

## Solar Value-Chain : Industry Update

*"The test of a first-rate intelligence is the ability to hold two opposed ideas in mind at the same time and still retain the ability to function."*



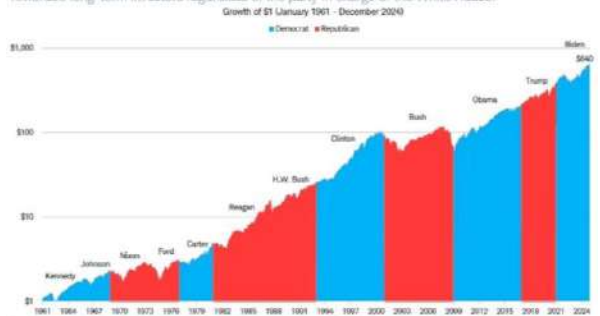
**All Megatrends may have pauses and drawdowns, but it is important to recognize their continuity and bigger picture**

### ► Executive summary key pointers to look beyond near-term noise :

#### S&P500 unchanged trend - Under different president regimes

##### Politics versus sound investment principles

Politics can be stressful and can create uncertainty and a lot of noise. Historically, markets have rewarded long-term investors regardless of the party in charge of the White House.



Source: Schwab Center for Financial Research, with data provided by Morningstar, Inc.

- **Fear of repeal of Inflation Reduction Act (IRA):** The White House's executive order has not specifically spelled out Solar or Battery; the extent of repeal, more so on funds that are already approved, has not been specified. Of the IRA spend, almost **~90% of the investments and jobs have gone towards the republican states. IRA is a mere \$30bn annual program vs the US' GDP of ~\$30tn (a mere 0.1% of GDP)**
- If the IRA does get repealed, it will make USA more dependent on imports from compliant and competitive trade partners
- Most global contracts have **'safe harbour regulations'**, which protect long-term contracts from unforeseen events. Furthermore, the change-in-law and **pass-through clauses** further safeguard business economics and continuity regardless of regulatory changes.
- **LCOE and IRR no more dependent on tax credits:** Solar developers significantly lesser dependent on tax credits, given 90%+ reduction in LCOE and attractive IRRs even without tax credits.
- **India/SE Asia probable 2<sup>nd</sup> order beneficiaries:** USA manufacturing costs are 2x of India and SE Asia, thus if tax incentives in USA are repealed, then USA will have to depend more so on imports.
- **India's share of imports to USA is a mere ~9-10%** for H1'CY24 and CY23, thus has room to grow.
- **China controls nearly ~90% of the entire renewables manufacturing value-chain.** Thus, the world is looking for credible, reliable, at-scale and competitive alternative trade partners, to de risk their own sourcing.
- Demand for compliant, fully traceable, **X-China manufactured Solar modules:** With restrictions, tariffs and duties on both China and SE Asian countries, **India is amongst the few fully compliant and competitive** manufacturing bases.
- Over the last 6 years 1450GW of Solar installation has occurred, mainly led by China. Yet, the world has reached just **~6% electrification via Solar generation.** A long road of growth exists going forward, with most countries targeting 15-30% electrification (via Solar) over the next few years
- **Solar PV Manufacturing a big boy game:** China has ~82% of global share, Top 10 global cos have a ~80% share. In India Top 10 companies have ~70% capacity share.

## Key Areas Covered In The Note



- I. Understanding regulatory uncertainties around IRA/USA, Southeast Asian nations and the health of the Chinese industry
- II. Solar Megatrend, the China+1 opportunity and India's positioning
- III. Capital markets perspective

### To know deeper about the Renewables GigaTrend:

<https://www.valuequest.in/gigatrend/>

“Multi-decadal, Multi-technology, Multi-Terawatt and Multi-Trillion-dollar GigaTrend



By **Ravi Dharamshi, Varun Goenka, Vishal Thanvi**  
**ValueQuest Investment Advisors Pvt. Ltd.**

[ValueQuest Green Revolution Webinar \(Click Here\)](#)




Covering areas around Renewables megatrends, Technology dimensions and manufacturing value chain



Distilling companies that are **current or emerging future leaders!**



### Areas covered:

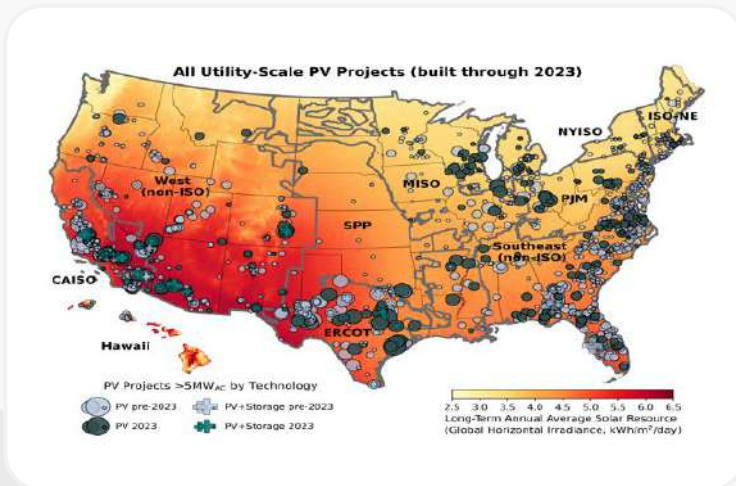
-  Trump policies: Understanding the Inflation Reduction Act (IRA)
-  Manufacturing and installations, with and without incentives
-  Chinese Solar companies' health, Industry cycle, Demand-supply balance

### ► Understanding policy environment, namely, the Inflation Reduction Act (IRA)

- USA has a history of such regulations to drive renewables energy growth, so IRA mere an extension. Investment Tax Credit (ITC) and Production Tax Credit (PTC)
- Tax credits have a long history : The ITC and PTC were **first introduced in the Energy Policy Act of 2005**, to encourage the development and deployment of renewable energy technologies. Over the years, the ITC and PTC have undergone several changes and extensions. The **American Recovery and Reinvestment Act of 2009** allowed taxpayers to receive a 30% tax credit for qualified renewable energy property, and the Treasury Department granted \$2.3 billion in stimulus grants to renewable energy projects. The IRA 2022 further extended and modified the ITC and PTC, increasing the tax credit rates and expanding eligibility to include energy storage technologies.
- The original cost estimate for the IRA was ~ \$366 billion over 10 years. The latest estimate is around \$1.6 trillion. **Only about 17% of the \$1.2 trillion that was obligated in those bills has been spent to date.**
- **Safe Harbor Clause:** Solar projects that qualify for ITC or PTC, accompanying IRA bonus credits aren't finished overnight. Timelines for securing financing, completing design, obtaining permits and installing a project are a measure of years, not days. Financiers looking to invest in IRA Solar projects need the certainty that the tax credits will materialize and provide a solid return on investment. **The “safe harbor” provision makes this possible.** Safe harboring allows companies to demonstrate a good-faith effort at starting a Solar project to lock in the applicable tax credits in place that year. Once they secure the credits, they have four years to complete the project — **known as the “continuity safe harbor”**. Contractors that were not ready to start construction last year **are now racing to do so before early spring**, when the House of Representatives Committee on ways and means is likely to begin reassessing the IRA. **“Anybody who starts construction before the tax bill starts moving, historically, has been grandfathered from the change as long as the project is completed within a certain period of time. So, there are people who are still rushing to start construction early this year,”** - Keith Martin, partner at law firm Norton Rose Fulbright



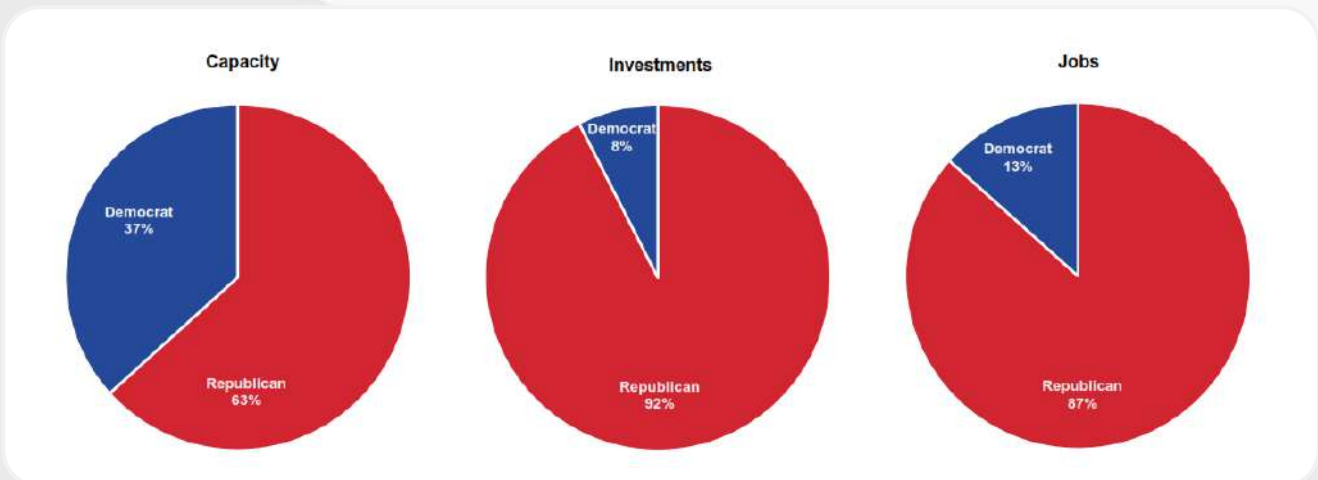
- On the repeal of the IRA: While it is easier for the IRA to be repealed under a Republican trifecta, it may be **difficult to build a sufficiently large coalition in Congress to repeal the IRA fully, as Republican lawmakers may prefer to retain certain IRA incentives that benefit their constituents.** In August 2024, 18 Republican House Representatives signed a letter to Speaker Mike Johnson (R-LA) that asked for the IRA's energy tax credits to be "spared" from attempts to repeal the IRA. A senior tax policy advisor on the Senate Finance Committee also noted that a **full repeal of clean energy tax incentives is unlikely regardless of the election results, as some parts of the IRA received bipartisan support before its enactment, which was expected to continue.** Republican-held areas have benefitted from the IRA since its enactment, as more than half of announced clean energy and vehicle projects are in Republican congressional districts.



*Southern part of USA, higher radiation, thus maximum recipient of Solar PV projects. Except California, most major southern states are Republican states*

Source : National Renewable Energy Laboratory (NREL)

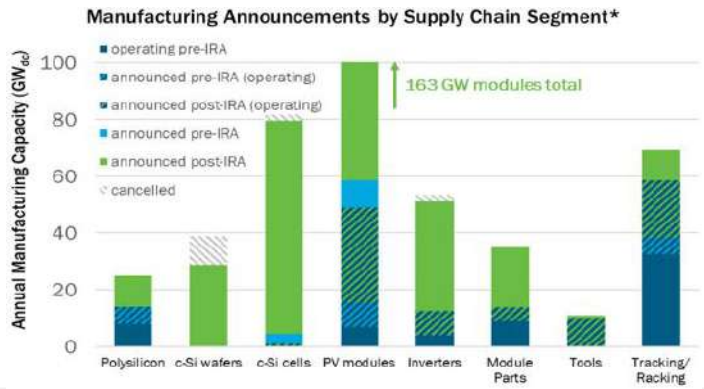
### As evident below, republican states are the biggest beneficiaries of the IRA



Source : Bernstein Note



**Since IRA, nearly ~\$17bn worth of announcements have been made towards Solar manufacturing with 37,000 potential jobs, mostly towards republican states**



Source : U.S. Census Bureau USA Trade Online and internal DOE tracking of public announcements, \*Not all announcements include facility locations, job, operating capacity, or investment numbers.

**Pause, if at all only on some programs,**

<https://www.whitehouse.gov/briefings-statements/2025/01/omb-memo-m-25-11/>

This pause only applies to funds supporting programs, projects, or activities that **may be** implicated by the policy established in Section 2 of the order. This interpretation is consistent with section 7’s heading (“Terminating the Green New Deal”) and its reference to the “law and the policy outlined in section 2 of the order

<https://www.whitehouse.gov/presidential-actions/2025/01/unleashing-american-energy/>

<https://www.inc.com/chloe-aiello/trump-paused-distribution-of-funds-related-to-biden-era-green-new-deal/91137334>

**“Can the president put a temporary freeze on the disbursement of appropriated funds? We’ll see if there are legal challenges to a temporary freeze. A decision to impound funds—that is to say, to not spend them ever—would face clear legal obstacles,”**

**Michael Burger**, executive director of the Sabin Center for Climate Change Law at Columbia University.

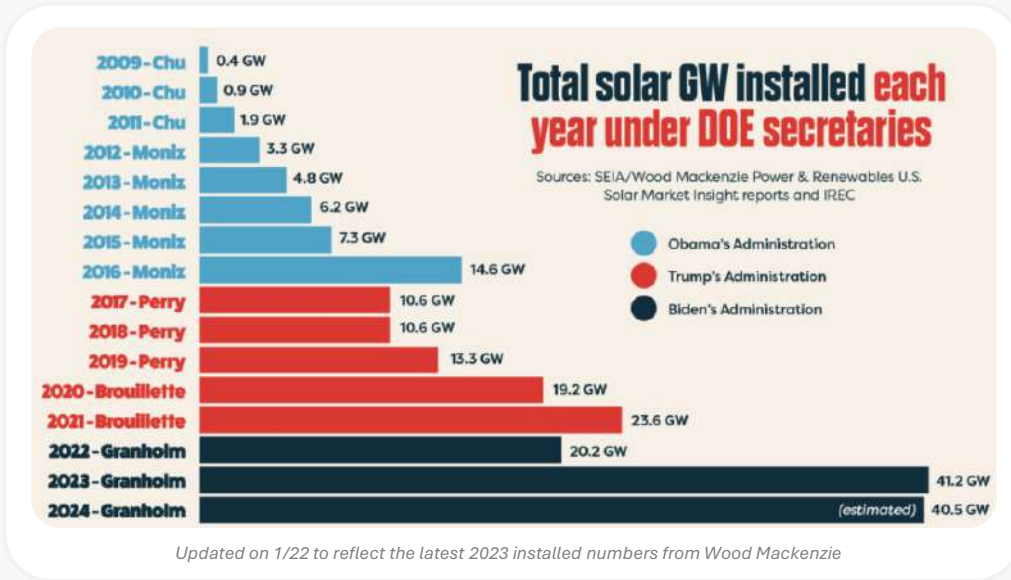
**One point of complexity is that the language of the order is broad enough that it isn’t clear whether it refers to “obligated” funds, or just those that have not yet been allocated,** Canary Media reported. As Congress controls spending, the president does not have the authority to impound funds.

“Congress holds the purse strings and instructs the administration to spend. He’s basically saying, ‘Sorry, you’re not spending this money,’” Wagner says. “If the Department of Justice doesn’t do anything about it, then he broke through a whole bunch of norms, screws over a whole bunch of industries and sectors and companies, and there is no recourse.”





## Solar installations have grown through all time periods,



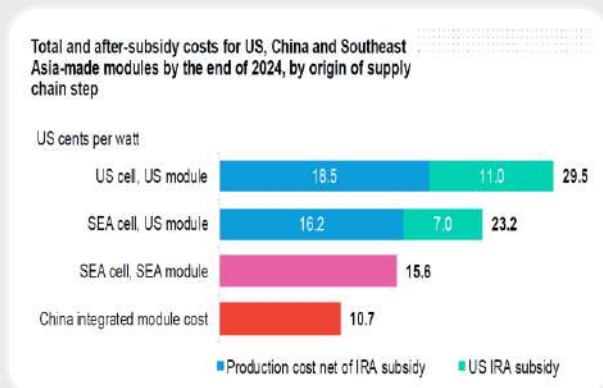
### ► Manufacturing or installations with or without incentives

Imports from China have significant tariff barriers and import restrictions. Several South-East Asian and Chinese companies have been imposed with tariffs. India is competitive versus **the manufacturing cost of USA PV (which is 3x of China and almost 2x of India or South-East Asia)**. India can possibly be a preferred import partner for USA, given that Mexico and South-East Asia are under tariffs.

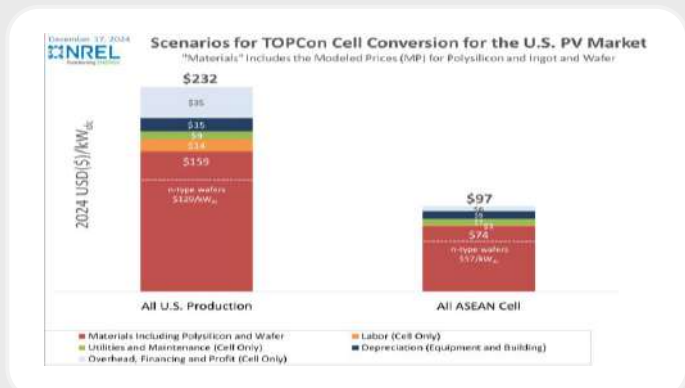
Cent/WP	Integrated	China Cell	Non-China Cell	Integrated	China Cell	SE cell	Integrated
	CHINA	SE Asia	SE Asia	INDIA	INDIA	USA	USA
Solar PV cost	~10.0	~15.0	19.5	~16.0	~14.0	~26.0	~32.0

Source : ValueQuest Internal Research

National Renewable Energy Laboratory (NREL), USA's own calculation of **Solar PV and Cell manufacturing cost shows, USA manufacturing cost at 2x of even Southeast peers**



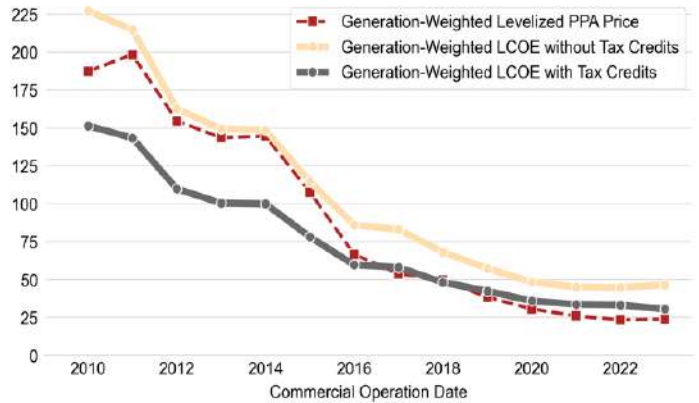
Source: BloombergNEF, IRA: Inflation Reduction Act, SEA: Southeast Asia





**For developers putting up Solar power plants: LCOE (Levelized cost of Energy), shows drastic improvements over and reducing dependence on tax credits**

**Average levelized cost of energy versus average levelized PPA price, by commercial operation date**  
Installed Project LCOE and PPA Price (2023\$/MWh)

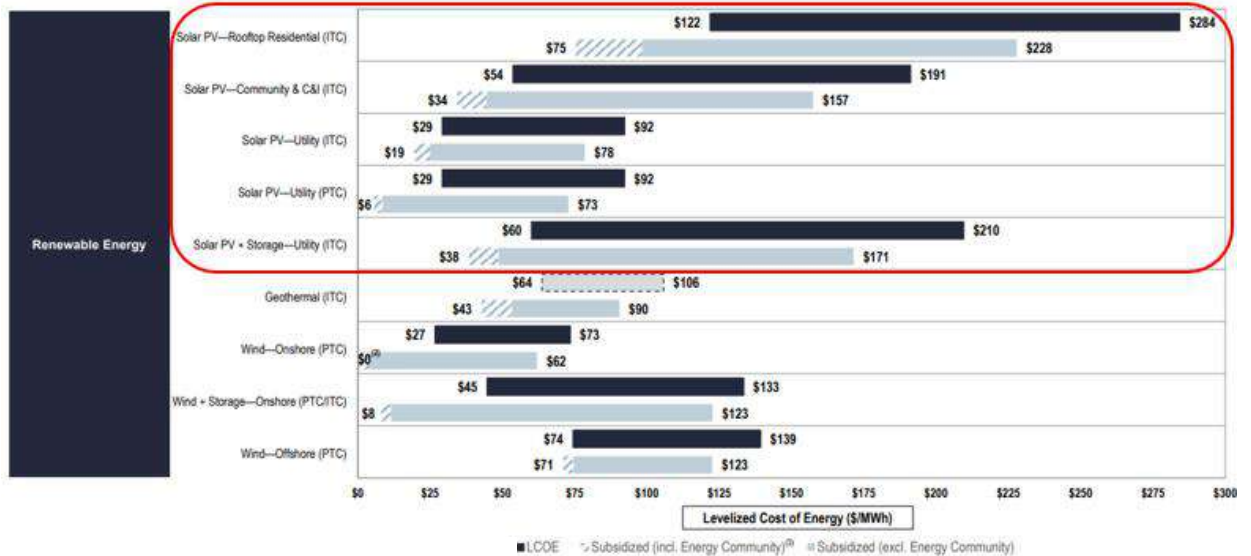


Source : Lazard LCOE Report, 2024

**As visible, the dependency on Tax credits or IRA, is not as critical as in earlier years**

**Levelized Cost of Energy Comparison—Sensitivity to U.S. Federal Tax Subsidies<sup>(1)</sup>**

The Investment Tax Credit (“ITC”), Production Tax Credit (“PTC”) and Energy Community adder, among other provisions in the IRA, are important components of the LCOE for renewable energy technologies



Note: Unless otherwise indicated, this analysis does not include other state or federal subsidies (e.g., domestic content adder, etc.). The IRA is comprehensive legislation that is still being implemented and remains subject to interpretation—important elements of the IRA are not included in our analysis and could impact outcomes.  
 (1) This sensitivity analysis assumes that projects qualify for the full ITC/PTC, have a capital structure that includes sponsor equity, debt and tax equity and assumes the equity owner has taxable income to monetize a portion of the tax credits.  
 (2) Results at this level are driven by Lazard’s approach to calculating the LCOE and selected inputs (see Appendix A for further details). Lazard’s LCOE analysis assumes, for year-over-year reference purposes, 60% debt at an 8% interest rate and 40% equity at a 12% cost (together implying an after-tax IRR/WACC of 7.7%). Implied IRRs at this level for Wind—Onshore (PTC) is 13% (i.e., the value of the PTC and Energy Community adder result in an implied IRR greater than the assumed 12%).  
 (3) This sensitivity analysis assumes that projects qualify for the full ITC/PTC and also includes an Energy Community adder of 10% for ITC projects and \$3/MWh for PTC projects.  
 This analysis has been prepared by Lazard for general informational and illustrative purposes only, and it is not intended to be, and should not be construed as, financial or other advice. No part of this material may be copied, photocopied or duplicated in any form by any means or redistributed without the prior written consent of Lazard.

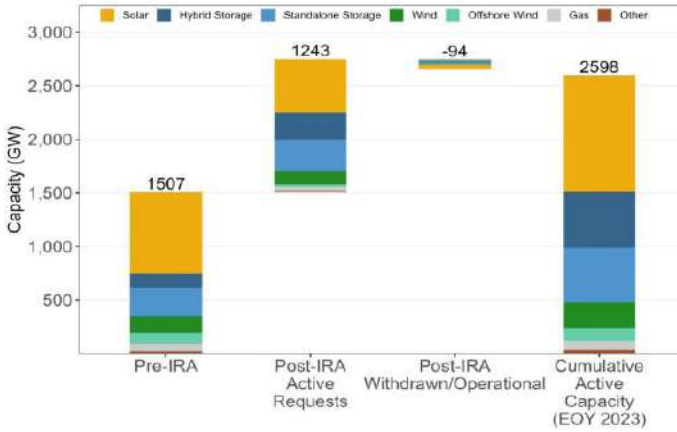
Source: Lazard & Roland Berger estimates and publicly available information





## How big is the USA Solar opportunity?

**Over 1,200 GW (including >500 GW of solar, >540 GW storage, and 125 GW wind) has requested interconnection since the passage of the IRA**



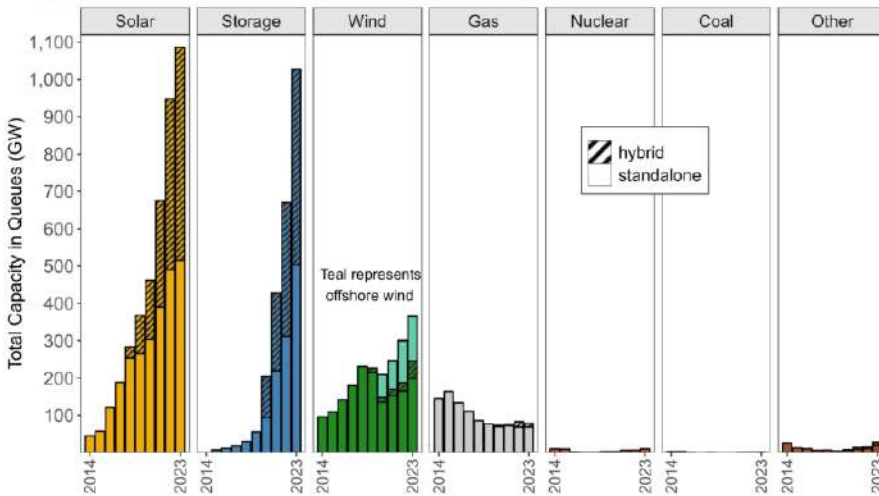
The IRA included a range of tax credits and other provisions anticipated to supercharge clean energy development. These include, for example:

- Extension of existing credits, including technology-neutral Production Tax Credits (PTCs) and Investment Tax Credits (ITCs)
- Emissions-based phase-out, no earlier than 2032
- Standalone storage eligible for ITC; new nuclear as of 2025
- Choice between PTC and ITC: whichever is most valuable
- Bonuses for energy community and domestic content
- USDA grants for rural coops to transition to clean electricity

**Although not all of the post-IRA interconnection requests can be attributable to the IRA, these provisions increased developer interest in clean energy and the queues are one indicator of this.**

Source: Solar Power World Online

**Solar (1,086 GW), Storage (1,028 GW), and Wind (366 GW) make up 95% of active capacity in queues, with 3% (79 GW) from Gas. Most solar and storage capacity is in hybrid plants**



- **"Wind"** includes both onshore and offshore.
- **"Other"** includes
  - Hydropower
  - Geothermal
  - Biomass/biofuel
  - Landfill gas
  - Solar thermal
  - Oil/diesel
- **"Storage"** is primarily (99%) battery, but also includes pumped storage hydro, compressed air, gravity rail, and hydrogen.

Source: Energy Trend



## ► Chinese Solar companies' health

Major Chinese companies have started making losses at current prices in the value-chain, even though their balance sheets are not stressed given that they hold net cash.

The industry losses have led to some pricing discipline measures being introduced by the government.

Several measures announced by China PV Association are as follows:

- From December 1, the export tax rebate offered to Chinese manufacturers for PV products like Solar cells, glasses and Solar ribbons has been lowered from 13% to 9%
- China also finalized new investment guidelines for PV manufacturing:
  - Companies must maintain a minimum capital ratio of 30% for Solar PV projects (earlier 20%)
  - Encouraged local governments to allocate manufacturing projects judiciously

USD Mn	CY19	CY20	CY21	CY22	CY23	9MCY24
Module Shipment - GW	44	76	110	174	274	235
Revenue	15,347	21,983	32,566	53,605	62,065	34,837
EBIT	1,699	2,447	2,974	3,451	4,743	-1,070
EBIT Margin	11%	11%	9%	6%	8%	-3%
PAT	1,284	1,919	2,227	3,899	4,320	-970
PAT Margin	8%	9%	7%	7%	7%	-3%
Cash PAT	1,942	2,868	3,540	5,499	7,044	1,228
Cash PAT Margin	13%	13%	11%	10%	11%	4%
Gross debt	4,610	5,096	7,035	6,626	11,815	
Cash	6,646	9,771	11,352	15,392	17,485	
<b>Net Debt</b>	<b>-2,037</b>	<b>-4,675</b>	<b>-4,317</b>	<b>-8,767</b>	<b>-5,670</b>	

Source : ValueQuest Internal research

## SECTION II

# Megatrend – Tailwinds That Need To Be Remembered



### Tailwinds/positives to explore :



Solar penetration megatrend



Solar manufacturing, China+1 opportunity

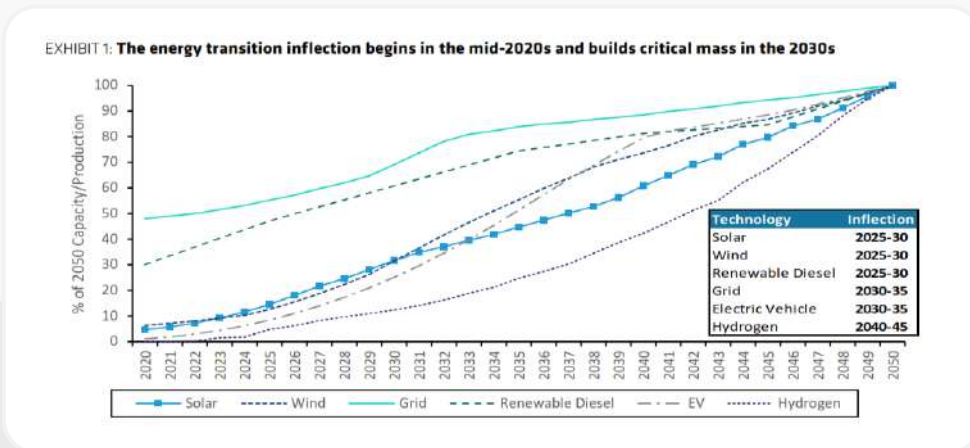


Cost of manufacturing in the USA vs Southeast Asia & India



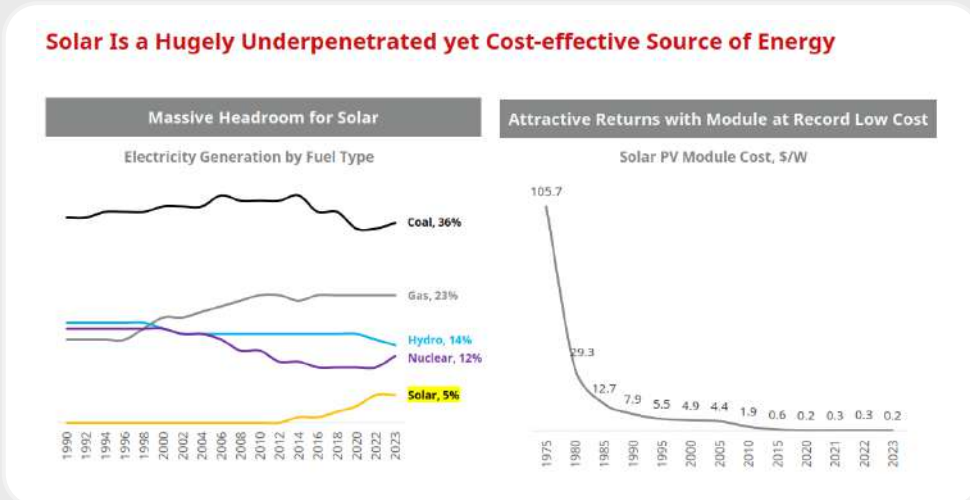
India's domestic & export opportunity

## ► The Solar megatrend has just about begun; will accelerate in the future



Source : BNEF, McKenzie, Bernstein analysis and estimates

## Power generation from Solar is around 6% in CY24



Source : BP Energy Outlook 2021, International Energy Agency (IEA), BNEF, S&P Global.



**In last 6 years cumulative installation of 1.45TW (mainly led by China) has occurred. Solar's share of electricity generation has reached 6%**

Particulars	Global		China		India		US		Europe	
	2015	2023	2015	2023	2015	2023	2015	2023	2015	2023
Power Generation (TWh)	24,010	29,540	5,815	9,456	1,322	1,958	4,084	4,254	5,045	4,950
- Coal & Oil	9,281	10,472	4,046	5,754	1,007	1,474	1,352	675	1,121	734
- Natural Gas	5,556	6,655	167	298	65	53	1,333	1,806	1,176	1,189
<b>-Solar</b>	<b>256</b>	<b>1,634</b>	<b>39</b>	<b>584</b>	<b>7</b>	<b>113</b>	<b>39</b>	<b>239</b>	<b>110</b>	<b>292</b>
<b>-Wind</b>	<b>830</b>	<b>2,307</b>	<b>186</b>	<b>886</b>	<b>33</b>	<b>82</b>	<b>191</b>	<b>421</b>	<b>319</b>	<b>610</b>
-Hydro	3,882	4,190	1,115	1,226	133	149	244	239	797	820
-Other	4,205	4,283	262	709	78	90	924	874	1,521	1,306
<b>%</b>										
- Coal & Oil	39%	35%	70%	61%	76%	75%	33%	16%	22%	15%
- Natural Gas	23%	23%	3%	3%	5%	3%	33%	42%	23%	24%
<b>-Solar</b>	<b>1.1%</b>	<b>5.5%</b>	<b>0.7%</b>	<b>6.2%</b>	<b>0.5%</b>	<b>5.8%</b>	<b>1.0%</b>	<b>5.6%</b>	<b>2.2%</b>	<b>5.9%</b>
<b>-Wind</b>	<b>3.5%</b>	<b>7.8%</b>	<b>3.2%</b>	<b>9.4%</b>	<b>2.5%</b>	<b>4.2%</b>	<b>4.7%</b>	<b>9.9%</b>	<b>6.3%</b>	<b>12.3%</b>
-Hydro	16%	14%	19%	13%	10%	8%	6%	6%	16%	17%
-Other	18%	14%	5%	7%	6%	5%	23%	21%	30%	26%

Source : ValueQuest Internal Research



## Various estimates show a 20yr+ runway of Solar installations, with the potential to reach over 25%+ of electricity generation share over years

Particulars	Global		China		India	
	2023	2030E	2023	2030E	2023	2030E
Total power Generation (TWh)	29,540	38,872	9,456	14,470	20,084	24,402
Solar Power Generation (TWh)	1,634	11,662	584	5,065	1,050	6,597
<b>Solar- % of total</b>	<b>6%</b>	<b>30%</b>	<b>6%</b>	<b>35%</b>	<b>5%</b>	<b>27%</b>
<b>Additional Solar Power Envisaged (TWh)</b>		<b>10,028</b>		<b>4,481</b>		<b>5,547</b>
CUF		22%		22%		22%
Power Generation (TWh) per GW		1.93		1,93		1,93
<b>Additional Capacity Required (GW)</b>		<b>5,203</b>		<b>2,325</b>		<b>2,878</b>
<b>Opportunity/ Year (GW)</b>		<b>743</b>		<b>332</b>		<b>411</b>
<b>Current Installation 2024 (GW)</b>		<b>550</b>		<b>277</b>		<b>273</b>
<b>Where are we today</b>		<b>74%</b>		<b>83%</b>		<b>66%</b>

Source : ValueQuest Internal Research

**An annual Solar PV installation opportunity of over ~700GW over the foreseeable future**





## 18 TW cumulative Solar capacity base by 20X0

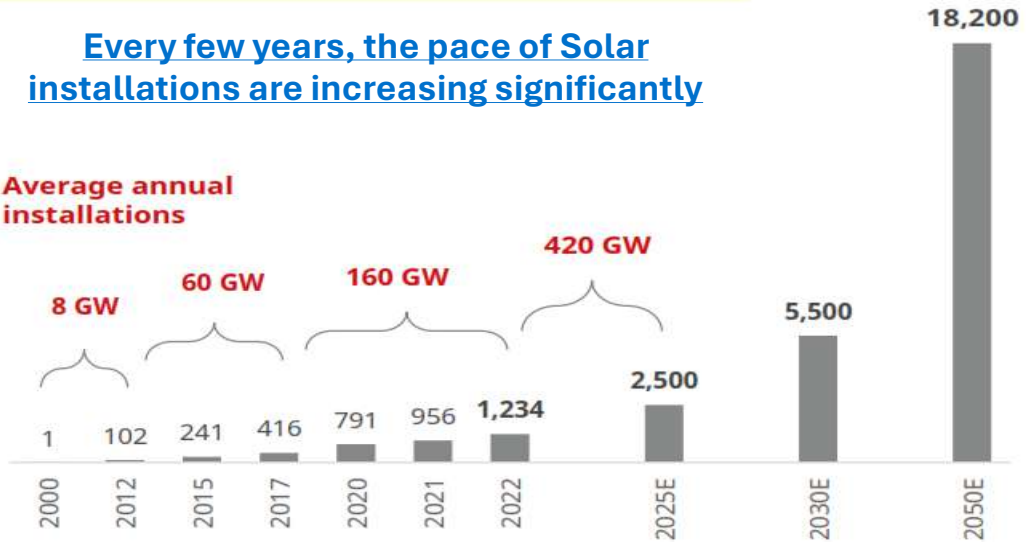
“We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run.” – Amara’s Law

### Global Solar PV Cumulative Installations, GW

To achieve the **1.5°C Paris Agreement** goal, solar PV’s global installed capacity must reach **5.5 TW by 2030** and exceed **18 TW by 2050**.

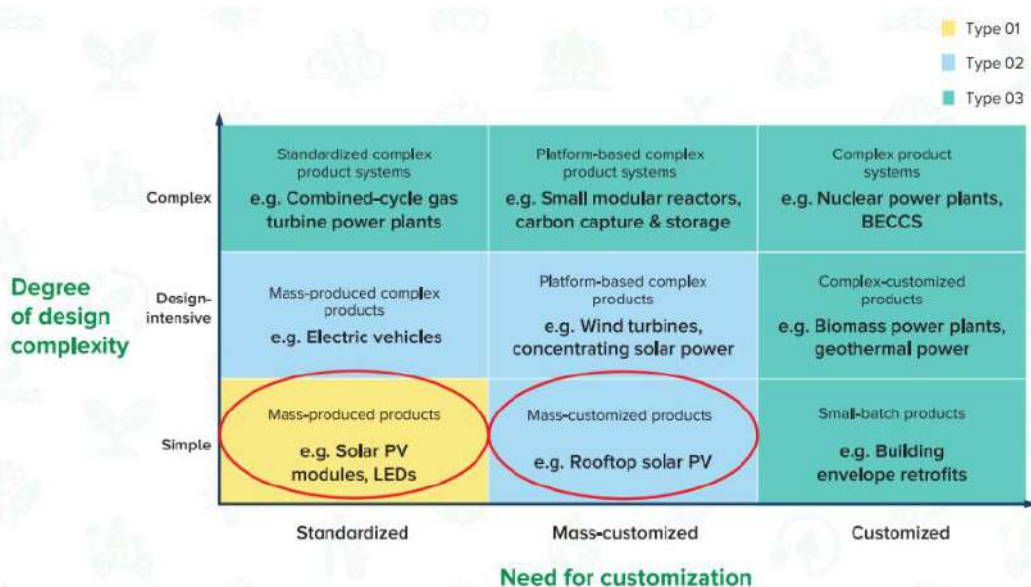
Every few years, the pace of Solar installations are increasing significantly

Average annual installations



Source : PV Tech

Studies find that simple and **standardized technologies** are more likely to scale



Source : Malhotra and Schmidt, 'Accelerating Low- Carbon Innovation' (2020)



## ► China+1 manufacturing opportunity

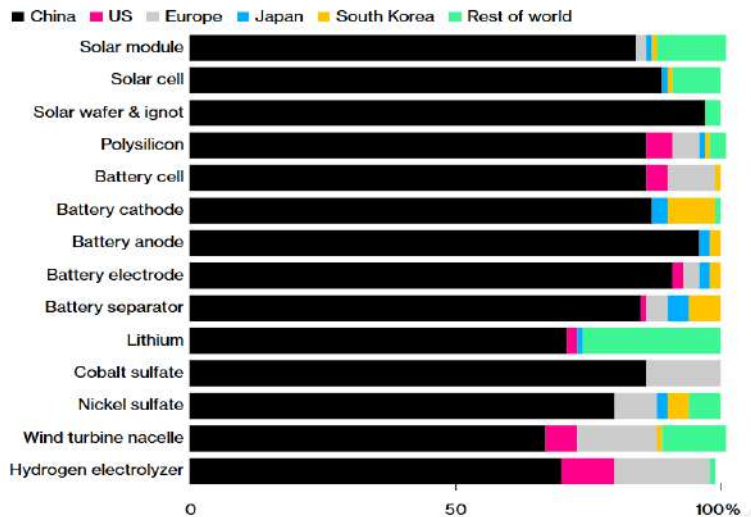
China, (including Southeast Asian capacities)

*Control ~90% or more of the critical value chains across clean energy technologies.*

*Its important that the world derisks its dependence to competing and equally competent manufacturing bases like India & SE Asia.*

### China Dominates Clean-Technology Supply Chains

Asian nation's share of global manufacturing capacity is above 80% in 11 segments



Source : BloombergNEGF

Note : Capacity is for physical facility location, not manufacturer headquarters. Lithium refers to lithium hydroxide and carbonate.

## “Manufacturing is war now”

<https://www.noahpinion.blog/p/manufacturing-is-a-war-now>

In the year 2000, the United States and its allies in Asia, Europe, and Latin America accounted for the overwhelming majority of global industrial production, with China at just 6% even after two decades of rapid growth. Just thirty year later, UNIDO projects that China will account for 45% of all global manufacturing, singlehandedly matching or outmatching the U.S. and all of its allies. This is a level of manufacturing dominance by a single country seen only twice before in world history — by the UK at the start of the Industrial Revolution, and by the U.S. just after World War II. It means that in an extended war of production, there is no guarantee that the entire world united could defeat China.

By creating overcapacity, China is forcibly deindustrializing every single one of its geopolitical rivals. Yes, this reduces profit for Chinese companies, but profit is not the goal of war.

**A military-industrial strategy** for the U.S. and its allies to match China will need to involve three elements:

- **Tariffs and other trade barriers against China**, in order to prevent sudden floods of Chinese exports from forcibly deindustrializing other countries.
- **Industrial policy**, to maintain and extend manufacturing capacity in democratic nations.
- **A large common market outside of China**, so that non-Chinese manufacturers can gain economies of scale



## Manufacturing & supply chains are now key geopolitical decisions:

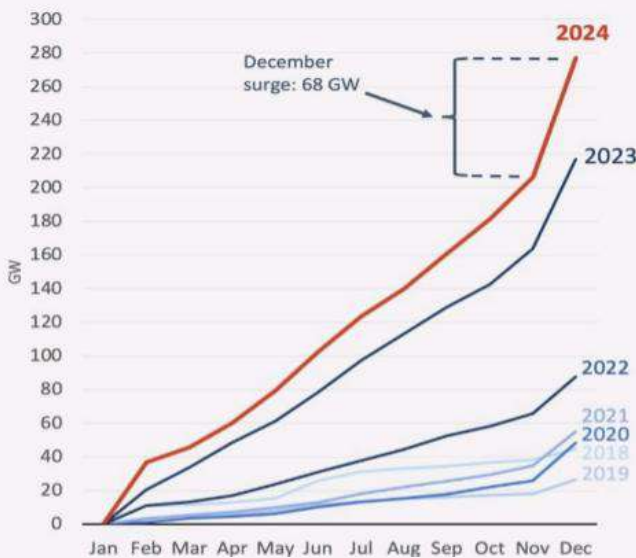
Energy & Technology independence is every country's pursuit

## Power Shift: from high dependence on oil nations to cleaner technologies led energy independence



## China installs record-breaking 277 GW of Solar in 2024

Surging clean energy is causing China's emissions to plateau



CHINA itself installed ~277GW of Solar PV + in-transit / inventory ~3months i.e 70GW

= ~350GW internal, growing ~20%

~200GW of surplus at China + production outside of China at ~170GW (280GW PV capacity outside of China \* 60% CUF = 170GW) = 370GW

World Installation CY24 ~580GW Vs World production ~700GW

Demand (China ~350GW + X-China ~400GW) = ~750GW Vs World production ~750-800GW

Source : Carbon Brief, Taiyang News, NEA, PV Magazine

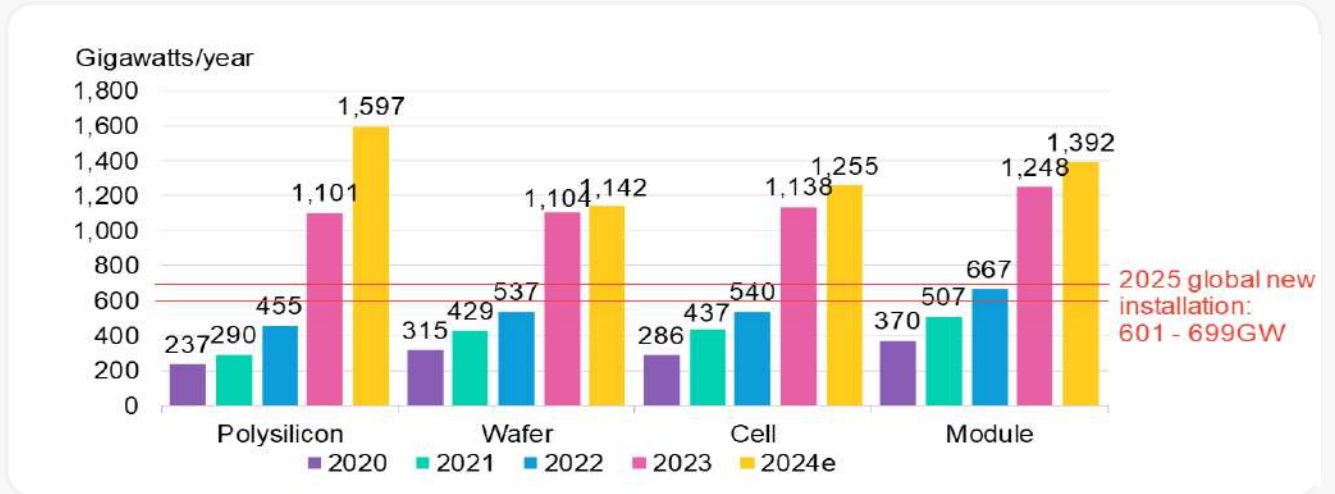


## Total global Solar PV capacity is ~1400GW

(However usually operating capacity utilization is at ~50%)

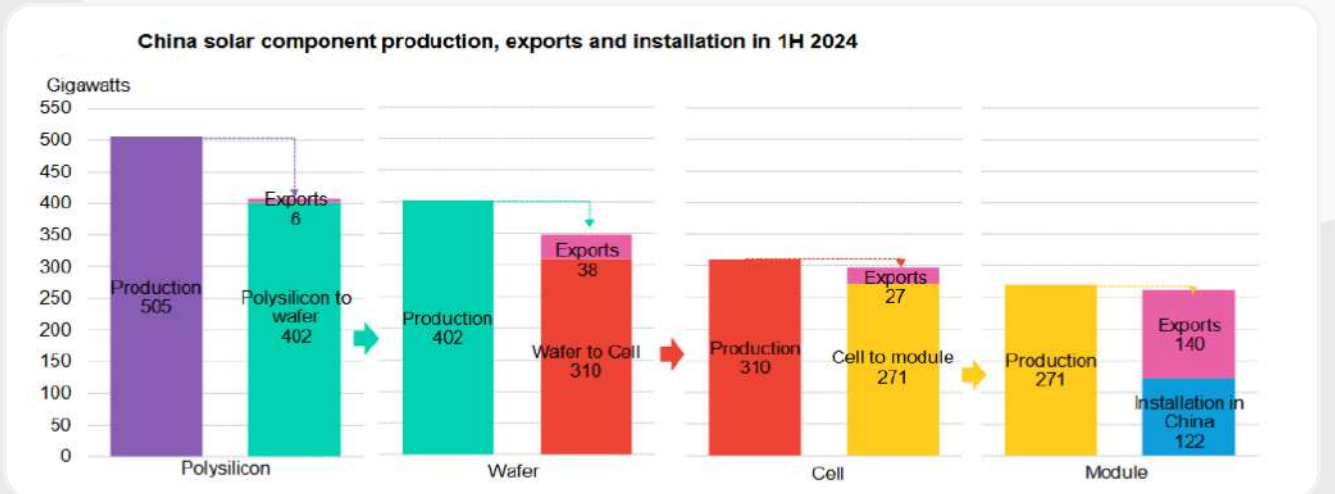
<https://www.pv-magazine.com/2024/05/07/global-Solar-manufacturing-sector-now-at-50-utilization-rate-says-iea/>

## Year-end PV manufacturing capacity



Source : BloombergNEF. Note: Polysilicon consumption assumed to be 2.1g/W in 2024. Thin-film modules (about 22GW in 2024) are not shown.

Assuming 271GW Production for H1, this annualized ~540GW production implies ~45% utilization

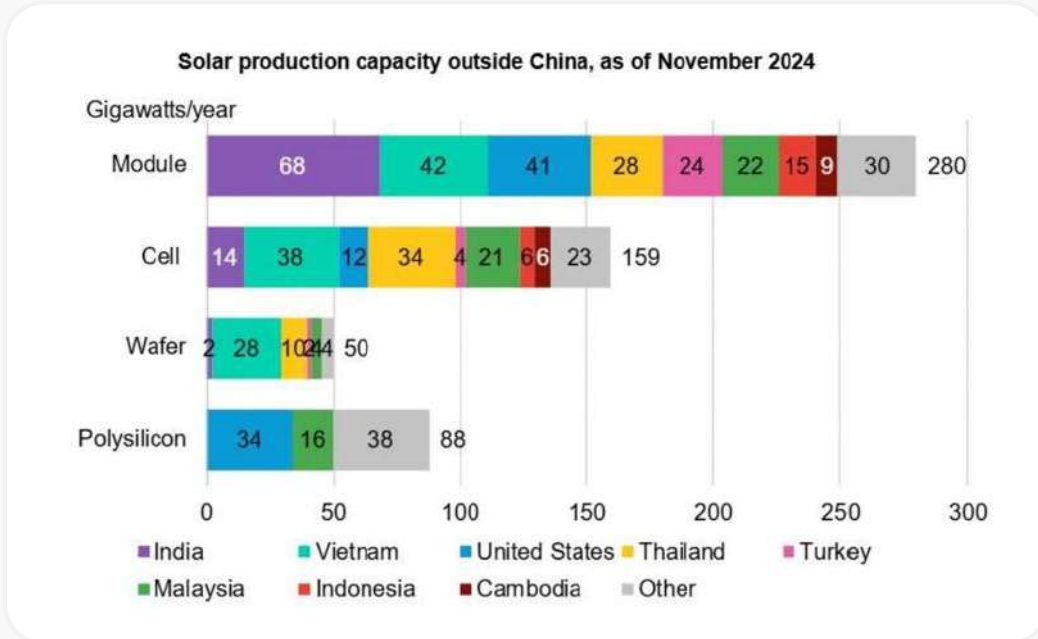


Source : BloombergNEF, Sinoimex, China Photovoltaic Industry Association (CPIA). Note : This is a simplified version of the input and output analysis for Solar supply chain in China. In reality, there is a lag time for polysilicon to be sold as modules. A blended 2.1 grams per watt and used to convert polysilicon from metric tons to gigawatts. Inverter loading ratio assumed to be 1.2 to convert the installation in alternating current reported in China to module consumption in direct current.





**Total Solar PV Capacity X-China ~280GW** (However several South-East Asian capacities are either owned or funded by Chinese)



Source : BloombergNEF, company filings. Note: Thin film cell and module production capacity is included.

**Duties on South-East Asia (Chinese companies), may open an opportunity for India**

Country	Finding	Company Investigated	Duty Rate
Malaysia (12%)	Positive	Hanwha Qcells	14.72%
		JinkoSolar	9.92%
		Baojia New Energy, Pax Union Resources, SunMax Energy	123.94%
		All others	9.13%
Vietnam (37%)	Positive	Boviet Solar	0.81%
		GEP New Energy, Shengtian New Energy Vina, HT Solar, Vietnam Green Energy	292.61%
		All others (including JA Solar)	2.85%
Thailand (23%)	Positive	Trina Solar	0.14%
		Taihua New Energy, Sunshine Electrical Energy	34.52%
		All others	23.06%
Cambodia (7%)	Positive	Jintek PV Tech and ISC Cambodia	68.45%
		All others (including SolarSpace New Energy)	8.25%

^Percentages for each country are of total H1 2024 cell and module imports combined.

**On Oct. 1, the Department of Commerce (DOC) issued a preliminary decision to impose countervailing duties (CVD) on c-Si panels and cells produced in Vietnam, Malaysia, Thailand, and Cambodia.**

Countervailable subsidy is when foreign governments provide financial assistance to foreign producers that is deemed unfair. CVD are imposed to level the playing field for domestic manufacturers. U.S. Customs and Border Protection began collecting these duties immediately.

These duties are preliminary and are subject to change. They will also be adjusted annually.

**Boldfaced** companies are the top 1–2 companies by volume in each country in 2023 according to DOC.

Source : U.S> Department of Commerce preliminary determination and update.





## USA Exports opportunity:

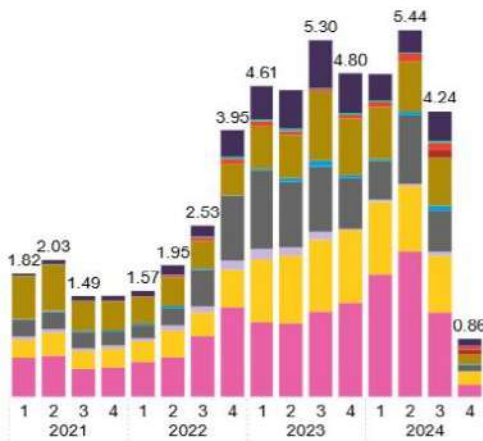
India's share in US exports is a mere ~9-10%, thus there is scope to capitalize further.

Module	GW						%Share					
Country	CY19	CY20	CY21	CY22	CY23	H1CY24	CY19	CY20	CY21	CY22	CY23	H1CY24
Vietnam	6.0	8.1	8.5	12.0	15.6	13.2	33%	36%	40%	42%	28%	40%
Thailand	1.0	3.0	3.0	4.0	11.1	8.0	6%	13%	14%	14%	20%	24%
Malaysia	8.0	8.0	8.0	4.0	10.0	4.2	44%	36%	37%	14%	18%	13%
Cambodia	-	0.2	0.5	1.0	6.7	1.8	0%	1%	2%	3%	12%	5%
South Korea	1.0	2.0	1.0	3.1	3.0	0.4	6%	9%	5%	11%	5%	1%
<b>India</b>	-	-	<b>0.5</b>	<b>1.6</b>	<b>5.6</b>	<b>3.0</b>	<b>0%</b>	<b>0%</b>	<b>2%</b>	<b>6%</b>	<b>10%</b>	<b>9%</b>
Others	2.0	1.2	0.0	3.0	3.7	2.4	11%	5%	0%	10%	7%	7%
<b>Total</b>	<b>18.0</b>	<b>22.5</b>	<b>21.5</b>	<b>28.7</b>	<b>55.6</b>	<b>33.0</b>						

Source : U.S. Energy information Administration, Form EIA-63B, Annual and Monthly Photovoltaic Module Shipments Report

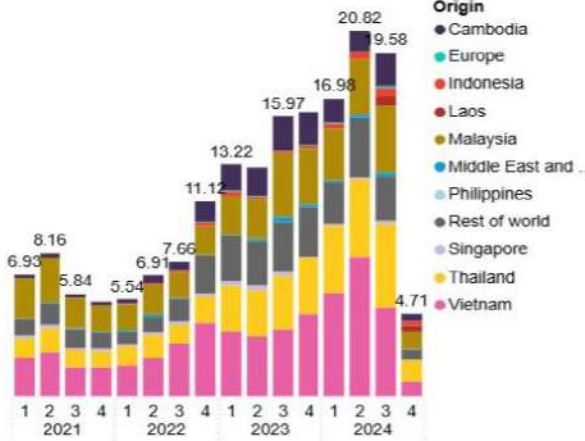
US imports of PV products (\$bn)

Click a cell for more details

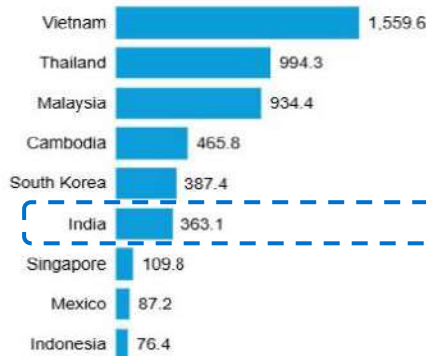


US imports of PV products (GW)

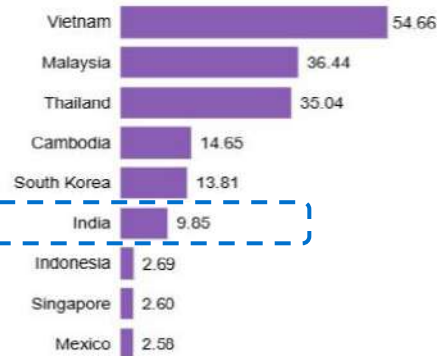
Click a cell for more details



Origins of PV products (\$m)



Origins of PV products (GW)



Source : BNEF

# SECTION III

## Capital Markets Perspective



### Areas covered:



The myth of solar PV being a commodity



Solar PV bankability ratings, a competitive advantage



Solar value-chain manufacturing is a big-boy game



Estimates – growth vs valuations of leading brokerage

### 1. The myth of solar PV being a commodity

Solar PV manufacturing is highly complex and takes years of learning curve. Even more complex is backward integration into cells, which is both capital and knowledge intensive.

COMPETITIVE ADVANTAGES	
TANGIBLE	INTANGIBLE
Capex / GW	Technology selection and adaption every few years
Capacity Utilization and line efficiency	High efficiency modules with 25 years performance reliability
Low opex costs	Quality management and testing
Customer mix (Exports, Domestic Utilities, DCR, RoofTop)	Global certifications related to testing and performance
Working capital management	Traceability of sourcing and compliant manufacturing
Supply chain – treasury management	Bankability certification
High productivity low conversion and breakage outcomes	Reinsurance
Large retail networks, brand, distribution	Long term performance track record of PV for global customers
	Consistent supply of critical equipment and materials



## Unit Economics of Solar PV & Cell manufacturing - growth & RoCE are attracting new entrants.

While entry barriers for small-scale are low, the **technical knowhow and scale barriers for large scale (5GW+)** are very high. Thus, a few players dominate the industry both in China & India.

Solar PV Manufacturing							
	India manufacturing				US Manufacturing		
	Non DCR Module	DCR Module	DCR Cell	Module export to US	US Module	US Cell	US Module +Cell
Realization (US\$ cents/wp)	17	25	13	28	28	15	28
Gross Margin (%)	16	39	54	26	28	11	10
EBITDA Margin (%)	10	33	43	20	44	28	40
RoCE (%)	23	28	22	72	89	7	23

Note:

(a) US EBITDA includes IRA AMPC rebate

(b) Utilization assumed at 60% for modules and 70% of cells and cells + module for RoCE calculation

Source : Kotak Institutional Equities Estimates

## 2. Solar PV bankability ratings – A key requisite

Solar PV bankability refers to the likelihood of a project being able to secure financing from lenders or investors. A bankability rating is a score assigned to a Solar PV project based on its creditworthiness and risk profile.



Source : PV ModuleTech Bankability Rating Quarterly Q2 2024



**i. Significance of Bankability Rating:** Access to Financing ; Lower Cost of Capital ; Increased Investor Confidence ; Competitive Advantage.

**ii. Importance of Bankability Rating:** Risk Assessment ; Project Viability ; Creditworthiness ; Industry Standards

**iii. Key Factors Affecting Bankability Rating:** Project Location ; Technology and Equipment quality and reliability ; Project design and Engineering ; Financial Performance ; Operational and Maintenance (O&M) Plan

By considering these factors, a bankability rating provides a comprehensive assessment of a Solar PV project's creditworthiness and risk profile, enabling lenders and investors to make informed decisions.

### 3. Solar PV manufacturing is a big-boy game (industry significantly consolidated)

China vs Ex-China Production Capacity		
Company	2024 GW	% Share
Jinko Solar	110	13%
Longi	100	12%
JA Solar	95	11%
Trina Solar	90	11%
Chint	60	7%
Tongwei	56	7%
Canadian Solar	47	6%
Risen Energy	40	5%
DAS Solar	30	4%
Suntech	26	3%
Huansheng Solar	15	2%
China Others	21	3%
<b>Total China</b>	<b>690</b>	<b>82%</b>
Total Ex-china	150	18%
<b>Total World</b>	<b>840</b>	<b>100%</b>
Top 3 Global (%)		36%
Top 10 Global (%)		80%

#### CHINA

- Three companies with ~100GW capacity
- Eight companies with over 40GW capacity
- Top 10 companies having 80% share of global capacity

Source : BNEF



Largest company with 20% capacity share

Top 10 ~70% share

ALMM – India Solar PV Capacity (GW)		
Cohort	In GW	% Share
Largest	13	20%
Top 3	24	36%
Top 10	45	67%
<b>Total</b>	<b>67</b>	<b>100%</b>

Source : MNRE

## 4. Estimates – growth vs valuations

Estimates by a leading broking firm showing the scale change for 2 leading players over the next 2 years

WAAREE ENERGIES Ltd					
(In crores)	CAGR				
Particulars	FY24	FY25E	FY26E	FY27E	FY25-27E
Sales	11,398	14,567	21,770	28,367	40%
EBITDA	1,574	2,358	4,396	6,706	69%
EBIT	1,298	2,058	3,743	5,614	65%
PAT	1,237	1,619	3,204	5,611	86%
Cash PAT	1,514	1,919	3,857	6,702	87%
OCF	2,305	1,626	4,067	6,628	102%
ROE	42%	24%	29%	37%	
RoCE (post-tax)	53%	40%	38%	36%	
Market Cap	64,000				
EV	60,073				
<b>Valuations</b>					
EV/EBITDA			13.7	9.0	
P/E			20.0	11.4	
P/Cashflow			16.6	9.5	

PREMIER ENERGIES Ltd					
(In crores)	CAGR				
Particulars	FY24	FY25E	FY26E	FY27E	FY25-27E
Sales	3,144	6,435	10,260	12,806	41%
EBITDA	478	1,410	2,280	3,240	52%
EBIT	382	1,045	1,783	2,436	53%
PAT	231	733	1,216	1,590	47%
Cash PAT	327	1,097	1,713	2,395	48%
OCF	90	931	1,410	2,193	53%
ROE	44%	42%	35%	33%	
RoCE (post-tax)	24%	43%	39%	30%	
Market Cap	45,000				
EV	44,726				
<b>Valuations</b>					
EV/EBITDA			19.6	13.8	
P/E			37.0	28.3	
P/Cashflow			26.3	18.8	

Source : Kotak Institutional Equities, Prices as on 30<sup>th</sup> January 2025





## VQ Deep Dive



13 January 2025

### **Decrypting the DNA of CRDMOs**



01 August 2024

### **Paving the Road for Energy Transition**



28 May 2024

### **Riding the Wealth Wave**

## VQ Perspectives



20 January 2025

### **Seeing the Glass Half Full**



16 October 2024

### **Beyond the Matrix: Illusion of Comfort or...**



17 July 2024

### **You must let go the illusion of control...**



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