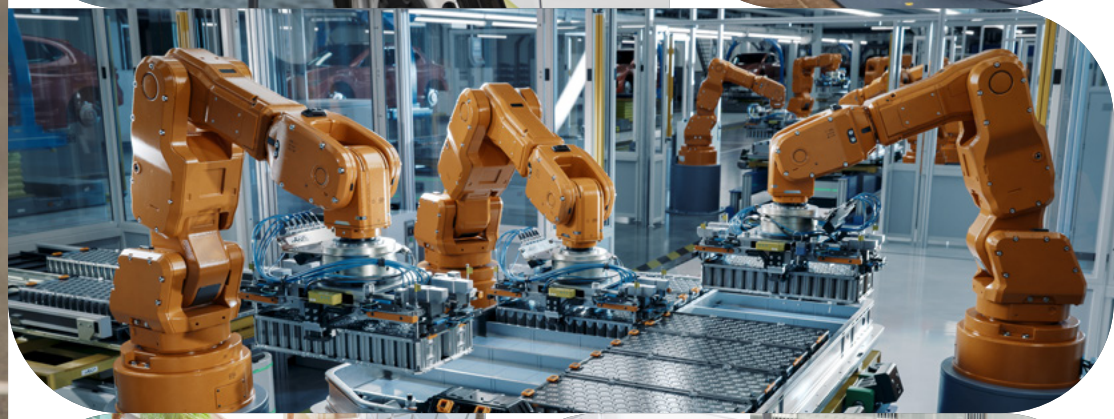
# ELECTRIC MOBILITY TRANSITION & LOCALISATION

## *Towards Unlocking the New Value Chain for Africa*



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# TABLE OF CONTENTS



## TABLE OF FIGURES



## LIST OF TABLES

# 1. NEV VALUE CHAIN STUDY

The aim of the study was to identify opportunities in the New Energy Vehicle (NEV) market that fall outside of the mainstream Original Equipment Manufacturer (OEM) supply chain, i.e. passenger vehicles. The study objective included identifying opportunities in adjacent markets driven to adopt the electrification of transport due to environmental, social and governance factors such as shareholder value and a just transition within South Africa and Africa. The study was divided into two phases:

## Phase 1

**A.** Situational Analysis Report: a comprehensive review of relevant literature and analysis of the NEV segments in South Africa and Rest of Africa.

**B.** Stakeholder Engagement with key role players to form an understanding of the industry's readiness for NEV migration.

**C.** Strategy and Investment Report captured the NEV market growth to substantiate developing industrial strategies as a catalyst to provide large-scale funding to support the development of a NEV ecosystem in South Africa and Africa.

**D.** Battery Value Chain Assessment Report evaluated the 'Battery Value Chain' within the NEV ecosystem in South Africa and Africa.

**E.** Economic Modelling Tool developed to model the impact of each segment and visually analysed the study via a dashboard interface. An Economic Modelling Handbook was developed to serve as a guide on how to use the tool.

## Phase 2

**A.** Scoping Report pre-feasibility study on the highest ranked opportunities. The final product should be able to guide the IDC and other stakeholders to decide on investments that will yield positive economic and developmental benefits for South Africa, the SADC and Africa.

*Below is an infographic that summarises the NEV Value Chain project.*

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05 BATTERY VALUE CHAIN

06 MANUFACTURING SKD ASSEMBLY PLANT

04 ECONOMIC MODELLING

03 CHARGING INFRASTRUCTURE

1.1 MIL ELECTRIC MOTORCYCLES BY 2040 IN AFRICA

01

02 INDUSTRY READINESS FOR ELECTRIC MOBILITY TRANSITION

LAST-MILE DELIVERY

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SITUATIONAL ANALYSIS | STAKEHOLDER ENGAGEMENT | STRATEGY & INVESTMENT | ECONOMIC MODELLING | BATTERY VALUE CHAIN ASSESSMENT | SCOPING

## 1.1 Situational Analysis and Literature Review

New Energy Vehicles (NEV) are seen as an important step towards achieving global climate change objectives. The Situational Analysis stage of the NEV Value Chain Study has undertaken a comprehensive review of the relevant literature as it relates to the current NEV industry globally, for South Africa, and the Rest of Africa (RoA). The report identified key role players and stakeholders and highlighted current and emerging gaps and opportunities in the NEV market. To evaluate the NEV segments, markets and policy along the value chain, the literature review has been structured to provide an overview of key NEV sectors in a logical framework:

1. **NEV Landscape Overview:** New Energy Vehicles (NEVs) are vehicles that are powered by electricity or fuels made from non-fossil fuel sources. In May 2021, the dtic released the Green Paper on NEVs[1] for public comment and the intention was clear that the South African Automotive Value Chain was ready to transition from 'Internal Combustion Engines' (ICE) to NEV. The Just Energy Transition Implementation Plan (JET IP) provides a means to achieve the transition through investments spearheaded by various government authorities, private institutions and development finance institutions (DFIs).

2. **Micro-mobility:** The context and rationale for micro-mobility, market developments and particularly the rise in electrified two- and three-wheelers, four-wheeler 'last mile' delivery vehicles, conversions and eco-tourism markets, together with closing comments.

3. **Public Transport:** This section reviews buses from a global perspective and for best practice lessons, 'battery swapping' as an emerging trend, South African trends and developments, minibus taxis, and case studies for Kenya, Ghana, Rwanda and Zimbabwe for consideration.

4. **Machinery and Equipment:** A review of the production and sale of zero emission heavy duty vehicles and equipment was undertaken, with trucks, mining equipment, agricultural equipment and the general electrification of various categories of machinery and equipment, together with ownership models, being analysed. Conversion of fossil fuel driven vehicles to NEV was also considered, and then role players and stakeholders are identified, together with opportunities in the NEV value chains and for FCEV components.

5. **Infrastructure Providing Energy for NEV:** The NEV industry requires support infrastructure in the form of fuel supply infrastructure, charging stations and equipment, policy and incentives, together with other support and enabling investments, including finance and insurance. These issues are traversed and opportunities identified.

6. **Battery Value Chain**: The batteries in various NEV are becoming an important technology in themselves and underpin certain elements and opportunities of the NEV industry. Battery types have been analysed, with smaller and larger mobility issues traversed, and a brief review of battery studies conducted in South Africa.

7. **Trade Policy Conformity:** A range of trade policies, incentives and tax schemes are considered that various countries employ to accelerate the transition to NEVs. Tariffs and regional integration for trade enhancement are considered, including Rules of Origin (RoO) and the implications of the African Continental Free Trade Agreement (AfCFTA) on the emerging NEV industry in Africa.

[1] DTIC, 2021. Auto green paper on the advancement of New Energy Vehicles in South Africa. (The Roadmap, 18th May 2021)

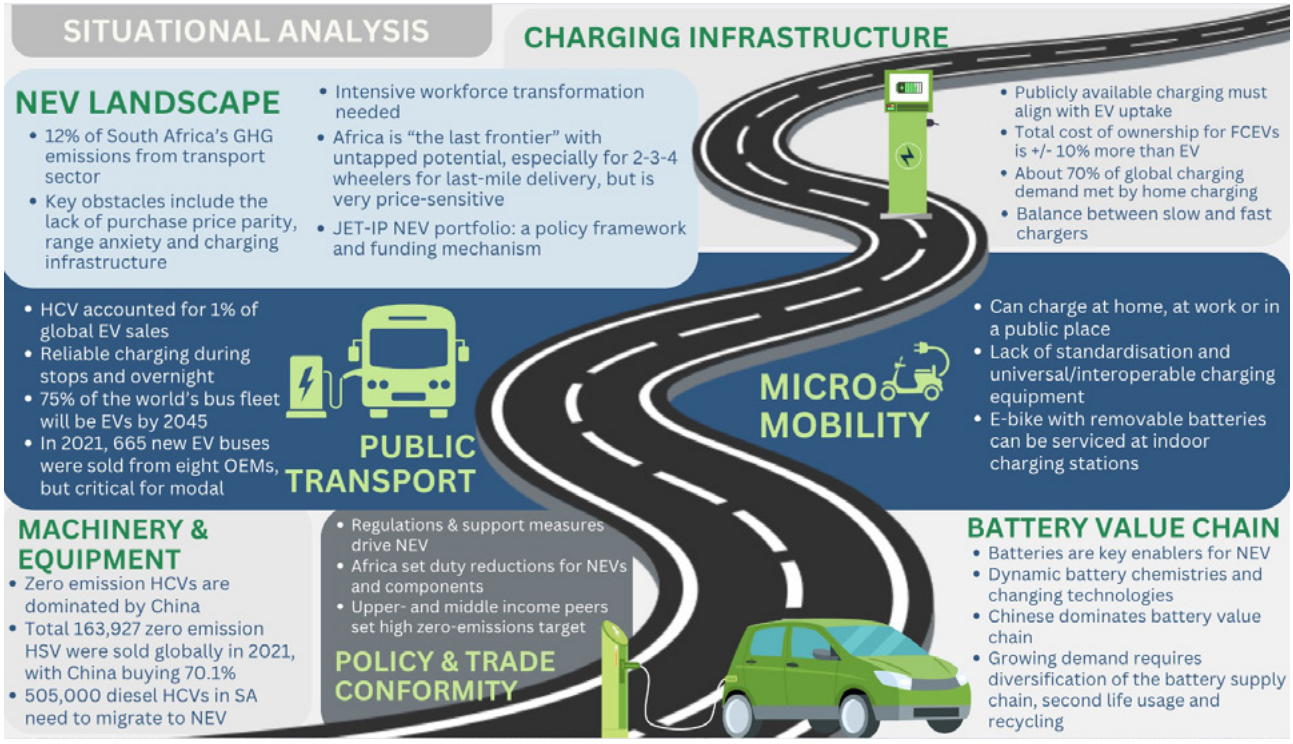


***Figure 1:*** NEV Situational Analysis Key Takeaways

The key takeaways from each of the segments have been summarised in the figure above. Each of these is dealt with separately in the series review reports, highlighting key role players and stakeholders, and culminating with an overview or statement of the opportunities which have been identified in the NEV segment considered.

## 1.2 Stakeholder Engagement

Implementing strategies and action plans to migrate from Internal Combustion Engines (ICE) to NEV is akin to solving a Rubik's Cube with multiple variables across many layers where one action disrupts other layers.

One such Rubik "layer" with its sub-elements in the equation are the many stakeholders with direct and indirect interest and influence in enabling NEV migration. It involves up- and downstream "drivers" and "constraints" on the automotive industry as part of a much bigger NEV transition ecosystem.

The Stakeholder Engagement stage of the NEV Value Chain Study sets out the methodology, stakeholder categories and stakeholder organisations, presents the findings, gives an overview of the NEV transition ecosystem, identifies key takeaways and notes potential investment areas to be explored. A high-level overview of the process and findings follows:


***Figure 2:*** NEV Stakeholder Engagement Overview

This part of the IDC NEV Value Chain Study engaged with a wide range of stakeholders. The survey methodology included structured and open-ended questions on topics such as industry readiness to migrate, challenges and opportunities, potential technology and component partnerships, and investment opportunities.

Noting that the NEV environment is still emerging and in flux with uncertainties, stakeholders were also afforded the opportunities to provide "any additional" comments. Given the divergent interests of stakeholders, the data collected covers a wide spectrum. Complementary to the survey, additional one-on-one interviews have been conducted.

From the stakeholder engagement a series of key takeaways and investment opportunities emerged, with an overall view that South African OEMs take their cue from their head offices and global industry;

affordability is key to NEV growth; with greater NEV policy clarity the NEV opportunities will grow; the "range anxiety" issue is being dealt with on a "wait-and see" basis; NEV should focus on "zero-emissions" to allow Green Hydrogen to be part of the solution; there are niche markets in agriculture, mining and last-mile two- and three-wheeler markets; various African trade blocs and agreements (AfCFTA, ECOWAS and AAAM) create opportunities; charging infrastructure should become a focal element; and NEV migration at scale demands a collaborative effort and the implementation of interconnected strategies.

**In conclusion, noting the industry's readiness for NEV migration and greater policy clarity, four potential investment opportunity areas that emerged from the stakeholder engagement process were:**

## 1. Electric L-class Vehicles

## 2. NEV Charging Infrastructure

## 3. Battery Value Chain

## 4. Battery Second Life and Recycling

## 1.3 Strategy and Investment

This report captured the NEV market growth to substantiate developing industrial strategies as a catalyst to provide large scale funding to support the development of a NEV ecosystem in South Africa and Africa.

The preceding work considered the entire NEV ecosystem in the Situational Analysis Report, as well as inputs from the Stakeholder Engagement Report and Economic Model outputs to inform the NEV landscape in Africa and South Africa over the next 20 years.

Four Pillars as seen in the figure below have been identified in the Strategy and Investment Report as the basis of the localisation strategy. These four pillars and value chains are: 1) Electric L-Class Vehicles, 2) NEV Charging Infrastructure, 3) Battery Manufacturing and Battery Pack Assembly, 4) Battery Recycling. A value chain is mapped for each of the four pillars to identify investment opportunities tailored for the South African and the African NEV environment. To start the localisation process, the most feasible and likely opportunities from the four value chains are recommended to be targeted first.

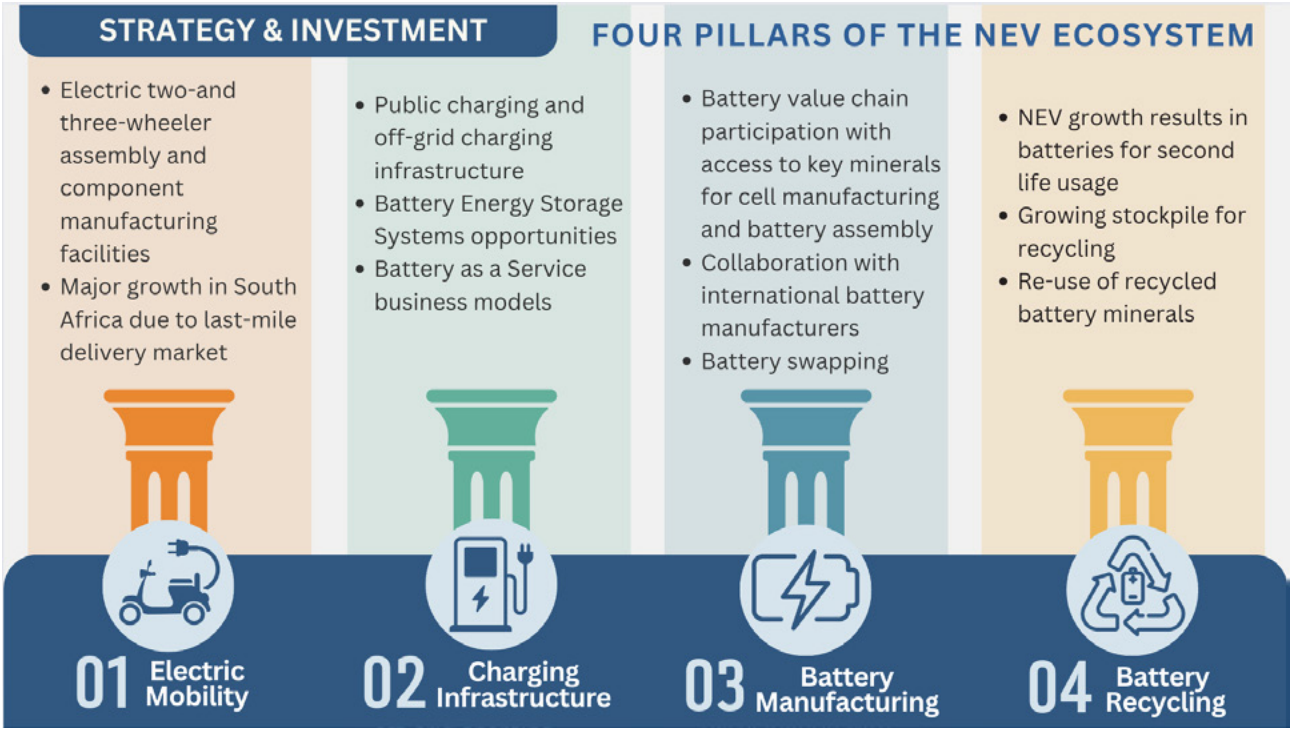


***Figure 3:*** The Four Pillars of the NEV Ecosystem

This report considered the light vehicle class (L-Class) in more detail, which includes two-, three-, and four-wheelers. Collectively these are also referred to as "micro-mobility".

NEV Sector Motorcycle Modelling: Using the insights and data collected for the study, the ICE and E-Bike two-wheeler markets have been estimated as follows:

***Table 1:*** ICE Two-Wheeler Market Assessment

| African Countries | 13 Surveyed | 51 Extrapolated |
|---|---|---|
| Units in 2022 | 902,583 | 1,412,928 |
| Units in 2040 (7% CAGR) | 1,993,336 | 2,627,373 |
| Market potential in 2040 | USD 5,261 million | USD 6,935 million |

***Table 2:*** Electric Two-Wheeler Market Assessment

| African Countries | 13 Surveyed | 51 Extrapolated |
|---|---|---|
| Units in 2022 | 10,705 | 13,300 |
| Units in 2040 (30% CAGR) | 848,729 | 1,118,687 |
| Market potential in 2040 | USD 3,027 million | USD 3,990 million |

In conclusion, this Strategy and Investment Report has laid out a strategy for establishing a sustainable NEV ecosystem in South Africa. The report identifies four pillars that form the foundation of the localisation strategy: Electric L-class Vehicles, NEV Charging Infrastructure, Battery Manufacturing/Battery Pack Assembly and Battery Recycling.

This report develops a investment strategy and localisation approach geared towards the development of electric micro-mobility. Considering the four pillars together is crucial for ensuring a sustainable NEV ecosystem. The aim is that the NEV ecosystem supports a circular economy and that it will position South Africa to become the NEV technology hub for Africa.

## 1.4 Battery Value Chain Assessment

This report provides an evaluation of the "Battery Value Chain" within the NEV ecosystem. It also determines how the rapidly expanding opportunities in this market, including the establishment of a "Gigawatt Factory", could be harnessed and expanded upon in South Africa and Africa.

The rapid development of battery gigafactories reflects the growing demand for electric vehicles and energy storage solutions, as well as the strategic importance of battery production capacity for national economies and the transition to sustainable energy. The concept of battery gigafactories has gained significant traction in recent years, with the battery value chain being integral. By 2030 the industry is seen as having the potential for 350,000 new employment opportunities and investments of €325 billion.

[2] Porsche Consulting Services, 2024. Battery Manufacturing 2030: Collaborating at Warp Speed. What it takes for equipment manufacturers to ride the coming wave of breakneck growth. https://www.porsche-consulting.com/international/en/publication/battery-manufacturing-2030

The battery value chain has been categorised as comprising of four primary sub-clusters, with material and system innovation underpinning them all: 1) Upstream Materials Building Stock; 2) The Core OEM Cell Manufacturing Cluster; 3) System Building Blocks; and 4) An Associated Manufacturing Block for Battery Plants, Machinery and Components. These sub-clusters are closely linked in global value chains and within plants.

The report provides an overview of the development and current status of the battery value chain and market, the geographical distribution of early and current industry participants, the battery chemistry trends, and price trends, culminating in the South African opportunities.

An overview of the battery cell manufacturing process with prevailing cost benchmarks has been undertaken, with specific attention to the prismatic cell, pouch cell, cylindrical cell, and battery pack, and coin cell assembly lines. It is noted that the manufacturing of lithium-ion batteries is a highly complex process, requiring the inclusion of different consecutive and interconnected units, within a highly competitive and capital intensive market.

The role of precursor materials is investigated in detail, with an emphasis on battery material supply in Africa, particularly cobalt, manganese, nickel and lithium. The various production processes for refining active material components in the battery are considered: electrode manufacturing, battery cell assembly and battery cell finishing processes. The anode of a battery is the costliest component, and costs are exposed to the sought-after refined battery minerals of lithium, nickel, cobalt and manganese, with volatile prices. All of these minerals are available in Africa and the opportunity is available to increase mining production, and beneficiate the minerals into lithium, cobalt and manganese sulphate, as well as lithium hydroxide.

Value addition opportunities across the battery value chain are assessed and a Techno-Economic model for benchmarking of the production cost of lithium-ion batteries is considered and contextualised against a full "Giga Factory" plant establishment and operation costs. Porsche Consulting estimate that bringing battery gigafactories online requires investments of € 1.5–3 billion per 30–40 GWh capacity.

Battery precursors are materials used in the final step before becoming cathode active materials (CAM) for lithium-ion batteries. They play a crucial role in determining the performance and characteristics of the battery. Precursor material production and the associated raw materials processing as an input is considered and various authorities reviewed with divergent opinions and costs being established. Using Bloomberg NEF's top-down approach, it was estimated that a 100,000 metric tons precursor plant built in the DRC could cost $301 million.

A "cost example" for a 1 GWh Gigafactory, together with the supporting sulphate and lithium hydroxide production is undertaken with the two-, three- and four-wheelers in Africa as potential market to support the plant, and concludes that the full African market would only require 19.7% of a potential gigafactories production capacity in a year, and therefore could not be the main driver to support the establishment of such a factory, with additional markets required.

The report concludes that the modelling versus the actual costs of the various announced projects shows a large variation depending on size, level of automation and location of the particular plant. For South Africa a battery cell plant cost of around $125 million per GWh is considered realistic and could be even higher based on South Africa's location. Factors that could increase the costs include:

- South Africa's ability to secure a reputable international partner with experience in the establishment and operation of such a gigafactory.
- The availability of manufacturing equipment and associated shipping, installation and commissioning costs for such a plant in South Africa.
- Local costs structures such as energy, labour and the like being less competitive, compared to the dominant regions.

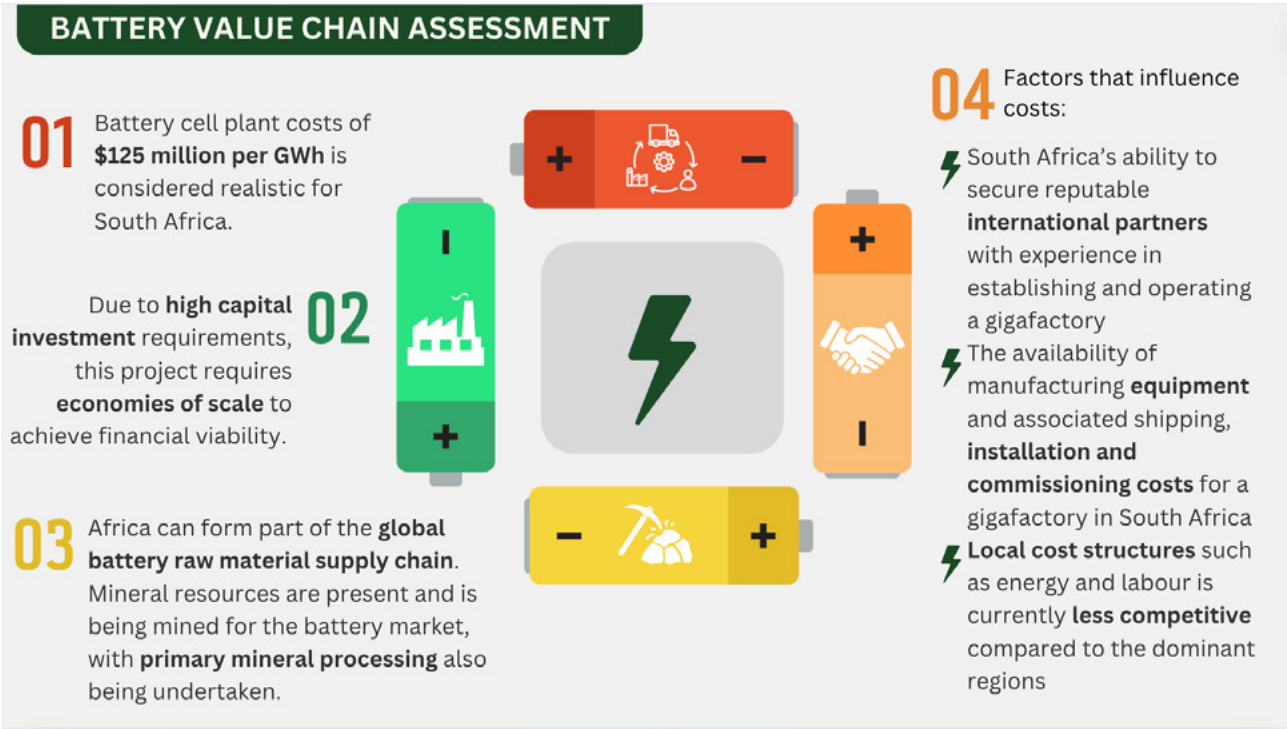


***Figure 4:*** Battery Value Chain Assessment Key Takeaways

In this context it is clear that South African and African battery manufacturing needs to be considered in a broader context due to the high capital investment requirements, which requires economies of scale to achieve financial viability.

As far a raw material processing is concerned, South African supply could form part of the global battery raw material supply chain, as the mineral resources are present and currently being mined for the battery market and other applications, with primary mineral processing also being undertaken.

Both the battery minerals mining and battery mineral processing, or beneficiation, could be expanded in the various value chains indicated in this report.

# 2. CONCLUSION

The study identified opportunities within the NEV market that fall outside of the mainstream OEM supply chain, i.e. passenger vehicles. It also highlighted potential in adjacent markets, driven by the imperative to electrify transport in response to environmental, social and governance considerations. These opportunities are essential for advancing shareholder value and facilitating a just transition within South Africa and Africa.

As the mobility market transitions to electric powertrains, supporting NEV localisation projects can enhance South Africa's manufacturing capabilities, driving economic growth, technological innovation, and environmental sustainability in the sub-Saharan Africa region.