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Battery Energy Storage Systems

BESS

IEHL has taken the necessary steps to ensure the successful implementation of the

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IEHL's BESS Project is a direct response to the urgent need to address South Africa's long running electricity challenges, by **transforming and strengthening grid capacity through battery energy storage.**

Through BESS, IEHL aspires to enable the integration of distributed energy resources, and pursues a low-carbon future to reduce the impact of greenhouse gas emissions on the environment. **Our 585MW/ 1,406 MWh BESS represents a giant leap forward in achieving this aspiration.**

Q&A

Q: What is Battery Energy Storage Systems (BESS)?

BESS, or Battery Energy Storage Systems, stores electricity in batteries for on-demand power supply. The phrase "battery system" encompasses battery design, engineering, and deployment. Various energy sources like gas, nuclear, wind, and solar can charge BESS, making it crucial for stabilising grids and enhancing renewable energy reliability.

IEHL's BESS investment aligns with grid enhancement, renewable energy integration, and resilience goals, offering a versatile solution for improved performance and sustainability.

Q: Why is IEHL investing in BESS and what are the benefits?

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Renewable Energy Integration:

BESS seamlessly integrates with renewable energy sources, optimising their utilisation, minimising waste, and bolstering grid reliability. This approach aligns with Eskom's goals of maximising renewable energy integration and efficient resource management. BESS stores excess energy during high generation periods and releases it during low renewable output, ensuring continuous power supply.

Environmental Impact:

Integrating energy storage with renewables aids in reducing greenhouse gas emissions and promotes sustainable energy practices.

Network Constraints and Congestion Relief:

BESS swiftly addresses grid challenges like undervoltages, overloads, and reactive power deficits by injecting or absorbing power. It effectively alleviates network congestion during peak periods, significantly reducing technical losses.

Mitigating REIPP Curtailment:

BESS efficiently absorbs excess energy generated during low demand periods, mitigating grid congestion and instability issues. Instead of curtailing **renewable energy independent power producer (REIPP)** output, which results in energy wastage, BESS provides a more economically viable solution.

Ancillary Services:

BESS contributes ancillary services such as frequency regulation, voltage support, and reactive power control, enhancing grid reliability and power quality.

Efficiency Improvements and Distribution Investment Deferral:

BESS improves overall grid efficiency by reducing technical losses associated with long distance power transmission. It can locally dispatch stored energy, reducing the necessity for extensive energy transfers and infrastructure upgrades.

Future-Proofing:

IEHL's implementation of an energy storage project prepares the National grid for the evolving landscape characterized by decentralized generation, distributed energy resources, and smart grid technology.

Grid Stability:

BESS offers rapid power output adjustments critical for grid stability, responding to supply and demand fluctuations, minimising outages, and ensuring reliable power delivery.

Peak Demand Management and Flexibility:

BESS manages peak demand by discharging stored energy during high consumption hours, reducing grid strain and the need for costly peak power plants. The IEHL BESS project will enable flexibility in energy resource management through BESS investment.

Q: What does a battery storage unit consist of and is it linked to the power grid?

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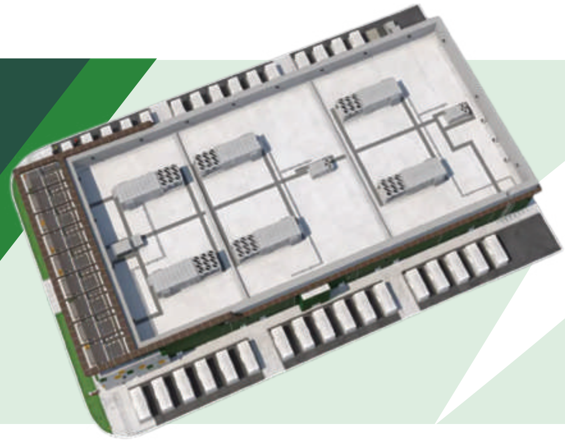
The technology comprises several components that work together to enable its functionality, this includes:



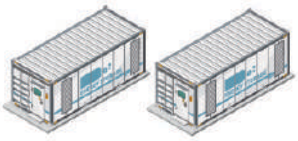
Battery Packs

These core units house multiple rechargeable batteries, efficiently storing and releasing energy.

Inverter

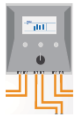
Converts battery output (DC) into usable alternating current (AC) for devices and grid connection.

Battery Management System (BMS)



Monitors and manages battery performance, charge state, and health, ensuring safety and optimal operation.

Cooling and Thermal Management



Maintains safe battery operating temperatures by managing heat generated during charging and discharging.

Control System

Maintains safe battery operating temperatures by managing heat generated during charging and discharging.

Energy Management System (EMS)

Analyses real-time data, energy prices, and grid conditions to optimise BESS operation for maximum efficiency and cost effectiveness.

DC-DC Converters

In certain configurations, these devices manage voltage levels for efficient energy transfer between components.

Enclosure and Safety Systems

Provides physical protection against environmental factors and implements safety measures to prevent hazards like thermal runaway and fires.

Monitoring and Control Interfaces

Allows real-time monitoring and adjustment of BESS performance and parameters.

Grid Connection and Power Electronics

Facilitates BESS interaction with the grid, delivering services such as frequency regulation, voltage support, and demand response.

Communication Systems

Enables communication with external entities, like grid operators, for coordinated and efficient operation.

Energy Storage System ESS

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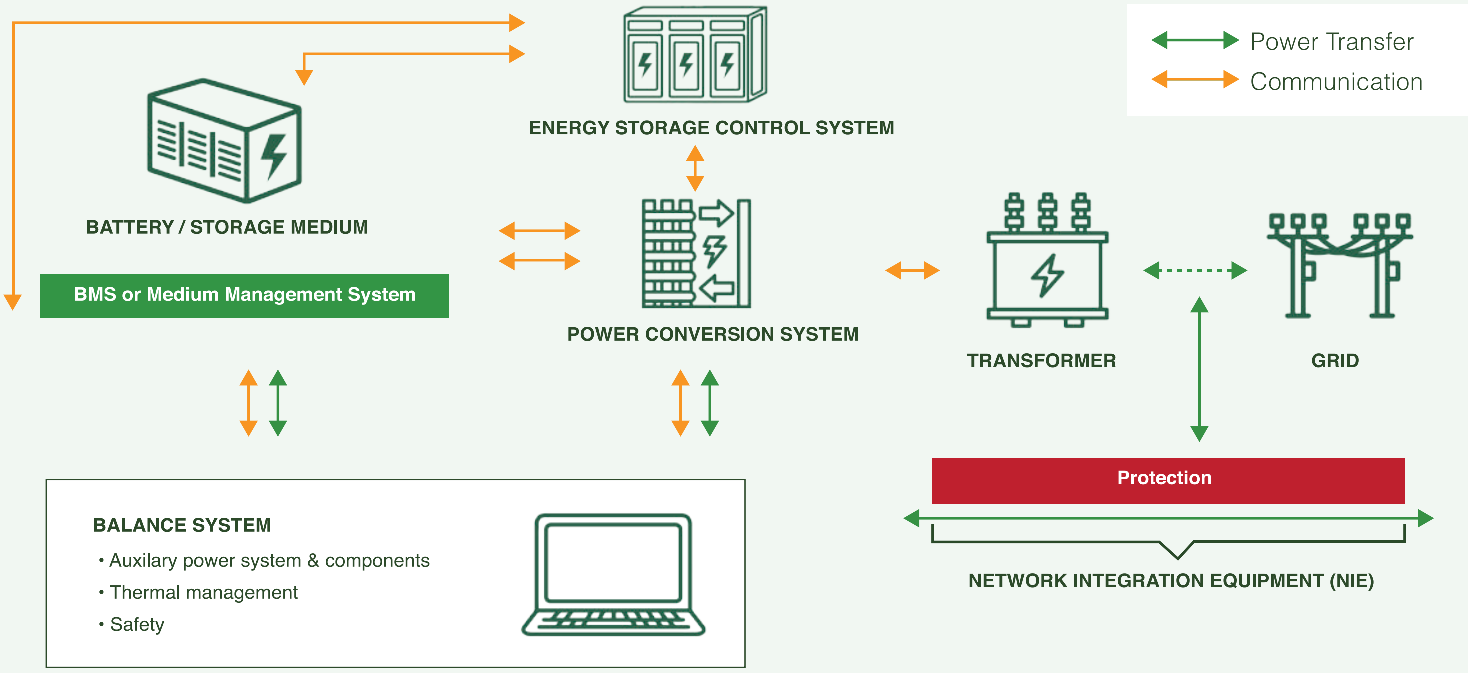


The diagram above shows the main components of the BESS, i.e. the battery (energy storage medium), Power Conversion System (PCS) and grid integration equipment. When required, the PCS is used to discharge/charge the battery and supply the energy into/from the network. The PCS is connected to a transformer which steps up the voltage required and then sends it into the Eskom grid.

BESS is a key element of modern energy systems, a versatile technology that can operate in various network configurations and structural setups.

On-grid and Off-grid:

BESS can be utilised in both on-grid and off-grid scenarios. On-grid refers to being connected to the main electrical grid, where BESS can provide services like load balancing, frequency regulation, and peak shaving. Off-grid refers to a situation where BESS is the primary source of power, often combined with renewable energy sources like solar or wind, to supply electricity in remote areas or during grid outages.

Centralised and Decentralised:

BESS can be part of centralised or decentralised energy systems. In a centralised setup, a large BESS could be located at a central point and provide services to the surrounding area. In a decentralised setup, smaller BESS units could be distributed across various locations, such as residential or commercial buildings, to enhance local power quality and grid stability.

The flexibility of Battery Energy Storage Systems to adapt to different network configurations and structural arrangements makes it a valuable tool for improving energy management, and overall energy reliability

Q: How is BESS maintained and serviced?

Maintaining involves a and blend servicing BESS of proactive monitoring, planned maintenance, potential component replacements, and technological advancements. Scheduled inspections follow manufacturer guidelines and operational experience, addressing physical and operational issues, ensuring safety, and cleaning components. BESS typically includes self-diagnostic tools that monitor system performance, identifying components requiring maintenance or replacement as they deteriorate.

As battery cells degrade, individual cells or entire packs may need replacement based on diagnostic data. Maintenance and operational practices for BESS are expected to advance with improving technology, increasing efficiency and reducing costs. This progress may also make BESS augmentation and replacement more accessible. Eskom leads the way in BESS implementation, serving as a commercial pioneer to validate its feasibility and benefits. Success here can expand BESS adoption and export beyond South Africa's borders.

Q: Can the BESS project alleviate loadshedding?

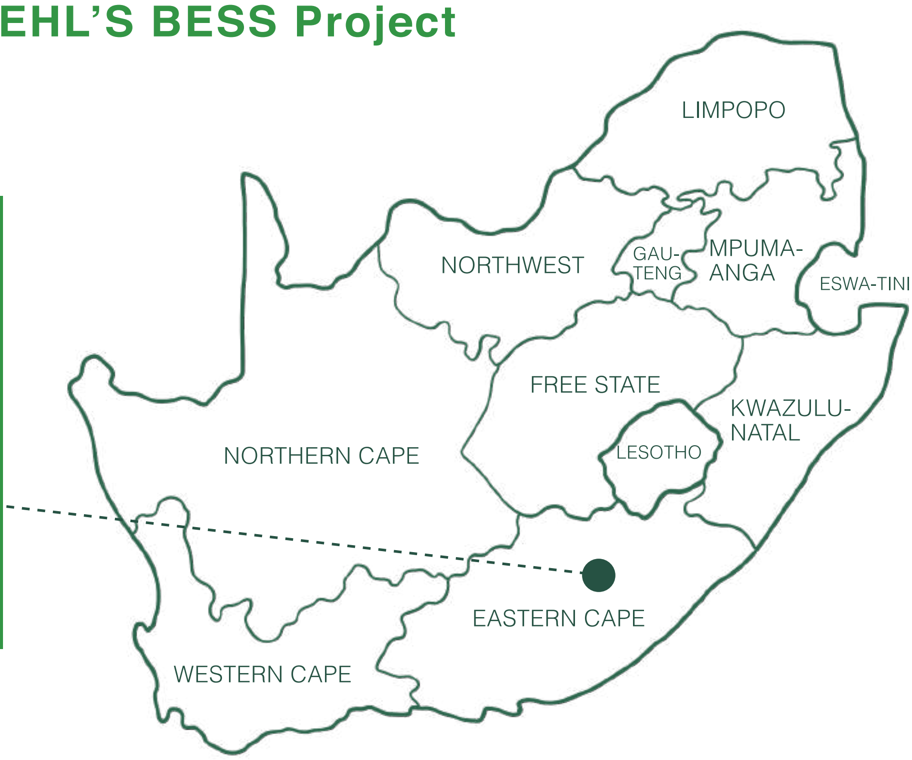
Yes. BESS discharges energy or a minimum of 4 hours.

MW/800 MWh holds a substantial amount of stored energy. This is equivalent to a single unit at Medupi Power Station running for an hour.

The technology should be strategically placed within the grid, especially near weak points or areas with voltage and power quality challenges, to help boost grid performance in those critical locations.

Q: Where is IEHL'S BESS Project located?

Location: 30KM between Queenstown and Tarkastad – Next to R61 road
Municipality: Enoch Mgijima Local Municipality
Ward: Ward 31
Village: Mitford Village, Ntabethemba
Land Coordinates: 31°55'32.5"S 26°32'09.6"E



Energy Arbitrage

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Average Cost of energy sold to Eskom by IPPs	188c/kWh
Average Cost of buying energy	45c/kWh

IEHL Limited BESS Capacity

Location	Queenstown
Size	416 MW/1000 MWh
Number of Units	160
CATL TENER Zero Degradtion ESS Capacity/Unit	2.6 MW / 6.25MWh

Total Capex - ESS and Grid Connection = ZAR 3.155 Billion

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