kV and less than 275kV
- Activity 11: Construction of infrastructure within 32m from a watercourse
- Activity 18: The infilling, depositing or removal of more than $5m^3$ from a watercourse

Government Notice R545: Listing Notice 2

- Activity 1: The construction of infrastructure for the generation of electricity where the electricity output is 20MW or more
- Activity 15: Physical alternation of vacant land of 20 hectares of more

Government Notice R546: Listing Notice 3

- Activity 14: Clearance of 5 hectares or more vegetation where 75% or more of vegetation constitutes indigenous vegetation outside urban areas

2017 EIA REGULATIONS

The current EIA Regulations were published in 2017 and the following activities could possibly be applicable to the proposed BESS development:

Government Notice R327: Listing Notice 1

- Activity 12: Development of infrastructure within 32m from a watercourse
- Activity 27: The clearance of 1 hectare or more of indigenous vegetation
- Activity 28: Industrial developments where the land was used for agricultural purposes

Government Notice R325: Listing Notice 2

- Activity 15: Clearance of 20 hectares or more of indigenous vegetation

Government Notice R324: Listing Notice 3

- None (the site does not fall within a CBA or endangered/critically endangered ecosystem)

Activities relating to the "*Development and related operation of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good*" are understood by the EAP and applicant as not being applicable to BESS's. This statement is in line with recent correspondence shared by DEFF with SAWEA indicating that the Battery Energy Storage Systems are not seen as '*facilities for the storage or handling of dangerous goods'* when operational and those NEMA activities are therefore not applicable.

When these proposed BESS components are being added to the project description of already approved sites and considering that all listed activities have been assessed during the original EIA studies and new activities are not being triggered, an amendment to the existing EA application can be made.

1.3 Proposed BESS Description

The following information was obtained from the applicant's report titled *Technical Engineering Report-Battery Energy Storage Systems: Analysis of the current state of electrical energy storage systems*, dated 5 August 2020 (Morse, WJ. 2020) and attached as Appendix B for reference.

Site position

The BESS site is situated within the previously authorised laydown area. The laydown area is 177 hectares and the proposed BESS site is 34 hectares in extent. The final footprint of the BESS is likely to be significantly less, however a larger assessed area allows for micro-siting of the BESS components to avoid possible site sensitivities and implement larger buffers if necessary. Also refer to Appendix A for maps of the site area.

Description

The BESS will comprise of multiple Lithium Ion battery modules housed in shipping containers and/or an applicable housing structure. The battery containers will be assembled at the manufactures factory and delivered pre-assembled to the project site. The containers are usually raised slightly off the ground and depending on the manufactures requirements, may be stacked on top of each other. Supplementary infrastructure and equipment may include power cables, transformers, power converters, buildings & offices, HV/MV switch gear, inverters and temperature control equipment that may be positioned between the battery containers.

The BESS has the following high level characteristics

- Footprint area required: <20 hectares (approximately 440m x 440m)
- Height: Battery Array <10m
- Height: Substation & Powerline <25m
- Voltage <132kV
- Power Output ~150MW
- Energy Capacity ~2500MWh

- Chemistry Lithium Ion (any combination of NMC, LCO, LMO, NMC, LFP, NCA, LTO chemistries)
- Charge & Discharge Duration 5-16 hours
- Construction Duration 6-12 months

Solar BESS Hybrid Facility in CA USA (Morse, WJ. 2020)


An example BESS design from Tesla - Megapack (tesla.com/utility

An example BESS design from Tesla - Megapack (tesla.com/utility)

Computer generated image of a similar scale BESS being developed in Australia (Morse,WJ. 2020)

Technology

Various battery storage technologies are used globally for grid stabilisation, load levelling and to provide uninterrupted power supply amongst others. These include kinetic, potential, thermal, electrochemical, and electrostatic. The selection of the technology can significantly influence a project's impacts on the environment and surrounds throughout its operations. Technical parameters such as chemistry, battery lifetime, efficiency, depth of discharge (DoD) and power density have been taken into consideration in selection of the BESS technology with the aim of minimising unnecessary impacts throughout the project's lifecycle whilst offering the least cost for the energy provided. Despite there being many forms energy storage technologies, by far the most mature and commonly used with utility scale solar plants, is solid-state lithium ion batteries.

Over the past 5 years in particular, lithium-ion technology has not only maintained, but further increased its market dominance as the preferred energy storage technology in the global transitioning of rigid fossil based power grids to cleaner, flexible, distributed based system models. Lithium Ion technology consists of multiple battery cells that are strung together in series to form rack mountable modules. Each cell contains a positive electrode (anode), a negative electrode (cathode) and an electrolyte that allows the flow of electrons and ions. The chemistry is sensitive to operating outside of its recommended temperature, voltage and current window and as a result, is actively managed by a Battery Management System (BMS) to ensure the long term life.

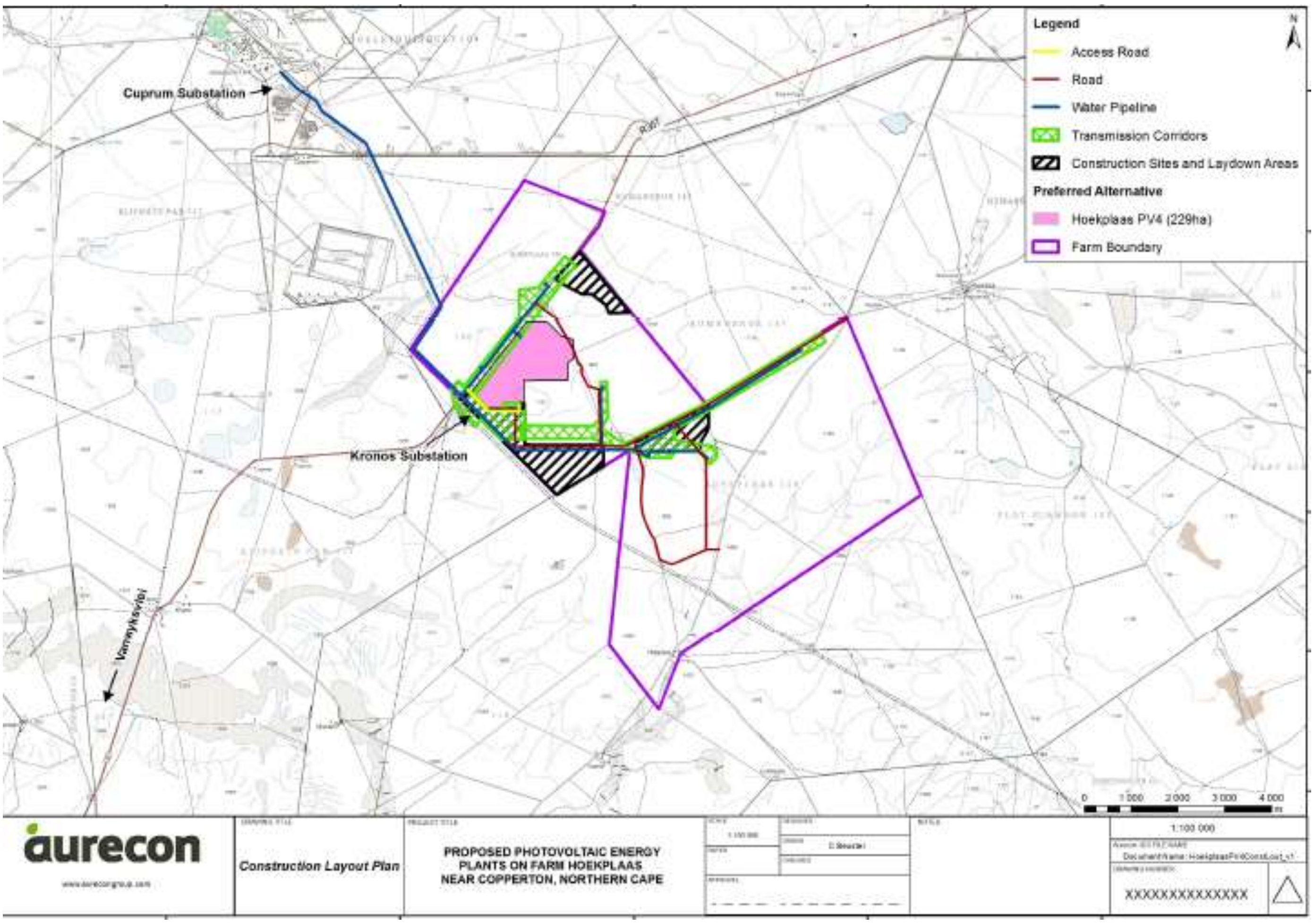
Lithium ion technology has unique attributes which suit the needs of the South African electrical network which requires both long, multi hour discharge durations in addition fast acting, millisecond response to grid events that threaten to destabilise the network. Further, the technology offers rapid construction timelines and favourable costs that lead to an energy tariff that does not burden the end user. Globally, the improving economics of Lithium Ion together with its favourable ancillary service functionality have led to it replacing costly Open Cycle Gas Turbines (OCGT's or Peaker plants) as well as hybridised with large solar PV or wind generation facilities. All of these cases are currently witnessing a sharp increase in installations replacing fossil based technologies. Solid state Lithium Ion battery technology has therefor been selected for the BESS technology for this amendment application.

1.4 Site Selection Process

Selecting the best site for a development forms an integral part of all EIA processes. In the case of this project, the following is applicable:

Authorised areas

The BESS site will be situated within the laydown area which was assessed and authorised as part the Hoekplaas Solar PV4 EIA application. An extensive site selection process for the authorised solar project was conducted during the EIA process and the preferred alternative site was authorised. It is logical to place the BESS within the already assessed and approved footprint of the PV project (the map below is also attached as Appendix A1b).



BESS Site Selection

The laydown area was selected as the most suitable location for the placement of the BESS due to the following attributes:

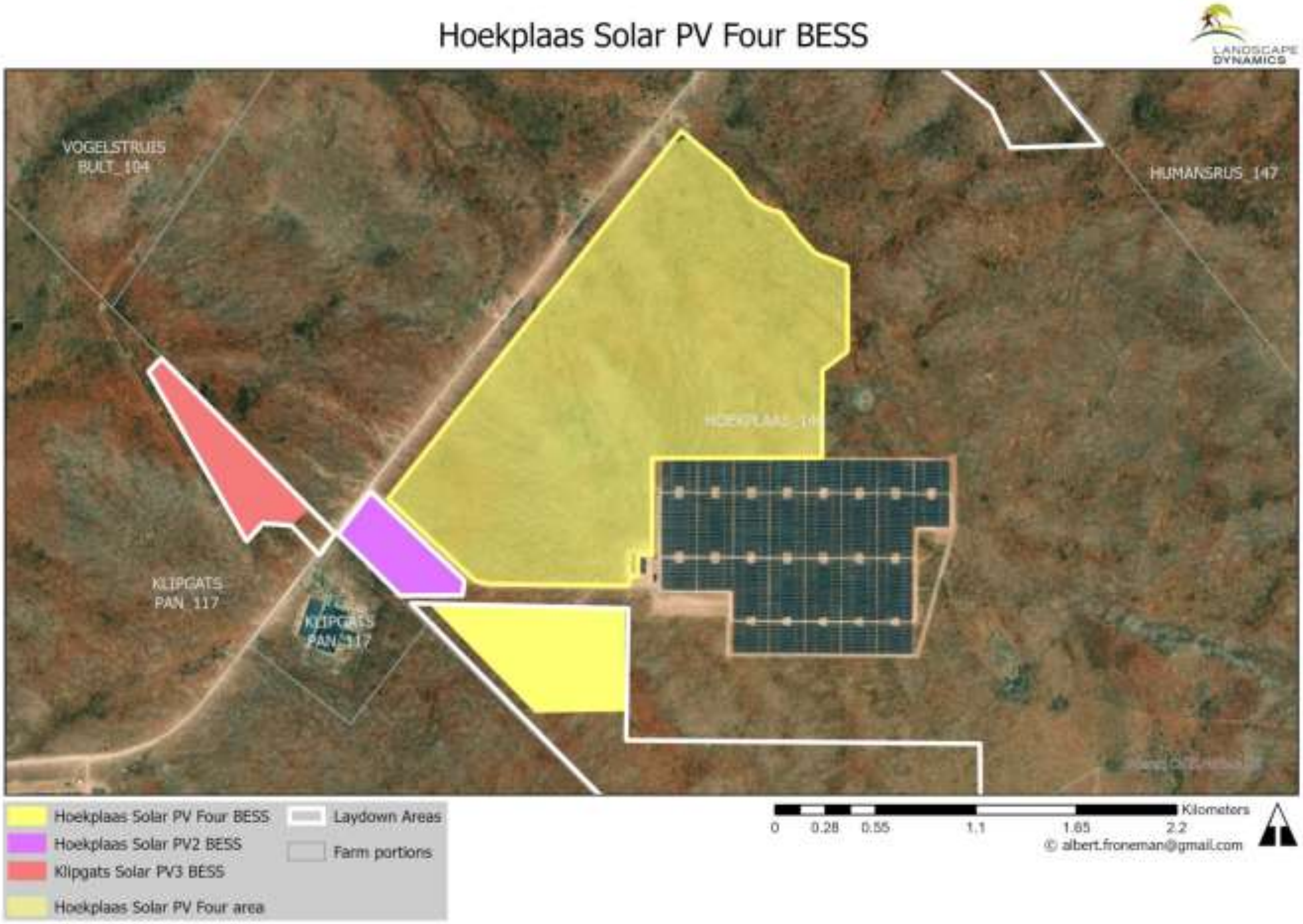
- the area is already authorised and therefore the site underwent a thorough site selection process;
- the area is already authorised and therefore the site underwent a thorough specialist assessment;
- the location it will not impact on the generation capacity of the PV plant; and
- it is situated in close proximity to the already authorised substation site; thereby addressing the technical requirement in the most effective manner.

The specialist studies further guided the site selection process. The specialists who conducted the respective studies-for this project confirmed that the proposed BESS site will not cause significant additional impact when situated within the laydown area at the sites as proposed. Where required, additional mitigation measures were provided.

Conclusion of Site Selection Process

There are no site specific attributes that should specifically be avoided and no additional mitigation measures are proposed that could influence the position of the proposed site.

Site map


Hoekplaas Solar PV Four BESS
LANDSCAPE DYNAMICS
VOGELSTRUIS BULT_104
HUMANSRUS_147
HOEKPLAAS_146
KLIPGATS PAN_117
KLIPGATS PAN_117
Hoekplaas Solar PV Four BESS
Hoekplaas Solar PV2 BESS
Klipgats Solar PV3 BESS
Hoekplaas Solar PV Four area
Laydown Areas
Farm portions
0 0.28 0.55 1.1 1.65 2.2
Kilometers
© albert.froneman@gmail.com

CHAPTER 2: NEED AND DESIRABILITY

2.1 Need and Desirability

2.1.1 Need

The following information was obtained from the applicant's report titled *Technical Engineering Report-Battery Energy Storage Systems: Analysis of the current state of electrical energy storage systems*, dated 5 August 2020 (Morse, WJ. 2020) and is attached as Appendix B.

Since solar and wind technology depend on whether the sun is shining or the wind is blowing respectively, these technologies can only address the electricity demand when these sources are available.

There is a growing need for renewable energy technologies, such as solar and wind, to be able to supply a reliable source of electricity to the grid. This more variable power generation pattern has significantly increased the need for flexibility in the electricity grid.

Battery Energy Storage Systems (BESS's) allow for fluctuating renewable energy sources to be utilised in a dispatchable manner, much like conventional thermal based generation systems. They also provide a means to de-couple generation of electricity from its use (i.e. provide electricity to the grid during peak demand in evenings) and therefore minimise supply and demand related issues.

Ultimately, energy storage can contribute to better use of renewable energy in the electricity system, lower cost of the overall energy mix and reduce harmful emissions since it can store clean renewable energy during low demands and replace fossil fuel based peaking stations usually limited to only high demand periods due to running costs.

The need for the project can further be justified when reviewing the South African **Integrated Resource Plan (IRP) 2019** which was gazetted by the Minister of Mineral Resources and Energy, Mr Gwede Mantashe, on 18 October 2019, updating the energy forecast for South Africa from the current period to the year 2030.

In summary, it is an electricity capacity plan which aims to provide an indication of the country's electricity demand, how this demand will be supplied and what it will cost. The IRP 2019 further states the following on renewables and energy storage:

- "South Africa continues to pursue a diversified energy mix that reduces reliance on a single or a few primary energy sources. The extent of decommissioning of the existing coal fleet due to end of design life, could provide space for a completely different energy mix relative to the current mix. In the period prior to 2030, the system requirements are largely for incremental capacity addition (modular) and flexible technology, to complement the existing installed inflexible capacity. "
- "Renewable Energy: Solar PV, and wind present an opportunity to diversify the electricity mix, to produce distributed generation and to provide off-grid electricity. Renewable technologies also present huge potential for the creation of new industries, job creation and localisation across the value chain. "
- "Energy Storage: There is a complementary relationship between Smart Grid systems, energy storage, and non-dispatchable renewable energy technologies based on wind and solar PV. The traditional power delivery model is being disrupted by technological developments related to energy storage, and more renewable energy can be harnessed despite the reality that the timing of its production might be during low-demand periods. "
- "Storage technologies, including battery systems, are developments which can address this issue, especially in the South African context where over 6 GW of renewable energy has been introduced, yet the power system does not have the requisite storage capacity or flexibility."

2.1.2 Desirability

The following tables address further issues as highlighted in the DEFF Need & Desirability Guidelines (2014).

Is this project part of a **national programme** to address an issue of national concern or importance?
The development was initially planned to be tendered into the REIPPP but is now being targeted for the Risk Mitigation Independent Power Producer Program RMIPPP which has been declared a strategic Infrastructure Program (SIP). Reliable, consistent power supply is a major concern in South Africa, and the project (if built) will contribute towards much needed additional electricity supply.

Do location factors favour this land use (associated with the development proposal) at this place? (This relates to the contextualisation of the proposed land use on the proposed site within its broader context.)
The proposed BESS development is perfectly situated because • *It is directly adjacent to the area where the electricity will be generated and* • *The site was thoroughly assessed by applicable specialists during the EIA process for the solar PV farm*

Will the development proposal or the land use associated with the development proposal applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?
The BESS proposal was assessed by the following specialists: • *Ecologist* • *Aquatic specialist* • *Ornithologist* • *Heritage consultant* • *Visual impact specialist* • *Consulting engineer (stormwater)* • *Chemical engineer (high level risk analysis)* *It was concluded that all impacts can be mitigated to acceptable levels and that the project could go ahead on condition that the Environmental Management Programme (EMPr) (attached as Appendix E) should be implemented at all times.*
Will the development impact on people's health and well-being (*e.g.,* in terms of noise, odours, visual character and 'sense of place'*, etc.*)?
Dust and noise will be created during the construction phase but mitigation measures are in place to minimise these temporary impacts. The development is situated on rural farm land which lowers the significance of impact associated with noise and dust. *The proposed BESS development will alter the visual character and sense of place in a negative way, but when seen in context with the, directly adjacent, authorised 75MW PV plant, as well as other existing operational large scale renewable energy project (wind and solar) in the broader area, the addition of the BESS will be acceptable in terms of visual impact.*
Is the development the best practicable environmental option for this land/site?
The, 'environment' should be seen as the sum total of one's surroundings, which include the natural, social and economic environments. Taking all constraints into account, the development as proposed underlines the principles as advocated by the term 'triple bottom line' (people, planet, profit) and this development proposal is in support of the goals of economic, social and ecological integration and sustainability.

What will the benefits be to society in general and to the local communities?
The BESS project will contribute to, amongst others, energy security and blackout relief, benefiting the entire South Africa. Temporary and permanent employment opportunities will be created and the work force will as far as possible be sourced from the local communities.
Will the benefits of the proposed land use/development outweigh the negative impacts of it?
Negative impacts associated with the proposed development could be mitigated to levels that will be acceptable within the receiving environment. The positive impact of energy security, blackout relief, increase capacity, reduction in the need to use diesel and other fossil fuels for peaking and baseload power far outweighs the negative impact that this project could have.
Describe how the **general objectives of Integrated Environmental Management** as set out in Section 23 of the NEMA have been taken into account:
Current procedures and/or organisational structures are not necessarily achieving integrated decision-making and/or co-operative governance and, as a result, there is a failure to properly achieve the objectives of IEM as set out in Section 23 of NEMA. EIA's however often focus on the immediate harm a project will cause rather than any benefits it might create in the long term to sustainable development. *The stated objectives of Section 23 are to ensure integrated decision-making and co-operative governance so that NEMA's principles and the general objectives for integrated environmental management of activities can be achieved. The goals are to* *a) promote the integration of the principles of environmental management set out in section 2 into the making of all decisions which may have a significant effect on the environment;* *b) identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2;* *c) ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them;* *d) ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment;* *e) ensure the consideration of environmental attributes in management and decision-making which may have a significant effect on the environment; and* *f) identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in section 2.*

For this project the following actions were taken to reach the general objectives of Integrated Environmental Management as set out in Section 23 of NEMA:

a) *Applicable environmental, economic and social aspects have been assessed, thereby ensuring an integrated approach in order to balance the needs of all whom would be affected by this development.*
b) *Mitigation measures have been supplied in the EMPr in order to ensure that all identified impacts are mitigated to acceptable levels.*
c) *The EA amendment proposal has to be evaluated and approved by DEFF and no construction may commence prior to the issuing of the Environmental Authorisation.*
d) *The procedures which are followed during the public participation programme are based on the NEMA EIA Regulations 2014, as amended.*
e) *DEFF will take all information as represented in this report into consideration and may request further information should they feel that further studies/information is required before an informed decision can be made.*
f) *The project team (inclusive of the specialists) is confident that the mitigation measures as supplied in the EMPr are reasonable and will be the best way to manage anticipated impacts.*

Describe how the principles of environmental management as set out in Section 2 of the NEMA have been taken into account

Chapter 2 of NEMA provides a number of principles that decision-makers have to consider when making decisions that may affect the environment, therefore, when a Competent Authority considers granting or refusing environmental authorisation based on an Environmental Impact Assessment, these principles must be taken into account.

The NEMA principles with which this application conforms are described as follows —

1. *Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.*
2. *Development must be socially, environmentally and economically sustainable.*
3. *Sustainable development requires the consideration of all relevant factors.*

The social, economic and environmental impacts of activities, including disadvantages and benefits, were considered, assessed and evaluated, and informed decision-making by the authority is hereby made possible.

CHAPTER 3: ADVANTAGES AND DISADVANTAGES

3.1 Advantages associated with the BESS

The main advantage of a BESS as an ancillary facility to a renewable energy generation project is obvious in terms of long term impact on the environment, as much less pressure on non-renewable energy sources will occur.

The following information was obtained from the applicant's report titled *Technical Engineering Report-Battery Energy Storage Systems: Analysis of the current state of electrical energy storage systems*, dated 5 August 2020 (Morse, WJ. 2020) and attached as Appendix B.

A Battery Energy Storage System (BESS) is a set of technologies which aim is to decouple energy generation from demand. The systems allow for excess electricity to be "stored" and released during periods of high electricity demand, providing cost-saving opportunities to consumers, and ensuring a steady and safe electricity supply.

BESS are flexible and can be used in many different ways, from ensuring energy security to blackout relief, including to energy arbitrage. Specifically, the adoption of energy storage could offset the need to use diesel and other fossil fuels for peaking and baseload power, provide backup power for commercial and industrial operations during blackouts, and increase the capacity of South Africa's electricity grid to successfully integrate renewable electricity generation sources, especially intermittent power sources such as solar and wind.

By adopting BESS on a commercial scale, the System Operator can decrease its energy imports, improve the efficiency of the energy system, and keep prices low by better integrating variable renewable energy sources.

Based on both a global shift to this form of clean energy or supply mix as well as the critical state of the South African electrical supply, incorporating BESS into renewable energy developments offers a unique solution which addresses one of the country's most critical issues, being an electricity supply deficit, that is hindering stimulus and investment solutions urgently needed in post COVID-19 economic recovery plans.

Bulk Energy Services are supplied by the BESS and can be describe as follows:

Time-shifting of electric energy (arbitrage)
Energy is stored at times of the day when electricity is in less demand and therefore less valuable (typically during night time hours) to allow the subsequent production and sale of electricity to the market at peak times when it is more valuable.

Schedulable Capacity
Stored energy is used to meet generation requirements during peak electricity consumption hours allowing grid operators and utilities to meet demand while incrementally deferring or reducing the need for new generation capacity.

Re-dispatch (> 15 min reserves)
Stored energy is used to serve load immediately in response to an unexpected contingency event, such as an unplanned generation outage or increased demand for periods longer than 15 minutes.

Other applications include Ancillary Services (frequency and voltage support, bottleneck management / congestion relief and back-start capabilities) Grid infrastructure (transmission and distribution upgrade deferrals) and Customer Energy Management Services (power quality and reliability as well as energy and demand charge management).

In summary, the BESS will allow the approved PV project to be more reliable and efficient, thereby assisting the project to provide clean renewable power to the electricity mix, thereby reducing the use of carbon-based non-renewable electricity and thus ultimately assisting in mitigating the negative effects of climate change.

3.2 Disadvantages / risks associated with the BESS

From an environmental perspective, the proposed amendment to include BESS in the project description of the already authorised PV plant will have very few disadvantages/risks. The specialists' studies obtained have shown that the BESS will not result in any new impacts (apart from a new low visual impact) that were not already assessed in the EIA for the solar PV plant. The only potential disadvantages or risks, relate more to potential safety risks.

The information below was derived from the *Safety Health and Environmental Risk Assessment* undertaken for this project by ISHECON Chemical Process Safety Engineers. The study is attached as Appendix C6.

Risks associated with the proposed BESS

- At a large BESS facility, such as those proposed, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest international standards for containerised battery designs include many preventative and mitigation measures to reduce these risks to tolerable levels.

- The most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases.
- This type of event also generates heat which may possibly propagate the thermal runaway event to neighbouring batteries if suitable state of the art technology is not employed.
- The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other parts of the installation.
- If the flammable gases accumulate within the container before they ignite, they may eventually ignite with explosive force.
- Due to a variety of causes, thermal runaway could happen at any point on route to the facility, during construction or operation / maintenance at the facility or during decommissioning and safe-making for disposal.
- Due to the containerized approach as well as the separation between containers and therefore the likely restriction of events to one container at a time, the main risks are close to the containers i.e. to transport drivers, employees at the facilities and first responders to incidents.
- In terms of a worst conceivable case container fires, the significant impact zone should be limited to within 10m of the container and mild impacts to 20m. **Impacts in the public areas such as on the road R357 are not expected.**
- In terms of a worst conceivable case explosion, the significant impact zone should be limited to with 10m of the container and minor impacts such as debris within 50m. **Impacts in the public areas such as on the road R357 are therefore not expected.**

In terms of a worst reasonably conceivable toxic smoke scenario, provided the units are placed suitably far apart to prevent propagation from one unit to another and large external fires are prevented, the amount of material burning should be limited to one container at any one time. In this case, beyond the immediate vicinity of the fire, the concentrations of harmful gases within the smoke should be low. **Therefore, the risks posed by BESS facilities to the occupied residential or industrial areas of Prieska or Copperton are negligible. Risks on the road R357 are low, although the road may need to be closed to traffic if there is noxious smoke blowing across the road.**

Regarding the disadvantages as mentioned above, the Risk Assessment concluded that the latest international standards (IEC, UL NPA etc.) for battery designs include **many preventative and mitigation measures to reduce these risks to tolerable levels.**

The risk assessment concluded that with suitable preventative and mitigation measures in place none of the identified potential risks are high, i.e. from a SHE perspective no fatal flaws were found with the proposed BESS installations.

CHAPTER 4: SPECIALIST INPUT

4.1 Specialist studies: Amendment Letters

The specialists mentioned below conducted the studies during the EIA process for the 75MW Hoekplaas Solar PV4 Energy Plant. Since the proposed BESS site falls within the authorised laydown area, the specialists were requested to compile amendment letters with the following Terms of Reference:

- Compile a statement confirming if additional impact that was not assessed in the original studies is foreseen and if so, to provide mitigation measures for inclusion in the EMPr – keeping in mind that the BESS will be constructed within the authorised (and therefore assessed) laydown area. However, the laydown area would only be used during the construction period so the impact would have been temporary but, with the new BESS the impact will be permanent.
- Provide a new impact rating, if required, considering the additional BESS component.

4.1.1 Avifauna

An amendment letter was compiled by Mr Andrew Jenkins from Avisense Consulting and is attached as Appendix C1. A summary thereof follows below.

INCLUSION OF THE BESS

The inclusion of the BESS equipment will increase the destructive footprint by about 8% and may add marginally to the disturbance impacts associated with both construction and operation of each plant. However, noting that the final approved development area covered by the existing authorisation is about 70% smaller than the area assessed in the corresponding bird impact study, ***any changes in the impact profiles of the three developments at the farm Hoekplaas would effectively be rendered negligible***.

FINDINGS OF PRE- AND POST CONSTRUCTION MONITORING

Although the addition of the BESS to the project components will have a negligible impact on the avifauna of the area, Avisense Consulting used this opportunity to provide new impact assessment tables due to information derived from the pre-construction bird monitoring study conducted for the inclusive Hoekplaas solar PV development area, and the post-construction bird study for PV1. The new impact assessment tables revise the impact ratings for Hoekplaas PV2-PV10 (or, in this instance, PV2-PV4).

The net result is that the revised impact ratings for the PV2-PV4 projects (both pre-mitigation and residual impacts) have been stepped up to reflect an increased risk of significant impacts on populations of threatened species.

Impact	Pre-mitigation	Residual (post-mitigation)
Construction Phase		
Habitat loss	Medium	Medium
Disturbance	High	Medium-High
Operation Phase		
Habitat loss & disturbance	High	Medium-High
Mortality	Medium-High	Low-Medium
Decommissioning Phase		
Disturbance	Medium-High	Medium

The above tables reflect the most recent and comprehensive data available on the birdlife of the receiving environment. This emphasises the need to apply mitigation already stipulated in the original EIA and/or referred to in either the pre- or post-construction bird studies.

In conclusion it is stated that changes in the impact profiles to the three developments at the farm Hoekplaas due to the addition of the BESS would effectively be rendered negligible.

4.1.2 Aquatic

An amendment letter was compiled by Mr James MacKenzie from MacKenzie Ecological & Development Services and is attached as Appendix C2. A summary thereof follows below.

No-Go areas

The spatial layout in relation to previously delineated No-Go areas is shown in Figure 1. Two No-Go areas are shown below in proximity to the BESS laydown area:

1. A small endorheic pan, extremely ephemeral, grass covered centre with shrub (mostly *Lycium cinereum*) boundary. Some *Prosopis glandulosa* present.
2. A drainage area that clearly channels flowing water during rain events. Vegetation composition and structure is different from upland area with a higher grass abundance and individual *P. glandulosa* along its route. Slight erosion and sediment movement is evident from past flows. The closest average distance from the boundary of the BESS (laydown) area to No-Go areas is 680m for the pan and 500m for the drainage channel.

Spatial layout of the proposed BESS in relation to previously delineated No-Go areas (red)

Potential Impacts and Mitigations

The proposed BESS installation will result in additional hardened surfaces such as roofing, paved areas, servitudes and roadways. These areas result in accelerated and altered flow/dispersal of rainfall when events do occur. That, together with general washing and day-to-day activities will likely result in additional runoff. Such runoff has the potential to erode surface water features such as the pan in question and also to alter the hydrological character of features e.g. the pan is currently ephemeral and should remain as such. As such, stormwater, as well as any waste water, should be channelled, collected and managed in such a way as not to enter or erode any previously delineated No-Go areas. **If runoff from BESS installations and operations is effectively managed, then no additional impacts to surface water features (previously delineated No-Go areas) is likely.** *Note from EAP: Storm water management is being addressed by Zutari (civil engineers) and described in paragraph 4.1.4 below*

In addition, previous mitigations still apply e.g.:

1) Use of erosion control measures to minimise erosion at excavation / clearing sites or aggregate storage sites and during operations. Earth moving construction activities to take place in dry season as far as possible.
2) Removal of perennial alien species such as *Prosopis glandulosa* at sites disturbed or cleared by construction activities. Care should be taken not to introduce additional seed or propagules of alien species that may be present in aggregates brought to site. This mitigation is already in force at the previous laydown area which is now the proposed BESS site.

   Note from EAP: these mitigation measures have been included in the original EMPr.

Conclusion

The proposed installation and operation of the BESS does not present direct impact probability to previously delineated No-Go areas (surface water features). However indirect impacts may exist depending on final and actual proximity to features such as the ephemeral pan. As such mitigation measures have been outlined to prevent erosion into / of surface water features or alteration of their hydrological character by employing effective storm and waste water management. **With mitigation in place additional foreseeable impacts are minimal.**

4.1.3 Flora

An amendment letter was compiled by Mr Dave McDonald from Bergwind Botanical Surveys and is attached as Appendix C3. A summary thereof follows below.

The vegetation at the farm Hoekplaas is Bushmanland Basin Shrubland and is an extensive vegetation type. It is not sensitive in the area approved for the solar PV installation and **it is envisaged that there would be no further negative impact associated with the construction of the BESS.**

Alien invasive vegetation was found at the agricultural watering points, near the site of the proposed PVSEF installation, in the original botanical survey. It is possible that due to disturbance, exotic invasive mesquite (*Prosopis glandulosa* var. *torreyana*) could be introduced to the site of both the solar PV as well as the BESS. This possibility must be carefully monitored, and these plants should be carefully removed should they appear. There is also a good chance that the disturbance would favour indigenous pioneer plants such as *Tribulus terrestris* (dubbeltjie). Control of this herbaceous ground-creeper using chemical herbicide may be necessary since it produces thorny fruits that are undesirable in a working environment. Such measures should be included in the EMPr. *Note from EAP: These mitigation measures have been included in the updated EMPr.*

4.1.4 Heritage

An Amendment Letter was compiled by Mr John Gribble from ACO Associates and is attached as Appendix C4. A summary thereof follows below.

The integrated Heritage Impact Assessment (HIA) considered archaeological heritage resources, the historical built environment, cultural landscapes, scenic routes, sense of place and graves.

Findings of the 2012 studies

The Hoekplaas HIA assessed two proposed PV site alternatives on the farm: Alternative 1 approximately 1 km to the southeast of the R357 and now the site of Hoekplaas PV4, and

Alternative 2, located directly alongside and to the northwest of the road, within which Hoekplaas PV2 and PV3 are now authorised. The findings of the HIA were:

Archaeology

- A background scatter of Early Stone Age (ESA) and Middle Stone Age (MSA) artefacts was found across the farm. This material was assessed to be of very low significance;
- Several discrete Later Stone Age (LSA) sites were found focused around the central pan adjacent to the eastern boundary of the authorised PV4 site; and
- A quarried pan located between the northern tip of the PV4 site and the R357 revealed a buried MSA site with at least one animal tooth preserved. The discovery of this site bears out evidence from further north in Bushmanland that important subsurface archaeological material can be expected close to the margins of pans.
- The HIA found that the LSA sites and buried MSA sites are of significance and would require mitigation should they be under threat. Both pans and their associated sites were subsequently excluded from the area chosen for and authorized as Hoekplaas PV4.

Built Environment

- Buildings or structures were not noted on the subject farm portion.

Cultural landscapes

- Only one cultural landscape was noted by the Hoekplaas HIA and it was assessed to be of very low significance. It comprised of an ephemeral pan with gum trees, a windmill, water troughs and an old cement dam alongside it located to the southeast of the PV4 site. All these elements are likely 20th century in age.

Scenic Routes and Sense of Place

- The HIA found that visual impacts to scenic routes and sense of place would be limited for Alternative 1 (the preferred layout) due to the topography of the site. Alternative 2 would result in more significant impacts due to its proximity to the R357 but these were somewhat offset by the existing abandoned mining infrastructure visible in the landscape to the northwest.

Graves

- No graves were reported by the HIA.

Assessment of impacts

The following assessment of impacts on heritage resources was made:

- The impacts to heritage resources were not considered to be highly significant provided the mitigation measures recommended in the HIA are implemented;
- Impacts of visual concern were rated as medium or low significance for the various site alternatives and no mitigation measures were suggested.

Mitigation measures proposed

The following heritage mitigation measures were proposed

- If development comes within 100m of any of the pan margins, test excavations around the pans should be done to check for buried archaeological material;
- The tower positions of the transmission lines should stay at least 100m away from the edge of any pans implicated in the final route; and
- If any human remains are uncovered during development, then work in the immediate vicinity should be halted and the finds protected and reported to the South African Heritage Resources Agency.

  Note from EAP: Applicable mitigation measures have been included in the updated EMPr

Heritage Impact Statement for the BESS

The BESS will be installed within the footprint of the areas that were subject to heritage impact assessment as part of the 2012/2013 EIA process. **No heritage resources identified by the HIA are located within the proposed development site.**

Furthermore, the laydown area does not appear to be associated with pans or koppies, which the HIA indicated were the focus of particularly LSA and, to a lesser extent, MSA sites. Thus, were archaeological material to be present in the laydown area, it is likely to comprise of the decontextualized background scatters of ESA and MSA artefacts reported by the HIA as occurring widely across the farms.

The installation of a BESS at the proposed site will occasion no changes to heritage resources, provided the mitigation measures recommended in the HIA are implemented.

With regard to cultural landscapes, scenic routes and sense of place, the development site is in a flat and largely featureless open area of the landscape, and is close to the R357. Their proximity to existing industrial features in the landscape – the Kronos substation and two nearby PV facilities will do much to mitigate their impact but they do have the potential to have a visually intrusive in the surrounding rural landscape.

The impact significance of the installation of the BESS on scenic routes and sense of place is medium (negative) **but this impact can be reduced significantly if BESS units are installed without stacking.**

From a heritage resources perspective, the proposed amendments to the environmental authorisations Hoekplaas PV4 facility are considered acceptable.

4.1.5 Stormwater Management Plan

An Amendment Letter was compiled by *Zutari (previously Aurecon) (Mr Martin Kleynhans)* and is attached as Appendix C5. A summary thereof follows below.

The study done for the original EIA process indicated that there would be increases in stormwater runoff in the catchments due to the proposed developments by 25% for the 1:20 year peak flow. The increased runoff and associated flooding and erosion potential can be mitigated by using detention ponds to attenuate peak flows, the inclusion of multiple stormwater outlets and energy dissipaters to spread flow across the landscape, where appropriate. Once a detailed survey and design of the stormwater infrastructure has been undertaken, it may be found that there is a need for on-site attenuation of the flood peak for the volume that exceeds the predevelopment flow especially where increased runoff in the downstream watercourse could cause increased flooding, excessive erosion, impact downstream dwellings, sensitive ecological areas, road crossings and other infrastructure. Furthermore, when a detailed survey for the site is available the catchment area of the two endorheic pans identified by the freshwater specialist should be delineated and the PV facilities should be placed outside of their catchment area.

Presumably the BESS platforms will be gravelled or paved with an appropriate storm water drainage system included, so that the batteries can be housed and maintained in an orderly fashion. Hence the permeability of the BESS platforms will be lower, and the runoff higher, than that of the natural predevelopment landscape or the equivalent solar PV area which may have alternatively been constructed on the in-situ soil.

It was estimated that the runoff coefficient (Rational Method C-value, which defines the proportion of the rainfall that will runoff during the design storm causing the flood downstream) for the 1:5 year return period event, would be 0.14 for the predevelopment state of the sites while the runoff coefficient for the sites developed with solar panels would be 0.29. For the 1:20 year return period, the C- value for the predevelopment state of the sites was estimated to be 0.16 and for the development with PV panels the C-value would be 0.20.

If the BESS platform area is surfaced with compacted gravel or paved, then the runoff coefficient could increase to a value of the order of 0.75. This suggests an increase in the runoff peaks by a factor of about five over the predevelopment state, and by a factor of between two and four for the alternative development state with PV panels. Thus, a significant increase in runoff peaks compared to the predevelopment state can be expected; an increase which will also be larger than if the same area had been developed with solar PV panels. Similarly, the runoff volumes can also be expected to increase.

The increased peak runoff could cause increased flooding, erosion, impact dwellings, sensitive ecological areas, road and railway crossings and other infrastructure downstream. Additionally, the increased runoff volumes from developed sites could cause elevated flood levels in endorheic pans downstream.

These impacts can however be mitigated to any desired return interval through the inclusion of the measures detailed in the original hydrology report including attenuation (detention) ponds to reduce the peak runoffs back to the predevelopment levels at the desired flood return interval before they exit the sites; and for the catchments of endorheic pans where increased flood levels in the pans may be unacceptable, diversion of excess stormwater flows into adjacent catchments together with detention facilities where needed, or alternatively the provision of enlarged detention facilities to store excess volumes on site. If desired and where this is acceptable environmentally, flows could be diverted into pan catchments for groundwater recharge as was suggested in the original hydrology report. The design of these measures can be undertaken during the detailed design phase.

The proposed amendment would have a marginal effect on the impact profile from a stormwater runoff perspective, a review of the assessment is deemed to not be required and the proposed amendment would not materially change the impacts already identified for the development.

4.2 Specialist studies: Impact Assessments

4.2.1 Visual Impact Assessment

A Visual Impact Assessment (VIA) was undertaken by *VRM Africa (Mr Steven Stead)* and is attached as Appendix C6. A short summary thereof follows below.

Landscape Context

- Surrounding land use is agricultural, predominantly pastures for sheep farming
- The R357 National Road and Copperton Road
- The Cuprum Substation was built to serve Copperton Mine and still operates together with Kronos substation, located adjacent to the proposed BESS site. There are existing powerlines that run through the area.
- The topography is made up of flat plains of the Nama Karoo plains, with a few ridges sporadically seen within the landscape.

A factor that is increasingly influencing the regional landscape character is the recognition of the area around Copperton as an important solar and wind renewable energy location. The property is situated within visual proximity of the Kronos Substation, located several kilometres to the south of the property. This creates vertical features in the landscape.

Given the prevalence for wind and solar energy projects in the area, some of which have already been awarded environmental authorisation, it is likely that the area will undergo a change to the current landscape character. As the area is strongly associated with the existing Copperton Mine tailings storage facility (TSF), the Kronos substation and numerous Eskom powerlines and is not associated with any landscape-based tourism, the suitability of using the site as a node for energy development increases.

Project Zone of Visual Influence

The viewshed analysis is undertaken to determine the extent to which the proposed landscape change would be visible to the surrounding areas. This mapping exercise is used to determine the human receptors located within the project zone of visual influence, as well as to define the significant visual resources that could be influenced by the proposed landscape modification.

Viewshed Map (Green area depicting visual incidence)

As can be seen from the viewshed, the outer extent where the project is likely to be visible is 10km, but with larger expansion to the areas to the north and west in the mid ground/ background distance. Within the fore-ground, only a small area of visual incidence exists, localising the actual zone of visual influence. The location of the Hoekplaas PV4 and surrounding proposed renewable energy sites will further visually obscure the BESS structures once the 3.5m high PV panels are constructed.

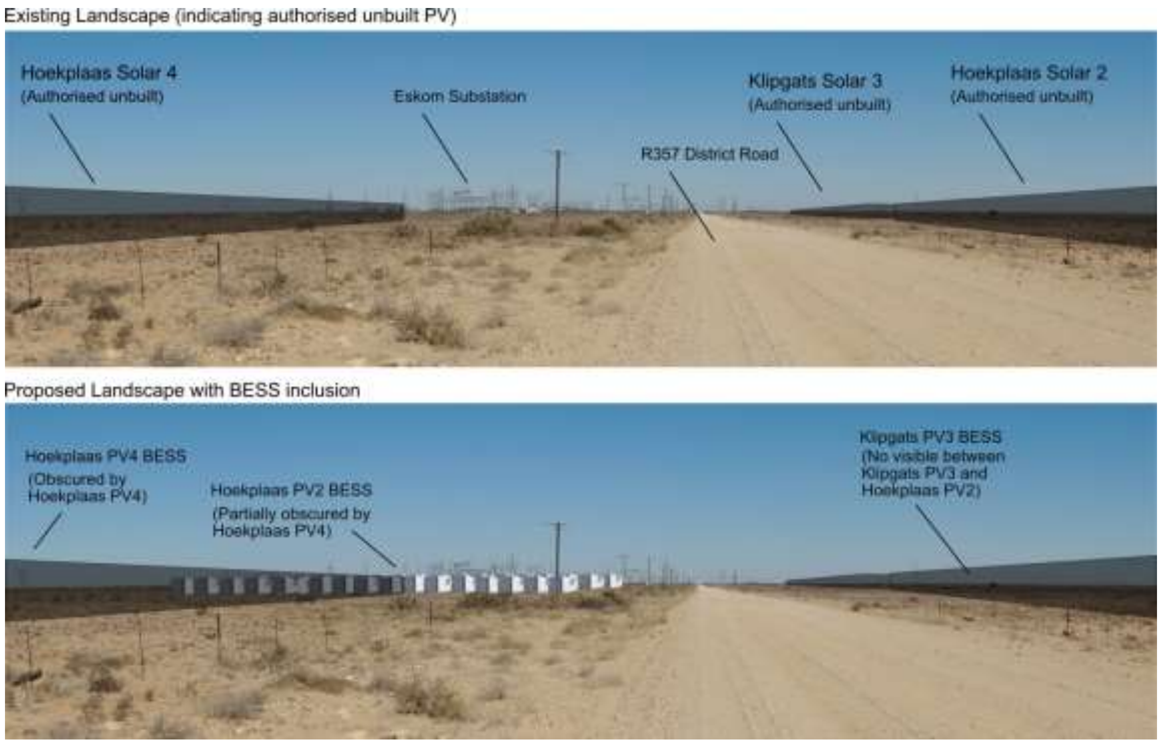
Receptors and Key Observation Points

As identified in the viewshed mapping exercise, the proposed development zones of visual influence does not include sensitive receptors. This is due to the remoteness of the site, as well as the sporadic ridges of the terrain that topographically screens the 3m high BESS structures. The nearest receptors are the R357 Regional Road Westbound and Copperton Mine users. As there are local scenic resources or associated tourist related activities and with the mine receptors being unlikely to be sensitive to landscape change, receptor sensitivity to landscape change is rated Low.

Impact Assessment

Due to the remoteness of the locality, no significant receptors were identified within the project Zone of Visual Influence. As such, a contrast rating exercise was not undertaken, and *only Landscape impacts will be assessed*.

While the adjacent receptors are rated as having a Low sensitivity to landscape change, the landscape character could also be influenced by the construction of the BESS structure in close proximity to the road. The following photomontages depict the expected change to the local landscape.



Existing landscape and proposed landscape change reflected as a photomontage

Conclusion

Due to the relative remoteness of the locality and some topographic screening, no sensitive receptors were identified for the site. As such, Visual Exposure to the proposed BESS is rated **High**, but Sensitivity to landscape change for the BESS project is defined as ***Low***. Based on the VRM methodology, the Scenic Quality of the area is defined as ***Low***.

There is a good policy fit for the PV project as the region already depicts a number of large-scaled renewable energy projects that define the sense of place. The sense of place is also degraded by the close proximity or the Copperton tailings storage facility.

Thus, the findings of this visual statement are that ***the BESS development for Hoekplaas Solar PV4 is unlikely to result in the loss of significant visual and scenic resources, and as such could be allowed to proceed***.

4.2.2 High Level Risk Assessment

A *Safety Health & Environmental Risk Assessment* was undertaken by ISHECON Chemical Process Safety Engineers. The study is attached as Appendix C7 and a short summary thereof follows below.

Risks

This assessment of risk comprises:

- Identification of the likely hazards and hazardous events related to the operation of the installation using a checklist approach.
- Estimation of the likelihood/probability of these hazardous events occurring
- Estimation of the consequences of these hazardous events.
- Estimation of the risk and comparison against certain acceptability criteria.

The facility and the project were divided into the sections/phases and using a checklist approach the hazards in each section/phase were identified. Each identified hazard was then analysed in terms of causes, consequences, expected and suggested preventive and mitigation measures to be in place.

Each hazard was qualitatively assessed using a qualitative risk ranking system applied widely in industry and finally, a very rough approximation of the probable impact zones for fires, explosions and toxic gas releases from thermal run-away events at the batteries as well as an approximation of the risks levels was undertaken using DNV-GL software PHAST RISK 6.7.

Findings

The findings as mentioned below are also provided in Chapter 3, paragraph 3.2 and are repeated for ease of reference.

The tables in Chapter 6: Impact Assessment contain all the recommendations. Below are a few extracted items that are possibly of highest risks and therefore a priority.

- At a large BESS facility, such as those proposed, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest containerised battery designs include many preventative and mitigation measures to reduce these risks to tolerable levels.
- The most significant hazard with battery units is the possibility of thermal runaway and the generation of toxic and flammable gases.
- This type of event also generates heat which may possibly propagate the thermal runaway event to neighbouring batteries if suitable state of the art technology is not employed.
- The flammable gases generated may ignite leading to a fire which accelerates the runaway process and may spread the fire to other parts of the installation.
- If the flammable gases accumulate within the container before they ignite, they may eventually ignite with explosive force.

- Due to a variety of causes, thermal runaway could happen at any point on route to the facility, during construction or operation / maintenance at the facility or during decommissioning and safe-making for disposal.
- Due to the containerized approach as well as the separation between containers and therefore the likely restriction of events to one container at a time, the main risks are close to the containers i.e. to transport drivers, employees at the facilities and first responders to incidents.
- In terms of a worst conceivable case container fires, the significant impact zone should be limited to within 10m of the container and mild impacts to 20m. **Impacts in the public areas such as on the road R357 are not expected.**
- In terms of a worst conceivable case explosion, the significant impact zone should be limited to with 10m of the container and minor impacts such as debris within 50m. **Impacts in the public areas such as on the road R357 are therefore not expected.**

In terms of a worst reasonably conceivable toxic smoke scenario, provided the units are placed suitably far apart to prevent propagation from one unit to another and large external fires are prevented, the amount of material burning should be limited to one container at any one time. In this case, beyond the immediate vicinity of the fire, the concentrations of harmful gases within the smoke should be low. **Therefore, the risks posed by BESS facilities to the occupied residential or industrial areas of Prieska or Copperton are negligible. Risks on the road R357 are low, although the road may need to be closed to traffic if there is noxious smoke blowing across the road.**

Regarding the disadvantages as mentioned above, the Risk Assessment concluded that the latest international standards (IEC, UL NPA etc.) for battery designs include **many preventative and mitigation measures to reduce these risks to tolerable levels.**

The risk assessment concluded that with suitable preventative and mitigation measures in place none of the identified potential risks are high, i.e. from a SHE perspective no fatal flaws were found with the proposed BESS installations.

Recommendations

The following recommendations are applicable and have been included in the updated EMPr:

- There are numerous different battery technologies, but using one consistent battery technology system in Prieska would allow for easy of training, maintenance, emergency response and could significantly reduce risks in a remote location.
- Due to the large size of the Prieska BESS installations the risks posed to employees and emergency first responders can be significant if the state-of-the-art containerized battery technology is not used.
- Prior to bringing any battery containers into the country:
    - An Emergency Response Plan should be in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and

once they are installed and operating.

    - An End-of-Life plan should be in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, module and containers.

- The site layout and spacing between the containers should mitigate the risk of a fire or explosion event spreading from one container to another.

- Under certain weather conditions, the noxious smoke from a fire in a battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. It may be necessary to close the road R357 to traffic if there is a fire blowing noxious smoke across the road.
- This risk assessment should be updated once the technology has been chosen and more details are available.

Further mitigation measures as well as preventative measures are provided in Chapter 6. These recommendations are also included in the updated EMPr.

CHAPTER 5: PUBLIC PARTICIPATION

5.1 Objectives of the Public Participation Programme

The main aim of public participation is to ensure transparency throughout the environmental process. The objectives of public participation are the following:

- To identify all potentially directly and indirectly affected stakeholders, government departments, municipalities and landowners;
- To communicate the proposed project in an objective manner with the aim to obtain informed input;
- To assist the Interested & Affected Parties (IAPs) with the identification of issues of concern, and providing suggestions for enhanced benefits and alternatives;
- To obtain the local knowledge and experience of IAPs;
- To ensure that all reasonable alternatives are identified for assessment.
- To communicate the proceedings and findings of the specialist studies;
- To ensure that informed comment is possible;
- To ensure that all concerns, comment and objections raised are appropriately and satisfactorily documented and addressed.

5.2 Public Participation Process Followed

Interested & Affected Parties Register

Significant measures were taken to ensure that all stakeholders that could have been affected or have an interest in this project were identified. The IAP Register (attached as Appendix D4) consists of directly and indirectly affected landowners, stakeholders and government departments.

Newspaper advertisement

A combined newspaper advertisement advertising the 5x sites as explained in Chapter 1 will be placed in a local newspaper when the report has been distributed for public comment. Proof thereof will be provided in the Final Motivational Report.

Onsite notices

An onsite notice was placed on 20 August 2020 at the entrance to the site next to the R357 road as well as at the Kronos Substation. Photographs thereof follow on the next page.

Onsite notice at the entrance to the Hoekplaas PV4 site next to the R357 road

Onsite notice at the Kronos Substation

Distribution of the Draft Motivational Report

The Draft Motivational Report (this document) will now be distributed to everybody on the IAP Register. Proof thereof will be submitted in the Final Motivational Report.

The EA Amendment Application Form and Motivational Report will be submitted to DEFF for registration of the project and their comment on the project.

Final Motivational Report

Comment received on the Draft Motivational Report will be included in the Final Report and submitted to DEFF for their approval and amendment of the Environmental Authorisation. The IAPs will be informed of their right to appeal DEFF's decision.

CHAPTER 6: IMPACT ASSESSMENT

6.1 Impact assessment and Mitigation Measures

6.1.1 Specialist studies where new mitigation measures were not proposed

The following specialists (refer to Chapter 4) confirmed that the BESS as proposed will not create additional impact that was not assessed during the EIA process for the 75MW solar PV plant and additional mitigation measures for the inclusion in the updated EMPr were not proposed. For ease of reference, the following conclusions apply:

Avifauna

The impact the BESS will have on the avifauna in the area is negligible and there are no additional mitigation requirements to add to the existing EMPr due to the addition of the BESS component.

Aquatic

The proposed installation and operation of the BESS does not present direct impact probability to previously delineated No-Go areas (surface water features). With mitigation in place additional foreseeable impacts are minimal.

Storm water management

The proposed amendment would have a marginal effect on the impact profile from a stormwater runoff perspective, a review of the assessment is deemed to not be required and the proposed amendment would not materially change the impacts already identified for the development.

6.1.2 Specialist studies where new mitigation measures have been proposed

The mitigation measures as mentioned below have been included in the updated EMPr.

Flora

It is possible that due to disturbance, exotic invasive mesquite (*Prosopis glandulosa* var. *torreyana*) could be introduced to the site of both the solar PV as well as the BESS. This possibility must be carefully monitored, and these plants should be carefully removed should they appear. There is also a good chance that the disturbance would favour indigenous pioneer plants such as *Tribulus terrestris* (dubbeltjie). Control of this herbaceous ground-creeper using chemical herbicide may be necessary since it produces thorny fruits that are undesirable in a working environment. Such measures should be included in the EMPr.

It is envisaged that there would be no further negative impact associated with the construction of the BESS.

Heritage

The installation of the BESS at the location proposed will occasion no changes on heritage resources, provided the mitigation measures recommended in the HIA are implemented. The following mitigation measures have been included in the updated EMPr:

- If development comes within 100m of any of the pan margins, test excavations around the pans should be done to check for buried archaeological material.

Visual Impact Assessment

The following landscape impacts were identified as having a likelihood of occurring during the construction and operation of the proposed BESS project.

- Construction Phase
  - Loss of site landscape character from the removal of vegetation and the construction of the BESS structures and associated infrastructure;
  - Wind-blown dust due to the removal of large areas of vegetation;
  - Possible soil erosion from temporary roads crossing drainage lines;
  - Windblown litter from the laydown and construction sites.

- Operation Phase
  - Light spillage making a glow effect that would be clearly noticeable to the surrounding dark sky night landscapes to the north of the proposed site;
  - Massing effect on the landscape from a large-scale modification;
  - On-going soil erosion;
  - On-going windblown dust.

- Decommissioning Phase
  - Movement of vehicles and associated dust;
  - Windblown dust from the disturbance of cover vegetation / gravel.

- Cumulative Impacts
  - A long-term change in land use setting a precedent for other similar types of solar and wind energy projects.
  - Loss of scenic resources located on the adjacent property to the west that could influence future eco-tourism opportunities in this area.

Impacts Ratings Table

Nature: Change of local and surrounds visual resources due to the construction and operation of the proposed (2.5m high) structures, and buildings.		
	Without mitigation	**With mitigation**
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Medium	Low
Probability	Probable	Probable
Significance	**Medium to Low**	**Low**
Status (positive or negative)	Negative	Negative
Reversibility	Possible	Possible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes
Impact Motivation • The proposed BESS development footprint area does not contain any significant visual resources or topographic prominence. • The area is remote with limited receptors and is located adjacent to the already authorized PV projects that clearly define the area as a renewable energy zone.		
Cumulative impacts: • Excessive lights at night could reduce the current dark sky sense of place that could detract from tourism opportunities in the area. • From a cumulative perspective, the area is already well established as a renewable energy zone, and the addition of the BESS plant with mitigation, is unlikely to degrade the regional landscape character with mitigation.		
Residual Risks: • Residual risks post mitigation are rated Low. On decommissioning, the limited earthworks required for the construction of the BESS plant would allow for effective rehabilitation of the impacted area back to the current agricultural land use and associated rural sense of place.		

Mitigation measures which did not form part of the original EMPr have been included in the updated EMPr:

Planning Phase

To reduce colour contrast, if permitted by the Original Equipment Manufacturer, the container structure should preferably be painted a light-brown colour so as to blend with the surrounding arid region landscapes. *Note from EAP: The containers cannot be painted a colour that absorbs heat as this will void warrantees.*

Construction Phase

The following actions should be implemented during the construction phase:

- Adopt responsible construction practices aimed at containing the construction activities to specifically demarcated areas thereby limiting the removal of natural vegetation to the minimum.

- Limit access to the construction site to existing access roads.
- Rehabilitate all disturbed areas to acceptable visual standards as soon as possible after construction is complete in each area.
- Construction should not take place at night-time.
- Topsoil from the footprints of the road and structures should be stockpiled for rehabilitation and restoration purposes.
- If very dry conditions prevail and dust becomes a nuisance, water should be sprayed on the road surface (or implement another suitable mitigation to reduce wind-blown dust).
- Strict litter control.
- Temporary roads should be well marked and should only cross drainage lines on areas identified as permanent road features where erosion and soil loss management can be contained.
- Signage on the R357 should be moderated.
- All buildings should be painted a grey-brown colour.
- Fencing should be simple, diamond shaped (to catch wind-blown litter) and be transparent in appearance. The fences should be checked on a monthly basis for the collection of litter caught on the fence.

Operation Phase

The following actions should be implemented during operation phase:

- Strict litter control.
- Continued erosion control and management of dust by ensuring that soil is covered.

Deconstruction Phase

The following actions should be implemented during deconstruction phase:

- Adopt responsible de-construction practices aimed at containing the activities to impacted areas only.
- Rehabilitate all disturbed areas to acceptable visual standards as soon as possible after de-construction is complete in an area.
- De-construction should not take place at night-time.
- Strict litter control.
- Signage on the R357 should be removed.
- All structures need to be removed from site and adequately processed in accordance with national legislation.
- All buildings should be broken down and the rubble and the foundations removed and dumped in accordance with national legislation.
- Fencing should be removed and preferably re-used / recycled.

The VIA concluded that the BESS development for Hoekplaas PV4 is unlikely to result in the loss of significant visual and scenic resources.

High Level Risk Assessment

NOTE – the likelihood (L), consequence (C) and Evaluation ratings in ALL the tables below **assume that the suggested preventative and mitigation measures <u>HAVE BEEN IMPLEMENTED</u>**. **<u>Without these measures in place the risks will be higher</u> and may even be unacceptably high**.

The preventative and mitigation measures as mentioned below have been included in the updated EMPr

The risk assessment concluded that with suitable preventative and mitigation measures in place none of the identified potential risks are high, i.e. from a SHE perspective no fatal flaws were found with the proposed BESS installations at Prieska.

CONSTRUCTION PHASE

QUALITATIVE RISK ASSESSMENT RECORD
PLANT: Prieska BESS
AREA / SYSTEM: Construction Phase including importation and transport to site as well as storage at ports and on site prior to commissioning
REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems

No	Hazardous event	Causes	Suggested preventative measures	L	Consequences	Suggested protective, mitigation measures	C	R	Evalua-tion	Additional Comments
	HEALTH RISKS									
H1	Chronic Chemical or Biological Toxic Exposure	Construction materials such as cement, paints, solvents, welding fumes, truck fumes etc.	The construction phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993 specifically the Construction Regulations. SHEQ policy in place. A detailed construction risk assessment prior to work. SHE procedure in place. PPE to be specified. SHE appointees in place. Contractors safety files in place and up to date.	3	Illness.	Emergency response plan to be in place prior to beginning construction and to include aspects such as appointment of emergency controller, provision of first aid, first responder contact numbers.	1	4	Low	

QUALITATIVE RISK ASSESSMENT RECORD
PLANT: Prieska BESS
AREA / SYSTEM: Construction Phase including importation and transport to site as well as storage at ports and on site prior to commissioning
REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems

No	Hazardous event	Causes	Suggested preventative measures	L	Consequences	Suggested protective, mitigation measures	C	R	Evalua-tion	Additional Comments
			All necessary health controls/ practices to be in place, e.g. ventilation of welding and painting areas. SHE monitoring and reporting programs in place.							
		Human pathogens and diseases, sewage, food waste.	All necessary good hygiene practices to be in place, e.g. provision of toilets, eating areas, infectious disease controls.	2	Illness and at worst without mitigation, possibly extending to fatalities.	Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others.	3	9	Medium	
		Snakes, insects, wild and domesticated animals and harmful plants.	Prior to construction determine the dangerous species in the area and what responses are needed to bites/exposure/attacks. Awareness training for persons on site, safety induction to include animal hazards.	2	Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc.	First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.	3	9	Medium	
H2	Noise	Drilling, piling, generators, air compressors	The construction phase will be the noisy phase of the project. No extreme construction envisaged, normal road, single storey building type construction similar to what would take place in a residential area.	4	Adverse impact on hearing of workers.	Health risk assessment to determine if equipment continuous noise exceeds 85dB at workstation and 61dB at boundary of the site Employees to be provided with hearing protection if working near equipment that exceeds the noise limits. Due to rural nature of sites, construction is unlikely to continue at after sunset.	1	7	Medium	
H3	Environment al	Heat during the day. Enclosed containers. Cold in winter.	Construction site facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces.	2	Heat stroke. Hypothermia.	Adequate potable water to be provided during all phases of the project. Bore hole, bowser and tank or small water treatment plant may be required to provide potable water for the plants during all phases of the project.	2	5	Low	
H4	Psychological	Large projects bring many contractor workers into a small isolated community.	Depending on size of contract and scope, project may need to provide temporary accommodation, regular/periodic transport to town and nearby cities.	3	Lack of sufficient accommodation, entertainment etc. Increase in alcohol	Local community involvement and preferably use of local persons as contract workers on the project.	2	8	Medium	Note. In small isolated communities, use of locals for construction projects is critical for

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: Construction Phase including importation and transport to site as well as storage at ports and on site prior to commissioning REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
					abuse, violence.					community safety and upliftment.
H5	Ergonomics	Lifting heavy equipment. Awkward angles during construction.	Training in lifting techniques. Ensure that despite the isolated location all the necessary equipment is available (and well maintained) during construction. Otherwise employees may revert to unsafe practices. Isolated location, maintenance of construction equipment to ensure safe operation is critical. Ensure this is in place prior to project beginning. Development of local service providers.	2	Back and other injuries.	First aid provision on site.	3	9	Medium	
	SAFETY RISKS									
S1	Fire	Damaged on route e.g. dropped in port (drops do happen about 1/2000 containers) and importing 500 containers it is possible that one will be dropped, traffic accident on-route. Involvement in an external fire e.g. at the port or on route.	Design includes abuse tests such as drop test, impact, rapid discharge etc. Propagation tests for systems, e.g. heat insulating materials between cells/modules. Factory acceptance test prior to prior to leaving manufacture. Batteries are usually stored at 50% charge to prolong life, but may be shipped fully discharged. This level of detail should be understood so as to assess the risk during transport and storage. Port Authorities need to be alerted to the overall project and the hazardous nature of the contents. Port emergency response in particular need training on mitigating battery hazards. Prior to bring any containers into the country a full Emergency response plan should be in place for the full route from the ship to the site. Data indicates installed facility events are 0.001/year. Transport of +500 units assumed to take 4 weeks each so f= 0.04 once in 25 years so L=2.	2	Injuries due to radiation especially amongst first responders and bystanders. Fatalities unlikely from the heat radiation as not highly flammable nor massive fire (refer to noxious smoke in S3 below for the major impact).	Emergency plan to determine: What gases would be released in a fire Are there inhalation hazards Extinguishing has two important elements, put out fire and to provide cooling. Different approaches for small fire – put out, and large fires cool with copious quantities of water. Inert gases and foam may put out the initial fire but fail to control thermal runaway or to cool the batteries resulting in reignition. What initial fire extinguishing medium should be used? Are there any secondary gases or residues from use of extinguishers? If water is appropriate, may need outside connections to inside sprinklers First responders need to know what media to use, especially if water totally unsuitable and if there are no connection points for water etc. Must the container be left unopened or opened? PPE to be specified including possible	3	9	Medium	Note. If, as per Tesla indications, the containers are classified as IMDG Class 9 – the containers will not receive any special care in the ports and may be stored next to flammables.

QUALITATIVE RISK ASSESSMENT RECORD
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No	Hazardous event	Causes	Suggested preventative measures	L	Consequences	Suggested protective, mitigation measures	C	R	Evalua -tion	Additional Comments
						exposure to chemicals and fumes as well as radiate heat. Containment of residues/water/damaged equipment. Suitable safe making a disposal plan considering after the event, how do responder deal with partially charged damage units, contaminated surfaces (e.g. HF residues).				
S2	Explosion	Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static.	During transport this is only likely to happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out.	1	Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g. other container in the port.	For simplicity one transport route would be preferable. The route needs to be assessed in terms of responding local services, rest places for drivers, refuelling if required, break down services available etc. Once an import route has been chosen, e.g. Cape Town port and up the N1, then key emergency services on route could be given awareness training in battery fire/accident response. Emergency response planning and training referred to above may be important for key locations such as the Du Toitskloof tunnel.	4	10	Medium	
S3	Acute Chemical or Biological Toxic Exposure	Damaged batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals.	Transport in accordance with Regulation 8 of the National Road Traffic Act 93 of 1996, Dangerous Goods. Not permitted to transport prescribed goods in manner not consistent with the prescriptions, e.g. consignor and consignee responsibilities. Prescription found in SANS 10228/29 and international codes for battery transport etc. Transport in sealed packages that are kept upright, protected from movement damage etc. Also packaged to ensure no short-circuiting during transport. Transport to prevent excessive vibration considerations as battery internal may be damaged leading to thermal run-away during	2	Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage.	Pre-assembled containers will most likely be supplied. These will be fitted with the necessary protective measures by the supplier considering marine and road transport as well as lifting, setting down etc. Route selection to consider possible incidents along the way and suitable response, e.g. satellite tracking, mobile communication, 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels, Trem cards, driver trained in the hazards of the load.	3	9	Medium	

QUALITATIVE RISK ASSESSMENT RECORD **PLANT: Prieska BESS** **AREA / SYSTEM: Construction Phase including importation and transport to site as well as storage at ports and on site prior to commissioning** **REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems**										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
		Thermal runaway and hazardous fumes released.	commissioning. Likelihood similar to fire above.							
S4	Acute physical Impact or violent release of energy	Construction moving equipment, heavy loaded, elevated loads, working at heights.	Refer to item H1 above for OHS Act issues. Standard construction site rules regarding traffic, reversing sirens, rigging controls, cordoning off excavations etc. Civil and building structures to National Building Regulations and building Standards Act 103 of 1977 SANS 10400 and other relevant codes. Other constructions such as roads, sewers etc also to relevant SANS standards. All normal procedures for working at heights, hot work permits, confined space entry, cordon off excavations etc to be in place before construction begins.	2	Injury or possibly fatality. Damage to equipment. Delays in starting the project, financial losses.	Emergency response plan to be in place before construction begins.	3	9	Medium	
S5	Generation impact	Use of electrical machines, generators etc.	Standard maintenance of condition of electrical equipment and safe operating instructions.	1	Electrocution.	Ability to shut off power to systems in use on site.	4	10	Medium	
		Hot dry area static generation is highly likely.	If persons are decanting fuels or dealing with other highly flammable materials care should be taken regarding possible static discharge.	1	Ignition and burns.	If decanting fuels ensure installations are to standard with regards static.	3	6	Medium	
		Lightning strike.	Lightning strike rate in Prieska is relatively low, but not impossible. Advised stop outside work during thunder storms.	1	Injury and death. Damage electrical equipment. Possible start for thermal run away within containers.	Lighting conductors will likely be required for the final installation.	4	10	Medium	
	ENVIRONMENTAL RISKS									
E1	Emissions	Dust from construction and generally hot dry area.	May need to use dampening on roads etc. as per normal construction practices. There will be packaging materials that will need to be disposed of after the entire system is connected and commissioned as well as after regular maintenance.	4	Adverse impact on employee health.	May need PPE (dust masks) for specific construction workers. There will need to be waste segregation (e.g. electronic equipment, chemicals) and management on the site.	1	7	Medium	

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: Construction Phase including importation and transport to site as well as storage at ports and on site prior to commissioning REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
E2	Pollution	Diesel for equipment, paints and solvents. Transformer oil spills.	Normal construction site practices for preventing and containing fuels/paint/oil etc spills. Sewage and any kitchen liquids - containment and suitable treatment/disposal.	3	Environmental damage.	Spill clean-up procedures to be in place before commencing construction.	1	4	Low	
E3	Waste of resources	Battery containers damaged	Handling protocols to be provided by supplier.	3	Loss of production capacity.	End of Life plan needs to be in place before any battery containers enter the country as there may be damaged battery unit from day 1.	2	8	Medium	
	GENERAL RISKS									
G1	Aesthetics	Bright surfaces reflecting light. Tall structures in a flat area.	Design indicate structure limited to 25m for electrical infra structure. Container singe storey as physical space is not a constraint that would require stacking of containers. Containers likely to be painted white, not left as reflective steel.	2	Irritation.	None.	1	2	Low	
G2	Financial	Defective technology. Extreme project delays.	Design by experienced contractors using internationally recognized and proven technology. Project management with deviation monitoring.	2	Financial loss	Project insurance for construction phase.	2	5	Low	
G3	Security	On route, potential hi-jacking of valuable but hazardous load. On site, theft of construction equipment and battery installation facilities.	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. The hazardous nature of the electrical and battery equipment should be clearly indicated – e.g. Skull and Cross Bones or other signs. Isolated location both helps and hinders security.	4	Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaway.	Night lighting unlikely to be provided, but could be considered.	2	12	Medium	
G4	Emergencies	Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structur al collapse. Inadequate	All safety measures listed above. Small events not handled correctly and escalate into larger events.	1	Injuries turn to fatalities, small losses become extended down time.	If batteries are stored at 50% charge, thermal run away can happen while in storage on site waiting for installation. In addition, if involved in an external fire thermal run away can happen even with uncharged batteries. Except during shipping, ideally the units should not be stored	4	10	Medium	

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: Construction Phase including importation and transport to site as well as storage at ports and on site prior to commissioning REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
		emergency response to small event leads to escalation.				any closer to each other than they would be in the final installation so that propagation is prevented. The company in charge of the containers at each stage in the transport process needs to be very clear so that responsibility for the integrity of the load and protection of the persons involved in transfer and coordination of emergency response on-route. E.g. if purchased from Tesla where does hand over occur to the South African contractor / owner, at the factory door in USA, at the port in RSA, at the site fence. For example, who will be accountable if there's thermal runway event on a truck with a container that stops in a small town for driver refreshments.				
G5	Legal compliance	Field is evolving quickly with new guides, codes and regulations happening at the same time as evolving technology.		1	Unknown hazards manifest due to using "cheaper supplier or less developed technology".	Use only internationally reputable battery suppliers who comply with all known regulations/guideline at the time of purchasing. Ensure only latest state of the art battery system are used.	4	10	Medium	

OPERATIONAL PHASE

From the details of some of the accidents that have happened it is clear that many potential problems manifest during the commissioning phase when unit are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that would be in place for full operation should be in place before commissioning commences.

QUALITATIVE RISK ASSESSMENT RECORD
PLANT: Prieska BESS
AREA / SYSTEM: Operation Phase including commissioning, maintenance, planned and unplanned shut downs, re-start
REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems

No	Hazardous event	Causes	Suggested preventative measures	L	Consequences	Suggested protective, mitigation measures	C	R	Evalua -tion	Additional Comments
	HEALTH RISKS									
H1	Chronic Chemical or Biological Toxic Exposure	Operation and maintenance materials such as spare batteries, paints, solvents, welding fumes, oils etc.	The operation and maintenance phase will be managed according to all the requirements of the Occupational Health and Safety Act 85 of 1993. SHEQ policy in place. A detailed risk assessment of all normal operating and maintenance activities on site to be compiled, and form the basis of operating instructions, prior to commencing commissioning. SHE procedure in place, e.g. PPE specified, management of change, integrity monitoring. SHE appointees in place. All necessary health controls/ practices to be in place, e.g. ventilation of confined areas, occupational health monitoring if required and reporting programs in place.	3	Illness.	Emergency response plan for full operation and maintenance phase to be in place prior to beginning commissioning and to include aspects such as appointment of emergency controller, emergency isolation systems for electricity, provision of PPE for hazardous materials response, provision of shelter in place facilities for staff at the main office building, provision of first aid, first responder contact numbers.	1	4	Low	
		Human pathogens and diseases, sewage, food waste.	The number of persons on site will reduce significantly after construction and would likely be limited to half a dozen or so at any one time. Never the less all necessary good hygiene practices need to continue to be in place, e.g. provision of toilets, eating areas, infectious disease controls.	1	Illness and at worst without mitigation, possibly extending to fatalities.	Policies and practice for dealing with known vectors of disease such as Aids, TB, COVID 19 and others.	3	6	Medium	

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No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
		Snakes, insects, wild and domesticated animals and harmful plants.	Prior to construction determine the dangerous species in the area and what responses are needed to bites/exposure/attacks. Awareness training for persons on site, safety induction to include animal hazards.	2	Effects can vary from discomfort to fatalities for venomous snakes or bee swarms etc.	First aid and emergency response to consider the necessary anti-venom, anti-histamines, topical medicines etc. Due to isolated locations some distance from town, the ability to treat with anti-venom and extreme allergic reactions on site is critical to mitigate the impacts.	3	9	Medium	
		Compromised battery compartments vapours accumulate in the containers, solids/liquids on surfaces.	Batteries sealed. Individual batteries in modules which are also sealed. Pre-packed in the container. Maintenance procedures will be in place. PPE will be specified for handling batteries and other equipment on site..	3	Dermatitis, skin /eye/lung irritation.	Possible detectors with local alarms if exceed STEL etc prior to entry for inspection. Labelling of batteries Confined space entry procedures? There needs to be careful thought given to procedures to be adopted before entry into a container under normal circumstances (confined space) but particularly after a BMS shut down where there may be flammable or toxic gases present, a fire etc. Any situation could await those entering. SDSs to be available on site. Operating manuals to be provided including start-up, shut-down, steady state, monitoring requirements. Maintenance manuals with make safe, decontamination and repair procedures. Proposed maintenance schedules daily, weekly, monthly, annual etc. Provided portable equipment for calibration and for testing/verification of defective equipment, e.g. volt/current meters, infrared camera.	2	8	Medium	
H2	Noise	Moving parts inside containers, cooling systems etc.	Design to ensure continuous noise does not exceed 85dB in the containers or at any other location on site or 61 dB at the site boundary, e.g. emergency generator, air compressor etc.	2	Adverse impact on hearing of workers. .	BESS located in rural area far from residential areas.	1	2	Low	

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No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
			Employees to be provided with hearing protection if working near equipment that exceeds the noise limits.							
H3	Environment al	Heat during the day. Batteries generate heat within enclosed containers. Cold in winter.	Container facilities to comply with Occupational Health and Safety Act 85 of 1993 specifically the thermal, humidity, lighting and ventilation requirements of the Environmental Regulations for Workplaces. Battery life optimal at temperature also optimal for humans. Lighting to be provided inside the containers, possibly linked to the door opening.	2	Heat stroke. Hypothermia.	Adequate potable water to be provided during all phases of the project. Night work is unlikely unless there is major outage, suitable lighting to be provided. PPE for operations and maintenance staff to be suitable for the weather conditions.	3	9	Medium	
H4	Psychological	Isolated work station and monotonous repetitive work.	Staff rotation to other sites may be necessary.	3	Low performance, system productivity suffers.	Performance monitoring of inspections / maintenance tasks in particular will be necessary.	1	4	Low	
H5	Ergonomics	Lifting heavy equipment. Awkward angles during maintenance, stretching reaching top high level batteries and bending to low level batteries. Working ta height if equipment located on top of container or elevated electrical equipment (e.g. pylons).	Training in lifting techniques.	2	Back and other injuries.	If batteries are at height, ensure suitable safe (electrically and physically) ladders are available. Working at height procedure to be in place.	3	9	Medium	
	SAFETY RISKS									
S1	Fire	Involvement in an external fire e.g. veld fire, maintenance vehicle	Grass cutting and fire breaks around the site to prevent veld fires. No combustible materials to be stored in or near the battery containers.	4	Contaminated run off. Radiation burns unlikely to be severe	Refer to construction phase above and apply. LEL gas detector for flammable and	2	12	Medium	Note. Refer to Appendix A for an initial approximation of worst case possible fire impact

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No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
		fire, electrical systems fire. Excessive dust ingress insulates causing heat to build up. Manufacturing defects or contamination. Damage to battery leading to shorting and heating. High humidity condensation of water shorting Ingress of water shorting. Flooding of containers. Excessive electrical loads - surges Mechanical damage, impact deformation. Operator abuse Low temperature – plating of lithium on the anode and shorting BMS failure or software failure. Thermal separation or insulation or spacers damaged, propagation. Thermal run away and resultant battery compromised and fire. Incorrect extinguishing.	Design codes from USA and standards of practice UL9540, NFPA 855 and DNV GL RP 43. Detailed FMEA/Hazop/Bowtie to done during design at the component level and system levels. Safety integrity level rating of equipment (failure probably) with suitable redundancy if required. Site Acceptance Testing as part of commissioning of each model and the overall system. BMS should be checking individual cell voltage as well as module/rack, container, system voltages/current etc. BMS tripping the cell and possibly the module, rack, container if variations in voltage. Diagnostics easily accessible. Diagnostics able to distinguish cell from module faults. Battery life starts to be impacted above 40 deg C and significant impacts above 50 deg C with thermal run away starting at 65-70 deg C. BMS trips system at 50 deg C. Suitable ingress protection level provided, e.g. IP55 - 66. If air cooling into container, suitable dust filters to be provided. Smoke detectors linked to BMS and alerts in the main control room. Effects of battery aging to be considered. Abuse tests conducted by supplier. Temperature monitoring to be in place. Data needs to be stored for trend analysis. Regular infrared scanning. Fire resistant barrier between the batteries and the PCS side if in the same container, or separate containers. Data indicates an event frequency of 0.001 and with +500 units per installation this would mean an event every two years (L=4). Most events will be small not resulting in injuries but this is		as not highly flammable materials. No affected bystanders. Damaged equipment. Fire spreads to other units or offsite if grass/vegetation not controlled.	shut down system. Emergency plan from transport and construction phase to be extended to operational phase and to include the hazards of the electrically live system. Procedure to address extinguishing, ventilating, entering as appropriate or not. 24/7 help line for local authorities in Prieska – fire, spills etc PPE include fire retardant, chemically resistant, nitrile gloves, antistatic acid resistant boots, fill face shields, BA sets. Separation of site diesel tank, transformers etc from battery packs, Lightning protection – low strike rate but flat open areas. IR scanning to determine if batteries are still smouldering / are sufficient cooled to handle. Very NB batteries thought to be extinguished can re-ignite days/weeks later. Some suggest after batteries are removed then still be submerged in outdoor water troughs. Fire water for cooling adjacent equipment – BESS units. 100m hydrants. Can use fogging nozzles to direct smoke. Clean up after event Lingering HF and				zones.

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No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
		medium, escalate the fire.	possible if the event is not controlled.			other toxic residues in the soil and on adjacent structures. Smoke or gas detector systems that are not part of the original battery container package, need to be linked to the main control panel for the entire system so that issues can be detected and responded to rapidly Suitable fire extinguishing medium, and cooling mediums and adequate supply of both is critical. Prieska is a very dry area and water supply may be an issue. A planned fire response to prevent escalation to an explosion is critical. Protective systems are only as good as their reliability and functionality testing is important, e.g. testing that the high temperature trips actually work.				
		Power Conversion System (PCS – DC to AC) cooling failure electrical fire	Failure of cooling on PCS or fires on other electrical equipment such as cooling system pump motors etc, and failure to trip the entire system and raise the alert.	3	Fire starts in PCS or another section or room and spreads to battery area.	Modern design put the PCS in another part of the container with a fire rated wall separating it from the battery. Alternately the PCS is another container altogether.	2	8	Medium	
S2	Explosion	Flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static. Lithium Cobalt Oxide generates O2 during decomposition - escalation	This is only really likely do happen due to possible inappropriate emergency response, e.g. opening containers when they may be the type that should be left to burn out. Modern state of the art containers have ventilation systems for vapours. Undertake a hazardous area classification of the inside of the container to confirm the rating of electrical equipment. Might be zone 2 due to	1	Potential fatalities amongst first responders. Damage to container, transport truck or other nearby items, e.g. other container in the port.	Emergency response plan and employee training referred to above is critical Suitable training of emergency responders in Prieska is critical. .	4	10	Medium	NOTE. Refer to Appendix A for an initial approximation of worst case possible explosion impact zones.

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			possible leaks of electrolyte or generation of flammable gases un thermal run away.							
S3	Acute Chemical or Biological Toxic Exposure	Damaged batteries release fumes, leak electrolyte, are completely broken exposing hazardous chemicals. Hazardous fumes released on thermal run away see fire above.	Batteries contained, modules contained and all inside a container that acts as bund. Refer to fire above as all the protective measures apply to prevent toxic smoke. Fumes tend to be directed upwards by the structure of the container.	2	Impacts can vary from mild skin irritation from exposure to small leaks to serious corrosive burns or lung damage. Depending on the wind direction the effects may extend over the R357.	Refer to fire above as all the measures apply to mitigate toxic smoke. 24/7 helpline response. Standard dangerous goods requirements for Hazmat labels. All operators/maintenance staff trained in the hazards.	3	9	Medium	NOTE Refer to Appendix A for an initial approximation of worst case possible noxious smoke impact zones.
S4	Acute physical Impact or violent release of energy	Moving equipment, pumps, heavy batteries at elevation, nip points, working at heights. Traffic accidents.	Apart from pumps, no major moving parts during operation. Maintenance equipment to be serviced and personnel suitably trained in the use thereof. Normally just small vehicles on site, bakkies, grass cutting, cherry-pickers etc. Possibly large cranes if whole container or elevated structure removed/replaced. Traffic signs, rules etc in place on site.	2	Injury. Fatality in unlikely worst case, e.g. traffic accidents or fall from heights. Damage to equipment.	All normal working at heights, hot work permits, confined space entry, cordon off unsafe areas/works etc to be in place. Emergency response plan.	3	9	Medium	
S5	Generation impact	Electrical equipment in container and high voltages systems outside for connection to the grid. Electrified fences.	Codes and guidelines for electrical insulation. PPE to suit. Low voltage equipment (e.g. batteries) separated from high voltage (e.g. transmission to grid). Trained personnel – IEE 1657 – 2018. Eskom Operating Regulations for high voltage systems including access control, permit to work, safe work procedures, live work, abnormal and emergency situations, keeping records. Electromagnetic fields, impact on other equipment e.g. testing devices, mobile phones – malfunction, permanent damage.	1	Electrocution. Mild impacts for low voltage systems, possibly fatal on high voltage systems.	Consider suitably located E-stops for the container and the other equipment on site.	4	10	Medium	

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No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
			Software also needs maintenance, patches, updates.							
		Hot dry area static generation is highly likely.	PPE to consider static accumulation for entering the battery containers especially after a high temperature shut down where there could possibly be flammable materials.	1	Ignition and burns.	The procedures for responding to alarm and auto shut down on containers, needs to consider that there may be a dangerous environment in side and how to protect personnel who may enter to respond.	3	6	Medium	
		Lightning strike.	Lightning strike rate in Prieska is relatively low, but not impossible. Advise stop outside work during thunder storms.	1	Injury and death. Damage electrical equipment. Possible start for thermal run away within containers.	Lighting conductors will be required for the installation.	4	10	Medium	
	ENVIRONMENTAL RISKS									
E1	Emissions	Refrigerant release. Maintenance waste, e.g. packaging, oils etc.	Refrigerant is asphyxiant if released indoors it can accumulate and displace oxygen.	1	Fatal impact	Especially after any warning alarms have gone off, but possibly even normally the container could be treated as entering a confined space and similar procedures could be in place, e.g. do not enter alone, gas testing prior to entering, ensure adequate ventilation.	4	10	Medium	
E2	Pollution	Spills from batteries, coolant. Fire water runoff control.	Normal site practices for preventing and containing diesel/paint etc spills. Sewage and any kitchen liquids - containment and suitable treatment/disposal. Procedures for dealing with damaged/leaking batteries as well as clean-up of spills.	3	Localized environmental damage.	Spill clean-up procedures to be in place before bringing container on site, including spill kits – non-combustible materials, hazmat disposal. Reportable Quantities NEMA	2	8	Medium	
E3	Waste of resources	Similar to construction phase.	End of Life plan to be on place.							
	GENERAL RISKS									

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: Operation Phase including commissioning, maintenance, planned and unplanned shut downs, re-start REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
G1	Aesthetics	Bright surfaces reflecting light. Tall structures in a flat area.	Design indicate structure limited to 25m for electrical infra structure. Container singe storey as physical space is not a constraint that would require stacking of containers. Containers likely to be painted white, not left as reflective steel.	2	Irritation.	None.	1	2	Low	
G2	Financial	Defective technology.	Design by experienced contractors using internationally recognized and proven technology.	1	Financial loss	Project insurance.	3	6	Medium	
G3	Security	On site, theft or damage to equipment and battery installation facilities. Cyber security attacks aim at the National Grid.	Fencing around electrical infrastructure to SANS standard and Eskom Guidelines. Isolated location both helps and hinders security. There should be clear labelling on fences and containers that they have highly hazardous contents – e.g. Skull and Cross Bones or other signs. Cyber security needs monitoring. Remote access to system needs to be negotiated and controlled. Pass word controls, levels of authority etc. Protection of the National grid from Cyber-attacks accessing through the BESS.	4	Theft. Injury to burglars. Damage to equipment possibly setting off thermal runaways. Ransom of the national grid.	If no night lighting provided consider motion detection lights and CCTV. Cyber emergency procedures.	2	12	Medium	
G4	Emergencies	Fires, explosions, toxic smoke, large spills, traffic accidents, equipment/structural collapse. Inadequate emergency response to small event leads to escalation.	All safety measures listed above. Storage of spare batteries (e.g. in stores o site or elsewhere) also needs to consider possible thermal run away.	1	Injuries turn to fatalities, small losses become extended down time.	Escape door open outwards, doors hooked open when persons inside. More than one exit from containers.	4	10	Medium	
G5	Legal compliance	Field is evolving quickly with new		1	Unknown hazards manifest due to	Use only internationally reputable battery suppliers who comply with all	4	10	Medium	

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: Operation Phase including commissioning, maintenance, planned and unplanned shut downs, re-start REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Comments**
		guides, codes and regulations happening at the same time as evolving technology.			using "cheaper supplier or less developed technology".	known regulations/guideline at the time of purchasing. Ensure only latest state of the art battery system are used.				

DECOMMISSIONING PHASE

Batteries have a limited lifespan and if there are damaged units, there could already be "waste" batteries on the first day of commissioning. An End-of-Life plan needs to be in place before the first batteries are brought on site.

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: De-commissioning Phase including Re-Purposing REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Recommendations**
	HEALTH RISKS									
H1	Chronic Chemical or Biological Toxic Exposure	Batteries reached end of life and may leak.	End of Life shutdown procedure including a risk assessment of the specific activities involved. Re-purpose the units with associated Environmental impact considered. Recycle the parts.	4	Environment damage from heavy metal ions.		2	12	Medium	

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: De-commissioning Phase including Re-Purposing REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Recommendations**
			Disposal according to local regulations and other directives such as the European Batteries Directive. End of life can be predefined and the monitoring can be in place to determine if it has been reached. Affected by temperature and time, cycles.							
H2	Noise	As for above phases								
H3	Environmental	As for above phases								
H4	Psychological	As for above phases								
H5	Ergonomics	As for above phases								
	SAFETY RISKS									
S1	Fire	Transport of used/damaged batteries poses more risk of damage occurring and thermal runaway.	Used / damaged batteries requires specific procedures as they may be more sensitive than new batteries Confirm if batteries should be stored long term in a discharged state or 50% charge.	2	Thermal run away on-route or at new location.	Procedures for handling damaged or discharged batteries, modules, racks etc. Considering that they may have damage and be prone to thermal run away, leaks and other failures.	3	9	Medium	
S2	Explosion	As for above phases								
S3	Acute Chemical or Biological Toxic Exposure	As for above phases								
S4	Acute physical Impact or violent release of energy	As for above phases								
S5	Generation impact	As for above phases								
	ENVIRONMENTAL RISKS									
E1	Emissions	As for above phases								
E2	Pollution	As for above phases								
E3	Waste of resources	As for above phases								
	GENERAL RISKS									
G1	Aesthetics	As for above phases								
G2	Financial	As for above phases								

QUALITATIVE RISK ASSESSMENT RECORD PLANT: Prieska BESS AREA / SYSTEM: De-commissioning Phase including Re-Purposing REFERENCE /DRAWING NO: Technical Engineering Study on Developing Battery Electrical Energy Storage Systems										
No	**Hazardous event**	**Causes**	**Suggested preventative measures**	**L**	**Consequences**	**Suggested protective, mitigation measures**	**C**	**R**	**Evalua -tion**	**Additional Recommendations**
G3	Security	Possible theft of batteries set aside of re-purposing or disposal								
G4	Emergencies	As for above phases								
G5	Legal compliance	Disposal of hazardous "waste" is rife with difficulties and numerous regulations that need to be complied with.	Refer to EoL plan above.							

CHAPTER 7: CONCLUSION

7.1 Assumptions, Uncertainties, and Gaps in Knowledge

Assumptions

It is assumed that all documentation and information obtained from the different stakeholders, professional team members and specialists are accurate, unbiased and valid.

Uncertainties

The development proposal in relation to its environment was thoroughly investigated by various specialists and professionals and there are therefore no uncertainties with regards to the development as proposed.

Gaps in knowledge

Extensive relevant specialist and engineering studies were undertaken for this project and it is highly unlikely that any missing information could influence the outcome of this project.

7.2 Environmental Impact Statement

A Final Environmental Impact Statement will be provided after the completion of the Public Participation Programme and will be included in the Final Motivational Report.

At this stage, the following however applies:

The following specialist studies were conducted:

- Amendment letters were obtained from the ornithologist, aquatic specialist, botanist, heritage consultant and stormwater engineer. **They concluded that the proposed BESS project will not change the impact ratings as given during the EIA process. Some new mitigation measures have however been given and was included in the updated EMPr.**
- A Visual Impact Assessment was conducted and **it was concluded that impacts are likely to be Medium without mitigation, and Low with mitigation**. Proposed mitigation measures have been included in the updated EMPr.
- **The High Level Risk Assessment concluded that the latest containerised battery designs combined with proposed preventative and mitigation measures will reduce the risks to tolerable levels**. Proposed mitigation measures have been included in the updated EMPr.

7.3 Why the Amendment Should, or Should Not be Authorised

Reasons for authorisation will be provided after the completion of the Public Participation Programme and will be included in the Final Motivational Report.

7.4 Recommendation by the Environmental Assessment Practitioner

Recommendations that should be included in the amended EA will be provided after the completion of the Public Participation Programme and will be included in the Final Motivational Report.

7.5 Affirmation by the Environmental Assessment Practitioner

We, Susanna Nel & Annelize Grobler, herewith affirm the following:

- The information contained in this report is to the best of our knowledge and experience correct.
- All relevant comment and input provided by the stakeholders and IAPs will be included and addressed in the Final Motivation Report.
- Input and recommendations from the specialist reports are provided in and integrated with the Motivation Report.
- All information made available by the EAP to IAPs and any responses thereto as well as comment and input from IAPs will be provided in the Motivation Report.

Susanna Nel
DATE: 16 September 2020

Annelize Grobler
DATE: 16 September 2020

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