

# MOZAMBIQUE INSTITUTE OF METALS

## ENERGY STORAGE



How can Mozambique achieve its electrification goal? The use of proven power generation technologies coupled with a well-structured and realistic data-driven plan will enable Mozambique to reach its electrification goal. To identify the optimal power system for Mozambique, a few key questions must be considered. Should Mozambique cap new renewable energy capacity to 100 MW/year?



What is the optimal power system expansion plan for Mozambique? The optimal power system expansion plan if wind and solar capacity are allowed to triple to reach almost 3 GW by 2032. Currently, the power system of Mozambique is separated into two transmission networks isolated from one another: the Central-Northern and Southern systems. Over 50% of the annual power demand is seen in the Southern system.



Why is technology modularity important in Mozambique? Technology modularity also plays a key role. Mozambique requires between 100 MW and 500 MW of new generation annually to be built across the country to be able to meet the increasing demand. On a regional level, this represents 60 to 80 MW of new power generation.



How will Mozambique benefit from a more distributed power system? With this strategy, Mozambique will also avoid locking the systems in for decades to come with large baseload plants, and benefit from a more distributed power system.



When will domestic gas be available in Mozambique? Domestic gas from the Northern coast of Mozambique is expected to be available by 2026. The pressing challenge for Mozambique's energy authorities is to ensure that the entire population gets affordable and uninterrupted access to electricity over the next decade.

# MOZAMBIQUE INSTITUTE OF METALS

## ENERGY STORAGE



Why is Mozambique focusing on hydropower projects? Since Mozambique has high hydro power potential, the country is focusing on developing large hydro projects that aim to be operational at the beginning of 2030s. Hydropower projects play an important role in decarbonizing the power sector in Mozambique.



The minerals and metals identified as critical to the development and deployment of four key green energy technologies—solar, wind, EVs and energy storage—are presented in Table 1. These minerals include, but are not limited to aluminium, cadmium, chromium, cobalt, copper, gallium, germanium, graphite, indium, iron, lead, lithium, etc.



The family of 2D transition metal carbides, carbonitrides and nitrides (collectively referred to as MXenes) has expanded rapidly since the discovery of  $\text{Ti}_3\text{C}_2$  in 2011. The materials reported so far



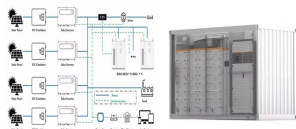
The Institute for Rare Earth Elements and Strategic Metals has been determining prices for all rare earth elements, their oxides, base metals, minor metals, exotic metals and stable isotopes since 2011.



"This marks a pivotal milestone as we expand our operations to meet the growing global demand for lithium, essential in producing batteries for electric vehicles and renewable energy storage systems," the company stated in its exchange filing. Deccan Gold Mines' Mozambique unit plans to increase shipments to nearly 1,000 tonnes per month

# MOZAMBIQUE INSTITUTE OF METALS

## ENERGY STORAGE



Hydrogen energy has been widely used in large-scale industrial production due to its clean, efficient and easy scale characteristics. In 2005, the Government of Iceland proposed a fully self-sufficient hydrogen energy transition in 2050 [3] 2006, China included hydrogen energy technology in the "China medium and long-term science and technology development ???



The considered reactive metals are analyzed based on their technical potential, availability, and technological readiness of the energy storage technology as energy storage and carrier media. Additionally, economic and environmental implications are addressed in an explorative way designating a circular metal economy where these vastly produced

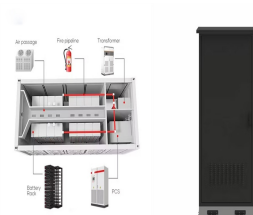


????????? Mozambique gets first solar energy storage facility.

Mozambique builds a US\$32 million solar system that comprises solar panels and utility-scale battery energy storage. will have a combined 19MWp (15MWac) of solar PV with 2MW (7MWh) of battery energy storage, according to Institute for Energy Economics and Financial Analysis



mineral industry facilities in mozambique. Commodity Review Metals Aluminum.???in 2019, mozambique produced 565,000 metric tons (t) of aluminum compared with 571,000 t in 2018. The mozal aluminum smelter, which was located 20 kilometers (km) west of maputo and operated by South32 Ltd. of australia,



The main advantage of hydrogen storage in metal hydrides for stationary applications are the high volumetric energy density and lower operating pressure compared to gaseous hydrogen storage. In Power-to-Power (P2P) systems the metal hydride tank is coupled to an electrolyser upstream and a fuel cell or H<sub>2</sub> internal combustion engine downstream

# MOZAMBIQUE INSTITUTE OF METALS

## ENERGY STORAGE



This work summarises the results of development and long-term testing of two prototype models of industrial-scale metal-hydride thermal sorption hydrogen compressors, TSC1-3.5/150 (up to 11 Nm<sup>3</sup> h<sup>-1</sup>; water cooling/steam heating) and TSC2-3.5/150 (up to 15 Nm<sup>3</sup> h<sup>-1</sup>; heating and cooling by circulating oil). Both compressors have a two-stage layout utilising ???



According to data from Future Power Technology's parent company, GlobalData, solar photovoltaic (PV) and wind power will account for half of all global power generation by 2035, and the inherent variability of renewable power generation requires storage systems to balance the supply and demand of the power grid. This considered, countries ???



Nanoporous metals and nanoporous metal oxide-based materials are representative type of porous and nanosized structure materials. They have many excellent performances (e.g., unique pore structure, large clear surface area and high electrical conductivity) to be prodigiously promising potentials, for a variety of significant applications ???



During the 10th edition of the Mozambique Mining and Energy Conference and Exhibition (MMEC), J?lio Carneiro, Research Leader at HyAfrica Project ??? a Portuguese company that explores natural hydrogen deposits ??? highlighted Mozambique's potential as a regional leader in energy supply and CO<sub>2</sub> emissions management, comparing the country to Norway in its ???



Electrification of rural Mozambique Sustainable energy solutions 2019  
Faculty of Engineering Department of Building and Environmental  
Technology Division of Water Resources Engineering Lund University  
ISBN 978-91-7895-137-6 ISSN 1101-9824 Report 1078 Electrification of  
rural Mozambique Sustainable energy solutions MIGUEL MEQUE  
UAMUSSE

# MOZAMBIQUE INSTITUTE OF METALS

## ENERGY STORAGE



MITEI's three-year Future of Energy Storage study explored the role that energy storage can play in fighting climate change and in the global adoption of clean energy grids. Replacing fossil fuel-based power generation with power generation from wind and solar resources is a key strategy for decarbonizing electricity. Storage enables electricity systems to remain in??? Read more



Metal batteries with high theoretical capacities have become more important than ever in pursuing carbon-neutral initiatives to reduce fossil energy consumption and incorporate intermittent renewable energy into the electric grid. However, cathode materials often encounter significant challenges, such as sluggish reaction kinetics, limited capacities, or low ???



Reactive Metals as Energy Storage and Carrier Media 2023. Sustainable Energy Storage in the Scope of Circular Economy ??? Advanced Materials and Device Design. Ed.: C. Costa, 17???41, John Wiley and Sons. Institute for Technology Assessment and Systems Analysis (ITAS) P.O. Box 3640 76021 Karlsruhe Germany. Tel.: +49 721 608-23215



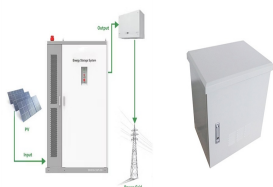
Scalable continuous flow metal-organic framework (MOF) synthesis using supercritical CO<sub>2</sub> (Energy Storage Materials, July 2019)  
Water???lubricated intercalation in V<sub>2</sub>O<sub>5</sub> ?nH<sub>2</sub>O for high???capacity and high???rate aqueous rechargeable zinc ???



Paper: "Magnesium-antimony liquid metal battery for stationary energy storage." Paper: "Liquid metal batteries: Past, present, and future." Paper: "Self-healing Li-Bi liquid metal battery for grid-scale energy storage." Paper: "Low-temperature molten salt electrolytes for membrane-free sodium metal batteries." Paper: "Lithium

# MOZAMBIQUE INSTITUTE OF METALS

## ENERGY STORAGE



Advanced Energy Materials is your prime applied energy journal for research providing solutions to today's global energy challenges. Abstract To reach a closed-loop material system and meet the urgent requirement of sustainable energy storage technologies, it is essential to incorporate efficient waste management into designing



Parties to the Paris Agreement (PA) have agreed on the goal of limiting the increase in global average temperature to well below 2 °C and are pursuing efforts to limit warming to 1.5 °C.



Dino Miguel Milisse, director-general of Instituto Nacional de Minas (INAMI), talks to The Energy Year about establishing mechanisms for the responsible extraction and export of Mozambican minerals and the enhanced capabilities of INAMI's new geology lab. INAMI is Mozambique's regulatory authority for public and private mining activities.



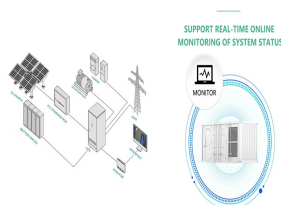
The highly conductive liquid metals can be heated to more than 700 °C using green electricity and can flexibly store industrial heat. From April 22 to 26, 2024, the researchers will present a model of their energy storage system at the KIT stand at the Energy Solutions (Hall 13, Stand C76) of the Hannover Messe.



Abstract Storage of electrical energy is a key technology for a future climate-neutral energy supply with volatile photovoltaic and wind generation. German Aerospace Center (DLR), Institute of Engineering Thermodynamics, Thermal Process Technology Department, Linder H?he, Building 26, 51147 K?ln, Germany thermal oil 85, molten metal



# MOZAMBIQUE INSTITUTE OF METALS ENERGY STORAGE



9 ? November 14, 2024. Michele Poggi, managing director of Saipem Mozambique, talks to The Energy Year about incorporating patented technologies into Mozambique's energy ???



The team has also created ceramic pumps that can handle the ultra???high-temperature liquid metals needed to carry heat around an industrial scale heat energy storage setup. "They've built a foundation for storing and converting heat at those high temperatures," Lenert says. This progress has triggered commercial interest.



Hydrostor, a Canadian company renowned for its patented advanced compressed air energy storage technology (A-CAES), has inked a binding agreement with Perilya (a leading Australian base metals mining and exploration company based in Perth, Western Australia) to tap into existing assets at the Potosi mine site near Broken Hill, propelling the



The MITEI report shows that energy storage makes deep decarbonization of reliable electric power systems affordable. "Fossil fuel power plant operators have traditionally responded to demand for electricity ??? in any given moment ??? by adjusting the supply of electricity flowing into the grid," says MITEI Director Robert Armstrong, the Chevron Professor ???



More specifically, the term "critical metals" defines those metals which are essential commodities for the construction of future clean energy devices such as wind and geothermal turbines (Archer, 2020), solar panels, and electric vehicles (Zhang and Kong, 2022) as well as in the production of hydrogen for clean-energy storage (Giebel et al