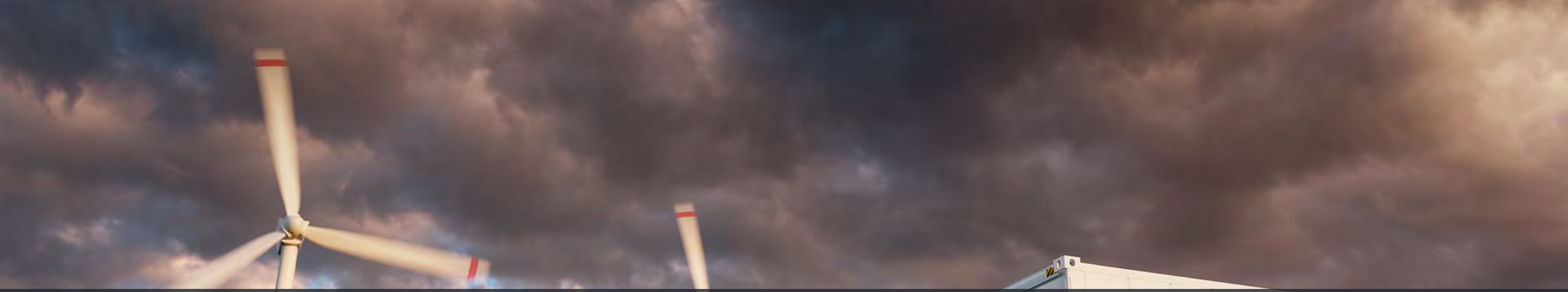


# ENERGY STORAGE PARTNERSHIP

## REUSE AND RECYCLING: ENVIRONMENTAL SUSTAINABILITY OF LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

Webinar - July 16, 2020

WORLD BANK GROUP
Energy & Extractives

Climate-Smart Mining

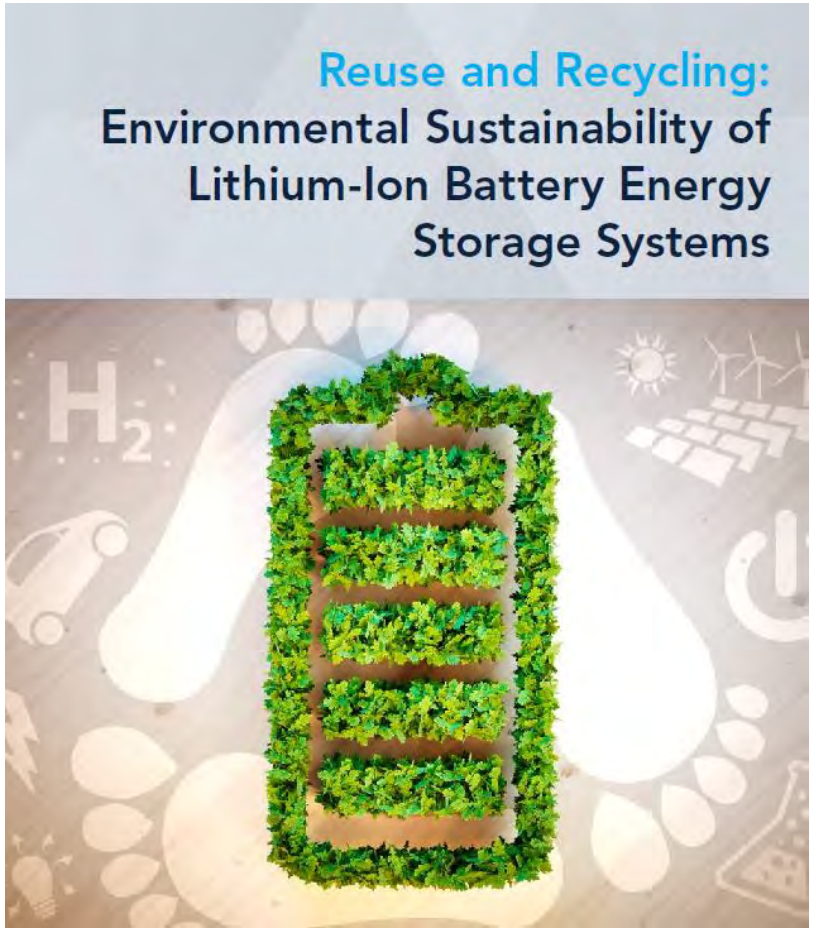
ESMAP

# REUSE AND RECYCLING: ENVIRONMENTAL SUSTAINABILITY OF LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

## UPCOMING REPORT

A work led by the **Climate Smart Mining Initiative** (CSM) within the framework of the **Energy Storage Partnership** and in collaboration with :

- The Faraday Institution
- National Renewable Energy Laboratory (NREL)
- National Physical Laboratory (NPL)
- Chinese Industrial Association of Power Producers (CIAPS)
- Korea Battery Industry Association (KBIA)
- Indian Energy Storage Alliance (IESA)
- Global Battery Alliance (GBA)
- Belgian Energy Research Alliance (BERA)
- UNEP DTU Partnership



# REUSE AND RECYCLING: ENVIRONMENTAL SUSTAINABILITY OF LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

The potential role of developing countries in a ‘circular economy’ approach for li-ion batteries :

- KEY TO ACHIEVING 1.5C CLIMATE GOAL
- CRITICAL IN MANAGING LOCAL ENVIRONMENTAL IMPACTS
- RECYCLING AND RENEWABLES: PLAYING A ROLE IN THE POST COVID GLOBAL GREEN ECONOMY

# REUSE AND RECYCLING: ENVIRONMENTAL SUSTAINABILITY OF LITHIUM-ION BATTERY ENERGY STORAGE SYSTEMS

## BUILDING BLOCKS OF 'CLIMATE SMART MINING'

**Strong governance and adequate regulatory framework**

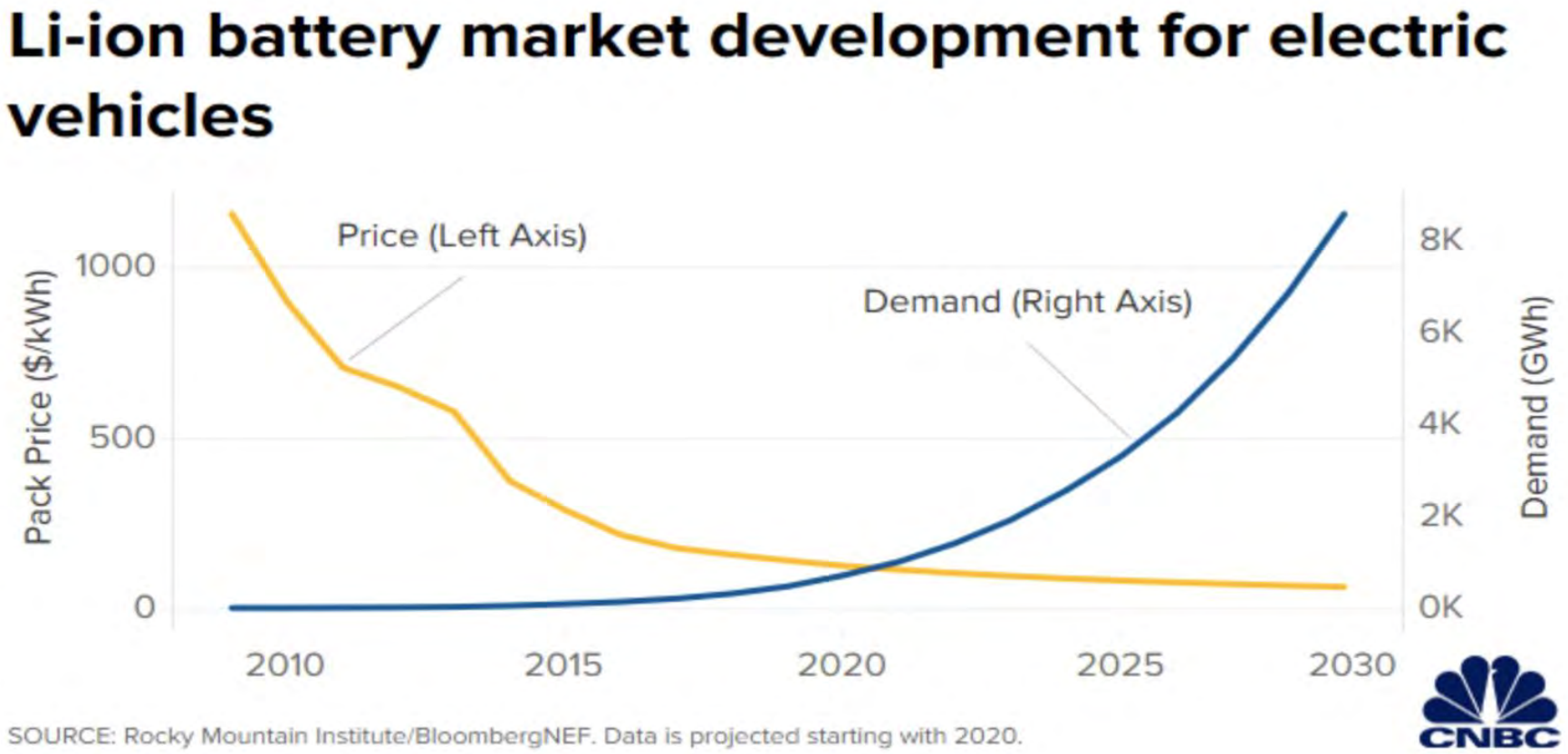
**World Bank, IFC support to decarbonize and reduce material footprint of mining sector**

| Climate mitigation | Climate adaptation | Reducing material impacts | Creating marketing opportunities |
|---|---|---|---|
| Integration of **renewable energy** in the mining sector | **Forest-Smart Mining** with landscape management | Adoption of a **circular economy** for low-carbon minerals | **De-risking investments** for low-carbon minerals |
| **Innovation** in extractive practices | **Resource efficiency** in mineral value chain | **Reuse / recycling** of low-carbon minerals | Leverage **carbon finance instruments** |
| **Energy efficiency** in mineral value chain | **Innovation waste** solutions | Low-carbon **mineral supply chain** management | Robust **geological data management** |

**Gender and multi-stakeholder engagement**

**Climate Smart Mining**

## ON THE VERGE OF A LI-ION BATTERY MARKET BULL MARKET…
## WHAT TO DO AT THE END OF ITS EV LIFE?



# A CIRCULAR ECONOMY APPROACH TO RECYCLING AND REUSE OF EV BATTERIES

- Recycling:
  - Focuses on retrieval of minerals/metals for use in a wide range of contexts (power, IT, small tools…) or as part of a country's critical minerals/metals strategic supply.
  - Current practices – pyrometallurgy and hydrometallurgy – both have environmental complications. Research is underway to pursue options : for example "direct recycling" out of NREL.
  - Critical to ensure a new 'ewaste' regime is developed for LiBESS in developing countries: from the 'dumping ground' of developed countries to a sustainable platform for the EV battery recycling industry
- Reuse:
  - Focuses on the 'repackaging' of EV batteries from their 1st life as an EV power provider to a stationary energy storage system provider
  - If properly implemented, has the potential to provide more economic and environmentally benign options, than new batteries, to meet clean energy goals.
  - Challenges with developing protocols as there are currently at least six different li-ion batteries in use.
- Impact on Extractive Practices:
  - Recent CSM Report (Minerals for Climate Action) concludes that while a robust circular economy approach should help to mitigate the demand for primary minerals and metals, the primary mining of critical 'climate action' minerals will continue to be necessary to meet the growing demand of clean energy technologies.

## SOME OBSERVATIONS ON CURRENT STATUS

- Opportunities:
  - Strategic value of ‘climate action’ minerals/metals
  - Economically and environmentally beneficial if repurposed well to provide power back up and support
  - Current profile of developing countries (with notable exception of China) is at a very nascent stage
- Challenges:
  - Design
  - Collection
  - Capacity
  - Co-ordinated standards/regulations
  - Liability

## CONCLUSIONS OF THE REPORT

- Research:
  - How best to integrate/balance competing considerations (safety, recycling capacity, economy of design…) in future battery design.
  - Collection systems
  - Expanding potential of repurposed ‘battery packs’ beyond micro grids and home support
  - Developing comprehensive indicators for a ‘circular economy’ approach to batteries
- Policy Recommendations:
  - Awareness raising : consumers, producers and recyclers;
  - Incentives/penalties based approaches towards full recycling;
  - Effective business models;
  - Framework for training and upskilling; and,
  - International, cooperative regime for future regs/standards and liability provisions

## GOING FORWARD

- Priorities (for Developing Countries):
  - Systems for integration and effective management
    - health and safety/recycling reuse capacity/competitive market
    - circular economy indicators
  - Collection practices
  - Enhancing the economics: building the business case
  - Regime building – strengthening standards, regulations and liability provisions (EPR)
  - Cross Working Group co-ordination: safety, warranty, test beds, multiple uses of LiBESS…

- Partnering with GBA and Faraday: developing roadmap(s) for deployment of second life EV batteries and battery recycling capacity in Africa.

- Collaboration amongst three critical constituencies: energy, extractives and climate….the dialogue has only just begun…

# CONTACTS

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# OVERVIEW

July 2020

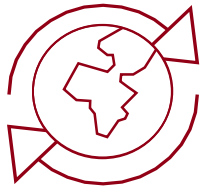
GLOBAL BATTERY ALLIANCE

BATTERIES POWERING SUSTAINABLE DEVELOPMENT

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

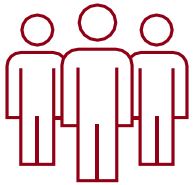
# GBA VISION: THE POTENTIAL OF A SUSTAINABLE BATTERY VALUE CHAIN IN 2030



**Establishing a circular battery value chain is a major driver for achieving the Paris Agreement**

**30%** emission reduction in the transport and power sector

**50%** emission reduction in the battery value chain

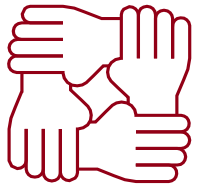


**Transforming the economy in the value chain creates new jobs and economic value**

**10 m** additional jobs

**150 bn** in economic value generated in a responsible and just value chain

**35%** increase in battery demand



**Safeguarding human rights and economic development is in line with the UN SDGs[1]**

**600 m** additional people with access to electricity, reducing the gap of people without electricity by 70%

Ensuring safe working conditions, fostering anti-corruption practice and eliminating child/forced labor

Additional impact of a sustainable value chain in 2030 compared to business as usual – unattainable with business as usual

1 Sustainable Development Goals

SOURCE: World Economic Forum, Global Battery Alliance

# GLOBAL BATTERY ALLIANCE ENERGY ACCESS INITIATIVE

## Goals of the initiative (until December 2020, potential for extension to Q1 2021)

1) Investigate the **systemic interventions** required to **enable the energy access potential** as outlined in the 2030 vision of the Alliance in a sustainable and responsible manner

2) Key **deliverables**:

- **An analytical study** with a set of **recommendations** for public-private interventions on future steps to address the barriers of a broader battery and recycling capacity
- **A roadmap** for an effective battery recycling industry
- Identification of **key stakeholders** for a coalition in Africa

## Scope of the roadmap

1) Summary of current knowledge on **energy access potential and key barriers**
2) **Required conditions and near-term actions to realize this potential**
3) **Gap analysis toward this potential** (e.g. current re-use and recycling systems)
4) **Practical recommendations** for action and pilots in specific countries

## Partners

WORLD BANK GROUP

THE FARADAY INSTITUTION

MINISTRY OF FOREIGN AFFAIRS OF DENMARK

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

United Nations Economic Commission for Africa

AFRICAN CIRCULAR ECONOMY ALLIANCE

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

A World Economic Forum initiative.

GLOBAL BATTERY ALLIANCE

BATTERIES POWERING SUSTAINABLE DEVELOPMENT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# *CSIR Energy Storage Test Bed -2020*

*MK Mathe*

Test beds for knowledge dissemination and capacity building
16 July 2020

ES = Future low-carbon energy system
@MKM 2020

our future through science

# South Africa Energy Storage Landscape

| Area | Use / Main Purpose |
|---|---|
| Bulk Energy Services | • Time-shifting of electric energy (arbitrage)<br>• Schedulable capacity<br>• Re-dispatch ("> 15-minute reserves") |
| Ancillary Services | • Frequency support (reserves)<br>• Voltage support (reactive power)<br>• Bottleneck management (congestion relief / N-1)<br>• Black-start capability |
| Grid Infrastructure Services | • Transmission upgrade deferral<br>• Distribution upgrade deferral |
| Customer Energy Management Services | • Power quality<br>• Power reliability (security of supply)<br>• Energy-charge management (arbitrage)<br>• Demand-charge management (peak shaving)<br>• Island and off-grid |

Industrial Development Corporation **(IDC**)

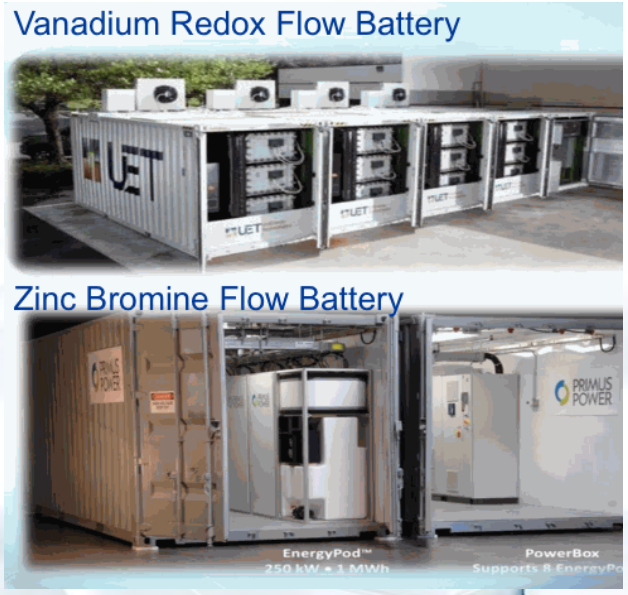
**Eskom** – National utility company

a. Lithium ion BYD

b. VRFB – Bushveld Energy

c. Zinc Bromine – Primus Power

Micro grids – EATON, ABB, other








Eskom and Bushveld photos acknowledged

# CSIR – Energy Storage Testbed

## Goal of the testbed

1: Lower-capacity clients have access to testbed facilities and use them for investment due diligence and the outdoor testbed facilities are prepared and specified

2: Benefits of battery storage for developing countries demonstrated

3: Testbed facilities serve as platforms for building capability and market knowledge

## Scope of energy storage testing

- Phase I: Cell & Pack level
  - R&D: Testing of new chemistries batteries
  - Secondary life use of EV batteries for energy storage capacity
- Phase II: System Level (TBD)
  - More mature technologies
- Standards and quality control: RE and Storage coupling
- Deployment and performance: demonstration plants?

**Capacity building and knowledge sharing:** Develop know how on the technical integration of Renewables and storage in the grid, together with sustainability impact analysis such as life cycle assessment (LCA) and life cycle costing (LCC)
**Major African Market Battery Storage hurdles**: skills gap, lack of policy commitment and end of the life cycle – recycling
**Unlimited opportunities**: better materials, local energy storage inexpensive, dependable and sustainable. Artificial Intelligence in Energy


The End