Global sustainable prosperity driven by Africa's green industrialisation

Battery Energy Storage System (BESS) Analysis

July 2025

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Truly green factories – can Africa produce for the world?

- Achieving net zero by 2050 requires greening everything we produce and consume.
- However, most forms of renewable energy, notably solar and wind, are not always available.
- As a result, fully renewably driven industrial production is typically assumed to be impossible.
- Intermittency is much lower in most African countries than in current global production centres.
- We compare the lowest-cost system of solar, wind, and battery storage that provides reliable[1] baseload.
- African locations can be far more efficient, with smaller and cheaper systems, **enabling renewably driven global production.**

[1] For the analysis, we use 98% availability as proxy for "reliable" – using 100% creates asymptotes in analysis. Analysis is based on 16 years of geolocated hourly energy data for both wind and solar (good locations for each in each country)

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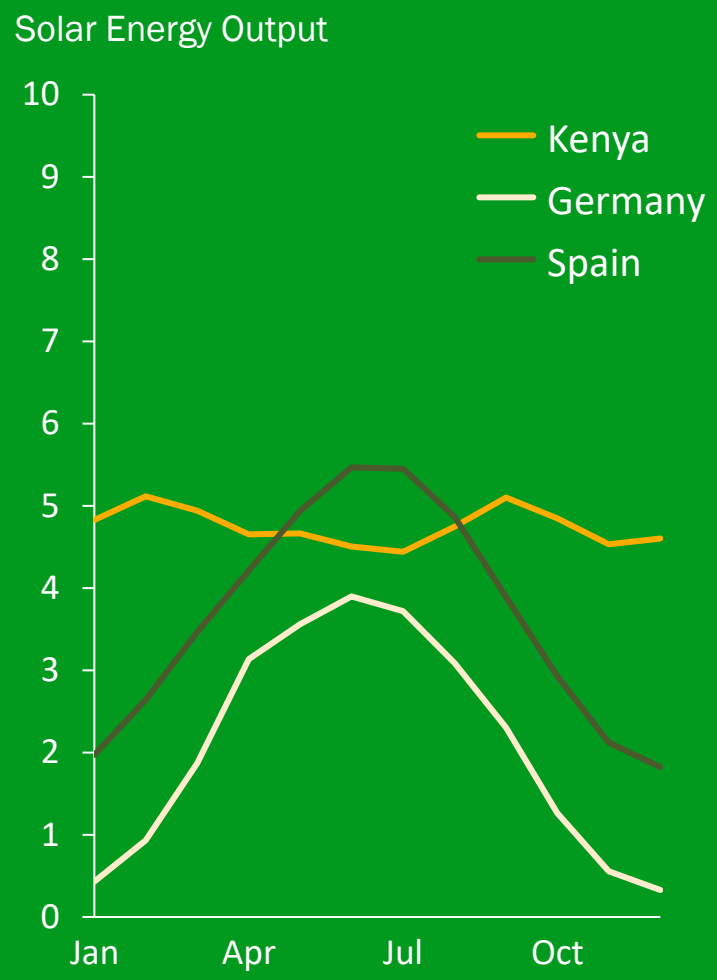
Africa may have great and stable solar potential, but Europe's wind potential is better – **how will this play out?**

Long-term Average Output[1]

Top performing Germany, Kenya, and Spain locations [kWh/kWp/day]



[1]Results are based on 16 years of geolocated hourly energy data for both wind and solar (2005-2020)

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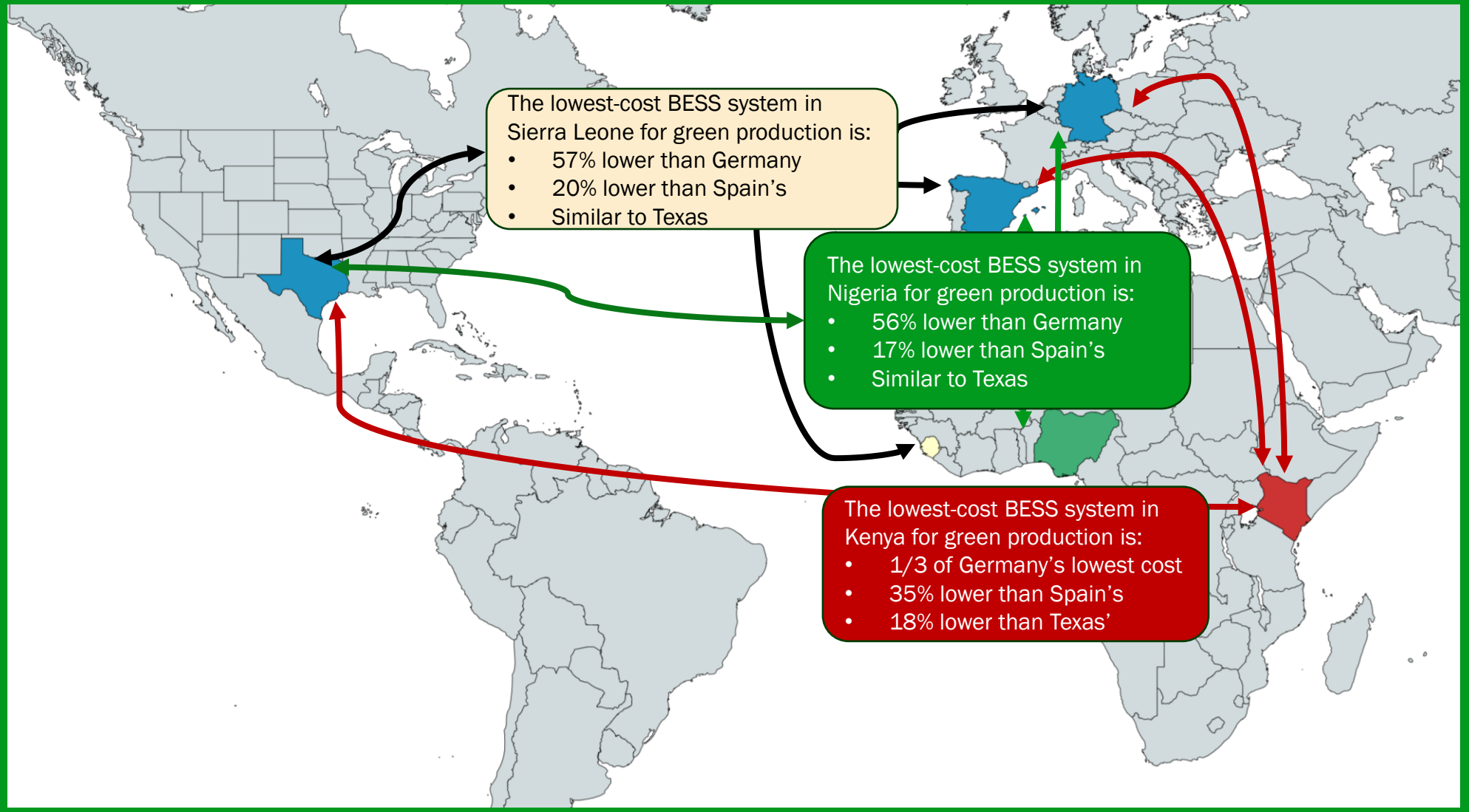
African countries can realise much lower BESS costs with industrial performance level than current industrial hubs



- Based on the lowest-CAPEX configuration of a BESS system using wind, solar, and battery storage in each location
- Total BESS system is scoped to meet a set, 24/7 power demand based on 16 years of hourly data[1]
- This allows to serve industrial demand
- Cost differential is largely driven by size differential – with lower seasonality and higher capacity factors, African countries can meet this need with a much smaller system – with secondary driver being higher proportion of (lower cost) solar vs wind

[1] Continuous availability modelled at 98% to avoid mathematical errors caused by asymptotic issues if using 100%

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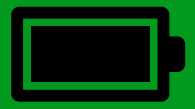
Location matters: the lowest-cost BESS to provide reliable 24/7 power **costs 3 times as much** in Germany as it does in Kenya

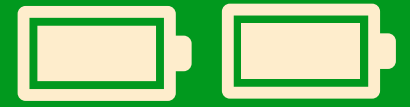
Kenya

Germany

~3x system capacity



~2x battery size



~3x costs

Analysis based on 16 years of geolocated hourly energy data for both wind and solar (good locations for each in each country)

Key cost assumptions based on most recently available installation cost data of $ 1,160 per kW onshore wind capacity, $ 758 per kW solar capacity, and $ 273 per kWh battery capacity

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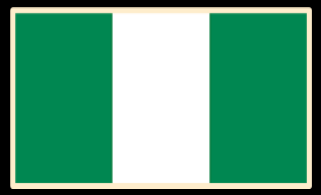
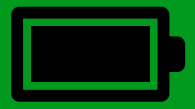


Location matters: the lowest-cost BESS to provide reliable 24/7 power **costs 2 times as much** in Germany as it does in Nigeria

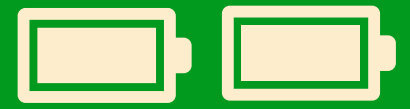
Nigeria

Germany

~2x system capacity



~2x battery size



~2x costs

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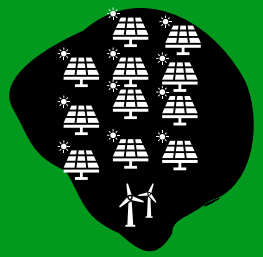
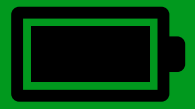
Location matters: the lowest-cost BESS to provide reliable 24/7 power **costs 2 times as much** in Germany as it does in Sierra Leone

Sierra Leone

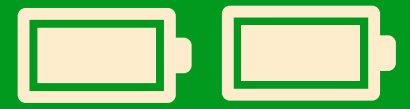
Germany



~2x system capacity



~2x battery size



~2x costs

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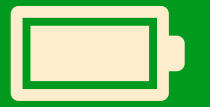
Kenya also beats Europe's top location, Spain, which has ~ **50% higher costs** than Kenya

Kenya

Spain



~2x system capacity

~1x battery size

~1.5x costs

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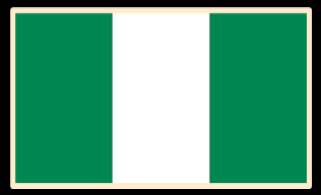

Nigeria also beats Europe's top location, Spain, which has **21% higher costs** than Nigeria

Nigeria

~1.3x system capacity

~1x battery size

~1.2x costs

Spain

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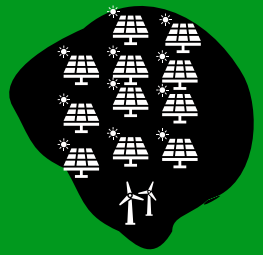
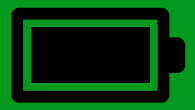
Sierra Leone also beats Europe's top location, Spain having which has **1.3x the cost**

Sierra Leone

Spain



~1.3x system capacity



~1x battery size

~1.3x costs

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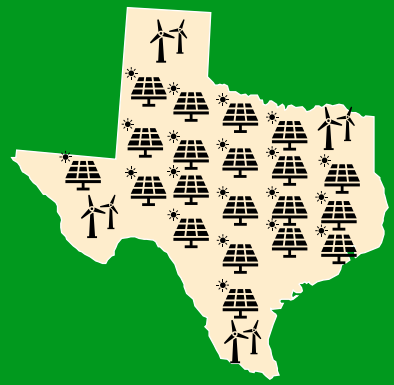
Kenya also outperforms Texas, which has **22% higher costs** than Kenya

Kenya

Texas



~1.3x system capacity

~1x battery size

~1.2x costs

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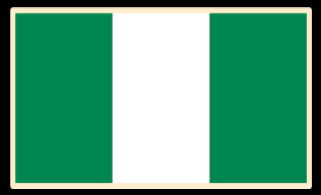
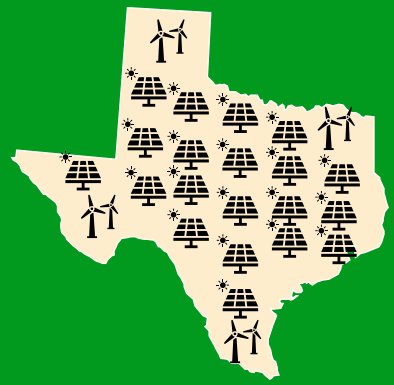
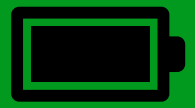
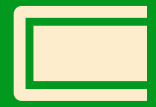


Nigeria and Texas show very similar performance for this system

Nigeria		Texas
	~1x system capacity	
	~0.8x battery size	
	~1x costs	

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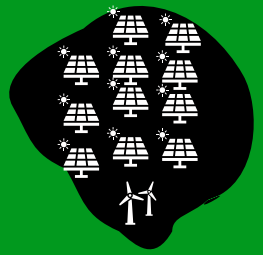
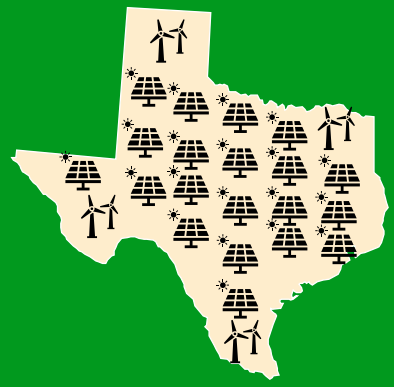
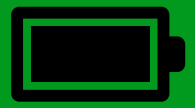
Sierra Leone and Texas show very similar performance for this system

Sierra Leone		Texas
	~1x system capacity	
	~1.1x battery size	
	~1x costs	

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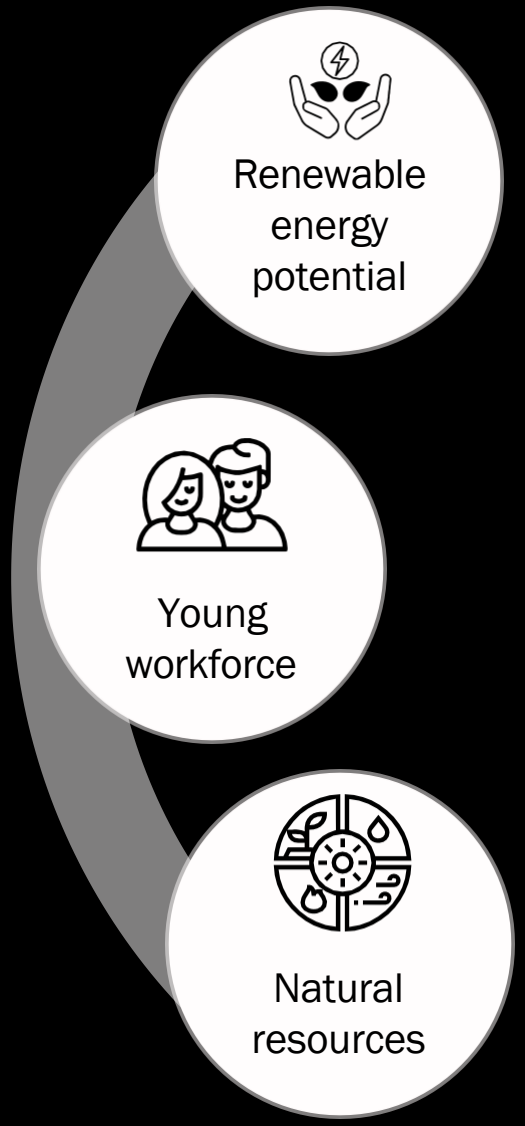
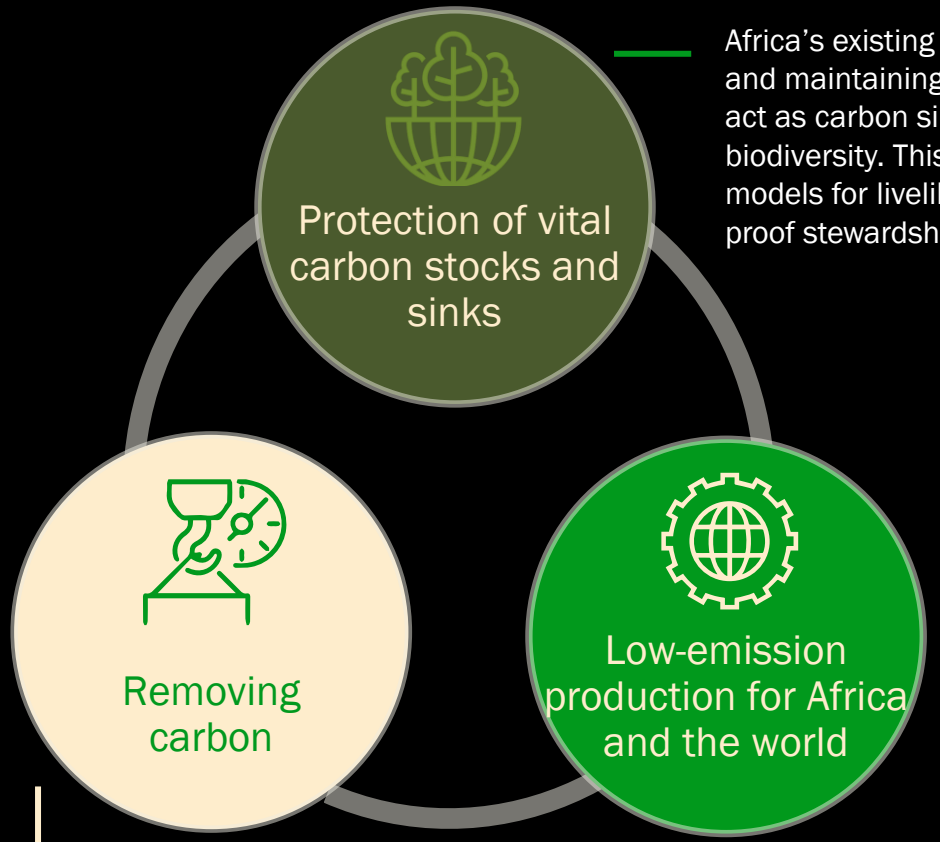
This green production potential is one of the ways in which Africa's economic assets can drive **Climate Positive Growth**

Africa's Assets



Climate Positive Growth Pathways



Africa's existing carbon stocks are a vital 'buffer' for the world – and maintaining their size and health ensures they continue to act as carbon sinks, 'lungs of the world' and essential habitat for biodiversity. This requires novel approaches to realizing viable models for livelihood retention and improvement through climate-proof stewardship of these resources.

Onshoring and reshoring production allows Africa to meet its growing local demand and serve global demand for green products without growing its footprint by leapfrogging to widespread adoption of green technologies and practices. Africa's regenerative agricultural potential can serve a growing global demand for climate-smart food, whilst restoring soils and biodiversity. Green-from-the-start industrial development allows Africa to become a global green manufacturing hub.

Recognising the anticipated need for carbon removals, ramping up Africa's potential for to do this at scale through a combination of restoring and expanding its natural carbon sinks, land use and ecosystem management, and investment in emerging hybrid and engineered removal technologies.

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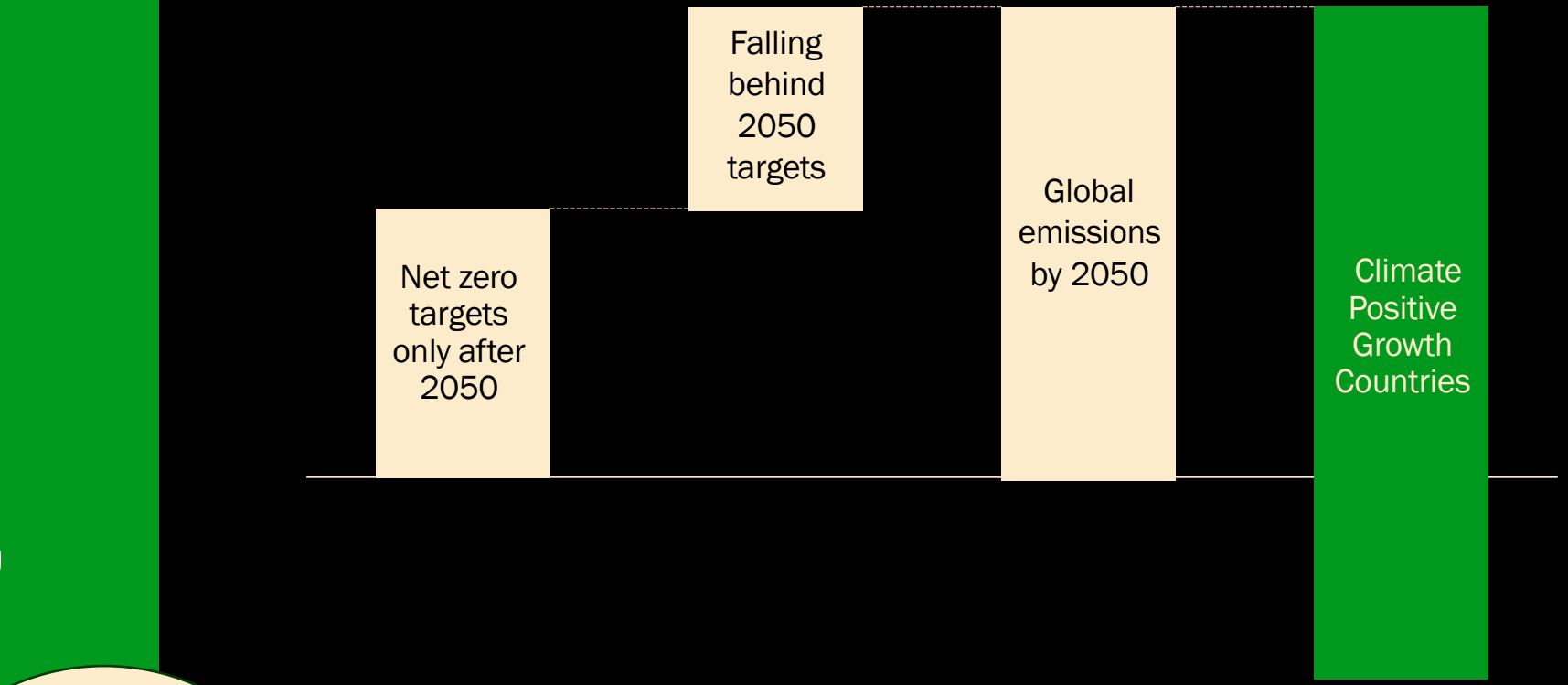
Climate Positive Growth in Africa can meet global demand for green products and carbon removal to reach global net zero by 2050

Global regulation, like CBAM will **drive demand** for green industrialisation goods and services in Africa, if implemented in an inclusive way

Global greenhouse gas emissions levels by 2050



Some countries can't aim to reach net zero by 2050

Many countries with net zero goals are not on track

Which sets us up to miss net zero goals by 2050...

...Unless some countries provide massively **net negative emissions**

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Africa's renewable energy potential can drive green industrialisation

Africa's renewable energy potential is **50 times the world's** estimated electricity demand by 2040

Africa can provide energy access for all Africans by 2030. A renewable-focused path to this, can be **30% cheaper**, reducing emissions by ~80% from generation and **reducing emissions per MWh by more than 90%.** Yet it does need anchor demand to create a bankable investment case for the 40% higher upfront investment required.

CAP-A Dalberg Research Energy Dashboard: Powering Africa's Future

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