



CLIMATE ENERGY FINANCE

Tim Buckley, Director,
[Climate Energy Finance](https://climateenergyfinance.org)
tim@climateenergyfinance.org

YPO Master Class:
The maths of energy
investments

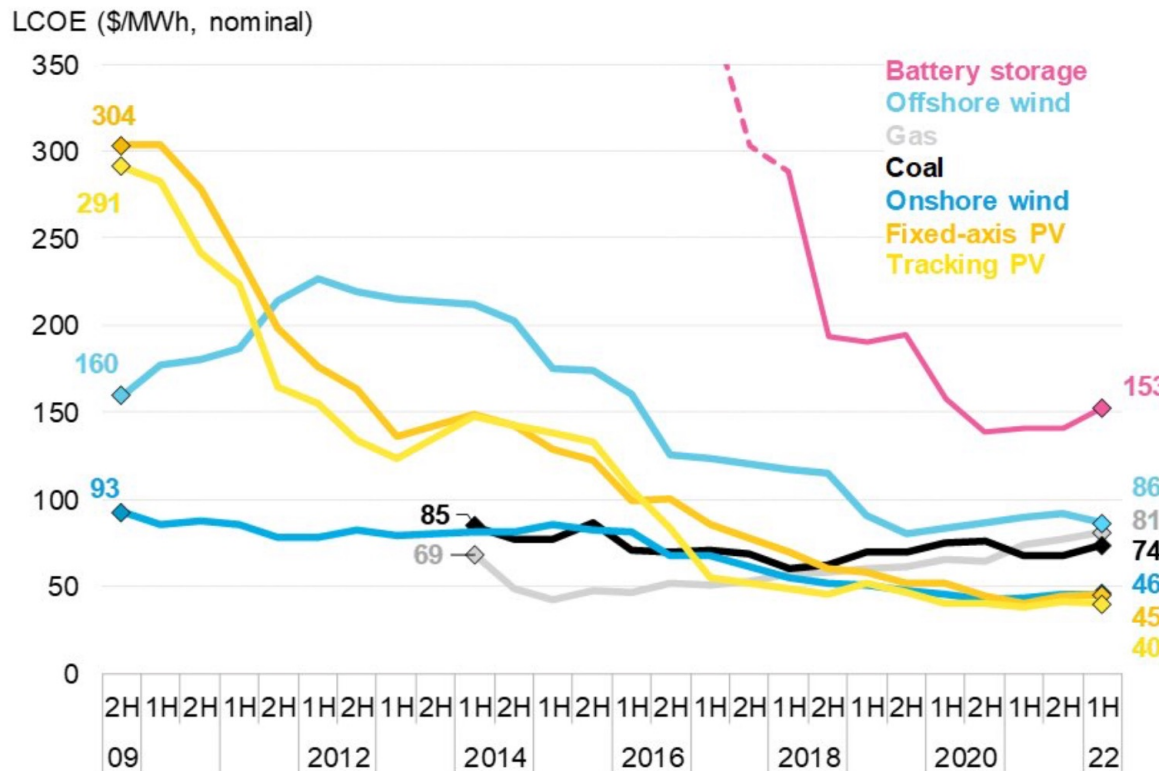
Energy Transition:
Momentum is Building

12 October 2022

Technology-Driven Deflation

Ongoing Renewable Energy and Battery Deflation

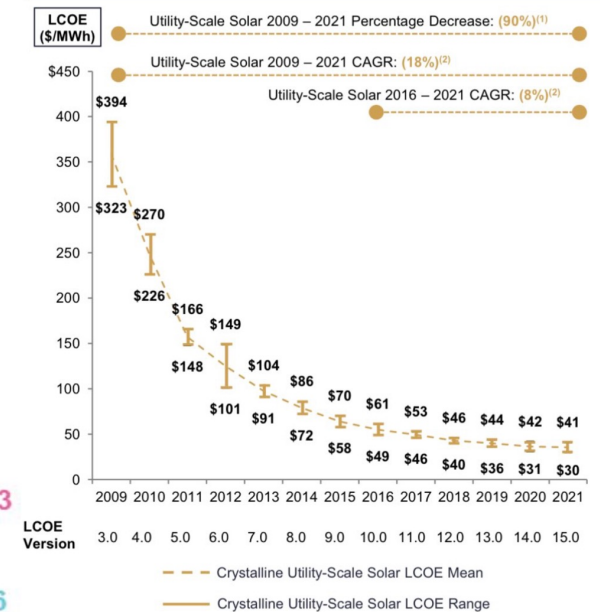
Figure 1: Global levelized cost of electricity benchmarks, 2009-2022



Source: BloombergNEF. Note: The global benchmark for PV, wind and storage is a country-weighted average using the latest annual capacity additions. The storage LCOE is reflective of a utility-scale Li-ion battery storage system with four-hour duration running at a daily cycle and includes charging costs.

Source: Bloomberg New Energy Finance, July 2022

Unsubsidized Solar PV LCOE



Relative advantage is accelerating vs hyperinflation in fossil fuel prices in 2022.

Global Finance Zero Emissions Pledges

UN Net Zero Finance Alliance aligning to 1.5°C

New Financial Alliance for Net Zero Emissions Launches



PRESS RELEASE ISSUED ON BEHALF OF THE COP25 and COP26 CLIMATE CHAMPIONS

Industry-led and UN-convened Net Zero Banking Alliance also announced today, co-launched by the UNEP Finance Initiative and the Financial Services Taskforce of the Sustainable Markets Initiative

- The Glasgow Financial Alliance for Net Zero (GFANZ), chaired by Mark Carney, UN Special Envoy on Climate Action and Finance, brings together over 160 firms (together responsible for assets in excess of \$70 trillion¹) from the leading net zero initiatives across the financial system to accelerate the transition to net zero emissions by 2050 at the latest.
- All GFANZ member alliances must be accredited by the UN Race to Zero campaign. They must use science-based guidelines to reach net zero emissions, cover all emission scopes, include 2030 interim target setting, and commit to transparent reporting and accounting in line with the UN Race to Zero criteria.
- 43 banks from 23 countries (with assets of \$28.5 trillion) form the Net-Zero Banking Alliance (NZBA) today – which joins GFANZ – with its members committing to align operational and attributable emissions from their portfolios with pathways to net-zero by 2050 or sooner.

**US\$130 trillion by Nov 2021
(+90% in 6 months)**

A Tectonic Shift Accelerates

In January of last year, I wrote that climate risk is investment risk. I said then that as markets started to price climate risk into the value of securities, it would spark a fundamental reallocation of capital. Then the pandemic took hold – and in March, the conventional wisdom was the crisis would divert attention from climate. **But just the opposite took place, and the reallocation of capital accelerated even faster than I anticipated.**

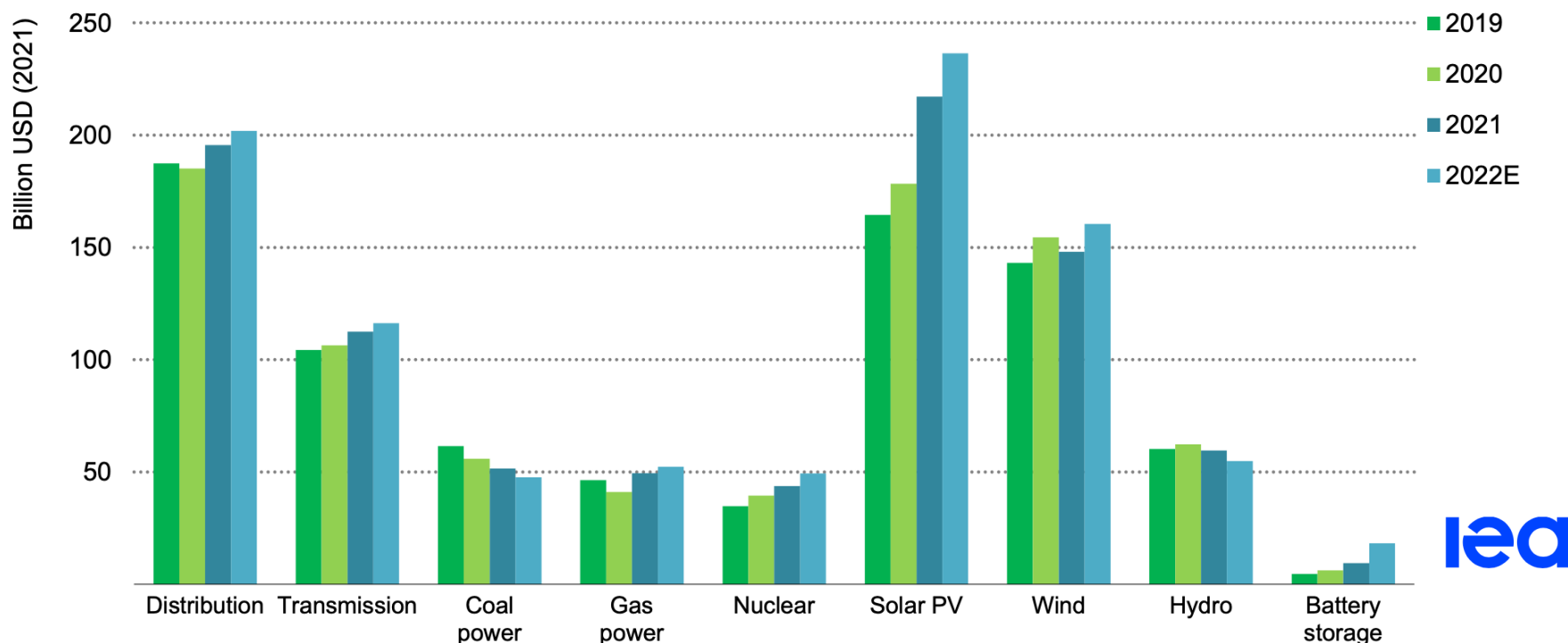
From January through November 2020, investors in mutual funds and ETFs invested \$288 billion globally in sustainable assets, a 96% increase over the whole of 2019.¹ I believe that this is the beginning of a **long but rapidly accelerating transition** – one that will unfold over many years and reshape asset prices of every type. **We know that climate risk is investment risk. But we also believe the climate transition presents a historic investment opportunity.**

BlackRock (AuM \$10 trillion)
[Larry Fink 2021 CEO Letter](#)

Global Energy Investments

The world will see a cumulative US\$100 trillion 'invested' in energy by 2050

Global annual investment in the power sector by technology, 2019-2022E



IEA. All rights reserved.

Notes: Gas-fired generation investment includes both large-scale plants and small-scale generating sets and engines; hydropower includes pumped-hydro storage.

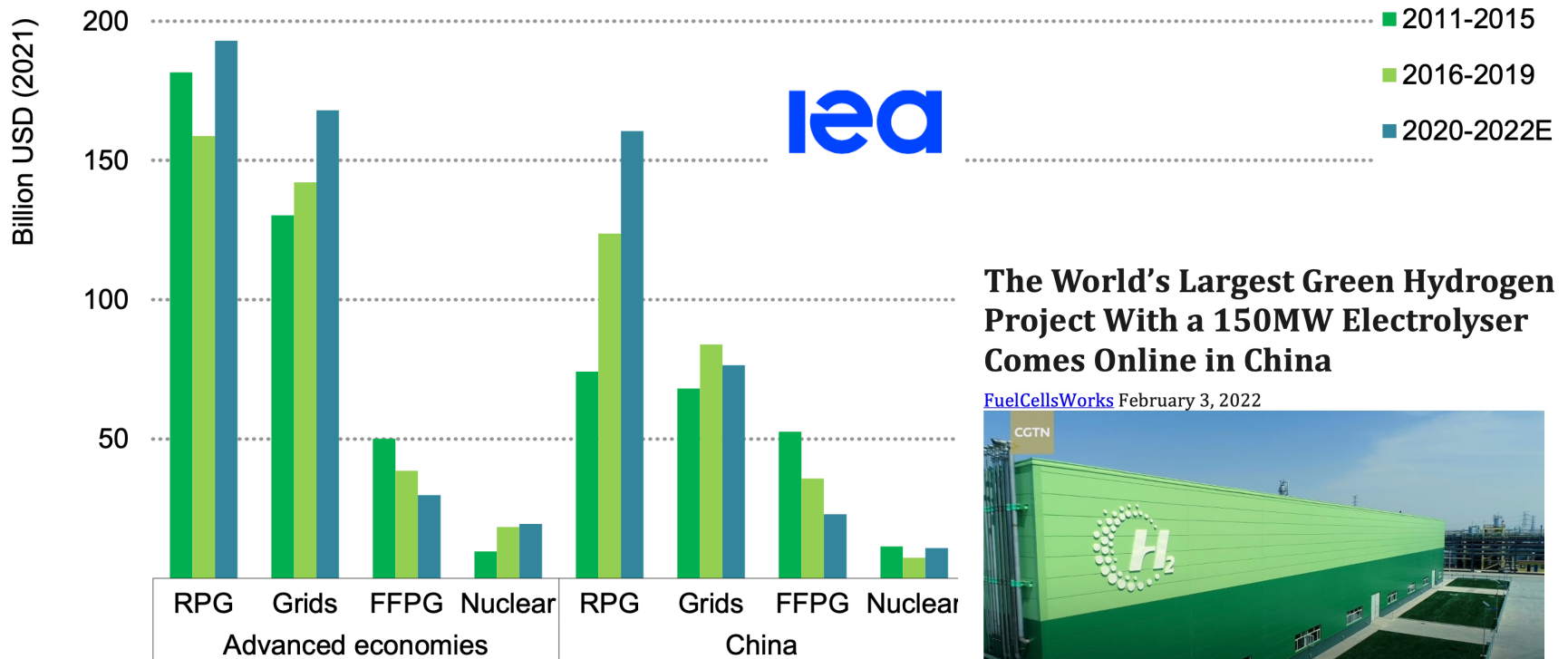
Source: IEA World Energy Investment 2022

As emerging markets grow, and annual fossil fuel spend is capitalised into upfront RE infrastructure capex, energy investments will rise to ~\$4 trillion pa - US\$100 trillion by 2050

China Leads the World on RE & EV Investing

China is big in coal, but it aims to be bigger in decarbonisation industries

Average annual investment in the power sector by geography and category, 2011-2022E



Source: IEA World Energy Investment 2022

Notes: RPG = renewable power generation; FFPG = fossil fuel power generation.

China leads the world on wind & solar installs & manufacturing, EV & batteries, hydro, nuclear, ground heat pumps, grid T&D, refining critical minerals (eg lithium, rare earths, nickel) and GH2.

CEF CGTN op-ed: [How China is leading in global energy transition](#)

The World's Largest Green Hydrogen Project With a 150MW Electrolyser Comes Online in China

[FuelCellsWorks](#) February 3, 2022



Chinese chemical manufacturer **Ningxia Baofeng Energy Group** has commissioned the world's largest green hydrogen project in central China's Ningxia Autonomous Region with a 150MW alkaline electrolyser powered by a 200MW solar array.

Baofeng Energy's unprecedented facility achieves full commissioning as Chinese oil giant Sinopec breaks ground on 260MW plant

China Leads the World in Electric Vehicles

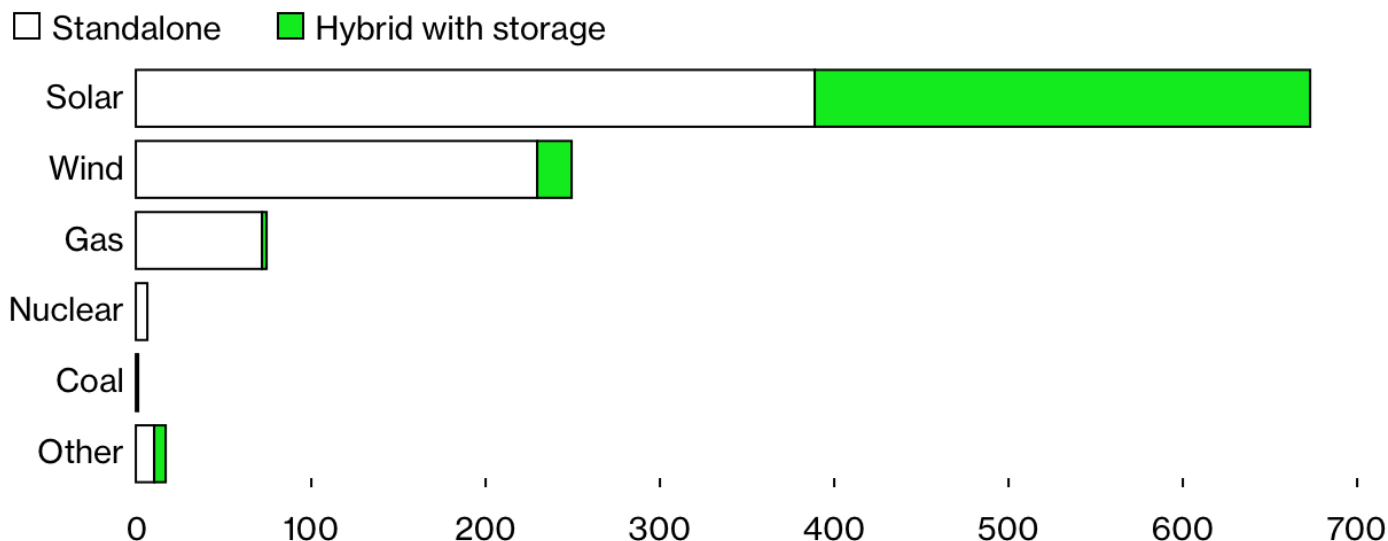
China has produced and sold 4.1 million EV/PHEV YTD'2022; growth of 110% yoy.
China is on track to sell ~60% of the world's EVs in 2022.
29% of all China car sales in August 2022 were EVs

China Autos - 2022 (1,000 sets)	August Absolute Value	August Increase rate Y/Y (%)	Share Aug	Jan-Aug Absolute Value	Jan-Aug Increase rate Y/Y (%)	Share Jan-Aug 2022
Automobile	2,426	39%		17,358	6%	
Of which: New Energy Autos	714	117%	29.4%	4,074	110%	23.5%
BYD (world's #1 EV firm)	175	155%	24.5%	974	274%	23.9%

US Inflation Reduction Act 2022

The US under President Biden has talked the talk, the IRA 2022 delivers serious firepower – US\$370bn

US interconnection queue by resource, year-end 2021, gigawatts



Source: Berkeley Lab

Note: Not all of these projects will ultimately be built!

The US has 1,000 GW of wind & solar proposals in development (US\$1.5 trillion). This includes a world leading 300GW of firmed RE proposals are in the connection queue. The US will install 6GW of batteries in 2022.

India's Aspirations: 400GW RE by 2030

Energy Security means reducing reliance on expensive, high emissions imported fossil fuels for India

India's Electricity Capacity and Generation (FY2021/22)

	---- Capacity ----		-- Generation --		Capacity	Increase
	GW	%	TWh	%	Utilisation	GW yoy
Coal-fired	210.7	52.7%	1,082.9	72.6%	58.9%	1.4
Gas-fired	24.9	6.2%	31.3	2.1%	14.3%	0.0
Diesel-fired	0.5	0.1%	0.5	0.0%	12.0%	0.0
Large Hydro	46.7	11.7%	151.6	10.2%	37.3%	0.5
Nuclear	6.8	1.7%	47.1	3.2%	79.2%	0.0
Renewables	109.9	27.5%	170.9	11.5%	19.1%	15.4
Bhutan (Import)	n.a	n.a	7.5	0.5%	n.a.	
Total	399.5	100.0%	1,491.8	100.0%		17.3

Source: CEA, CEF Calculations

Electricity demand	2021/22	1,491.8	8.0% yoy
	2020/21	1,381.9	

India's June 2022 fossil fuel import bill was >US\$800bn annualised.

Australian Electricity Generation

Coal closures are accelerating, private investors are only backing firm VRE

Renewable Share of NEM:

2017: 16%

2022 (YTD): 33%

2030 (f): 82%

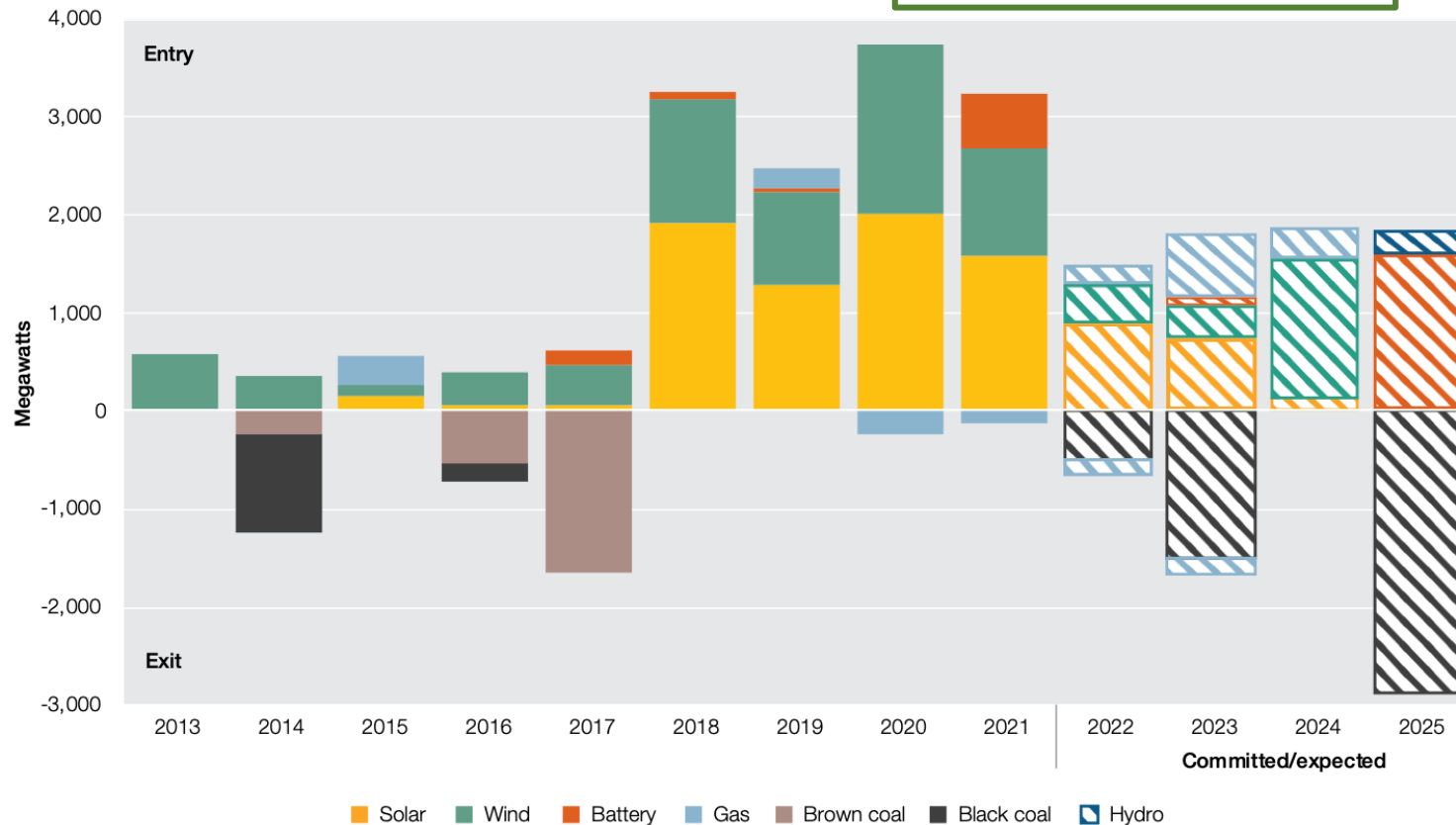
NEM coal closures pending:

2023: Liddell (2.05GW)

2025: Eraring (2.88GW)

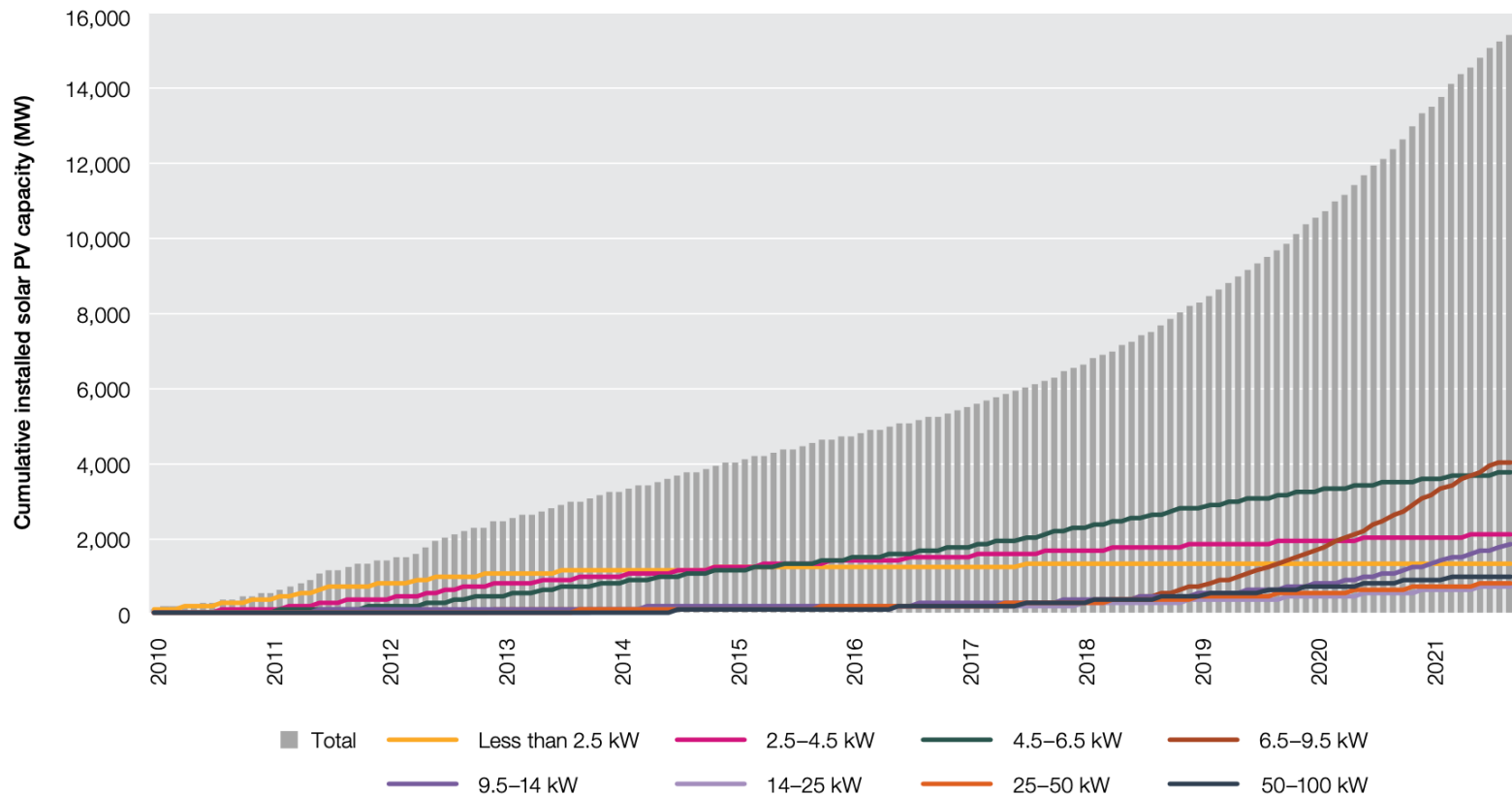
2028: Yallourn (1.48GW)

2030-33: Bayswater (2.64GW)



Rooftop Solar + EV + Storage => Disruption

Australia: 15GW of Rooftop Solar, 3GW pa adds



AEMO's Integrated System Plan:
2022: 15GW rooftop solar
2050: 68GW rooftop solar

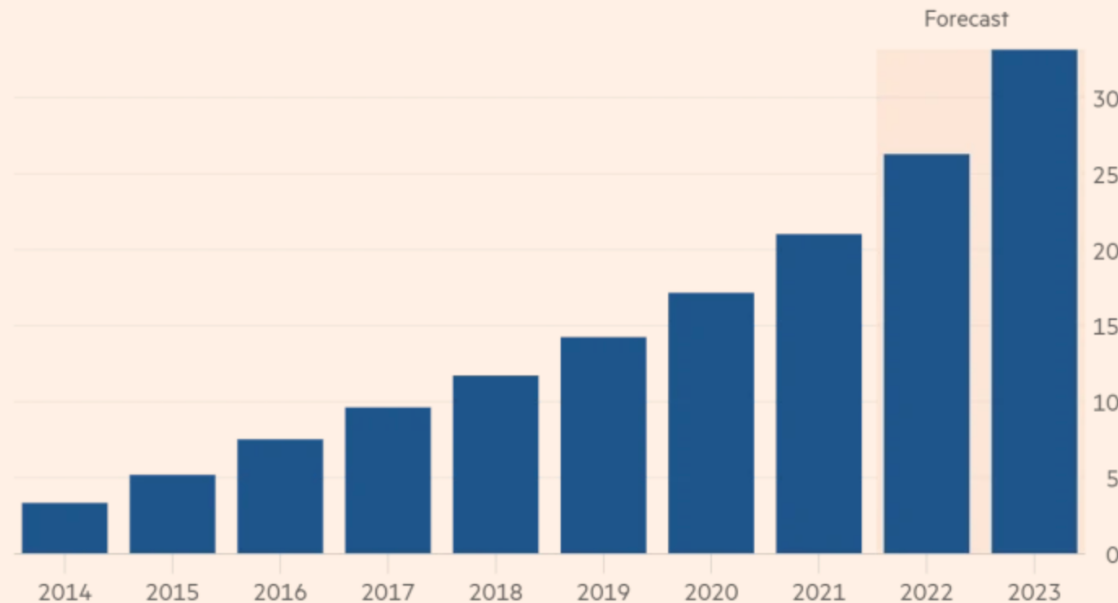
Rooftop Solar + EV + Storage => Disruption

US: 22GW in total, potentially 5.3GW adds in 2022

Storms and steep utility bills drive US rooftop solar boom

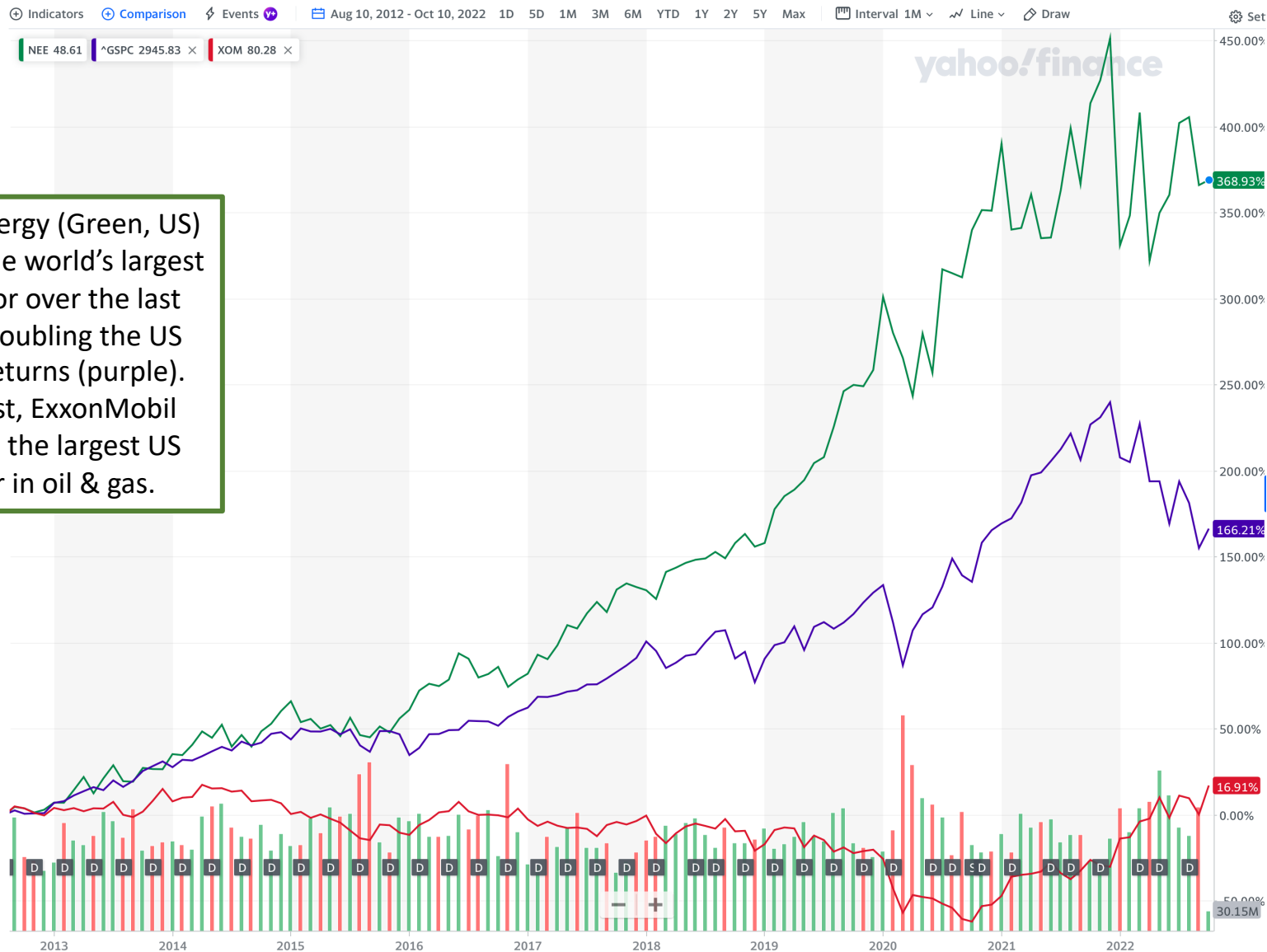
Installations have risen by 40% year on year as households seek alternatives after blackouts

Installed rooftop solar capacity, gigawatts



Source: Energy Information Administration

Nextera Energy vs ExxonMobil



NextEra Energy (Green, US) has been the world's largest RE investor over the last decade, doubling the US S&P500 returns (purple). In contrast, ExxonMobil (Red) was the largest US investor in oil & gas.