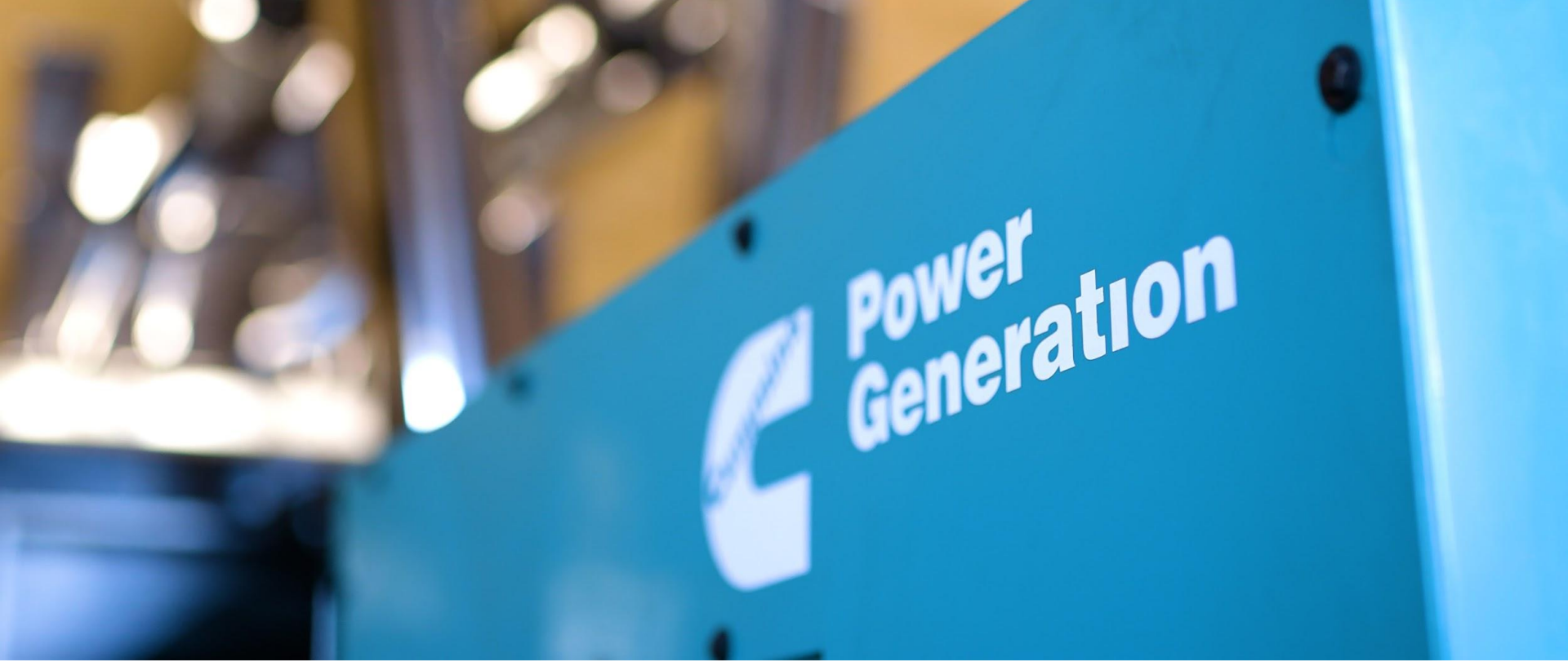
Energy Storage, A Game Changer for Mining in Africa

321 MW
PPA Projects Developed

61 MW
C&I Projects incl. Awarded, Designed And Built

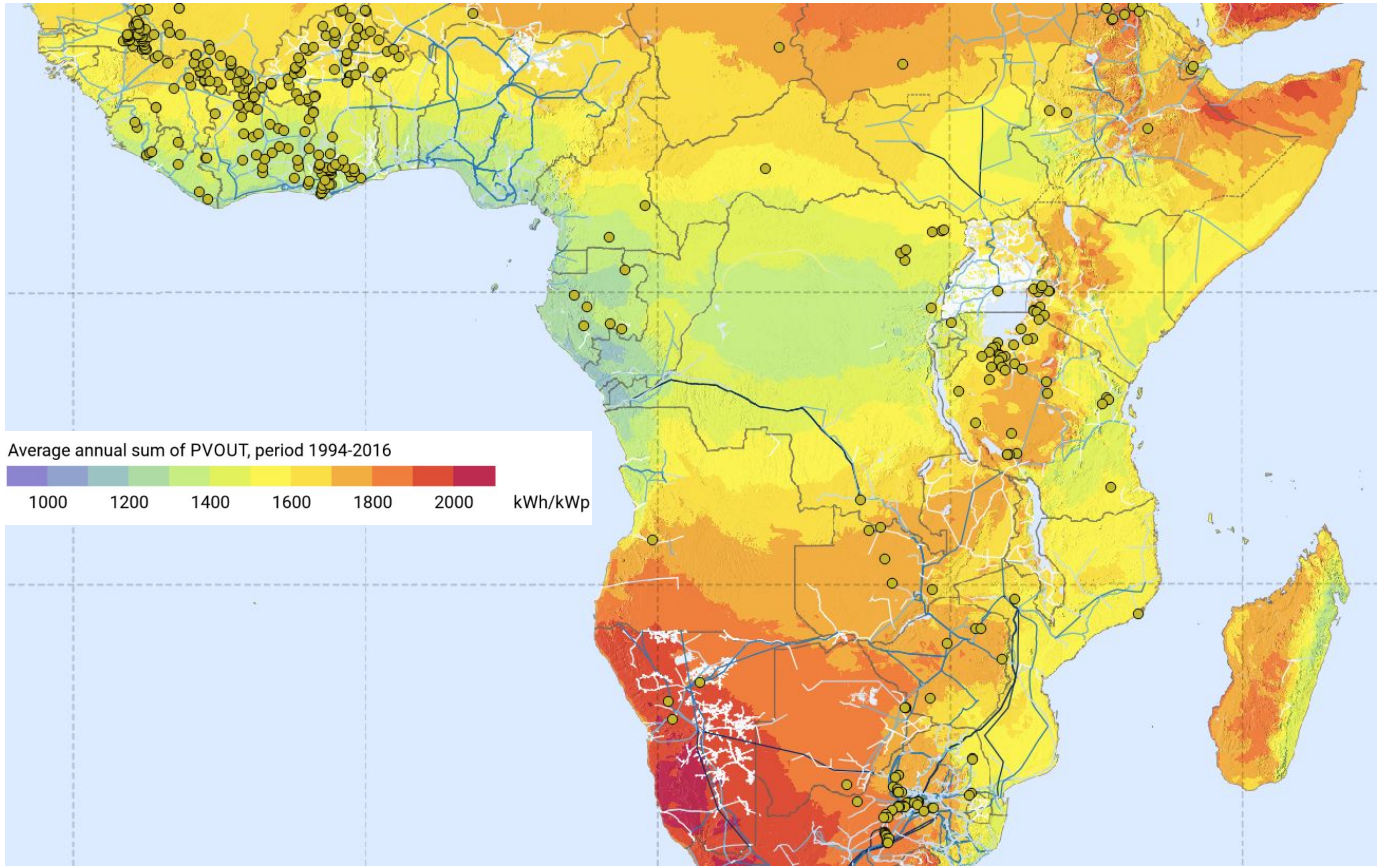
45 MW
Projects Currently Operated

1.6 MWh
Storage Projects Designed and Built



Why should remote mines in Africa consider clean energy and storage

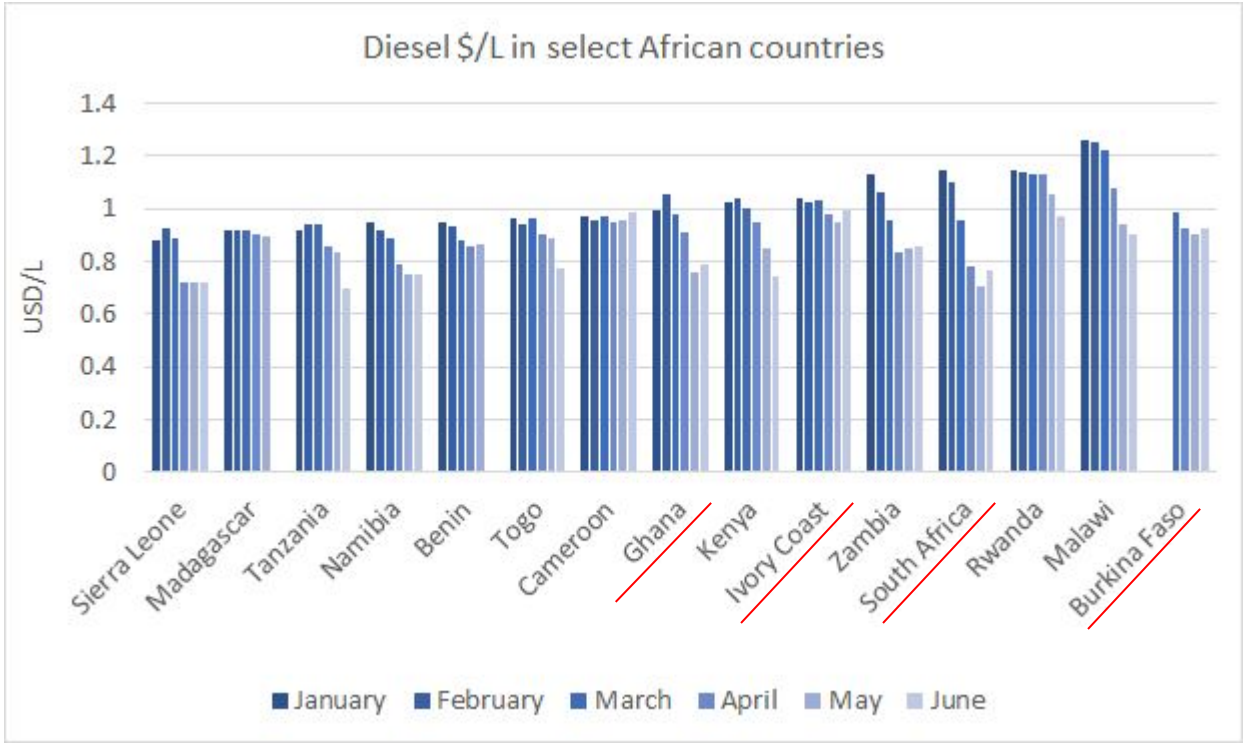
Gold Mines in Africa



Options for remote mining electricity provision

Energy in Africa - Options - Diesel

$1/L ~ US 30c per kWh



Rankings by Largest Gold Producer

Ghana:	7th
South Africa:	8th
Burkina Faso:	16th
Ivory Coast:	22nd

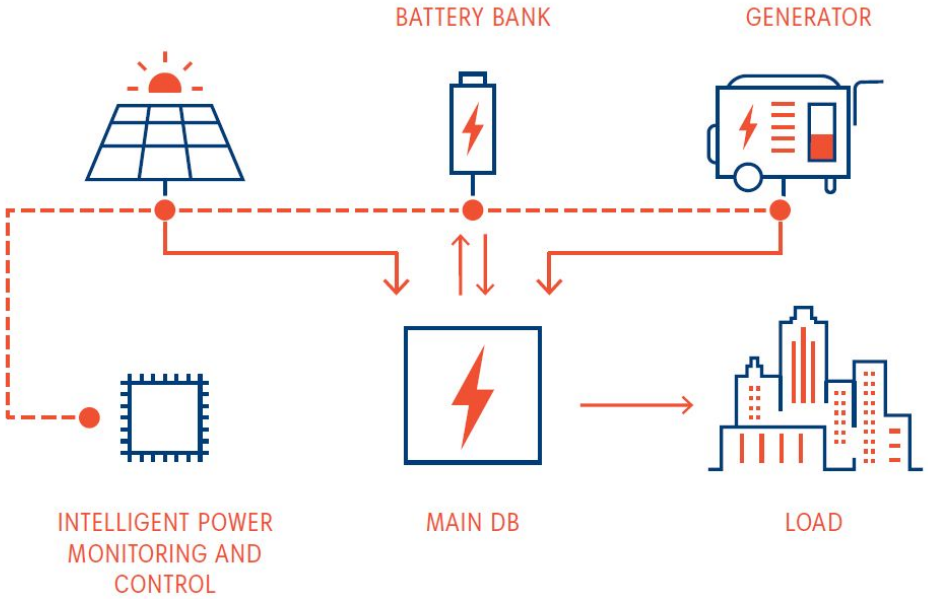
Energy in Africa - Options - Transmission Lines

Risks of new powerline

- How long will it take to build?
- What are the costs?
- Who will maintain it?
- Who will fix it?
- How long will it take to restore?

This is after Political, regulatory, logistics, planning, theft, terrorism are solved for.

Energy in Africa - Options - Solar plus Storage



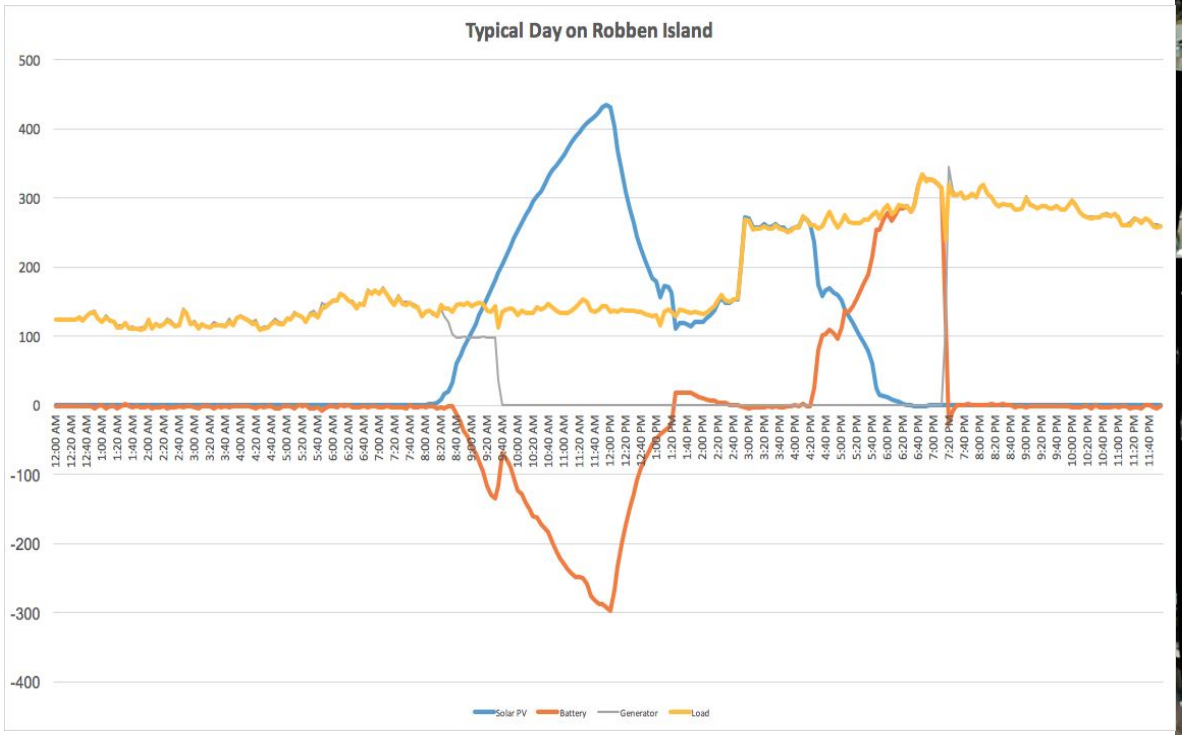
Control of power and energy
High renewables consumption enabled by storage allows complete control of energy costs, eliminating logistics risks and price fluctuations.

Financing Options
Upfront investment or long-term power purchase agreement/lease allows a volatile cost of mining to be locked in

The SOLA Group provides both EPC and financed solutions

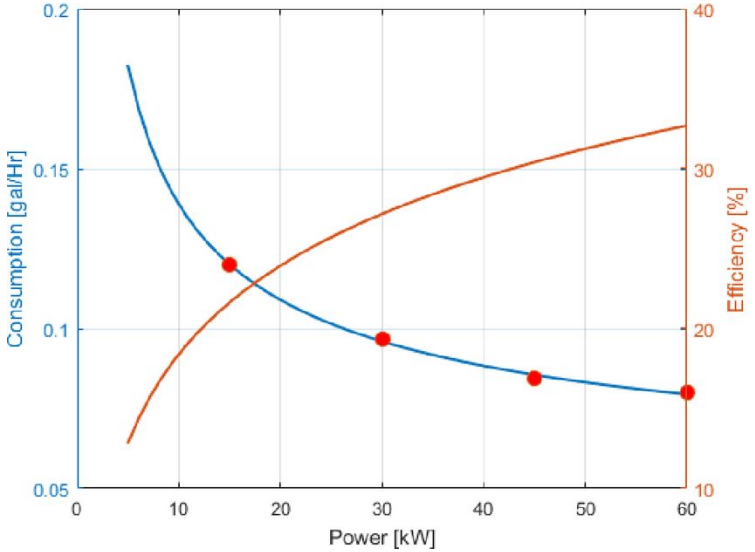
Case study: Robben Island

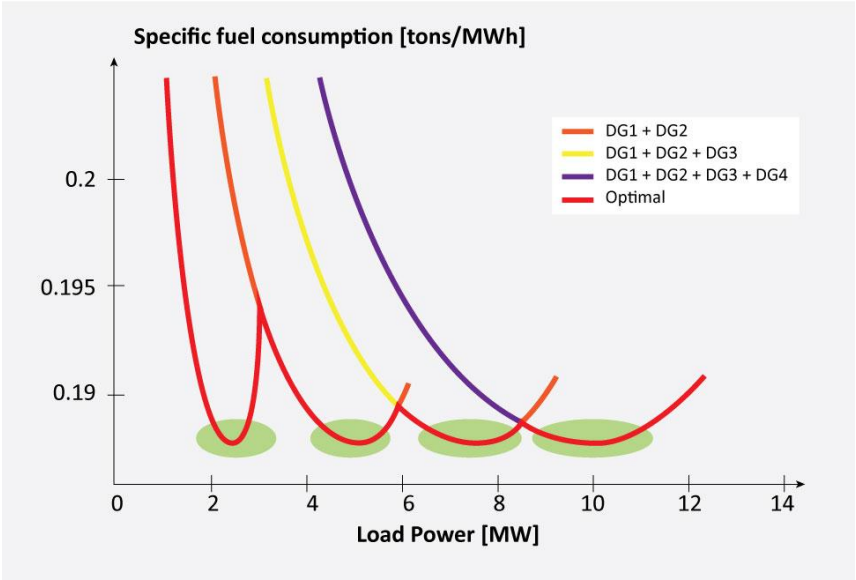
Case Study 1: Robben Island



Batteries are able to respond to step changes in the load, and reactive power increases instantaneously

Other Applications - Generator Support and Spinning Reserve





Batteries as spinning reserve can have a ~2% saving on diesel consumption

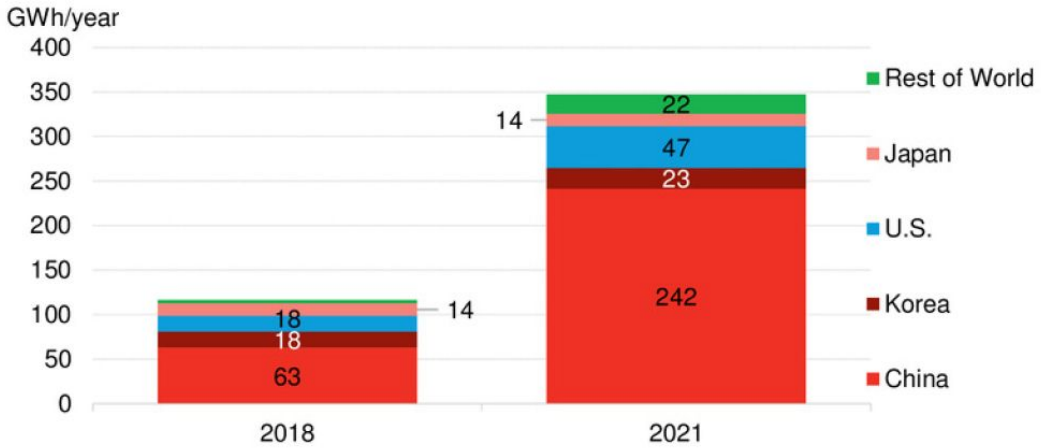
2MVA of batteries as spinning reserve for a mine with average load of 6MVA could save ~260,000 Litres of diesel

Market drivers for clean energy storage

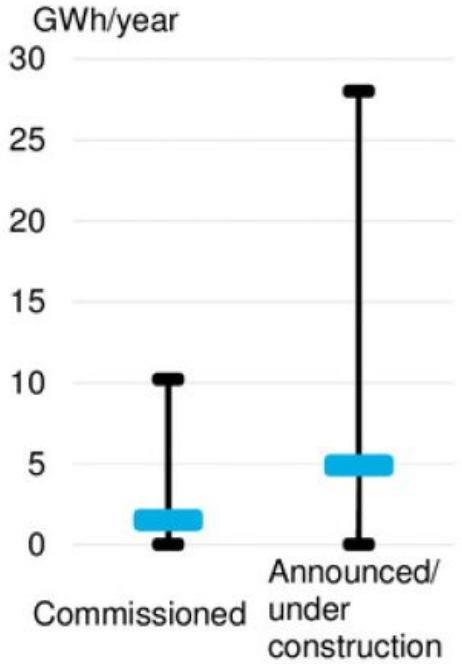
Market Driver - Manufacturing Capacity

Global Lithium-ion battery manufacturing capacity

-Estimated Forecast from 2018



Increasing Average Manufacturing plant size



Market Driver - Manufacturing Capacity

Global Lithium-ion battery manufacturing capacity

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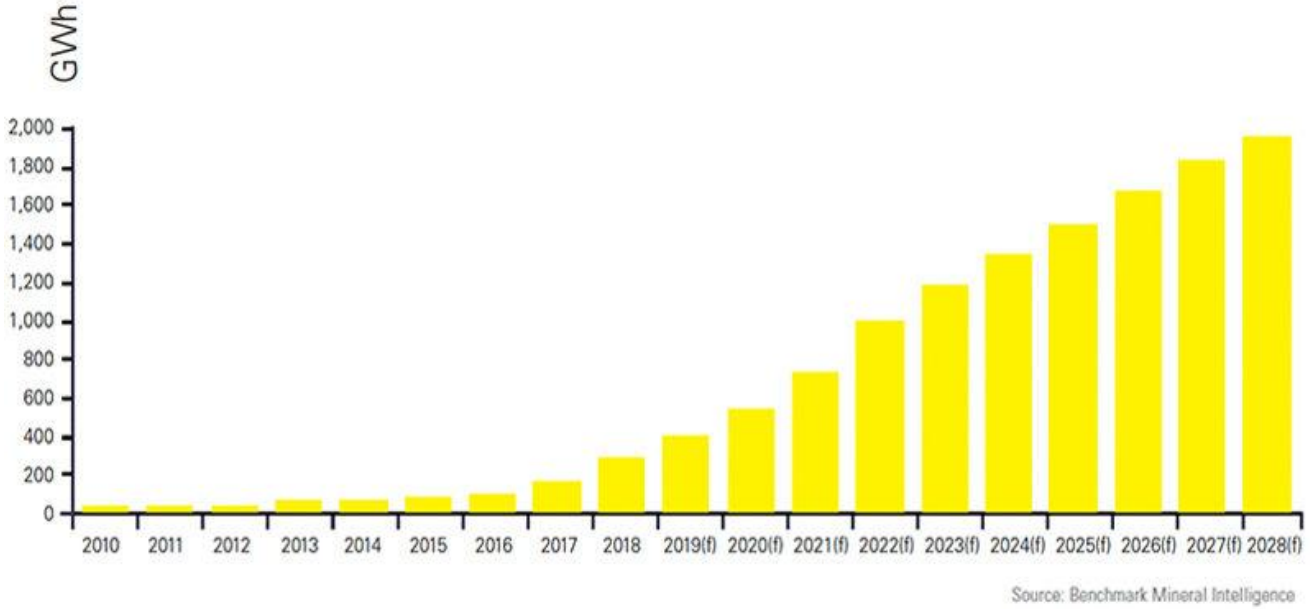
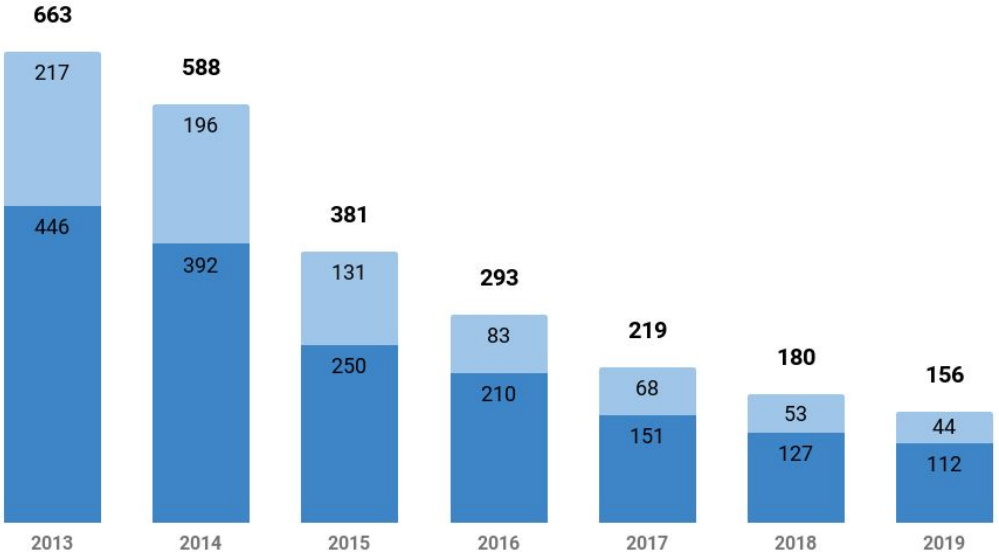


-in 1 year, forecast for 2021 increased from 350 GWh to ~700 GWh

Market Driver - Effect on Price Points

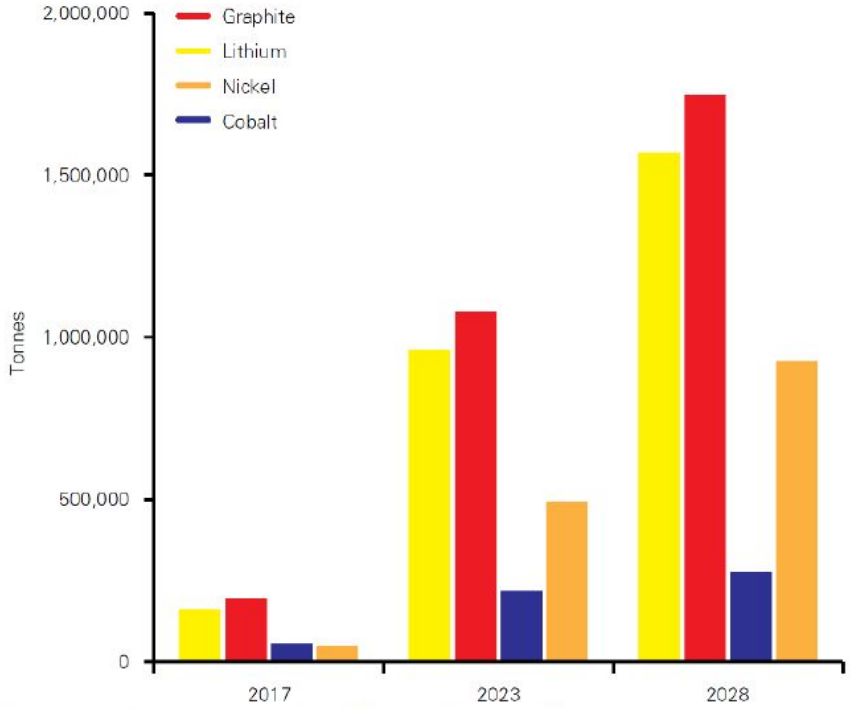
Lithium-ion battery price survey: pack (light blue) and cell (dark blue) breakdown ($/kWh).
-Bloomberg



Graphic © Maximilian Holland / CleanTechnica

Storage for mines is more affordable than mine managers think, becoming more so each year

Effect on demand for metals



Source: Benchmark Mineral Intelligence

Africa supply of minerals

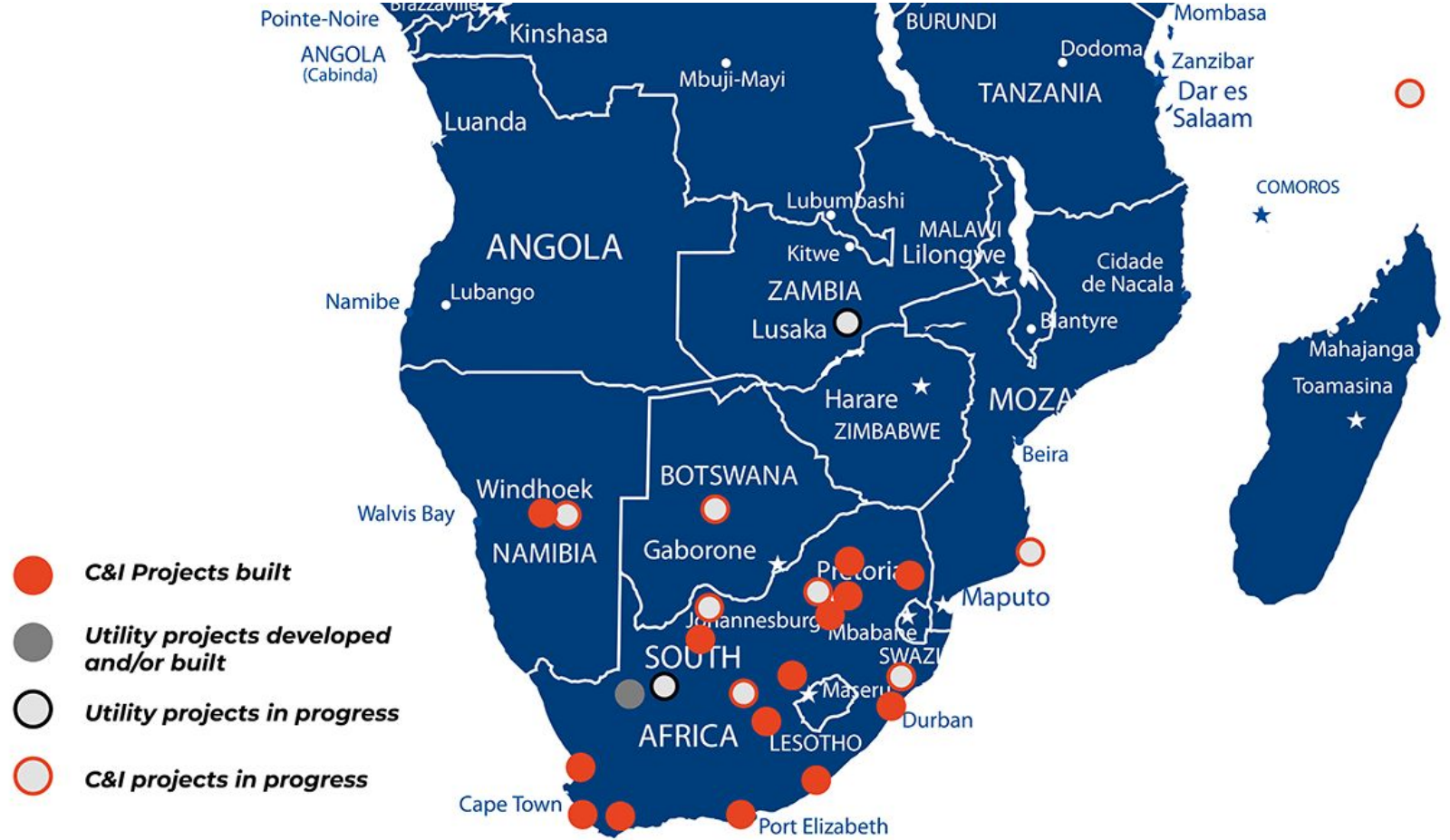
- Lithium
  - DRC
  - Mali
  - Namibia
  - Botswana
  - Zimbabwe
- Graphite
  - Madagascar
  - Tanzania
  - Mozambique
  - Namibia
- Cobalt
  - DRC
  - Madagascar
  - Zambia
  - South Africa
  - Morocco
- Nickel
  - South Africa
- Manganese
  - South Africa
  - Ghana
  - Gabon

Producers of these minerals have an opportunity to prime their own market and showcase this technology for other mines to adopt

Concluding remarks

Closing Comments

- Solar alone, saves money. Storage solves a problem
- Adding storage allows a whole range of services to be unlocked
- Storage is where solar was five years ago
    - Solar now an obvious decision
    - Storage business case to be investigated more closely
- However, Storage gives almost complete control over a major cost and risk centre
- If you are mining battery minerals in africa, you have to be investigating storage


Pointe-Noire
Kinshasa
ANGOLA
(Cabinda)
Luanda
Mbuji-Mayi
BURUNDI
Mombasa
Dodoma
Zanzibar
TANZANIA
Dar es
Salaam
COMOROS
Lubumbashi
MALAWI
Lilongwe
ANGOLA
Kitwe
Cidade
de Nacala
Namibe
Lubango
ZAMBIA
Lusaka
Blantyre
Mahajanga
Toamasina
Harare
ZIMBABWE
MOZA
Beira
Windhoek
BOTSWANA
Walvis Bay
NAMIBIA
Gaborone
Maputo
Johannesburg
Mbabane
SWAZI
SOUTH
Maseru
Durban
AFRICA
LESOTHO
Cape Town
Port Elizabeth
C&I Projects built
Utility projects developed and/or built
Utility projects in progress
C&I projects in progress

Selected Clients

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AB InBev

sasol

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Operating throughout Africa

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In association with:

Dwyka Mining Services is a pan-African technology platform focused on making mining safer and more productive by augmenting human effort with technology.