

Renewable Power Generation Costs in 2023

Presenters:

Deborah Ayres & Lourdes Zamora, Renewable Energy Costs and Outlook team

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SPEAKERS



Deborah Ayres
IRENA



Lourdes Zamora
IRENA



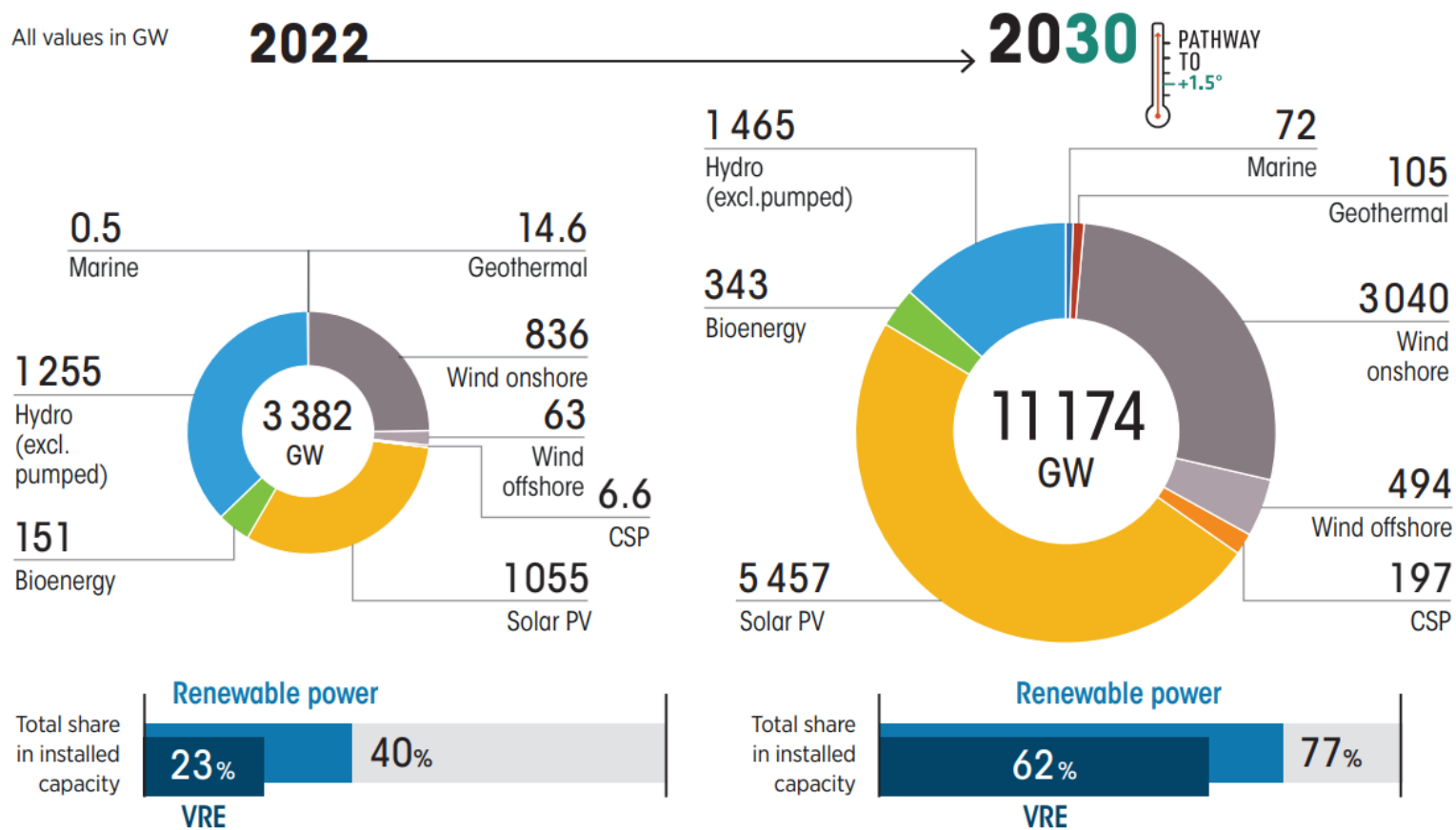
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3x RE Capacity
2x Energy Efficiency
by 2030

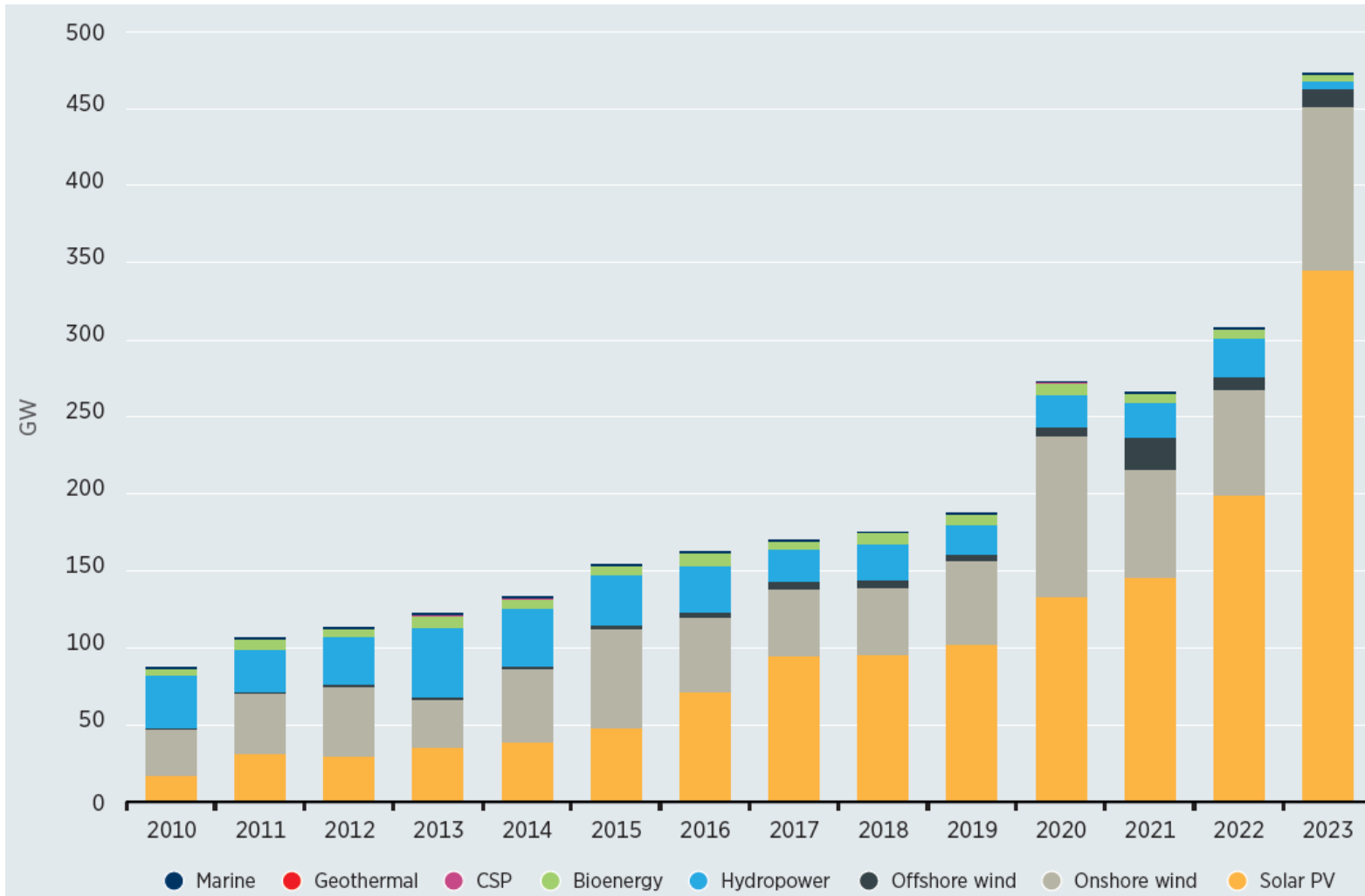


An increase of around 7.8 TW in eight years

An average new capacity addition requirement of 974 GW each year

IRENA (2024), Tripling renewable power by 2030: The role of the G7 in turning targets into action

Global annual new capacity additions of renewable power, 2010-2023



2022-2023

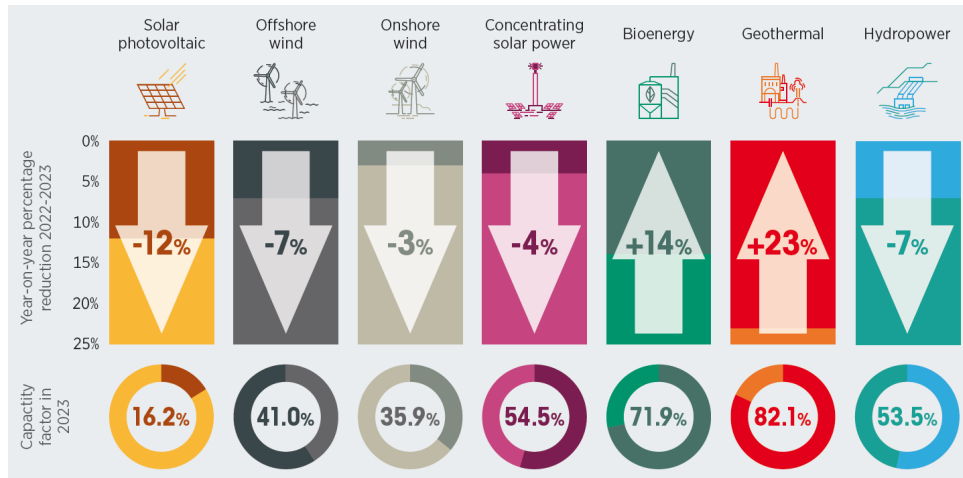
- **Installed capacity** 473 GW
- **Capacity additions** increased +54%

Solar PV accounted for 73% of new installed capacity

Other significant contributors were:
Onshore and Offshore Wind,
Hydropower and Bioenergy

Cost reductions over the last 13 years for main RE technologies

Global weighted-average LCOE decreased in 2023 compared to 2022 – except for bioenergy and geothermal



2010-2023

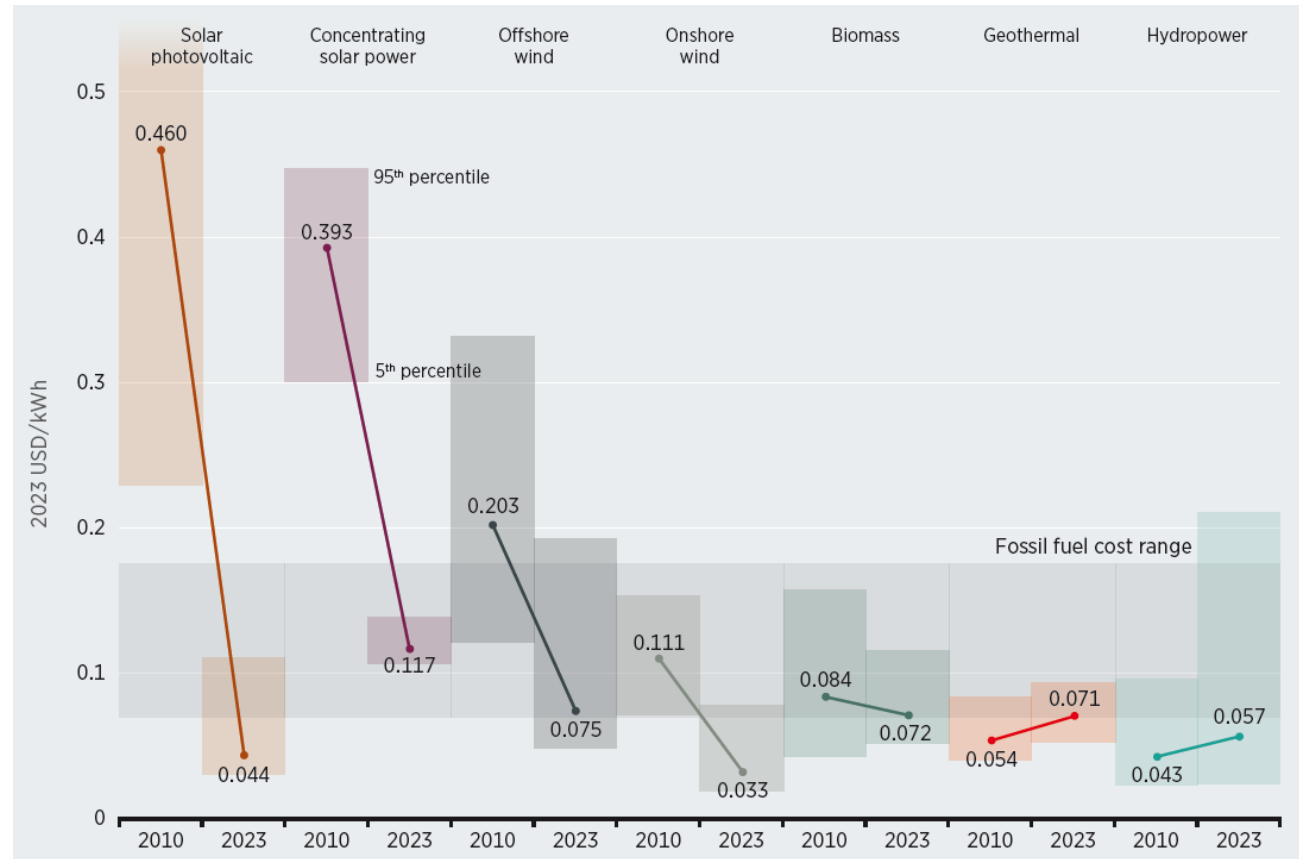
the global weighted average LCOE decreased

Solar PV 90%

Onshore Wind 70%

CSP 70%

Offshore Wind 63%

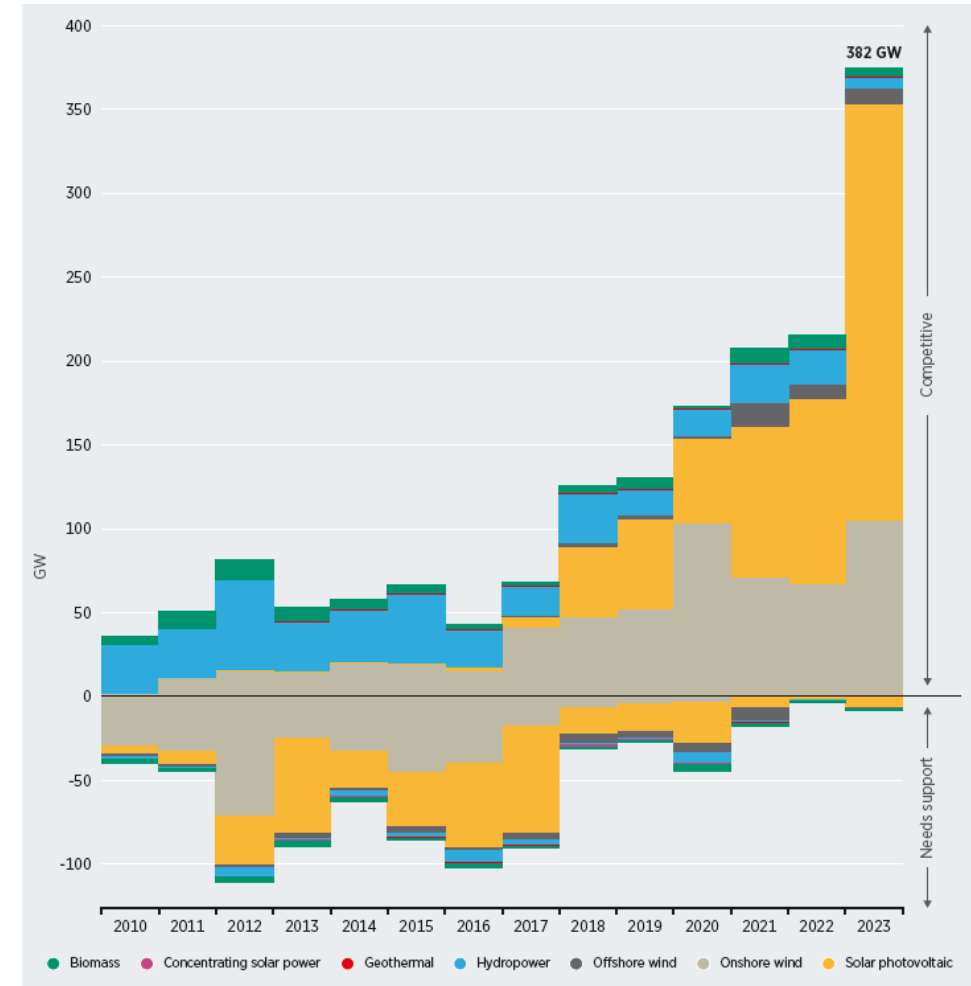
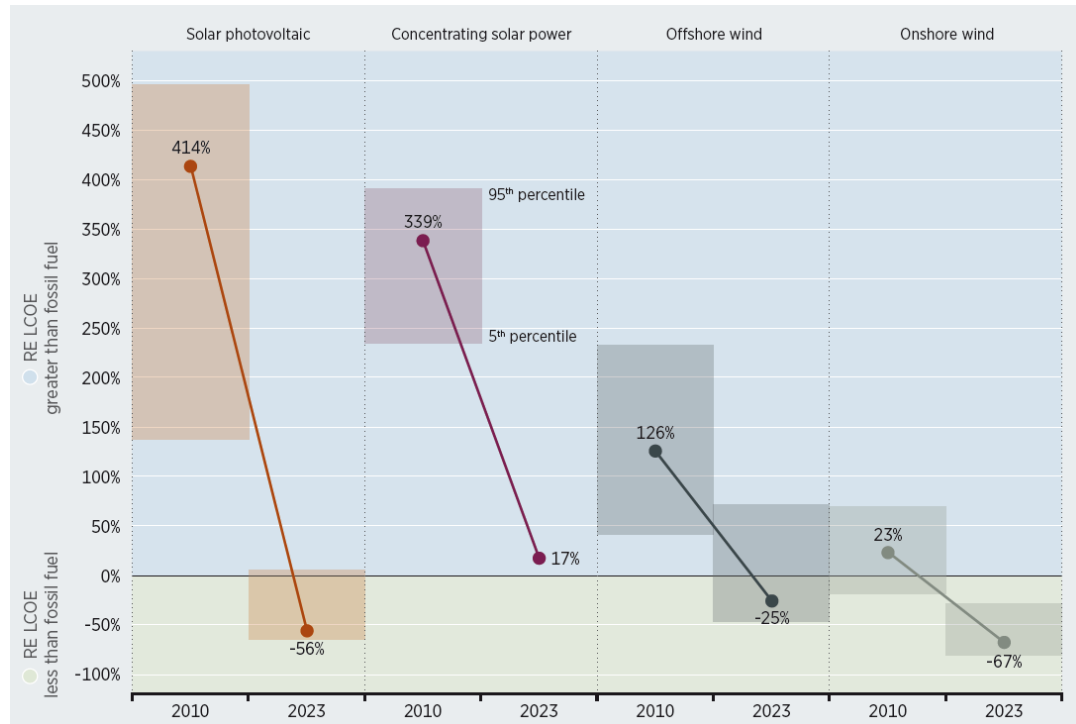


PV and on-shore wind are under cutting the LCOE from new fossil fuel projects

Solar and wind power offer very competitive electricity

The global weighted-average LCOE of onshore wind was 67% lower than the weighted-average fossil fuel option in 2023...

While for utility-scale PV, it was 56% lower



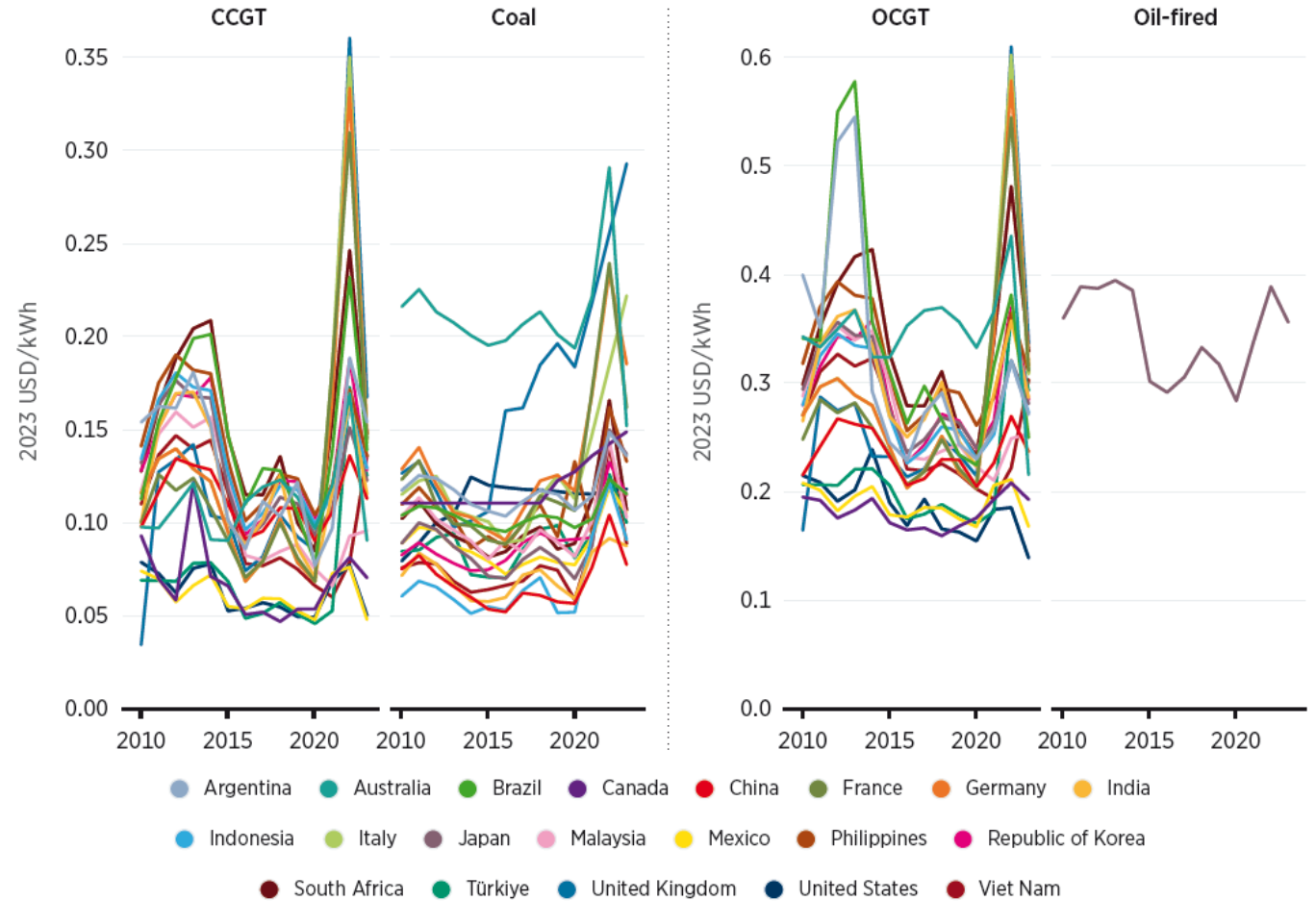
81% of the new utility-scale capacity added in 2023 cost less than the weighted-average fossil fuel option

Fossil fuel LCOE decrease in 2023

In 2023, fossil fuel prices returned to historic levels after the 2022 price hike crisis.

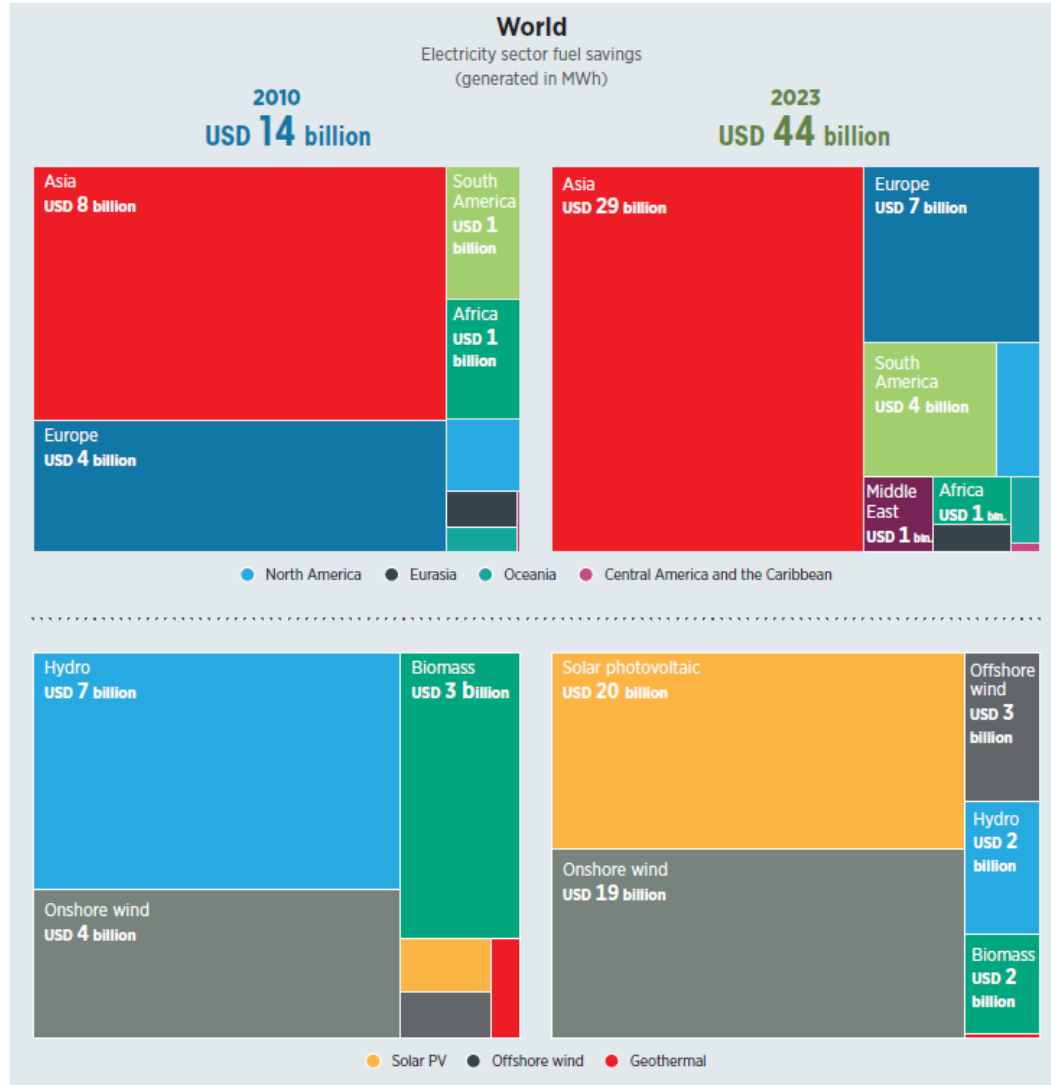
The fossil fuel price decrease was driven by a decline in electricity demand during 2023.

This is a result of a decline in energy intensive industry, decreased demand for heating, increased electrification and a greater share of renewable energy in electricity generation



Despite the decrease in fossil fuel-fired power generation costs in 2023, renewable power generation continued to be more competitive than fossil fuel options.

Renewables represent energy savings



In 2023, annual savings in Asia were USD 29 billion, 3.5 times higher than in 2010....

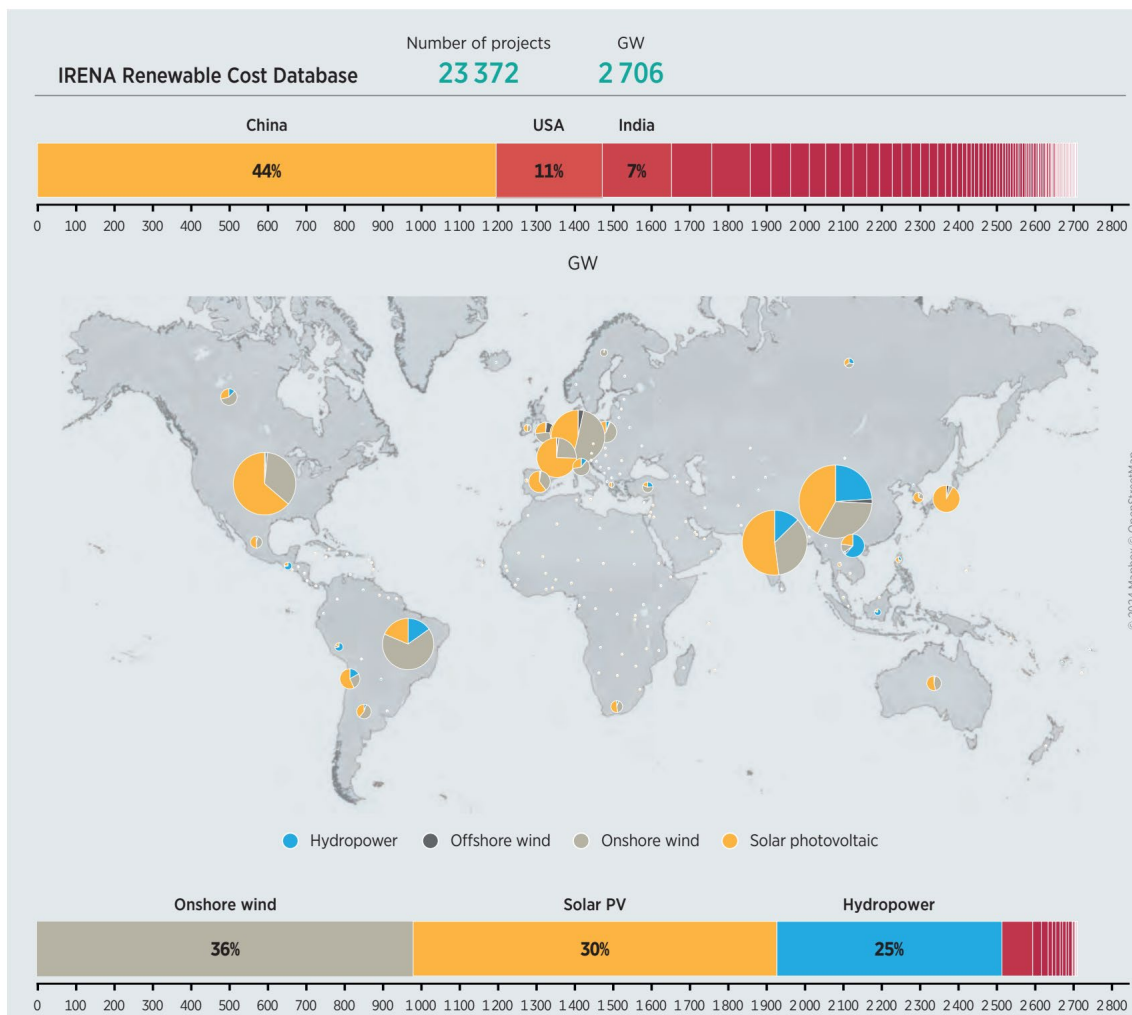
While in Africa remained modest.

The largest savings contributions were from solar PV and onshore wind. These two represented 87% of the total savings, demonstrating that trends in capacity additions are not distributed.

An effort is required to accelerate renewable power generation deployment across different technologies and regions to meet the goals set by the tripling pledge made at COP28.

Renewable Power Generation Costs Database /Datafile

Renewable Power Generation Costs in 2023 Datafile



IRENA
International Renewable Energy Agency

RENEWABLE
POWER
GENERATION
COSTS
IN 2023

September 2024

**Renewable Power Generation
Costs in 2023**

The levelised cost of electricity produced from most forms of renewable power continued to fall year-on-year in 2023, with solar PV leading the cost reductions, followed by offshore wind.

ISBN: 978-92-9260-621-3

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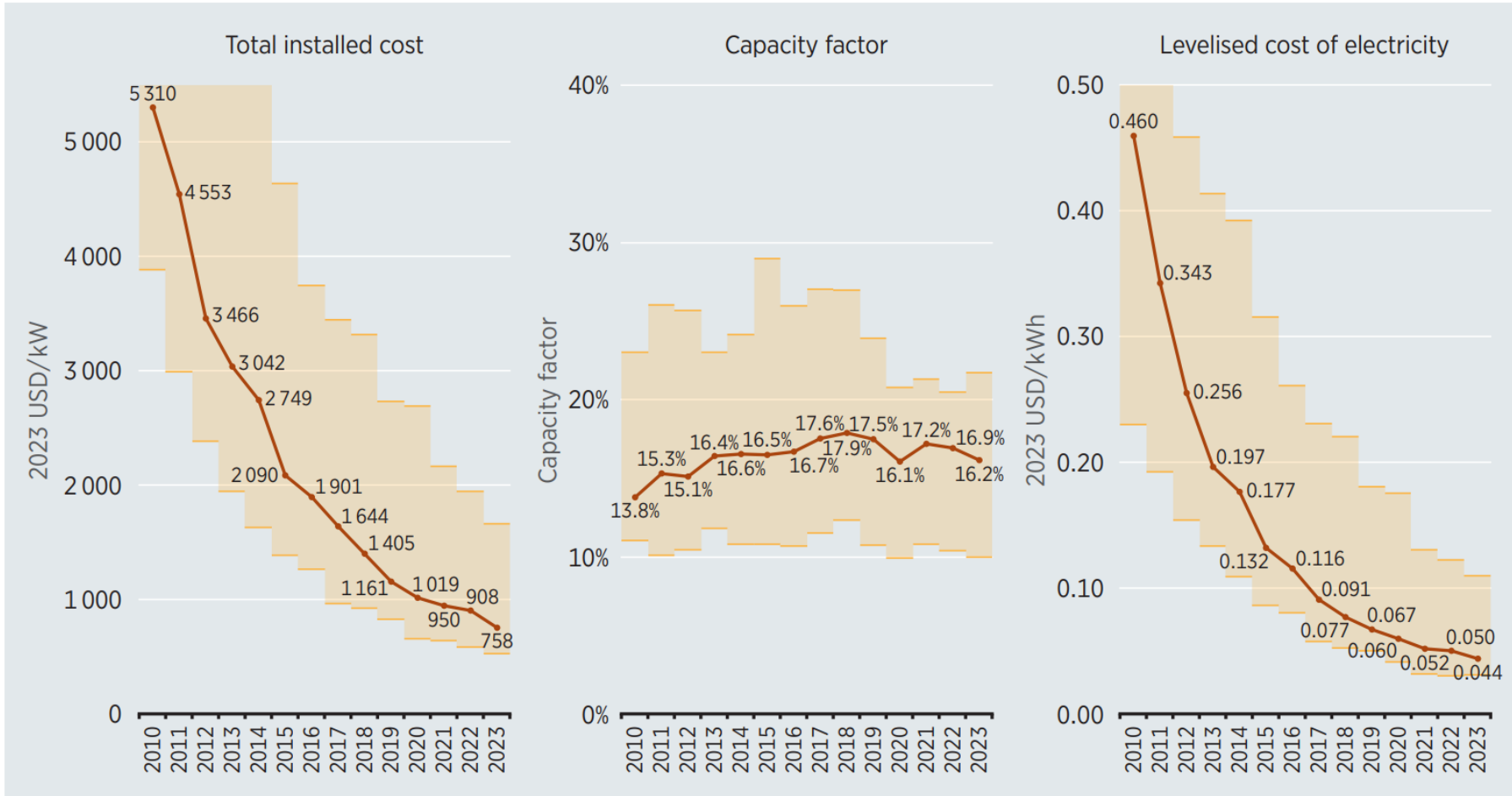
Executive Summary

Download data

<https://www.irena.org/Publications/2024/Sep/Renewable-Power-Generation-Costs-in-2023>

Solar Photovoltaic

Utility scale solar PV cost trends between 2010-2023



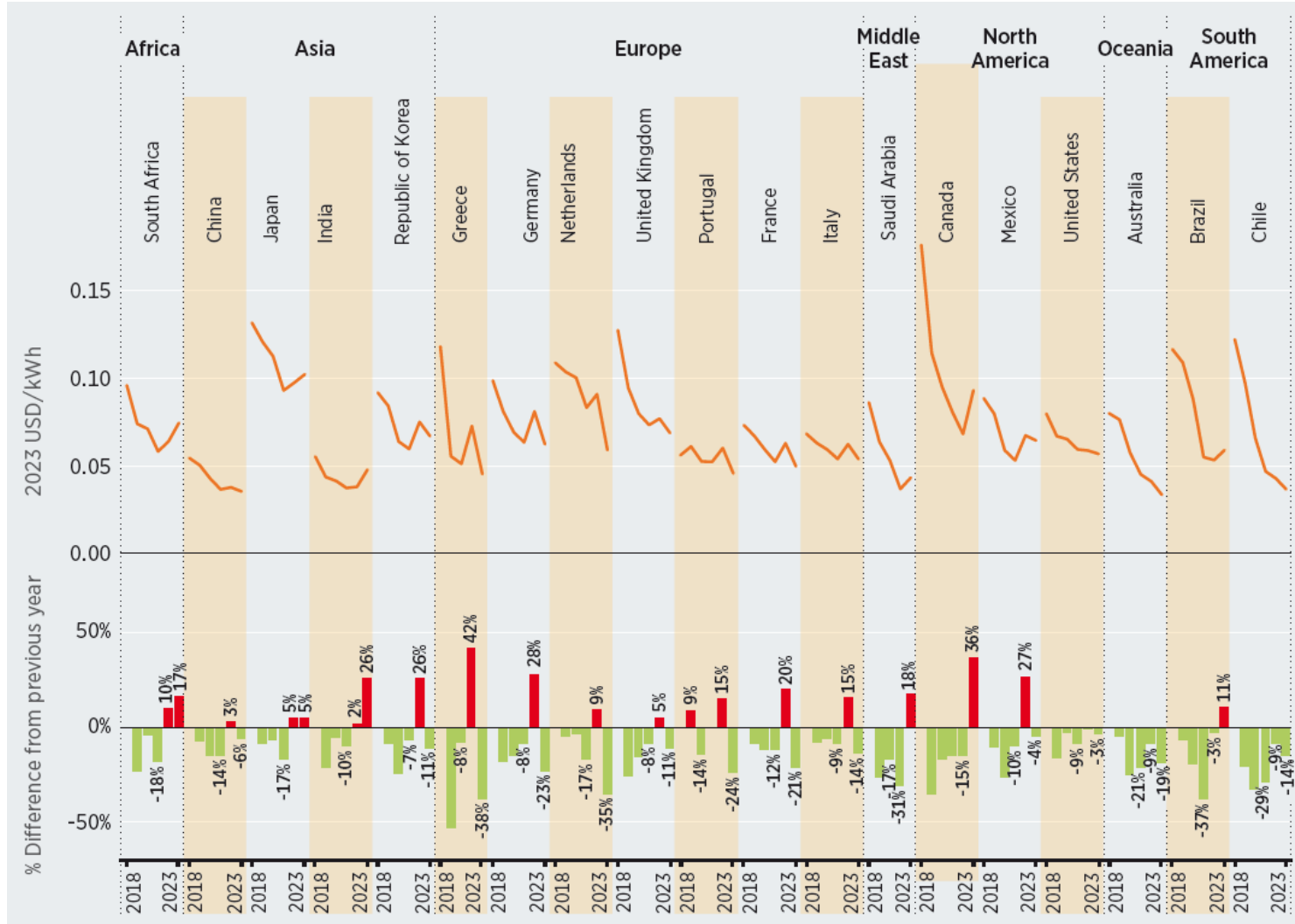
In 2023, 373 GW were commissioned (238 GW in Asia)

2010-2023

The global weighted average:

- **LCOE decreased by 90%**
- **Total installed cost fell by 86%**

Major markets also saw a decrease in the LCOE in 2023

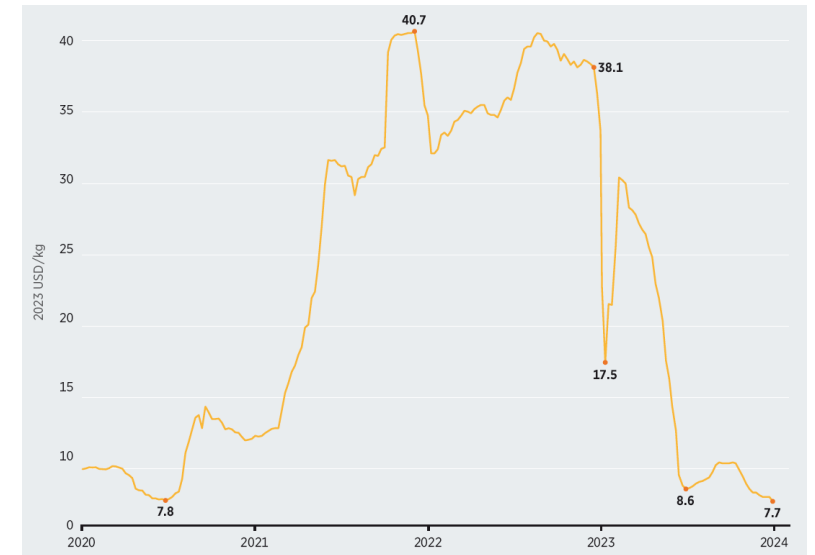
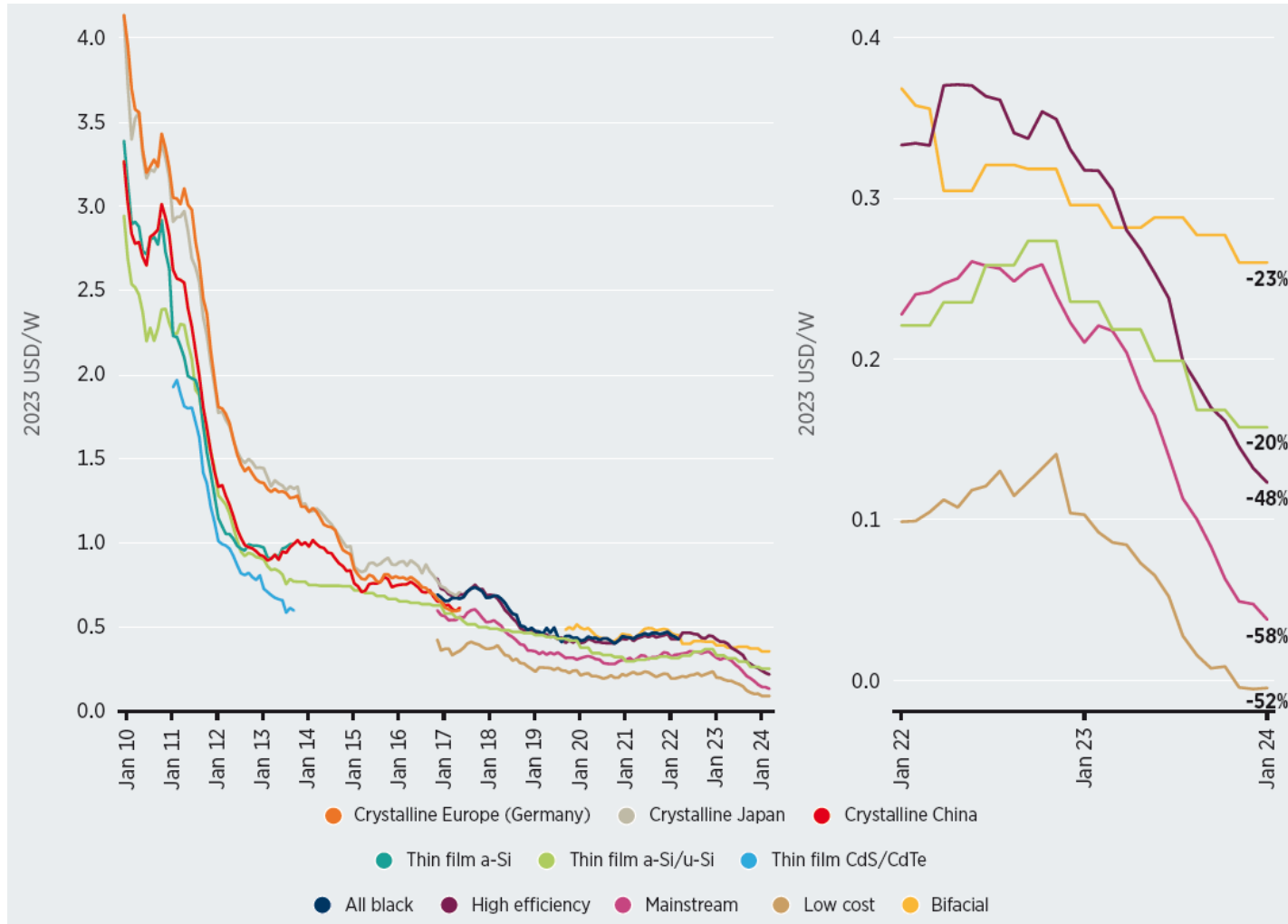


2022-2023

Costs declined in 14 of the markets shown in the figure, with major LCOE reductions in the top markets in Europe, United States, Australia and China.

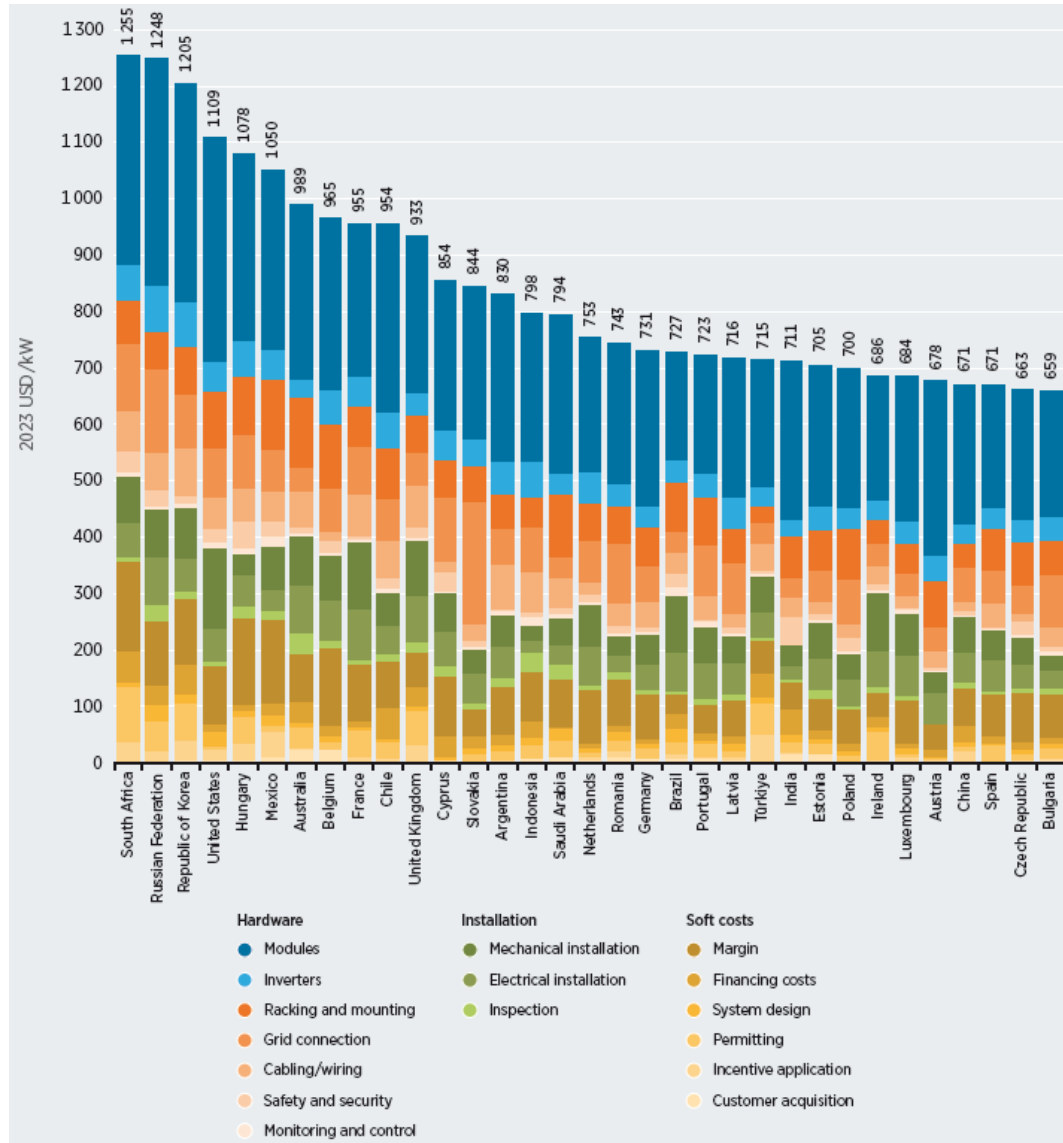
Solar PV Modules and Polysilicon Prices, 2020 to Q1 2024

The weighted average cost of crystalline modules declined 93% between 2009 and 2023



The oversupply of polysilicon accelerated the module price downtrend during 2023

PV total installed cost breakdown



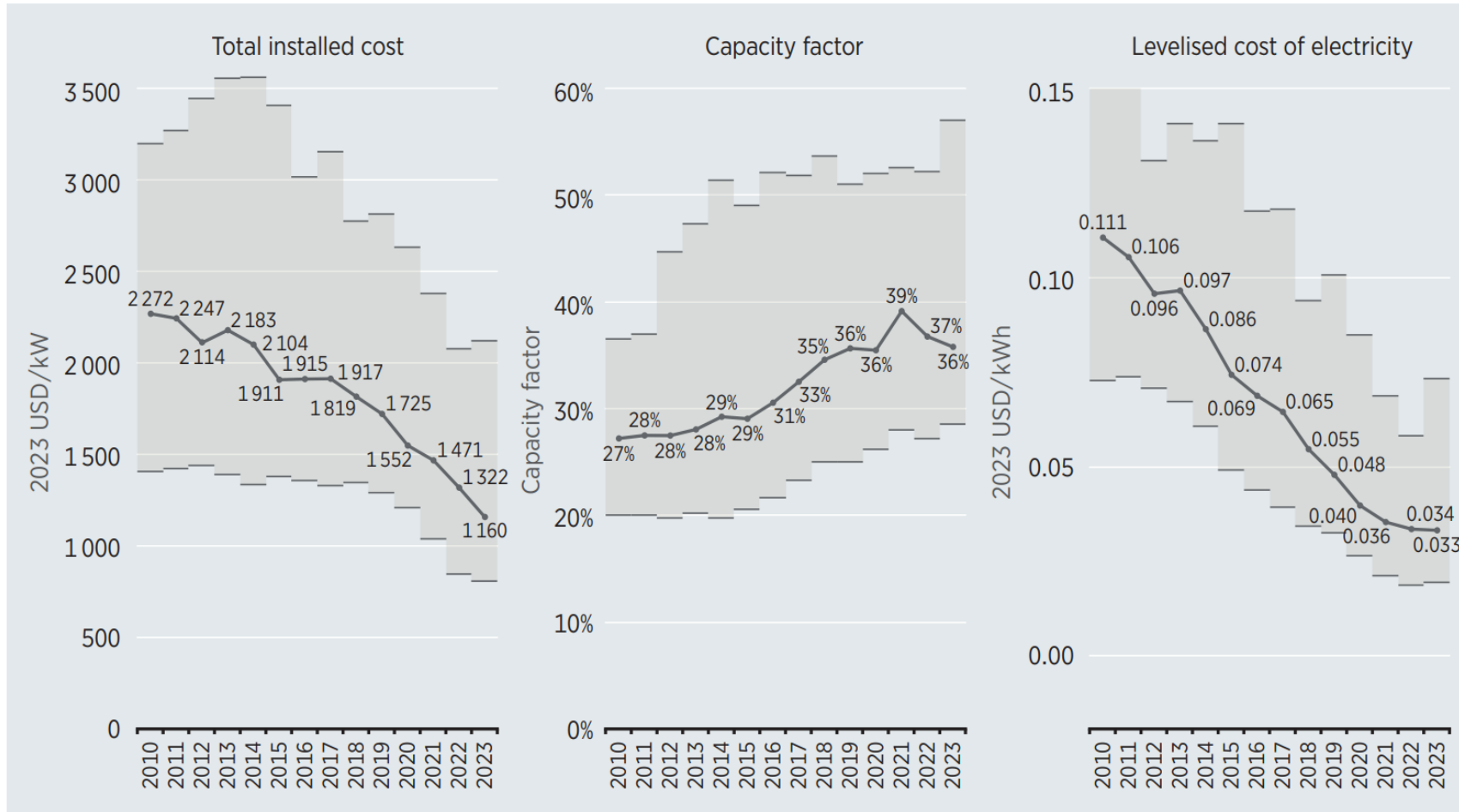
Prices are not only related to modules...

BoS cost made up about 61% of total installed costs of utility-scale PV plants.

BoS cost reductions relate to competitive market and increased installer experience.

Onshore wind

Onshore wind cost trends between 2010-2023



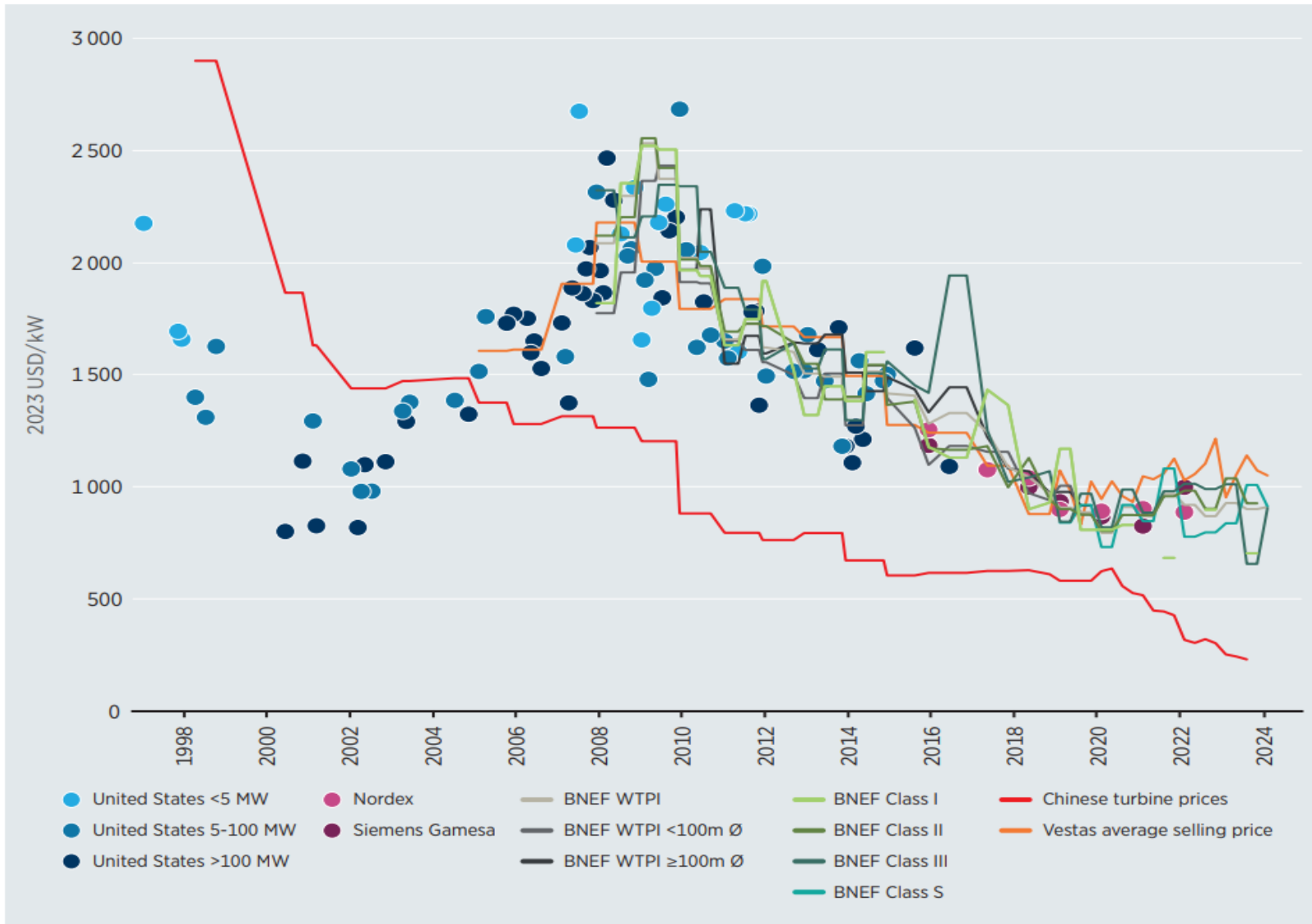
All 104 GW commissioned in 2023 were cheaper than fossil fuels

2010-2023

The global weighted average:

- **LCOE** decreased by 70%
- **Capacity factor** increased from 27% to 36%
- **Total installed cost** fell by 49%

Wind turbine prices trends



Turbine pricing in 2023

China: USD 233/kW

Excluding China: USD 706/kW-
USD 1 040/kW

2010-2023

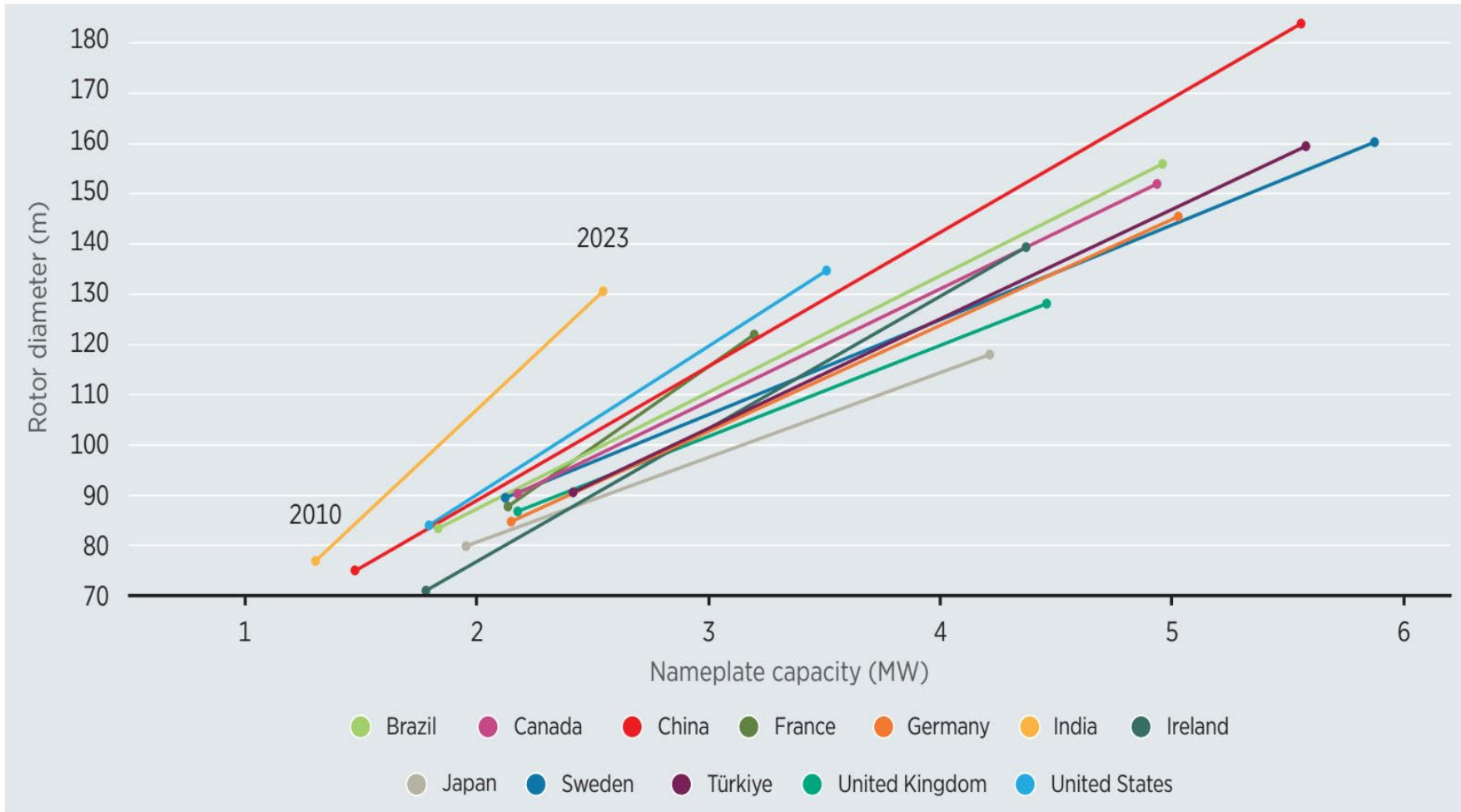
Prices have fallen:

China: 73%

Excluding China: 41%-64%

Significant uncertainty related to
supply chains and manufacturers
profitability about future trends

Technological improvements

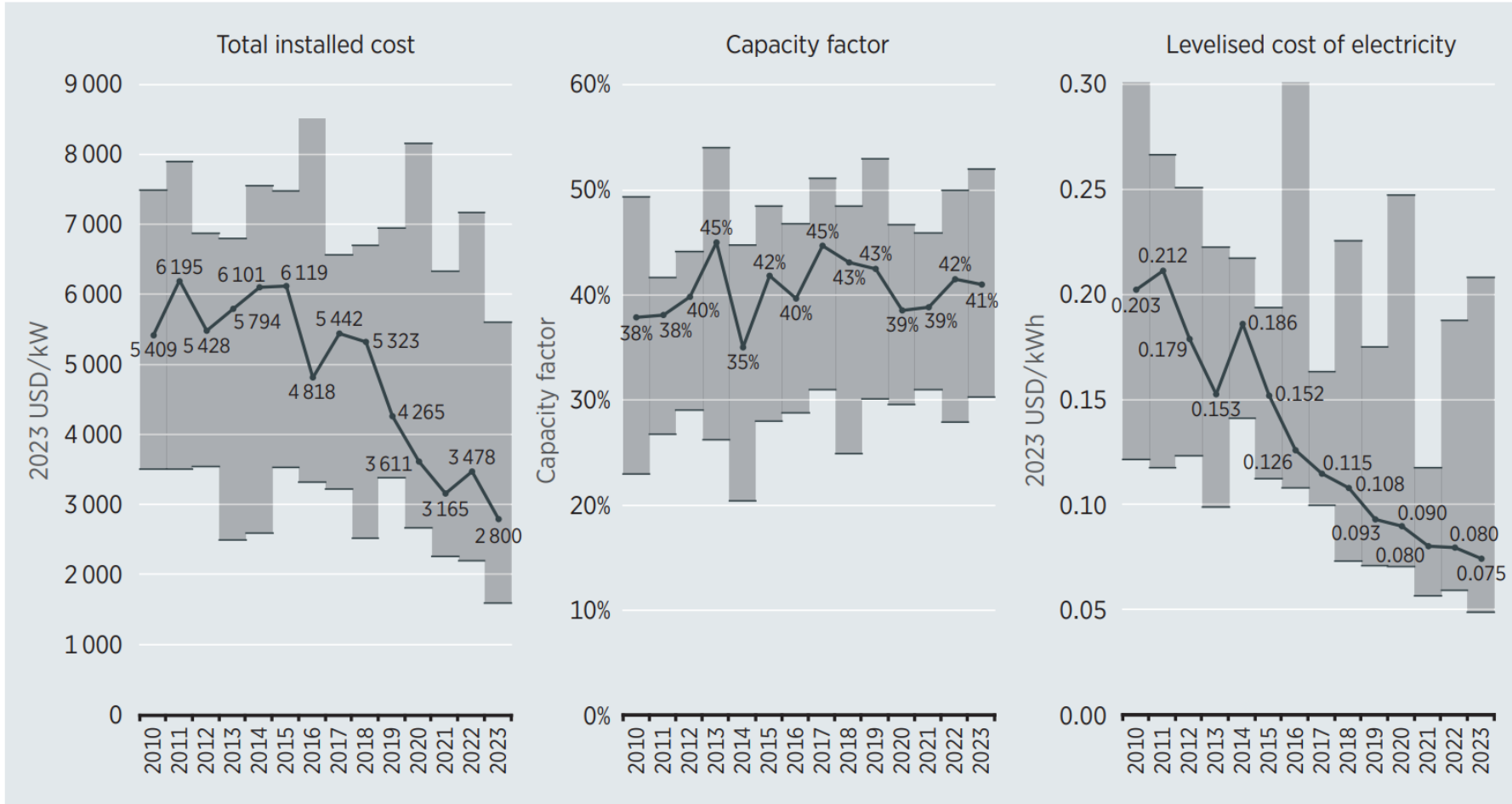


Trend towards **larger wind turbines** with **greater rotor diameters** and **higher hub heights**

While turbine technology advances have contributed to reduce costs, **additional factors** have also an impact.

Offshore wind

Offshore wind cost trends between 2010-2023



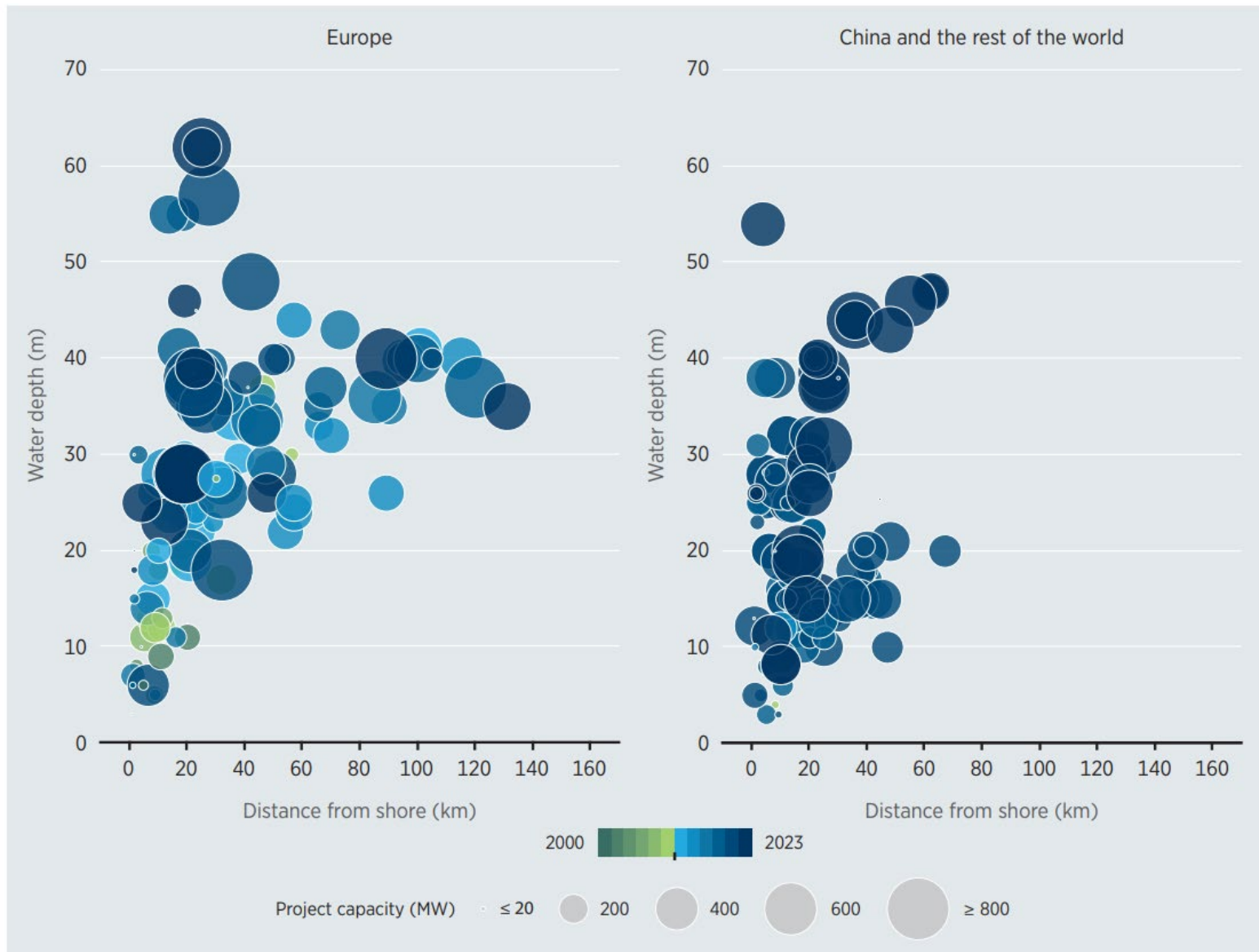
In 2023 nearly 11 GW were commissioned (Asia 8 GW, Europe 3 GW)

2010-2023

The global weighted average:

- **Total installed cost** reduced by 48%
- **Capacity factor** increased from 38% to 41%
- **LCOE** decreased by 63%

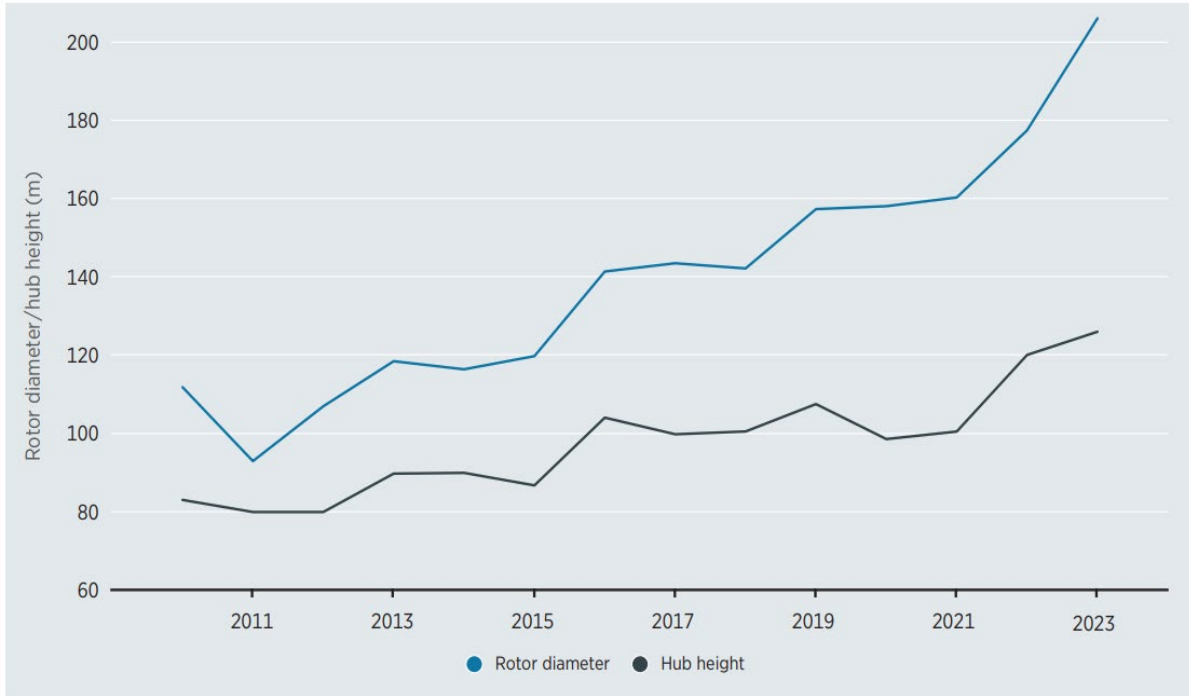
Water depth and distance from shore



Logistical factors in offshore wind significantly impact costs

Siting projects in **deeper waters and farther from shore** is increasing, especially in Europe

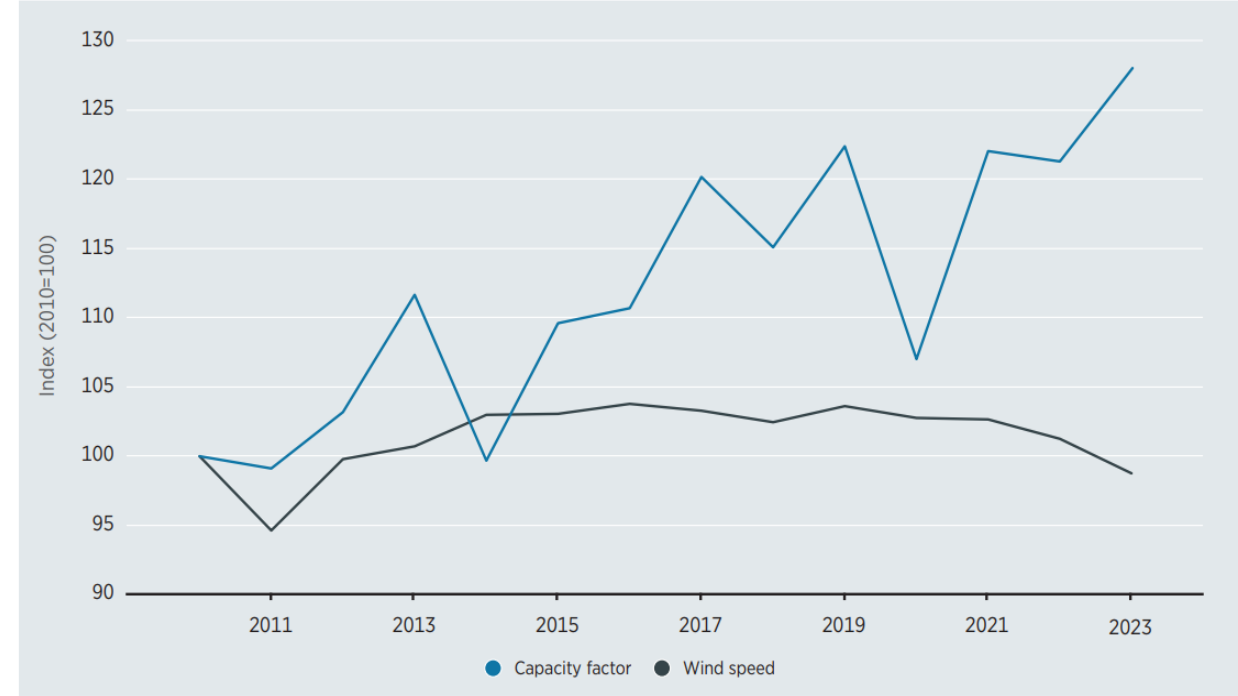
Technological improvements



Trend towards **larger rotor diameters and higher hub heights**

2010-2023

- Rotor diameter had an 84% increase (2023 - 206m)
- Turbine hub height grew by 25% (2023 - 126m)



Innovations enable wind farms in previously unsuitable, lower wind speed areas, **expanding wind energy potential.**

Battery storage

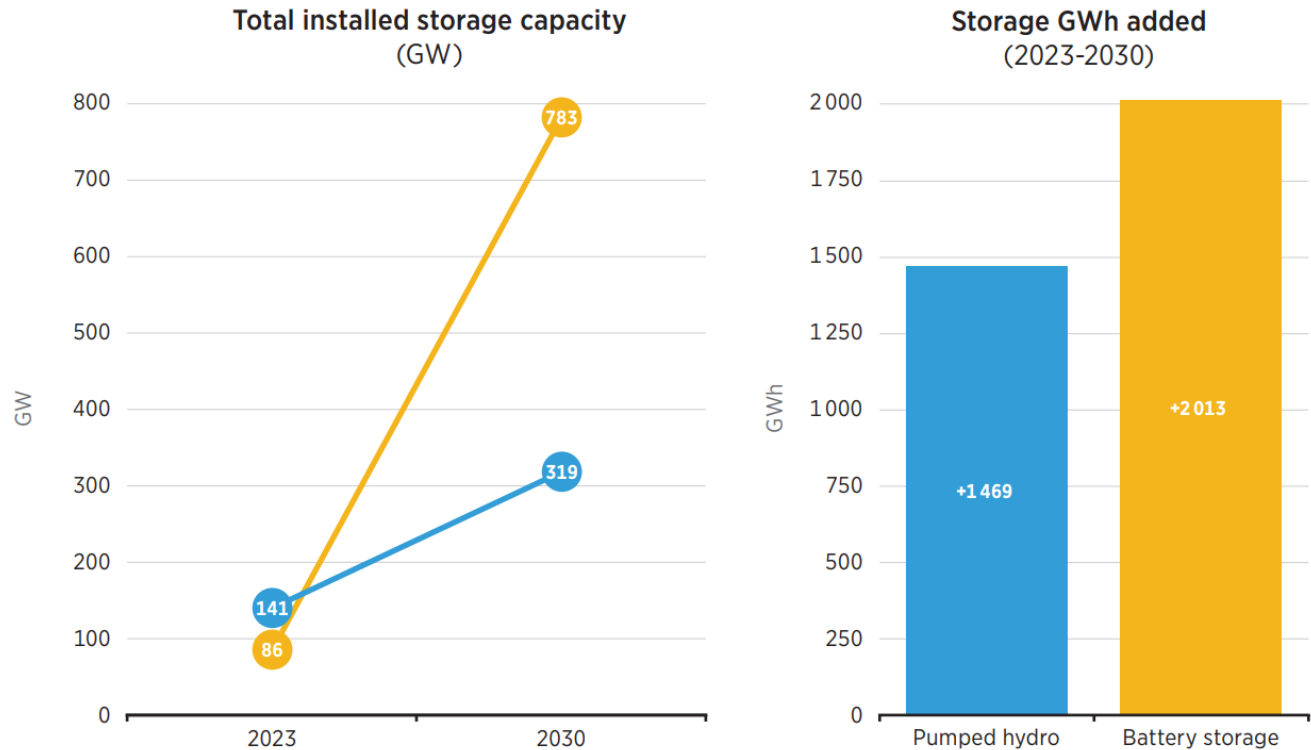
Projected battery storage growth to 2030

The global energy storage market is growing...

Energy shifting is the main application of battery storage.

It is being used to accelerate solar and wind deployment in response to grid-related challenges.

Pumped storage is still the most competitive LDES technology, with a global average installed cost of USD 149/kWh.



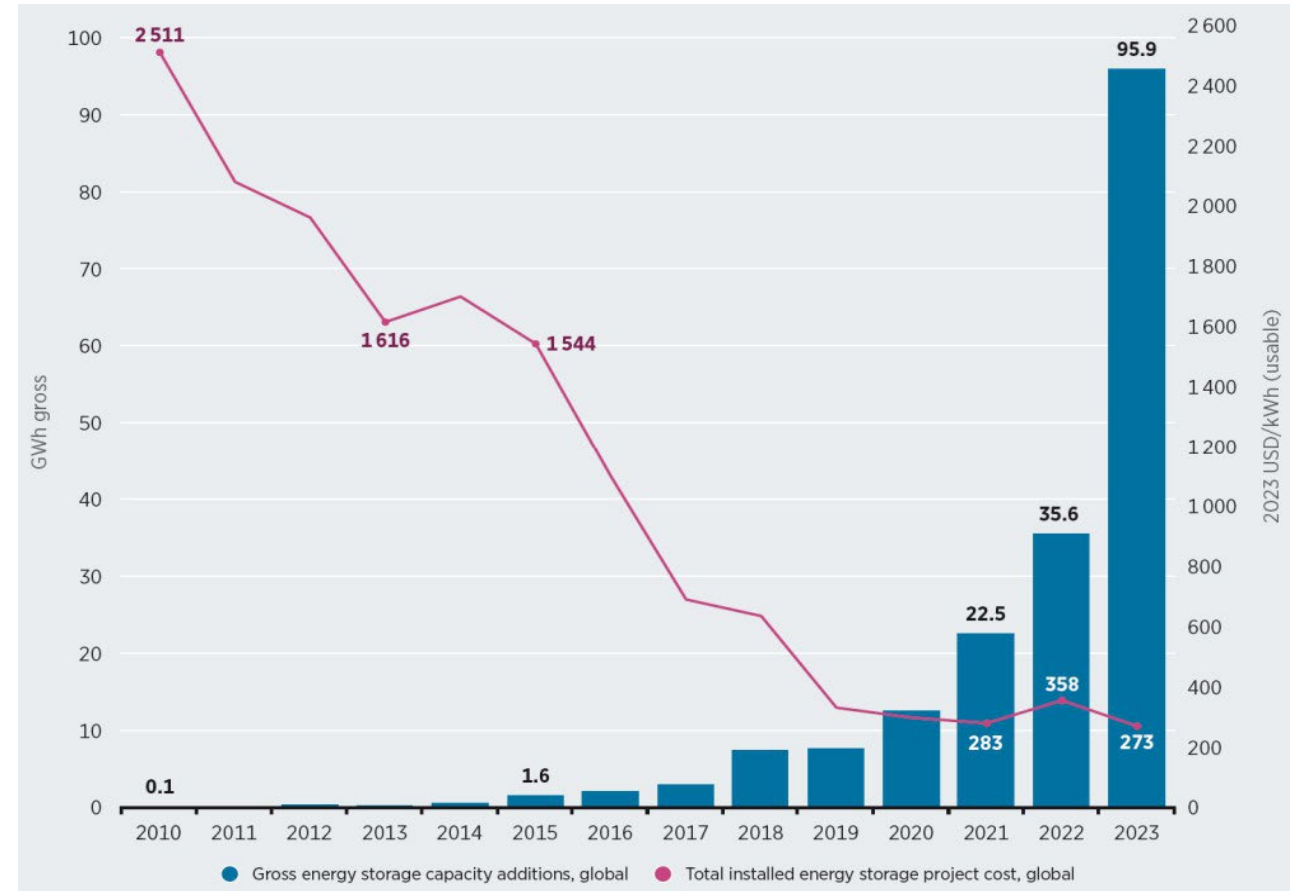
IRENA (2024), Tripling renewable power by 2030: The role of the G7 in turning targets into action

Battery storage cost reduction

2010-2023

Costs of installed energy storage projects fell by -89%

....driven by technological developments, improved materials efficiency and manufacturing processes.



2023 registered a record annual capacity increase....

New additions were dominated by China and United States.

- 1 **Costs decreased in 2023** of PV, CSP, onshore, offshore wind, hydro and battery storage projects
- 2 Fossil fuel-fired prices decreased but **renewable power generation continued to be more competitive than fossil fuel options**
- 3 Focus on **addressing challenges and barriers** to meet the climate goals
- 4 **Accelerated deployment of battery storage** is needed to increase the flexibility of electricity systems



Q & A
5 min

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