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NamPower Battery Energy Storage System (BESS)
Environmental and Social Scoping Report and ESMP

NamPower

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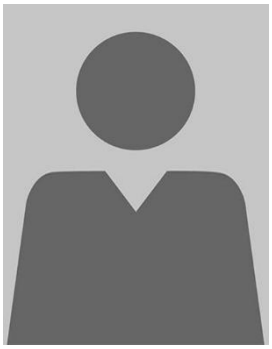

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List of abbreviations and acronyms

AC	Alternating Current
AFOLU	Agriculture, Forestry and other Land Use
BESS	Battery Energy Storage System
BID	Background Information Document
BMS	Battery Management System
BOP	BESS Balance of Power
CBD	Convention on Biological Diversity
CENORED	Central Northern RED
CFC	chlorofluorocarbons
CHS	Community health and safety
CNES	Comprehensive National Energy Strategy
DC	Direct Current
DEA	Directorate of Environmental Affairs
DWA	Department of Water Affairs
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
ECB	Electricity Control Board
ECC	Environmental Clearance Certificate
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMA	Environmental Management Act (Act No. 7 of 2007)
EPC	Engineering, Procurement, and Construction
ERP	Emergency Response Plan
ESDD	Environmental and Social Due Diligence
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESS	Environmental and Social Standards (World Bank)
EU	European Union
FCCC	Framework Convention on Climate Change
FDS	Fire detection system
FI	Financial Intermediaries
FSS	Fire suppression system
HS	Health and Safety
HSE	Health Safety and Environment
HVAC	Heating, ventilation, and air conditioning
IAP	Interested and affected parties
ILO	International Labour Organisation
IMP	insulated metal panels
INC	Intergovernmental Negotiating Committee
IPP	Independent Power Producer

KfW	Kreditanstalt für Wiederaufbau (Development Bank)
LFP	Lithium Iron Phosphate
MAWF	Ministry of Agriculture, Water and Forestry
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MGECW	Ministry of Gender Equality and Child Welfare
MHSS	Ministry of Health and Social Services
MLR	Ministry of Lands, Resettlement and Rehabilitation
MLRS	Ministry of Labor and Social Welfare
MME	Ministry of Mines and Energy
MSDS	Material Safety Data Sheet
MV	Megavolt
MVA	Megavolt Ampere
MW	Megawatt
MWT	Ministry of Works and Transport
NBSAP	National Biodiversity Strategy and Action Plan
NCA	Lithium Nickel Cobalt Aluminium Oxide
NDC	Nationally Determined Contribution
NDP	National Development Plan
NEMWA	National Environmental Waste Management Act
NGO	Non-governmental Organization
NHC	National Heritage Council
NIRP	National Integrated Resource Plan
NMC	Lithium Nickel Manganese Cobalt Oxide
NORED	Northern Regional Electricity Distributor
NP	National Park
OEC	Office of the Environmental Commissioner
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PCS	Power Conversion Systems
PM	particulate matter
PPC	Power Plant Controller
PPE	Personal Protective Equipment
PPP	Public Participation Process
PV	Photovoltaic
RETF	Recipient Executed Trust Fund
RED	Regional Electricity Distributors
SAIEA	Southern African Institute of Environmental Assessments
SAPP	Southern African Power Pool
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SL	Service Level
UN	United Nations
UNEP	United Nations Environmental Program

UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollar
VAT	Value Added Tax
WMP	Waste Management Plan

1 Introduction

1.1 Background of the project

NamPower's strategy is to augment its supply with cost-efficient renewable energy sources while at the same time maintaining high grid reliability to ensure a secure and continuous electricity supply to Namibia.

Currently, a large portion of Namibia's energy demand requirements must be imported from neighbouring countries. However, further large-scale PV, wind, biomass, and hydro as well as firm power projects are under implementation to reduce energy imports which can be, depending on the time of import, very expensive. A first BESS project is under implementation at the Omburu substation. To support the development and uptake of renewable energy plants, NamPower is exploring the feasibility of integrating additional Battery Energy Storage Systems (BESS) into the transmission network.

The main goal is to identify where and how a second BESS can be implemented in the most feasible way possible. A detailed technical feasibility study was undertaken to determine the required BESS application for integration into the grid, its operating regime, sizing, technology, location, and time of implementation to suit the Namibian energy market. As part of the feasibility study an environmental and social scoping report (this report) was undertaken to assess potential environmental and social risks and impacts, and to a provide measures to avoid or mitigation impacts.

1.2 Objectives and Methodology of the Scoping Study

The scoping study was carried out based on internationally accepted standards (World Bank Environmental and Social Standards, as well as General Environmental, Health and Safety (EHS) Guidelines and EHS Industry Sector Guidelines of the World Bank Group and Core Labour Standards of the International Labour Organization (ILO). The process included information gathering, the analysis of the obtained data and the production of this Report. Applicable national standards, laws and regulations were also considered.

The steps undertaken for the study, include desktop review of available data, conducting site verification visits, formal engagement with key stakeholders, as well as development of this Report.

For the data gathering, background information was collected and reviewed to present a description of the project and of the existing environmental and social conditions. A site visit was undertaken to the project site with the aim to provide enough baseline information about the environmental and social components of the project area, and support undertaking an identification of the main sensitivities associated with each of them. The site visit was conducted 28th October 2023 by Fichtner's international experts.

Various other stakeholders were contacted between 6th November and 10th November 2023, and again during a stakeholder meeting in Swakopmund on the 9th April 2024. The list of the contacted stakeholders and the summary of the feedback are provided in **Section 8**.

2 Legal and Policy Requirements

The legal and policy requirements regarding assets in general and BESS in particular that are considered in this report cover the following items:

- Occupational health and safety
- Waste and Hazardous Materials
- Community health and safety: safety of people and assets in the vicinity of the BESS
- Protection of the physical, biological and socio-economic environment
- Power quality and reliability of the electricity supply.

The Republic of Namibia has five tiers of law and several policies relevant to the proposed project and these include:

- The Constitution
- Statutory laws
- Common law
- Customary law
- International law.

As the main source of legislation, the Namibian Constitution makes provisions for the creation and enforcement of applicable legislation. In this context and in accordance with its Constitution, Namibia has passed numerous laws intended to protect the natural environment and to mitigate against adverse environmental impacts.

As financiers of the project, the World Bank requires compliance with its own Environmental and Social Standards (ESS), reflected in the Bank's Environmental and Social Policy and a set of Environmental and Social Framework (ESF).

The following sections provide a summary of the relevant Namibian legislation, international treaties to which the country is signatory/a party, the applicable World Bank ESS, and other and industry standards and guidelines applicable to the proposed BESS project.

2.1 National Laws, Regulations, Plans and Policies

2.1.1 The Constitution of the Republic of Namibia (1990) and amendments (1998, 2010 and 2014)

The following articles of the Constitution are relevant for the project and this report:

- Article 91: defines the function of the Ombudsman.
- Article 91 (c) describes the duty to investigate complaints concerning the over-utilization of living natural resources, the irrational exploitation of non-renewable resources, the degradation and destruction of ecosystem and failure to protect the beauty and character of Namibia.

- Article 95 (l): states that "*the State shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at … maintenance of ecosystems, essential ecological processes and*

biological diversity of Namibia and utilization of natural resources on a sustainable basis for the benefit of all Namibians both present and future; in particular the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian Territory."

- Article 100: states "*that the land, water and natural resources below and above the surface of the land …shall belong to the State if they are not otherwise lawfully owned*."

The constitutional recognition of environmental concerns triggered widespread legislative reform relating to the management of natural resources in Namibia. The country's environmental protection effort is currently comprised of the Environmental Management Act (No. 7 of 2007) and its Regulations (2012).

2.1.2 Environmental Management Act (Act No. 7 of 2007)

The Environmental Management Act (EMA) has three main purposes:

- to make sure that people consider the impact of activities on the environment carefully and in good time.
- to make sure that all interested or affected people have a chance to participate in environmental assessments.
- to make sure that the findings of environmental assessments are considered before any decisions are made about activities which might affect the environment.

The EMA presents the procedures and application process to obtain an environmental clearance certificate (ECC) for a proposed activity and defines the respective roles and responsibilities. If an environmental clearance certificate is required, certain activities may first require an environmental assessment, which shall serve the following purposes:

- ensure that activities which may have a significant effect on the environment follow the principles of environmental management planning and development process.
- analyze the possible environmental impacts of activities and look at ways to decrease negative impacts and increase positive ones.
- make sure that the environmental effects of activities are given adequate consideration before the activities are carried out.
- provide an opportunity for public participation in considering the environmental impact of a project.

2.1.3 Legislation

The following table provides an overview of Namibian Legislation pertaining to environmental and social sectors.

Table 2-1: Overview of Namibian Legislation

Sector	Primary agency	Title and date of document	Purpose
National Environmental Management	Government of Namibia	Namibian Constitution First Amendment Act (Act No. 34 of 1998)	The constitutional recognition of environmental concerns triggered widespread legislative reform relating to the management of natural resources in Namibia. The country's environmental

Sector	Primary agency	Title and date of document	Purpose
			protection effort is currently comprised of the EMA and its Regulations (2012).
Environmental Management	Ministry of Environment, Forestry and Tourism	Environmental Management, Act 7 of 2007	The Act promotes sustainable management of the environment and the use of natural resources. It provides a process of assessment and control of activities that may have a possible significant effect on the environment.
Environmental Management	Ministry of Environment, Forestry and Tourism	Environmental Assessment Policy for Sustainable Development and Environmental Conservation (1995)	The EIA Policy of 1995 promotes accountability and informed decision making through the requirement of EIAs for listed programmes and projects. The EIA policy is currently enforced through the EMA and its Regulations (2012).
Soil	Ministry of Environment, Forestry and Tourism	The Soil Conservation Act (Act No. 76 of 1969)	Law relating to the combating and prevention of soil erosion, the conservation, improvement and manner of use of the soil and vegetation and the protection of the water sources of Namibia.
Heritage	Ministry of Environment, Forestry and Tourism	National Heritage Act (Act No. 27 of 2004)	This Act provides for, inter alia, the protection and conservation of places and objects of heritage significance. A National Heritage Council has been established to identify, conserve, manage, and protect places and objects of heritage significance.
Heritage	Ministry of Environment, Forestry and Tourism	National Monuments Act (Act No. 28 of 1969)	This Act establishes a National Monuments Council and provides for the preservation of certain property as National Monuments and the maintenance of certain burial grounds.
Labour	Ministry of Labour, Industrial Relations	Labour Act (Act No. 11 of 2007)	This Act consolidates and amends the labour law, establishes a comprehensive labour law, entrenches fundamental labour rights and protections, regulates basic employment terms and conditions, ensures the safety, health, and welfare of employees, protects employees from unfair labour practices, regulates trade union and employer organisation registrations, regulates collective labour relations, provides for systematic prevention and resolution of labour

Sector	Primary agency	Title and date of document	Purpose
			disputes, establishes the Labour Advisory Council, the Labour Court, the Wages Commission and the labour inspectorate, provides for the appointment of the Labour Commissioner and Deputy Labour Commissioner, and provides for incidental matters.
Energy	Ministry of Mines and Energy (The electricity sector is regulated by the Electricity Control Board)	Electricity Act of 2007	Establishment of the Electricity Control Board; to provide for the requirements and conditions for obtaining licenses for the provision of electricity; to provide for the powers and obligations of licensees; and to provide for incidental matters.[1]
Water	Ministry of Agriculture, Water and Land Reform	Water Resources Management Act, No. 11of 2013	The Act provides for the management, development, protection, conservation and use of water resources, and established various regulatory and advisory institutions.
Atmospheric Conditions	Ministry of Health and Social Services	Atmospheric Pollution Prevention Ordinance, No. 11 of 1976	Air pollution is controlled primarily by this Ordinance, which deals with air pollution as it affects occupational health and safety issues if these are the subject of one of the conditions of a registration certificate issued under the Ordinance. It considers air pollution from point sources, but it does not address ambient air quality.
Roads	Ministry of Works and Transport	Road Traffic and Transport Act, 22 of 1999	Provides for the control of traffic on public roads and the regulations pertaining to road transport.
Pollution	MEFT and others	Pollution Control and Waste Management Bill (3rd Draft September 2003)	The purpose of this Bill is to regulate and prevent the discharge of pollutants to the air and water; and enable the country to fulfil its international obligations in this regard. With respect to water pollution, the draft Bill forbids any person from discharging or disposing of pollutants into any water or watercourse without a Water Pollution License, aside from the discharge of domestic waste from a

[1] https://laws.parliament.na/annotated-laws-regulations/law-regulation.php?id=422

Sector	Primary agency	Title and date of document	Purpose
			private dwelling or the discharge of pollutants or waste to a sewer or sewage treatment works.
Health and Safety	Ministry of Health and Social Services	Regulations relating to the health and safety of employees at work (GN 156 of 1997)	These Regulations establish health and safety regulations for the workplace.
Hazardous Waste	Ministry of Health and Social Services	Hazardous Substances Ordinance 14 of 1974	The Hazardous Substances Ordinance 14 of 1974 provide for the control of toxic substances which may result in injury, ill health, or death of human beings.
Public Health	Ministry of Health and Social Services	Public Health Act, No. 36 of 1919, with subsequent amendments	This Act is only relevant in as much as workers must be protected from harm, especially during construction.

2.1.4 The Green Plan and Vision 2030

In 1992, Namibia's Green Plan was drafted by the newly created Ministry of Environment and Tourism (MET) (now Ministry of Environment, Forestry and Tourism (MEFT)) and presented at the United Nations Conference on Environment and Development in Rio de Janeiro. This document analysed the main environmental challenges facing Namibia and specified actions required to address them. Following on the foundation laid by the Green Plan, an effort was made to incorporate environmental and sustainable development issues and options into Namibia's National Development Plans (NDPs), which run for a period of five years each.

In addition, Vision 2030, which was formulated in 2001/02, aims to guide the country's development plans from NDP 2 through NDP 7, while providing direction to government ministries, the private sector, non-governmental organizations (NGOs) and local authorities. The most recent NDP is NDP 5 covering the period 2017/2018 until 2021/22. NDP 5 is based on four pillars, namely Economic Progression, Social Transformation, Environmental Sustainability (climate change falls within this area) and Good Governance. Vision 2030 fully embraces the idea of sustainable development. For the first time in a National Development Plan (NDP 5), Namibia included an intermediate emissions reduction target (Greenhouse gas emissions 30% reduction against Business-as-Usual projection, by 2022). For the natural resource sector, it states:

"The nation shall develop its natural capital for the benefit of its social, economic and ecological well-being by adopting strategies that: promote the sustainable, equitable and efficient use of natural resources; maximize Namibia's comparative advantages; and reduce all inappropriate resource use practices. However, natural resources alone cannot sustain Namibia's long-term development, and the nation must diversify its economy and livelihood strategies."

2.1.5 Policies

Namibia's policies provide the framework for the applicable legislation. Whilst policies do not often carry the same legal recognition as official statutes, policies can and are used in providing support to legal interpretation. Relevant policies currently in force include:

Policy	**Relevance**
The EIA Policy (1995)	The Policy defines the required steps for an EIA, the required contents of an EIA report, the need for post-implementation monitoring, and the system of appeals. The purpose of the Policy is seen as: informing decision makers and promoting accountability; ensuring that options and alternatives and environmental costs and benefits are considered; striving for a high degree of public participation and involvement of all sectors; incorporating internationally accepted norms and standards; taking into account secondary and cumulative environmental impacts; promoting the user pays principle; and promoting sustainable development.

Namibia's Environmental Assessment Policy for Sustainable Development and Environmental Conservation (1994)	The EIA Policy of 1995 promotes accountability and informed decision making through the requirement of EIAs for listed programmes and projects. The EIA policy is currently enforced through the EMA and its Regulations (2012).
National Development Plan 5 (NDP) and Vision 2030	The Visions rationale is to provide long-term policy scenarios on the future course of development in the country at different points in time up until the target year 2030.
National Renewable Energy Policy (2017);	The renewable energy policy is intended to provide the necessary boost to renewable energy development in Namibia and to serve as a clear signal of the government of Namibia 's commitment to a clean energy future for its people powered by renewables and replete with economic opportunities created by the growth of the renewable sector
National Energy Policy (2017)	The Ministry of Mines and Energy issued the National Energy Policy aiming to ensure the security of all relevant energy supplies, to create cost-effective, affordable, reliable and equitable access to energy, to promote the efficient use of all forms of energy, and to incentivise the discovery, development and productive use of Namibia's diverse energy resources.
National Industrial Policy (2012)	Namibia's Industrial Policy is aimed at achieving Vision 2030. Since it is a policy document, it is confined to principles and broad parameters that will guide Namibia's approach towards industrial policy over the next two decades.
Policy for the Conservation of Biotic Diversity and Habitat Protection (1994)	The policy is to ensure adequate protection of all species and subspecies of ecosystems and of natural life support processes.
The National Climate Change Policy of Namibia (2011)	The Policy seeks to outline a coherent, transparent and inclusive framework on climate risk management in accordance with Namibia's national development agenda, and the relevant legal framework.
National Integrated Resource Plan (NIRP 2016	The NIRP is a 20-year electricity sector development plan. It aims to provide an indication of Namibia's electricity demand, how this demand could be supplied and the cost of supply.
National Policy for Independent Power Producers (2018)	The national IPP policy is part of the government's drive in creating a conducive environment for private sector investment and outlines the key provisions of the government's commitment to encourage private investment in Namibia's power sector
National Land Tenure Policy (2003)	The policy covers all land tenure systems in urban, communal, commercial (freehold) and resettlement areas, and is intended to guide all land tenure rights in Namibia.

2.2 International Conventions, Guidelines and Standards

2.2.1 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1992)

Namibia became a signatory to the Basel Convention in 1995. The Convention establishes a global notification and consent system for the transboundary shipments of hazardous and other wastes among Parties and requires Parties to manage and dispose of waste in an environmentally sound manner.

2.2.2 United Nations Framework Convention on Climate Change (1992)

The first World Climate Conference was held in 1979, followed by several more specific meetings and, in 1990, by the establishment of a UN sponsored Intergovernmental Negotiating Committee (INC), which was tasked with establishing the finer details of the Framework Convention on Climate Change (FCCC). The convention was duly completed and signed by 154 governments, including Namibia, at the Earth Summit in Rio de Janeiro in 1992. The main objective of the convention is to '*stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous, man-made interference with the climatic system*'. It hopes to achieve this as quickly as possible, thereby allowing ecosystems time to adapt naturally to gradual climatic change. The FCCC emphasized the responsibility of developed countries in reducing and stabilizing greenhouse gas emissions to 1990 levels by 1995. They are furthermore expected to transfer technology to developing countries so as to enable the latter to meet their own commitments (UN 2005).

Namibia is a non-Annex I Party to the UNFCC. The country is required to provide information to the Convention on the national inventory of anthropogenic emissions (carbon dioxide, methane, nitrous oxide and precursor gases), steps taken or planned to implement the Convention and any other relevant information the country considers relevant to achieve the objectives of the Convention through national communications.

Namibia has ratified the Kyoto Protocol to the UNFCC (2003) and the Paris Agreement (2016) and has been meeting its reporting obligations. According to Namibia´s Updated Nationally Determined Contribution (NDC) from 2021, the total national emissions increased by 1.7% over the years 2010-2015. The Agriculture, Forestry and other Land Use (AFOLU) sector are responsible for 80% of the total national emissions followed by Energy with 17% in 2015. The updated NDC presents a progressive shift above the 2015 pledge to reduce emissions from 89% to 91% by 2030.

Namibia's vulnerability to climate change is high, as it is the driest country in Southern Africa in terms of water resources and as much as 70% of its people depend on agriculture for their existence. The Updated NDC points out different mitigation measures such as increasing the share of renewable in electricity generation and increase energy efficiency.

By harnessing solar and other forms of renewable energy, the country would be making a small but important contribution to the world's environmental stability.

2.2.3 Convention on Biological Diversity

The Convention on Biological Diversity (CBD) is the first global agreement on the conservation and sustainable use of biological diversity. Over 150 governments signed the document in 1992 at the Rio conference, and since then more than 175 countries have ratified it. Namibia is a party to the Convention on Biological Diversity since August 1997 by ratification.

The responsibility for achieving the CBD's goals rests largely with the countries themselves. Under the Convention, governments undertake to conserve and sustainably use biodiversity and are required to develop national biodiversity strategies and action plans, and to integrate these into broader national plans for environment and development.

The first Namibian National Biodiversity Strategy and Action Plan (NBSAP 2001-2010) constituted a ten-year strategic plan of action for sustainable development through biodiversity conservation. In 2012, Namibia set about the process of developing its second-generation NBSAP (NBSAP2). The vision of NBSAP2 is for Namibia's biodiversity to be healthy and resilient to threats, and for the conservation and sustainable use of biodiversity to be key drivers of poverty alleviation and equitable economic growth, particularly in rural areas.

2.2.4 Ramsar Convention

The Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat (the Ramsar Convention) entered into force in Namibia on 23 December 1995. The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".

Namibia currently has 5 sites designated as Wetlands of International Importance (Ramsar Sites). A check has to be made if the final site is close to them (Namibia | Convention on Wetlands (ramsar.org)).

2.2.5 World Heritage Convention

The World Heritage Convention (Convention Concerning the Protection of the World Cultural and Natural Heritage, 1972) defines the kind of natural or cultural sites which can be considered for inscription on the World Heritage List, sets out the duties of States Parties in identifying potential sites and their role in protecting and preserving them, explains how the World Heritage Fund is to be used and managed, stipulates the obligation of States Parties to report regularly to the World Heritage Committee, and encourages States Parties to strengthen the appreciation of the public for World Heritage properties.

Namibia accepted the Convention in April 2000 and has 2 properties inscribed on the World Heritage List. 8 sites are presently on the Tentative List (an inventory of those properties which each State Party intends to consider for nomination). Once the location of the project is known, the Consultant will assess its proximity to an inscribed or tentative property and whether this could affect the development of the project (Namibia - UNESCO World Heritage Convention).

2.2.6 ILO Conventions

The International Labor Organization (ILO) aims to promote rights at work, encourage decent employment opportunities, enhance social protection, eliminate forced or compulsory labour and child labour and strengthen dialogue on work-related issues. Therefore, the ILO lists fundamental principles and rights at work, laid down in eleven fundamental conventions.

Namibia has been a member of ILO since 1978, and has ratified and set into force 8 of the 11 ILO Fundamental Conventions, namely:

- C029 - Forced Labour Convention, 1930 (No. 29)
- C087 - Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87)
- C098 - Right to Organize and Collective Bargaining Convention, 1949 (No. 98)
- C100 - Equal Remuneration Convention, 1951 (No. 100)
- C105 - Abolition of Forced Labour Convention, 1957 (No. 105)
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- C138 - Minimum Age Convention, 1973 (No. 138)
- C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)

The Ministry of Labour and Social Welfare administers industrial relations, employment, migration and social security as well as being responsible for labour inspection. The Directorate for Labour Services is responsible for inspections whilst the following laws cover labour matters:

- Labour Act No. 11 of 2007:

  The Act consolidates and amends the labour law, establishes one comprehensive labour law, that entrenches fundamental labour rights and protections, regulates basic employment terms and conditions, ensures the safety, health, and welfare of employees, protects employees from unfair labour practices, regulates trade union and employer organisation registrations, regulates collective labour relations, provides for systematic prevention and resolution of labour disputes, establishes the Labour Advisory Council, the Labour Court, the Wages Commission and the labour inspectorate, provides for the appointment of the Labour Commissioner and Deputy Labour Commissioner, and provides for incidental matters.
- Regulations relating to the health and safety of employees at work (No. 156 of 1997)

  The Regulations relating to the health and safety of employees at were established under the Labour Act. The regulations are aimed at ensuring the health and safety of employees at work.
- Public Service Act, 1995

  The Act is a Namibian law that provides for the establishment, management, and efficiency of the public service. It also regulates the employment, conditions of service, discipline, retirement, and discharge of staff members in the public service, and other incidental matters. The Act establishes a Public Service Commission in accordance with the provisions of Chapter 13 of the Namibian Constitution.

2.2.7 World Bank Environmental and Social Framework

The World Bank's Environmental and Social Framework (2016) determines 10 Environmental and Social Standards (ESS) which have been designed to meet sustainable development in financing projects throughout the lifecycle. The standards, their objectives and their applicability for the project are listed as follows:

Table 2-2: Environmental and social standards of the World Bank and their applicability for the project

WB ESS	Main topics	Applicability to the project
ESS1: Assessment and management of environmental and social risks and impacts	ESIA, ESMP (content and outlines), project monitoring, stakeholder engagement	For the project, an Environmental & Social Assessment report, and an ESMP are prepared.
ESS2: Labor and working conditions.	Working conditions and management of worker relationships; Protecting the work force; Grievance mechanism; OHS. Specifically designed to protect/manage project workers: direct, contracted, primary supply and community workers; full-time, part-time, temporary, seasonal and migrant workers	The project will employ workers for construction and operation.
ESS3: Resource efficiency and pollution prevention and management	Resource usage efficiency (energy, water, raw materials), pollution prevention and management (waste, air pollution, chemicals, hazardous materials and pesticides),	The project potentially could generate (noise/ waste/soil) pollution.
ESS4: Community health and safety	CHS (Infrastructure and equipment design and safety, Safety of services, Traffic and road safety, Ecosystem services, health issues, hazardous materials, emergency preparedness and response), security personnel, safety of dams	The project potentially impacts the health, safety, and security of project-affected communities during the construction phase (due to transport etc.)
ESS5: Land acquisition, restrictions on land use and involuntary resettlement	Definition of eligibility criteria (not only legal landowners are entitled to compensation), avoidance of resettlement by project design alternatives, compensation and benefits, community engagement, grievance mechanism, requirements for displaced persons. Outline and contents of resettlement instruments: → Resettlement Plan → Resettlement Framework → Process Framework	NOT APPLICABLE The project will not cause permanent or temporary involuntary resettlement, as the land belongs to NamPower. Similarly, there will also be no need for livelihood restoration measures.
ESS6: Biodiversity conservation	Definition of modified, natural and critical habitat (different requirements apply), biodiversity offsets, legally and	The ESS is still regarded as relevant, however the Lithops site has been cleared of

WB ESS	Main topics	Applicability to the project
and sustainable management of living natural resources	internationally protected/recognized areas, invasive alien species, sustainable management of living natural resources.	vegetation and is largely a modified habitat therefore little to no impact is anticipated.
ESS7: Indigenous peoples/sub-saharan African historically underserved traditional local Communities	Impact assessment specifically on IP/SSAHUTL, Free, Prior, and Informed Consent (FPIC), IP/SSAHUTL Plan, consultation, cultural heritage, grievance management	NOT APPLICABLE
ESS8: Cultural heritage	Cultural Heritage Management Plan, Chance finds procedure, stakeholder consultation.	NOT APPLICABLE
ESS9: Financial Intermediaries	ESMS for FIs, stakeholder engagement	NOT APPLICABLE The project is not financed by Financial Intermediaries (FIs)
ESS10: Stakeholder engagement and Information Disclosure	Stakeholder Engagement Plan, information disclosure, meaningful consultation, grievance mechanism, external reporting,	The project will involve stakeholders; a SEP is prepared

2.2.7.1 General Environmental Health and Safety Guidelines of the World Bank Group

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents that provide Good International Industry Practice in investment projects. The standard states that the applicability of the EHS Guidelines is tailored to the hazards and risks established for each project on the basis of the results of an environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are taken into account.

Considering the type of technology and location of the project the main areas of EHS assessment includes:

- **Environmental assessment**, e.g. waste streams, and noise.
- **Occupational health and safety** such as physical hazards, personal protective equipment, communication and training.
- **Community health and safety**, e.g. hazards for the surrounding communities. The risks and impacts of the BESS have been assessed throughout their lifecycle regarding the above-mentioned aspects. The Environmental and Social Management Plan will list the identified issues and determines appropriate management actions and monitoring procedures for mitigation.

2.2.7.2 World Bank Group Environmental Health and Safety Guidelines for the Power Sector

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in

addition to power distribution from a sub-station to consumers located in residential, commercial and industrial areas.

This document provides impacts and mitigation measures for issues such as terrestrial habitat alteration, aquatic habitat alteration, electric and magnetic fields and hazardous materials. For the BESS the industry specific EHS guideline that is relevant is the Electric Power Transmission and Distribution (2007) Guideline.

The environmental issues related to the construction, operation and decommissioning of energy projects and facilities include:

- Electric and magnetic fields
- Hazardous materials
- Occupational Health and Safety

3 Project Description

3.1 Location of the Project Site

The project is proposed to be located at the existing Lithops substation, whose land was obtained over 10 years ago for the purpose of constructing a substation. The Lithops substation is in the Erongo region falls directly on the edge of the Dorob National Park. The substation is located adjacent to the B2 which is the main road between Swakopmund and Windhoek, at a distance of approximately 45 kilometres east from Swakopmund in the direction of Windhoek (see Figure 3-1 below). Further details relating to the physical environment can be found in section 6.

Figure 3-1 Location of Lithops SS

The desert around the substation has almost no vegetation and requires almost no clearing or levelling. The area selected for the installation of the BESS is therefore considered to be largely characterized by modified habitats. A modified habitat, in terms of the World Bank ESS6 is considered to be an area that may contain a large proportion of plants and/or animals species which are not native and or where human activities has substantially modified an area's primary ecological function and species composition as in the case of the BESS location.

Figure 3-2: Arial view of Lithops SS (Source: NamPower)

The site can be accessed from the B2 (tarred road) turning south onto the private access mine road to Husab Mine. The mine road is a dirt road (see Figure 3-3 below) that is well constructed and graded and in excellent condition. This road provides direct access to the Lithops substation.

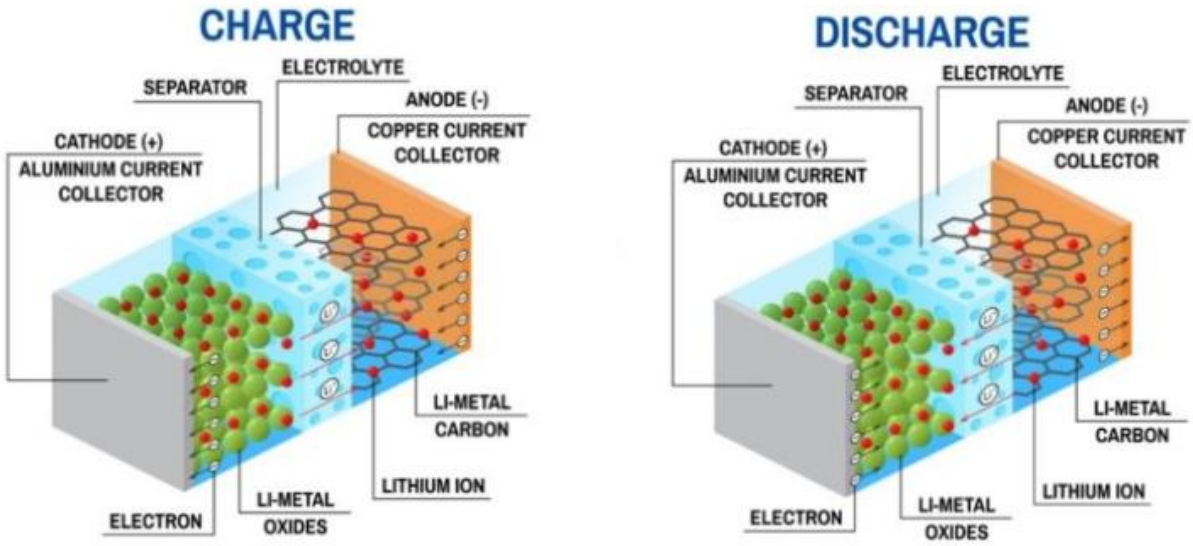
Figure 3-3: Access Road to Lithops Substation

3.2 Technical description

A Battery Energy Storage System is an electro-chemical energy storage which can charge and discharge electrical energy with a fast response time. These electro-chemical accumulators convert electricity by

means of chemical reactions. There are two types of electro-chemical batteries. One has an internal storage, where the energy is stored where the reaction takes place. The other one has an external storage, where the reaction unit and electro-chemical storage are physically segregated. In addition, there is a distinction between low and high-temperature batteries.

- Function of Anode: Stores lithium and releases lithium–ion when discharging
- Function of Cathode: Stores lithium and releases lithium–ion when charging.



Source: Hideninc

Figure 3-4: Schematic of electro-chemical accumulators

The combination of materials for electro-chemical storage is theoretically unlimited. In practice, the following batteries are commonly used, have a great potential from a technical or economic perspective and differ fundamentally in their technology:

- Lead-Acid (Low Temperature)
- Lithium (Low Temperature)
- Sodium-Sulphur (High Temperature)
- Flow Battery (External Storage).

Mostly, battery storage plants are used for short-term peak power and ancillary services to increase the grid stability. With recent cost reductions, the shift of energy for several hours is becoming more feasible. The term BESS refers to the whole integrated turnkey battery system including the required auxiliaries and balance of system.

A typical BESS contains the following main components:

- Housing: The BESS is often containerized with indoor or outdoor power conversion and transformer stations.
- Battery cells: The building block of any battery system, which is a single cell consisting of cathode and anode.
- Battery module: Multiple cells connected in series and/or parallel to form a battery module, which typically includes protection elements, module management system, cells' state and temperature monitoring.

- Battery rack: Multiple modules stacked together, usually connected in series, and stacked vertically. Racks are the BESS main building unit.
- Power Conversion System (PCS): Usually a bi-directional power electronics converter to convert between the battery DC and the grid AC in both directions for charging /discharging.
- Battery Management System (BMS): The controller of the battery system, which monitors and controls the batteries, usually implemented on module level, rack level, and BESS level.
- BESS Balance of Power (BoP): All auxiliaries required for the BESS electrical installation including cabling, transformers, protection devices, etc.
- BESS Balance of System (BoS): All auxiliary systems required by the BESS to function correctly and safely, including HVAC equipment, fire detection & suppression system, lighting, surveillance & alarms, etc.

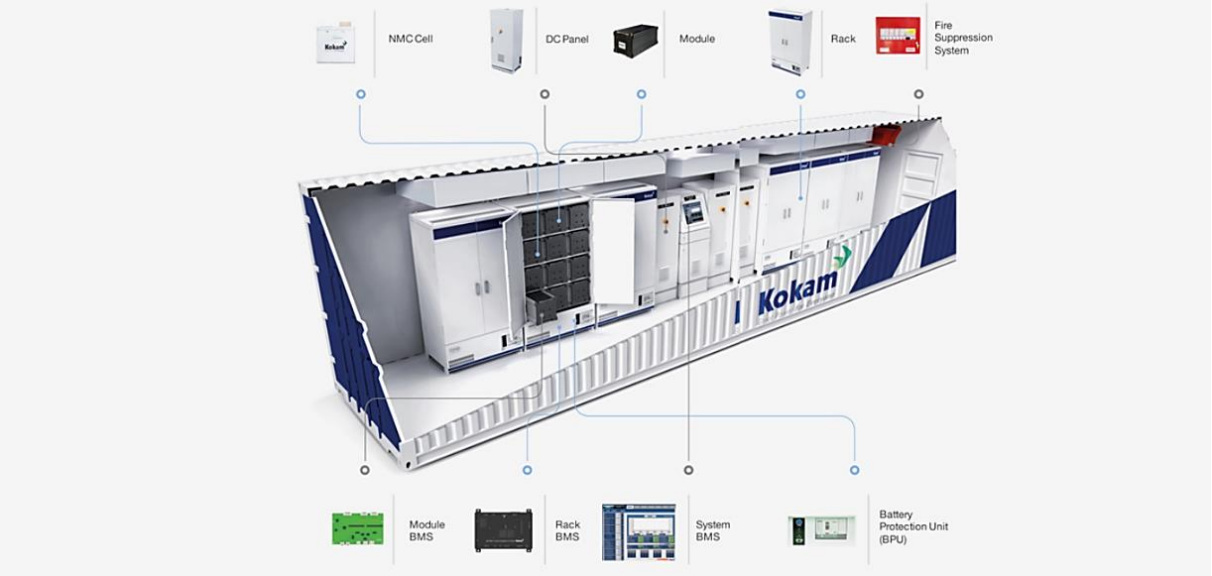


Figure 3-5: Typical containerized BESS Source: Kokam

The following conversion losses of major equipment need to be taken into account in a BESS to determine the round-trip efficiency. In addition, auxiliary losses for I&C and HVAC systems will increase the difference between charged and discharged energy.

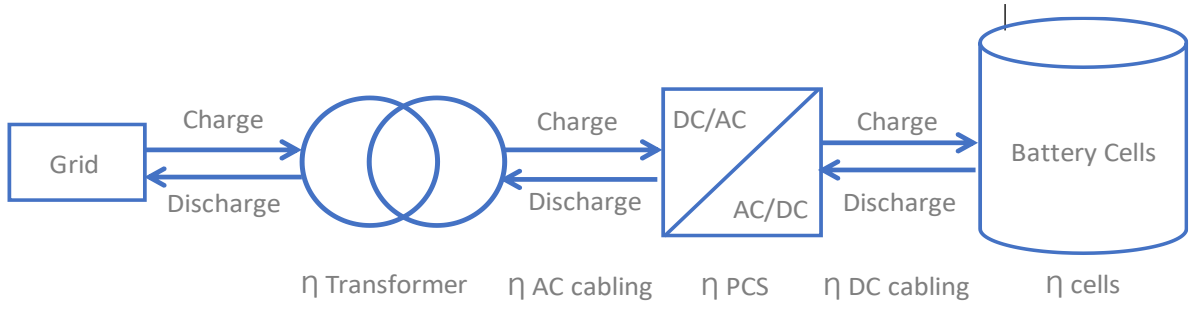


Figure 3-6: Efficiencies of BESS main equipment

3.2.1 BESS terminology

The BESS technology as a unique simultaneous generation and load asset differentiates from other generation or grid infrastructure technologies. The following terms summarize the most important energy storage terminology and definitions:

- Battery capacity is the nameplate energy capacity of the battery at the beginning of life. It is usually expressed in MWh or Ah.
- Usable battery energy capacity is the actual utilizable energy capacity of the battery expressed in MWh (at beginning of life at the point of connection). It is slightly less than the battery capacity due to conversion and transmission losses.
- BESS maximum charge/discharge power is the maximum power that can be supplied or absorbed by the BESS. This value can differ between the charge and discharge and is typically expressed in MW.
- C-rate is the ratio between the maximum power of BESS or battery to the battery capacity.
- Storage-hours is the inverse of C-rate, expressed in hours.
- State of Discharge (SoC) is the ratio of actual energy stored in the battery to the total battery capacity, which is typically expressed in % (e.g. 100% SoC means fully charged battery).
- State of health (SoH) is a complex indicator of the health state of the battery that indicates if the battery needs maintenance or replacement.
- Depth of Discharge (DoD) is the inverse of SoC, which is the ratio of the total battery capacity to the actual energy stored. It is typically expressed in % (e.g. 100% DoD means fully discharged battery).
- Maximum Depth of Discharge is a set-point of the BESS BMS to determine the maximum allowable depth of discharge that the battery in this system can reach. This is important for the protection of excess degradation of the battery and usually a manufacturer recommendation.
- Cycle: The complete charge and discharge of the BESS. One cycle is measured by the discharged energy of the currently available useable battery energy capacity at the point of connection.
- End of Life (EoL) is the point where the battery needs to be replaced and is considered as having reached its end of life. It is typically a manufacturer given figure and expressed with % of initial nameplate capacity (typically EoL is at 70-80% of initial battery capacity for Li-ion batteries).
- Lifetime cycles is the number of full cycles a battery can perform before reaching EoL. The value is typically between 4,000-6,000 for mainstream Li-ion commercial technologies. However, flagship Li-ion battery technology may reach more than 10,000 cycles.
- Capacity degradation: The cells degrade by various factors including consumption pattern, temperature, performed cycles, etc. This value depends on the application and is usually provided by the BESS supplier.
- Battery aging is the % loss of battery initial capacity due to chemistry aging, typically below 3%/year for Li-ion batteries.
- Augmentation is the additional installation of battery modules during operation to offset battery aging.
- Calendric lifetime is the end of life of battery due to aging only, regardless of cycles performed, typically around 15-20 years for Li-ion Batteries.
- Cells round-trip efficiency is the typical cycle efficiency of the cells accounting only for the losses due to battery cells chemistry and electrodes. It is typically above 90% for Li-ion Batteries.
- Charging/discharging efficiency is the one-way efficiency that accounts for charging or discharging losses expressed in %. This can account for PCS and DC losses or only DC losses.
- BESS round-trip efficiency is the combined efficiency for a typical charge and discharge cycle. For AC coupled Li-ion BESS systems, the AC-AC round-trip efficiency is typically around 85%.
- BESS auxiliary demand is the power demands of the auxiliary systems in BESS including HVAC, BMS, lighting, transformer, and PCS standby losses, etc.
- Use cases are the potential application scenarios of the BESS in which it will try to create value for the owner.

- Duty cycle is an annual charge and discharge operational procedure based on the Use Cases for the BESS which is required by BESS suppliers to design the optimum suitable system and forecast the battery aging.

The following schematic shall aid in understanding the different BESS terminologies for a BESS system with three differently aged and charged battery systems.

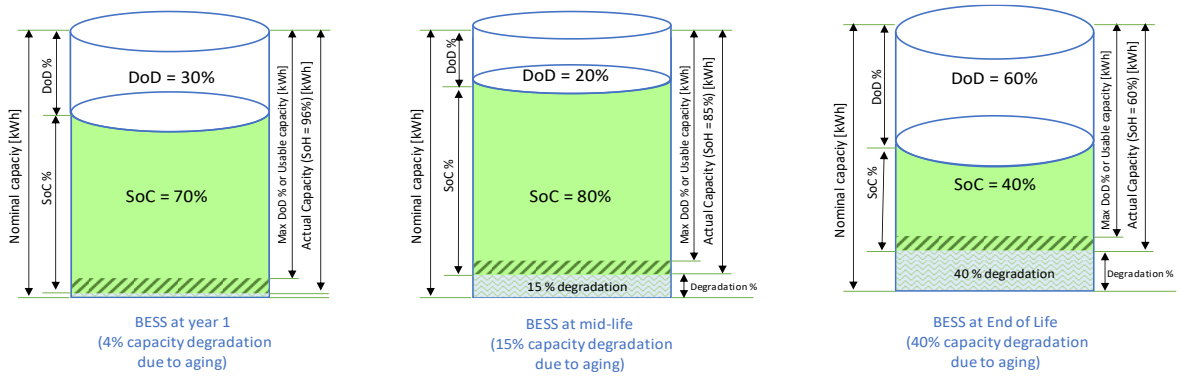


Figure 3-7: Visual explanation of BESS terminologies

3.2.2 Technology recommendations

While for long periods of time the lead-acid technology has been the predominant technology for battery applications, lithium-ion, sodium and redox flow technologies are today also potential solutions. When selecting the current technology for the desired application, the power-to-energy ratio is important. While lead-acid and lithium-ion technology can work with a high power-to-energy ratio, sodium and redox flow require a lower power ratio to be feasible.

The table below lists some battery system technologies suitable for different power-to-energy ratios.

Table 3-1: Typical power-to-energy ratios for different technologies

Technology	Optimum power to energy ratio in MW/MWh
Lead acid: high power	3:1
Lead acid: standard	1:20
Lithium Ion: LFP type	5:1 - 1:4 (most typical: 1:1 1:2)
Lithium Ion: NMC type	2:1 - 1:4 (most typical: 1:1 1:2)
Lithium Ion: LTO type	10:1 - 5:1 (most typical: 1:1 1:2)
Sodium sulphur	1:6 - 1:8 (most typical: 1:6)
Sodium Nickel Chloride	1:2 1:4
Vanadium Redox Flow	1:4 - 1:10 (most typical: 1:6)

It should be noted that the power-to-energy ratio is only one of multiple performance benchmarks relevant for the selection of a suitable battery technology. Other benchmarks include:

- Efficiency
- Calendric and cycle lifetime
- Material and product availability
- Compatibility with ambient conditions (e.g. temperature, dust, earthquake resistance).

Due to their broad power-to-energy ratio range and drastic CapEx decrease, a BESS using a battery system of lithium-ion type is currently the most economical choice both for power-based use cases with high power-to-energy ratios around 1:1 and energy-based use cases with power-to-energy ratios around 1:4.

This is in line with the general trend of BESS installations by technology as shown in the Figure 3-8 below. It is apparent that lithium-ion batteries currently dominate the market.

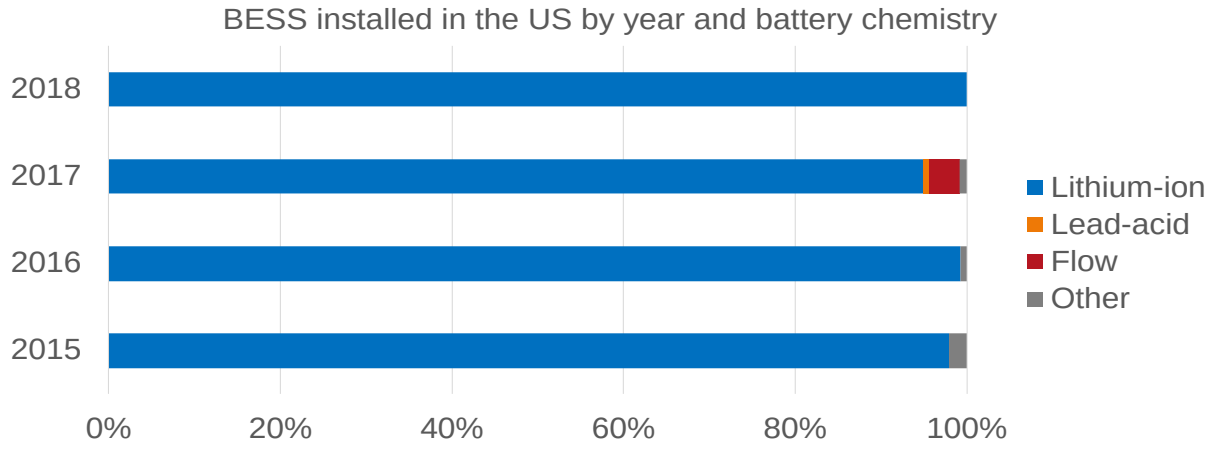


Figure 3-8: BESS installed in the US by year and battery chemistry.

Lithium-ion accumulators are known for their high energy density, and they find application in mobile devices like phones, laptops and electric vehicles. Due to the vast range of applications, most of the research and development budget in recent years has gone into this technology. The stationary lithium storage profits from the large-scale factories deployed for the demand of electric vehicles. There is currently no other storage technology which benefits from technical improvements and cost reductions in a similar way.

Within the lithium-ion technology, three major sub-technologies are available on the market. They differentiate mostly by their cathode materials:

- NCA: nickel cobalt aluminum oxides
- NMC: nickel manganese cobalt oxides
- LFP: iron phosphate

Fichtner's recent large-scale BESS tender experience from 2023 confirms the best value of lithium-ion, in particular the LFP technology. A potential tender for this project shall be kept open to lithium-ion cell chemistries such as NMC, NCA, LFP, etc. as well as potential upcoming sodium-ion technologies to benefit from potential market shifts. However, the LFP technology has been selected for this project. Cost parameters and technical specifications will be based on this technology, as it will be the most likely selected technology for this project.

3.2.3 Equipment

A BESS using lithium-ion batteries features the following main components:

- Battery system with accessories
- Power Conversion System (PCS) for AC/DC conversion to charge and discharge the battery system.
- Main transformers (standard types for inverters)
- Main switchgear (standard types)

- Control system
- Electrical Balance of Plant (BOP)
- Civil Balance of Plant (BOP)

3.2.3.1 Battery system with accessories

In most contemporary BESS, the battery system with accessories comes factory-made. This reduces the time and possible errors of any integration on site. Due to transport safety concerns, the battery modules may be shipped separately and mounted on site.

Battery systems for large-scale BESS often come in 40' (12.2 m) sea freight containers due to the ease of transport and handling of these units. One container typically has an energy capacity of between 2 MWh and 4 MWh. Higher energy densities of up to 9 MWh are possible, but these densities significantly increase cost, maintenance effort and result in cooling difficulties.

Figure 3-9: 2.7 MWh battery system in 40' (12.2 m) container. Image: Sungrow / Samsung SDI

3.2.3.2 Power conversion system (PCS)

Power conversion systems for large-scale BESS are often adaptations of inverters from PV or wind. Central PCS of a nominal power between 2 MVA and 3 MVA are used in most applications.

High-voltage (HV) and medium-voltage (MV) equipment

Just as in any larger electrical asset like transformer substations, wind power plants and large industrial customers, large-scale BESS contain HV and MV transformers, switchgears, cables and other accessories. These components are typically operated at lower currents, but much higher voltages, than the low-voltage components. Therefore, they have a higher risk of emitting high-level electric fields at the grid frequency (usually 50 Hz).

The countermeasures against these emissions include shielding of the affected components and suitable arrangement of the cables. As this risk is existent in most other electrical assets, the countermeasures are state-of-the-art technology.

Inverters and other low-voltage (LV)2 equipment

The power conversion structure between DC and AC in a BESS is very similar to the power conversion in PV power plants and DC-coupled wind power plants. All energy that is fed into the grid from the battery

[2] According to the IEC definition, low voltage refers to voltages up to 1000 V AC and 1500 V DC

and charged from the grid into the battery passes through a *Power Conversion System* (*PCS*, also referred to as *Inverter*). This PCS is a device that uses fast switching solid-state switches to convert DC to AC and AC to DC. Common switching frequencies are in the range of 1 kHz to 4 kHz and the associated rise times of the current are in the range of 10 ns to 300 ns.

These steep current rise times naturally lead to the emission of high-frequency magnetic and electromagnetic fields, which are harder to shield than the low-frequency electrical fields from the HV and MV components. These fields can be radiated from the inverter cabinet itself. They can also be transmitted through the AC low-voltage cabling up to the step-up inverter and the DC low-voltage cabling and radiated from these cables or the transformers and batteries.

Figure 3-10: WSTech APS series; Image I WSTech

Figure 3-11: SMA Sunny Central Storage PCS; Imal(c) SMA

Figure 3-12: GPTech WD3 Central PCS; Ige (c) GPTechs

3.2.4 BESS technical specifications

The following technical specifications have been based on actual performance and guaranteed results from other recent BESS projects for the LFP lithium-ion technology to be implemented in 2024. No major further technology improvements are expected for the implementation in 2026. Currently, the trend is to increase the energy density for EV applications and reduce the costs from economy of scale.

- Useable Energy Capacity (State of Health) depending on utilization and typical warranty conditions of LFP cells for 2020.
- Round-trip efficiency of 85% (up to 87% possible in moderate climates) with load factor of 17%. This includes the auxiliary losses during operation.
- For the climate of 20-25 °C average annual ambient temperature, an auxiliary consumption for stand-by (no charging or discharging) will be required of 0.995%/MWh/h of installed BESS energy capacity. This means that for the given climate, a 1 MWh BESS will consume around 10 kW during stand-by.
- Footprint Energy Capacity: up to 5 MWh for the battery system fit in one 40-foot (12.2 m) container.
- Footprint Power: up to 5 MVA for the Power Converter, transformer and MV Switchgear fit in one or two outdoor stacks (8 m) container.
- Depth of Discharge is 100%.
- End of Life in the year where the State of Health drops below 60% for the first time.

The lifetime and degradation are dependent on the utilization of the BESS. The utilization is measured by the amount of average annual cycles per day. The definition of cycles can sometimes vary between suppliers. For the figure below, the definition of one cycle shall be the discharge at the point of connection of the current energy capacity of the storage (i.e. if a 10 MWh BESS discharged 3,650 MWh per year). The degradation as shown in Figure 3-13 is rather significant in the first year (initial degradation). Afterwards, the degradation is almost linear with the slope depending on the number of cycles a day. Since the End-of-Life energy capacity (i.e. State of Health below 60%) is reached earlier with more cycles, the potential lifetime can be determined. While a BESS with 1 cycle or less per day can reach a lifetime of 20-23 years, two cycles per day will result in a lifetime of only 18 years.

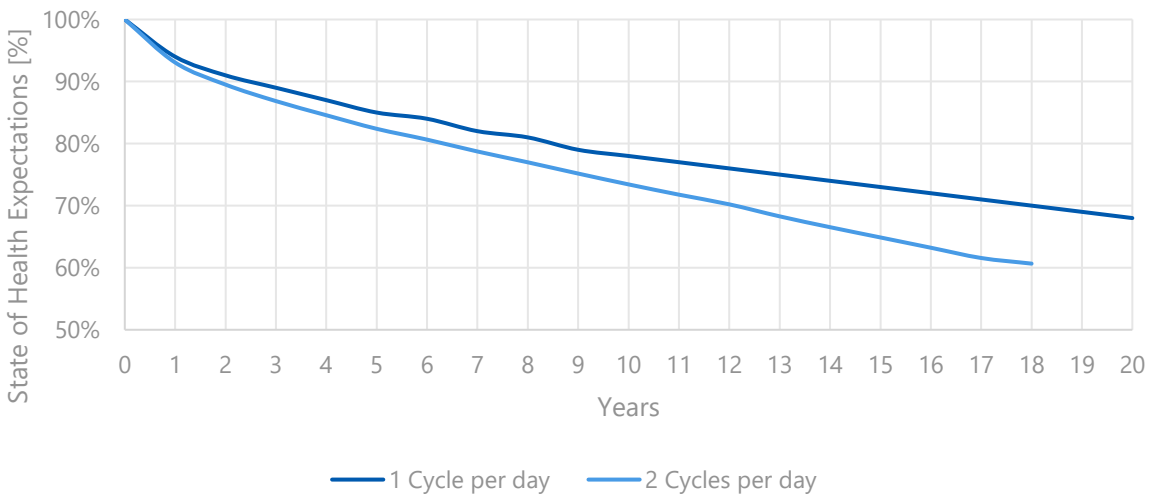


Figure 3-13: Degradation of BESS with typical LFP technology of a 2023 model

Augmentation of the BESS, meaning the installation of additional battery modules throughout the lifetime, would increase the State of Health and could potentially increase feasibility further. This should, however, not be used for decision-making due to uncertainties in the augmentation costs. Whether the option of augmentation will add value should be decided during operation when the actual degradation is known and the investment in additional energy capacity vs potential additional revenues can be calculated with greater certainty. It is, however, recommended to leave around 20% additional physical space for potential augmentation. Below a remaining SoH of 60%, the lithium cells should be decommissioned and recycled, as they have reached the end of life and larger cell variations could increase safety risks.

3.3 Project Stages

The BESS will be constructed within the footprint of the existing land of the Lithops Substation. An ESIA was undertaken in 2011 where an optimum location for the Lithops substation was identified, based on the following reasoning:

"The selection of a suitable site for the substations was made on the basis that the substations must be placed on level ground, it should be outside of sensitive environmental and tourism areas, it cannot be placed on marble because as it must be earthed, it must fit into the planning for the temporary and permanent power line routes, and must adhere to the aviation authority restriction on placing the substation outside of the critical zone of the Arandis airport." Metago, 2011.

3.3.1 Pre-construction

During the pre-construction phase, all environmental and socioeconomic risks and impacts as identified in this report will be incorporated into the design.

For the current planned BESS project in Namibia, it is assumed that parts and equipment will need to be internationally sourced. Port of entry for these parts etc. will most likely be Walvis Bay industrial port in the Erongo region, which allows for easy and reliable access to site.

Li-ion batteries can generate a great amount of heat if short circuited. In addition, the chemical contents of these batteries may catch fire if damaged or if improperly designed and/or assembled. Hence, batteries and their respective components should be packed to eliminate the possibility of a short-circuit or activation while in transport. For these reasons, there are safety regulations controlling the shipment and transport of these types of batteries. Usually Li-ion batteries are regulated as hazardous materials or as dangerous goods, that may only be transported under specific hazardous materials/dangerous goods regulations. It is recommended for NamPower to source Batteries from suppliers which considers sustainability as part of their manufacturing strategy. NamPower should also include commitments to identify battery technology which considers use of materials that are considered sustainable and that their installer/ contractor will demonstrate, it has done its due diligence on the battery supply chain as was as reasonably possible.

3.3.2 Construction

The BESS containers will arrive preassembled and placed their designated location on the levelled site.

The BESS will require a footprint of roughly 4000m^2 (or 0.4 ha) for 9 units of 5 MVA / 10 MWh to achieve a useable BESS capacity of 45 MVA / 90 MWh. The total footprint of those BESS units including PCS and transformer would be with a typical design 3000 m^2. An additional area of 1000 m^2 should be considered for the MV Switchgear station, maintenance roads and fencing.

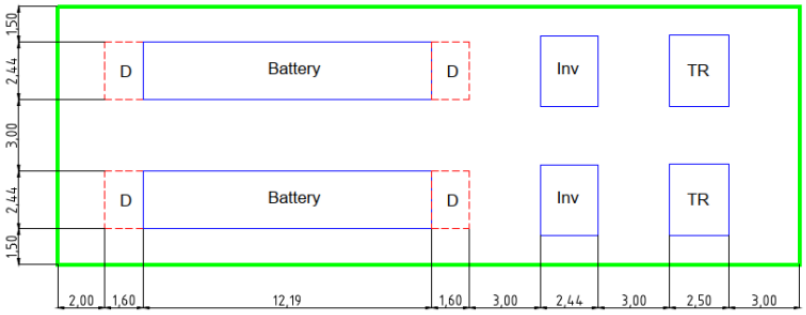


Figure 3-14 Estimated footprint and layout of 5 MVA / 10 MWh BESS units.

The area in white would indicate the 16 hectares of land that is available to NamPower at Lithops Substation of which 8 hectares is unfenced and available for the placement of the BESS. Currently only the existing infrastructure is fenced as can be seen in figure 3-15. The actual placement of the BESS on the available land will be determined by the transmission connection planning which is currently ongoing. Less than 4000m^2 (or 0.4 ha) will be needed for the BESS and will therefore have sufficient area within the existing Lithops SS footprint.

Construction, site preparation

Construction risk for large scale BESS projects is generally regarded as low and is classified as a simple building task. This is because the BESS is pre-assembled and containerized, with limited construction activities required at site.

The actual works at the Lithops substation will include general civil work such as minimal land clearing, land levelling, preparation for the site office and temporary facilities, foundation work of the battery

system, Power Conversion System (PCS), Medium Voltage (MV) switchgear and then the electrical cables trench works for connection to the actual substation.

Construction risks will be managed in accordance with the Management Plan.

Figure 3-15: BESS Layout at Lithops

There are steps to reduce risks on the BESS site which must be part of the emergency preparedness plan:

- Locate storage systems well away from critical buildings or equipment. Each BESS container must be situated 1-3m away from the next.
- Exterior protection such as a passive thermal barrier and active fire protection such as drenchers must be part of the design of the BESS.
- Battery management systems and the electrical switch gear must not be located within the preassembled containers and must be situated between 10–20m away from the closest container.
- Adequate fire doors (>FR60) must be installed as part of the preassembled containers. They must be maintained in the closed position and equipped with automatic closure mechanisms. Where insulated metal panels (IMPs) are used, these should contain a mineral wool core and be installed in accordance with the terms of their approval. Only non-combustible IMPs should be installed.
- Ensure proper management of cable/service penetrations. Cable penetrations should be adequately sealed to meet the fire resistance of the compartment (two-hour fire resistance rating). Heating, ventilation and air conditioning ducts must have fire dampers provided that automatically close on activation of the fire alarm. Establish a permit to access system to manage changes to service or cable penetrations under an audited system.
- Develop a fire protection Plan, that includes highly sensitive smoke detectors, and an inert gas and/or foam fire suppression system to control thermal runaway.

3.3.3 Operation

During Operation this section lists the typical tasks that apply for large-scale BESS using lithium-ion batteries. Specific technologies and suppliers may require additional works.

This section lists typical O&M tasks that apply for large-scale BESS using lithium-ion batteries. Specific technologies and suppliers may require additional works. The following terms are used.

Term	Meaning
Battery system	The DC battery system including cells, modules, DC switchgears and cabling
PCS / Power Conversion System	The bidirectional inverter
PPC / Power Plant Controller	The central controller for the operation of the BESS power plant
Primary equipment	Other equipment that takes part in the main power flow, e.g. transformers and medium-voltage switchgear
FDS	Fire detection system
FSS	Fire suppression system (if any)
Auxiliaries	Other equipment, e.g. auxiliary power, UPS, lighting
BESS	Battery energy storage system, i.e. the combination of all of the above

The column "S" indicates whether the task is BESS-specific ("Y") or also commonly has to be carried out for other energy installations ("N").

The column "SL" indicates the service level that is usually required for the task:

1. Means general tasks that can be carried out by local personnel, e.g. technicians.

2. Means tasks that require specific education. These can be carried out by specially educated local personnel or the suppliers' personnel.

3. Means tasks that require expert skills. Usually carried out by the supplier**.**

Table 3-2: Operation

Equipment(s)	S	SL	Work (Operation)	Interval
BESS	N	1	Site safety monitoring	Continuously
BESS	N	2	Operation control and supervision including remote diagnosis (usually in a remote operations and control centre)	Continuously
BESS	Y	2	Health and safety management (including battery-specific risks with specific skill and PPE requirements)	Continuously
BESS	N	2	Monitoring of economic key performance indicators, e.g.: ▪ Service quality ▪ BESS availability	Continuously
All	N	2	Switching procedures for start-up and shutdown	When required

Equipment(s)	S	SL	Work (Operation)	Interval
All	N	2	General isolation and connection procedures	Maintenance, repair
PCS, battery system	Y	2	Isolation and connection procedures on the DC system	Maintenance, repair
BESS	Y	2	Emergency procedures management	In case of emergency
BESS	Y	2	Operation documentation (including verification of data log completeness required for warranty)	Continuously

3.3.3.1 Maintenance

Predictive maintenance

Table 3-3: Predictive maintenance

Equipment(s)	S	SL	Work (Preventive Maintenance)	Interval
PCS, PPC, battery system	Y	3	Remote monitoring by supplier	Continuously
BESS	Y	2	Monitoring of technical key performance indicators, e.g.: ▪ Equipment availability ▪ Efficiency ▪ Auxiliary power consumption	
BESS	N	1	Visual inspection	1 week

Preventive maintenance

Table 3-4: Preventive maintenance

Equipment(s)	S	SL	Work (Preventive Maintenance)	Interval
HVAC, PCS	N	1	Air filter replacement	1 month -1 year
PPC, other IT security-related equipment	N	3	IT security updates and patches (usually serviced remotely)	1 month or when needed
PCS, battery system	Y	2	General maintenance according to manufacturer's instructions	1 year
HVAC, PCS	N	2	Cooling system preventive maintenance (pumps, fans, cooling liquid status, etc.)	1 year
All	N	2	Cleaning	1 month -1 year
All	N	1/2	General electrical safety testing (HiPot, AC protection functions, thermography)	1 year
All	Y	2	Battery system electrical safety testing (insulation resistance, protection functions, thermography)	1 year
Battery system	Y	2	Energy capacity test	1 year

Equipment(s)	S	SL	Work (Preventive Maintenance)	Interval
PCS, PPC, battery system	Y	3	Software and firmware updates	Continuously or 1 year
PCS, battery system	Y	2	Spare parts maintenance (restocking, inspection, spare battery recharging)	1 year
FDS, FSS	Y	3	Minor maintenance	3 months
FDS, FSS	Y	3	Major maintenance	1 year
Auxiliaries	N	1	General auxiliaries' maintenance (inspection, UPS battery replacement, lamp replacement, etc.)	1 year

Corrective maintenance and repair

Table 3-5: Corrective maintenance and repair

Equipment(s)	S	SL	Work (corrective maintenance and repair)	Interval
BESS	N	2	Fault identification	After fault
Battery system	Y	2	Battery module and fuse replacement	After fault
PCS	Y	3	Power stack and fuse replacement	

The developer, owner and operator (NamPower) should prepare a fire safety and emergency plan which will contain, but not be limited to, the ingress and egress routes to buildings, access routes for emergency vehicles, fire management and compliance with fire safety legislation.

3.3.4 Decommissioning

The BESS system must be de-energised safely before any other steps can be taken. Before the transportation of the components, relevant safety prescripts must be in effect, to ensure that the BESS system and its components are safe to transport.

A decommissioning plan will be prepared before any decommissioning activities begin. The plan must and clearly define which parties are responsible for decommissioning the BESS. The plan should be a living document that is updated as technologies, experience with BESS, and relevant codes and regulations evolve over the project lifecycle. This plan must be submitted to MEFT for approval prior to the decommissioning phase.

The decommissioning of the BESS site itself must be done in accordance with the site specific NamPower ESMP:

3.3.5 Disposal and recycling of batteries

As most batteries contain heavy metals and other toxic substances, it is not desired to dispose of them in general landfills or in the environment. The battery "blades" contain valuable rare earth metals - particularly Lithium and Cadmium that are sealed within gel structures. These are of high value when they reach the end of their working life and should be returned to the manufacturer for recycling.

The major environmental risk is leakage of the battery cells when they have been disposed of improperly after the decommissioning of the BESS. This leakage may lead to soil and groundwater contamination.

There are currently no regulations in Namibia which governs safe disposal of electronic waste therefore the project will adopted international best practices for the disposal of batteries. Furthermore, in an effort to reduce impacts associated with battery waste the project will prioritize procurement of batteries from suppliers with a take back policy. In the instance where batteries are disposed of without returning to the supplier, only local recycling processors that adhere to appropriate methods of disposal and recycling will be used, and under the guidance of the original equipment manufacturer and as stipulated in the WEEE plan that will be developed for the project.

NamPower will ensure that the decommissioning and disposal (D&D) costs at end of life are duly considered and factored into the operational cost of the project.

4 Methodology for assessment of the significance of impacts

Fichtner's methodology for classifying the impacts of a project on the environment is based primarily on the ARVI approach (IMPERIA, 2015). ARVI is an approach for assessing the significance of the expected impacts of a proposed development project and was the key deliverable of the EU sponsored IMPERIA Project[3].

The ARVI approach was adapted by Fichtner's experts based on the European Commissions' Guidance on Scoping (EU, 2017) and Fichtner' s long term experience with ESIAs. This resulted in a transparent, reliable and objective methodology that is depicted into the following 3 steps:

- Step 1: Distinguish positive and negative impacts.
- Step 2: Dismiss non-significant impacts.
- Step 3: Multi-criteria analysis for significant impacts pre- and post-mitigation

A scheme of the three steps and the interactions among them is shown in Figure 4-1. An explanation is provided in the following paragraphs.

[3] More on this project here: https://www.jyu.fi/science/en/bioenv/research/natural-resources-and-environment/imperia-project

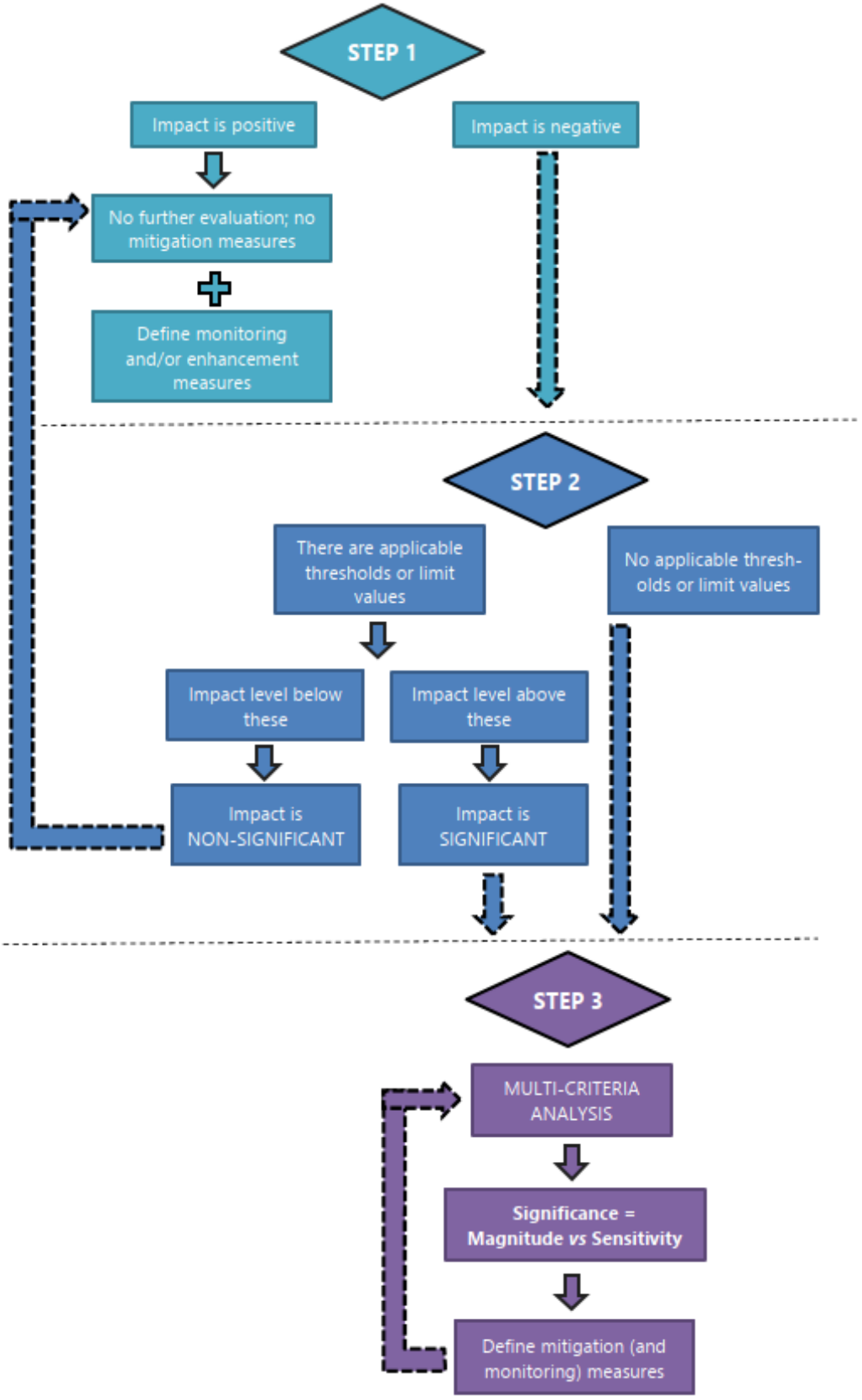


Figure 4-1: Fichtner's methodology for assessment of the significance of impacts

4.1.1 *Step 1: Distinguish positive and negative impacts.*

The methodology begins by distinguishing positive from negative impacts. **Positive** impacts do not require further evaluation but require the development of enhancement and respective monitoring measures were pertinent and feasible.

Negative impacts shall be further evaluated in Step 2.

4.1.2 Step 2: Dismiss non-significant impacts.

For those impacted components for which a threshold or a limit value is defined (in the national legislation or international guidelines), these shall be used to initially understand the degree of change in the receiving environment. If the impact of the project is foreseen as being below the threshold or limit value, then the impact can be classified as **non-significant** and can be dismissed from further assessment. For non-significant impacts mitigation measures are not necessary, but monitoring may be applicable.

If the impact of the project is foreseen as being above the threshold or limit value, then the impact can be classified as **significant** and shall be subject of further assessment by using the multi-criteria analysis method (Step 3). This method is also to be used when no thresholds or limit values are available.

4.1.3 *Step 3: Multi-criteria analysis for significant impacts pre- and post-mitigation*

At present, there is no international consensus among practitioners on a single or common approach for analysing and classifying the significant impacts. Fichtner developed an approach based on the one commonly followed in the EU that consists of evaluating significance based on the magnitude of the predicted effect and the sensitivity of the receiving environment:

Magnitude vs Sensitivity = Significance

The formula above is applied exclusively to negative significant impacts, i.e., to those impacts that need further assessment beyond steps 1 and 2.

For all significant impacts, mitigation measures are defined to lower, eliminate or compensate for negative effects. The residual significance, i.e., the significance after specified measures are applied is then assessed by applying once more the multi-criteria analysis.

Magnitude

The magnitude of the negative significant impacts is evaluated based on 6 criteria, each of them being evaluated based on 2 to 4 levels:

- Spatial extent of the impact
  - local: up to 5 km (typically including site + neighbouring properties/settlements)
  - municipal: 5 -10 km (typically including one municipality)
  - regional: 10 - 100 km (typically including one region)
  - wide range/transboundary: > 100 km (typically including several regions and/or crossing national borders)[4]
- Duration of the impact
  - short term: construction activity[5] <1 year
  - medium term: construction activity >1 year
  - long term: project life (operation)
  - permanent: lasting (even after decommissioning)
- Frequency of the impact
  - once
  - irregular but less than or equal to once per year
  - seasonal (2 to 4 times per year)
  - repeatedly (more frequently than 4 times per year)
- Ability of the receiving environment to recover/degree to which impact can be reversed.
  - Ability to recover - reversible impact.
  - No ability to recover - irreversible impact.
- Probability of the impact occurring (expert assessment)
  - unlikely: unlikely to occur.
  - possible: may occur.
  - probable: likely to occur.
  - definite: will certainly occur.
- Intensity (can often be measured with various physical units; if not, expert assessment is used)
  - low - the change to environmental conditions or on people is small (or up to 5% above thresholds/standards)
  - medium - the project has a clearly observable negative effect on nature or environmental load (or up to 25% above thresholds/standards). A social change has an observable effect on people's daily lives and may impact daily routines.
  - high - the project has a large detrimental effect on nature or environmental load (or up to 50% above thresholds/standards). A social change clearly hinders people's daily lives.
  - very high - the project has an extremely harmful effect on nature or environmental load (or equal to or more than 75% above thresholds/standards). A social change substantially hinders people's daily lives.

[4] A transboundary impact is always classified as a wide range impact, even when it is expected within a range shorter than 100 km.

[5] Construction activity in this context refers to specific time-limited activities leading to impacts such as excavations, levelling, blasting, etc., and not to the whole construction period.

After each magnitude criteria is classified according to one of the 4 levels (or 2 levels, in case of "ability to recover"), these are evaluated by means of a scoring system, improving thereof the level of transparency and objectivity of the analysis. The result is a classification of the magnitude of each impact as low, medium, high, and very high.

MAGNITUDE					*EXAMPLE*
Scoring Criteria	**-1:**	**-2:**	**-3:**	**-4:**	*Impact X*
Spatial extent	Local	Municipal	Regional	Wide range/Transboundary	*Regional: -2*
Duration	Short term	Medium term	Long term	Permanent	*Permanent: -4*
Frequency	Once	Irregular	Seasonal	Repeatedly	*Once: -1*
Ability to recover	Reversible	-	-	Irreversible	*Reversible: -1*
Probability	Unlikely	Possible	Probable	Definite	*Possible: -2*
Intensity	Low	Medium	High	Very high	*Medium: -2*
Sum					*-14*
Magnitude of the impact					*Medium*

Key:

Magnitude	**Sum**
Low	-6 to -9
Medium	-10 to -14
High	-15 to -19
Very high	-20 to -24

Sensitivity

The sensitivity of the receiving environment is evaluated based 3 criteria, each of them being evaluated based on 4 levels.

- Existing regulations and guidance - there are specific receptors[6] in the impact area which have some level of protection, either by law or other regulations:
  - very high protection level - the impact area includes an object that is protected by national law, EU Directives, or international agreements which may prevent the proposed development.
  - high protection level - the impact area includes an object that is protected by national law, EU Directives, or international agreements which may impact the feasibility of the proposed development.
  - medium protection level - national regulation sets recommendations or reference values for an object in the impact area, or the project may impact an area conserved by a national or international program.

[6] Population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage, and the landscape

- low protection level - few or no recommendations which add to the conservation value of the impact area, and no regulation restricting use of the area (e.g., zoning plans)

- Value of the receptor to the society - economic values, e.g. water supply; social values, e.g. landscape or recreation; or environmental values, e.g. natural habitat:
  - very high - the receptor is unique, very valuable to society and possibly irreplaceable; it may be deemed internationally significant and valuable; the number of people affected is very large.
  - high - the receptor is unique and valuable to society; it may be deemed nationally significant and valuable; the number of people affected is large.
  - medium - the receptor is valuable and locally significant but not very unique; the number of people affected is moderate.
  - low - the receptor is of small value or uniqueness; the number of people impacted is small.
- Vulnerability to the changes (ability to tolerate changes; number of sensitive targets):
  - very high - Even a very small external change could substantially change the status of the receptor. There are many sensitive targets in the area.
  - high - Even a small external change could substantially change the status of the receptor. There are many sensitive targets in the area.
  - medium - At least moderate changes are needed to substantially change the status of the receptor. There are some sensitive targets in the area.
  - low - Even a large external change would not have substantial impact on the status of the receptor. There are only few or no sensitive targets in the area.

After each sensitivity criteria is classified according to one of the 4 levels, these are evaluated by means of a scoring system, improving thereof the level of transparency and objectivity of the analysis. The result is a classification of the sensitivity of each impact as low, medium, high, and very high.

SENSITIVITY					*EXAMPLE*
Scoring / **Criteria**	**-1:**	**-2:**	**-3:**	**-4:**	*Impact X*
Existing regulations and guidance	Low protection level	Medium protection level	High protection level	Very high protection level	*Very high: -4*
Value of the receptor	Low	Medium	High	Very high	*High: -3*
Vulnerability to the changes	Low	Medium	High	Very high	*Low: -1*
Sum					*-8*
Sensitivity of the receptor					*Medium*

Key:

Sensitivity	**Sum**
Low	-3 to -5
Medium	-6 to -8
High	-9 to -10
Very high	-11 to -12

Significance

The level of significance of each impact is finally assessed as low, medium, high, or very high. This is done by means of a matrix evaluating the magnitude of the impact against the sensitivity of the receiving environment.

SIGNIFICANCE		**Magnitude of the impact**			
		Very high	*High*	*Medium*	*Low*
Sensitivity of the receptor	*Low*	High	Medium	Low	Low
	Medium	High	High	Medium	Low
	High	Very high	High	High	Medium
	Very high	Very high	Very high	High	High

5 Analysis of Project Alternatives

5.1 Location selection

This section provides a summary of the assessment for the different possibilities in terms of sites for installation of the second BESS in the Namibia electrical power system. In addition, for the different case studies, a differentiation of the technical applicability for voltage support, peak load reduction, loss reduction compared to the alternative projects and the flexibility of operation has been made.

The installation of the BESS close to renewable production areas such as Rosh Pinah, Arandis and Khan could also reduce the peak load in the day or during night-time (by partially meeting the demand with the energy stored). The BESS could increase the NamPower revenue by storing energy during curtailment or low tariff periods (no wheeling charges at MV level from PV to BESS) and delivering this energy during expensive periods that typically coincide with high peak demands. Furthermore, the BESS could help to reduce energy curtailment during high energy production periods, thus energy arbitrage service shall reduce renewable energy curtailment and hence improve the revenue of the second (new) BESS. In addition, another example could be Rosh Pinah in which the solar farm surplus could be stored, and it then could also deliver to the grid. A drawback for this example is that there are no significant population or demand areas close to this energy production area. Therefore, the surplus should be rather collected at medium voltage levels in areas with a load center. Thus, the most suitable solution - for this point - is to store the energy surplus in Lithops substation at MV level from upcoming nearby PV power plants (e.g. 100 MW Arandis in 2028).

Once the optimum location for a BESS was identified, placing the BESS at Lithops Substation was optimum as the site is a modified habitat which therefor significantly reduce impacts. Lithops Substation also has existing additional space for the BESS which did not require any enlarging of the existing disturbed area footprint, this reduces further environmental risks significantly.

5.2 Analysis of technologies and design

In Section 3 a detail description regarding BESS technology is provided in that section technical data and information is provided as to how the technical team arrived at the decision of choices in equipment.

While for long periods of time the lead-acid technology has been the predominant technology for battery applications, lithium-ion, sodium and redox flow technologies are today also potential solutions. When selecting the current technology for the desired application, the power-to-energy ratio is important. While lead-acid and lithium-ion technology can work with a high power-to-energy ratio, sodium and redox flow require a lower power ratio to be feasible.

The table below lists some battery system technologies suitable for different power-to-energy ratios.

Table 5-1: Typical power-to-energy ratios for different technologies

Technology	Optimum power to energy ratio in MW/MWh
Lead acid: high power	3:1
Lead acid: standard	1:20
Lithium Ion: LFP type	5:1 - 1:4 (most typical: 1:1 1:2)

Lithium Ion: NMC type	2:1 - 1:4 (most typical: 1:1 1:2)
Lithium Ion: LTO type	10:1 - 5:1 (most typical: 1:1 1:2)
Sodium Sulphur	1:6 - 1:8 (most typical: 1:6)
Sodium Nickel Chloride	1:2 1:4
Vanadium Redox Flow	1:4 - 1:10 (most typical: 1:6)

It should be noted that the power-to-energy ratio is only one of multiple performance benchmarks relevant for the selection of a suitable battery technology. Other benchmarks include:

- Efficiency
- Calendric and cycle lifetime
- Material and product availability
- Compatibility with ambient conditions (e.g. temperature, dust, earthquake resistance).

Fichtner's recent large-scale BESS tender experience from 2023 confirms the best value of lithium-ion, in particular the LFP (Lithium Iron Phosphate) technology. LFP technology offers optimum power-to-energy ration whilst also providing optimum results in efficiency, cycle lifetime, product and material availability as well as being compatible with the ambient conditions expected at Lithops Substation.

In most contemporary BESS, the battery system with accessories comes factory-made. This reduces the time and possible errors of any integration on site. Due to transport safety concerns, the battery modules may be shipped separately and mounted on site.

Battery systems for large-scale BESS often come in 40' (12.2 m) sea freight containers due to the ease of transport and handling of these units. One container typically has an energy capacity of between 2 MWh and 4 MWh. Higher energy densities of up to 9 MWh are possible, but these densities significantly increase cost, maintenance effort and result in cooling difficulties.

One of the biggest advantages of this technology lies in its positive environmental impact. BESS reduces the reliance on less environmentally friendly power sources, helping minimize greenhouse gas emissions and creating a more sustainable energy future.

5.3 ´´Without project´´ situation

This alternative considers the option of 'do nothing' and maintaining the status quo. Should the proposed project not proceed, the site will remain unchanged. NamPower will not be able tp provide short-term peak power and ancillary services to increase the grid stability. Therefore, the no-go alternative is not considered to be feasible. Also, by not going ahead with the project it would result in Namibia lagging behind in meeting its Green Plan and Vision 2030 goals as well as becoming more energy dependant.

6 Description of the Existing Environment

This section provides a description of the project relevant environmental and social baseline conditions at the site, i.e., the existing physical, biological and socio-economic conditions before the project's implementation. The determination of the baseline status of the project area is essential to assess the significance of the negative and positive impacts to be eventually delivered by the project´s construction and operation.

The following aspects are considered in this section:

- Physical Environment
- Biological Environment
- Human Environment

Along with a description of the existing physical, biological and human environment in the project affected area, this chapter classifies the degree of sensitivity of the receptors to impacts according to the methodology described in Chapter 6.

6.1 Physical Environment

The Erongo Region is located in the central western part of Namibia (Figure 6-1). Landmark features of its boundaries include the Atlantic Ocean in the west, the Ugab River in the north, and the Kuiseb River as part of the southern border. Much of the region is occupied by the Namib Desert which stretches parallel to the coast for the length of the country, to about 120-150 km inland. The Lithops Substation lies entirely within the central Namib of the Erongo Region (refer to Figure 6-2).

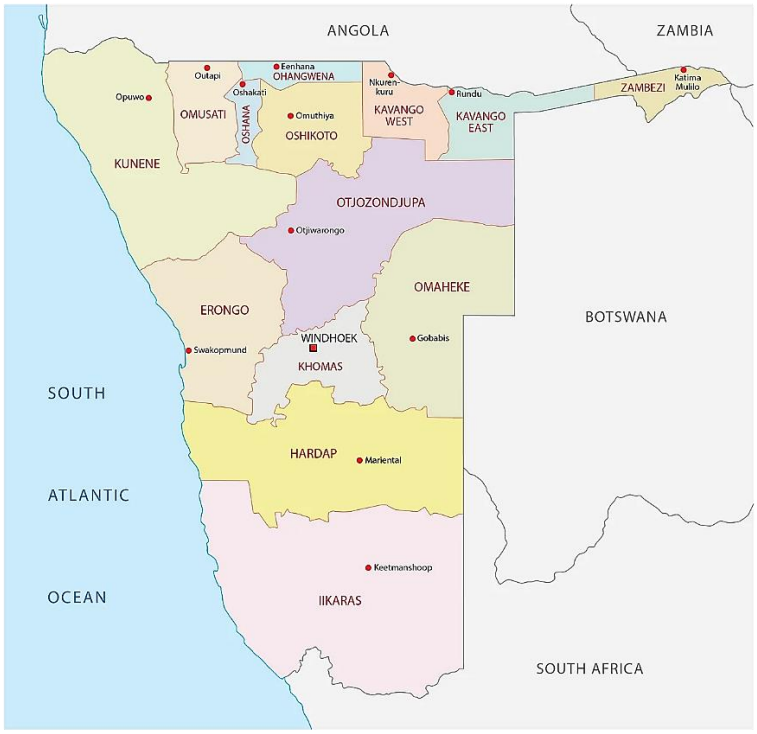


Figure 6-1: Location of Erongo Region (Source: World Atlas)

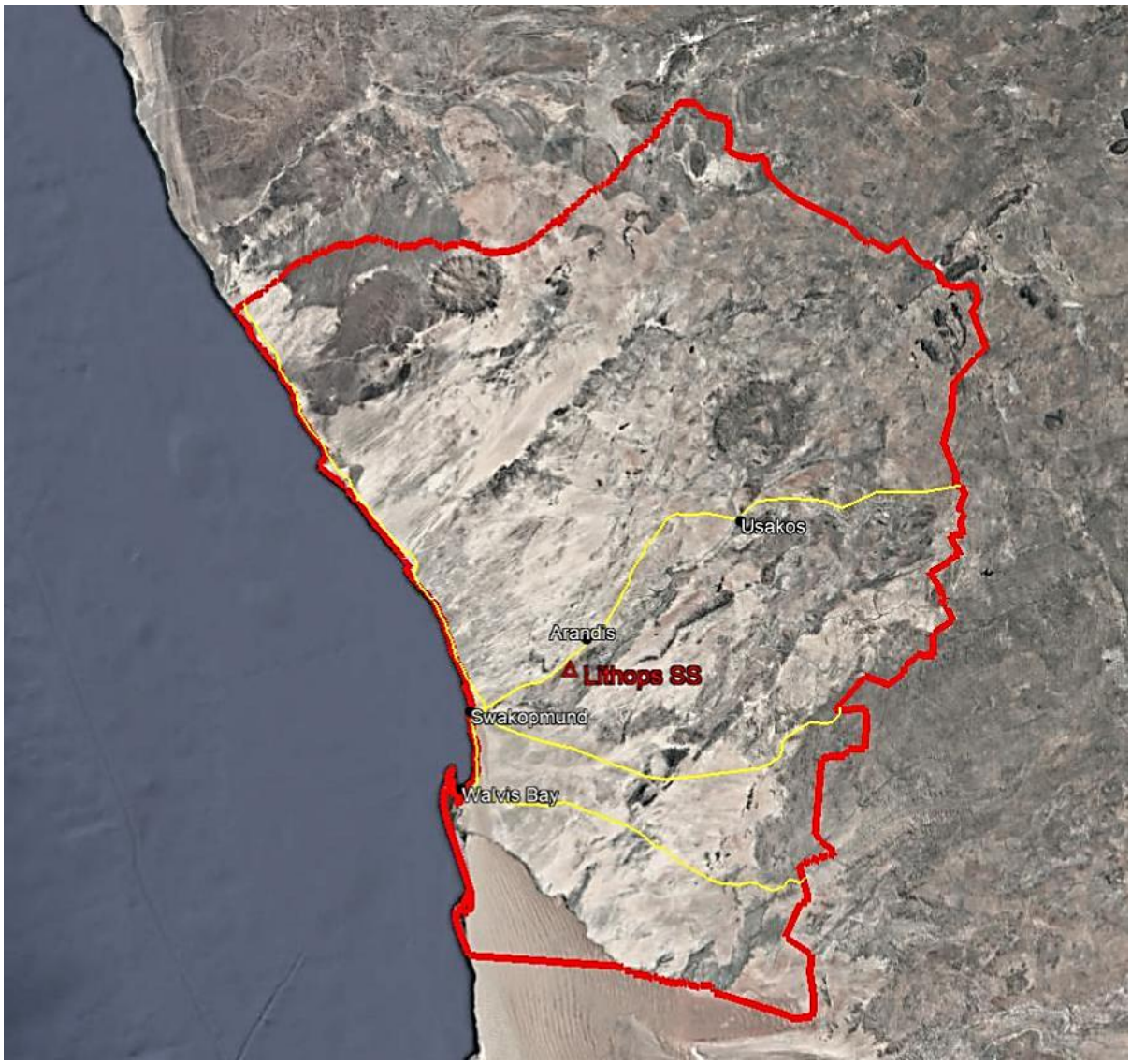


Figure 6-2: Lithops BESS location in the Erongo Region

6.1.1 Topography, Geology and Soils

Lithops Substation is located in the desert zone of the Namibia desert. The area consists largely of sandy gravel plains dissected by ephemeral watercourses. The plains are scattered with koppies (rock outcrops or hills) and rocky ridges of varying composition, including marble ridges.

The geology of the area is characterised by the Damara Supergroup and Gariep Complex geological division and falls within the Swakop Group (Mendelsohn, Jarvis, Roberts, et al., 2002). The dominant soils for the Swakop Group consist of Schists.

The site's geology is not considered to be a sensitive receptor for the project's impacts. This is because the project's construction and operation do not have an influence on the site's geology.

The landscape at the Substation is characterised by shallow and hardened soil profiles on an old landscape surface. This surface also exhibits very distinct crusting that is dominated by gypsum salts with

the Sulphur probably from oceanic and mist origin. These surface crusts and dense subsoils lead to very low infiltration rates with the result that any significant rainfall leads to some runoff.

The gypsum crusts are formed from the very long-term addition of Sulphur from marine fog and the subsequent rapid oxidation of Sulphur, formation of sulphate and precipitation as CaSO4 due to the high Ca levels in the calcrete. Gypsum mobilisation takes place in the soils and this gypsum is precipitated along preferential flow channels and cracks in the weathering calcrete.

The BESS will be installed on a prepared platform adjacent to the existing Lithops substation. The platform forms part of the Lithops substation but is currently not fenced and contains no build structure.

Run-off from the Lithops substation could potentially contribute to erosion, however since it is an arid area, rainfall is low and not likely to cause significant erosion.

Sensitivity of the receptor

The site's topography, geology and soils are not considered to be a sensitive receptor for the project's impacts. This is because the project's construction and operation do not have an influence on the site's topography, geology and soils.

6.1.2 Groundwater

The groundwater baseline information was obtained by conducting a desktop review.

The sources of water in the central Namib are fog, direct summer rainfall, surface water runoff during the rainy season in the rivers running from the interior of the country through the central Namib, groundwater and seawater. However, the origin of all water in the desert is due to some form of precipitation and the occurrence of this vital resource is determined by important factors such as climate, hydrology, topography and geology. Unfortunately, the hydro-climate does not lend itself to produce an abundance of water.

There are four main ephemeral rivers flowing through the central Namib: the Omaruru, Khan, Swakop and Kuiseb Rivers. The Khan and Swakop River are in the vicinity of the project. All of these contain intermittent surface flows following rain, but most of the time, water 'flows' below the surface in the sediments of the riverbed. All the coastal aquifers are recharged by runoff originating in the central highlands of Namibia where rainfall is higher and more reliable.

The Swakop River can be described in compartments of approximately 25km in length. These compartments are separated by basement highs covered by shallow alluvial deposits of 5m maximum depth. All basement highs are characterised by a shallow water table and dense vegetation which results in high evapotranspiration rates. Water levels in the compartments between the basement highs are found at depths of between 23m to 26m. Similar alluvial aquifer descriptions are associated with the Khan River.

Perched aquifers are thought to occur on the plains in association with the washes. In addition, bedrock aquifers exist at depths of approximately 60m below the plains that are located to the north and south of the Swakop River.

Sensitivity of the receptor

The site's groundwater is not considered to be a sensitive receptor for the project's impacts. This is because the existing aquifers at the project site are compartmentalised and not easily accessible, therefore eventual oil spills or other soil pollution would unlikely affect the groundwater. This low risk however does not allow NamPower to allow any spillages and accidents to go unremedied and all mitigations to prevent any form of soil contamination must at all times be enforced.

6.1.3 Surface Water

No surface water was evident during the site visit and desktop research showed that no surface water has been recorded at the substation location in recent recorded history.

With a rainfall significantly less than 100 mm per annum (Mendelsohn et al. 2002), recharge to most aquifers (especially bedrock aquifers) is expected to be very low (below 1% of total rainfall). The Khan and Swakop Rivers are recharged after most large flood events although surface runoff generated in the higher rainfall inland areas seldom reaches the coast (for example as a result of dams upstream), resulting in lower recharge to the alluvial aquifers in the coastal areas. Flood events are short lived and stay within the river channels, characterised by flash flood waves and short durations. The alluvial aquifers of both the Khan and Swakop Rivers are not homogenous but separated into sections called compartments created by outcropping bedrock or narrowing of the river gorge. These compartments are mostly dominated by vertical flow (evapo-transpiration and recharge), rather than lateral flow. The stored water volumes in each compartment are therefore not replenished on a continual basis from upstream, but rather from occasional flood events (SAIEA, 2010).

Figure 6-3: Lithops BESS location in relation to nearest Rivers.

Sensitivity of the receptor

The site's surface water is not considered to be a sensitive receptor for the project's impacts. This is because there is no existing surface water.

6.1.4 Climate

Summers are moderately hot (average maximum temperature during the hottest month is about 30°C), but the climate is tempered by cool coastal conditions brought inland by prevailing westerlies, south-westerlies, and southerlies (Lindesay & Tyson 1990; Mendelsohn et al. 2002). Winters are cool (average minimum temperature in coldest month is between 10 and 12°C), but hot easterly bergwind conditions can result in unseasonal warm conditions. This is verified by statistics from 2017-2019 taking at the Marble Ridge just south of Swakop Uranium Husab Mine.

The highest temperatures recorded during the three-year period between January 2017 and December 2019 was 41°C (November) with monthly averages of indicating August and September to be the cooler months, and October to March being the hottest.

Table 6-1: Monthly Temperature Summary (Marble Ridge Weather Station Data, 2017 - 2019)[7]

Hourly Minimum, Hourly Maximum and Monthly Average Temperatures (°C)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum	12	11	11	8	9	8	7	6	5	8	9	10
Average	20	21	23	24	24	21	21	18	18	20	21	21
Maximum	32	39	39	38	37	35	34	36	37	39	41	33

6.1.4.1 Rainfall

The Lithops Substations is situated within a hyper-arid region, with a long-term average rainfall of less than 50 mm rain pa (Mendelsohn et al. 2002) (Figure 4-1). Spatial and temporal variability in rainfall is high (Mendelsohn et al. 2002). Rainfall mainly occurs as convective summer storms (Lindesay & Tyson 1990), sporadic, and often falling in one area (e.g. thunderstorms) rather than widespread across the region. The Namibian rainy season occurs most often in March and April. Average rainfall recorded at the Swakop Uranium Husab Mine in the past years has always been below the 50mm average.

Sensitivity of the receptor

The site's climate is not considered to be a sensitive receptor for the project's impacts. This is because the project's construction and operation entail very little or no greenhouse gases emissions. For the construction phase all water will be trucked to site for human consumption and construction needs. The potential of fire is not increased due to climate factors and will be managed in the ESMP.

[7] Scoping Report (Including Impacts Assessment) For the Proposed Changes to The Husab Mine and Linear Infrastructure. Report to the client Swakop Uranium, SLR, 2021.

6.1.5 Ambient air quality

The main sources of air pollution in the region include mining operations, public roads (paved, treated and unpaved), and natural exposed areas prone to wind erosion.

The main pollutant of concern in the Erongo Region is particulate matter (PM). The impact of PM on human health is largely dependent on (i) particle characteristics, particularly particle size and chemical composition, and (ii) the duration, frequency, and magnitude of exposure. The potential of particles to be inhaled and deposited in the lung is a function of the particles size, shape, and density.

Due to the nature of work and type of facility air quality is not considered to be of concern.

6.1.6 Ambient noise

Just as any other electrical installation, the components of a Battery Energy Storage System emit acoustic noise into their vicinity. It is not anticipated that the BESS will emit any significant noise or air pollution. The noise generated is generally comparable to electrical substations or PV power plants.

The current ambient noise conditions were low, no noise was identified from the road or the mine at the time of the site visit. It is anticipated that at times an airhorn from trucks or other vehicular noise may be heard from the B2, however this is infrequent and would be continuous. No noise could be heard from the mine as this facility was also out of sight. Again ad hoc noise such as explosions or vehicular traffic passing the Substation may disturb the serene conditions at the substation.

The only current noises present continuous were from transformers on site these were well below 55dB.

The sound power represents the power of the noise output of a device and is expressed in decibel (dB). The main sources of noise emissions from a BESS and exemplary sound powers are:

- Transformers (as in other electrical installations); e.g. SGB DOTML 2.5 MVA: 55 dB
- Power Conversion System (inverters, as in PV power plants); e.g. SMA 3 MVA: 92.6 dB
- Fans and pumps of heat exchangers and chillers, e.g. Lenox LGH036 sufficient for one 40’ battery container: 73 dB.

These sound powers refer to operation at rated power and decrease when the BESS is idle or at partial load. Some reference sound powers for comparison are:

- Household fridge: 50 dB
- Vacuum cleaner: 80 db
- Loud conversation: 90 dB
- Diesel truck: 115 dB

The World Bank Group’s General EHS Guideline (2007) addresses impact of noise beyond the property boundary of the facilities. According to these international guidelines noise impacts should not exceed the levels presented in Table 6-2 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

Table 6-2: Noise Limits according to international guidelines (World Bank Group, General EHS Guideline (2007), Chapter 1.7)

Receptor	One-hour L_{Aep}* (dB(A)	
	Daytime	Nighttime
	7:00am – 10:00pm	10:00pm – 7:00am
Residential, institutional, educational	55	45
Industrial, commercial	70	70

*Note: *L_{Aep} is the A-weighted equivalent continuous sound level in decibels measured over a stated period of time.*

No Sensitive receptors were identified at the time of the site visit nor during desktop review.

Sensitivity of the receptor

Due to the BESS being located directly adjacent a Substation and in an area with the nearest neighbour being a mine (12,5 km away), the significant of the noise being generated is not considered significant although the ambient conditions are very low.

6.2 Biological environment

6.2.1 Biodiversity

Biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons.

Biodiversity can be impacted upon in the following manner by the proposed project:

- Physical destruction and/or disturbance of fauna and flora.
- WWater resources as an ecological driver.

Figure 6-4: Picture taken 28th October 2023 of the proposed site.

Sensitivity of the receptor

The site falls within the desert biome, which is characterised with a low density of fauna and flora (Barnard, P 1998). Considering that the location at Lithops substation has been recently cleared and that the biodiversity of site is not of significant status as can be seen in Figure 6-4 above, the sensitivity of placing the BESS at this location is deemed low to biodiversity.

6.2.2 Flora

The project area falls in the central desert biome. This biome is known for high levels of endemism in plants, reptiles, invertebrates, and mammals. Vegetation cover is sparse, mostly concentrated in washes and ravines and on rocky marble ridges, as well as on distributed patches of mostly perennial grasses on the gravel plains that form an important part of the available fodder for large grazers such as Hartmann's Mountain zebra. These patches are probably formed by surface water flows, a well-known phenomenon in arid and hyper-arid areas, but are maintained by gerbils (AWR, 2021).

Fog-dependent species such as *Zygophyllum stapffii* (no conservation value) and *Stipagrostis* spp (LC) are generally dominant, but plant communities are set apart by numerous endemic and near-endemic taxa, including *Commiphora oblanceolate* (LC), *Euphorbia giessii* (LC), *Ruellia diversifolia* (LC), *Aloe asperifolia* (LC) and others. According to the initial EIA done for the substation, Wassenaar & Mannheimer (2010) defined twelve habitats across the whole study area[8] based on their physical and ecological characteristics:

1. Khan and Swakop River
2. Rocky Valley Drainages
3. Plains Drainage Channels
4. Pink Gramadoelas
5. Black Gramadoelas
6. Marble in Gramadoelas
7. Gypsite Plain
8. Grasssy Plain
9. Hard Undulating Plain
10. Koppies and Ridges on Plains
11. Welwitschia Plains
12. Aquatic Habitat

Based on habitat and least impact and sensitive biodiversity the choice of locality for the substation in the EIA was then chosen to be in the least sensitive habitat of the grassy plains habitat. This habitat has the following physical and ecological characteristics:

- Largest part of study area, consists of pale semi-consolidated eroded material
- Substrate mostly deep loamy gravel-sand

[8] The Environmental Impact Assessment Report for The Husab Mine Linear Infrastructure (2011) detailed the study area of the mine and all associated Infrastructure as covered in that EIA.

- Drained by numerous sinuously twisting drainage channels that often fan out and disappear on very gentle or flat slopes
- Includes sheet drainages that are too small to map out separately
- Includes area underlain by metamorphosed sediments of the Kuiseb formation forming fine-grained dark sandy surfaces
- Includes small pockets of aeolian sand at the edge of the gramadoelas, integrating with the sandy bottom of rocky valley drainages
- Contains high numbers of annual and perennial grasses
- Primary habitat for small burrowing and digging mammals: gerbils, suricates and a number of unidentified viverids; especially gerbil burrowing may result in localised fertilisation (potential keystone process and keystone group)
- Possibly important area for re-charge of superficial aquifer/s on the plain (needs to be confirmed through dedicated study)
- Probably seasonally important grazing areas for zebra; year-long important grazing areas for springbok and ostrich
- Represents the only habitat with significant numbers of Cape hare
- Together with Rocky Valley Drainages and Plains Drainage Channels, is important habitat for Rüppel's Korhaan
- Includes a significant part of the Welwitschia population; those parts of this habitat containing Welwitschia plants are dealt with as an independent habitat (Welwitschia Plain)

Aloe asperifolia is endemic to western Namibia and occurs on limestone and conglomerate in parts of the Namib Desert which are not only devoid of other plant life, but almost devoid of soil. Most of the moisture available to plants of this species is derived from fog. The species is rated to be of least concern.

Figure 6-5: Flowering wild aloe (aloe asperifolia) only plants located on site.

Sensitivity of the receptor

The flora is classified as having low sensitivity to the project's impacts. There are no nationally or internationally protected flora species in the project area. It is also classified as low as the site has been previously cleared.

SENSITIVITY - Flora		
Criteria	**Classification**	**Scoring**
Existing regulations and guidance	Medium protection level	-2
Value of the receptor	low	-1
Vulnerability to the changes	low	-1
Sum		**-4**
Sensitivity of the receptor		**Low**

6.2.3 Fauna

Small endemic mammals such as the dassie rat (*Petromus typicus*) (LC), pygmy rock mouse (*Petromyscus collinus*) (LC) and Setzer's hairy-footed gerbil (*Gerbillurus setzeri*) (LC) also occur, and often play an ecological engineering role, creating habitat for plants (particularly grasses) and thus food for a range of large mammal herbivores. A recent study has shown how widespread the effect of gerbils is on the productivity of the gravel plains (Shaanika, 2020).

Sensitivity of the receptor

The fauna is classified as having low sensitivity to the project's impacts. There are no nationally and internationally protected fauna species in the project area. It is also classified as low as the project site for the BESS is a very small piece of land that will be affected and thus disturbance to the small mammals and reptiles etc. will not be deemed significant.

SENSITIVITY - Fauna		
Criteria	**Classification**	**Scoring**
Existing regulations and guidance	Medium protection level	-2
Value of the receptor	low	-1
Vulnerability to the changes	low	-1
Sum		**-4**
Sensitivity of the receptor		**Low**

6.2.4 Protected and Conservation Areas

Dorob National Park is a protected area in the Erongo Region along the central Namibian. It was gazetted as a National Park and then the nature conservation ordinance No.4 of 1975 on 1st December 2010.

The Dorob National Park is located along the coast between Skeleton Coast NP and Namib-Naukluft NP. The park extends to 8,118 km^2 and is approximately 260 km long and 40 km wide.

The park's northern border is shared with the Skeleton Coast NP, while to the south it is contiguous with the Namib-Naukluft NP. It is one of the six coastal protected areas of Namibia (five terrestrial protected areas and one marine protected area) (Figure 6-6).

Figure 6-6: Dorob National Park in relation to neighbouring protected areas and communal conservancies.

Dorob is classified as a National Park:

i. to protect the ecological integrity of one or more ecosystems for present and future generations, and exclude exploitation or occupation inconsistent with such protection; and

ii. ii. to provide a foundation for compatible cultural, scientific, educational, recreational and visitor opportunities.

The main purpose of Dorob NP is captured in the following six strategic objectives[9]:

[9] Ministry of Environment, Forestry and Tourism, 2021.
Management Plan for Dorob National Park 2021/2022-2030/2031.

1. To secure and increase landscape connectivity.
2. To protect and maintain biodiversity.
3. To develop, implement and maintain regional conservation synergy through effective interaction with all park neighbours, residents, and major stakeholders.
4. To maximise regional economic development, based on the principles of sustainable utilisation.
5. To protect and maintain cultural and historic, archaeological, and paleontological assets.
6. To provide for recreational opportunities to park visitors without compromising environmental values Dorob is a multi-use park with recreational areas.

Sensitivity of the receptor

Lithops Substation and the BESS fall on the border to the Dorob National Park, a mere 300m outside the Park, due to proximity it should not be argued whether the BESS falls inside or outside the park, but cognisance of the Dorob NP regulations and objectives should be included in the planning of the BESS.

When reviewing the Management Plan for Dorob National Park this project falls within objective 4 above, (to maximise regional economic development, based on the principles of sustainable utilisation) whilst not contravening the other objectives. It is for this reason that the significance of the Dorob national Park is give a low significance.

SENSITIVITY - Protected and Conservation Areas		
Criteria	**Classification**	**Scoring**
Existing regulations and guidance	Medium protection level	-2
Value of the receptor	low	-1
Vulnerability to the changes	low	-1
Sum		**-4**
Sensitivity of the receptor		**Low**

6.3 Human environment

6.3.1 People

The people affected by the BESS will be NamPower staff operating at the substation and the BESS as well as employees and visitors to the Husab Mine. Due to access to the BESS being along the mine road the site is not accessible by the general public and no other communities live in the vicinity.

It is estimated that at a peak during the construction phase of this project 50 workers may be present on site. This peak workforce will last a maximum time of 2 months. It is anticipated that that total construction phase will take about 6 months with only a few people at site during most of the duration.

Sensitivity of the receptor

The people driving by the project affected area are classified as having low sensitivity to the project's impacts.

SENSITIVITY - People		
Criteria	**Classification**	**Scoring**
Existing regulations and guidance	Low	-1
Value of the receptor	Low	-1
Vulnerability to the changes	Low	-1
Sum		**-3**
Sensitivity of the receptor		**Low**

6.3.1.1 Land ownership

The Lithops Substation along with the adjacent land for the BESS belongs to the proponent NamPower.

6.3.2 Tourism

The site is within a restricted mining area. Access to NamPower for the substation and the proposed BESS is given as this site lies close to the entrance of the mining road and before any mining operations. However due to this being a restricted mining area, the area has no tourism value.

Sensitivity of the receptor

Due to the site being a restricted area no sensitivity of impact is identified.

6.3.3 Cultural, religious, and historical sites

Over the past 12 years several archaeological studies have been done as part of the Husab Mine Project. The area has thus been well studied and the only heritage sites of significance surveyed and documented, are the Welwitchia siding and Khan Mine valley, approximately 15km from site. The Welwitschia siding and remnant of the rail embankment on the west of the site have been protected from disturbance by physical barriers.

Sensitivity of the receptor

The sensitivity of receptors for all human environmental factors have been combined as no impact and thus no sensitivity is identified.

SENSITIVITY - Cultural, religious and historical sites		
Criteria	**Classification**	**Scoring**
		-3

Existing regulations and guidance	Medium protection level	
Value of the receptor	Low	-1
Vulnerability to the changes	Low	-1
Sum		**-5**
Sensitivity of the receptor		**Low**

7 Assessment of Impacts and Mitigation Framework

This section presents the expected impacts from operation and construction of the BESS project, as well as mitigation measures that could be applied to reduce/eliminate impacts. The measures shall be read as recommendations and are not binding at this stage.

7.1 Impacts and Mitigation Measures during Design, Construction and Operational Phase

7.1.1 Impacts on the Physical Environment

7.1.1.1 Topography

The construction of the BESS will include clearing of the site area and required earthworks. The construction of the project facilities will in addition imply levelling, operation of construction machines and vehicles, possible hammering, drilling works, etc.

Such activities will not result in alteration of the landscape of the area and thus not affect the natural drainage channels and local topography settings of the site.

Magnitude and significance pre-mitigation

Impacts on topography are not anticipated and be insignificant.

Mitigation measures

No additional mitigation measures will be required.

7.1.1.2 Soil and Groundwater

Improper housekeeping practices during construction (such as illegal disposal of waste to land, hazardous materials/waste spills) could contaminate and pollute soil which in turn can pollute groundwater. This could also indirectly affect flora/fauna and the general health and safety of workers (from being exposed to such wastewater streams).

Hazardous waste is expected to be generated throughout the construction phase and this could include consumed oil, chemicals, paint cans, etc. Hazardous waste generated within the project activities will be collected and stored safely (sealed area with controlled access) on site and then managed (collected, treated and disposed) by a specialized company approved for such activity.

The nature of construction activities entails the use of various hazardous materials such as oil, chemicals, and fuel for the various equipment and machinery. Improper management of hazardous material entails a risk of leakage into the surrounding environment either from storage areas or throughout the use of equipment and machinery.

The site is flat with very low rainfall (less than 100mm per year), there is no risk for soil erosion.

Magnitude and significance pre-mitigation

Impacts on soil and groundwater are negative and may be significant. These are anticipated to happen throughout the whole construction period, and to be long-term and irreversible. Given this, the topography impacts pre-mitigation are considered of medium magnitude. Considering that the sensitivity of the receptors "soil" and "groundwater" is classified as low, and that the magnitude of the impacts on these receptors during construction is medium, the impacts' significance is classified as **medium**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on soil and groundwater CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Medium term	-2
Frequency	Irregular	-2
Ability to recover	-	-2
Probability	Possible	-2
Intensity	Low	-1
Sum		-10
Magnitude of the impact		Medium
vs		
Sensitivity of the receptors		Low

Mitigation measures

The following identifies the mitigation measures related to hazardous waste and materials management, which are to be applied by the Contractor during the detailed design and construction phase and which include:

- adhering to the BESS O&M recommendation set by the technical team.
- hiring a contractor authorized for the collection, treatment, and disposal of hazardous waste.
- prohibiting illegal disposal of hazardous waste to the land.
- arrangements for management of hazardous waste in accordance with the Regulations on the manner of storage, packaging and labelling of hazardous waste (according to ESS 3 and the Hazardous Substances Ordinance 14 of 1974)

- ensuring that containers are emptied and collected by the contractor at appropriate intervals to prevent overflowing.
- ensuring that hazardous materials are stored in proper areas and in a location where they cannot reach the ground surface in case of accidental spillage. This means storage facilities that are of hard impermeable surface, flame-proof, with 110% containment capacity, accessible to authorized personnel only, locked when not in use, and prevent incompatible materials from coming in contact with one another.
- a register of all hazardous materials used and accompanying Material Safety Data Sheet (MSDS) must be present at the storage and usage location at all times. Spilled material should be tracked and accounted for; incorporate dripping pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc.).
- regular maintenance of all equipment and machinery used on site. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (impermeable surface) with appropriate measures for trapping spilled material.
- ensuring that a minimum of 1,000 litres of general-purpose spill absorbent is available at hazardous material storage facility. Appropriate absorbents include zeolite, clay, peat and other products manufactured for this purpose; and
- if spillage occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste.

The above listed requirements, among others, shall be stipulated in a Waste Management Plan (WMP) for construction phase which must be developed for the project by the Contractors in accordance with the Law on Waste Management (Pollution Control and Waste Management Bill) and related legislative requirements, and WB General HSE Guidelines, for various types of waste, such as hazardous, biomedical, municipal solid waste, electronic waste, etc. The WMP will also meet the WB ESS3 Standards on Resource efficiency and pollution prevention and management.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's frequency to "seasonal" and its probability to "unlikely": Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**.

MAGNITUDE - Impacts on soil and groundwater CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Medium term	-2
Frequency	Seasonal	-3

Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		-9
Magnitude of the impact	Low	
vs		
Sensitivity of the receptors	Low	

7.1.1.3 Surface water

Due to a lack of surface water at site the concern of potential impact on surface water is only during the transportation of equipment and materials during the construction phase. Surface water sources are evident from along major transport routes to the site.

The construction phase of the project will involve transportation of various equipment and materials. The nature of construction activities entails the use of various hazardous materials such as oil, chemicals, paint cans and fuel for the various equipment and machinery.

The use of transportation equipment and mobile machinery, which is inappropriate for the purpose, and/or is in unsatisfying technical condition, could lead to pollution of water by leakages of oils in or near a water body. In addition, spillage or fallout of the transported materials, in particular paints and other chemicals in or near a water body poses a risk of pollution as well.

Improper management of hazardous materials entails a risk of leakage into the surrounding environment during the transportation of equipment and machinery.

Magnitude and significance pre-mitigation

Impacts on surface water are negative and may be significant, if not properly addressed when incidents occur. Given this, surface water impacts pre-mitigation are considered of low magnitude, for transport. Considering that the sensitivity of the receptor "surface water" is classified as low, and that the magnitude of the impacts on these receptors during construction is medium, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on surface water CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Medium term	-2

Frequency	Irregular	-2
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		-8
Magnitude of the impact	Low	
vs		
Sensitivity of the receptor	Low	

Mitigation measures

Appropriate management of hazardous material during transportation is to be planned and implemented by the contractors and their sub-contractors. The personnel shall be trained with regards to good housekeeping practices.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's frequency to "seasonal" and its probability to "unlikely": Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as low.

MAGNITUDE - Impacts on surface water CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Irregular	-3
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		**-8**

Magnitude of the impact	Low
vs	
Sensitivity of the receptors	Low

7.1.1.4 Landscape and visual impacts

It is not anticipated that the BESS will have any impacts on the landscape or pose a visual impact, as the public has no access to the area. With the existing substation in place, a visual impact has been created (albeit limited), adding the BESS directly next to it would not exacerbate the impact.

Some visual and landscape impact would occur during construction activities. However, these impacts are also considered negligible, as the area is already disturbed and known as restricted mining area.

7.1.1.5 Ambient Air Quality

The construction of the BESS will cause short-term and local gaseous and particulate air emissions. Initially, these will be associated to the clearing of the site. The construction of the facilities will in addition imply levelling. All these activities are potentially generators of short-term and local air emissions, especially of dust. The trucks used to transport materials, as well as other construction equipment's movements, such as power generators, loaders and vehicles, will also be a source of short-term air emissions in the project areas (such as SOx, NOx, CO, etc.) which would also have minimal direct impacts on ambient air quality. However, it is important to note that the generation and dispersion of dust depends on weather conditions; dry conditions with high wind speeds would cause excessive dust generation, while wet conditions and low wind speeds would not.

Magnitude and significance pre-mitigation

Impacts on ambient air quality are negative and may be significant, as the emissions of the vehicles and machinery, and/or the consequent ground level concentrations in the ambient air may be above the national and international standards, even if only locally and temporarily. All the above impacts are anticipated to be temporary as they are limited to the construction period only. Impacts on air quality are reversible as baseline conditions will revert back after construction works are completed.

Given the above, the pre-mitigation impact is considered of medium magnitude. Considering that the sensitivity of the receptor "ambient air quality" is classified as low, and that the magnitude of the impacts on this receptor during construction is medium, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on ambient air quality CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-2

Frequency	Repeatedly	-4
Ability to recover	Reversible	-1
Probability	Definite	-4
Intensity	Medium	-2
Sum		-14
Magnitude of the impact		Medium
vs		
Sensitivity of the receptor		Low

Mitigation measures

The following identifies the mitigation measures to be applied by the Contractor during the construction phase (to prevent impacts caused by the construction activities and which are within his control). Such measures include:

- If dust or pollutant emissions are found to be excessive, construction activities should be stopped until the source of such emissions have been identified and adequate control measures are implemented.
- Comply with NamPower internal Occupational Health and Safety Procedures, developed in accordance with the national legal occupational health and safety requirements, and the Occupational Safety and Health Administration (OSHA) requirements to ensure that for activities associated with high dust levels, workers are equipped with proper Personal Protective Equipment (e.g. masks, eye goggles, safety boots, etc.).
- Apply basic dust control and suppression measures which could include:
  >>regular watering of all active construction areas
  >>proper planning of dust causing activities to take place simultaneously in order to reduce the dust incidents over the construction period.
  >>proper covering of trucks transporting aggregates and fine materials (e.g. through the use of tarpaulin)
  >> adhering to a speed limit of 15km/h for trucks on the construction site.
  >> Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of pollution sources to avoid unnecessary pollutant emissions.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's intensity to "low", its frequency to "seasonal" and its probability to "possible". Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**. Compensation measures are required and suggested below.

MAGNITUDE - Impacts on ambient air quality CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Medium term	-2
Frequency	Irregular	-2
Ability to recover	Reversible	-1
Probability	Possible	-2
Intensity	Low	-1
Sum		-9
Magnitude of the impact		Low
vs		
Sensitivity of the receptor		Low

7.1.1.6 Ambient Noise

The construction of the project together with the associated infrastructures will result in the generation of short-term noise emissions. Initially, these will be associated with the clearing of the site area and access to the site and with any type of earthworks required. The construction of the other facilities will in addition imply levelling, operation of construction machines and vehicles, possible hammering, drilling works etc. All these activities are potentially generators of short-term and local noise emissions. All the above activities will likely include the use of machinery and equipment such as generators, hammers, compressors, etc., which are expected to be a source of noise and vibration generation within the Project site and its surroundings. If improperly managed, there is risk of nuisance and health effects to construction workers on site and to a lesser extent to the nearby receptors.

Magnitude and significance pre-mitigation

Impacts on ambient noise levels are negative and may be significant. However, these are anticipated to be temporary and of short-term nature as they are limited to the construction period only and are reversible as baseline conditions will be restored upon completion of construction works. Impacts on the construction workers may occur if proper protection equipment (ear plugs, for example) is not provided.

Given the above, noise impact is considered of the pre-mitigation impact is considered of low magnitude. Considering that the sensitivity of the receptor "ambient noise" is classified as high, and that the magnitude of the impacts on this receptor during construction is medium, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on ambient noise CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Medium term	-2
Frequency	Repeatedly	-4
Ability to recover	Reversible	-1
Probability	Definite	-4
Intensity	Medium	-2
Sum		-14
Magnitude of the impact		Medium
Vs		
Sensitivity of the receptor		Low

Mitigation measures

The following identifies the mitigation measures to be applied by the Contractor during the construction phase and which include:

- Apply adequate general noise suppressing measures. This could include the use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery, and equipment for early detection of issues to avoid unnecessary elevated noise level, etc.
- Comply with NamPower internal Occupational Health and Safety Procedures, developed in accordance with the national legal occupational health and safety requirements, to ensure that for activities associated with high noise levels, workers are equipped with proper Personal Protective Equipment (e.g. Earmuffs).
- The vehicles and equipment's shall be kept in good maintenance state. If generators are used, sound barriers such as portable or free-standing screens shall be installed around the generators.
- Before construction commences, properly plan work activities to ensure that noisy activities are restricted between late evening hours and early morning hours (from 10 pm till 6 am) especially at those areas close to the nearby receptors (such as nearby houses) to the greatest extent possible.
- Trucks and vehicles crossing housing areas shall reduce their speed to a maximum of 30 km/h; traffic speed on unpaved access roads shall be reduced to 15 km/h.
- If noise levels were found to be excessive (complaints by residents), noise level shall be monitored throughout the construction phase on the identified sensitive receptors.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's intensity to "low", its frequency to "seasonal" and its probability to "possible". Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as low. Compensation measures are required and suggested below.

MAGNITUDE - Impacts on ambient noise CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Medium term	-2
Frequency	Irregular	-2
Ability to recover	Reversible	-1
Probability	Possible	-2
Intensity	Low	-1
Sum		-9
Magnitude of the impact		Low
Vs		
Sensitivity of the receptor		Low

7.1.2 Impacts on the Biological Environment

7.1.2.1 Terrestrial flora

During construction of the BESS, the initial process will include clearing of the land through earthworks. The construction of the project facilities will in addition imply levelling, operation of construction machines and vehicles, possible hammering, drilling works, etc.

The resulting impacts are loss of vegetation within areas physically affected by the construction activities.

Magnitude and significance pre-mitigation

Impacts on terrestrial flora are negative and not considered significant. These are anticipated to happen during site clearing. Considering that the sensitivity of the receptor "terrestrial flora" is classified as low, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on terrestrial flora CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	-	-2
Probability	Probable	-3
Intensity	Low	-1
Sum		**-9**
Magnitude of the impact		Low
vs		
Sensitivity of the receptor		Low

Mitigation measures

- The removal of vegetation should be reduced to the minimum extent possible; it is forbidden to use any chemicals for this activity.

Magnitude and significance post-mitigation

The mitigation measures will not affect the rating however best management principles and mitigation techniques should always be utilised.

MAGNITUDE - Impacts on terrestrial flora CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1

Probability	Possible	-2
Intensity	Low	-1
Sum		**-7**
Magnitude of the impact		Low
vs		
Sensitivity of the receptor		Low

7.1.2.2 Terrestrial fauna

Impact on the fauna is classified is not seen to be significant. There are no nationally and internationally protected fauna species in the project area. It is also deemed as low due the very small piece of land occupied by the BESS, thus disturbance to the small mammals and reptiles etc. will not be deemed significant.

Magnitude and significance pre-mitigation

Impacts on terrestrial fauna are negative and are not significant. These are anticipated to happen during site clearing. Considering that the sensitivity of the receptor "terrestrial fauna" is classified as low, the impacts' significance is classified as low. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on terrestrial fauna CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Definite	-4
Intensity	Low	-1
Sum		**-9**
Magnitude of the impact		Low
vs		
Sensitivity of the receptor		Low

Mitigation measures

- The removal of vegetation should be reduced to the minimum extent possible to reduce on the impact on the habitat of terrestrial fauna; it is forbidden to use any chemicals for this activity.
- All cleared areas must be re-vegetated and rehabilitated as soon as construction in that area has been completed.

Magnitude and significance post-mitigation

The mitigation measures will not affect the rating however best management principles and mitigation techniques should always be utilised.

MAGNITUDE - Impacts on terrestrial fauna CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Possible	-2
Intensity	Low	-1
Sum		**-7**
Magnitude of the impact		Low
vs		
Sensitivity of the receptor		Low

7.1.2.3 Natural Protected areas

Lithops Substation on the BESS fall on the border to the Dorob National Park, due to proximity it should not be argued whether the BESS falls inside or outside the park, but cognisance of the Dorob NP regulations and objectives should be included in the planning of the BESS.

Magnitude and significance pre-mitigation

Impacts on Dorob National Park are negative and but not significant. These are anticipated to happen due to the presence of the BESS. Considering that the sensitivity of the receptor "natural protected areas" is classified as low, the impacts' significance is classified as low. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on natural protected areas CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Repeatedly	-4
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		**-4**
Magnitude of the impact	Low	
vs		
Sensitivity of the receptor	Low	

Mitigation measures

The main mitigation measures are to ensure that the flora and fauna mitigation measures are implemented.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's frequency to "once" and its probability to "unlikely": Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**.

MAGNITUDE - Impacts on ambient noise CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1

Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		-6
Magnitude of the impact	Low	
Vs		
Sensitivity of the receptor	Low	

7.1.3 Impacts on the Human Environment

7.1.3.1 Health & Safety Impacts

Worker's Health and Safety impacts are addressed in the World Bank's ESS2 and the Namibian Labour Act. Construction activities pose risks to the health, safety, security and wellbeing of construction workers if not managed appropriately.

Similarly, there is the risk of adverse occupational health and safety (OHS) impacts related to personal accident or injury on any construction site. Some of the OHS risks which are likely to arise during the construction phase of the project and are typical to many construction sites include: exposure to physical hazards from use of heavy equipment; trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery. Other risks common to electricity infrastructure projects specifically include working in trenches, live power equipment.

7.1.3.1.1 Thermal runaway and fire

The largest concern associated with Li-ion batteries is the possibility of thermal runaway and resulting fire. The energy density of the cells and the combustibility of the organic-based electrolyte make these batteries a fire hazard. Excessive charging, discharging, high current, or imbalances between cells can cause overheating in a cell and result in thermal runaway as neighbouring cells also overheat. Extreme high temperatures lead to leaks, smoke, gas venting, and/or combustion of the cell pack. Manufacturers of large systems have employed sophisticated battery management systems to monitor cell performance and limit operation to safe and acceptable performance ranges.

In addition to this generic fire risk, a BESS causes a specific risk due to the "electrochemical" and chemical energy stored in its cells. The "electrochemical" energy is repeatedly stored and released during charging and discharging whereas the chemical energy is only released in the case of a fire.

Magnitude and significance pre-mitigation

Impacts on Thermal Runaway and fire are negative and may be significant to the project, however no significant impact is foreseen on the environment in this circumstance. This is only anticipated to happen when poor housekeeping and poor discipline is present on site. Given this, impacts pre-mitigation are considered of low magnitude. Considering that the sensitivity of the receptor "environment" is classified as low, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on Fire CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Medium	-2
Sum		
Magnitude of the impact	Low	
vs		
Sensitivity of the receptor	Low	

Mitigation measures

The principal effort for BESS-specific fire protection is built up in around mitigating any safety related incident before it occurs. Thus as part of the design and operation of the BESS the following three principles will be considered and adhered to:

1. The cells should not be charged or discharged to voltages beyond their operational range as specified by their manufacturer. This will be achieved by continuous monitoring and regular maintenance.

2. The cells should not be exposed to temperatures above or below the range specified by their manufacturer. This will be prevented through the implementation of Cell level temperature monitoring devices.
3. The safety concept should be robust against cells that have manufacturing defects. It will be ensured that batteries are transported in a manner to prevent accidental damage and will need to be inspected prior to installation and part of maintenance. Any damaged or defected batteries will need to be disposed of in accordance with the WEEE plan to be developed for the project

A fire risk assessment will be undertaken once the type of battery technology has been confirmed. An adequate number of Class A and Class D fire extinguishers shall be installed on site. As part of fire protection, the following is recommended:

- A fire monitoring system with early warning smoke detection;
- A fire suppression system that will not aggravate a fire (e.g. prevent the application of water to metallic sodium);

Personnel shall be trained in the correct emergency response procedure and fire fighting techniques in the event of a fire associated with the BESS.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the intensity to "low": Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**.

MAGNITUDE - Impacts on Fire CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1

Sum	-6
Magnitude of the impact	Low
Vs	
Sensitivity of the receptor	Low

7.1.3.1.2 Radiated electromagnetic emissions

As with any other electric device and asset, BESS emit electromagnetic radiation during operation. The purpose of emission regulations regarding these fields is not to reduce them to zero, but to keep their impact on the environment within reasonable limits.

The common objective of regulations regarding electromagnetic emissions is to protect people, assets and the environment outside the BESS from negative impacts. Negative impacts from electromagnetic emissions may include:

- Malfunction of electronic devices: Malfunction of non-critical devices, e.g. flickering of consumer electronics displays, may already occur at low levels. Malfunction of critical devices such as vehicle and plane controls or pacemakers usually only occurs at very high levels that cannot be transmitted to their outside.
- Malfunction of radio-based communication: may occur at very low levels of radiated emission.

Remarks on the scope of this section:

- These emission regulations only cover the so-called non-ionizing radiation in the electromagnetic spectrum. Ionizing radiation (e.g. like from nuclear plants) is usually not an issue with BESS.
- In some regulations, mains-borne (or line-bound) electromagnetic emissions from the BESS to the electricity grid (e.g. flicker, harmonics, pulse voltages) are considered together with the radiated (i.e. air-borne) emissions.
- In some regulations, the electromagnetic emissions inside and outside the BESS are considered together. This section only covers the BESS emissions to the outside of the BESS.
- In some regulations, the electromagnetic immunity, i.e. the resistance to withstand mains-borne and air-borne electromagnetic disturbances from other sources towards the BESS, are considered together with the emissions.

Magnitude and significance pre-mitigation

Impacts on radiated electromagnetic emissions are negative and may be significant to the project, however no significant impact is foreseen on the environment in this circumstance. This is only anticipated to happen when poor housekeeping and poor discipline is present on site. Given this, impacts pre-mitigation are considered of low magnitude. Considering that the sensitivity of the receptor "environment" is classified as low, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on occupational H&S CONSTRUCTION | PRE-MITIGATION

Criteria	Classification	Scoring
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Medium	-1
Sum		
Magnitude of the impact	Low	
vs		
Sensitivity of the receptor	Low	

Mitigation

The following methods are common as a proof that the radiated (air-borne) electromagnetic emissions from a BESS are within reasonable boundaries:

- All major components shall be type-tested not to exceed standard emission levels, e.g. according to IEC 61000-6-4.
- The installation of components shall be in compliance with general good practice for EMC reduction.
- Careful shielding of the inverter cabinet
- Usage of EMC filters of all connections that enter and leave the inverter cabinet, including:
- AC low-voltage connection to the transformer ("AC filter")
- DC low-voltage connection to the batteries ("DC filter")
- Inverter auxiliary power supply
- Inverter data interfaces (may include galvanic separation, e.g. via optocouplers)
  EMC-compliant design and installation of the entire electrical system, e.g.:
- Low-resistance functional grounding
- Avoidance of ground loops
- Appropriate cable management and cable shielding

Magnitude and significance post-mitigation

The mitigation measures will ensure the magnitude post-mitigation to remain classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**.

MAGNITUDE - Impacts on ambient noise CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		-6
Magnitude of the impact	Low	
Vs		
Sensitivity of the receptor	Low	

7.1.3.1.3 Occupational Health & Safety and Labour Standards

Potential Labour and Workers Rights impacts are related to inhumane labour conditions and refusal of human rights. ESS 2 has the objectives to promote safety and health at work, to promote the fair treatment, non-discrimination and equal opportunity of project workers, to protect workers, including vulnerable workers such as women, persons with disabilities, children (of working age, in accordance with this ESS) and migrant workers, contracted workers, community workers and primary supply workers, as appropriate and to prevent the use of all forms of forced labour and child labour. ESS 2 further has the objectives to support the principles of freedom of association and collective bargaining of project workers in a manner consistent with national law and to provide project workers with accessible means to raise workplace concerns.

The Project shall also meet the following International Labour Organization (ILO) core standards:

- Forced Labour (C105).
- Child Labour (C182).
- Discrimination (C111).
- Freedom of Association and the Right to Organize (C 87).
- Equal Remuneration (C100); and
- Minimum Age (C138).

Magnitude and significance pre-mitigation

Impacts on occupational H&S are negative and may be significant. These are anticipated to happen especially when poor housekeeping and poor discipline is present on site. Given this, impacts pre-mitigation are considered of low magnitude. Considering that the sensitivity of the receptor "people" is classified as low, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on occupational H&S CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Irregular	-2
Ability to recover	Reversible	-1
Probability	Possible	-2
Intensity	Low	-1
Sum		**-8**
Magnitude of the impact		Low
vs		
Sensitivity of the receptor		Low

Mitigation measures

- Contractor to develop OHS Plan consistent with national regulations and WB ESS2
- Enforce the site ESMP and engage in regular toolbox talks.
- PPE must be utilised at all times when on site.
- Ensure during construction a Health and Safety officer is at site at all times.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's frequency to "once" and its probability to "unlikely": Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**.

MAGNITUDE - Impacts on ambient noise CONSTRUCTION | POST-MITIGATION

Criteria	Classification	Scoring
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		-6
Magnitude of the impact	Low	
Vs		
Sensitivity of the receptor	Low	

7.1.3.1.4 Community Health and Safety

The people affected by the BESS will be NamPower staff operating at the substation and the BESS, as well as employees and visitors to the Husab Mine. Due to access to the BESS being along the mine road the site is not accessible by the general public and no other communities live in the vicinity.

7.1.3.2 Cultural Heritage

With the closest site of cultural significance, the Welwitschia siding and remnant of the rail embankment being approximately 15 km away, no impact is anticipated.

7.1.4 Impacts and Mitigation Measures during Decommissioning

7.1.4.1 Disposal and recycling of Batteries

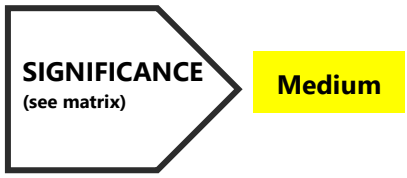
As most batteries contain heavy metals and other toxic substances, it is not desired to dispose of them in general landfills or in the environment. The battery "blades" contain valuable rare earth metals particularly Lithium and Cadmium that are sealed within gel structures. These are of high value when they reach the end of their working life and should be returned to the manufacturer for recycling.

The major environmental risk is a leakage of the battery cells when they have been disposed of improperly after the decommissioning of the BESS. This leakage may lead to soil and groundwater contamination.

Magnitude and significance pre-mitigation

Impacts on radiated electromagnetic emissions are negative and may be significant to the project, however no significant impact is foreseen on the environment in this circumstance. This is only anticipated to happen when poor housekeeping and poor discipline is present on site. Given this, impacts pre-mitigation are considered of low magnitude. Considering that the sensitivity of the receptor "environment" is classified as low, the impacts' significance is classified as **low**. Mitigation measures are required and suggested below.

MAGNITUDE - Impacts on occupational H&S CONSTRUCTION | PRE-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Long term	-3
Frequency	Repeatedly	-4
Ability to recover	Irreversible	-4
Probability	Possible	-2
Intensity	High	-3
Sum		-17
Magnitude of the impact		High
vs		
Sensitivity of the receptor		Low



Mitigation

As a lot of materials in batteries can be recycled easily, recycling regulations aim at forcing the separation and re-usage of the materials in a battery in specialized facilities. As an example, 99% of the materials in lead-acid batteries sold in Germany are currently recycled. The recycling quota is lower for lithium-ion batteries, but in the waste treatment process, toxic substances are eliminated before storing the battery waste in landfills. As part of the WEEE Plan to be developed once the battery technology has been confirmed. NamPower may investigate the possibility of recycling in Namibia and within the regional context of SADC.

Furthermore, in an effort to reduce impacts associated with battery waste the project will prioritize procurement of batteries from suppliers with a take back policy. In the instance where batteries are disposed of without returning to the supplier, only local recycling processors that adhere to appropriate

methods of disposal and recycling will be used, and under the guidance of the original equipment manufacturer and as stipulated in the WEEE plan that will be developed for the project.

The transport, storage, handling and disposal of the respective materials and components will be addressed in detail in the NamPower WEEE, once the battery type and technology is defined.

Magnitude and significance post-mitigation

The mitigation measures may allow reducing the impact's frequency to "once" and its probability to "unlikely": Therefore, the magnitude post-mitigation is classified as low. Based on the significance matrix, the significance of the residual impact (impact post-mitigation) is classified as **low**.

MAGNITUDE - Impacts on ambient noise CONSTRUCTION | POST-MITIGATION		
Criteria	**Classification**	**Scoring**
Spatial extent	Local	-1
Duration	Short term	-1
Frequency	Once	-1
Ability to recover	Reversible	-1
Probability	Unlikely	-1
Intensity	Low	-1
Sum		-9
Magnitude of the impact	Low	
Vs		
Sensitivity of the receptor	Low	

7.2 Summary of the impacts' significance

Table 7-1 show a summary of the significance of the impacts expected to be delivered by the project's construction and operation. Whenever the significance post-mitigation is medium or high, the table indicates the need for compensation measures. Compensation and mitigation measures will be defined in the forthcoming ESIA.

Table 7-1: Summary of the significance of the impacts of the project during construction

CONSTRUCTION		
Feature	**Significance of the impacts**	
	Pre-mitigation	**Post-mitigation**
PHYSICAL ENVIRONMENT		
Topography	Low	Low
Soil & Groundwater	Low	Low
Surface Water	Low	Low
Landscape and Visual	None	None
Ambient Air Quality	Low	Low
Ambient Noise	Low	Low
BIOLOGICAL ENVIRONMENT		
Flora	Low	Low
Fauna	Low	Low
Natural Protected Areas	Low	Low
HUMAN ENVIRONMENT		
Thermal Runaway and Fire	Low	Low
Radiated Electromagnetic Emissions	Low	Low
Occupational H&S	Low	Low
Cultural heritage	Low	Low
DECOMMISSIONING PHASE		
Battery and Disposal	Medium	Low

8 Consultation and Public Participation

An important element of the planning and decision-making process is to involve the affected communities and keep the public informed. Stakeholder engagement, in form of a Background Information Document (BID), was sent to identified stakeholders on the 7th November 2023. The BID was sent to consult with the affected people, authorities and non-governmental organizations (NGOs) and identify any concern by any party.

The initial communication of the BID was simply to establish whether any concern or comments are presents from known Stakeholders. NamPower will undertake a comprehensive a Stakeholder engagement process at the same time as applying for Environmental Clearance with MEFT. The decision was taken at this time not to engage the public at large as this may cause confusion when the MEFT application requires the same process.

As part of a separate ESIA running as a parallel project to this BESS project, an Environmental and Social Impact Assessment for the Proposed 400 kV Transmission Line from Auas to Kokerboom Substation was undertaken by EnviroDynamics. Due to the larger project and more significant impact EnviroDynamics undertook a detail Stakeholder Engagement Plan[10] and detail engagement process. The focused stakeholder strategy undertaken in this project was specifically done so as to dovetail into the SEP done by EnviroDynamics.

NamPower is required to conduct a meaningful participation and consultation process that allows affected people and interested stakeholders to express their views and concerns on project risks, impacts and the proposed mitigation measures. At the same time, the process shall also enable the executing agency to take these views into account and to react. For the sake of transparency, the executing agency is required to disclose relevant information on the environmental and social assessment and a non-technical summary via appropriate media channels at an accessible location and in a timely, appropriate manner. The whole process shall be comprehensive and cover all phases of the project.

The public participation process for this project aims to ensure that all persons or organizations that may be affected by, or are interested in, the proposed BESS project are informed of the issues and can register their views and concerns.

8.1 Identification of interested and affected parties.

The site for implementing the BESS will be within an existing NamPower substation, at Lithops Substation in the Karas Region near Swakopmund. The site is located with no residential areas in the vicinity, the only nearest neighbours are mines.

Consultation with the public forms an integral component of an environmental and social assessment and enables Interested and Affected Parties (IAPs) e.g. neighbouring landowners, local authorities, environmental groups, civic associations and communities, to comment on the potential environmental and social impacts associated with the operations and to identify additional issues which they feel should

[10] Proposed 400kV Transmission line from Auas to Kokerboom Substations ESIA and ESMP - Stakeholder Engagement Plan and Report. Prepared for NamPower. Envirodynamics. 2023.

be addressed in the detailed assessment phase. Consultation will be initiated and facilitated through notification letters, site and press notices and stakeholder meetings.

The following stakeholders have been identified:

- NamPower
- Ministry of Mines and Energy (MME) as competent authority
- Ministry of Environment, Forestry and Tourism, (MEFT) as regulator
- Ministry of Agriculture, Water and Land Reform (MAWF)
- Ministry of Works and Transport (MWT)
- Ministry of Labour and Social Welfare (MLRS)
- Ministry of Health and Social Services (MHSS)
- Ministry of Industrialization, Trade and SME Development
- National Heritage Council (NHC)
- Regional Council of Erongo
- City of Arandis and Swakopmund as off-takers
- Adjacent Landowners - Usab Mine, Sahara Mine Dimension Stone, Khan Mine, Stone Africa Dimension Stone, Savanah Marble, Roessing Mine.

8.2 Steps in the Consultation Process

According to the Environmental Management Act (Act No. 7 of 2007) and the respective EIA regulations and policies (Section 2.1), the following steps need to be undertaken:

- Identification of interested and affected parties (IAPs) (Section 8.1)
- Background Information Document
- Notification letters to stakeholders and relevant local authorities
- Press notice
- Site notice
- Stakeholder database
- Stakeholder meeting / Public consultation
- Public disclosure of assessment report
- (potential comments, response trail).

The project shall additionally comply with the requirements of the WB regarding stakeholder engagement and information disclosure in a way proportionate to the nature and scale of the project and its potential risks and impacts. The requirements are described on the bank's ESS 10 and summarized as:

- stakeholders are engaged throughout the project life cycle.
- such engagement commences as early as possible in the project development process.
- the engagement follows a timeframe that enables meaningful consultations with stakeholders on project design.
- all stakeholders will be engaged in meaningful consultations.
- stakeholders will be provided with timely, relevant, understandable and accessible information.
- consultation will be undertaken in a culturally appropriate manner, which is free of manipulation, interference, coercion, discrimination and intimidation.

Also following the WB ESS10, the process of stakeholder engagement must involve:

1. stakeholder identification and analysis.
2. planning how the engagement with stakeholders will take place.
3. disclosure of information.
4. consultation with stakeholders.
5. addressing and responding to grievances; and
6. reporting to stakeholders.

Stakeholder engagement shall be in line with the Stakeholder Engagement Plan compiled by Enviro Dynamics for the RETF.

8.2.1 Background Information Document

Interested persons must be notified about the project and the Scoping Report. Background Information Documents (BIDs) will be provided to IAPs. This document provides an overview and non-technical summary of the proposed development and act as an easy reference to proposed project information.

This step was done at this time and the BID is attached to this report as Annex 1.

8.2.2 Notification letters

The Environmental Commissioner (appointed by the Ministry of Environment and Tourism) can take care of the notification or can require that the proponent takes care of the notification and then provide the Environmental Commissioner with proof that it has been properly done. The notification must say that interested persons can view the full application and assessment report at the Office of the Environmental Commissioner. It must also invite interested persons to make written submissions to the Environmental Commissioner and give the deadlines for these submissions.

8.2.3 Press and site notice

Information to a wider public was done by publication of a notice in local newspapers, by advertisements and posters. These were place in National Namibian newspapers on 27th March 2024 and again on April 9th, 2024, refer to Annex 3 for copy of the advertisement.

8.2.4 Stakeholder database

During the public consultation process, IAPs will be made aware of their rights to provide input into the assessment process through registering on the project and providing comments and concerns. The invitation to register as an IAP shall appear on all the press and site notices. The registered IAPs with those previously identified to be IAPs by the project (which received notification letters), comprise the stakeholder list for the project.

8.2.5 Public consultation

It was decided to hold a public hearing on the report, and to carry out a process of public consultations. 14 days' advance notice was given to all identified stakeholders. Public notice of the meeting was published 14 days in advance, with the date, time and place of the hearing and a brief description of the proposed activity which is under consideration. This process is intended to make sure that everyone with

an interest in the proposed activity had a fair chance to have a say. The public consultation meeting was held on the 9th April in Swakopmund, at the MTC Dome.

The following attendees at the public meeting were recorded (Annex 4 for attendance register):

1. Elifas Iilende
2. Christina Mansfeld
3. Onesmus Jacobus
4. Marlon Izaks
5. Linekela Haipinge
6. Niita Hamunyela
7. Sharlien Tjambari
8. Isabel Bento
9. Isidor Shilongo
10. Adolf Kaure
11. Renate Rengura
12. Rainer Horsthemke

8.2.6 Public disclosure of ES Scoping Report

The notification stated that interested persons can view the full application and assessment report at the NamPower. Persons and parties who may be affected by the proposed project must be given a chance to inspect the assessment report and given the opportunity to make submissions on it. The comments received from stakeholders were recorded, responded to and reflected in this updated and revised ES Scoping report.

8.2.7 Comments received from stakeholders

The following individuals and company's responded acknowledging that they had received the information regarding the BESS and Lithops substation and would respond should any concerns arise:

- Annelize Swart - Executive Assistant at the **Municipality of Swakopmund**
- Gerhard Coeln - **GeCoCo (Gerhard Coeln Consulting)**
- Esleen Guriras - Property Clerk & Acting PA to CEO of **Arandis**

The only queries came from Sharlien Tjambari a Journalist at **the Namib Times,** she requested additional information about the project and had some questions for the article, these as well as feedback are reflected in Annex 5.

9 Environmental and Social Management Plan

The potential environmental and social impacts of the project, as described in Section 7, can be avoided, minimized, mitigated or compensated by performing suitable measures. This chapter describes a set of indicative mitigation and monitoring measures (Section 9.2) to be undertaken during the pre-construction, construction, operation and decommissioning of the project. These measures will need to be updated once the project location is known.

9.1 Institutional Requirements

Table 9-1: Overview of Institutional Entities

AGENCY	RESPONSIBILITY
Office of the Environmental Commissioner (OEC), Ministry of Environment, Forestry and Tourism (MEFT)	Issue of Environmental Clearance Certificate (ECC) based on the review of the Environmental Assessments (EA) reports prepared in accordance with the Environmental Management Act (2007) and the Environmental Impact Assessment Regulations, 2012. Conduct participation and consultation process that allows affected people and interested stakeholders to express their views and concerns on project risks, impacts and the proposed mitigation measures and public disclosure of project documents related to environmental and social risks.
Ministry of Mines and Energy (MME)	Is responsible for development and implementation of wider electricity industry legislation and institutional mechanism including – the overall exercise control over the electricity supply industry and to regulate the generation, transmission, distribution, use, import and export of electricity in accordance with prevailing Government policy so as to ensure order in the efficient supply of electricity.
Electricity Control Board (ECB)	Falling under the Ministry of Mines and Energy (MME). The Electricity Control Board (ECB) is a statutory regulatory authority established in 2000 under the Electricity Act 2 of 2000; which has subsequently been repealed by the Electricity Act, 4 of 2007; the latter Act having expanded the ECB mandate and core responsibilities. The core mandate of the ECB is to exercise control over the electricity supply industry with the main responsibility of regulating electricity generation, transmission, distribution, supply, import and export in Namibia through setting tariffs and issuance of licenses. The ECB executes its statutory functions through the Technical Secretariat headed by the Chief Executive Officer.
NamPower	NamPower is a state-owned enterprise, registered and operating according to the Companies Act. NamPower's core business is the generation, transmission and energy trading within the Southern African Power Pool (SAPP). NamPower supplies bulk electricity to mainly Regional Electricity Distributors (REDs), and to Local Authorities and, Farms (where REDs are not operational) and Mines throughout Namibia.
Regional Electricity Distributors (REDs) Northern Regional Electricity Distributor (NORED), Central Northern RED (CENORED) and Erongo RED	A RED is a regional electricity distributing company tasked with supplying electricity to the residents in a specific region. In the central and southern regions where REDs have not become operational yet, NamPower is responsible for the MV electrification and bulk supply to local authorities, villages and settlements.
Ministry of Agriculture, Water and Land Reform	The Directorate of Resource Management within the Department of Water Affairs (DWA) at the MAWF is currently the lead agency responsible for management of surface and groundwater utilization through the issuing of abstraction permits and wastewater disposal permits. DWA is also the Government agency responsible for water quality monitoring and reporting.

9.2 ESMP

The following tables present an indicative environmental and social management plan which includes:

a) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address social and environmental impacts that have been identified.
b) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and
c) a description of the way the applicant intends to modify, remedy, control or stop any action, activity or process which causes adverse social impacts, environmental pollution or degradation, and offset social impacts and remedy the cause of pollution or degradation and migration of pollutants.

Management and monitoring measures are presented for pre-construction, construction, operation and decommissioning phases. This distinction allows providing the different project actors with compartmented and, consequently, easier-to-understand information about their responsibilities.

Table 9-2: Indicative ESMP - Mitigation and Monitoring Measures during pre-construction

	Environmental Management and Monitoring Plan			
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures, Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
Land Requirements	No land acquisition is required for the project site.	No mitigation anticipated.	NamPower / Contractor	A grievance mechanism may be required.
Vegetation clearing	The land requirements result in site-specific construction issues such as the removal of vegetation. In case of the Lithops site, vegetation clearing will be restricted to a few individual plants as the site was previously cleared and is in a low vegetation habitat.	• Limit vegetation clearing to areas within the site boundary. • Only clear where it is strictly necessary.	Contractor	Site inspection prior to commencement of activities. Marking the borders of works site boundaries.
		• Clarify with responsible authorities whether a license is needed. • Describe the methods of vegetation clearance. • Ensure that no chemicals/pesticides are used, burning of vegetation is restricted etc. • Do not clear vegetation more than two months in advance of operations.	Contractor	Site inspection prior to commencement of activities. Site inspection during site clearance. No use of fires or chemicals on site; usage of warning signs.
Archaeological Chance Finds	No archaeological chance find is expected at Lithops site.	Develop a chance finds procedure and ensure all finds of cultural heritage (e.g. graves, old ceramic, old building fragments) are reported immediately to the relevant authority and avoid excavation in the neighbourhood of a chance find, fence the chance find and await instructions from the competent authority.	Contractor	Site inspection during excavation activities. Notification records to relevant authority. Training records, Records about chance finds.
Human Environment	The construction activities may result in need for local workforce. Potential risks that may occur related to the arrival of workers from outside are the risk of human trafficking, GBV, child labour and sexual abuse.	• Job opportunities shall be prioritized for residents, especially groups of people who live below the poverty line to get the work they can do. • Collaborate with the local government in involving local workers. • Provide training for certain types of work (capacity building). • Prioritize buying food items from residents, e.g. vegetables to meet consumption needs for employees. • Promote fair treatment, non-discrimination, and equal opportunity of project workers, including vulnerable workers such as women, persons with disabilities, migrant workers, etc. as appropriate and to prevent the use of all forms of forced labour and child labour. • Establish a grievance mechanism. • Regarding the issue of human trafficking, sexual harassment, GBV and child abuse, the project shall make guidelines and	NamPower / Contractor	Site inspection during pre-construction activities. Training records. Grievance records. Developed guidelines. related to human trafficking, sexual harassment, GBV and child abuse. Security Personnel Management Plan developed.

	Environmental Management and Monitoring Plan			
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures, Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
		monitor outsiders not to be involved in these illegal activities. • In case security services are contracted, assure that those providing security are not implicated in past abuses, are adequately trained, have an appropriate conduct towards the citizens and other workers, and act within the applicable law.		
Labor and Working Conditions	All Project phases involve the employment of personnel. All activities of the involved parties must comply with the listed ILO core standards.	• Promote fair treatment, non-discrimination, and equal opportunity of project workers, including vulnerable workers, such as women, persons with disabilities, migrant workers, etc. as appropriate and to prevent the use of all forms of forced labour and child labour. • The contractor must establish guidelines for the labour recruitment and employment system in line with ILO core standards that include no use of forced labour, no discrimination, no child labour, equal pay for women and men, respect of working hours and respect of freedom of association and right to organize. • Regarding the issue of human trafficking, sexual harassment, GBV and child abuse, the project shall make guidelines and monitor outsiders not to be involved in these illegal activities. This issue should also be discussed during public consultations to create awareness within the communities. • Prohibit the involvement of children (minimum age 18 years) in working directly or indirectly on the project and enforce this prohibition. • In case security services are contracted, assure that those providing security are not implicated in past abuses, are adequately trained, have an appropriate conduct towards the citizens and other workers, and act within the applicable law. • Establish a grievance mechanism.	NamPower / Contractor	Site inspection during pre-construction activities. Guidelines for labour recruitment and employment system in line with ILO cores standards. Guidelines related to human trafficking, sexual harassment, GBV and child abuse available at project site and included in training material. Review of grievance records. Visual inspection on regular basis.
Health & Safety (H&S)	Construction activities may pose a risk to the health, safety, and well-being of workers on site and members of neighbouring communities.	• The contractor shall develop and implement a site-specific Health & Safety Management Plan. • Health & Safety manager on duty. • Provide adequate, timely and regularly updated training and briefings for workers on safety precautions.	NamPower/ Contractor	Notification records to relevant authority (e.g. road authority). To be consulted on site: Workers Code of Conduct, Fire Safety and Emergency Response Plan,

	Environmental Management and Monitoring Plan			
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures, Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
		• Notice of commencement of construction to the Ministry of Labour at least 30 days prior to the commencement of works. • Construction site shall be fenced, and the entrance gates shall be guarded by security staff to prevent any unauthorized access to the site, thus also minimizing possible impacts on community health. • Inform population of settlements along public roads in advance, in case of transporting heavy equipment. • Security arrangements to be guided by principles of proportionality, good international practice, and national law. • Develop and implement a site-specific Fire Safety and Emergency Response Plan. • Operate accessible Grievance Redress Mechanism and document all grievances and follow up until resolution in grievance logbook. Appropriate staffing to be planned.		Traffic Management Plan; and Health and Safety Management Plan. Security Personnel Management Plan. A grievance mechanism may be required. Training records. Site Inspections.
End-of-life battery disposal (Hazardous waste management)		• Procurement of batteries should prioritize manufacturer/ suppliers with a take back policy. • E-Waste (WEEE) management plan to be developed which outlining disposal and recycling procedures (e.g. recyclable metals) that will be followed for end-of-life batteries. •	NamPower/ contractor	WEEE Plan[11]

[11] The WEEE Plan must be developed by NamPower during to the operations phase once all design and technical specifications are finalised.

Table 9-3: Indicative ESMP - Mitigation and Monitoring Measures during construction

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
Considering ESS 1 and WB Standards and General HSE Guidelines						
Soil	Soil erosion by site preparation works (land clearing, levelling)	Ensure that work site boundaries and limits are in accordance with plans and technical design as agreed upon in advance. All construction activities should be carried out within boundaries. Restrict vehicle movements to paved roads and wet roads.	Contractor	Traffic Management Plan Site Inspection In presence of high winds	Continuously on site	NamPower / Contractor
Soil	The construction activities will generate waste which has the potential to affect the soils of the project area physically and chemically. The following **waste streams** are expected: excess soil or rocks from levelling: plant debris; construction waste like unused / unusable construction material, wood from frameworks, maintenance waste, packaging material, empty containers, etc. **hazardous waste**: fuel, engine oil, and lubricants; drums and containers (of hazardous and non-hazardous materials); domestic/household garbage; domestic wastewater.	A **Waste Management Plan** shall be developed prior to construction with measures to handle the different waste streams. The following basic principles shall be considered in the WMP: • A waste management hierarchy of avoidance, minimization, reuse, recycling, treatment and disposal • Segregation of all waste based on their nature and ultimate disposal sites. • Ensure that hazardous materials are stored in proper areas and in a location where they cannot reach the soil surface in case of accidental spillage. This means storage facilities that are of hard impermeable surface, flame-proof, with 110% containment capacity, accessible to authorized personnel only, locked when not in use, and prevent incompatible materials coming in contact with one another. • good technical planning to minimize the generation of construction waste. • staff training to increase awareness of waste management hierarchy and procedures, segregation, storage, and labelling issues. • inspecting and auditing principles.	Contractor	Waste Management Plan Site Inspection	Weekly	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		• A register of all hazardous materials used must be present at any time. Spilled material should be tracked and accounted.	Contractor	Waste Management Plan Site Inspection	Weekly	NamPower / Contractor
		The following measures shall be included in the **WMP**: • The construction waste shall be reused as much as possible on site. • Any construction debris generated shall be sorted by type managed and ultimately disposed, reused or recycled in accordance with the WMP. • Incorporate drip pans at machinery, equipment, and areas that are prone to contamination by leakage of hazardous materials (such as oil, fuel, etc) • Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material. • Prohibit fly-dumping of any solid waste to the land. • Distribute an appropriate number of bins and containers, each designed to securely contain waste and properly marked with the type of waste they are intended for.	Contractor Contractor	Waste Management Plan Site Inspection Waste Management Plan Site Inspection	Continuously Daily	NamPower / Contractor NamPower / Contractor
		To handle hazardous waste: • Store the hazardous waste on separate locations on site with the following characteristics:				

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		• Labelled, enclosed and impermeable containers. • Floor made of impermeable material. • Safety sheets available on the containers. • Final transport and disposal to be done by an authorized company. • Agree with the supplier of oils, and other hazardous materials to take back the empty drums after construction. • Drain the oil filters to remove the excess oil. • Deliver used oil to companies that are accredited to recycle it. • Ensure that a minimum of 110 % of spill absorbent is available at hazardous material storage facility. • If spillage occurs, spill must be immediately contained, cleaned-up, and contaminated soil disposed as hazardous waste. • Ensure all works carried out minimize pollution risk (e.g. liquid effluents, air emissions, noise and vibration management, vehicle and equipment maintenance and selection, fuel, oil and chemical storage and handling). • Store construction material (bags of cement etc.) in containers.	Contractor Contractor	Waste Management Plan Site Inspection Waste Management Plan Site Inspection	Continuously Continuously	NamPower / Contractor NamPower / Contractor
		The Construction Contractor shall deposit excess soil at existing landfills after agreement with the regional authorities concerning the quantity and types of waste to be deposited. Maintain records and manifests that indicate volume of waste generated onsite, collected by contractor, and disposed of at the landfill. Numbers are to be consistent to ensure no illegal dumping at the site or other areas.	Contractor	Prevention, planning	Continuously	NamPower / Contractor
Considering WB ESS 2 & ESS 4 and General HSE Guidelines (Waste Management, Hazardous Material Management)						

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
Noise	The construction works will cause noise emissions during clearing, trenching, movements of vehicles and machinery, hauling, stringing, welding, lowering, excavations, concreting, backfilling, usage of pumps and compressors, etc.	Apply adequate general noise suppressing measures which could include use of well-maintained mufflers and noise suppressants for high noise generating equipment and machinery, developing a regular maintenance schedule of all vehicles, machinery for early detection of issues.	Contractor	Site Inspection	Daily	NamPower / Contractor
Considering WB ESS 2 General HSE Guidelines and HSE-Guideline: Construction Materials Extraction						
Air Quality	Construction activities will likely result in an increased level of dust and particulate matter emissions due to temporary and permanent infrastructures during clearing, and movements of vehicles and machinery, excavations, concreting, backfilling etc. If improperly managed, there is a risk of nuisance and health effects to construction workers onsite and possibly nearby surrounding receptors from windblown dust. Other impacts on the air quality during construction are related to the air emissions derived from the diesel generators that will work to provide energy to the workers camps and some construction equipment.	If dust or pollutant emissions are found to be excessive, construction activities shall be stopped until adequate control measures are implemented.	Contractor	Site Inspection	Daily	NamPower / Contractor
		Spray unpaved areas subject to vehicle movements with non-drinkable water in case dust suspension is visible and considered critical; keep in mind that this activity must not result in the formation of puddles, lead to rutting by equipment or vehicles, tracking of mud onto roads or siltation of watercourses.	Contractor	Site Inspection	Continuously	NamPower / Contractor
		Cover the trucks transporting earth and loose materials with tarpaulins.	Contractor	Site Inspection	Continuously	NamPower / Contractor
		Do not store earth and pulverous materials in the open, ensure that material cannot be blown away.	Contractor	Site Inspection	Continuously	NamPower / Contractor
		Keep diesel generators further away from the workers occupational areas.	Contractor	Site Inspection	Continuously	NamPower / Contractor
		Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant emissions.	Contractor	Engines switched off during breaks and after work finished. Review of grievance records, accident/ incident records and training records.	Weekly	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
Considering WB ESS 1 and WB General HSE Guidelines						
Landscape and visual aspects	Temporary impacts may be caused due to the circulation of vehicles and machinery, presence of piles of excavated material, storage, borrow and deposit areas	No dumping of rocks or soils indiscriminately in the vicinity or edge of the site. No new rock piles or soil dumps to be created from overburden or waste materials from construction. All excess material to be removed to an approved waste site.	Contractor	Site Inspection	Continuously during construction	NamPower / Contractor
Considering WB ESS 6 and General HSE Guidelines						
Biodiversity / Biological Environment	Loss of **vegetation** within areas physically affected by the construction activities. **Terrestrial fauna** injuries, death or temporary disturbances due to construction activities.	The construction activities shall be limited to the defined construction corridor and vehicle movements and storage of construction material outside of this site shall be prohibited.	Contractor	Site Inspection	Continuously	NamPower / Contractor
		Hunting shall be prohibited for all.	Contractor	Site Inspection	Continuously	NamPower / Contractor
		Avoid to the extent possible areas of ecological value. Avoid natural habitats disturbance. Adjust working times to only during daytime hours (no activities at night). Speed limits set to 20 km/h for construction vehicles on access roads, to avoid collisions with animals. Well maintained and noise-reduced machinery and technologies shall be used.	Contractor Contractor	Site Inspection Site Inspection	Site inspection prior to commencement of activities and during site clearance Regularly	NamPower / Contractor NamPower / Contractor
	Improper management of construction activities could potentially disturb existing habitats (flora and fauna) within the Project area.	The removal of vegetation should be reduced to the minimum extent possible; it is forbidden to use any chemicals for this activity. In case of removal of vegetation or restoration of damaged areas, restoration must be done with indigenous species from the wider area.	Contractor	Site Inspection	Upon occurrence	NamPower / Contractor
	Site Clearing	Prior to the site being cleared and levelled an ecologist familiar with the central desert biome	Contractor/ NamPower	Site Inspection	Prior to site clearing	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		should conduct an inspection to ensure that no endangered or vulnerable species are present.				
		No fires may be used to clear any vegetation and no open fires may be made at any time.	Contractor	Site Inspection	Continuously	NamPower / Contractor
Considering WB ESS 6 &ESS1 and General HSE Guidelines						
Natural Protected Areas	General impacts related to losses of protected flora and disturbances and losses of protected fauna within protected areas	Should any species of concern be identified, permits to be able to relocate must be obtained prior to an on-going activity.	Contractor/ NamPower	Site Inspection	Continuously	NamPower / Contractor
Considering WB ESS 2, General HSE-Guideline and HSE-Guidelines: Occupational Health and Safety; Construction Materials Extraction						
Occupational Health and Safety	Risks for the workers' health and safety during construction activities and general incident/accidents on and off- site; accommodation, worker´s rights, rules and obligations and employment standards, injuries and accidents by lifting operations, working at height, working in remote locations with slow rescue chain	Development of a **Health & Safety Management Plan** and a **HSE team organigram** showing HSE personnel and responsibilities. • Execution of appropriate risk assessments with all needed actions to prevent workers from possible incidents and accidents. • The construction activities will be supported by a suitable health & safety management plan including and outlining all required health & safety prevention and control procedures. • Availability and use of personal protective equipment • Availability of communication equipment • Appointment of HSE staff • Appointment of first aid staff and availability first aid equipment • Provision of training prior commencing any work	Contractor/ NamPower	Regular health & safety inspections; HSE Plan in place. PPE used by everyone on site; Training performed and recorded;	Regular health & safety inspections CC Daily during construction. promptly whenever accidents, incidents and emergencies occur. Project Owner - monthly during construction. promptly whenever accidents, incidents and emergencies occur	NamPower / Contractor
		The **HSE Plan** shall comply with requirements as per WB General EHS Guidelines, as well as sector specific WB HSE Guidelines (for Electric Power	Contractor/ NamPower	HS Site Inspections	Daily	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		Transmission and Distribution), national legislation, and NamPower internal procedures and requirements.				
		Train staff in H&S topics, conduct daily toolbox talks, allow only qualified personnel for specific tasks, provide respective PPE.	Contractor/ NamPower	HS Site Inspections	Daily	NamPower / Contractor
		Have a clear, understandable, and accessible human resources policy	Contractor/ NamPower	HS Site Inspections	Prior to construction works begin	NamPower / Contractor
		Communicate to all workers their working conditions and terms of employment and provide them with pertinent documentation.	Contractor/ NamPower	HS Site Inspections	Continuously	NamPower / Contractor
		Provide and make accessible a transparent grievance mechanism for workers	Contractor/ NamPower	HS Site Inspections	Continuously	NamPower / Contractor
		Make all security arrangements compliant with the best international standards	Contractor/ NamPower	HS Site Inspections	Continuously	NamPower / Contractor
		Provide adequate, timely and regularly updated training and briefings for workers on occupational health and safety	Contractor/ NamPower	After incidents and near misses, and inductions	Every time before a worker is hired or changes to a new function Regularly during construction	NamPower / Contractor
		Require the workers to use the provided personal protective equipment	Contractor	HS Site Inspections	Continuously during construction	NamPower / Contractor
		Report and record any accidents, incidents and/or breach of relevant legislation	Contractor/ NamPower	HS Site Inspections	Continuously during construction	NamPower / Contractor
		Assure that all workers have access to adequate, safe, and hygienic basic facilities on-site, with separate facilities for women and men, and that qualified first-aid can be provided	Contractor/ NamPower	HS Site Inspections	Continuously during construction	NamPower / Contractor
		Emergency and Response Plan shall include:				

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		• Assure the rapid availability of trained paramedical personnel, and emergency transport. • provisions for containment of hazardous materials stored on site (with containment capacity 110%) etc. • provision of emergency equipment such as first aid and medical kit, fire extinguishers, spill kits, etc., which will always be accessible during working hours and provided in appropriate amount for the size of the site and number of personnel. • Ensure the workforce has access to primary healthcare, providing prescriptions and vaccinations. In case more than 35 workers are present on site, ensure that a hospital, medical clinic or a health centre can be reached within a period of 45 minutes. • responsibilities and communication procedures in the event of different types of emergencies. • information posters showing instructions for behaviour in case of different types of emergencies. • plan for emergency drills. • measures for restoration and cleanup of the environment following any major accident	Contractor/ NamPower	Emergency Response Plan and HS Site Inspections	Regularly, at least monthly	NamPower / Contractor
		The ERP shall be reviewed on a regular basis (with frequency of 6 months and as necessary, e.g. based on lessons learned after a drill or an accident, change of responsible personnel, etc.).	Contractor/ NamPower	Prevention, planning	Every 6 months and as necessary	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
	Hygiene and Sanitary conditions	Ensure the provision of hygienic and sanitary facilities at the site, including shaded welfare areas, bathrooms, changing rooms and potable water. Ensure toilets and changing rooms are separated between male and female employees. Ensure the provision of adequate space, supply of water, adequate sewage and garbage disposal system, appropriate protection against heat, cold, damp, fire and disease-carrying animals, adequate sanitary and washing facilities, adequate lighting, and basic medical services, in accordance with all applicable health and safety regulations and norms. Report any occurrence of any communicable diseases amongst the workforce (STD, HIV/AIDS, TB, and Hepatitis B and C). Sensitize workers through toolbox talks.	Contractor/ NamPower Contractor/ NamPower	Appropriate H&S and sanitary facilities provided at site. Appropriate conditions and infrastructure for workers on site (e.g. accommodation, sanitation facilities, changing rooms etc.). Review of grievance records. Communicable Diseases Register. Training performed and recorded.	Regular and random inspection Regular and random inspection	. NamPower / Contractor NamPower / Contractor
	Unlawful labour and working conditions	Developing and implementing of a clear, understandable and accessible human resources policy in accordance with national labour and employment law (which will include any applicable collective agreements), including workers' rights related to hours of work, wages (shall not be below minimum wage rate specified by Namibian government), equality of wages between male and female workers, overtime, compensation and benefits, as well as those arising from the requirements of the World Bank ESS2; • procedure to ensure that all workers are in possession of a valid work permit in Namibia.	Contractor/ NamPower	Prevention and control	Regular inspections	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		• procedure to ensure that no children are employed according to Namibian regulations documenting of and communicating to all workers their working conditions and terms of employment. • respect the requirements of all existing national legislation on Occupational Safety and Health and international best practices, inclusive in the supply chain. • development of measures for emergency prevention, preparedness and response. • providing and making accessible a transparent grievance mechanism for workers (and their organizations, where they exist) in accordance with this Scoping report	Contractor/ NamPower	Prevention and control	Regular inspections	NamPower / Contractor
		Providing adequate, timely and regularly updated training and briefings for workers on safety precautions and their responsibility for their safety and the safety of others; · work specific safety procedures for all project activates, such as lifting procedure, working in and over water procedure if applicable, manual handling, working close to and in water, etc. requirement for the workers and visitors to use the provided personal protective equipment, mandatory for all persons present on site (safety helmet, safety shoes appropriate for the type of work, high visibility vest), as well as additional required task-specific PPE; providing and maintenance of welfare facilities on each project micro location where works are being performed, e.g. mobile toilets; · reporting and recording of any accidents, incidents and/or breach of relevant legislation arising from the project assuring that all workers have access to adequate, safe and hygienic basic facilities	Contractor/ NamPower	Prevention and control	Regular inspections	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		onsite, and that qualified first aid can be provided any time; · assuring of the rapid availability of trained paramedical personnel, and emergency transport to nearest hospital with accident and emergency facilities; ·ensuring that primary sub-contractors and first-tier suppliers uphold the same principles.	Contractor/ NamPower	Prevention and control	Regular inspections	NamPower / Contractor
		Project proponent shall ensure, in case of any accident/injury/loss of life, that the worker is paid a minimum compensation as calculated under the national legal requirements.	Contractor/ NamPower	Mitigation	Upon occurrence	NamPower / Contractor
Considering WB ESS 4 & ESS 9, General EHS-Guideline and EHS-Guidelines: Community Health and Safety; Construction Materials Extraction						
Economy and employment		It is recommended that the project makes use of the possibilities for renting of accommodation for the project personnel in the surrounding settlements. This could enhance positive attitude towards the project and contribute to local economy	Contractor/ NamPower	n.a.	During construction	NamPower / Contractor
		Hiring of local labour force during the construction phase of the project, subject to the availability of the required skills shall be prioritized.	Contractor/ NamPower	n.a.	During construction	NamPower / Contractor
Considering WB ESS 8 and General EHS-Guideline						
Cultural Heritage	Damages to known and unknown archaeological sites, buildings and objects	Consultation with the local communities shall be undertaken to determine if small objects or sites related to cultural traditions exist along the project area (like crosses placed in specific areas to mark a funeral procession, among others).	Contractor/ NamPower	As needed	During detailed design	NamPower / Contractor
		Establish a **Chance Find Procedure** which should contain measures such as: -ceasing work as soon as historical and cultural sites, buildings, or objects are encountered during earthworks or other construction activities.	Contractor/ NamPower	Prevention Site inspection during excavation activities. Notification records to relevant authority. Records about chance finds	One month before construction works begin	NamPower / Contractor

Environmental Management and Monitoring Plan						
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/ Type of Management**	**Frequency of monitoring**	**Responsibility for monitoring**
		-providing relevant information to the **MEFT**. The **Ministry** will then determine the value of the historic/archaeological monuments and provide guidance on if and how to proceed with the construction.				

Table 9-4: Indicative ESMP - Mitigation and Monitoring Measures during operation

Environmental Management and Monitoring Plan				
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
Landscape	The operational BESS is being installed in compact containers and does not include any components of height. The existing substation facilities are taller in height.	no visual impact expected		
Noise and Air Quality	The BESS will emit acoustic noise into their vicinity when in operation from power transformers, cooling compressors and fans. Noise can affect stakeholders and cause potential health implications.	Component selection: Special low-noise cooling compressors, fans and transformers. • Erection of physical barriers • Provision of ear protection equipment to maintenance staff.	NamPower	Regular noise measurements.
Labor and Working Conditions	All Project phases involve the employment of personnel. All activities of the involved parties must comply with the listed ILO core standards.	Promote fair treatment, non-discrimination, and equal opportunity of project workers, including vulnerable workers such as women, persons with disabilities, migrant workers, etc. as appropriate and to prevent the use of all forms of forced labour and child labour. • The EPC contractor must establish guidelines for the labour recruitment and employment system that comply with ILO core standards that include no use of forced labour, no discrimination, no child labour, equal pay for women and men, respect of working hours and respect of freedom of association and right to organize. • Regarding the issue of human trafficking, sexual harassment, GBV and child abuse, the project shall make guidelines and monitor outsiders not to be involved in these illegal activities. This issue should also be discussed during public consultations to create awareness within the communities. • Prohibit the involvement of children (minimum age 18 years) in working directly or indirectly on the project and enforce this prohibition.	NamPower / Contractor	Site inspection during operation. Review of grievance records. Visual inspection on regular basis. Implementation of Security Personnel Management Plan.

Environmental Management and Monitoring Plan				
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
		• In case security services are contracted, assure that those providing security are not implicated in past abuses, are adequately trained, have an appropriate conduct towards the citizens and other workers, and act within the applicable law. • Establish a grievance mechanism.		
Hazardous Substances	Hazardous substances in the form of chemicals are an integral part of the workings of batteries. Lithium batteries may contain heavy metals such as cobalt and manganese, as well as an organic solvent solution of lithium perchlorate, acetonitrile solution with lithium bromide. In the event of containment failure, hazardous substance may contaminate surrounding water resources as well as soil. Lithium, for example, causes long-term biodegradation.	• Some lithium-ion batteries under development use an aqueous electrolyte which significantly reduces the hazards associated with organics and acids. • Lithium-ion batteries require battery management systems to monitor and protect cells from overcharging or damaging conditions. • Large BESS systems should be designed with appropriate fire detection and suppression systems.	NamPower	Depending on the selected technology / supplier.
	Emissions may arise due to reactions occurring within the battery. If over-charged, batteries have a high explosion risk, due to the emission of hydrogen. This poses risks to both air quality and to the health of battery operators and workers on site.	• Large BESS should be in an isolated location or containerized with battery management, and monitoring systems. • Fire Safety and Emergency Response Plan, depending on the selected technology.	NamPower	Depending on the selected technology / supplier.
	Maintenance of batteries may result in the generation of waste which will need to be disposed of. Hazardous waste has severe negative impacts on the environment. Maintenance of batteries will also have a degree of risk in terms of spillages during the maintenance procedure. These pose risks to the ecosystem and to the health of	• E-Waste (WEEE) management plan to be implemented which outlines disposal and recycling procedures (e.g. recyclable metals). • Maintenance personnel should be properly trained, knowledgeable in hazardous materials and have the necessary equipment to deal with leaks and spills. • Maintenance of lithium-ion batteries is generally limited to replacement (and disposal) of battery cells	EPC Contractor	Depending on the selected technology / supplier.

Environmental Management and Monitoring Plan				
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
	battery operators due to the hazardous nature of the chemicals used. Lithium-ion batteries require low maintenance and are generally considered field replaceable components. When exposed to water and air (moisture), lithium emits flammable gases; therefore, maintenance procedures may result in safety risks.	at the end of life. • Fire Safety and Emergency Response Plan, depending on the selected technology. • The owner may request the supplier to provide a warranty for certain parts or whole modules, in case of failure of parts before end-of-life time. • The project should have a set aside for decommissioning and disposal, e.g. in form of a reserve account.		

Overheating / Fire / Lightning	Lithium batteries are subject to thermal runaway and can rapidly overheat if operated outside of normal parameters. Most lithium batteries use organic electrolytes, which are combustible.	• Conduct a fire risk assessment once the battery technology has been confirmed
		• Fire Safety and Emergency Response Plan, depending on the selected technology.
		  • An adequate number of Class A and Class D fire extinguishers shall be installed on site.
		  • Personnel shall be trained in the correct emergency response procedure and fire fighting techniques in the event of a fire associated with the BESS.
			NamPower	Depending on the selected technology / supplier.

Table 9-5: Indicative ESMP - Mitigation and Monitoring Measures during de-commissioning

Environmental Management and Monitoring Plan				
E&S Aspect/Receptor	**Potential Impact/ Negative Impact**	**Mitigation and/or compensation measures; Management Action**	**Responsible for implementation**	**Monitoring Action, Procedure/Type of Management**
Visual Impact & Landscape	Modularized and packaged systems offer ease of system removal from site for disposal at end of life. Site contamination is unlikely.	• Site restoration would include infrastructure removal and revegetation of cleared areas, where possible using native species. • Rehabilitate borrow areas, backfill material stockpile sites and access roads, where applicable. • Spill Prevention Plan and respective equipment in place. • Train staff in handling of hazardous materials and spill prevention.	NamPower	Site inspection
Hazardous Waste Management	Disposal and/or recycling will highly depend on the type of battery. Container and infrastructure might be reusable. The materials used in Li-ion batteries are typically considered non-hazardous waste. The metals in the system can be recycled, but they do not represent a high salvage value. Certain materials within the battery can be recycled; however, a significant amount will be disposed of. Hazardous landfill sites are generally the main route for disposal of a hazardous substance. However, other mechanisms are available. These mechanisms include incineration and disposal of the hazardous waste to land (not in a government owned landfill site). These mechanisms will be governed by the NEMWA. The transportation of the hazardous waste to either a recycling facility or a hazardous	• The disposal of hazardous substances will need to be at a hazardous waste disposal facility. There are only a few of these facilities in the country and will require a specific license. • The recycling of lithium is an extremely complicated process, as the material is toxic, highly reactive and flammable. Furthermore, due to the high costs of recycling lithium and the associated risks, there is a global absence of lithium recycling. Owners should consider provisions for disposal at end of life to ensure proper disposal. There are currently a limited number of facilities that recycle lithium-ion batteries. Because lithium battery systems currently have negative scrap value, it is important that the decommissioning plan is sufficiently well financed to cover the full costs of decommissioning and removal from site. • Environmental regulations prohibit disposal of hazardous waste in general landfills, thus need to be disposed of at a hazardous landfill facility. • Some programs provide for disposal and decommissioning of battery systems at end of life. The project should have a set aside for decommissioning and disposal in form of a reserve account.	EPC Contractor / Battery cell supplier	Depending on the selected technology / supplier.

	waste disposal facility will have associated risks (contamination emanating from spillages).	• The owner may request the supplier to provide a warranty for certain parts or whole modules. • Measures to be defined in an E-waste (WEEE) Management Plan, adjusted to the specific battery technology and transport routes. Which must be finalised prior to the construction		

10 Cost Estimate of ESMP implementation

Physical, biological and social management, mitigation and monitoring measures will be carried out during the pre-construction, construction and operation phases. The measures for physical and biological impacts overlap for the largest part, and therefore the price depiction shown below covers both issues.

Decommissioning could range from partial to full removal of all BESS components; thus, costs cannot be estimated at this point of time. Decommissioning shall be done based on a Decommissioning Plan, which shall also include a respective estimate of costs.

The total estimated cost for the management and monitoring plan, including the applicable VAT of currently 15% and a contingency budget of 5%, is 23,100 USD. The total cost estimation can be taken from the following table.

Table 10-1: Total Estimated Costs for Environmental and Social Management & Monitoring Plan

Activities	Estimated Cost (USD)		
	Pre-construction phase	Construction phase	Operation phase
Management	1,500	2,000	-
Physical and Biological Environment	2,000	3,000	-
Social Environment	2,000	1,000	-
Monitoring	-	2,000	2,000
Training of local staff in HSE monitoring	2,000	1,500	1,000
Total	7,500	9,500	3,000
Total estimated cost	**20,000**		
VAT 15%	2,000		
Total incl. VAT 15%	22,000		
5% Contingency Budget	1,100		
Grand total	**23,100**		

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11 Conclusions and Recommendations

The main potential impacts of the project may take place during the construction stage and could leak to contamination of soil and water (mainly during the transportation phase), and the impacts of health and safety on the workers through air and noise emission. The impacts on soil and water will be really easily to mitigate through implementation of the ESMP and Good Housekeeping. Insuring all employees and staff on site are fully equipped with proper PPE at all times will also protect them from air and noise emissions especially dust and particles in the desert environment.

The few medium impacts that have been identified for the Lithops substation should all be able to be mitigated down to a low if all measures of the ESMP are implemented; it is not anticipated that there will be any severe environmental nor social impacts from the project. This Project does not require any resettlement aspects, nor livelihood restoration, as the land is already in possession of NamPower.

Positive impacts of the project are related to creating job opportunities especially during the construction phase, it is not in anticipated that any new job opportunities will arise from the operational phase during this construction phase. With new investment the potential of training and more qualified workers could arise. The additional power storage will increase the total output and stability of the network in the Erongo region and especially support the energy usage of the mining industry which is an industry crucial to the Namibian economy.

In summary it can be concluded that the proposed project can be implemented without having significant adverse impacts on the environment and if all mitigation and monitoring measures are implemented as recommended in the ESMP this project can mostly be positive in impact.

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Mendelsohn, J., Jarvis, A., Roberts, C., Robertson, T. (2002). Atlas of Namibia. David Philip Publishers, Cape Town. Petavratzi E, Kingman S, Lowndes I. (2005). Particulates from mining operations: A review of sources, effects and regulations. Minerals Engineering 18: 1183–1199

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Annex 1

BID

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Annex 2

Background Information Document (BID)

NAMPOWER Battery Energy Storage Systems (BESS)

1. Aim of this Document

This BID aims to provide stakeholders / Interested and/or Affected Parties (IAP) with the following information:

- Brief description of the proposed project.
- Motivation for/or desirability for the proposed project.
- The potential key issues as identified during the initial assessment phase, both positive and negative which may arise as a result of the proposed project.

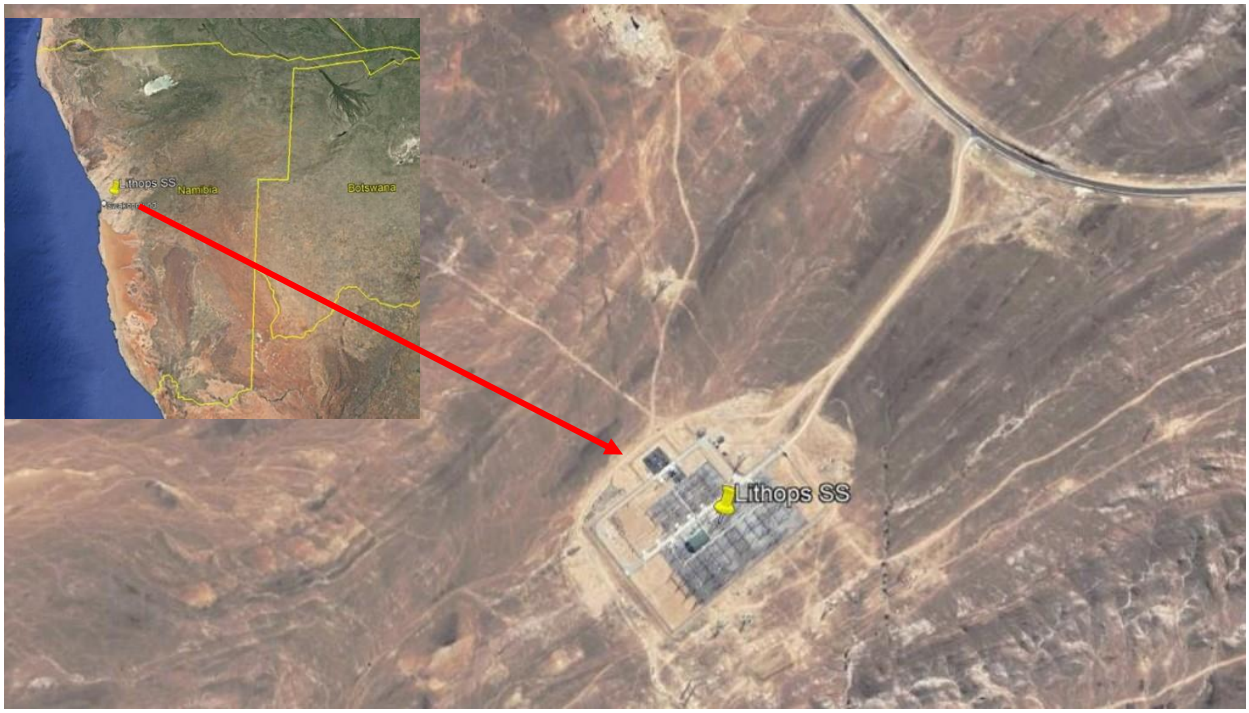

Figure 1: Lithops Substation Location

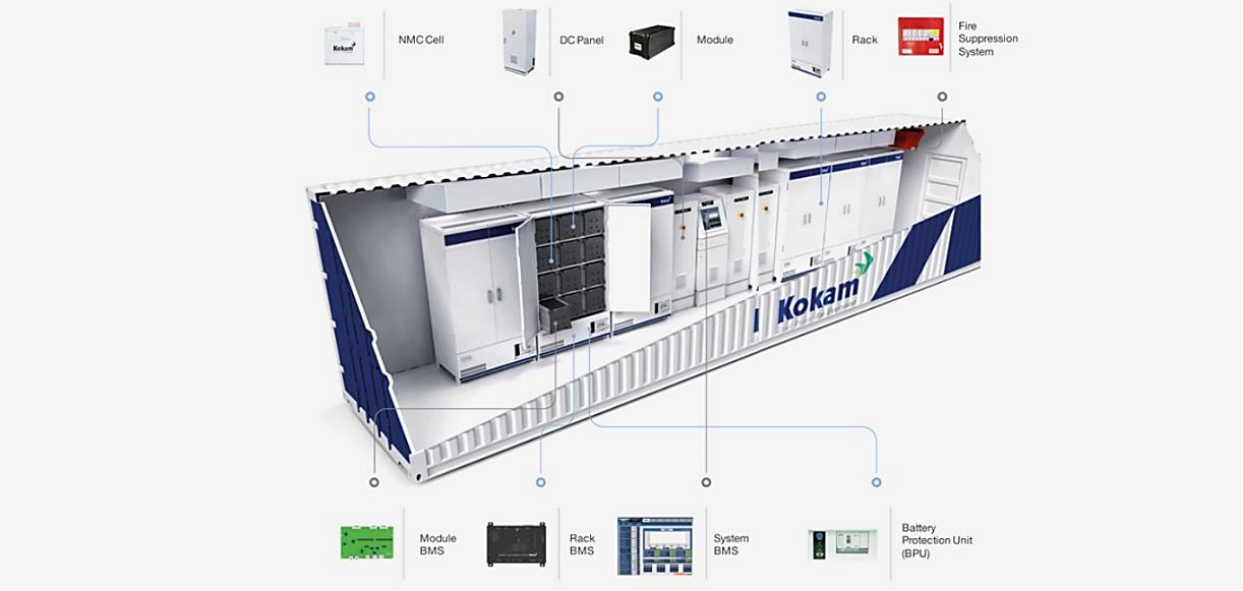

Figure 2: Typical containerized BESS

Figure 3: Typical containerized BESS facility (source: smart-energy.com)

2. Introduction

As part of NamPower's short-to-medium term strategy to fulfil its future energy demand, NamPower is exploring the feasibility of the integration of Battery Energy Storage Systems (BESS) Project into the transmission network with an estimated capacity of 45 MW / 90 MWh and market standard lithium-ion technology.

Fichtner has been appointed by NamPower to conduct the Environmental and Social Assessments for the Project and produce a scoping Report as well as Environmental and Social Management Plan (ESMP), as per the World Bank Environmental and Social Framework (ESF) and the respective Environmental and Social Standards (ESS) and Namibia's Environmental Management Act No. 7 of 2007 and its Regulations.

3. Project Description and Motivation

The Government of Namibia is committed to environmental protection and socioeconomic and sustainable development, as expressed, and articulated in the Environmental Management Act No. 7 of 2007, whose objective is to prevent and mitigate the significant effects of activities on the environment.

The following two phases are being conducted as part of the project:

d) Phase I: consisted of a detailed technical feasibility study to determine the required BESS application for integration into the grid, its operating concept, sizing, technology, location, and time of implementation to suit the Namibian energy market. This included aScoping Report and overview (Table of Content) of an Environmental and Social Management Plan (ESMP), a preliminary carbon credit and avoided emissions calculation, and a high-level financial feasibility assessment.

e) Phase II: consists of the design basis report, the detailed financial feasibility study and economic modelling of the BESS project. This will serve as the basis for project appraisal by NamPower, as well as for NamPower's discussions with the regulator (Electricity Control Board) on a suitable tariff regime to cover the long-term cost of the BESS project. This phase also includes the detailed project risk assessment report, detailed carbon credit and avoided emissions calculation, as well as the Scoping Report including an Environmental and Social Management Plan (ESMP) for submission to the Ministry of Environment, Forestry and Tourism (MEFT).

A Battery Energy Storage System (BESS) is comprised of three major components: the battery which is the energy container; the power conversion system/inverter, which interfaces the DC battery system to the AC power system; and the power plant controller which governs, monitors, and executes the intended functions of the energy storage application.

Since the BESS needs to be operated economically within the current power system, BESS must be designed to meet all economic, legal, and safety-related requirements that best suits its intended use case.

BESS can be placed either in a building or module-wise within containers. In this present project, a container concept is planned. Several battery modules will be installed in one container with their respective cooling system, and battery management systems. It is estimated that a total area of approximately 2 hectares will be utilized at an existing substation of NamPower.

4. Project specifics

The NamPower grid shows strong feasibility during normal operation. The final decision to install the BESS at Lithops substation is taken in terms of arbitrage. This is a suitable location for the BESS installation:

- This location is close to high-loading mine area and the BESS could reduce the inrush current when the heavy machinery is connected.

- Power fluctuations from upcoming PV projects can be compensated directly at the source.

- BESS will allow PV penetration to be increased beyond the current committed expansion plans in the region. The demand here for captive PV power plants is especially interesting due to the large industrial loads.

5. The Affected Environment

The Lithops Substation falls within the Dorob National Park. The Lithops substation already belongs to NamPower, and no additional land would be required for the BESS. The BESS would be located at the Lithops SS with no additional access roads required for construction or operation and no other additional infrastructure needed either.

The Dorob National Park was proclaimed in 2010 and covers the central Namib desert. This area also contains a few surprises. Extensive lichen fields are found north of Wlotzkasbaken and Cape Cross, while the Messum Crater in the north contains San rock paintings and archaeological sites from Damara nomads. Site visit and desktop review will be done to ensure that the site surrounding Lithops does not contain any Rock art, lichens, or plants such as the welwitschia as part of ensuring the immediate environment remain unaffected.

6. Potential Impacts Identified

The following potential impacts may result from the proposed project.

Table 1: Impacts Identified

Impact	Description
Hazardous Substances	Hazardous substances in the form of chemicals (e.g. sulfuric acid) are an integral part of the workings of batteries. Furthermore, the battery includes the use of heavy metals (lead).
Noise	The BESS will emit acoustic noise to their vicinity when in operation from power transformers and cooling compressors and fans.
Disposal of Waste	Hazardous landfill sites are generally the main route for disposal of a hazardous substance. However, other mechanisms are available. These mechanisms include incineration and disposal of the hazardous waste to land (not in a government owned landfill site).

7. Possible Mitigation Measures

The following mitigation measures are envisaged to remediate the potential impacts associated with the proposed project.

Table 2: Mitigation Measures

Impact	Proposed Mitigations
Hazardous Substances	▪ BESS should have secondary containment systems that prevent environmental release following spill or damage. ▪ Some lithium-ion batteries under development use an aqueous electrolyte which significantly reduces the hazards associated with organics and acids.

	▪ Lithium-ion batteries require battery management systems to monitor and protect cells from overcharging or damaging conditions. ▪ Large BESS systems should be designed with appropriate fire detection and suppression systems.
Noise	▪ Component selection: Special low-noise cooling compressors, fans and transformers ▪ Barriers ▪ Provision of ear protection equipment.
Disposal of Waste	▪ Owners should consider provisions for disposal at end of life to ensure proper disposal. There are currently a limited number of facilities that recycle lithium-ion batteries. ▪ The owner may request the supplier to provide a warranty for certain parts or whole modules. ▪ Some programs provide for disposal and decommissioning of battery systems at end of life. ▪ The project should have a set aside for decommissioning and disposal, e.g. in form of a reserve account. ▪ Decommissioning and Disposal costs at end of life should be considered and factored into any facility financial model. Disposal costs tend to increase with system size. ▪ Because lithium battery systems currently have negative scrap value, it is important that the decommissioning plan is sufficiently well financed to cover the full costs of decommissioning and removal from site.

8. How to register comments

To register any comments as a stakeholder/ Interested and/or Affected Parties (IAP) for the proposed project, please submit **in writing** your complete contact details; your interest in the proposed project (direct business, financial, personal, etc.) as well as your comments and/or concerns to Fichtner as listed below:

Fichtner: Christina Mansfeld	NamPower: Connie Pandeni
E-Mail Address: Christina.Mansfeld@fma.fichtner.de	E-Mail Address: Connie.Pandeni@nampower.com.na
Postal Address: Fichtner GmbH & Co. KG Sarweystraße 3 70191 Stuttgart Germany	Postal Address: NamPower Center 15 Luther Street P O Box 2864, Windhoek
Telephone Nr.: +27 (72) 4490353	Telephone Nr.: 061 205 2974

Figure 4: Indicative location of BESS at Lithops substation

Annex 3

NOTICE

NamPower
Powering the Nation and beyond

NOTICE OF ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR NAMPOWER BATTERY ENERGY STORAGE SYSTEM (BESS) AT LITHOPS SUBSTATION.

Notice is hereby given to all Interested and Affected Parties (I&APs), that an application for an Environmental Clearance Certificate (ECC) will be submitted to the Ministry of Environment, Forestry and Tourism (MEFT) in accordance with the Environmental Management Act, No. 7 of 2007 for the following activities.

Project title: NamPower Battery Energy Storage System (BESS)
Project location: Lithops Substation, Swakopmund District, Erongo Region
Proponent: NamPower

Description:
As part of NamPower's short-to-medium term strategy to fulfil its future energy demand, NamPower is exploring the feasibility of the integration of Battery Energy Storage System (BESS) into the transmission network with a capacity of 45 MW / 90 MWh and market standard LFP technology. A BESS is comprised of three major components: the battery which is the energy container; the power conversion system/inverter, which interfaces the DC battery system to the AC power system; and the power plant controller which governs, monitors, and executes the intended functions of the energy storage application. All of these components will be housed on the already developed property at the Lithops Substation.

Registration of I&APs and Submission of Comments:
Members of the public are invited to register as Interested and Affected Parties (I&APs) in order to comment/raise concerns or receive further information on the ESIA process. Registration requests and comments should be forwarded to the EAP at contact details below before 30 April 2024.

Public Meeting:
A public meeting will be held where the findings of the ESIA process will be presented.
Date of Meeting: 09 April 2024
Meeting Location: The MTC Dome, Hoaruseb Room (Swakopmund)
Meeting Time: 10:00 – 13:00

Report Availability:
The draft ESIA Report will be available on request for a 21-day comment period from 09 April to 30 April 2024.

Contact Details
Christina Mansfeld
Tel: +27 72 449 0353
Email: mansfeldc@fis.fichtnergroup.com

www.nampower.com.na

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Annex 4

Lithops BESS Project: ESIA Public Participation Meeting

NamPower
Powering the Nation and beyond

MEETING ATTENDANCE REGISTER (EXTERNAL)

Venue: The MTC Dome, Hoaruseb Room, Swakopmund **Date**: 09 April 2024 **Time**: 10:00

NO	NAME	ORGANISATION	DESIGNATION	CONTACT NO.	E-MAIL	SIGNATURE
1.	Elifas Ilende	NamPower	Engineer	061 205 2760	Elifas.Ilende@nampower.com.na	
2.	Onesmus Jacobus	Swakop Uranium	Superintendent	081 233 5428	onesmusj@gmail.com	
3.	Marlon Izaks	Swakop Uranium	Env: Superintendent	08466 29300	Marlon.Izaks@cgnpc.com.cn	
4.	Lineekela Haiping	Sheq iQ Consult	HSE Consultant	081 297 8075	haiping@sheq-iq.com	
5.	Nuta Hamunyela	M.E.E.T	Banger	064 404 576 0817522226	hamunyela05@gmail.com	
6.	Sharlien Tjambari	Namib Times	Journalist	0813259372	Sharlien@namibtimes.net	
7.	Isabel Bento	NAMPA	Journalist	0812387823	isabel@nampa.org	
8.	Isidor Shilongo	NBC	CAMERA operator	0812556935	ishilongo@nbc.na	
9.	Adolf Kaure	freelancer Journalist	Journalist	+264 81 360 8605	kaureadolf@gmail.com	
10.	Renate Rangua	NBC	Chief Reporter	0811410920	renateclara@gmail.com	
11.	Rowren Horsthemke	Private-Consultant	Elec. Engineer	0811225204	hillrain@iway.na	
12.						
13.						
14.						

GxCP_REG_ Lithops BESS ESIA Public Meeting_09Apr24_v0.0 Page 1 of 1

Annex 5

Media Query:BESS Lithops

sharlien@namibtimes.net
To Mansfeld, Christina

Reply | Reply All | Forward

Tue 2024/04/09 14:26

You replied to this message on 2024/04/09 14:53.

ADVICE: This email is from an external source - be careful of attachments and links.

Good Afternoon Christina

I am a reporter for the Namib Times Newspaper here at the Coast, I attended the Public Meeting today.

I have two or three Questions I need clarity on.

1. What is the importance of the BESS?
2. What will the electricity stored at this facility be used for?
3. When will Construction start? And when is it expected to be completed?
4. Who will benefit most from the BESS?

I hope to hear from you soonest.

Kind Regards
Sharlien Tjambari
Journalist
081 325 9372
sharlien@namibtimes.net

Namib Times
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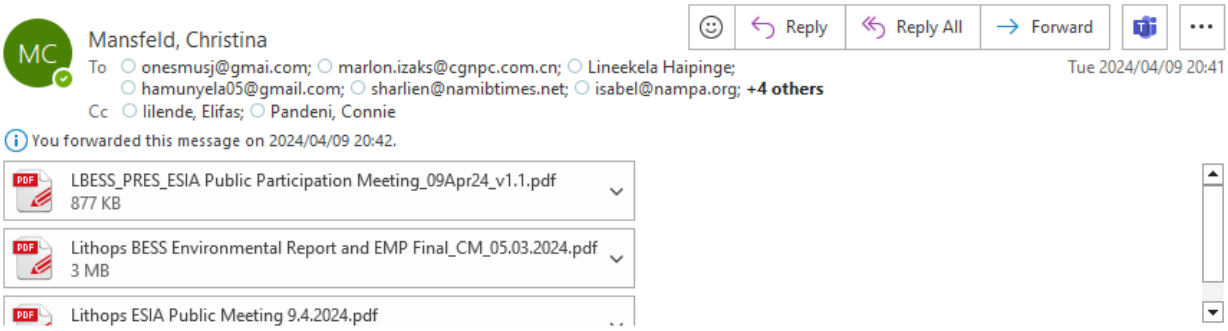
Feedback regarding Public Participation Meeting for Lithops Substation by NamPower



Dear All

I would like to thank you all for participating in todays meeting, it was really good to have the opportunity to share the project with you and to have your insightful questions.

Attached to this email please find:

- Presentation by Elifas Iilende from NamPower
- Presentation by Christina Mansfed from Fichtner
- Draft ESIA report for the Lithops substation

I have already been asked the following questions and would like to answer them below:

1. What is the importance of the BESS?

   Use Case 1: Reduction of Peak Load
   - *Reduction of load on transformer and grid*

   Use Case 2: Provision of reactive power
   - *Reduction of further required SVC*
   - *Reduction of Van-Eck low load operation for VC*

   Use Case 3: Reduction of Renewable Energy Curtailment
   - *Curtailment could result from exceeding export limitations of interconnections*
   - *Curtailment could result from take-or-pay PPA conditions (if not changed in future)*

   Use Case 4: Reduction of additional Peaking Power Plant Capacity
   - *Growing load in Namibia will require further sources for peak coverage*

   Use Case 5: Arbitrage
   - *Taking advantage of SAPP and MSB market price differences (charging at off-peak, discharging at peak)*

   Use Case 6: Ramp-Rate Control at Interconnections
   - *Reduction of low load operation of Van-Eck Anixas I and Anixas II*
   - *Reduction of Ruacana, Biomass and PV curtailment*

   Use Case 7: Provision of emergency power (intra day)
   - *Reduction of expensive emergency power*

   Use Case 8: Combination of the above

   (see Presentation LBESS_PRES_ESIA Public Participation Merting_09Apr24_v1.1 Slide 7)
2. What will the electricity stored at this facility be used for?

   It will feed into the national grid and be utilized by all electricity users.
3. When will Construction start? And when is it expected to be completed?

   Ideally construction will start towards mid to end of 2026, but this is not confirmed, numerous factors may still affect this date. Completion will be approximately 6 months later.
4. Who will benefit most from the BESS?

   Users who receive their electricity via the Lithops substation will see the most benefit due to benefits explained in question 1, but the BESS does have a positive contribution to all Namibians.

Thank you again for all your attention today and I look forward to hearing back from you.

Kind regards
Christina Mansfeld

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