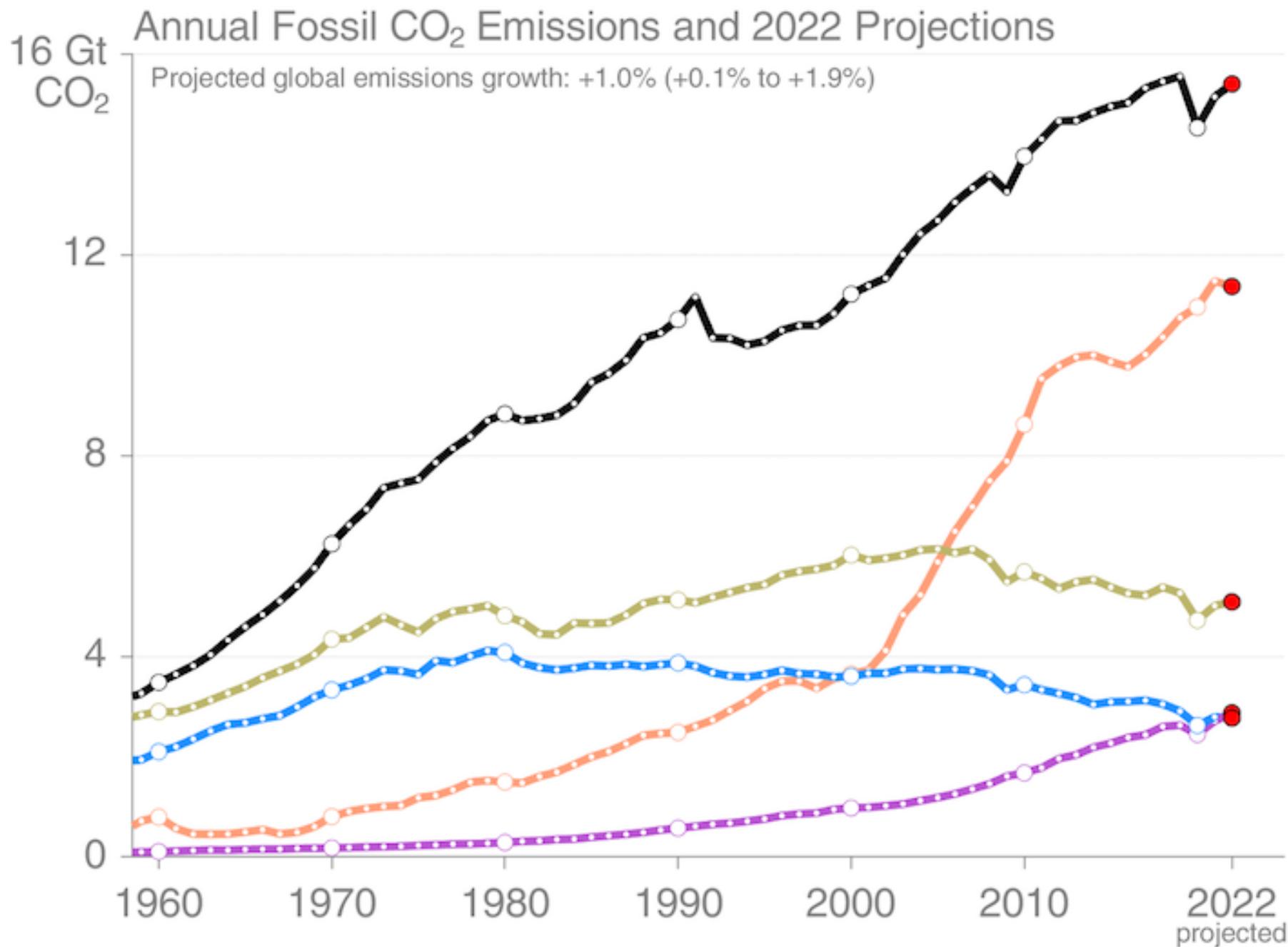


# Convegno per i 25 anni del Kyoto Club Roma 26 giugno 2024 - Spazio Europa



Gianni Silvestrini  
Direttore scientifico Kyoto Club e QualEnergia





Projected Gt CO<sub>2</sub> in 2022

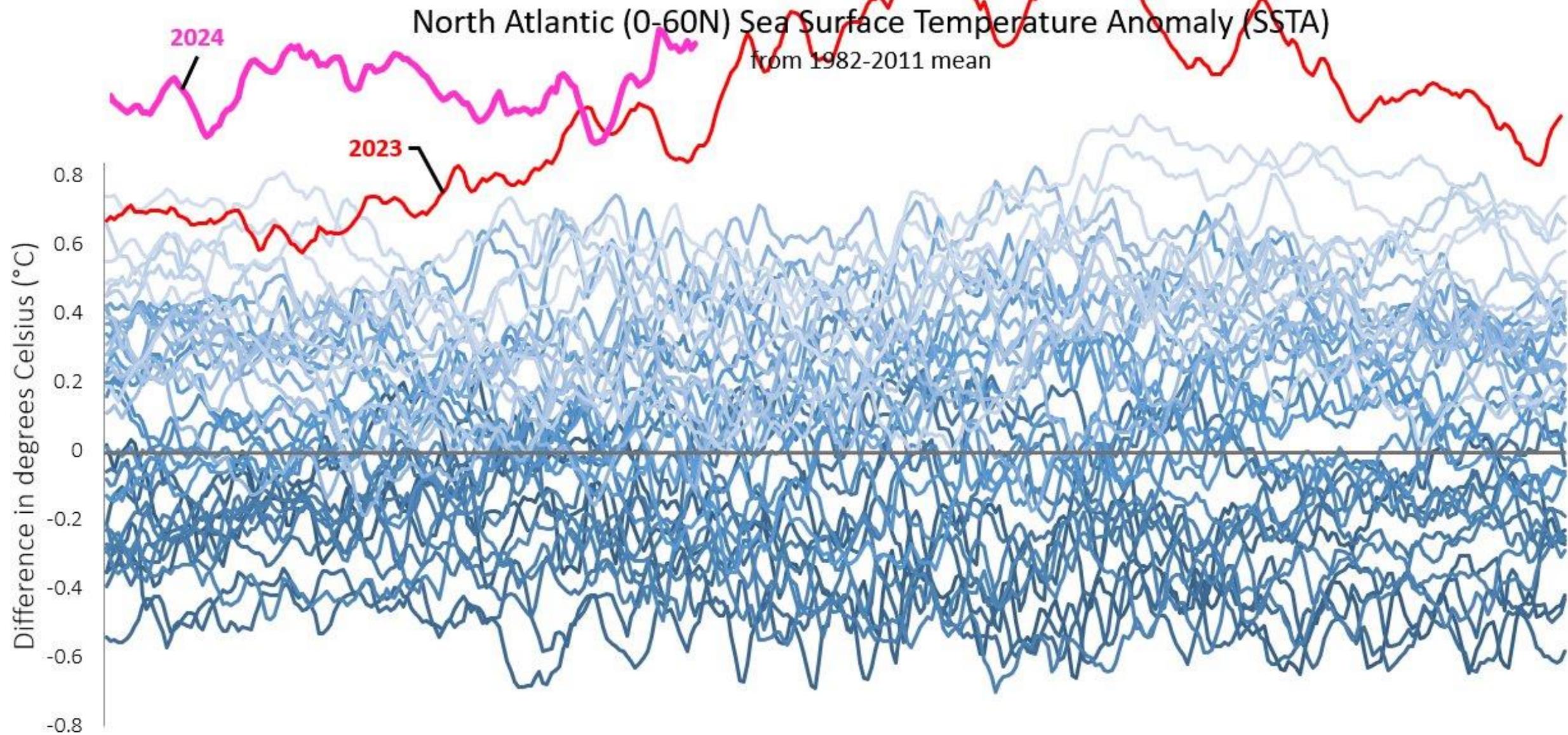
**All others 15.4**  
▲ 1.7% (+0.1% to +3.3%)

**China 11.4**  
▼ 0.9% (-2.3% to +0.4%)

**USA 5.1**  
▲ 1.5% (-1.0% to +4.0%)

**India 2.9**  
▲ 6.0% (+3.9% to +8.0%)

**EU27 2.8**  
▼ 0.8% (-2.8% to +1.2%)



# La crescita esponenziale del solare

La potenza fotovoltaica solare installata raddoppia all'incirca ogni tre anni, e quindi decuplica ogni decennio.

Fra un decennio potrebbe essere la principale tecnologia per la produzione di elettricità nel mondo.

Copertina del 20 giugno 2024



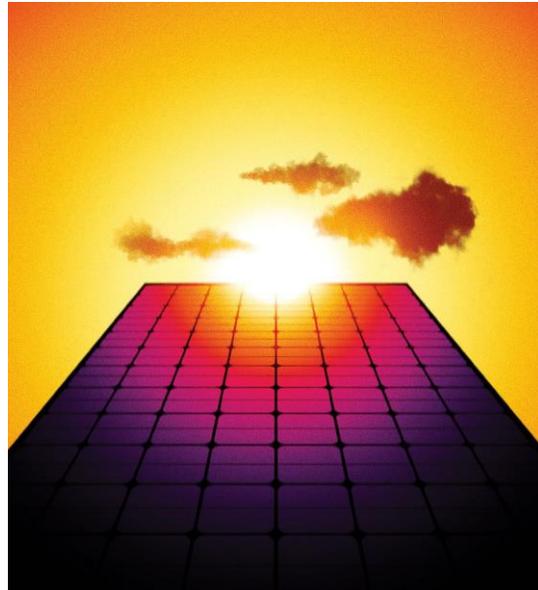
Nel 2004, ci è voluto un anno per installare  
1 GW solare nel mondo.

Nel 2010, un mese.

Nel 2016, una settimana.

Nel 2023, un giorno.

Nel 2024, mezza giornata



FEDERICO BUTERA  
GIANNI SILVESTRINI

# IL FUTURO DEL SOLE

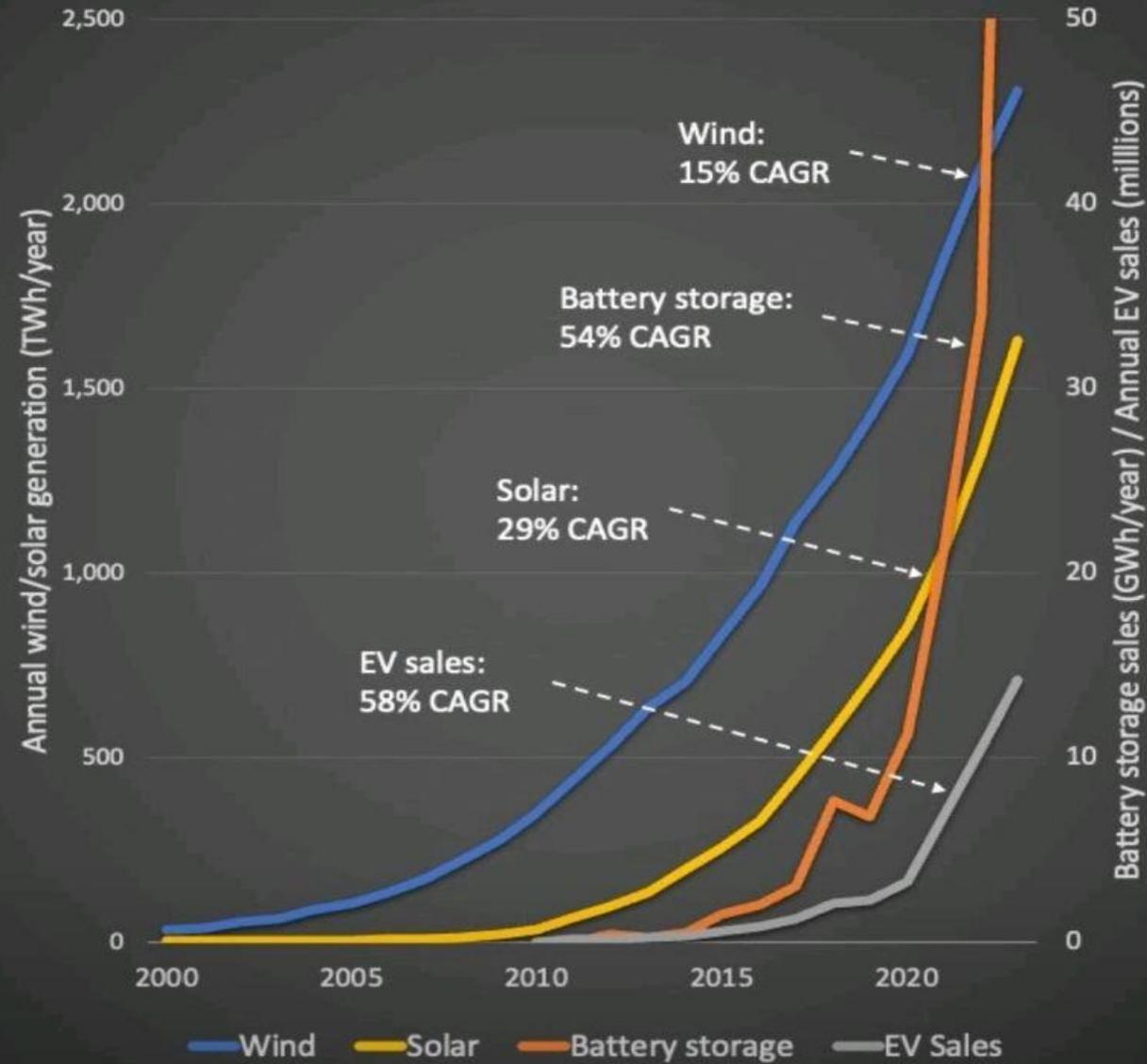
POTENZIALITÀ DELLE FONTI RINNOVABILI  
NELLA PRODUZIONE DI ENERGIA ELETTRICA

AMBIENTE E SOCIETÀ



1990

# The energy transition is exponential

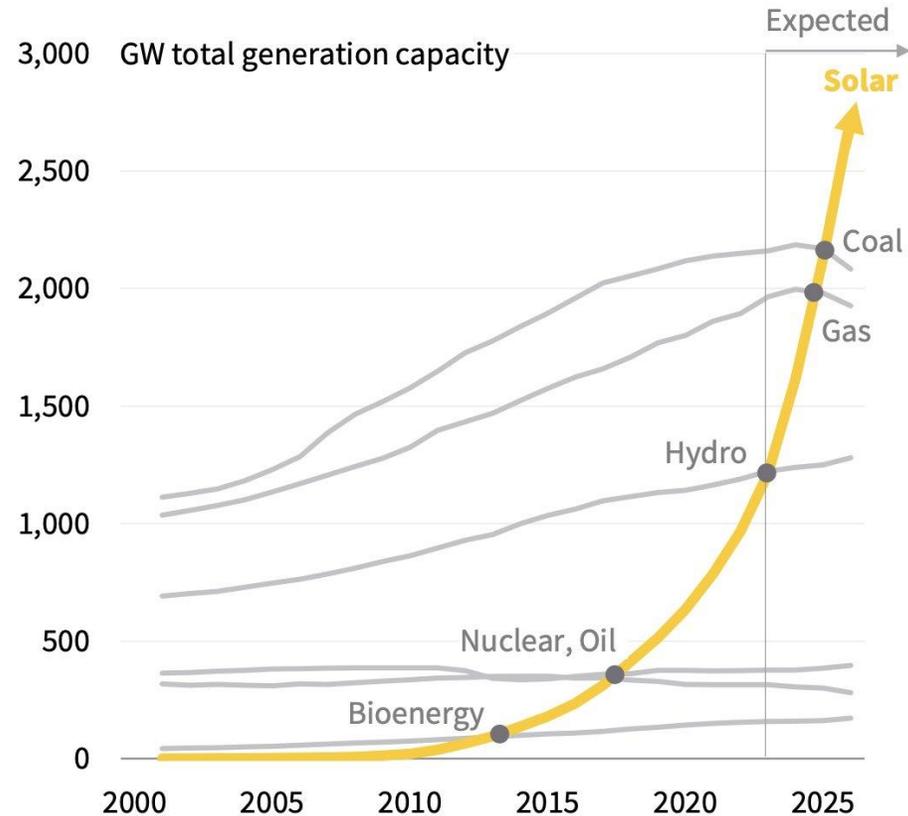


Sources: RMI, BNEF, BP, Ember, EV Volumes  
CAGRs shown are from 2012-2022

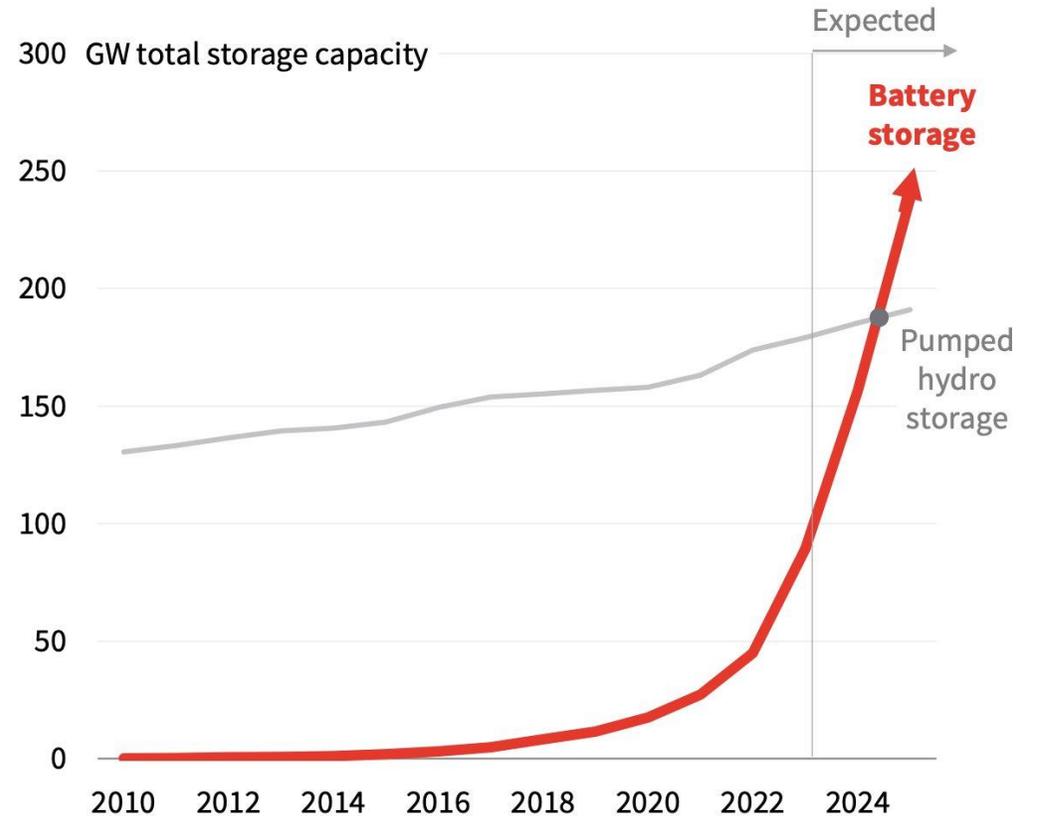
# Solar and batteries are taking over

Solar will shortly overtake every other type of capacity, and battery storage will leapfrog pumped hydro

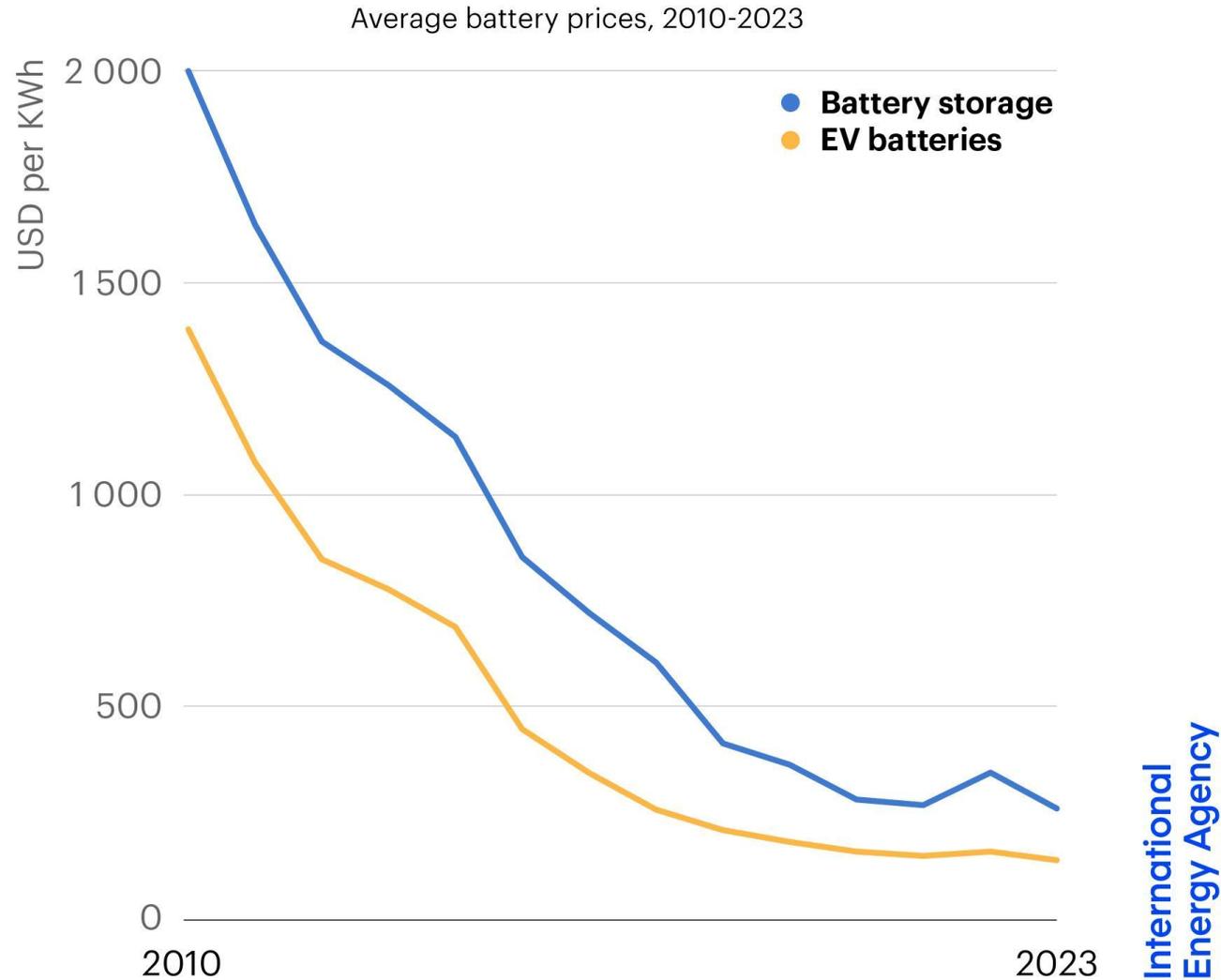
## Solar



## Batteries



# In less than 15 years, **battery costs have fallen by more than 90%**, one of the fastest declines ever seen in clean energy technologies

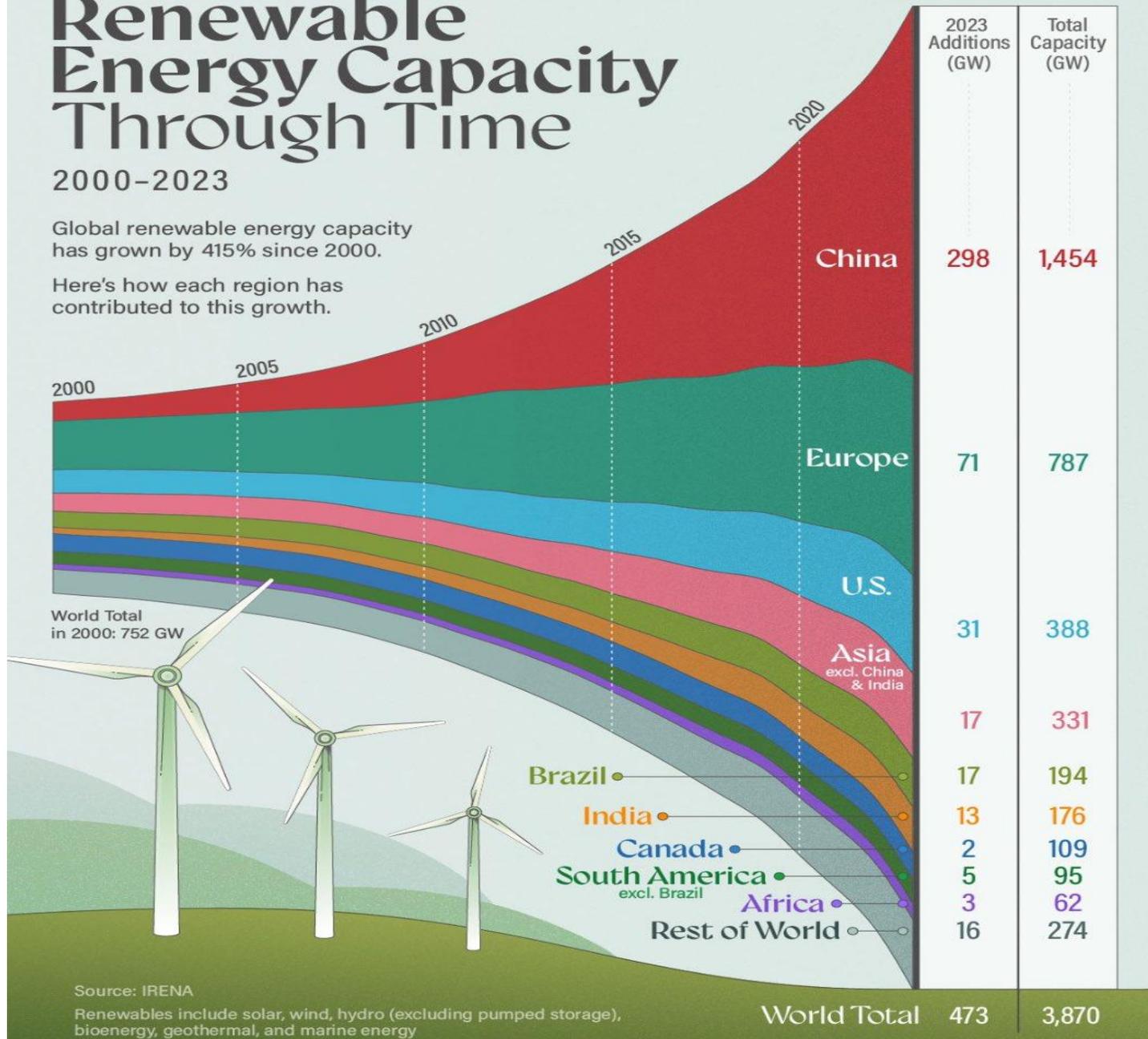


# Renewable Energy Capacity Through Time

2000-2023

Global renewable energy capacity has grown by 415% since 2000.

Here's how each region has contributed to this growth.

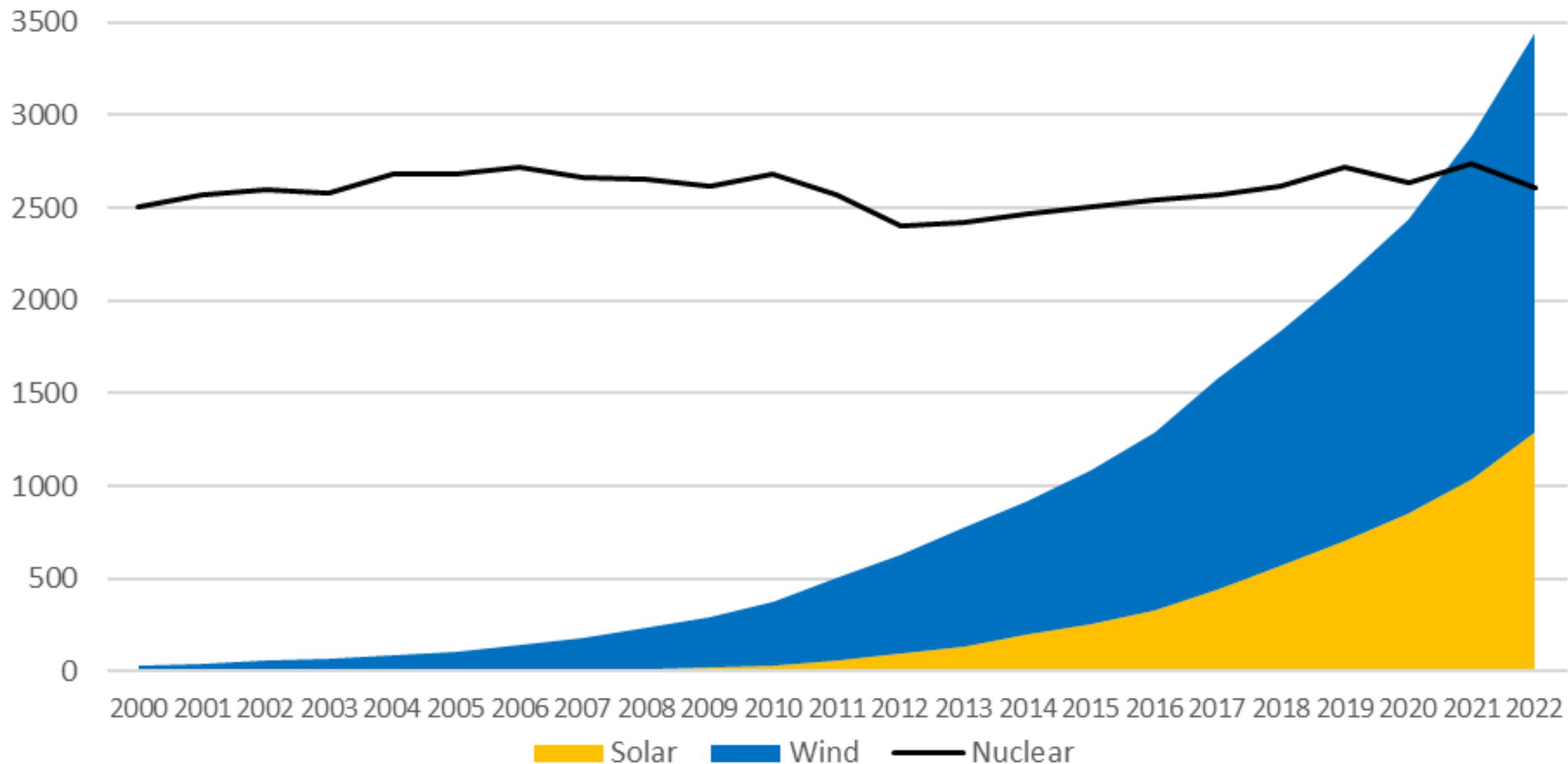


Source: IRENA

Renewables include solar, wind, hydro (excluding pumped storage), bioenergy, geothermal, and marine energy

# Global Wind+Solar vs. Nuclear Generation [TWh/y]

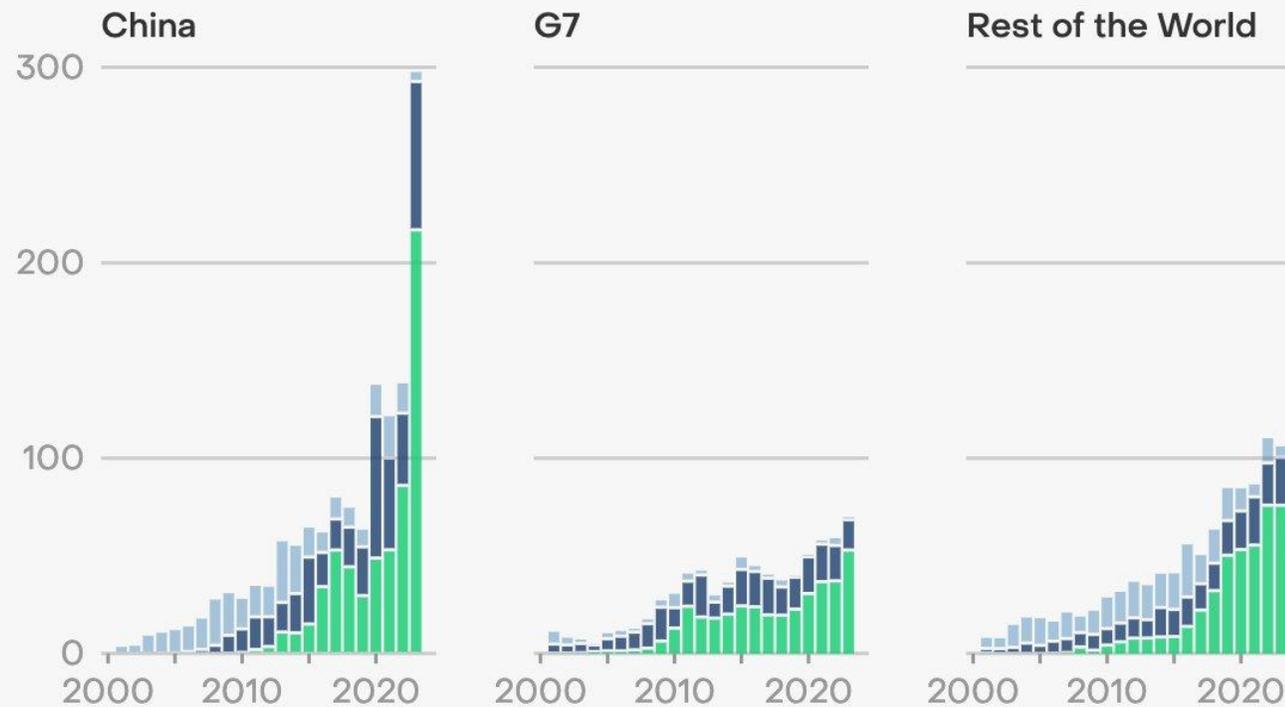
Source: [www.ember-climate.org/data-catalogue/yearly-electricity-data](http://www.ember-climate.org/data-catalogue/yearly-electricity-data)



# China renewables capacity additions soared in 2023, growing more than four times faster than the G7

Annual renewable capacity additions, GW

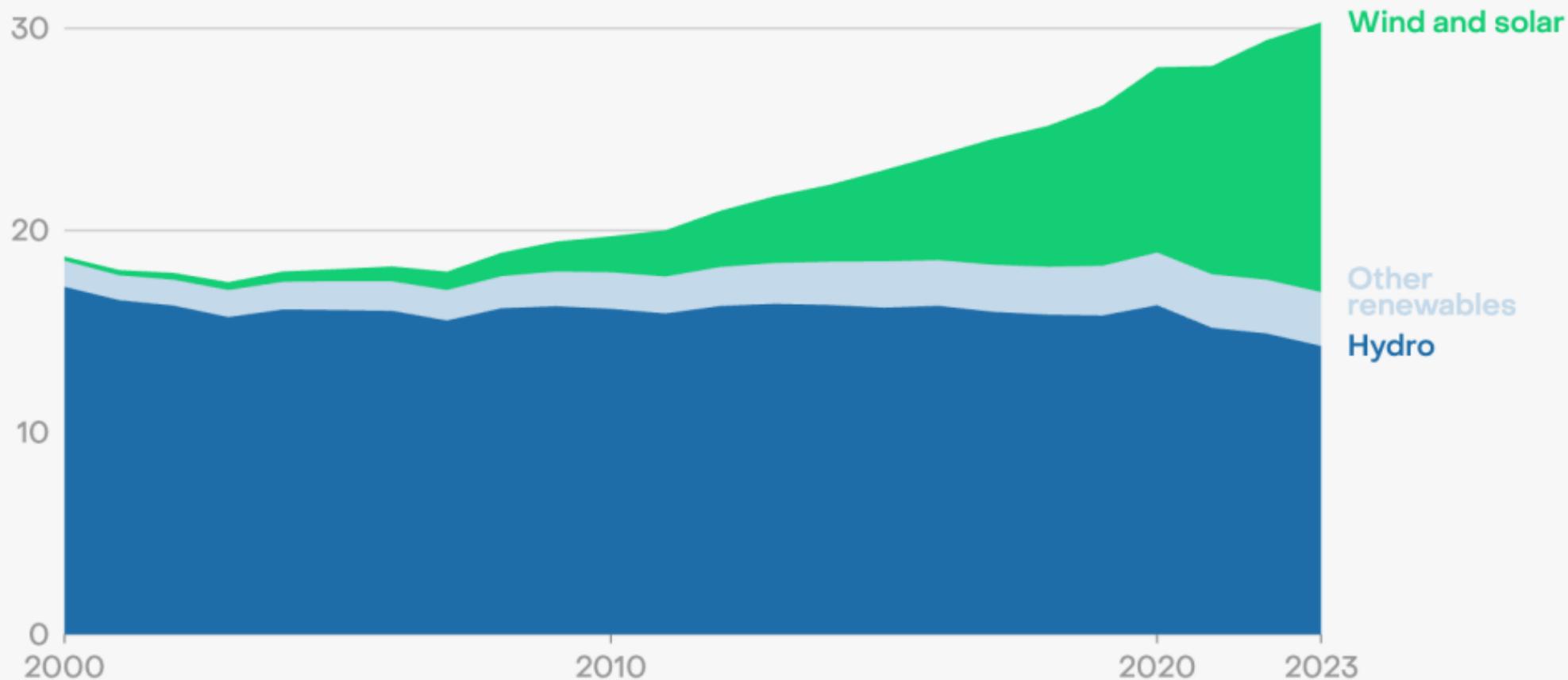
Solar Wind Other renewables



Source: Ember calculation based on IRENA Renewable Capacity Statistics 2024 · G7 includes the seven member countries, not the EU  
Rest of the World excludes the G7

# Global growth in wind and solar pushed renewables to make up more than 30% of the global electricity mix in 2023

Share of global electricity generation from renewable sources (%)

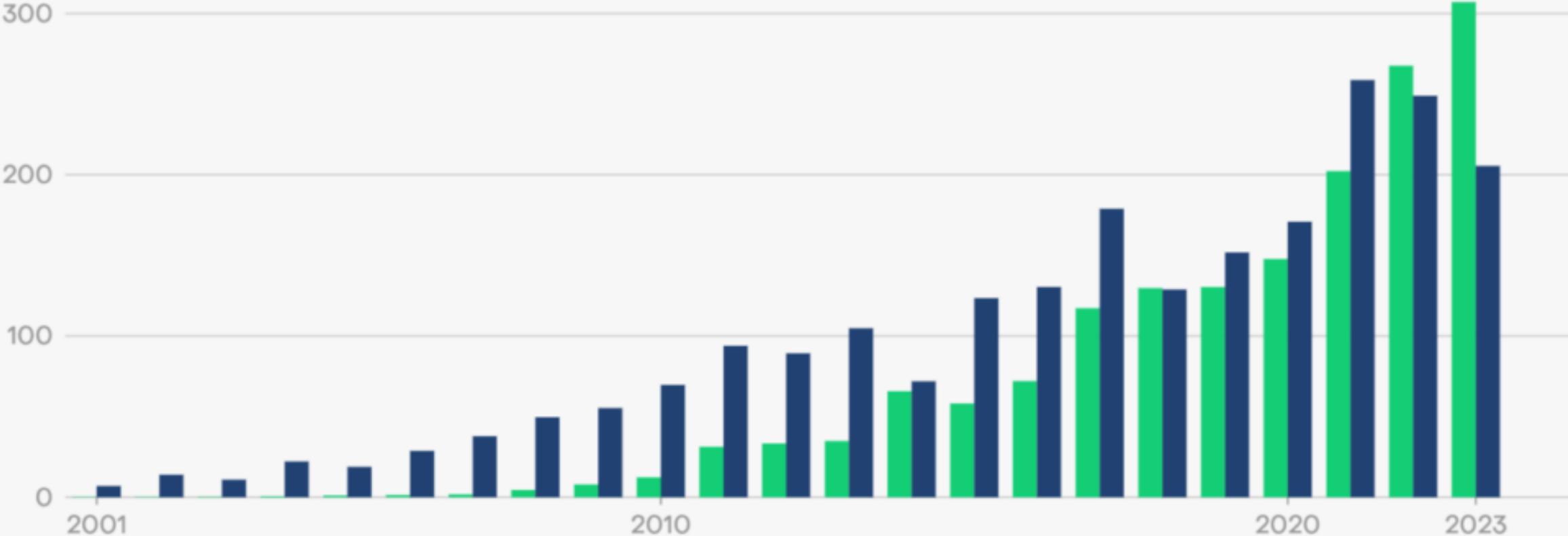


Source: Annual electricity data, Ember

# Solar outpaced wind generation growth in 2023 for the second year running

Annual change in electricity generation (TWh)

Solar Wind

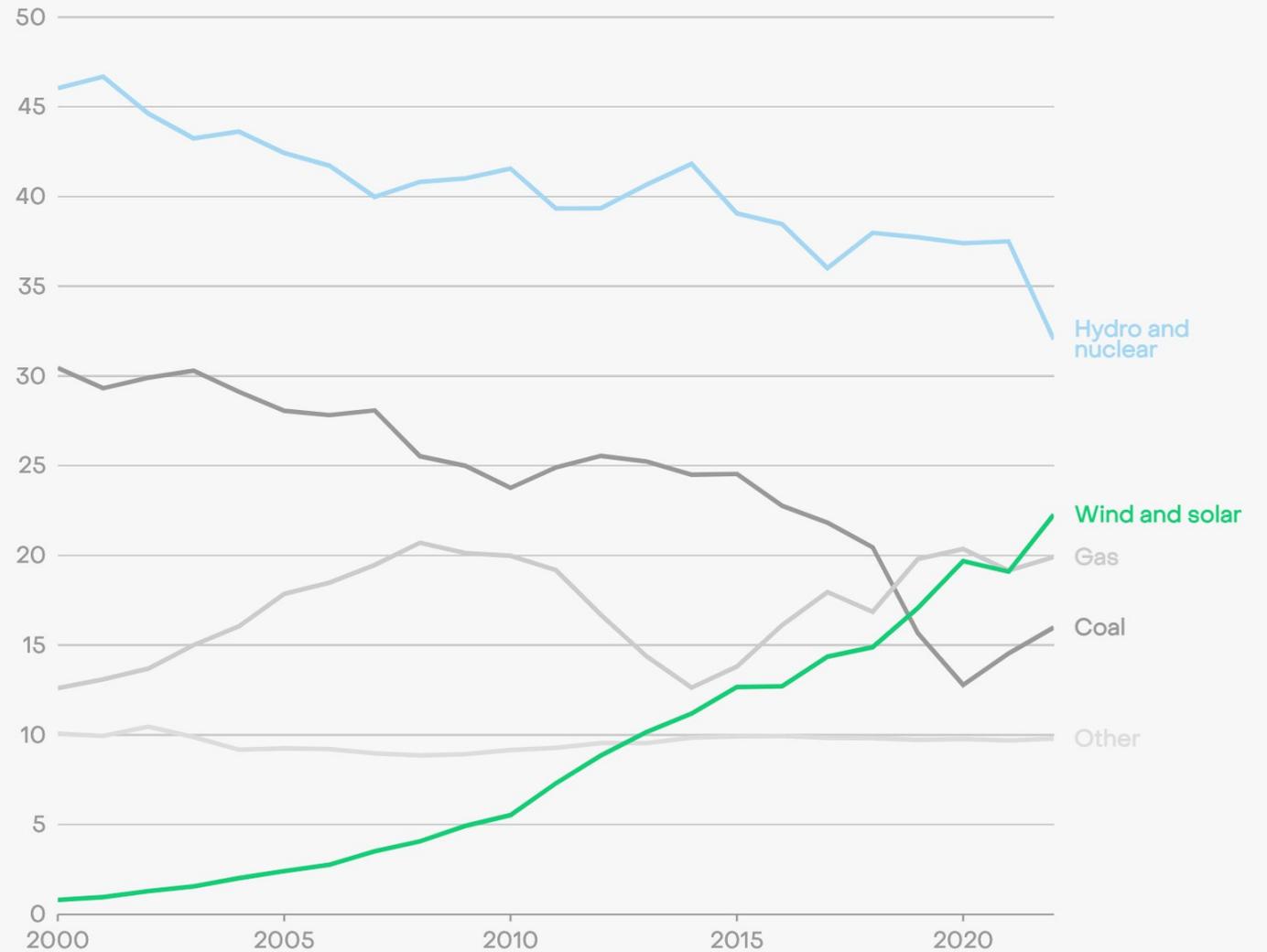


Source: Annual electricity data, Ember

Nel 2023 l'elettricità solare ed eolica ha superato sia quella da gas che quella da carbone nella UE

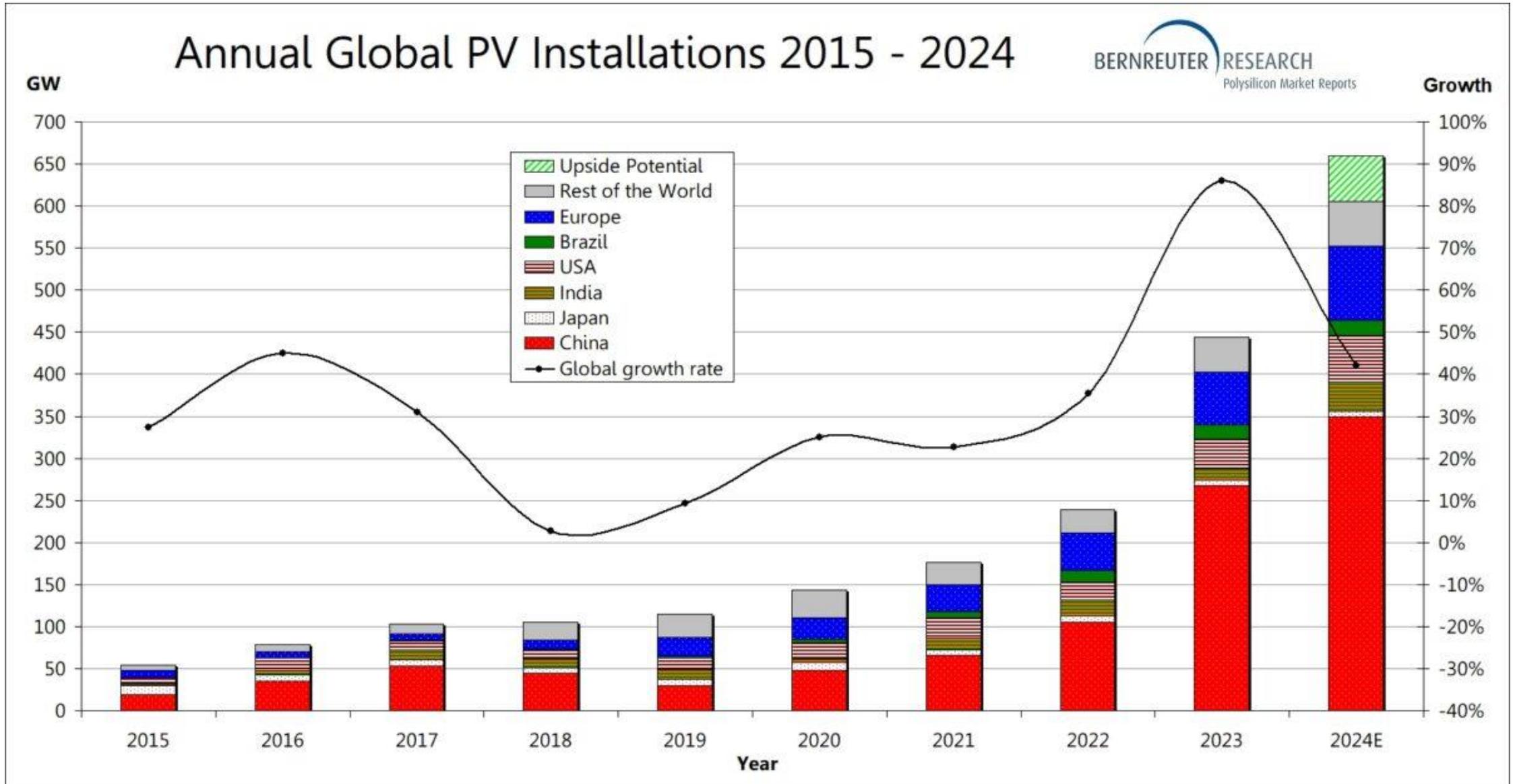
## EU wind and solar generated more than gas for the first time

Share of electricity generation (%)



Source: Annual electricity data, Ember

2023 444 GW    2024: 660 GW ?



# How California powered itself in April 2024

25k –  
megawatts

20k

15k

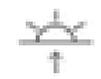
10k

5k

0

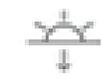
12a.m.

5a.m.



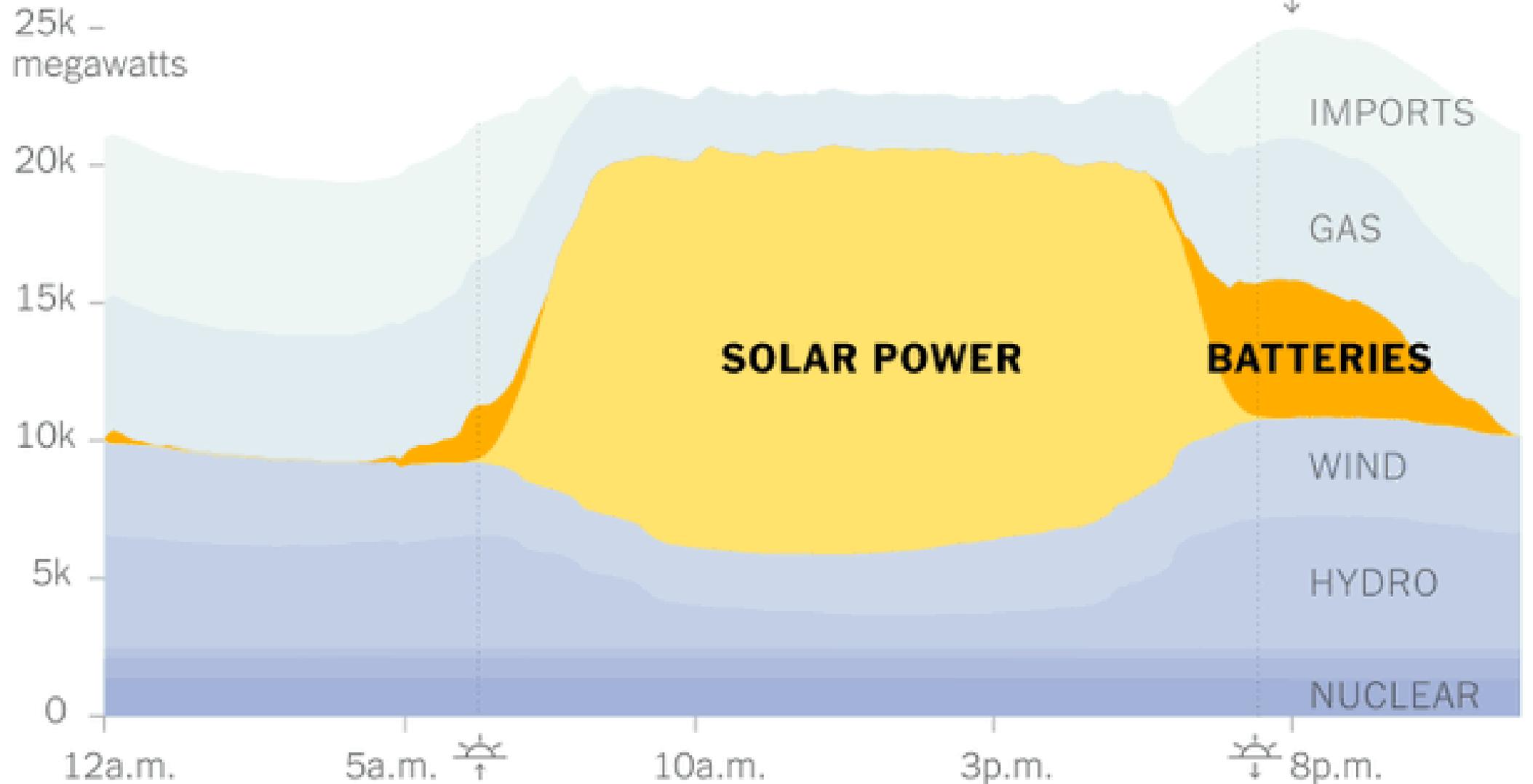
10a.m.

3p.m.



8p.m.

Peak demand  
↓



**SOLAR POWER**

**BATTERIES**

IMPORTS

GAS

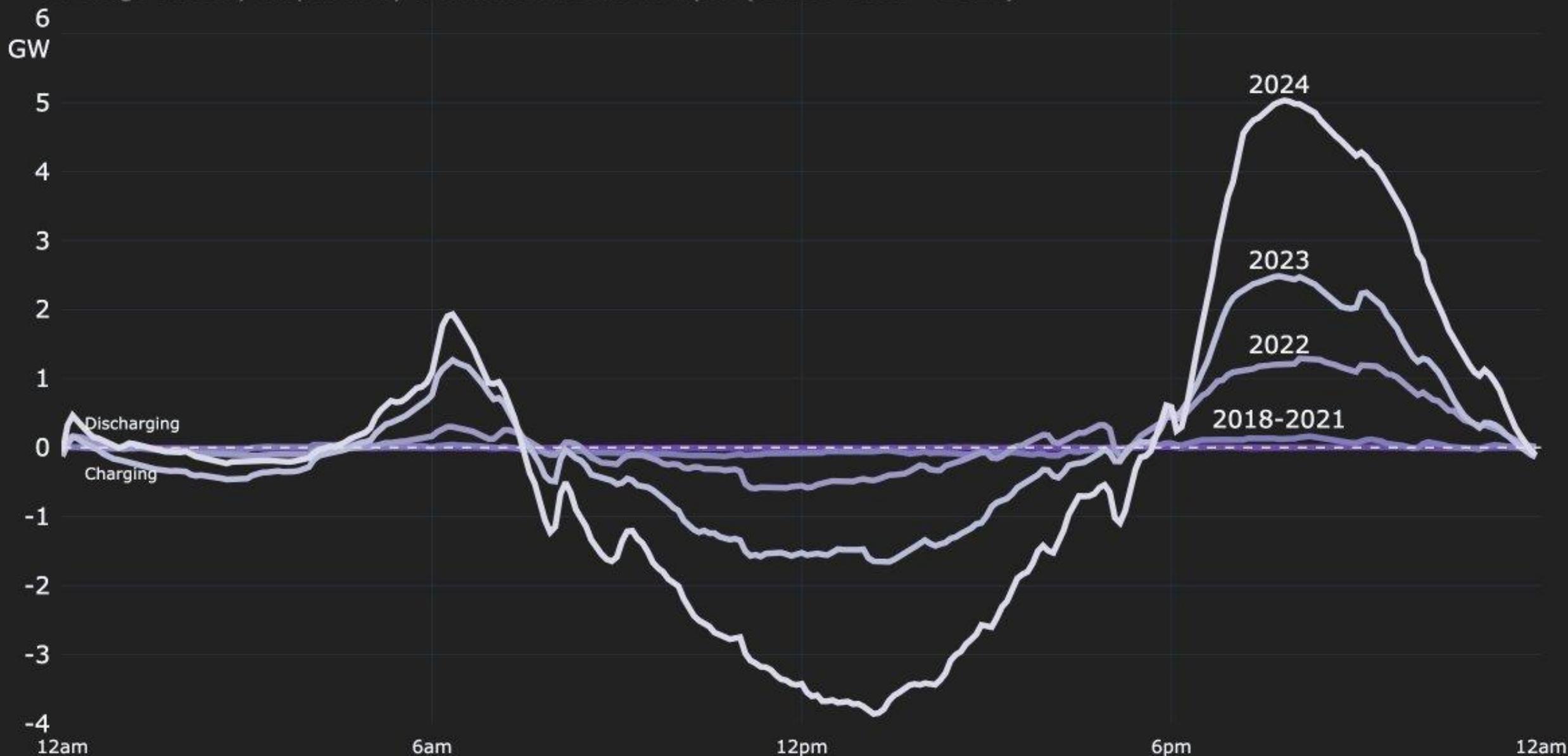
WIND

HYDRO

NUCLEAR

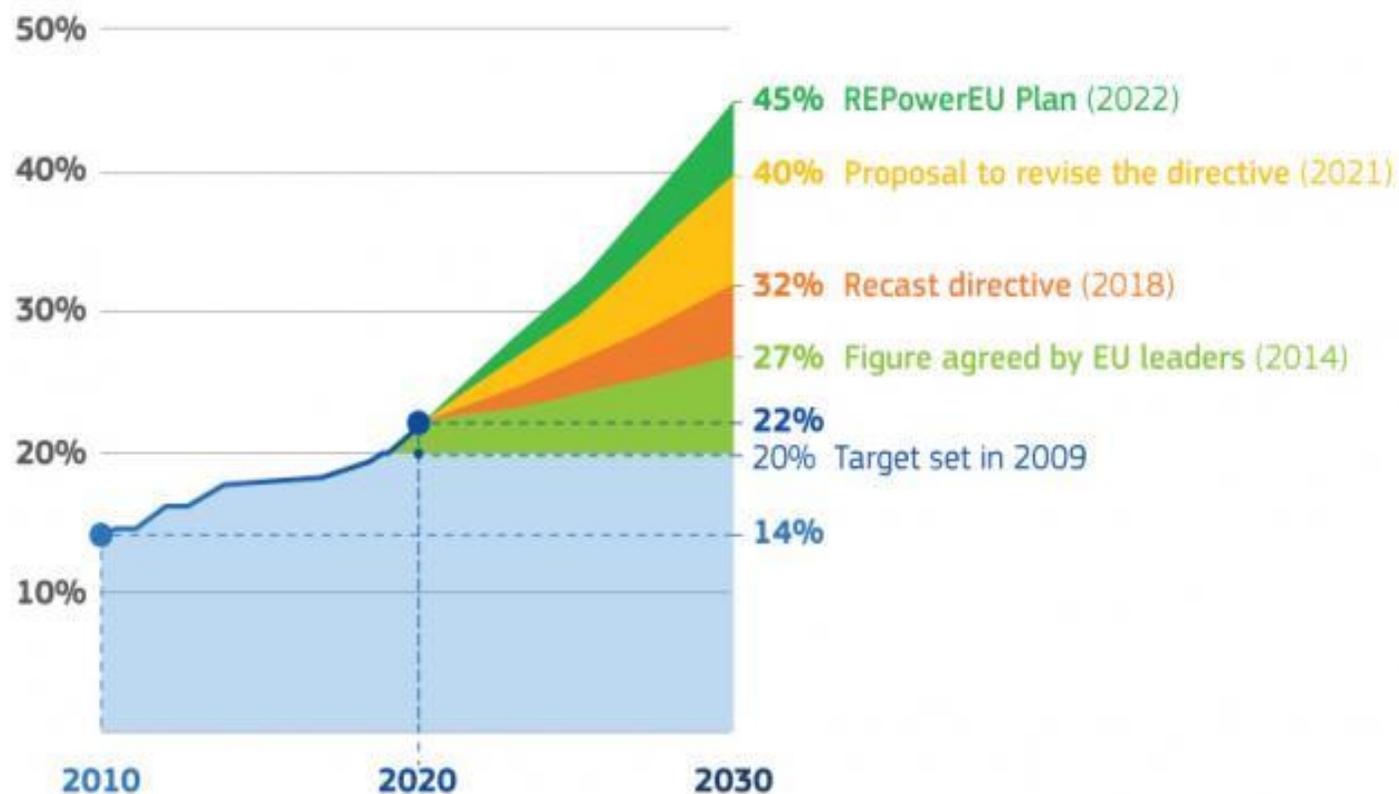
# Batteries Taking Charge of the California Grid

Average battery dispatch by 5 minute interval in April (CAISO 2018 - 2024)



# La forte risposta UE con un progressivo innalzamento dell'obiettivo 2030 sulle rinnovabili

## Evolution of renewable energy targets

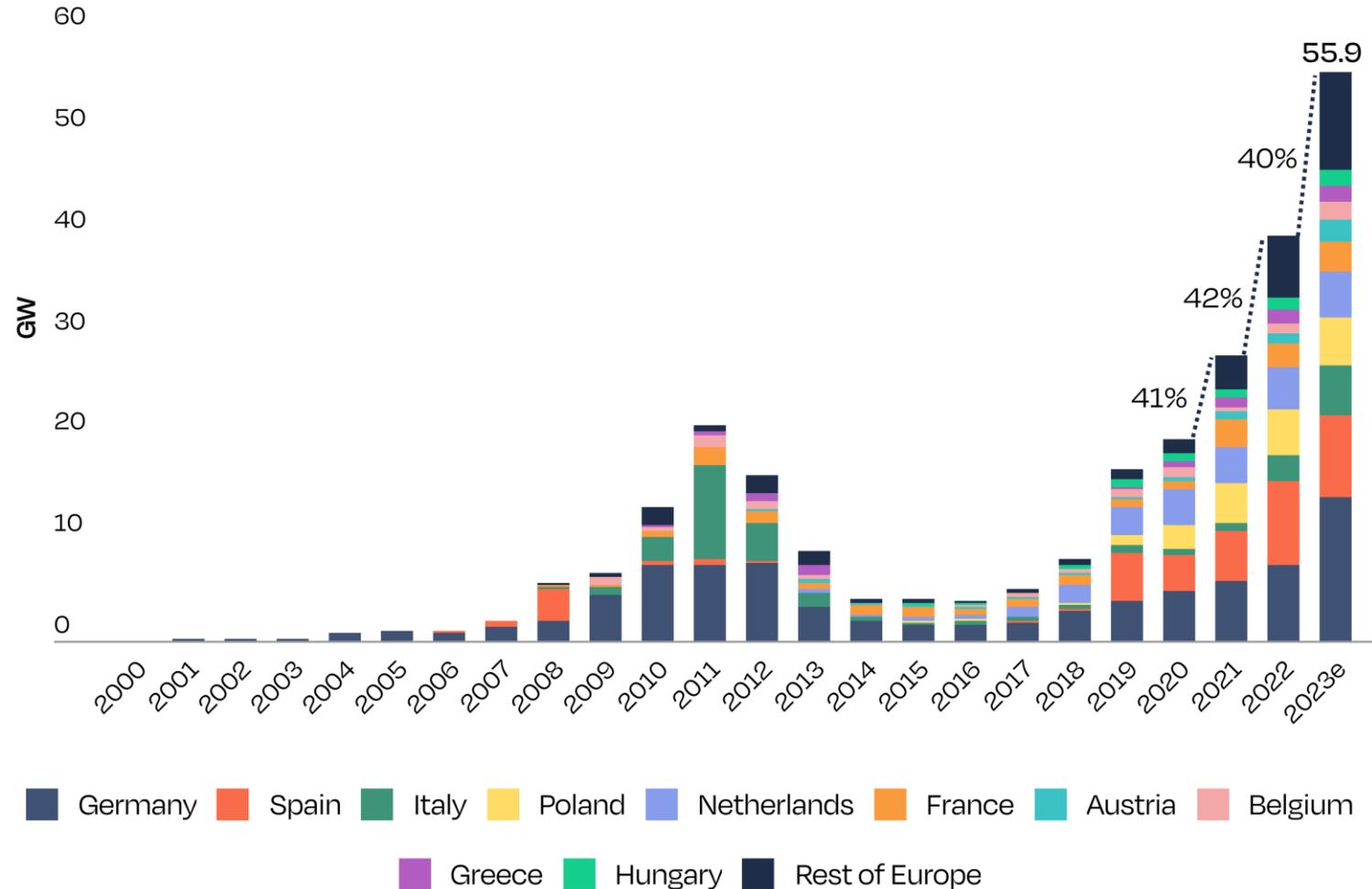


Target 45% consentirebbe di risparmiare 200 mld € nelle importazioni di gas nella UE

Attuale proposta 2030  
**42,5% dei consumi energetici,**  
target che implica 60-80% di rinnovabili elettriche

# L'Europa solare ha ripreso a correre

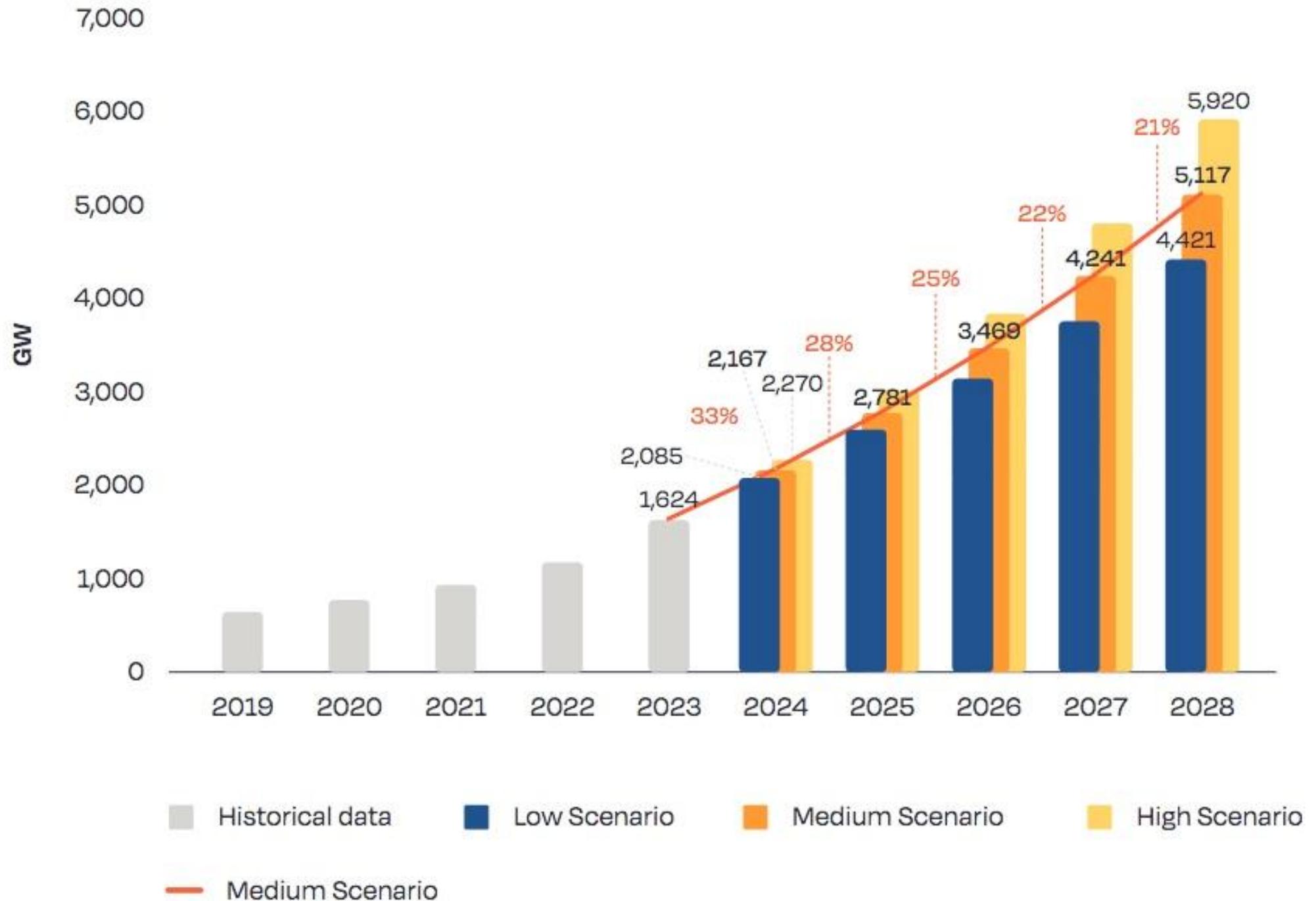
EU-27 Annual Solar PV Installed Capacity, 2000-2023



SOURCE: European Market Outlook for Solar Power 2023-2030

UE

SPE 24

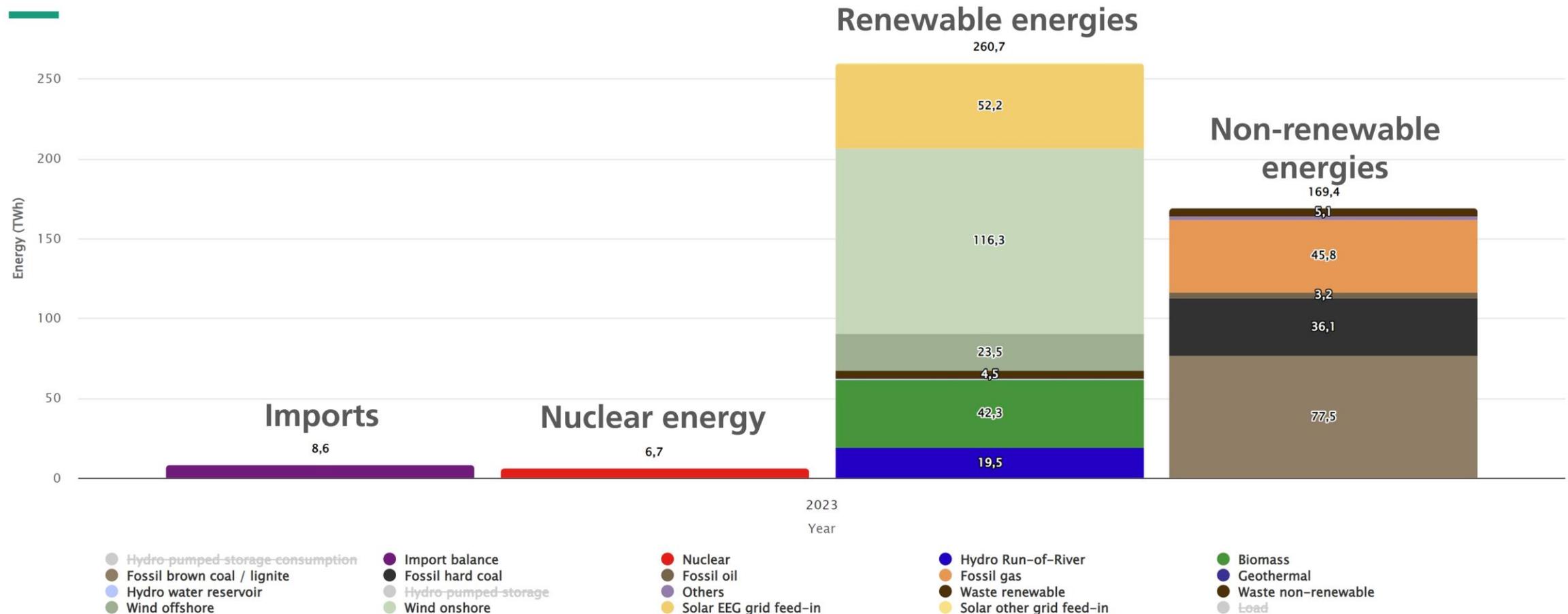


# Germany Share of renewables in the load was 57.1% in 2023

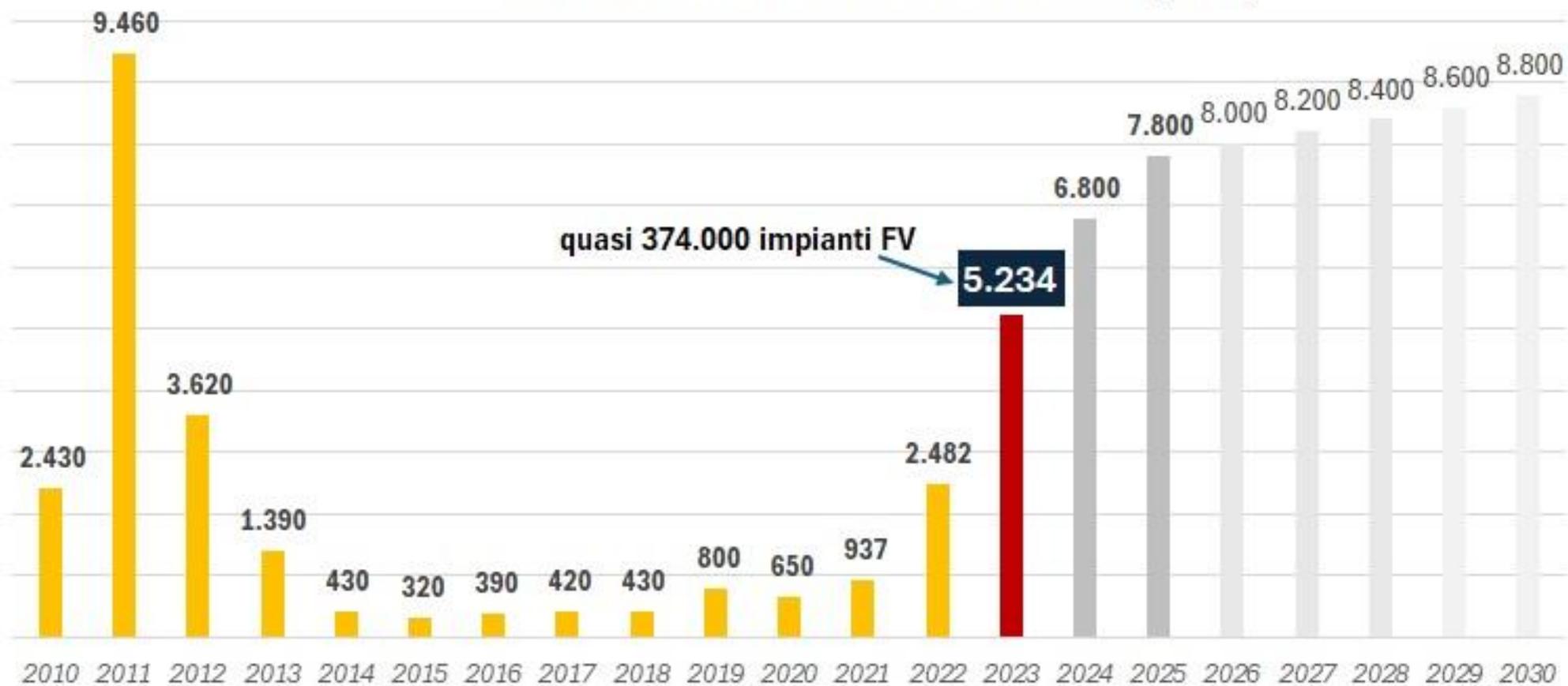
[Fraunhofer Institute for Solar Energy Systems ISE](#)

## Public net electricity generation

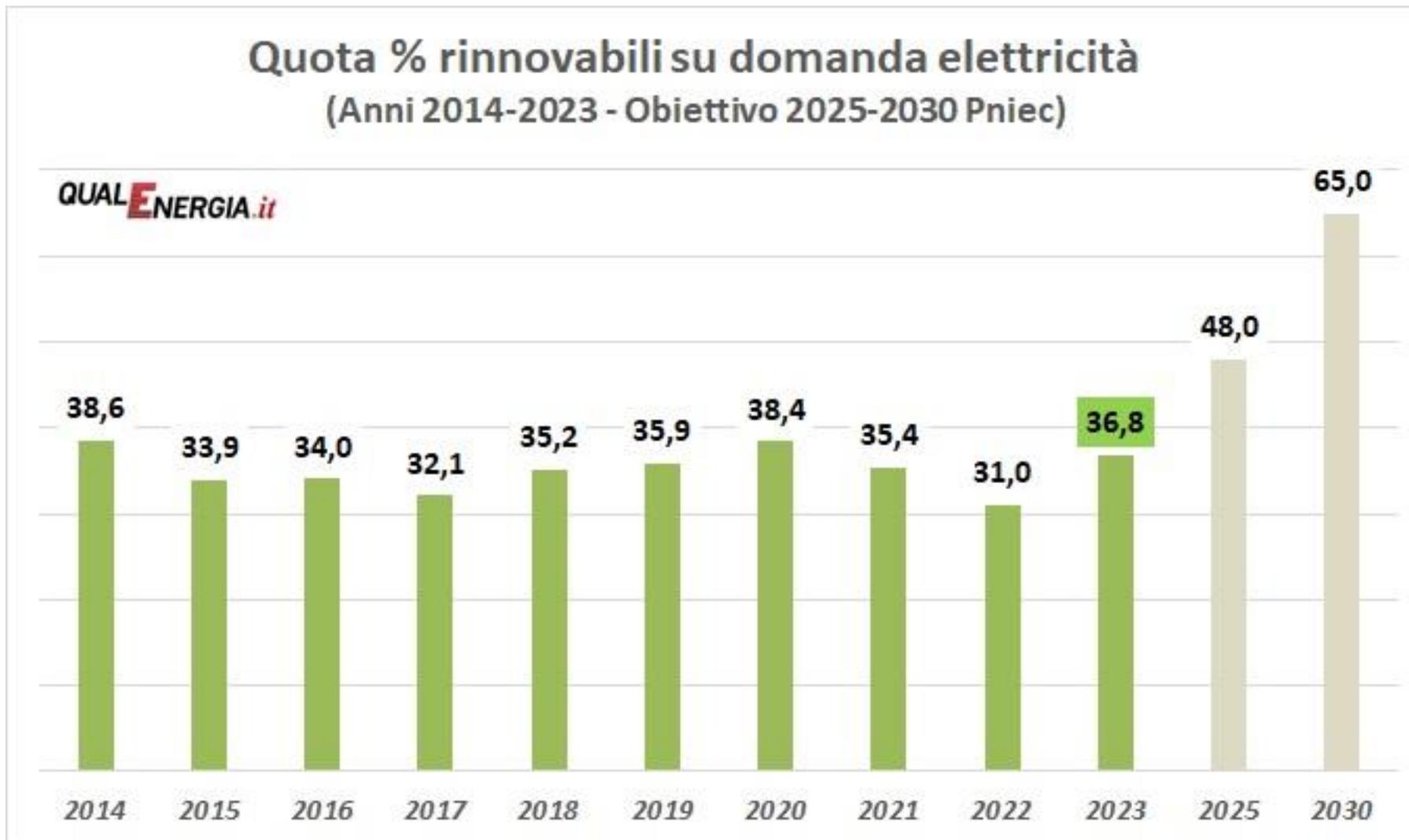
Year 2023



## FOTOVOLTAICO INSTALLATO ANNUALE IN ITALIA (MW)



# E sul fronte della generazione elettrica?



2013-2021  
Media 0,8 GW

2022  
2,5 GW solari

2023  
5,2 GW solari

Genn - Apr 24  
39,6%

# Consumi di energia elettrica in Italia

Maggio 2024

**24,7** mld kWh

Maggio 2024

+1,9%

SU MAGGIO 2023

+1,1%

SU GENNAIO-  
MAGGIO 2023

**125,9** mld kWh

Gennaio-  
Maggio 2024

Consumi  
industriali\*

**+1,4%**

SU MAGGIO 2023

\*Indice IMCEI

**84,7%**

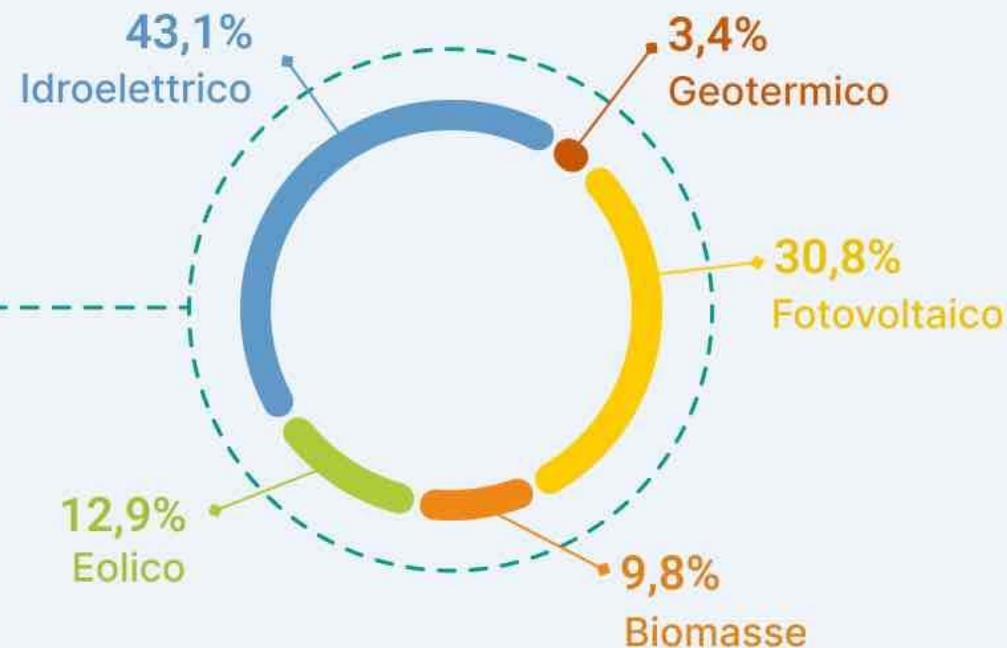
Produzione  
nazionale

**15,3%**

Energia  
scambiata  
con l'estero

**52,5%**

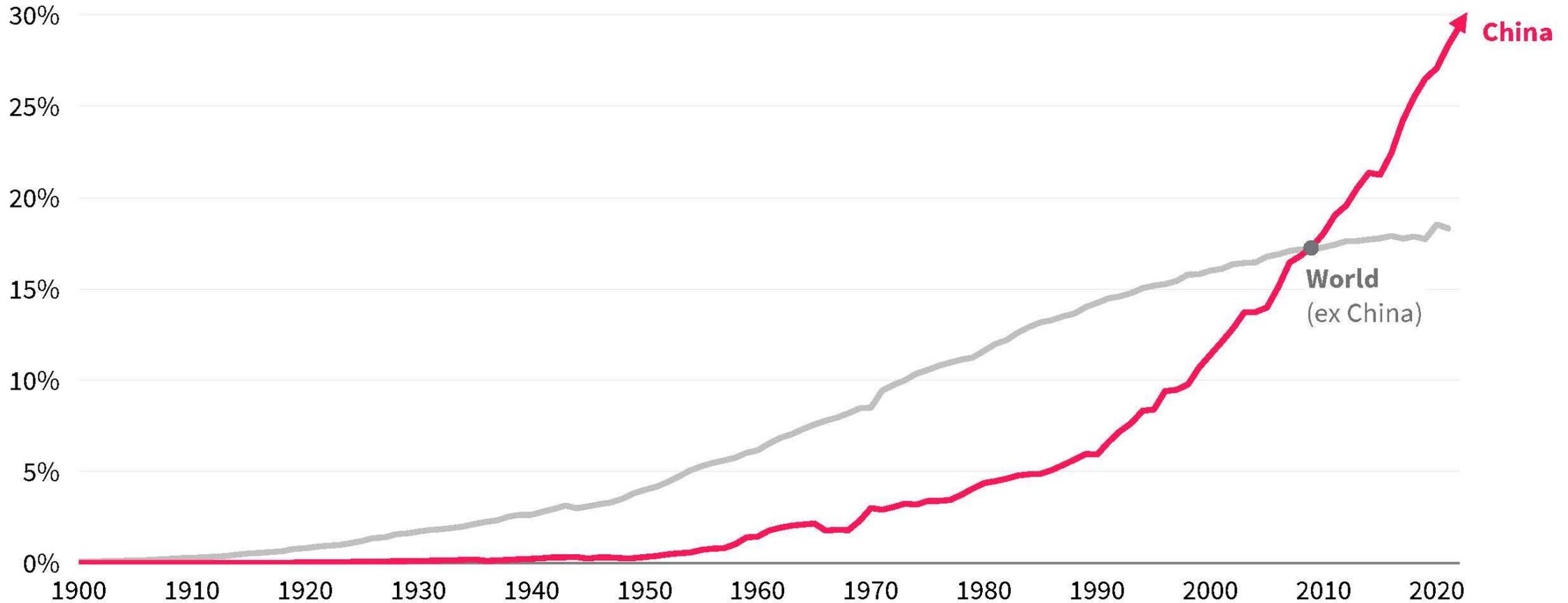
Copertura  
rinnovabili della  
domanda



# China has become the first major electrostate

China has been electrifying at 10 percentage points per decade, nine times faster than the rest of the world

## Electricity share of final energy



Notes: IIASA data to 1971, IEA onward.

Source: IIASA, IEA WEB. WEB defines final energy slightly differently than WEO.

# Share of electric cars in China priced higher or lower than conventional alternatives, 2018 & 2023

Global EV Outlook 2024

