Promise and pitfalls for global green industrial policy

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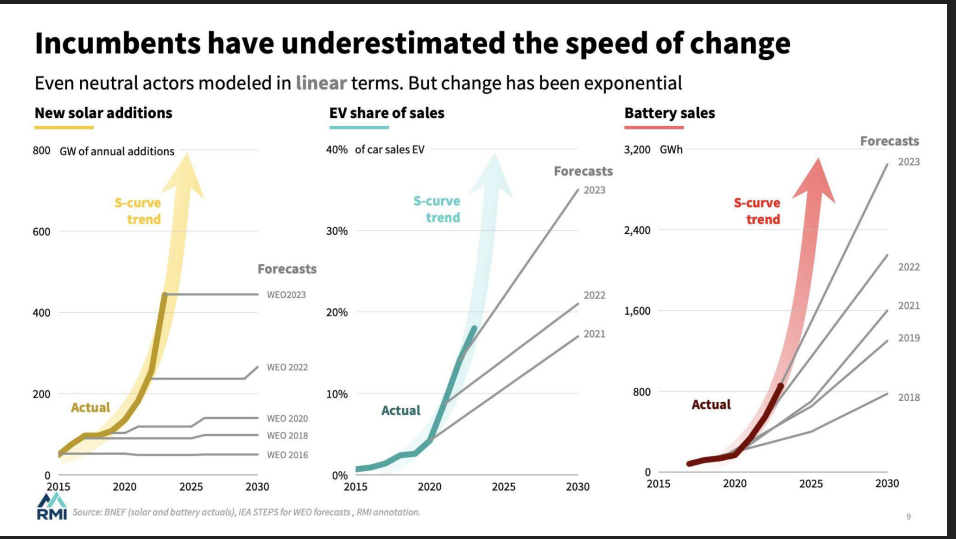
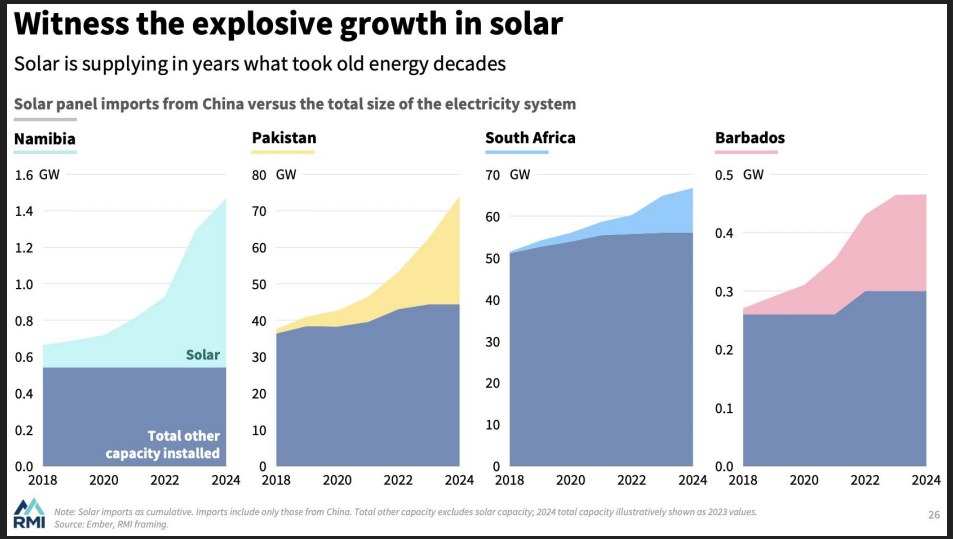
Net Zero
Industrial Policy Lab

The rise of global green industrial policy

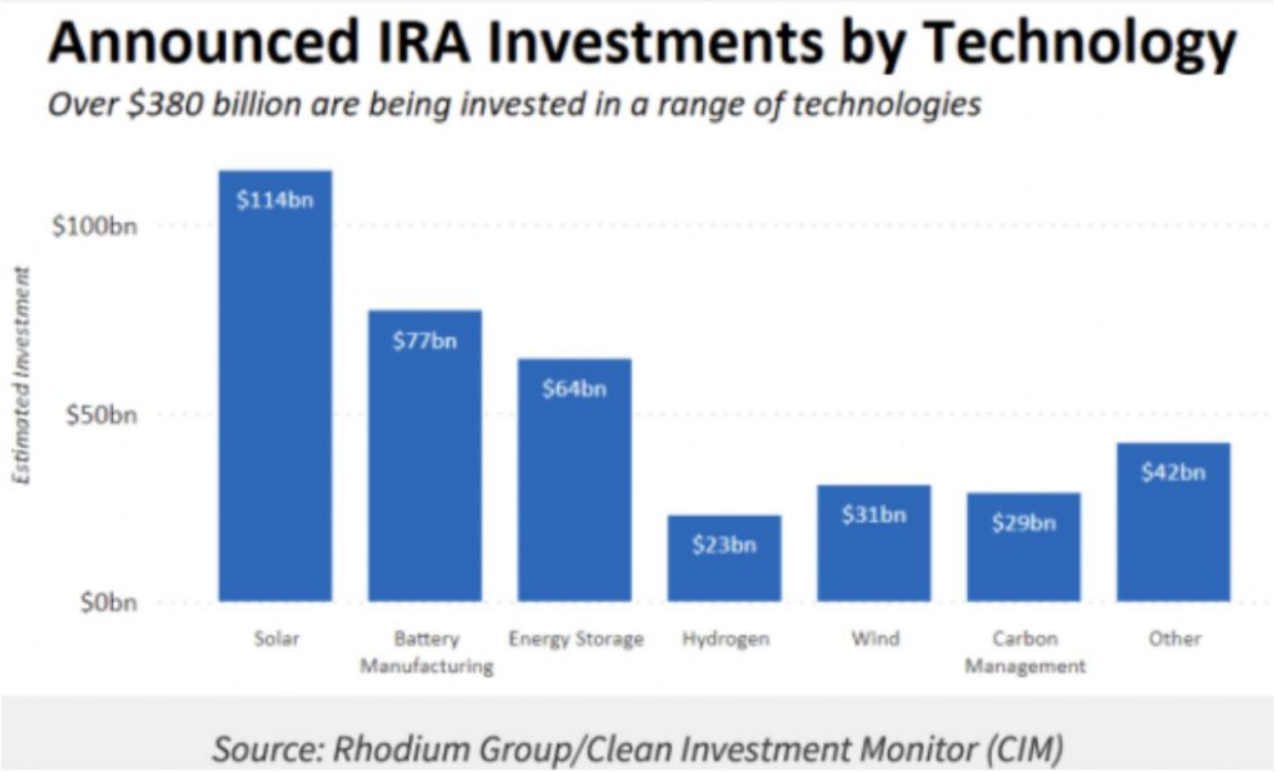
A clean energy revolution led by China, and leading to conflict between fossil and green political interests in all countries

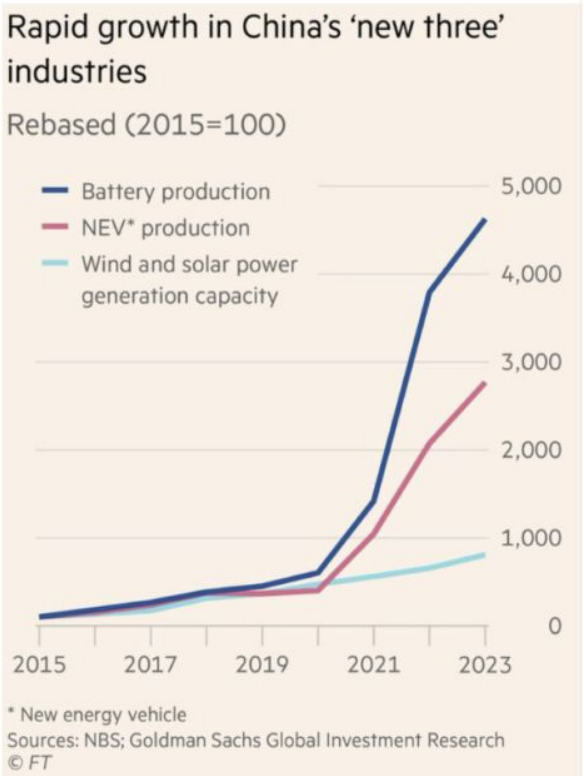




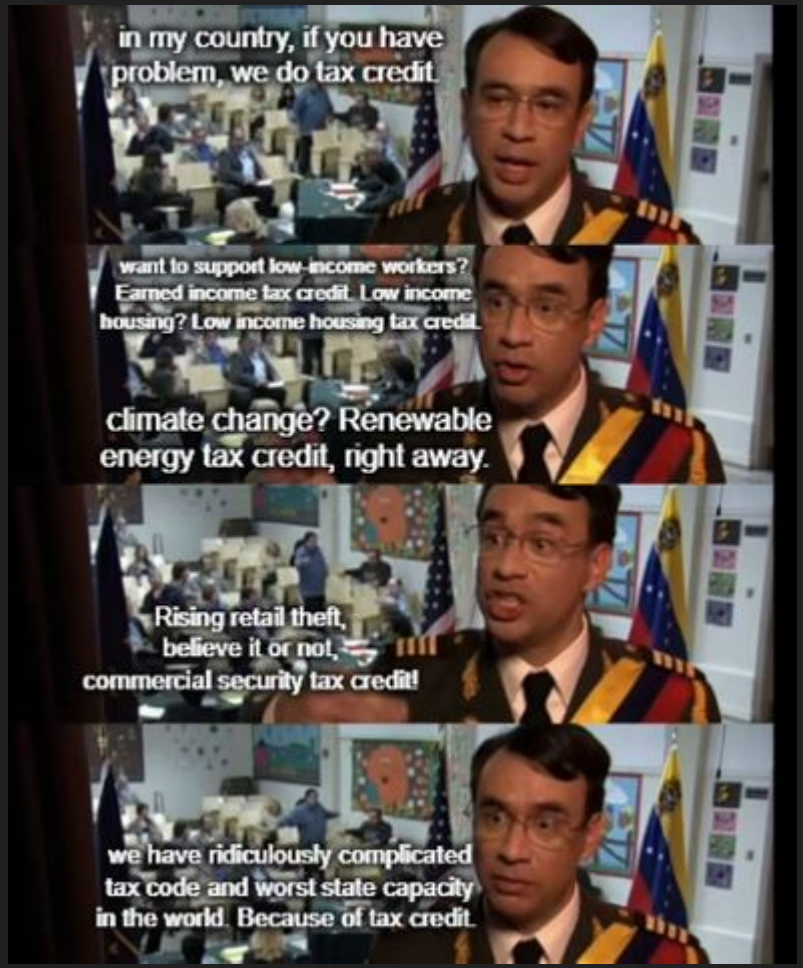
Source: Clean tech revolution: its exponential, disruptive and now (RMI); Oatley, Allan, Lewis (2021); Colgan, Green, Hale (2020)

US is a late entrant and is playing catchup to China with classic ‘developmentalist state’ tools






Bottomless
Mimosas


in my country, if you have problem, we do tax credit.
want to support low-income workers? Earned income tax credit. Low income housing? Low income housing tax credit.
climate change? Renewable energy tax credit, right away.
Rising retail theft, believe it or not, commercial security tax credit!
we have ridiculously complicated tax code and worst state capacity in the world. Because of tax credit.

IRA Changes the IRS software to make clean energy tax credits bottomless i.e uncapped. The Treasury will keep giving you public money (mimosas) if you want them and satisfy conditions. Credit Suisse think CBO has lowballed how much business, individuals, local govts, nonprofits will use tax credits by 3-5 times (report, US treasury). Caused a very real manufacturing boom (Employ America)

TABLE A1

Technologies included in the Clean Investment Monitor

Segment	Technology	Subcategories	Tax Code
Manufacturing	Solar	Modules, Cells, Wafers, Polysilicon, Torque Tubes, Structural Fasteners, Polymeric Backsheets, Inverters	45X, 48C
	Wind	Blades, Nacelles, Towers, Offshore Foundations, Related Vessels, Distributed Wind Inverters	45X, 48C
	Critical Minerals	All Eligible for 45X Credits	45X, 48C
	Batteries	Electrode Active Materials, Cells, Modules	45X, 48C
	Zero Emission Vehicles	BEVs, PHEVs and FCVs	48C
	Electrolyzers	PEM, Alkaline or SOE	48C
	Fueling	EV Charger Equipment	48C
Energy and Industry	Solar	Solar PV, Concentrating Solar Power	45, 48, 45Y, 48E
	Wind	Onshore Wind, Offshore Wind	45, 48, 45Y, 48E
	Geothermal	Geothermal	45, 48, 45Y, 48E
	Nuclear	Retention of existing and construction of new nuclear	45U, 45Y, 48E
	Storage	Batteries, Pumped Storage, Long-Duration Storage	48, 48E
	Other Electricity	Landfill Gas, Hydroelectric, Biomass	45, 48, 45Y, 48E
	Hydrogen	PEM, Alkaline, SOEC, AEM, Oil w/ CCUS, NG w/ CCUS,	45V
	Carbon Management	CCUS, Direct Air Capture	45Q, 48C
	Sustainable Aviation Fuels	HEFA, AtJ, PtJ, Bio-FT, Methane Pyrolysis	40B, 45Z
Retail	Zero Emission Vehicles	Battery Electric Vehicles, Plug-in Hybrid Electric Vehicles, Fuel Cell Vehicles	30D, 45W
	Heat Pumps	Ducted ASHP, Ductless ASHP, Geothermal Heat Pumps, ASHP Water Heaters	25C
	Distributed Electricity and Storage	Distributed Solar, Wind, Hydro, Fuel Cells and Storage	25D, 45, 48, 45Y, 48E

IRA's "foreign entity of concern" rules aim to bar the $3,750 tax subsidy from going to EVs containing critical minerals processed in China, whether by foreign or Chinese firms.

Biden's intention is to stave off the Chinese and stimulate a domestic and friendshored buildout of the EV supply chain, stretching from mines to the factory floor. Side deals with friendly governments have been made; Canada and Australia have both been deemed eligible for Defence Production Act support for their battery metals.

Souce: Great green wall

Explainer: US IRA Clean Vehicle Tax Credit (30D)

New vehicles[4] must satisfy two initial conditions to qualify for a purchase tax credit up to $7,500:

1. Assembled in North America +
2. **Foreign Entity of Concern (FEOC) compliant:** Vehicles may not contain any critical minerals (from 2025) or battery components (from 2024) that were extracted, processed, or manufactured by a FEOC.

Vehicles must also meet **critical mineral** and **battery component** requirements, each accounting for 50% of the total credit:

Part 1: Critical Mineral Requirement
$3,750
Minimum % value of critical minerals[1] in the battery must be extracted OR processed[2] in the US or Free Trade Agreement country.

Part 2: Battery Component Requirement
$3,750
Minimum % value of components[3] in the battery must be manufactured or assembled in North America.

	2023	2024	2025	2026	2027	2028	2029
Minerals	40%	50%	60%	70%	80%	80%	80%
Component	50%	60%	60%	70%	80%	90%	100%

Notes:
1- Critical minerals applicable to batteries include: Li, Ni, Co, Mn, graphite, among trace minerals
2- Processing means the refining of minerals into constituent materials include powder of CAM and AAM, foils, electrolyte sales and additives etc.
3- Battery Components include: electrode, electrolyte, separator, battery module
4- Selling price must not exceed $80k for vans, SUVs, and pickup trucks, and $55k for other vehicles

IEA's Energy Technology Perspectives 2024 report – came out this week, and is fantastic. IEA is the global observatory of data collected from firms and governments. It is usually the first report that IP bureaucrats and companies reach for when undertaking any investment project

Four-fifths of the clean technology manufacturing investment in 2023 went to solar PV and battery manufacturing.
EV plants another 15%

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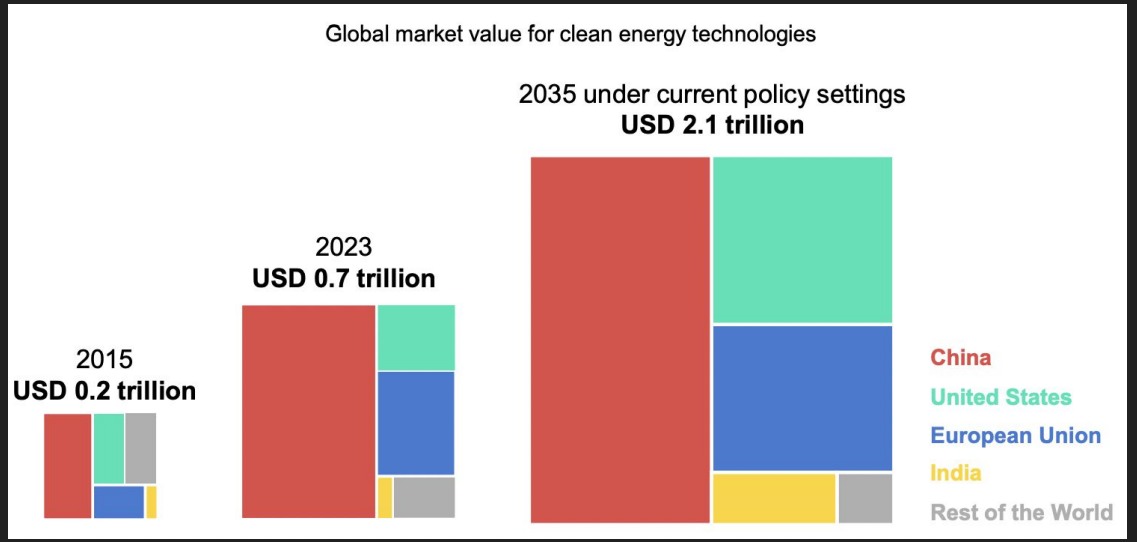

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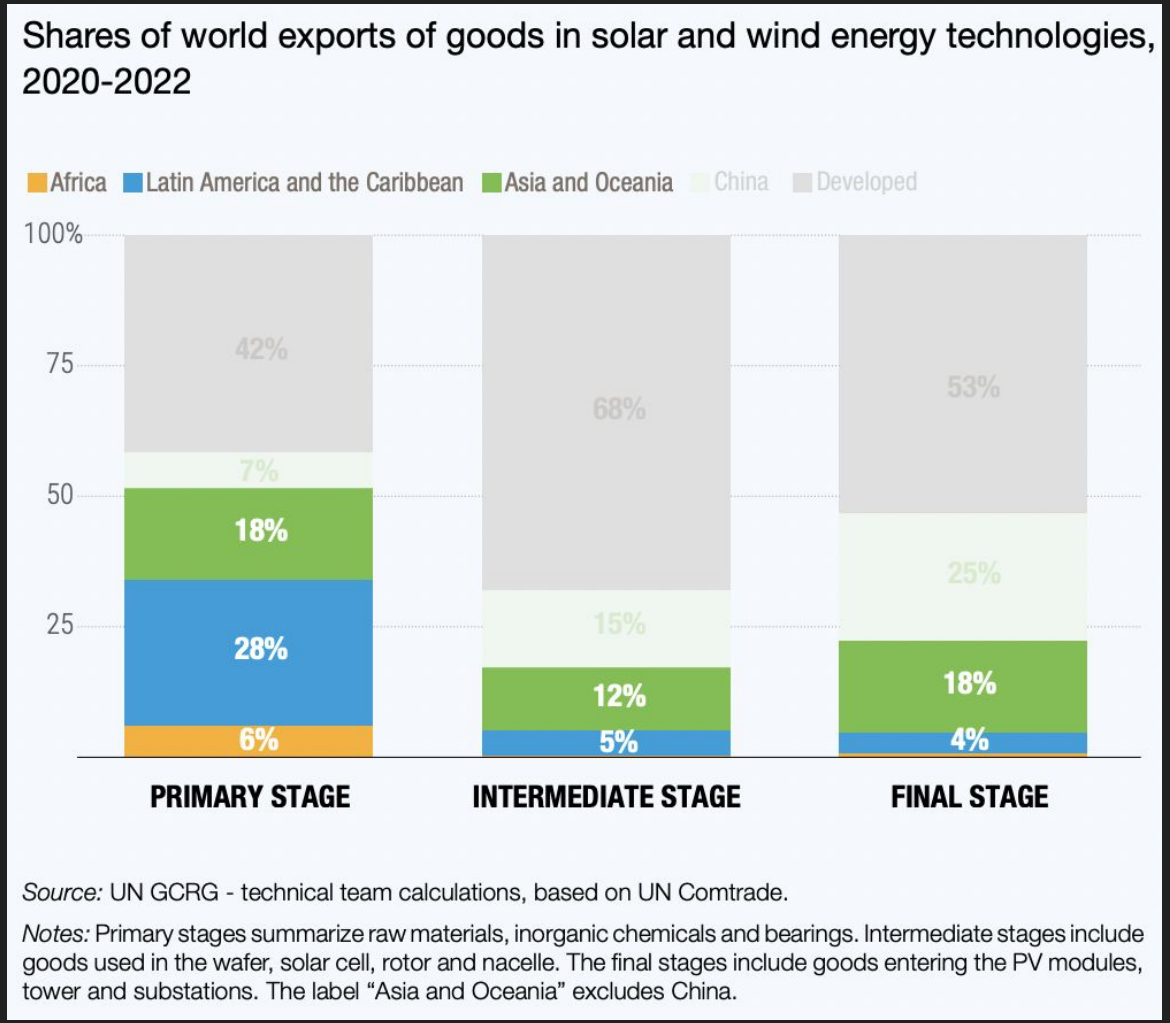
UNCTAD Powering Trade 2024:
"Developing countries are slipping into traditional **trade** patterns, acting as net exporters of raw materials for solar and wind energy value chains, but net importers of manufactured goods"



New “Green Industrial diplomacy”: developing countries are bargaining market access, finance, and technology deals with green leaders: US, EU and China

New "Green Industrial Green diplomacy": developing countries are bargaining market access, finance, and technology deals with green leaders: US, EU and China

Country	Existing mfg policies	Manufacturing economy	Key manufacturing sectors	Mineral base	Potential comparative advantages in clean energy
Brazil	Nova Indústria Brasil (2024): comprehensive industrial policy to increase mfg competitiveness	11% of GDP, largest manufacturing economy in South America	Automotive, aerospace, chemicals, electrical machinery (including wind turbines), steel	Sizable graphite, manganese reserves	Critical minerals & processing, SAF, hydrogen, turbine components
India	2020 Covid-19 stimulus bill included local production incentives, including for clean energy industries	13% of GDP, largest manufacturing economy in South Asia	Chemicals, pharmaceuticals, electronics, automotive, industrial machinery, wind turbines, solar	Some graphite reserves	Wind, solar
Kenya	2023/24 budget prioritized manufacturing and industrialization as key vectors for economic development.	8% of GDP, fifth largest in Africa	Some iron/steel production	Some domestic iron reserves; large resource bases in neighbors (graphite in Tanzania, cobalt in DRC)	Geothermal, critical minerals processing, services

Administration

• **Launching a New Clean Energy Supply Chain Collaborative.** According to the International Energy Agency, the world must invest $1.24 trillion in clean energy technology supply chain capacity between now and 2030 to be on track to achieve net zero energy by 2050. To help meet this challenge, the United States announced a new Clean Energy Supply Chain Collaborative (CESC Collaborative) aimed at expanding and diversifying clean energy supply chains that are critical to the clean energy transition. The Collaborative will enable like-minded countries to advance policies, incentives, standards, and investments to create high-quality, secure, and diversified clean energy supply chains across seven critical technologies: wind, solar, batteries, electrolyzers, heat pumps, direct air capture, and sustainable aviation fuels. Participating countries will work together to optimize the economic opportunities the clean energy transition provides, strengthen key stages of global clean technology supply chains where challenges related to lack of capacity are most acute, and further reduce the cost of clean energy technologies. To jump-start clean energy supply chain investment in developing countries, the United States announced up to $568 million in new concessional lending available from the U.S. Department of Treasury through the Clean Technology Fund (CTF) to support eligible projects in CTF-eligible countries.

World order is currently unsafe for developing countries to pursue industrial policy

WB, IMF, WTO spent decades suppressing industrial policy

– Imposing conditionalities on counter-cyclical spending by developing countries

– Austerity policy impede health, education (human capital), worsen inequality

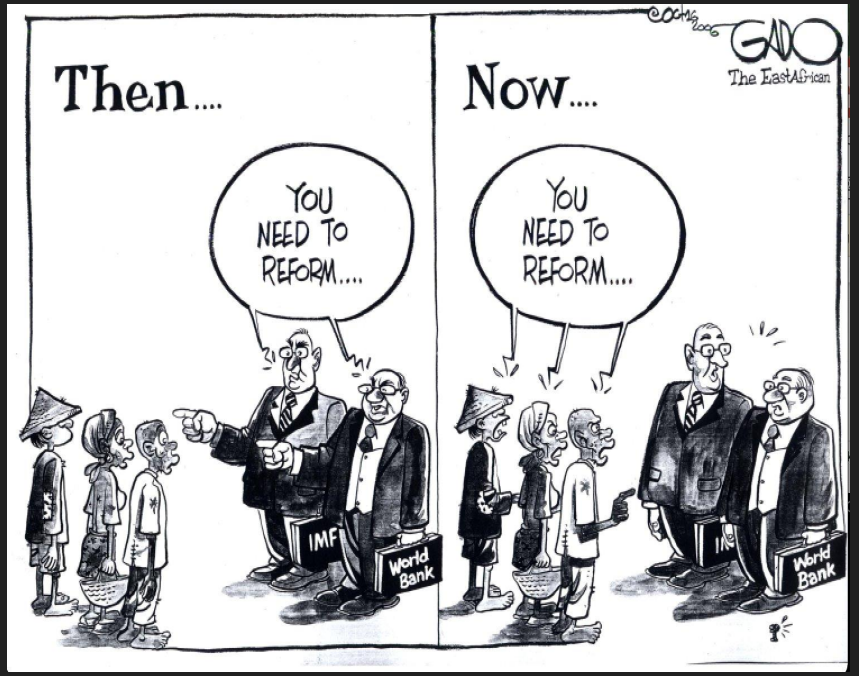
– Promoting privatization, outsourcing staff to consultants --> loss of state capacity

Now the space is open, but:

– industrial policy is hard

– Too much effort in too few verticals

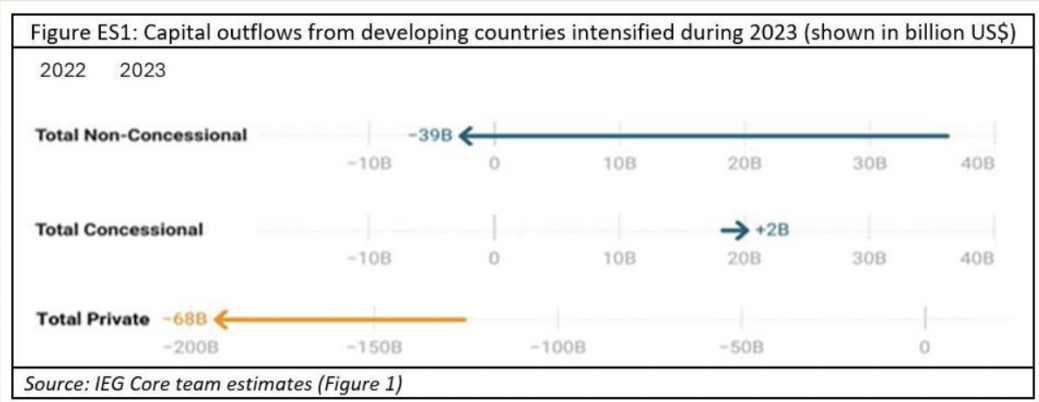
– Translating FDI into value-add and technology transfer can be tricky



Challenge 1: **Debt problem of Post-IRA regime**: Global South left high and dry. Two-tier Global South- developmentalist states like Brazil, India, Indonesia while smaller countries in debt distress like Kenya cannot pursue investment out of domestic revenue.

"IMF is on net withdrawing funds from the developing world..defaults have been avoided only by the moral default of slashing health & education"

- Larry Summers & NK Singh, G20 Independent expert Group 2023report



"Billions to trillions," the catchphrase for the World Bank's plan to mobilize private-sector money for development, has become "millions in, billions out."

— Larry Summers and NK Singh

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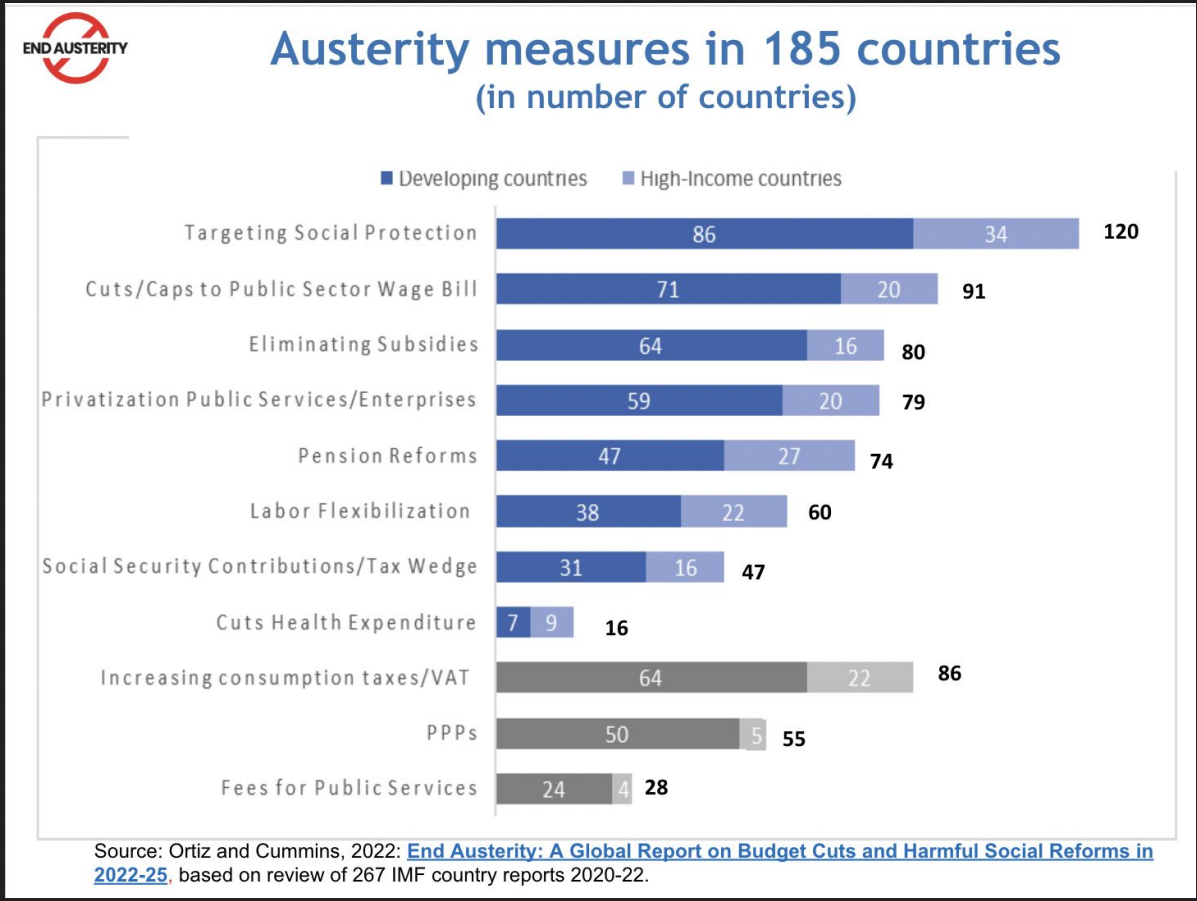


Ruto’s Washington state visit in April advanced green “technological cooperation” with the US. The idea is for the US to facilitate investments in Kenya’s green growth agenda—data centers, geothermal electricity, electric two wheelers, green fertilizers—that Ruto launched as a “African Green Investment Initiative” at COP28 with $4.5 billion from UAE.

African economy + Add to myFT

Kenya's mass protests expose African fury with IMF

William Ruto is latest president of developing country caught between multilateral lenders and angry population

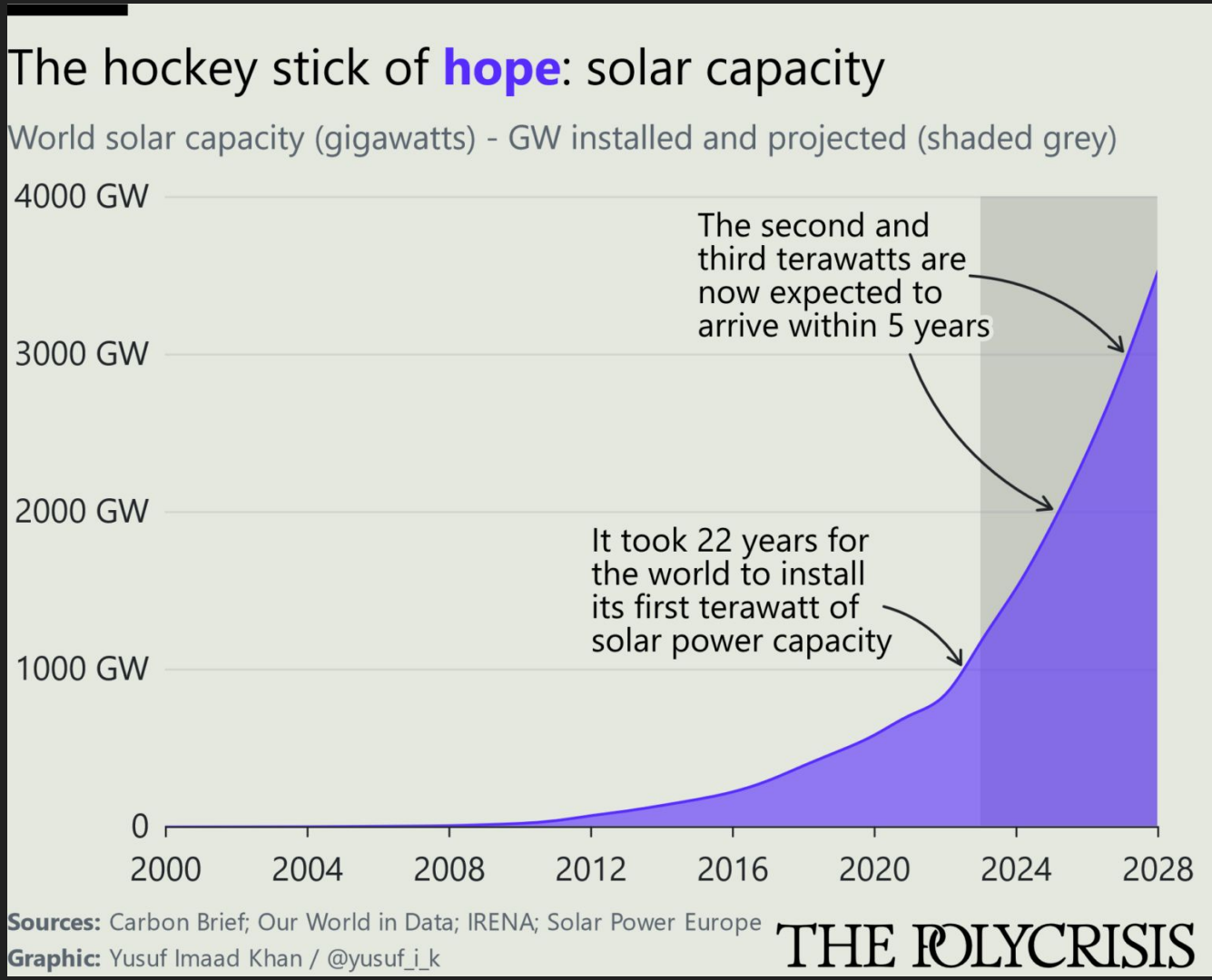
© James Wakibia/SOPA/LightRocket/Getty Images

In 2004, it took a year to install a gigawatt of PV globally.

In 2010, a month.

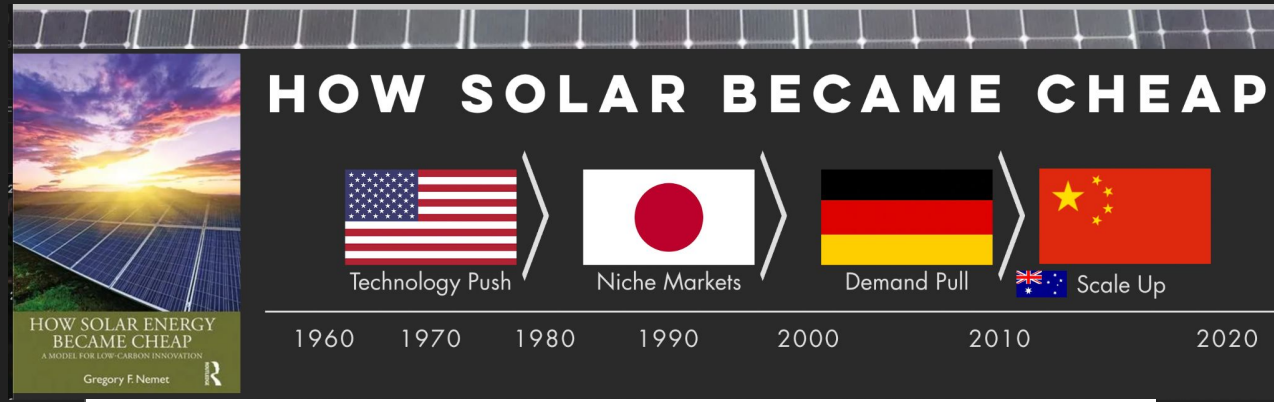
In 2016, a week.

In 2023, a day.



"PV's evolution can be summarized as the result of distinct contributions by the US, Japan, Germany, Australia,& China—in that sequence" (nemet)

China's policy targeted solar with Place & innovation subsidies that led to production efficiencies,patents, learning-by-doing. A cambrian explosion of pvt firms (van reenen)

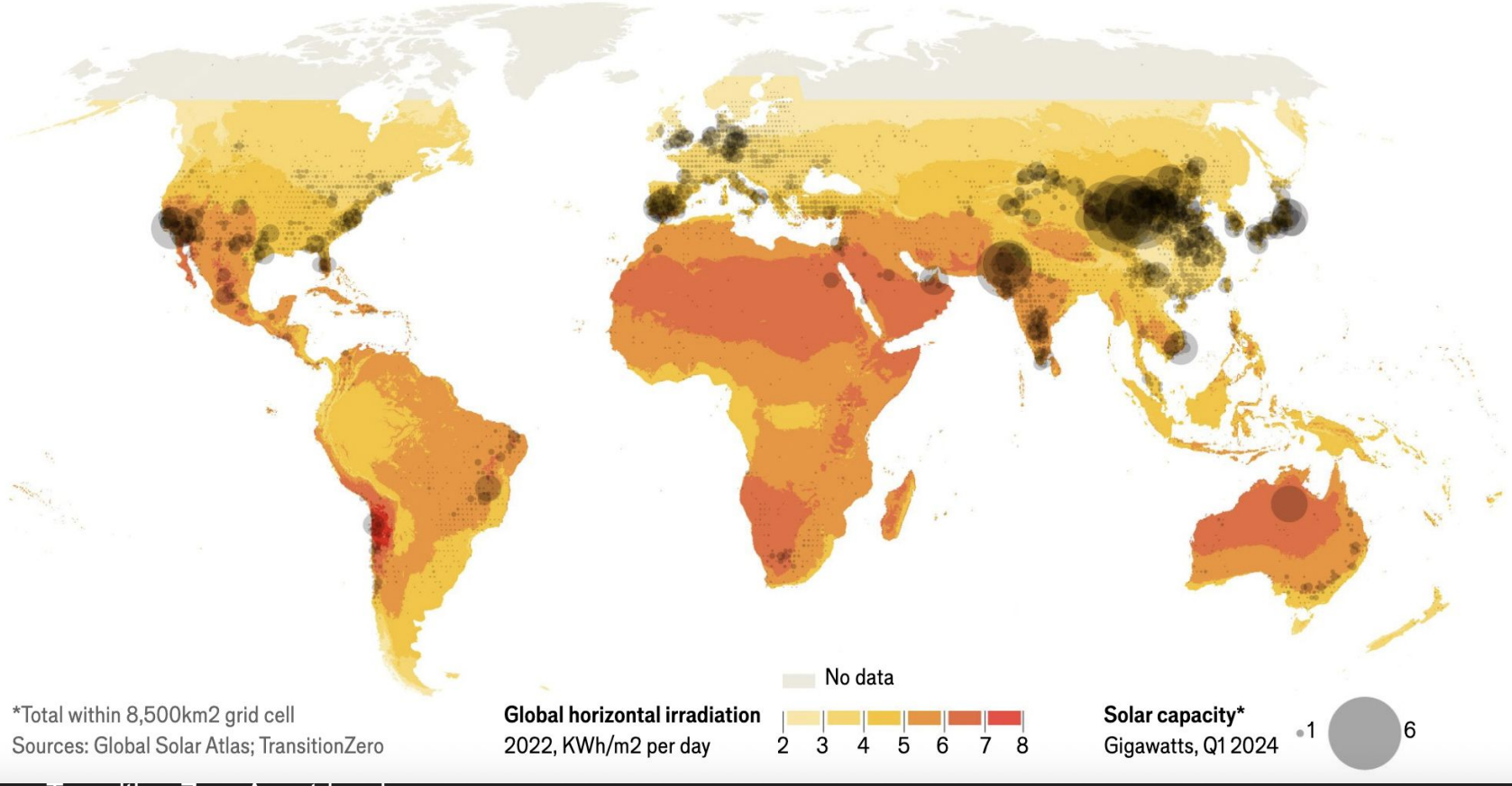


National vision for sectoral industrial policies in The Five-Year Plans

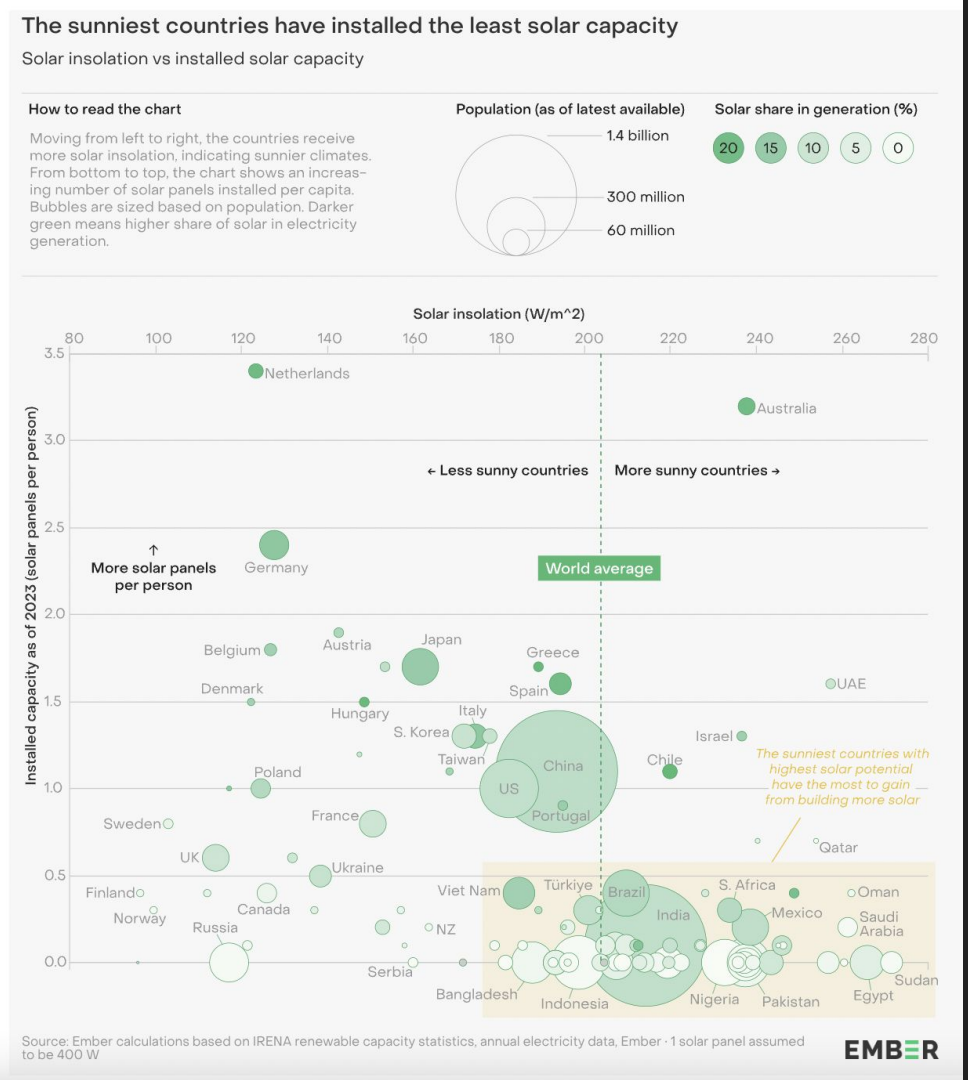
- **2001-2005 Tenth Five-Year Plan:**
  - Solar a targeted sector for first time, together with other renewable energies.
  - In 2001 no solar industry.
  - In 2005 considerable growth.
- **2006-2010 Eleventh Five-Year Plan:**
  - Solar industry as an opportunity to attain technological leadership.
  - Included funding for R&D and manufacturing development for the first time.
  - Solar industry witnessed exceptional growth
- **2011-2015 Twelfth Five-Year Plan:**
  - Government kept pushing for solar adoption, supply-chain expansion and indigenous R&D.
  - R&D goals gained in detail and scope
- **2016-2020 Thirteenth Five-Year Plan:**
  - Targeting capacity and R&D expansion, as well as industry-wide cost-reduction.
  - Includes Thirteenth Five Year Plan for Solar Energy Development.

Back

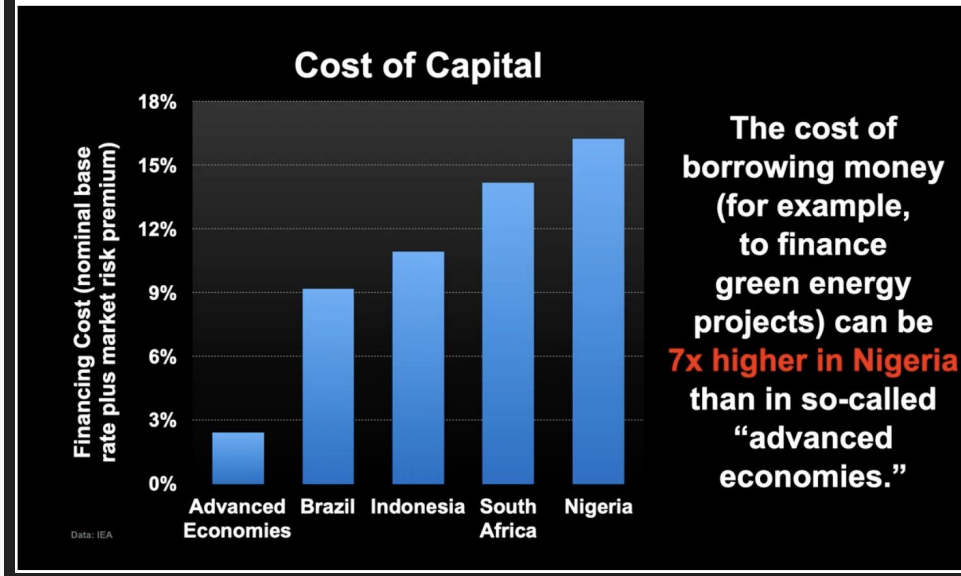
↓ SUN SEEKERS *sunlight and solar capacity*



Source: Transition Zero Asset-level mapper



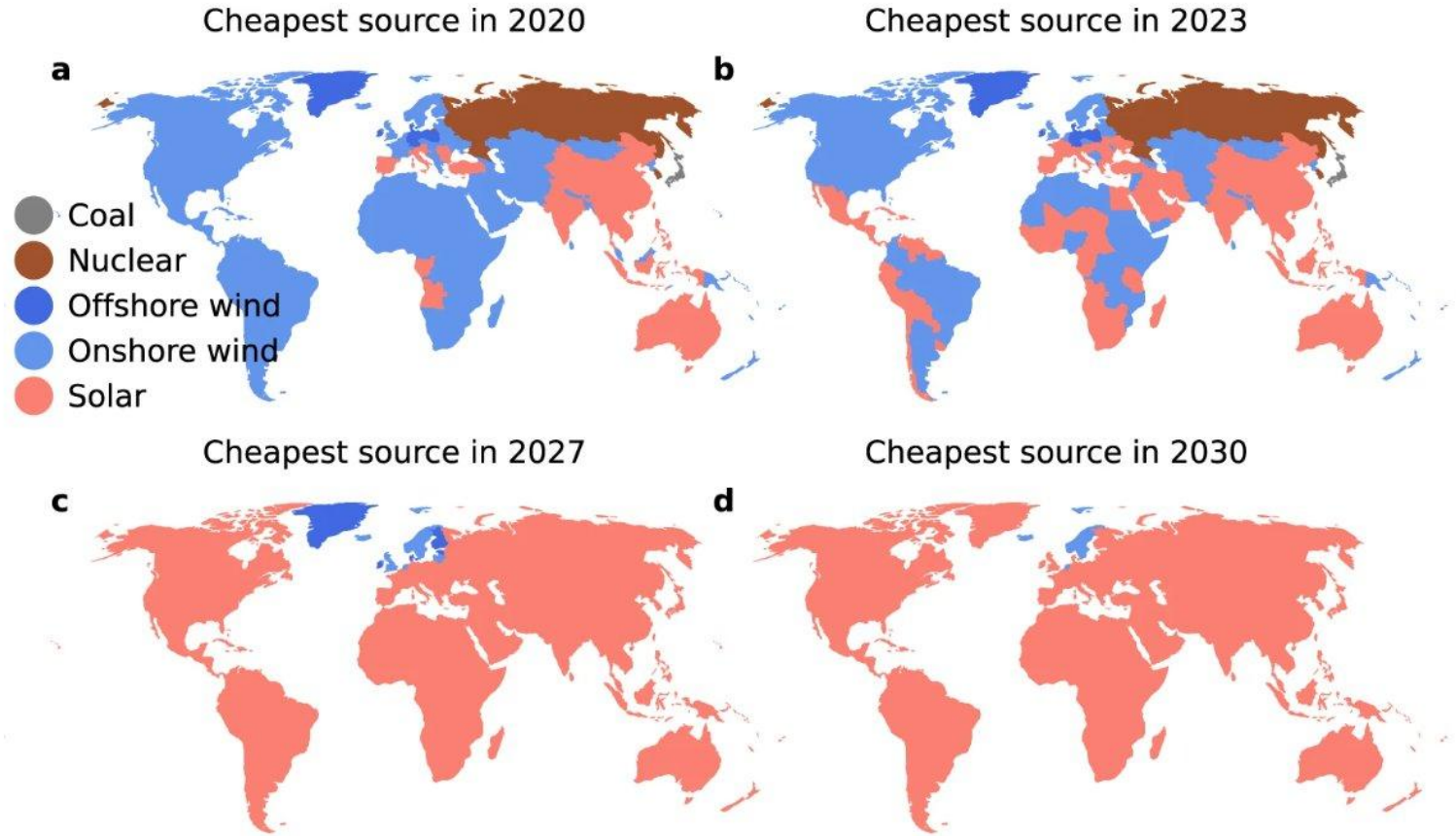
Renewable investment requires capital upfront. That is why monetary hierarchy & cost of capital a sticking point in global north-south climate negotiations.
Stark example - Netherlands, one of the rainiest countries in Europe, generates more solar electricity than all of sub-Saharan Africa



Source: Ember; Todd Moss

Fig. 4: Technology with the lowest $LCOE_{ssc}$ by year and E3ME region.

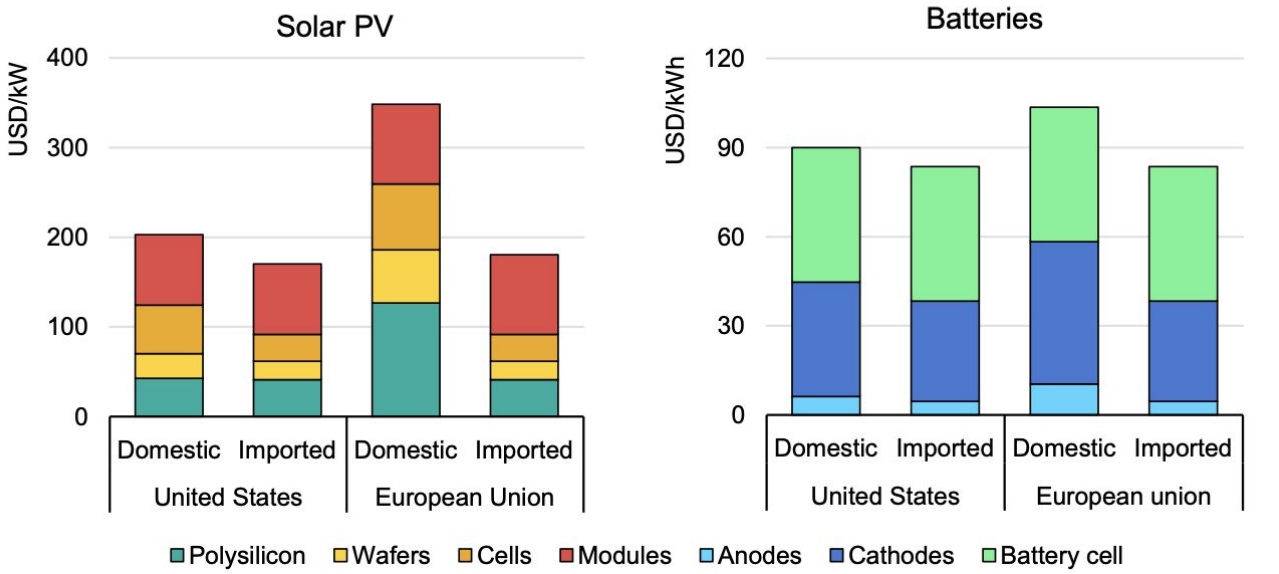
From: The momentum of the solar energy transition



Each map shows the 70 E3ME regions: in 2020 (**a**), 2023 (**b**), 2027 (**c**) and 2030 (**d**). The biggest shift occurs between 2020 and 2027, which sees a range of technologies give way to solar PV as the cheapest source of electricity.

Manufacturing solar PV modules using domestically produced components costs around twice as much as using imported components in EU

Figure 1.29 Levelised cost of production for batteries and solar PV modules by origin of components in the United States and the European Union, 2023



Notes: Domestic refers to the production cost using components produced entirely within the country/region; imported refers to the production cost using components imported from China and only the last production step happening locally. Tariffs, shipping cost, profit margins of components, and financial support are excluded. USD = USD (2023, MER).

Sources: IEA analysis based on NREL (2017); NREL (2019); NREL (2023); Wood Mackenzie (2024); BNEF (2024a); IEA-PVPS (2024); BNEF (2024b); IEA (2024a); IEA (2024g); Argonne (2024); JETRO (2024); Dai et al. (2019); and Frith, Lacey, & Ulissi, (2023).