



From Resource Advantage to Net Zero reality: Three Breakthrough Technologies for Oman & OQ

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Introduction

Framing a personal journey

- Thanks to JCCP
- My personal decarbonization journey



Decarbonization Principles



It's all about maximizing shareholder value

Energy transition should be about economic sense

Economically viable technologies exist today that drive decarbonization and they keep improving in efficiency and reducing in costs

Profit from abatement curves guide investments

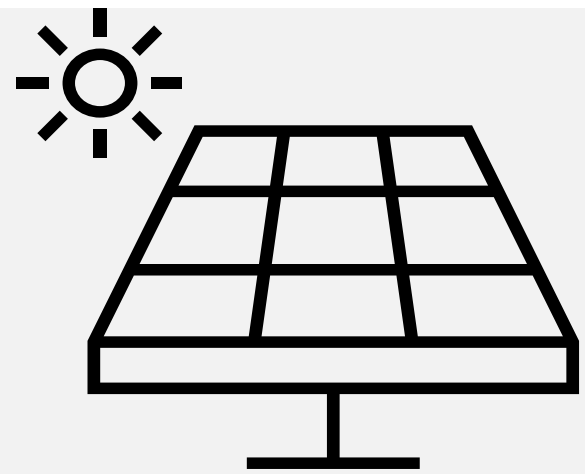


Lowest cost of energy (LCOE)

Renewables make Financial & Economic sense



1970s to today



Solar module prices have dropped by over 99.9%

1970s: \$100 per watt

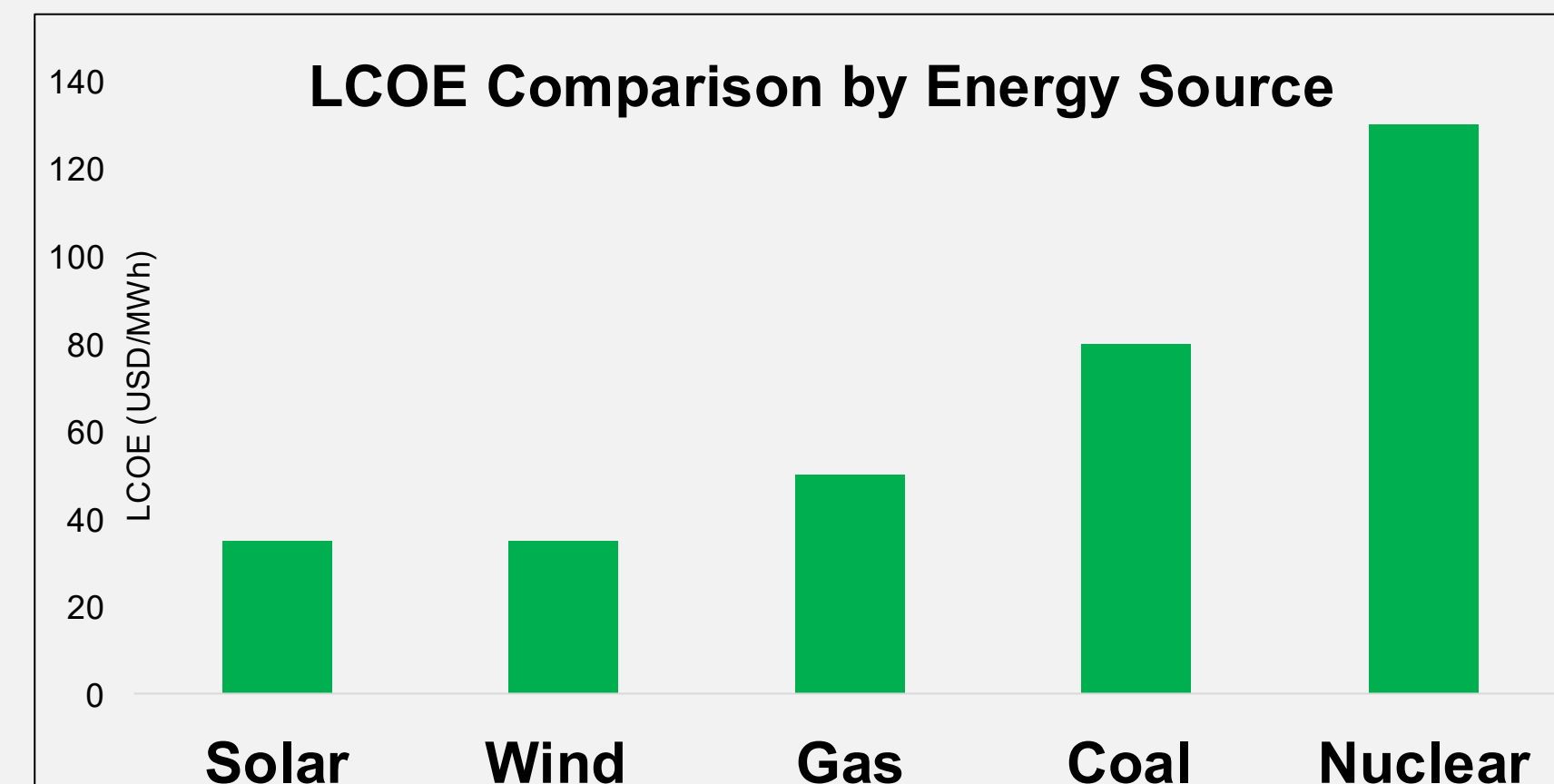
2025: \$0.10-\$0.20 per watt

Since 2010

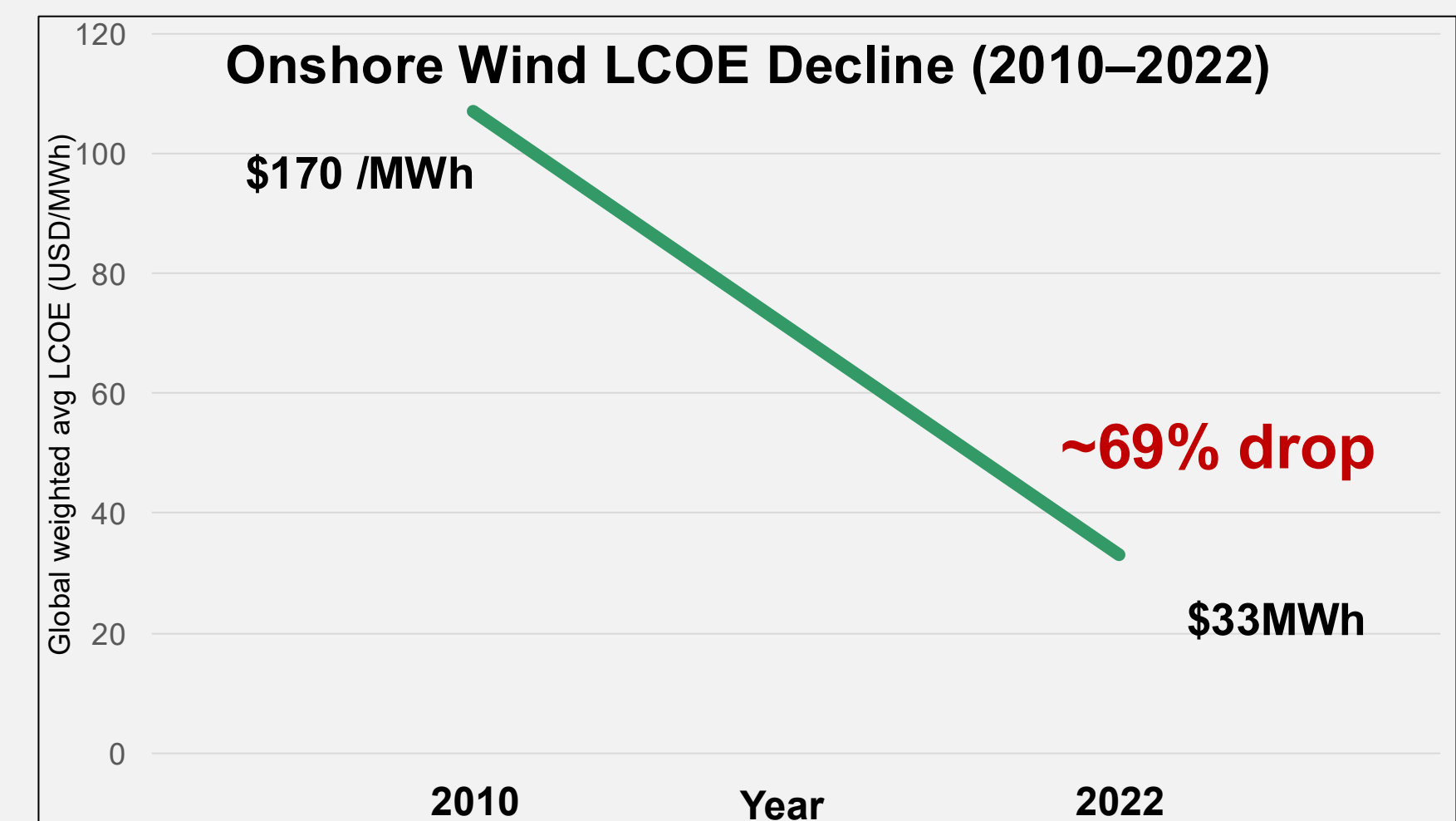
Solar and wind: generally the cheapest LCOE options (\$40-\$50/MWh)

Significantly undercutting fossil fuels and nuclear (\$40-\$220+/MWh)

Coal: higher & less competitive, especially with carbon pricing (\$70-\$170+/MWh)



Onshore wind: Global weighted average LCOE dropped by ~69% (from \$107/MWh in 2010 to \$33/MWh in 2022)



A composite background image showing a close-up of a white wind turbine blade in the foreground, with a grid of solar panels visible in the background under a blue sky with clouds.

Lowest cost of energy (LCOE)



Renewables make Financial & Economic sense

In the last five years (2020-2025)

Renewable energy deployment experienced unprecedented growth, far outpacing fossil fuels

- accounted for **over 90% of total global power capacity expansion**

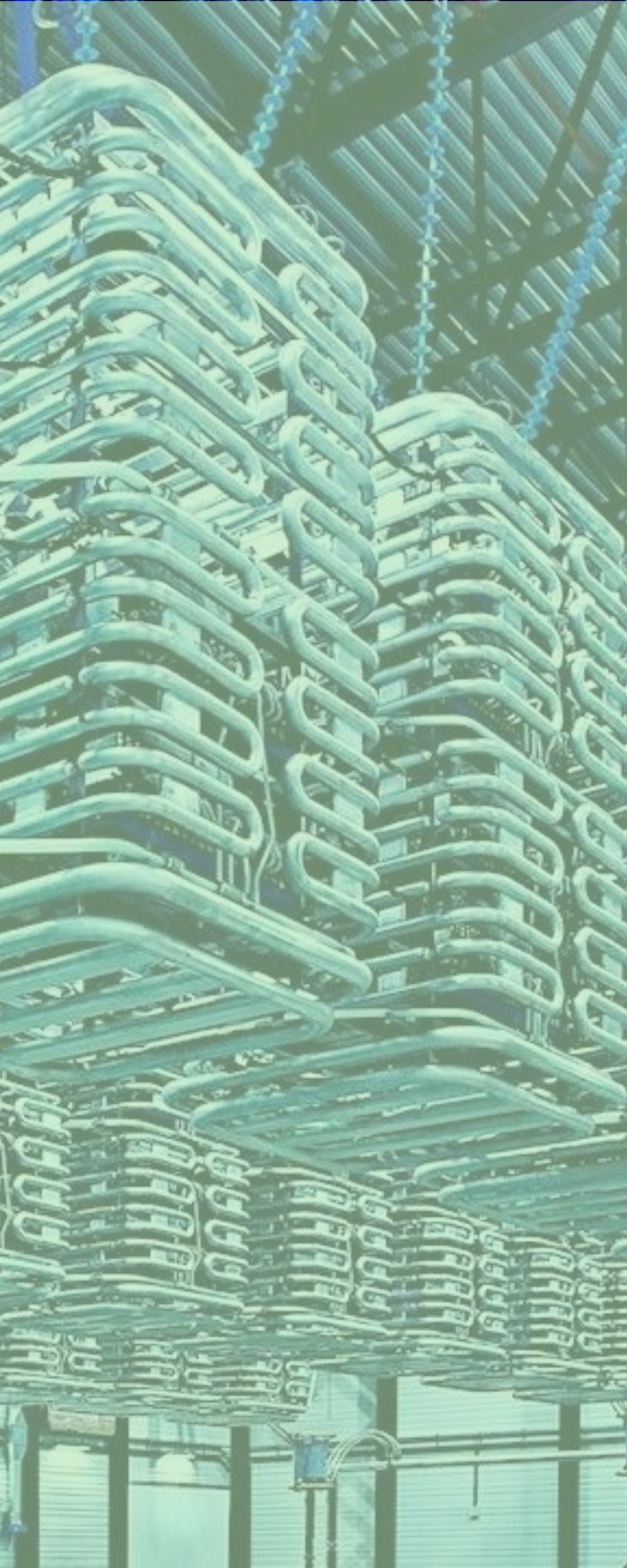
In 2024 alone, 585 GW of new renewable capacity was installed

- **record rate of annual growth**

Perovskite-Silicon Tandem Cells

Represent the **most significant breakthrough**, stacking a thin layer of perovskite on top of traditional silicon to capture a broader spectrum of light

Lab efficiencies have reached over 34.6%, with commercialization beginning in 2025 through companies like Oxford PV and Caelux



Transmission

HVDC for long distances



Collocating is the best solution

**Voltage Source Converters
(VSC) HVDC**

**HVDC is making transmitting
power over long distances
500KM+ more economical**

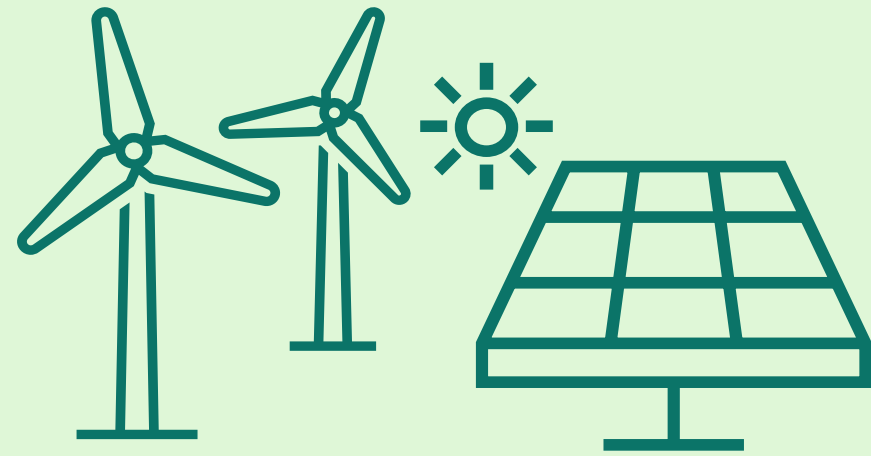
525 kV VSC Systems

**Industrial clustering ensures scale
efficiencies**

Dynamic Line Rating (DLR)

Managing Intermittency

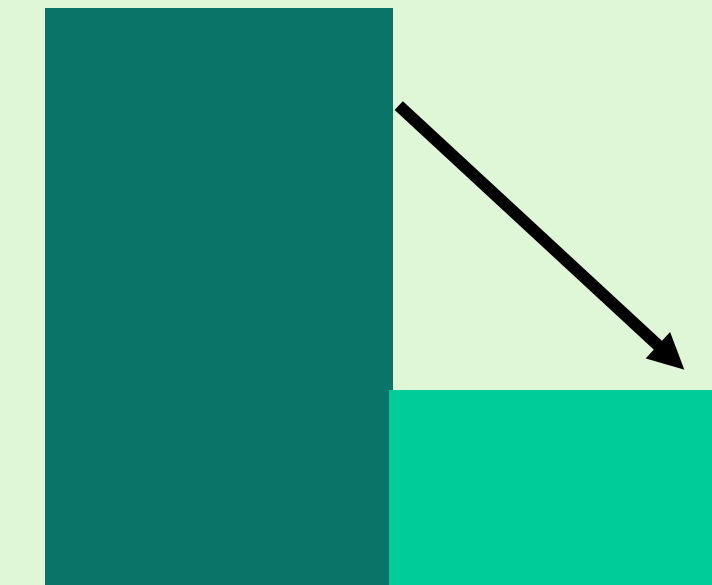
Energy Storage & Complementarity of supply



**Wind – Solar
complementarity**



**BESS: 31-40% drop in
turnkey system costs
from 2024 to 2025**



**BESS: 88% drop in
installation costs**



**156 GWh deployed by
October'25**

38% yearly jump



**Sodium-ion battery
promising over 50%
reduction in costs
compared to LiPo**

The diagram illustrates the power flow in a solar system. On the left, a **Solar PV Array** (represented by a blue grid) is connected via a solid orange line to an **MPPT** (Maximum Power Point Tracking) controller (a yellow box with a lightning bolt icon). Below the MPPT controller, a dashed line labeled **DC** connects it to a **Battery Pack** (a blue box with three battery icons). From the Battery Pack, a solid blue line connects to an **Inverter** (a white box with a sine wave icon). Below the inverter, a solid blue line connects to an **AC** output (a circle with the letters AC). A dashed line also connects the MPPT controller directly to the inverter.

CO₂ Mitigation, Capture & Storage



Elimination strategies

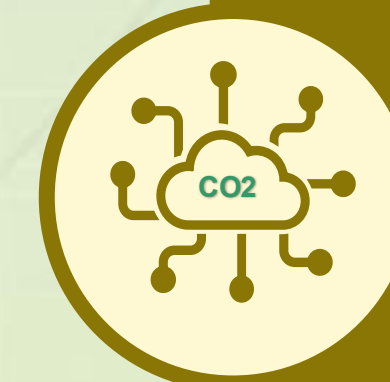


Industrial Clustering to reduce infrastructure needs

Geological Solutions - Olivine



**Energy Efficiency - Process Optimization
- Energy management solutions**
Artificial Intelligence



CO₂ eliminations technologies

Methane Pyrolysis



Conclusion

Improving Profits

- Energy generation, storage and transmission key enablers with declining costs and improved efficiencies.
- Mindset shift from Cost of Abatement to Profit from Abatement
- Decarbonization technologies have become an economic enabler in many countries which lack fossil fuels.