Transforming Sierra Leone through Climate Positive Growth

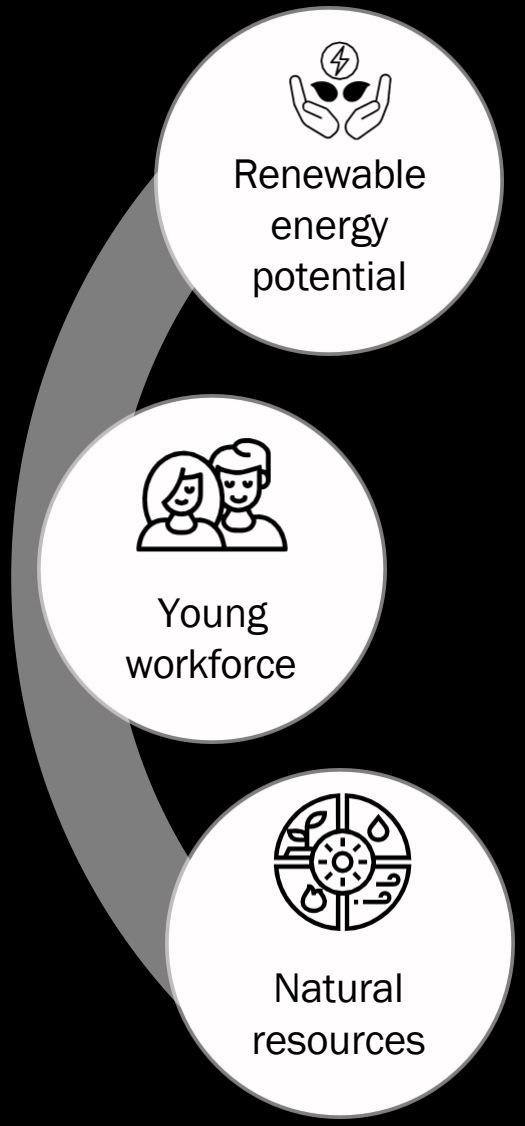
Battery Energy Storage Analysis

October 2023

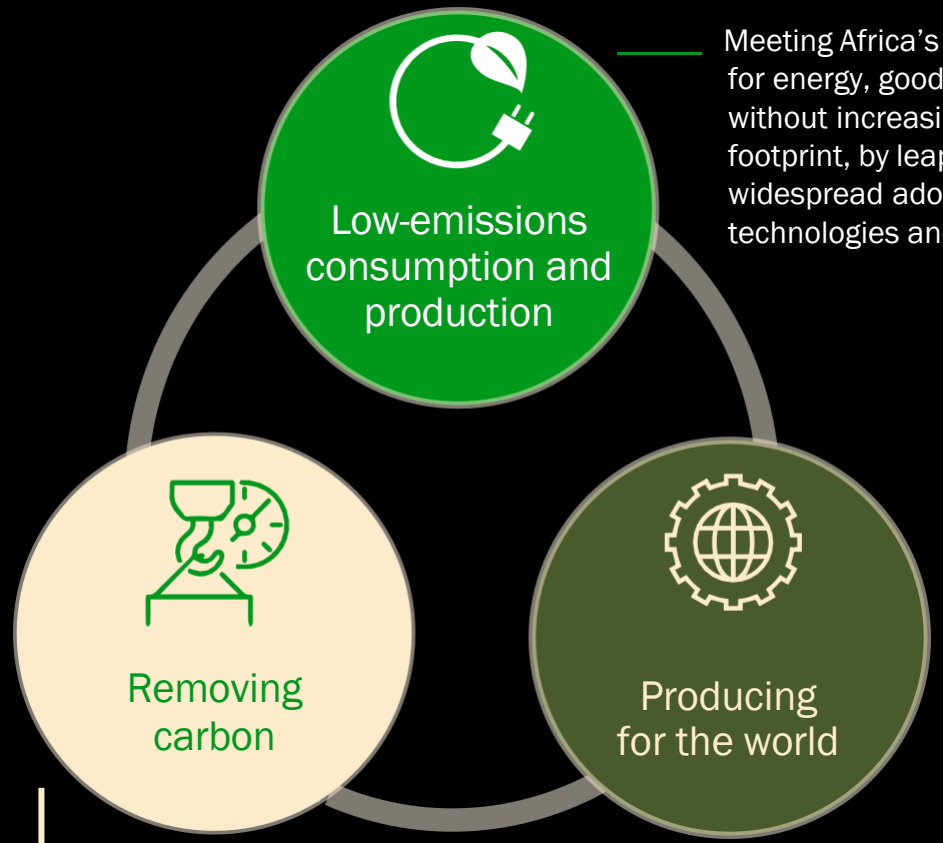
Climate Action Platform Africa

Africa's economic assets give it the potential to tap three pathways to drive Climate Positive Growth

Africa's Assets



Climate Positive Growth Pathways



Meeting Africa's own growing demand for energy, goods and services without increasing the continent's footprint, by leapfrogging to widespread adoption of green technologies and practices

Utilising green manufacturing capacity to provide climate friendly production (expansion) potential for the world, as an increasingly competitive green manufacturing and energy hub that accelerates the greening of global industry

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

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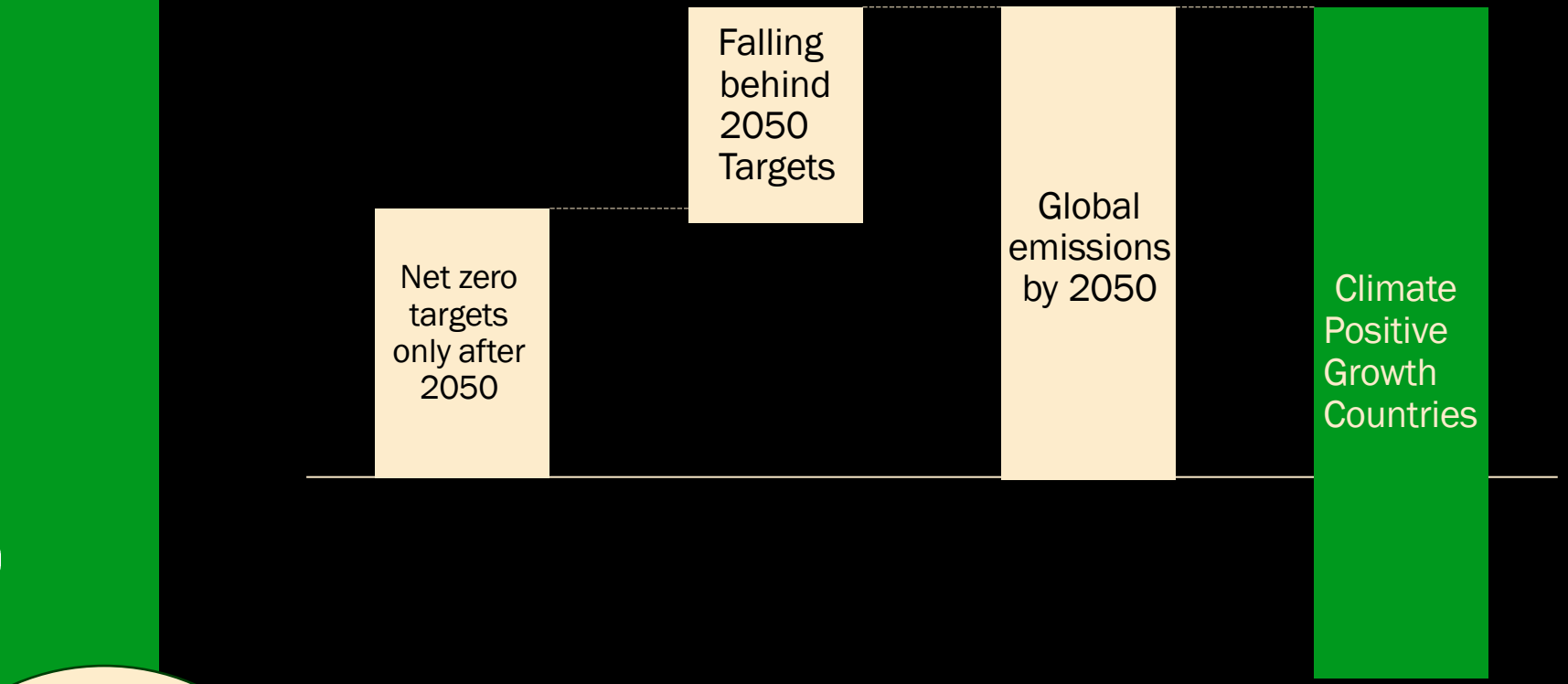
Climate Positive Growth in Africa can meet global demand for green products and carbon removal to reach global net zero by 2050

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



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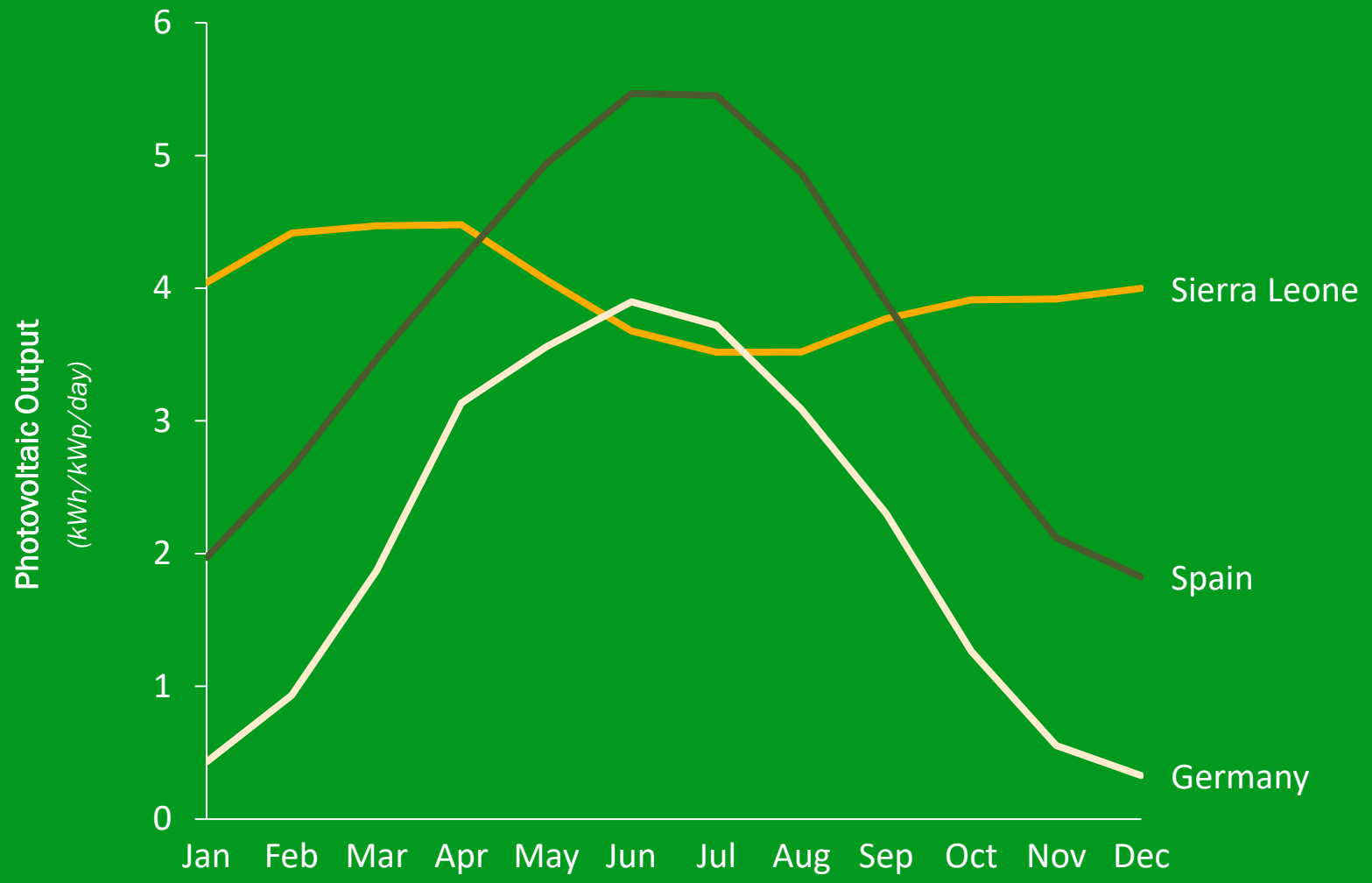
Africa's low seasonal variation can create renewable baseload

Long-term Average Solar Energy Output

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



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Solar PV in Sierra Leone vastly outperforms Europe's industry centre – and even Europe's top PV spot

The same battery-supported PV system in Sierra Leone will enable a baseload that is **~8 times as big** as Germany

Similarly, the same PV system can support a baseload that is **80% greater** in Sierra Leone as in Spain

Performance data of the same PV system at a baseload that would have a 98% reliability in Sierra Leone

PV system specifications

Peak Capacity: *10MWp* *Reliability:* *98%*

Battery capacity: *50MWh*

PV system specifications

Peak Capacity: *10MWp* *Baseload:* *1.5MW*

Battery capacity: *50MWh*

Analysis conducted using hourly energy output from specified PV system specifications

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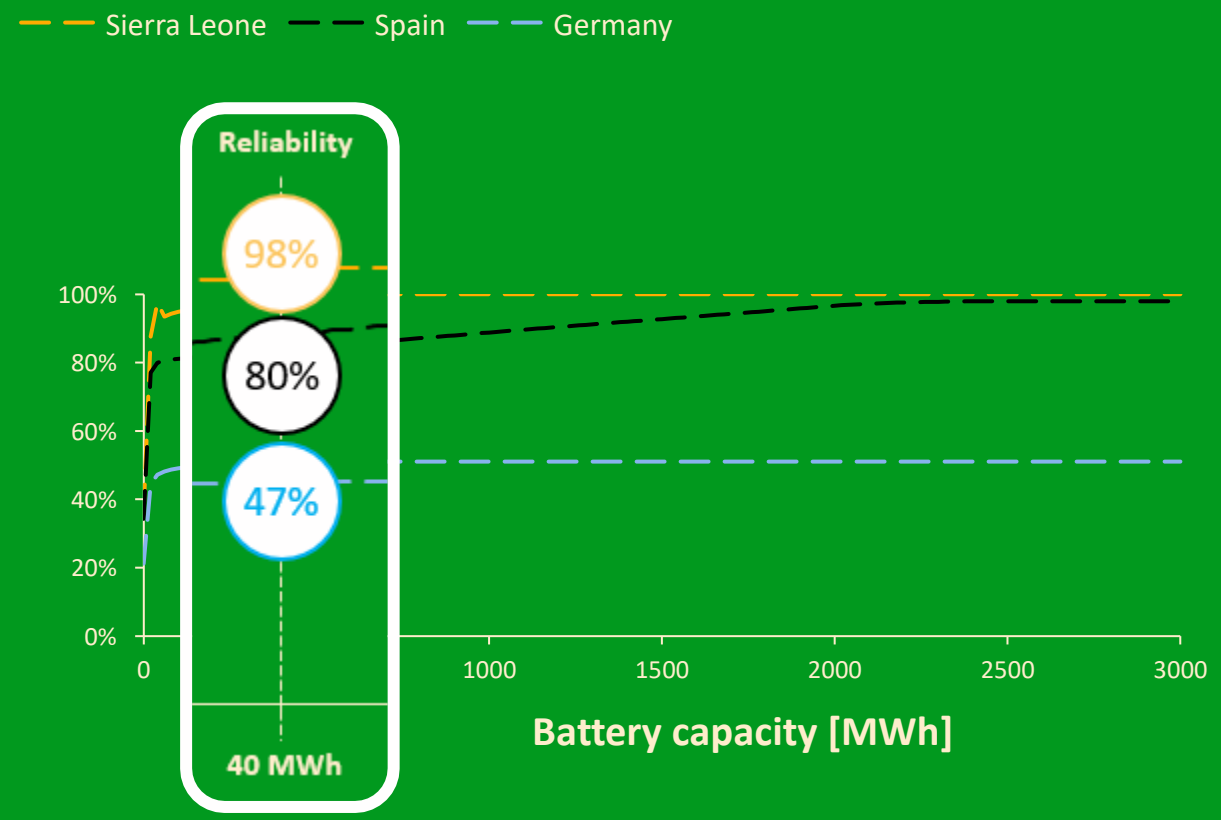
When maximising PV system performance, the difference is even starker

To reach 98% reliability, the same PV system in Spain will require a battery capacity **over 50 times as big** as required in Sierra Leone to deliver the same baseload reliably

The same PV system set-up that allows Sierra Leone to deliver that same baseload with **98%** reliability, yields only **80%** reliability in Spain, and a mere **47%** in Germany

Performance the for same installed capacity and baseload in 3 locations (baseload set by max theoretical potential in Spain)



PV system specifications

Peak Capacity: *10MWp* *Baseload:* *1.54MW*

Analysis conducted using hourly energy output from specified PV system specifications, with 15 years of geolocated hourly solar energy output data

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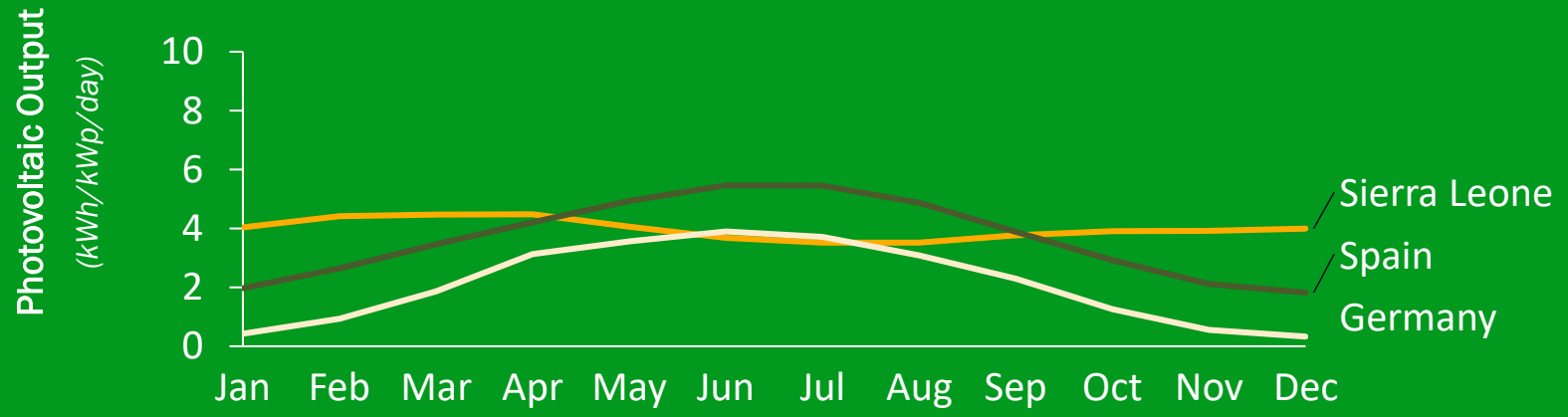
Africa may have great solar but Europe's wind potential is better...

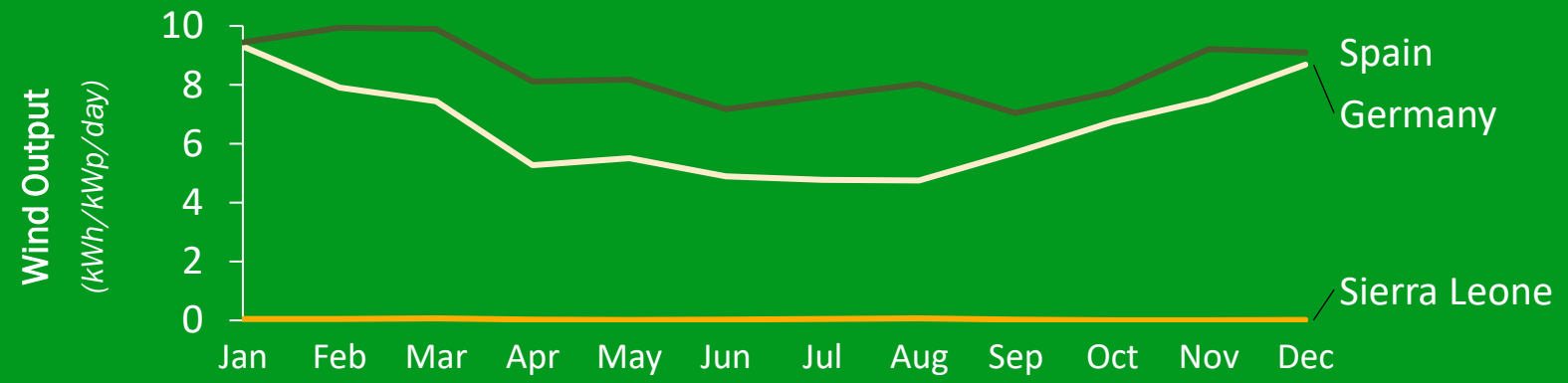
Long-term Average Solar Energy Output

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



Long-term Average Wind Energy Output

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



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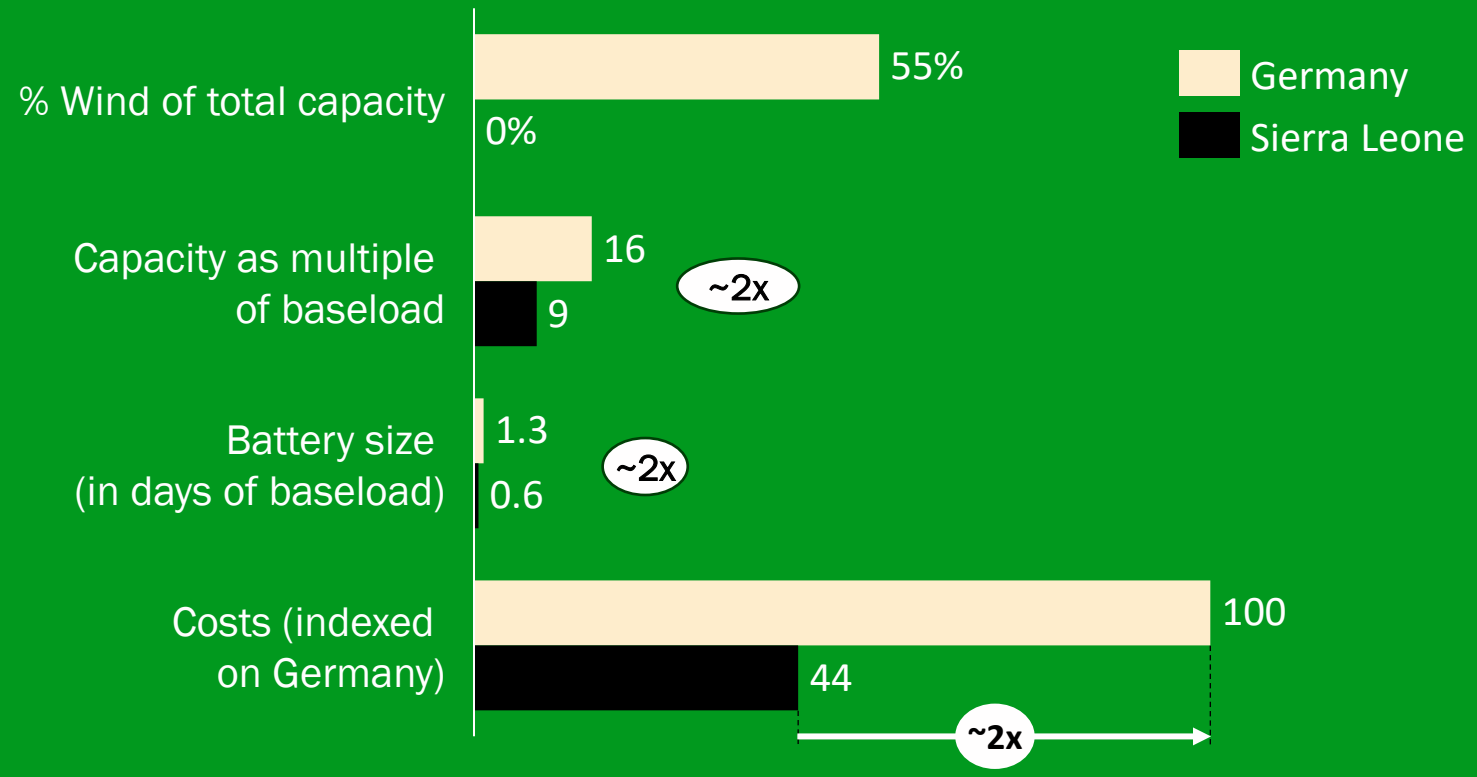
The optimal set-up of wind, solar, and battery storage to generate baseload reliably, is nearly twice the capacity, twice the battery size, and nearly 2 times the costs in Germany when compared to Sierra Leone

System parameters for the cheapest total system (combining wind, solar, and battery storage), to deliver a continuous 2 MW baseload, at 98% reliability



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 $ 1,274 per kW onshore wind capacity, $ 867 per kW solar capacity, and $ 400 per kWh battery capacity

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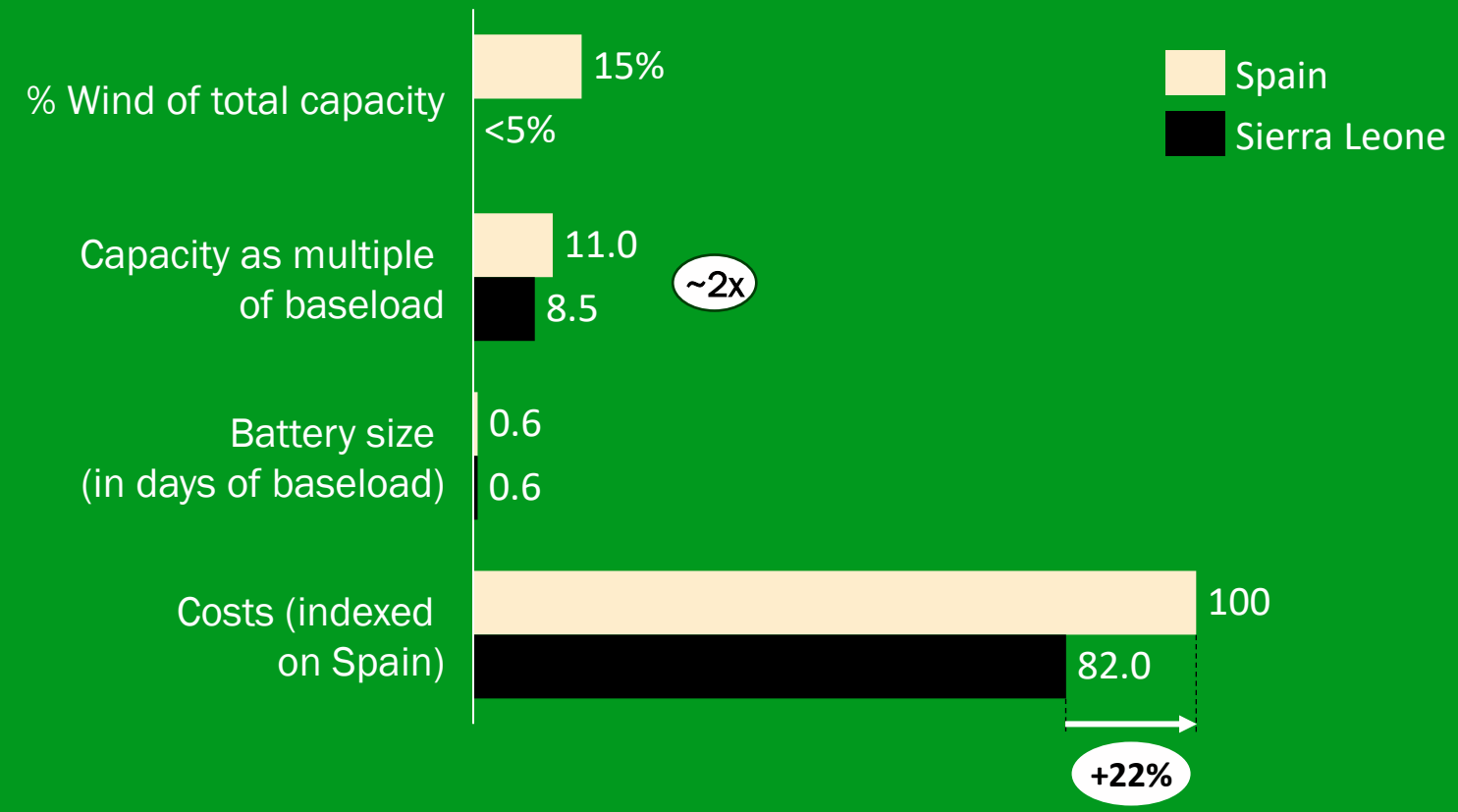
Sierra Leone also beats Europe's top location, Spain, which has over 20% higher costs than Sierra Leone

System parameters for the cheapest total system (combining wind, solar, and battery storage), to deliver a continuous 2 MW baseload, at 98% reliability



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