QS QUO VADIS- TECHNOLOGY, TRANSFORMATION AND TOMORROW

AAQS / INQS CONFERENCE 2026

Swakopmund, Namibia • 22–27 July 2026

Powering Africa's Fourth Industrial Revolution

The role of renewable energy and battery storage in closing Africa's power deficit — and how cost engineers and project managers turn ambition into abundant, self-sufficient, sustainable power

Renewable Generation • BESS • 4IR Growth • Bankable Delivery

Prepared by **Iyaloo ya Nangolo** Pr Quantity Surveyor, BSc QS, Hon (UCT) MBA Finance (UCT+LBS)

AGENDA

Table of Contents

THE STARTING POINT

Africa's power deficit, in scale

~600M

people across Africa still lack electricity access

~3%

of global electricity consumption despite ~20% of world population

65%+

of installed capacity sits in just South Africa and North Africa

$15B/yr

in incremental investment required to reach universal access

Source: IEA, Financing Electricity Access in Africa (2025); IEA World Energy Investment 2025; African Development Bank.

The deficit is now a growth constraint, not just an access gap. Population and electrification are growing in step, but industrial and digital ambitions — manufacturing corridors, agro-processing, data infrastructure — need firm, scalable power that outpaces basic access targets.

THE COST OF UNRELIABILITY

What outages actually cost consumers and businesses

1-5%

of GDP lost annually across Sub-Saharan African economies to power interruptions

R1.0B

estimated cost to South African businesses per load-shedding stage, per day

Up to 31%

of sales lost by firms in the worst-affected African markets due to unreliable supply

~71%

of Nigerian firms now own or share a diesel generator just to keep operating

Source: Oxford Policy Management; CSIR / FTI Consulting (South Africa load-shedding studies); Center for Global Development; African Development Bank, African Economic Outlook 2026.

The hidden costs run deeper than lost sales. Spoiled cold-chain inventory, damaged equipment from surges, foregone investment, and diesel backup running at several multiples of grid tariffs all fall hardest on SMEs and lower-income households — the consumers least able to absorb them.

WHY THIS MATTERS NOW

In the 4IR era, power is the precondition for growth

Digital economy & data

Cloud, AI compute, fintech and mobile money infrastructure all demand firm, 24/7 power — a single mid-size data centre can rival a small town's load.

Industrialisation & AfCFTA

Manufacturing, agro-processing and value-addition under the African Continental Free Trade Area depend on predictable, competitively priced electricity to be globally cost-competitive.

Productivity & jobs

Unreliable power forces firms onto costly diesel backup, eroding margins and discouraging the FDI needed to industrialise and create jobs for a young, growing workforce.

2026 outlook: ~17 GW of new capacity is expected across Africa this year, roughly half of it solar — the fastest-growing single technology on the continent.

Source: Rystad Energy, via African Business (Feb 2026).

THE GENERATION MIX

Renewables are the fastest, cheapest path to new capacity

Solar PV	Shortest construction lead times; module prices fell ~66% (2022-24), making utility-scale and distributed solar the default new-build technology across most markets.
Wind	Complements solar's diurnal profile; strongest in South Africa, Morocco and Egypt's coastal corridors, improving overall grid load-factor when co-optimised with PV.
Hydropower	Africa's traditional baseload backbone, but increasingly exposed to hydrology risk (droughts) — reinforcing the case for diversified, storage-backed portfolios.

The constraint is intermittency — which is exactly the gap battery storage is built to close.

INSIDE THE TECHNOLOGY

How a battery energy storage system actually works

Battery cells (LFP)

Lithium iron phosphate is now the default chemistry — no cobalt, strong thermal stability, and 4,000-6,000+ cycles at 80% depth of discharge.

Power conversion system

The bidirectional inverter converts DC battery power to grid AC and back, at 96-99% conversion efficiency, and can operate grid-following or grid-forming.

Battery management system

Monitors cell voltage, temperature and current in real time, enforces safe state-of-charge limits, and triggers curtailment within milliseconds of a fault.

Energy management system

The dispatch intelligence layer — reading load, weather and price signals to decide when to charge, discharge, or hold for grid services.

2-4 hrs	0.25-1C	90-95%	<20 ms	4,000-6,000+	$150-320/kWh
Duration	C-rate	Round-trip eff.	Response time	Cycle life	Turnkey cost

Grid-forming inverters — increasingly specified alongside BESS — synthesise voltage and frequency directly, letting storage stabilise weak or islanded African grids the way spinning generators traditionally did.

THE ENABLING TECHNOLOGY

BESS: turning variable renewables into firm, dispatchable power

What storage actually does

1. Shifts solar/wind generation from peak production to peak demand hours
2. Provides frequency and voltage stability services to weak or islanded grids
3. Displaces costly diesel backup for mines, industry and C&I users
4. De-risks PPAs by smoothing output volatility offtakers are exposed to

700%

possible growth in Africa's installed BESS capacity, 2025-2030

1.5-2.5 GW

of new BESS expected annually across Africa from 2026, led by South Africa, Egypt and Morocco

Source: Rho Motion BESS Forecast via Watson Farley & Williams (2026); NextG Power market analysis (2026).

THE DESTINATION

From deficit to abundance: a self-sufficiency framework

Sovereign generation

Domestic renewable capacity reduces exposure to imported fuel prices and FX-denominated energy bills.

Firm, dispatchable supply

Storage and grid flexibility convert intermittent renewables into baseload-equivalent, industrial-grade power.

Sustainable growth path

Lower-carbon capacity additions position African economies competitively as global capital favours green industrial output.

Regional integration

Cross-border power pools and interconnectors let surplus renewable generation reach deficit markets, smoothing continental supply.

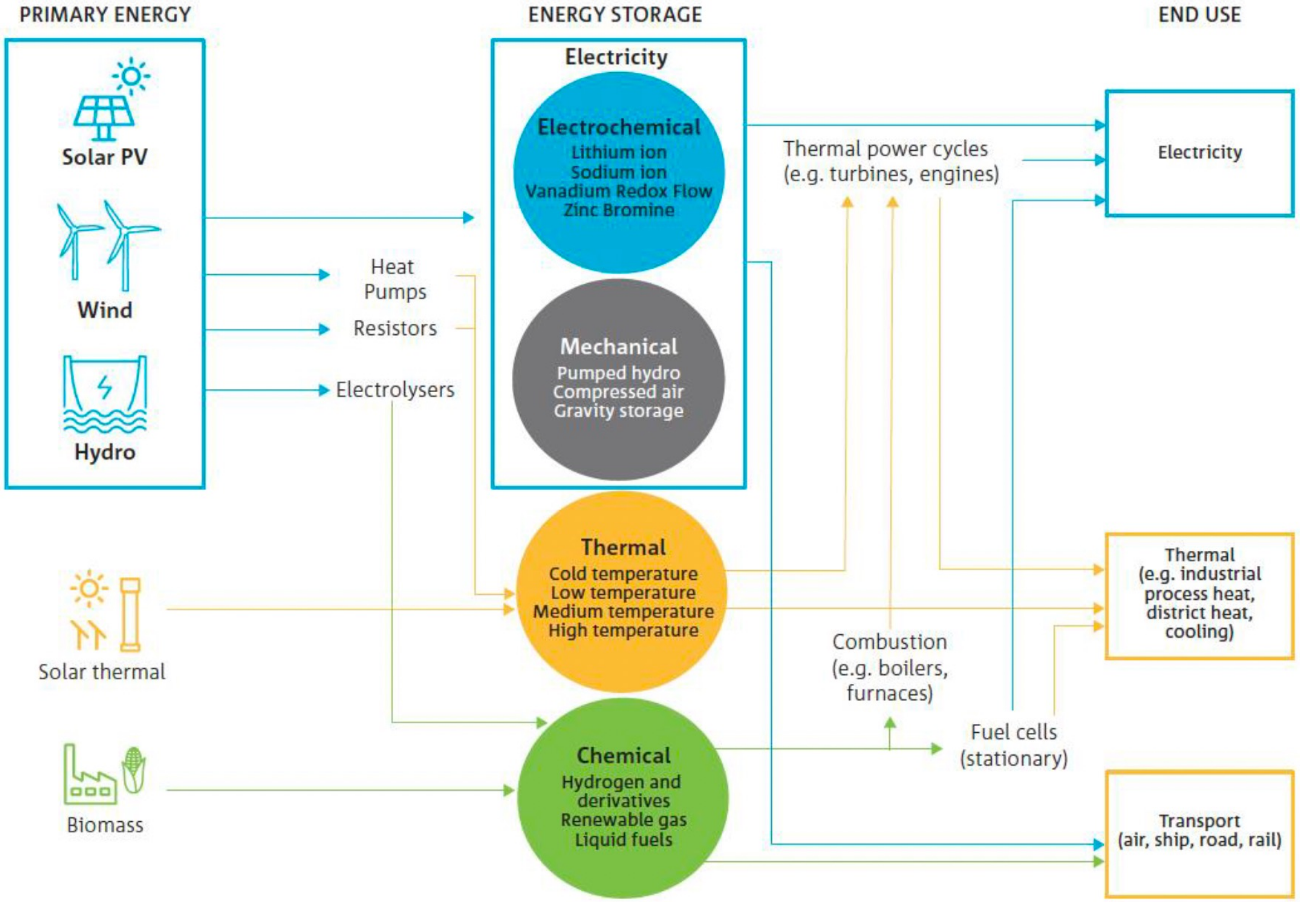
Abundance is not just more megawatts — it is power that is reliable, affordable, and bankable enough to sustain 4IR-era industries.

BESS & LEVERAGING PROVEN TECHNOLOGY

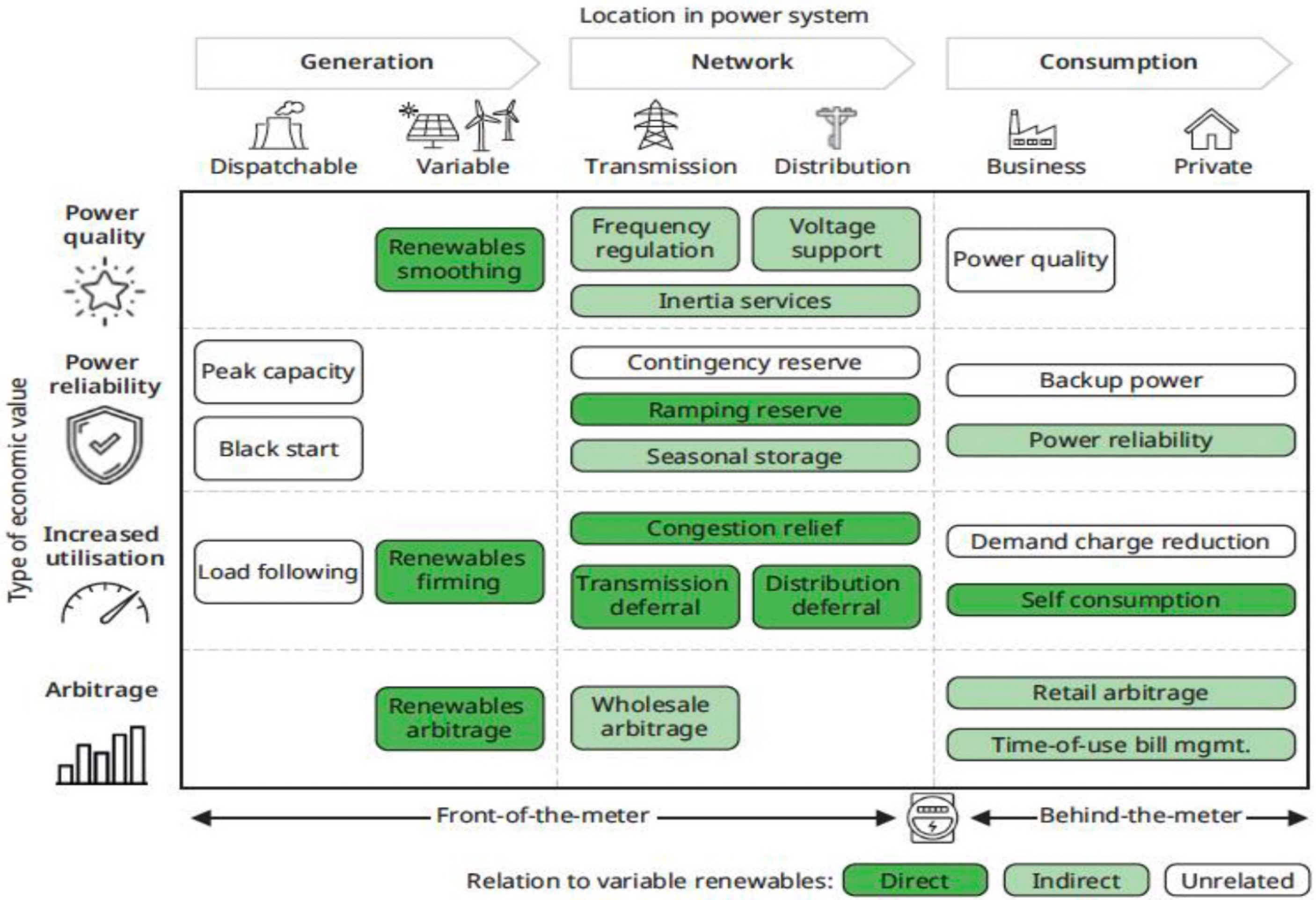
Key Takeaways

- **Various types of electricity storage technologies / systems**
  - Thermal, mechanical, electrical, chemical, electrochemical => all at different stage of maturity and technology readiness (leading the way: Lithium-ion, Vanadium RF, pumped hydro, H_2, steam accumulator)
  - 4 groups depending on duration: long (H_2), medium-long (hydro, compressed air), short-medium (batteries), short (flywheel)
- **Various applications of storage, each with different requirements**
  - Different storage services for system operators, utilities and customers
  - Different storage applications (23x) have different requirements (annual cycle, discharge duration, response time, etc)
- **Storage costs (measured in LCOS) are falling fast**
  - Current costs and how fast they fall with scale-up determines which technologies win each application => storage costs are getting cheaper, fast (batteries will soon cross the USD 100/MWh watershed)
  - Lifetime cost (LCOS) is the metric for comparing the different technologies – using cost ranges makes the most sense
  - For most electricity storage projects, the most important drivers of lifetime cost are the <u>technology's investment cost</u>, the application's <u>annual cycle frequency</u>, its <u>discharge-duration requirement</u>, and the <u>applied discount rate</u>

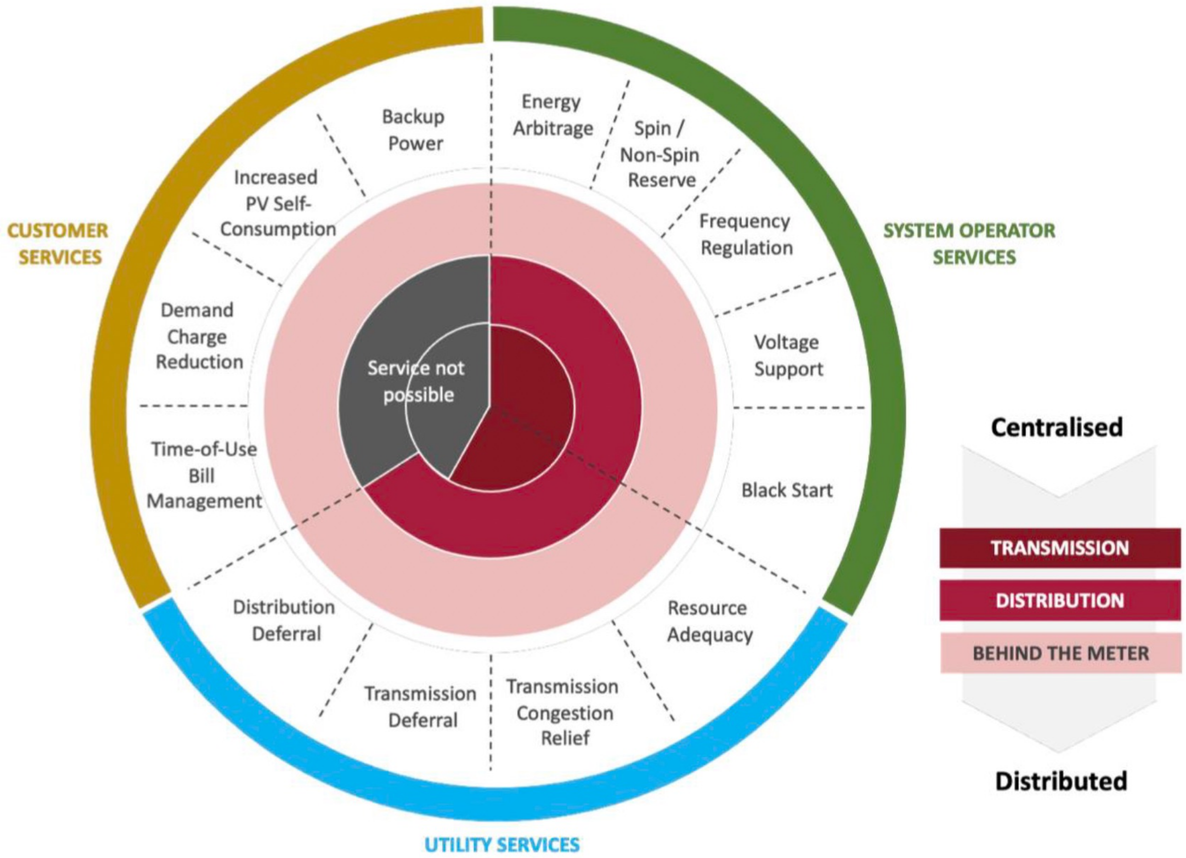
ROLE OF RE STORAGE IN AN ENERGY SUPPLY SYSTEM..



THE 23 MOST COMMON ELECTRICITY STORAGE APPLICATIONS..



BESS APPLICATIONS w/o. SYSTEM OPERATORS, UTILITIES AND CUSTOMERS



Ambition is not the constraint — bankable execution is

Where projects stall

- Underestimated CAPEX and schedule slippage erode investor confidence at financial close
- Offtaker credit risk (utility payment delays) inflates the cost of debt and equity
- Weak cost baselines make DFI and lender due diligence slower and more conservative
- Execution delays push projects past tariff and currency assumptions used at bid stage

What de-risks delivery

- Rigorous, benchmarked cost estimating from feasibility through FID
- DFI and blended finance structures (e.g. ATIDI/RLSF-type credit enhancement) that price offtaker risk down
- Disciplined schedule and interface management across EPC, grid and land
- Transparent change-control and reporting that lenders can rely on post-financial close

Quantity Surveyors/Cost Engs: The discipline that makes projects financeable

Estimating & benchmarking

Class-appropriate CAPEX/OPEX estimates for solar, wind and BESS scopes, benchmarked against comparable African builds to defend assumptions in due diligence.

LCOE & value engineering

Stress-tests design choices against levelised cost of energy, identifying trade-offs between upfront cost and long-run tariff competitiveness.

Cost control & change management

Tracks commitments against budget through EPC execution, flagging variance early enough for corrective action before it threatens financial covenants.

Risk-adjusted contingency

Builds defensible contingency and escalation allowances that satisfy lender and DFI scrutiny without over- or under-pricing the project.

Project managers: the discipline that turns bankable into built

Schedule & interface control

Sequences grid connection, land, permitting and EPC milestones so delays in one workstream don't cascade into the whole project.

Stakeholder & offtaker alignment

Coordinates utilities, regulators, communities and DFIs so technical progress and financing conditions move in step.

Risk & contract management

Owns the EPC/O&M contract risk allocation, keeping performance guarantees and liquidated damages enforceable, not theoretical.

Commissioning to COD

Drives grid-code testing and commissioning of solar, wind and BESS assets to firm commercial operation date, protecting revenue start dates lenders modeled.

WHY BOTH, TOGETHER

Cost discipline + delivery discipline = bankable, replicable projects

1. Feasibility

Cost engineer sets the estimate baseline; PM scopes execution plan and risk register

→

2. Financial close

Joint cost/schedule package gives lenders and DFIs a defensible basis for terms and covenants

→

3. Construction

Cost control and interface management keep budget and schedule aligned through EPC execution

→

4. Operation

Actuals feed back into future project benchmarks — sharpening the next deal's bankability

This is the same discipline DFIs and lenders already expect on Zanzibar-style solar-plus-storage builds and Kenyan PPA-backed transactions — applied at continental scale.

CALL TO ACTION

A practical path to power abundance

1	**Prioritise storage-paired renewables**	Mandate BESS co-location on new solar/wind tenders to convert variable output into firm, creditworthy capacity.
2	**Standardise bankable cost baselines**	Deploy consistent, benchmarked cost-engineering practice across the project pipeline to speed DFI due diligence.
3	**Strengthen delivery governance**	Embed disciplined PM practice — schedule, interface and contract control — from feasibility to commissioning.
4	**Scale blended and regional finance**	Expand DFI/ATIDI-type credit enhancement and cross-border power pooling to unlock private capital at volume.

Abundant power is Africa's 4IR dividend

Renewables and storage set the technical direction. Cost engineering and project management make it financeable, deliverable, and repeatable — at the scale self-sufficiency requires.

Thank you | Asante Sana | Shookran | Danke Schön | Discussion!