Relevance of Energy Storage Testbeds in Developing Countries

South African perspective

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Opportunities in energy storage testbeds

Energy access in Sub-Saharan Africa is the greatest impediment to social and economic development, but an opportunity for storage

Market Overview: African & Regional perspective

Electricity access rate in Africa is one of the lowest in the world

Energy access

1.3 billion people globally have no access to electricity

More than **95%** of these people in **Sub-Saharan Africa** and parts of Asia

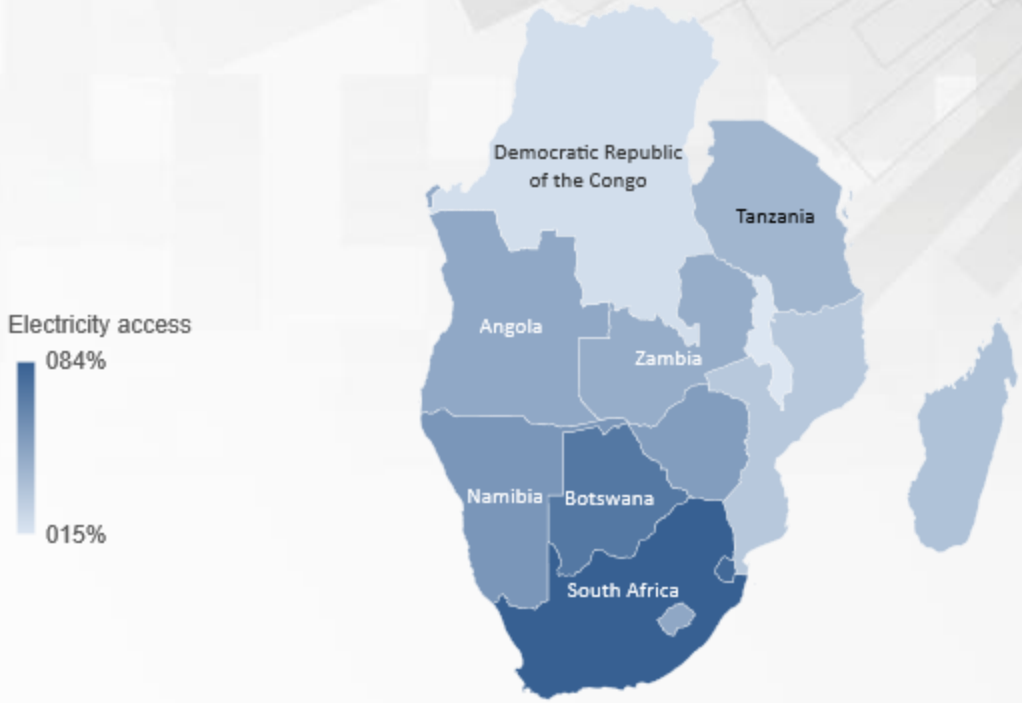
Environmental drives

Pressures to transition to sustainable energy sources at a scale and pace that contributes to **global decarbonisation efforts**

Storage

Energy storage, through battery, will play a critical role in **stationary application for electrification** both for large-scale deployment and **micro-grids.**

Southern Africa electricity access rate



SA - highest electricity access rate although the rural rates are lagging compared to other SADC regions such as Malawi and the DRC

Source: The World Bank data, Access to electricity (% of population), CSIR analysis

South Africa has increased its import for lithium-ion cells and primary battery mostly for stationary applications

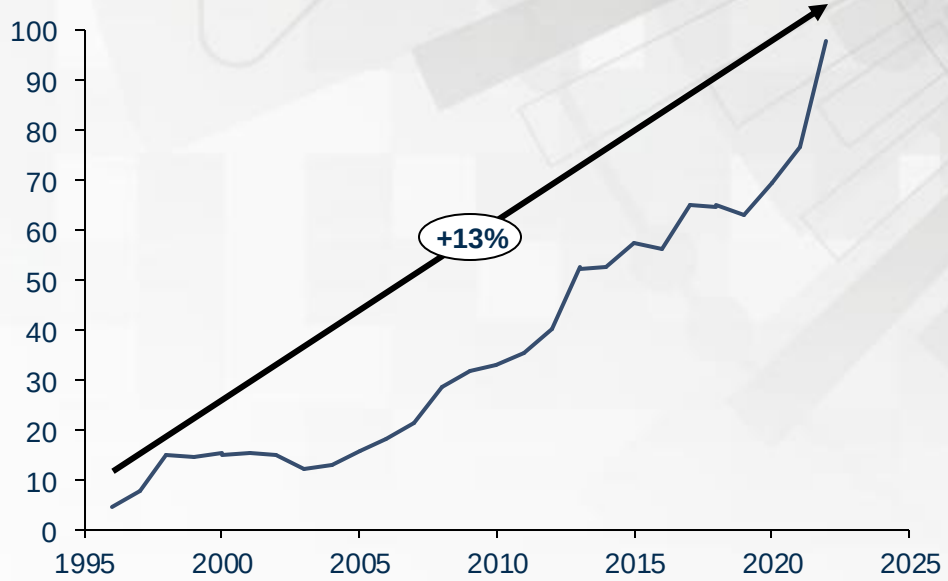
Market Overview: South Africa

Up to

$350mil

Of imported Li-ion in 2022

Primary cells & batteries + **Linking electrical & parts** =



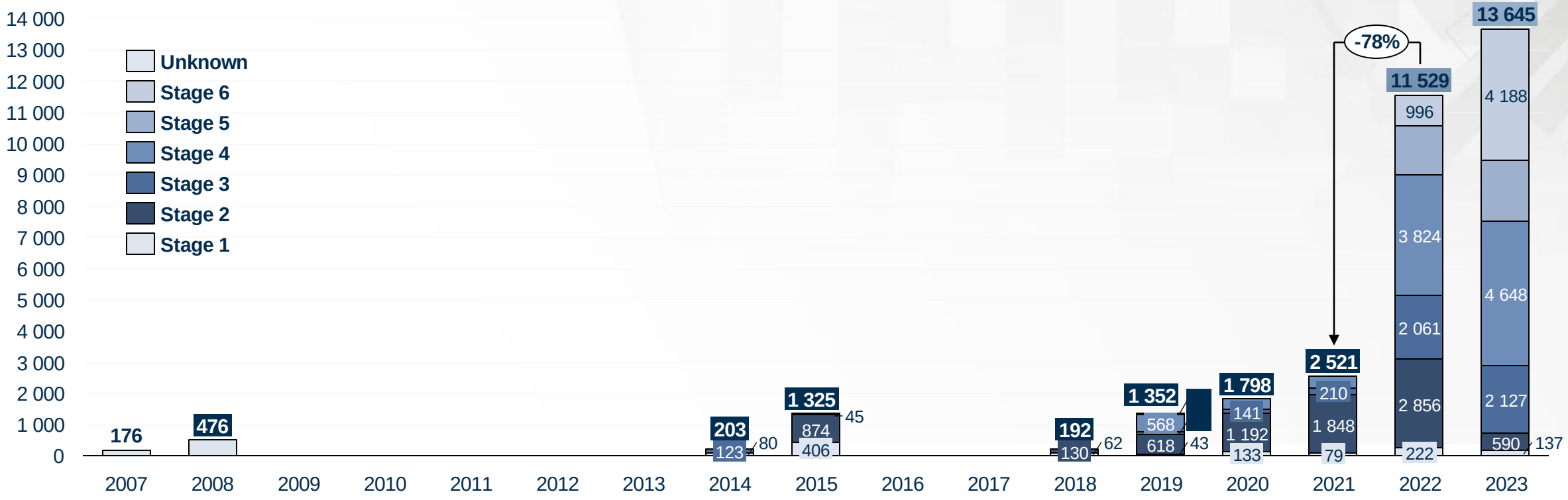
The driver for the massive increase in Lithium-ion battery imports has been the rolling blackout in the country. This is mainly attributed to the poor **electricity availability factor** (<55%).

Source: TradeMap data, CSIR analysis

Total GWh load shed from 2017 – 2023 (up to 31 May 2023) an opportunity for LiBs

Opportunities

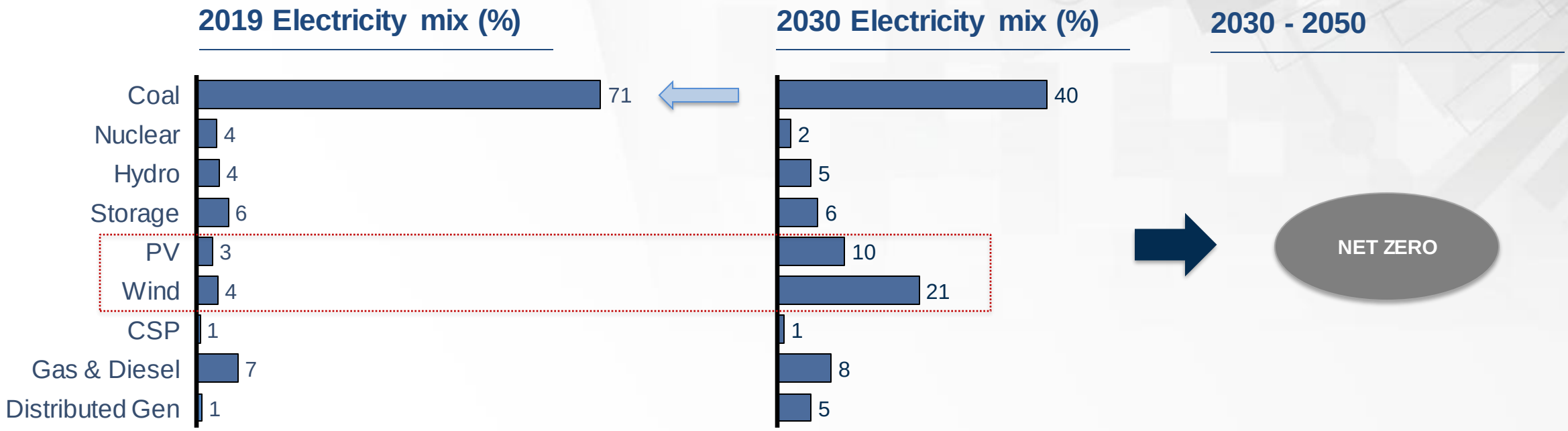
Load shed, upper-limit [GWh]



Notes: Loadshedding assumed to have taken place for the full hours in which it was implemented. Practically, load shedding (and the Stage) may occassionally change/ end during a particular hour; Total GWh calculated assuming Stage 1 = 1 000 MW, Stage 2 = 2 000 MW, Stage 3 = 3 000 MW, Stage 4 = 4 000 MW, Stage 5 = 5 000 MW, Stage 6 = 6 000 MW;
Sources: Eskom Twitter account; Eskom Hld SOC Ltd FaceBook page; Eskom se Push (mobile app); Nersa; CSIR analysis

SA Renewable energy mix between 2013 – 2022 and beyond

Opportunities



- Since 2013, SA has ramped up renewable energy penetration at an average rate of 33% since 2013. To date SA has 6.2 GW of RE installed
- Decarbonisation and integration of existing renewable energy sources with battery storage for flexibility → beyond 2030
- Lack of local testing and certification facilities for Li-ion batteries locally.

Source: IRP 2019, IPP Office: An overview of the IPPPP – Dec 2021, CSIR analysis

Global perspective to new energy vehicle sales and local perspective driven by the just energy transition

Opportunities

Up to

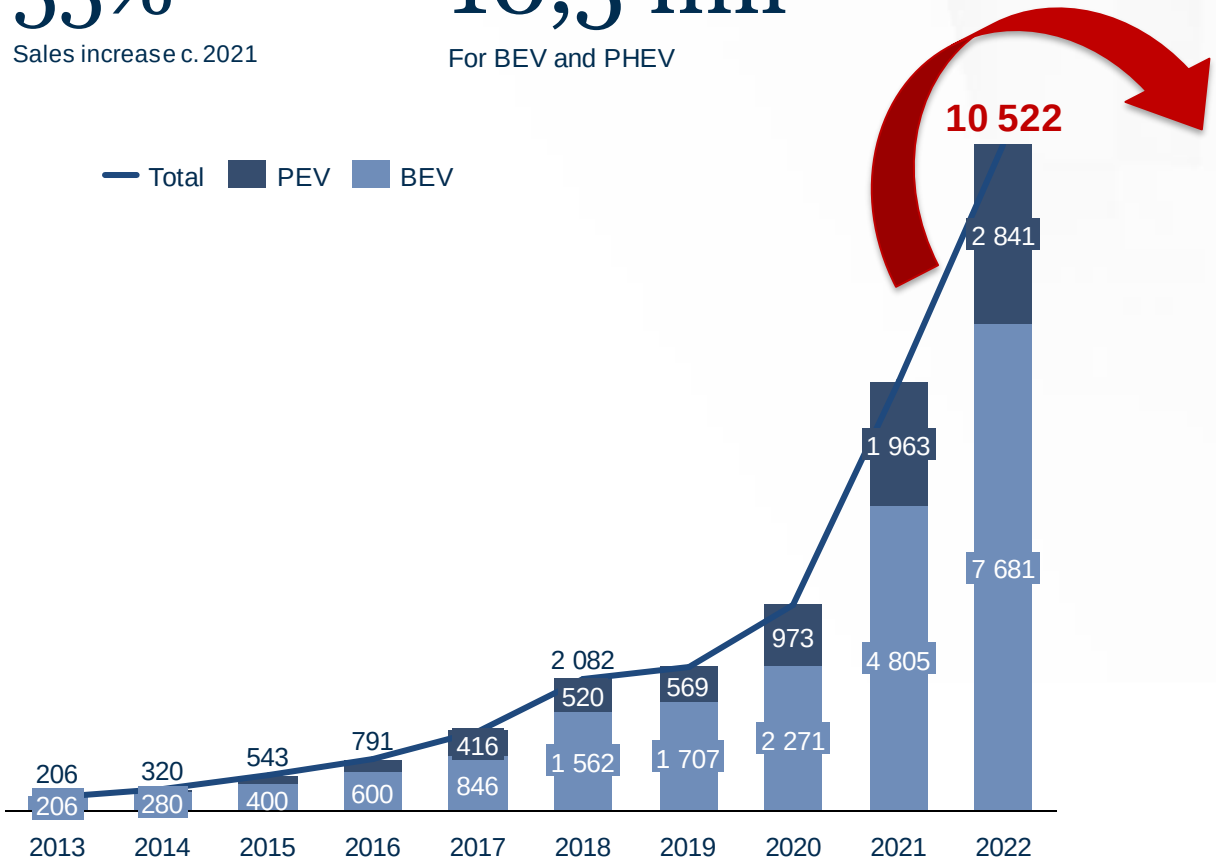
55%

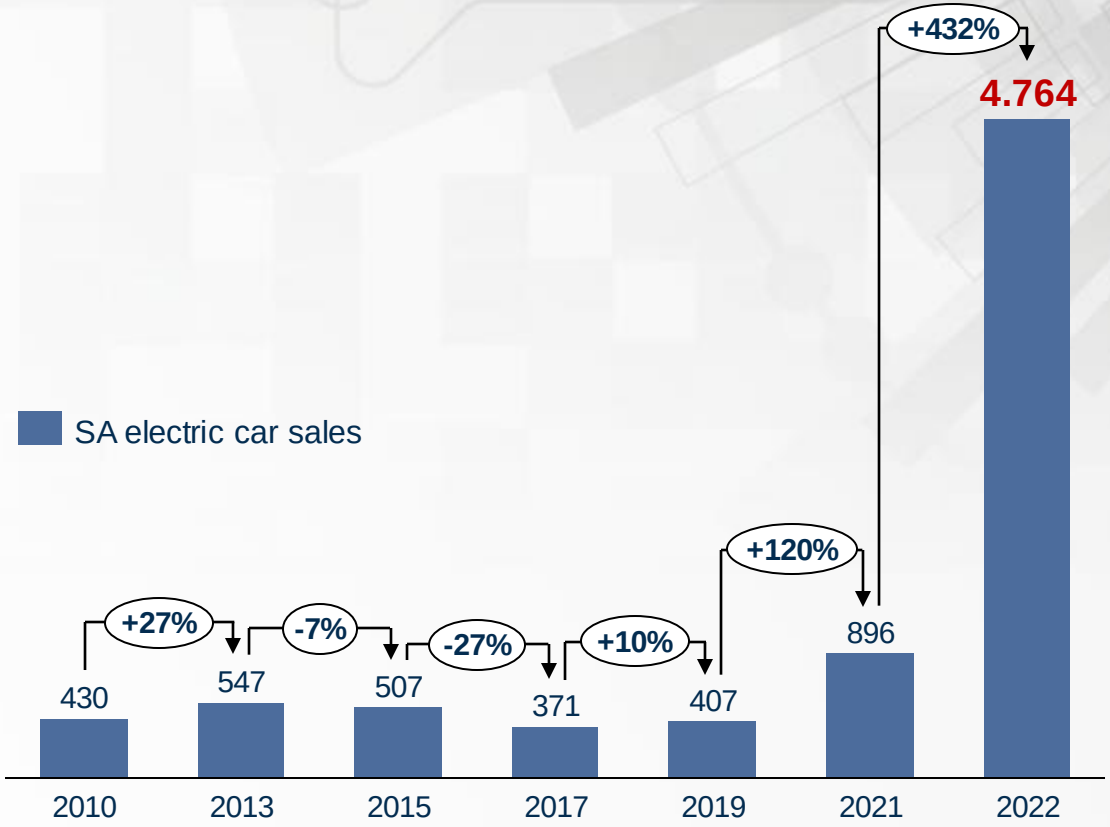
Sales increase c. 2021

Up to

10,5 mil

For BEV and PHEV





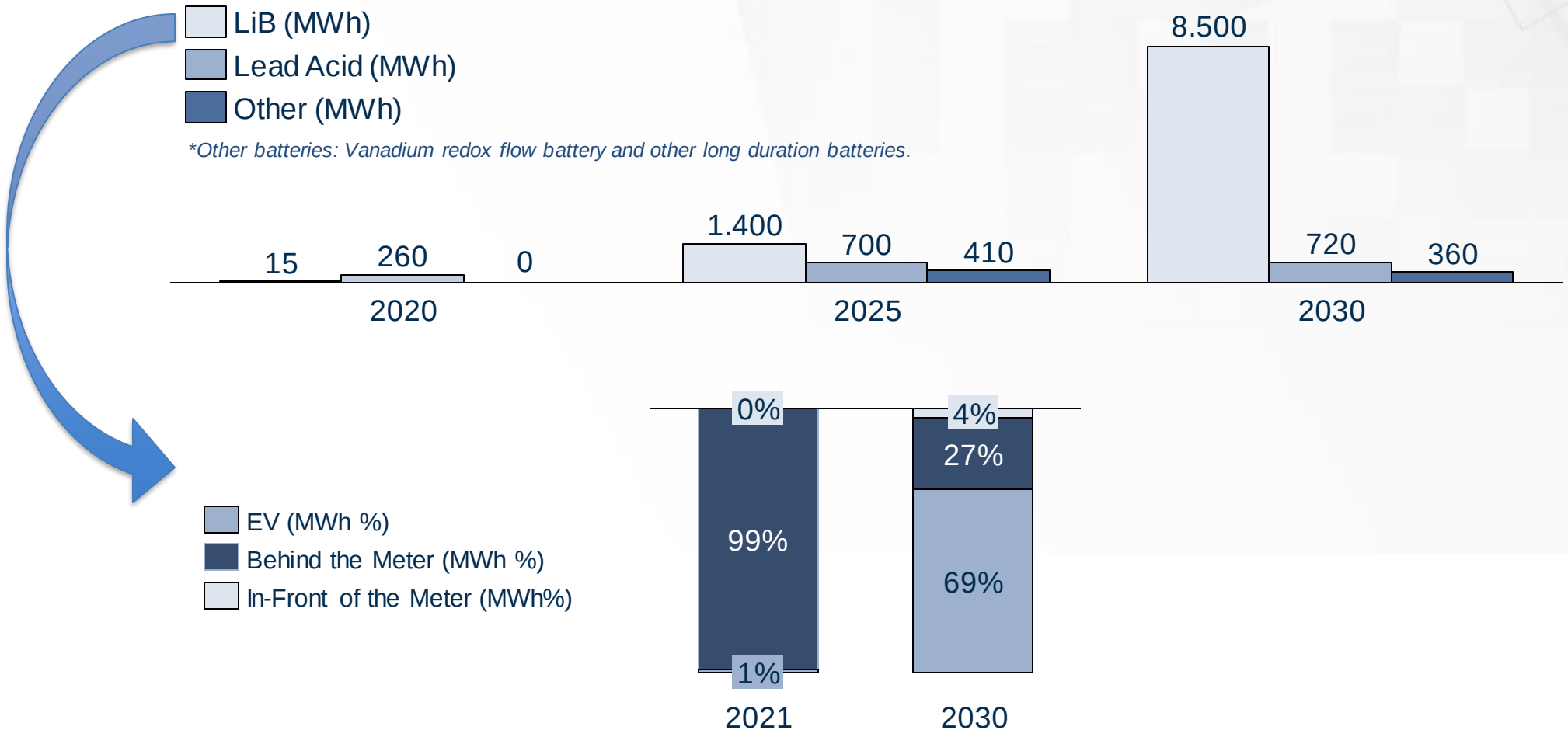
- Although the electric vehicle sales in South Africa are still low compared to the rest of the world – the market is slowly gaining traction due to just energy transition

Source: NAAMSA, IEA and EV volumes 2022;CSIR analysis

Growth in the use of LiB will create new opportunities in both first-time application for electric vehicles and stationary application for electrification

Opportunities

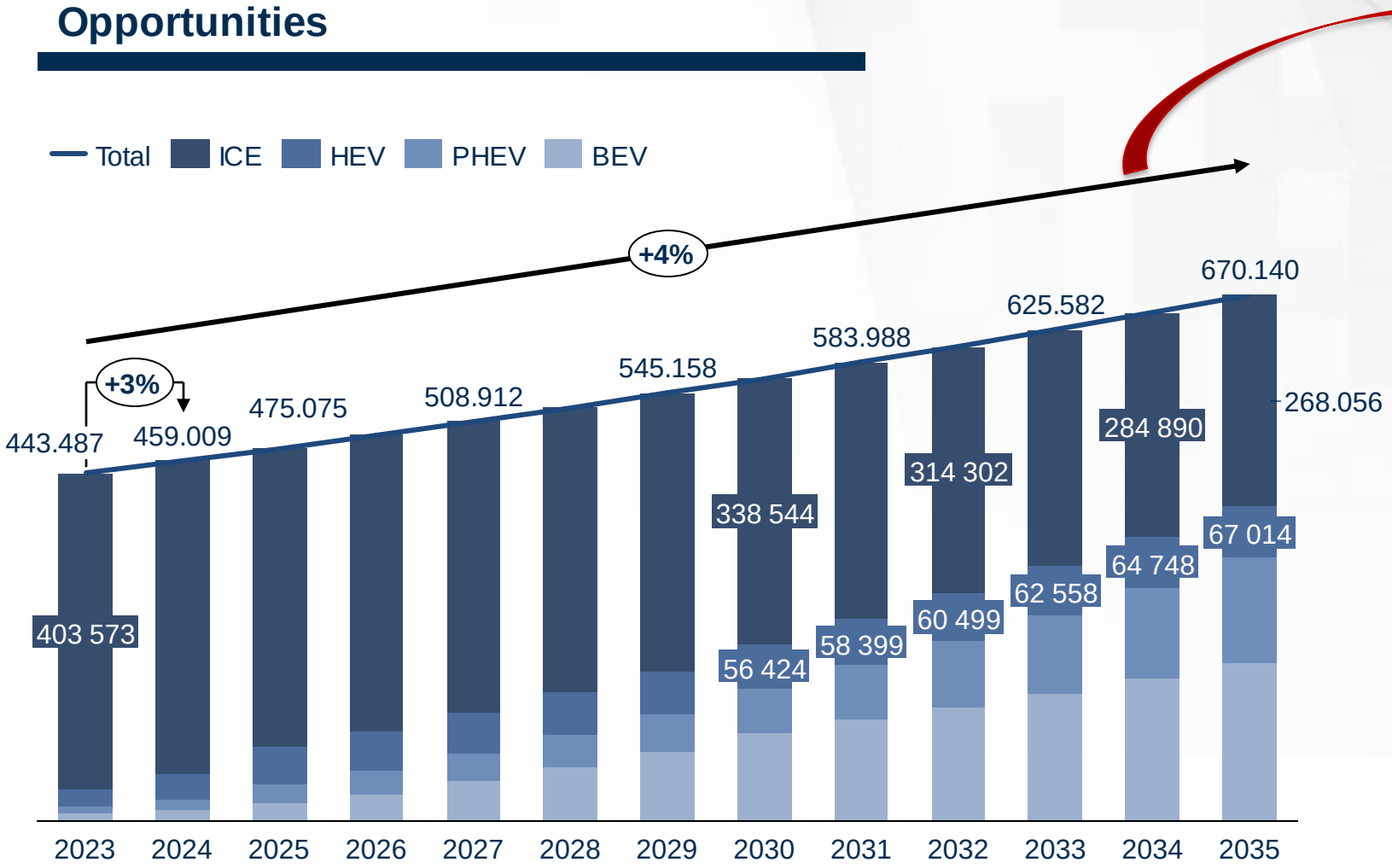
Energy storage testbed opportunities in South Africa

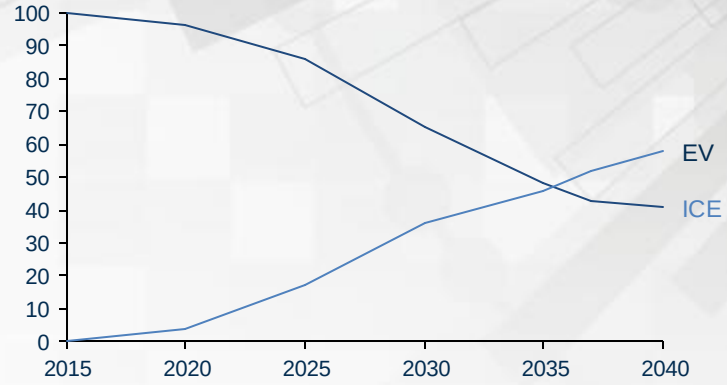


Sources: World bank South Africa & Southern Africa Battery Market & Value Chain Assessment

Projected light vehicle sales in South Africa market from 2023 to 2035 based on a CAGR of 3.5%

Opportunities





- Global EV sales continue to rise, with a number of European countries placing a future ban on ICE vehicles between 2030 – 2040
- Need for robust testing and validation of EV batteries.

Source: NAAMSA, DTIC NEV research study, CSIR analysis, Greencape

The energy transition has created new opportunities in both first-time application for electric vehicles and stationary application for electrification

Opportunities

Energy storage testbed opportunities in South Africa

1

Electric vehicle battery testing

Opportunities in the EV market are driven by the JET IP, climate conscious consumers, rising fuel costs, reductions in cost of EV's, increase in driving range

2

Stationary application: microgrid batteries and small to medium scale testing

In the stationary application related to small scale testing for mini-grids, micro-grids and small to medium scale testing driven by decarbonisation and load shedding

3

Stationary applications: large-scale outdoor testing

The driver for large-scale outdoor testing are driven by decarbonisation and integration of existing renewable energy sources with battery storage for flexibility.

4

Other

The medical industry (pacemakers; hearing aids etc); agriculture; and road works.

Implementation of suitable supportive policies and regulations would elevate energy storage development

Enablers

No clear policy on energy storage –

Relative lack of development of this sector.

NATIONAL

- **IRP2019 (i.e. REIPPPP)** and the **Risk Mitigation IPP Procurement Program** promote storage at the utility-scale level;
  - with 500MW annually allocated for “distributed generation” in the IRP2019
- **Automotive Master Plan 2035** promotes e-mobility through local content requirements and incentives
- **Green Transport Strategy (2018-2050)** promotes e-mobility:
  - incentives for manufacturing and sale of EVs
  - support EV batteries research
  - introduce technology to retrofit current ICE vehicles into EVs
- **Existing import control measures** that can equally apply to the battery value chain.

LOCAL

- Embedding **Small-scale embedded generation (SSEG):** accelerated by removal of licensing requirement in 2022
- **Feed-In-Tariffs for Distributed Generation:** for customers feeding self-generated power into the municipal distribution network.

The drive to sustainable low carbon energy sources opened opportunities to collaborate on the first-ever indoor test bed in South Africa

Flanders-VITO-CSIR collaboration

Government of Flanders

vito

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2020 Inception

VITO and CSIR set-up a collaboration agreement that entered into force on 1 December 2020. Collaboration agreement includes

- Funding agreement with Flemish Government - VITO;
- Project proposal
- Logical framework;
- Operational plan
- Exchange of skills development, and more.

2022 Development

In 2022, the CSIR and VITO signed a memorandum of understanding to establish a strategic partnership in order to enhance research capabilities for the benefit of both parties

- Align the project scope with WBG and with other testbeds in developing countries;
- Specification of the testbed
- Provide climate chamber and a first set of testing equipment

.

2023 commercial operation

Site acceptance testing has been concluded. The CSIR energy storage team is undergoing thorough training in preparation of the November commercial operation date.

- Chroma training partially concluded (80%)
- Battery fundamentals training is scheduled for the month of July 2023

Indoor energy storage testbed facility

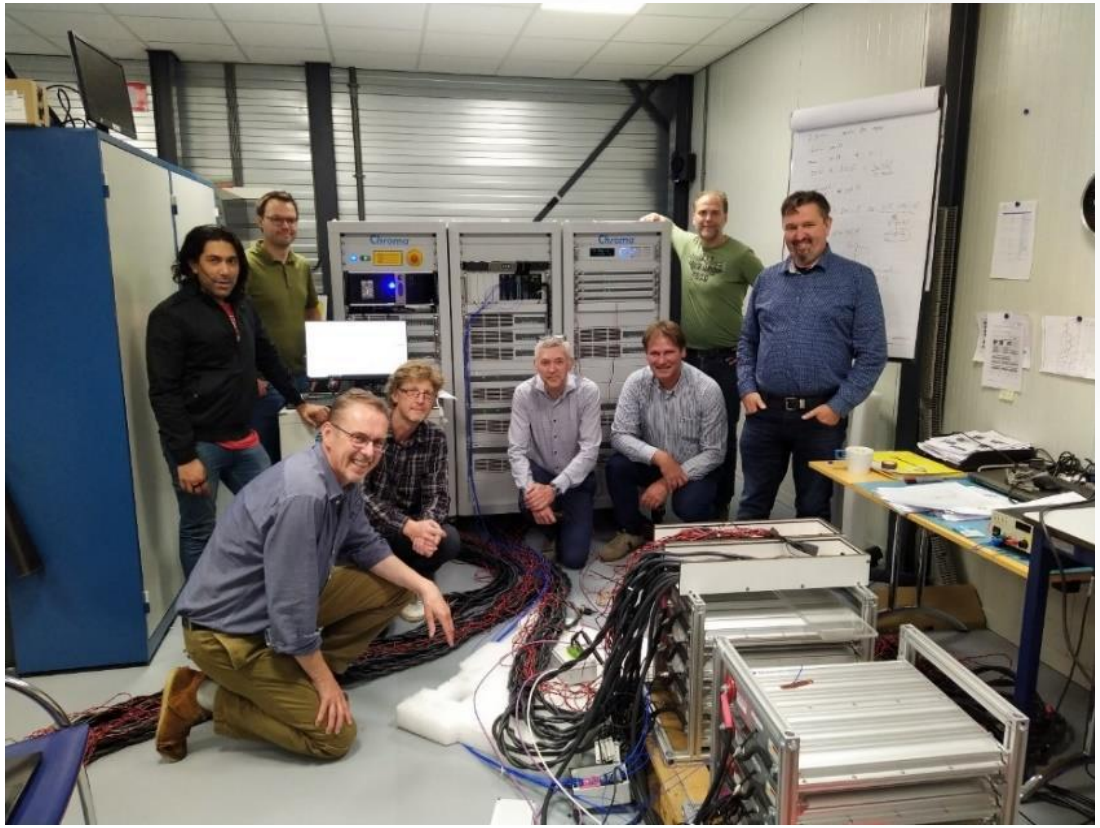
Flanders-VITO-CSIR collaboration

- Testing Energy Storage technologies
  - **Indoor (Nov 2023)**
    - Lithium-ion Batteries
    - Next Gen batteries
    - Local Standards
    - Battery Management Systems
  - **Outdoor (future)**
    - RTDS with HIL
    - Inverter Performance
    - Fire prevention
    - Microgrid Testing
    - Grid-tied system testing

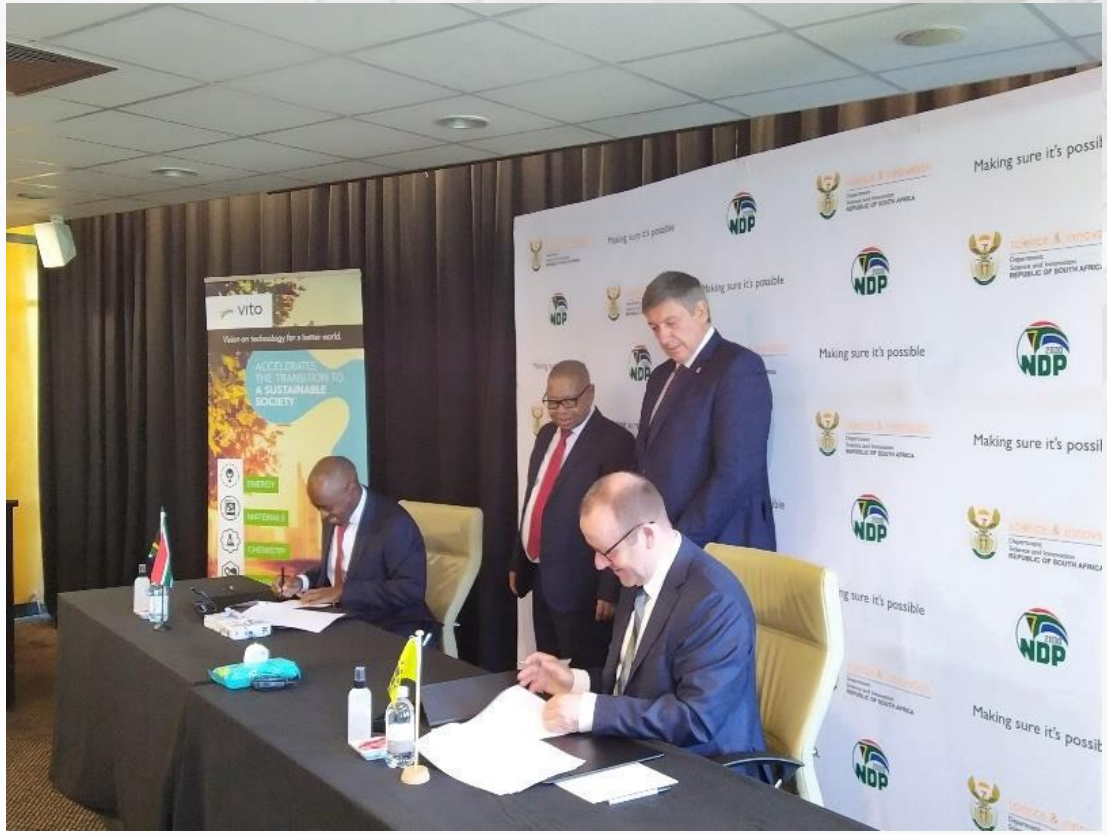
Performance and reliability testing | Cycle life

Battery calendar life | Storage capacity

Site acceptance test of the indoor energy testbed



July 2022: CSIR, VITO and CNRood Teams in Ede, Netherlands for Factory-acceptance-testing



April 2022: Minister Dr Blade Nzimande (standing, left) and Minister President Jan Jambon (Standing, right) oversee the signing of the CSIR-VITO MoU by CSIR CEO Dr Thulani Dlamini (seated, left) & VITO Commercial Director Bruno Reyntjens (seated, right)

Energy access in Sub-Saharan Africa is the greatest impediment to social and economic development

Key Takeaways: Benefits

1	**Innovation**	The project will contribute to bridging the gap to bring new storage technologies to implementation. The project will deliver testing infrastructure for existing and new companies that supports innovation in the field of energy storage & microgrids.
2	**Localisation**	Energy storage technologies will be adopted to local conditions: temperature, dust, humidity, low technical capacity of users.
3	**Demonstration**	The testbed will demonstrate the benefits of electricity storage in a sustainable energy system.
4	**Standardisation**	Testing standards are needed to guarantee comparability and safety of battery test. Testing standards will be offered for characterisation/performance testing, ageing, safety and type approval/certification.
5	**Facilitation**	Facilitation and acceleration of renewable energy deployment due to the inherent flexibility benefit of battery energy storage.

Thank you