Solar PV manufacturing in India

Industry Roundtable: Key Takeaways

DRAFT

I. Background:

In February 2026, the Net Zero Industrial Policy Lab organized two industry roundtable sessions in New Delhi, India with a sectoral focus on solar PV and BESS respectively. The roundtable brought together industry leaders, sectoral experts, and scholars to create space for collaborative problem-solving: identifying which policies are generating catalytic outcomes and productive investment, and which are creating unnecessary costs. The aim was to solicit systematic feedback from firms on what has worked and not worked in India's clean technology industrial strategy and create structured yet informal dialogue between policymakers and industry actors to inform future policy design.

II. Key Recommendations:

1. India Solar Growth 2035-40: Develop a medium-to-long term national solar manufacturing roadmap that signals technology priorities (including next-generation technologies), capacity targets (both from domestic installation and export perspectives), and upstream integration timelines to industry and R&D institutions.
2. Ecosystem-wide mapping: Commission a comprehensive solar PV ecosystem mapping exercise that identifies gaps and deficiencies across the value chain. This would entail tracking metal and machinery dependencies, equipment-vendor gaps, and single-source (by firm and/or country) vulnerabilities. While data gathered through the REIIMS portal will be critical to this endeavor, such a mapping exercise entails close collaboration between the central and state governments, MNRE, NITI Aayog, industry, and academia.
3. Roadmap-Linked Incentives (RLI) scheme: Redesign the incentive architecture to enable the participation and growth of small and mid-tier players in the solar PV value chain. Create a complementary RLI Scheme that is aligned to milestones like domestic content addition, R&D expenditure, and upstream integration. Such a scheme can also be tweaked to cater to scale-oriented firms that can compete with China.
4. Extend the ALMM scheme: Extend and regularly fine-tune the ALMM framework, including a new ALMM scheme for critical ancillary components and machinery. This will hinge on the ecosystem wide mapping exercise to determine key bottlenecks and will require regular, structured industry consultations.

5. **Closing the upstream gap**: This brief outlines the continued upstream gap with limited polysilicon and ingot/wafer domestic manufacturing capacity. Given the high capital costs for these upstream segments, the government should focus on closing the upstream gap through the provision of targeted capital support, volatility hedging instruments, and potentially dedicated upstream PLI tranches to build the needed backward linkages.
6. Strengthen government-industry-academia tracks: The government can consider instituting a CSR-style R&D funding vehicle enabling greater integration and collaboration between the state, industry, and academia. This is particularly important to ensure there are investments in frontier and next-generation technologies, such as perovskite tandem cells, as well as for process innovation and materials research. This will entail strengthening interactions between leading research labs (at NCPRE, IISc, NISE) and industry players. Investments in next-gen technologies will create the grounds for India to leapfrog dominant players.
7. Develop anti-dumping and boom-bust monitoring capabilities: A standing cell or unit housed within the Ministry of Commerce or NITI Aayog entailed with tracking price movements, loss-making capacity, and detailed subsidy patterns in China is crucial to understanding competition and distinguishing genuine competitiveness from state-backed dumping. Some of these capabilities already exist within the DGTR and through the REIIMS portal.

III. Participation:

Key stakeholders in India's solar PV manufacturing landscape participated in the roundtable. These figures represented the following institutions:

- A vertically integrated solar PV manufacturing firm
- Wafer manufacturing firm (with in-house R&D capabilities)
- Industry associations & trade bodies
- Leading R&D institutions
- Think tanks
- Energy-focused consultancy firms

IV. Overview (policies & capabilities):

India's renewable energy landscape has transformed over the past decade. This transformation has been led primarily by scaling solar. India's installed solar capacity rose from about 3 GW in 2014 to 140 GW in January 2026. In FY2025-26, India added 52.5 GW of generation capacity (highest capacity addition thus far) of which 39.6 GW was renewable energy with solar energy alone accounting for 34.9 GW. Tracking the status of renewable energy, the International Energy Agency (IEA) estimates that India will become the second-largest growth market for clean energy, and capacity is set to rise by 2.5 times in five years.

These headline figures represent remarkable progress. However, it is crucial to examine changes within and across India's solar PV value chain. This is particularly pertinent given that the national government has stated that it aims to become self-reliant in solar PV manufacturing and establish itself as a major player in the global value chain.

To strengthen its domestic manufacturing capabilities, the government has instituted several policies, most notably post 2019. The gamut of India's industrial policy toolkit is highlighted in Table 1 (see Appendix I).[1]

Policy domain	Instruments & Initiatives			
	Market-based	*Govt. policies*	Public goods/direct provision	*Govt. policies*
Product market	• Import tariffs	*JNNSM (2010); Safeguard duties (2018);*	• Procurement policy	*Solar-specific RPOs (2011); CPSU Scheme*

[1] In the Taxonomy of Industrial Policy, John Weiss sets up a framework on the application of industrial policy, and creates a taxonomy that separates policy measures on the basis of policy domains (product market, labor market, capital market, land market and technology) and two broad categories of policy instruments – market-based interventions and public inputs. Weiss doesn't provide a distinction between horizontal instruments (those that are available for all manufacturing) and vertical instruments (applied selectively). This framing is helpful as a starting point to segregate the various policy measures that the Indian government has deployed to spur the domestic solar PV manufacturing industry.

	• Export subsidies • Duty drawbacks • Tax credits • Investment/FDI incentives	*PM Kusum scheme (2019); PLI scheme (2021); Basic Customs Duty (2022); Reduction of GST (2025)*	• Export market information/trade fairs • FDI country marketing • One-stop shops • Investment promotion agencies	*Phase II (2019); PM KUSUM scheme (2019); ALMM (2021); PMSGY (2024); REIIMS Portal (2025)*
Labor market	• Wage tax credits/subsidies • Training grants		• Training institutes • Skills councils	*NISE (2013)*
Capital market	• Directed credit • Interest rate subsidies	*PMSGY (2024)*	• Loan guarantees • Development bank lending	*PM KUSUM scheme (2019)*
Land market	• Subsidized rental		• EPZs/SEZs • Factory shells • Infrastructure • Legislative change • Incubatory programs	*GEC Phase I (2013); Solar Park Scheme (2014); GEC Phase II (2022); GEC Phase III (2025)*
Technology			• Tech transfer support • Tech extension program	*NCPRE (2010); NISE (2013)*

Table 1. Policies and initiatives instituted by the Government of India to strengthen the domestic manufacturing of the solar photovoltaic value chain (table adapted from John Weiss, Taxonomy of Industrial Policy, United Nations Industrial Development Organization, 2015)

As Table 1 (and Appendix I) illustrates, the central government has deployed a wide array of policies and initiatives from its industrial policy toolbox to spur and strengthen solar PV manufacturing. India's solar PV policy toolkit leans heavily on product market instruments. This is done either by shaping the relative profitability of manufacturing activities (adjusting the impact on prices received or paid or changing tax rates) or by instituting government procurement policies to create and broaden the market for domestic suppliers.[2]

How have these policies shaped India's solar PV manufacturing capabilities across the value chain? Table 2 outlines the changes across the solar PV value chain from 2010 onwards.

[2] For an extended discussion on product market IP tools see Weiss, Taxonomy of Industrial Policy, 2015, p. 10-11, and p. 9-22 for the early-stage IP toolkit. Weiss makes a distinction among economies with early-stage IP referring to economies with relatively low income per capita (up to US$3,000) and a relatively small manufacturing sector (below 15 percent of GDP), p. 7. India satisfies both these requirements to be considered within the early-stage IP framework devised by Weiss.

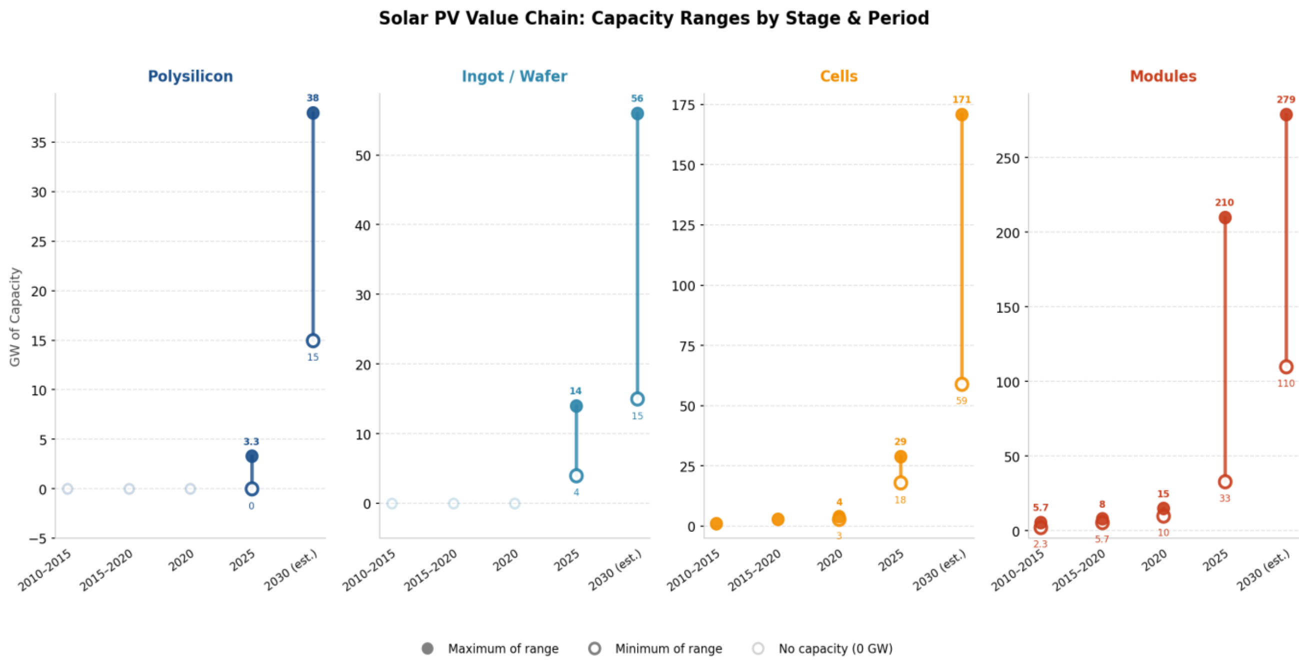

Fig. 1. India's manufacturing capacity (in GW) across the solar PV value chain, 2010-2030 (see Appendix II for further details; note: each panel has its own y-axis)

Value chain stage	2010-2015	2015-2020	2020	2025	2030 (estimated)
Polysilicon	0	0	0	0-3.3	15-38
Ingot/Wafer	0	0	0	4-14	15-56
Cells	1.2	3	3-4	18-29	59-171
Modules	2.3-5.7	5.7-8	10-15	33-210	110-279

Table 2. India's manufacturing capacity (in GW) across the solar PV value chain, 2010-2030 (see Appendix II for further details)

As Table 2 makes clear, India has made significant strides in the downstream stages of the solar PV supply chain, increasing its cumulative module manufacturing capacity from about 2 GW in 2010 to an estimated 210 GW by 2025 (see Appendix II for the range of estimates). These gains are more modest for cell production, which grew from about 1 GW in 2010 to 18-29 GW in 2025 (depending on the estimated). India's upstream capabilities in the solar PV value chain – for polysilicon and ingot/wafer – remain highly limited.

The government has recognized some of these constraints, instituting policies that directly target upstream stages in the supply chain. Notably, the government formalized ALMM List III (for ingots and wafers) in March 2026, stating that from June 2028, only locally produced ingots and wafers would be eligible for domestic projects including net-metering solar projects such as PM KUSUM (2021) and PMSGY (2024), and for SECI tenders. This move was welcomed by industry actors when first announced and builds on ALMM List-I (for modules) and List-II (for cells) with the government targeting the establishment of the entire solar manufacturing ecosystem within India. As an IEEFA study notes, the addition of ALMM List-III represents the government's aim to "reinforce backward linkages."

As the IEA makes clear, delays in commissioning projects in the upstream stages of the supply chain are attributed to technical, financial, and competitive challenges. On the financial side, setting up upstream manufacturing units, such as an integrated wafer to module plant, the capital investment for ingot-wafers and cells is significantly higher.

Furthermore, volatility in polysilicon and wafer prices globally complicates project economics. The competitive element of the upstream integration challenge refers to the China challenge. As statements in the parliament make clear, the central government is attuned to India's upstream import dependencies and the risks it poses – from supply chain disruptions to price fluctuations.

A recent CSIS study highlighted the scope of this challenge. According to China Photovoltaic Industry Association (CPIA) data analyzed by CSIS, China remains dominant across the value chain (see Table 3).

Value chain stage	China's production (as % of the global total)
Polysilicon	93.2
Ingot/Wafer	96.6
Cells	92.3
Modules	86.4

Table 3. China's share of the solar PV value chain (2024)

China's share across the solar PV value chain is further complicated by the upheavals in its domestic industry. As the CSIS study underlines, prices across the solar value chain have been collapsing since 2023 with the industry undergoing massive changes – module prices dropped by half in 2023 followed by a further 25% in 2024, polysilicon prices declined by more than 70% in 2023 followed by another 40% drop in 2024. In 2025, wafer, cell, and module prices remained at "depressed levels" with price pressures persisting[3].

Given the myriad challenges affecting India's solar PV manufacturing landscape, NZIPL convened the industry roundtable to gain an on-the-ground perspective from manufacturers, scientists, developers, and industry body representatives. The following section covers the key points raised in the discussion.

[3] A 2026 IRENA report on the solar PV supply chain found the total module cost (USD/Wp) in India is slightly higher compared to China and Vietnam, which have highly competitive costs.

V. Key takeaways:

1. Manufacturing ecosystem:

A leading manufacturer of solar modules stated that key decisions regarding the manufacturing of their products hinges on three factors: efficiency, energy, and cost.

- Manufacturing ecosystem: There are limitations when it comes to equipment vendors for key machinery in the process and value chain. The government, industry, academia and others should actively map the ecosystem to identify deficiencies and dependencies.
- Design & fabrication capabilities: Module assembly capabilities in India are currently well-established and cell fabrication capabilities are increasing. Stakeholders need to invest in bolstering domestic design and fabrication capabilities.
- Falling costs: Policy and industry strategy need to account for the broader implications of a continuing decline in the levelized cost of energy (LCOE) for solar PV, including the margin pressures on domestic manufacturers.

2. Key inputs, machinery & materials:

- Machinery: A systematic mapping is needed of domestic capabilities and deficiencies in machinery and metals critical to the solar value chain.
- Perovskite: There are incremental changes with perovskites. Tandem solar cells have resulted in efficiency rates above 30%. This has not been commercialized yet and is limited to labs or at the R&D stage at various firms.
- Key components: Participants highlighted the importance of components such as silver paste, junction boxes, and diamond wire saws.
    - Silver paste: This is a critical component in solar cell manufacturing (due to its superior electrical conductivity) but materials research for this product is limited. A senior research scientist highlighted an example wherein extensive R&D was conducted for silver at a leading institution but received no support from the government or industry despite repeated requests (see Figure 1 & Box 1).

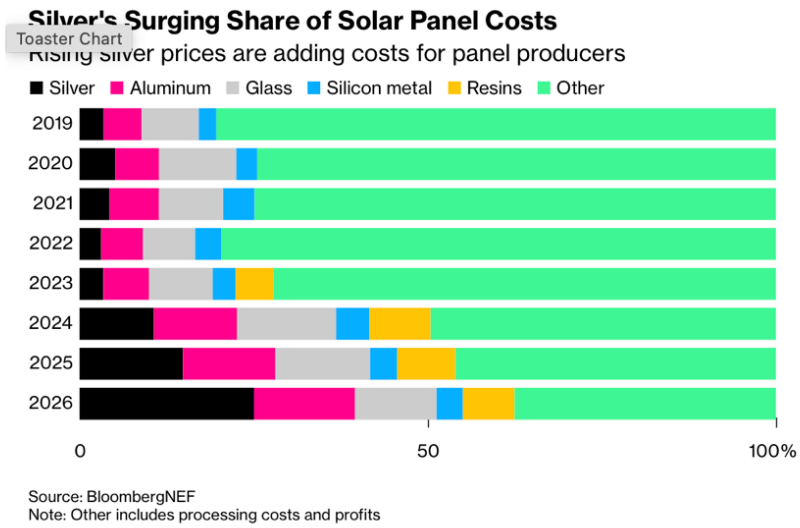

Fig 1. Silver's share of solar panel costs, 2019-2026 (source: Bloomberg)

Box 1. Impact of fluctuating silver prices on solar PV manufacturing: Silver paste is a key material for photovoltaic panels, with the PV sector accounting for 17% of total silver demand in 2025 (at 196 million troy ounces). In 2025, silver rallied 130% (reaching highs of $121.64 an ounce) with senior consultants estimating that the metal accounts for one of the greatest contributors to the increased cost of manufacturing panels. This price rise is in part due to U. S. tariff policy in 2025. Firms are responding to this price rise in two ways. The first is to seek alternatives such as copper (which trades at $12,823 per metric ton compared to silver at $2.5 million per ton). An executive focusing on the solar supply chain expects "broader industry shifts" in 2026 with "leading manufacturers moving to pure copper metallization and hybrid silver-copper pastes." Manufacturers could also turn to silver-free technology such as cadmium telluride thin-film technology. Market analysts expect these trends to play out over years. Firms are also offsetting raw material volatility through technology gains and value addition. A leading Indian manufacturer noted that silver paste accounts for a smaller share of total cell costs in 2026 compared to previous years due to "sustained reductions in consumption through process innovation and R&D."

  - Junction boxes: These are critical components and there are greater demands for higher-rated current junction boxes. While there is growing indigenous capabilities for this component, industry should strengthen its domestic manufacturing capabilities.

3. Policy & regulatory landscape:

- National roadmap: The domestic industry has strengthened considerably over the past decade. The government should consider creating a national roadmap for the solar industry over the medium to long term to provide policy signals to the industry and direct R&D efforts.

- Approved List of Models and Manufacturers (ALMM) scheme: This scheme has been crucial in building up the domestic industry and further modifications to the scheme (including the proposed addition of solar wafers starting in June 2028) are important.[4] The ALMM scheme should be regularly fine-tuned following consultations between the industry and government.
    - The government should consider instituting an ALMM scheme for key ancillary products in the solar module value chain.
- Production-Linked Incentives (PLI) scheme: Select participants pointed out that the PLI scheme favors large, incumbent players. This prompted a healthy discussion, with others noting that solar manufacturing depends on scale, and given the scope of the China challenge, a PLI-like scheme that enables large players is better suited for the Indian market.
    - The government could consider a 'Roadmap-Linked Incentives' (RLI) scheme that could level the playing field (for firms of varying size) by incentivizing firms to achieve set milestones along a defined roadmap (combining metrics such as domestic content addition, R&D investment, capital investment, and manufacturing capacity).
- and instead of a production-defined scheme, the government could consider instituting a 'Roadmap-Linked Incentives' (RLI) scheme. A RLI scheme would equalize the playing field allowing for firms that achieve certain set milestones along a roadmap (defined by a combination of domestic content add, R&D investment, capital investment, manufacturing capacity etc.)
    - Other participants pointed out that solar manufacturing is a game of scale and given the China challenge, a PLI-like scheme that enables large players is better-suited for the Indian market.
- Distribution-focused policies: Over the last few years, the government has instituted policies that focus on the distribution side which has in turn shaped the domestic solar manufacturing industry. Notable policies include PM-SURYA and PM-KUSUM.

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[4] In the latest MNRE drafts, the ministry mandates that government-backed ALMM projects should source modules from List-I manufacturers, cells from List-II and wafers from forthcoming List-III firms. The policy targets increased domestic production across the value chain. The proposed List-III for solar wafers will be published after a minimum of three independent manufacturers have set up wafer facilities and collectively reach annual capacity of at least 15 GW. See: https://www.pv-tech.org/indias-solar-manufacturers-applaud-almm-proposal-boost-domestic-wafer-production/

    - Participants highlighted state-level policies, including strides made by the Maharashtra State Electricity Distribution Company Limited (MSEDCL, also known as Mahavitaran) in their tendering.

4. R&D:

- Reliance on foreign researchers: A senior research scientist pointed out that domestic firms continue to seek external experts for key R&D and manufacturing projects.
- Funding: Scientists reflected on the transformed funding landscape in India. Participants noted that the quantum of and access to funding R&D projects used to be a challenge previously, this is not the case anymore.
- Firms: Private firms invest none to limited resources towards research and design.
    - A major producer of solar modules stated that their firm is actively investing in startups across the solar value chain in India.
- Government research institutions: Key research institutes highlighted during the discussion include the National Centre for Photovoltaic Research and Education (NCPRE) at the Indian Institute of Technology, Bombay (IIT-B) and the Indian Institute of Science (IISc; see Box 2)[5].
- Process innovation & material R&D: Increasing investments in process innovation, design R&D, and materials research is crucial. Process innovation occurs as much on factory floors as it does at R&D labs. This necessitates collaboration between academia, government, and industry.
    - Industries that are aligned with firms and products in the solar value chain could potentially partner and work with the government to invest in process innovation and materials research.
- Next gen technologies: Participants emphasized the importance of investing in next gen technologies that could enable Indian firms to leapfrog key competitors. This entails identifying frontier technologies and key R&D projects across the solar value

> **Box 2. An Indian scientist on their experience at a Chinese R&D lab**: A participant recounted their visit to the 'State Key Laboratory of PV Science and Technology' located in Changzhou, China. The lab is housed within the headquarters of Trina Solar, a leading Chinese manufacturer. The lab focuses on "investigating novel mechanisms for achieving high-efficiency photovoltaic conversion in crystalline silicon cells and advancing industrialization" and comprises more than 200 permanent members, setting "32 world records in both crystalline silicon cell efficiency and module power." The participant noted this experience to highlight an example of academia, industry, and government collaboration.

[5] IISc established the 'Solar PV Outdoor Reliability Testbed' (one of the first such large-scale research facilities dedicated to "understanding the real-world performance and reliability of solar PV technologies") at its Challakere campus in 2010. There are several start-ups at IIT-B that focus on different aspects of the value chain including solar cells, battery storage systems, and silver.

chain, and charting avenues for academia, government, and industry to work together in this domain.

- Purchasing patents: Participants questioned the potential for industry actors to purchase patents instead of investing in R&D. This could be cost-saving in the short-term for resource-limited firms.
- Pilot manufacturing: Participants questioned the cost competitiveness of conducting pilot projects in India, relative to other countries. Some argued that industry players should focus on the design aspect of R&D given the relative gains.
- CSR models for R&D: Participants recommended novel R&D funding mechanisms, including a CSR-style model for R&D purposes.

5. Circularity:

- Emissions intensity: Participants highlighted the energy-intensive nature of manufacturing PV panels and underscored the importance of building up circularity in the value chain. The production processes for certain forms of solar modules have greater emissions intensity.[6]

6. China factor:

- Trade practices: In today's geopolitical climate, **trade policy is climate policy**.
- Comparisons between India and China: The solar industry in China has been built up and nurtured for more than two decades now.[7] Comparisons between the industries in India and China need to be done keeping in mind the differing timelines of the policies instituted, and the resources invested in the two countries.
  - India has had a national solar mission in place since 2010 but has significantly accelerated its efforts post 2019. As Nemet makes clear, the Chinese industry went "from a few nascent start-ups to the world leader in PV" between 2000 and 2007, two years before India even instituted a national solar policy.[8]
- Chinese solar PV industry: The Chinese industry, while dominant, is also characterized by a significant share of loss-making firms that are supported by local and state governments (see Figs. 2 & 3, Box 3). A central challenge for Indian policymakers is to figure out how to create *and* protect domestic industries.

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[6] See: https://www.ceew.in/sites/default/files/how-can-india-enable-circular-economy-with-solar-waste-management.pdf

[7] In the seminal *How Solar Energy became Cheap*, Gregory Nemet notes that activities in China between 2000 and 2016 "contributed most directly to cheap PV" and that by 2007, China was already producing more PV than any other country. See: Nemet, 133-4.

[8] Nemet, *How Solar Energy Became Cheap*, 133-4.

- Boom and bust cycles: The Chinese industry undergoes boom and bust cycles, and it is crucial for stakeholders across the value chain to keep track of movements in the industry to identify opportunities and headwinds in global demand and supply.

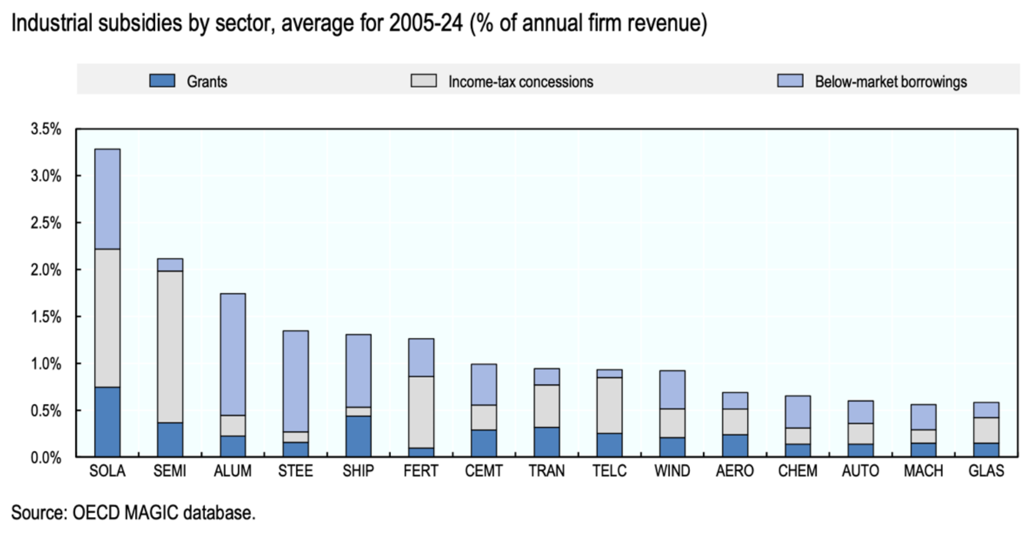

Fig. 2. OECD estimates that the production of solar cells and modules has been the most subsidized industrial sector since 2005 (source: OECD)

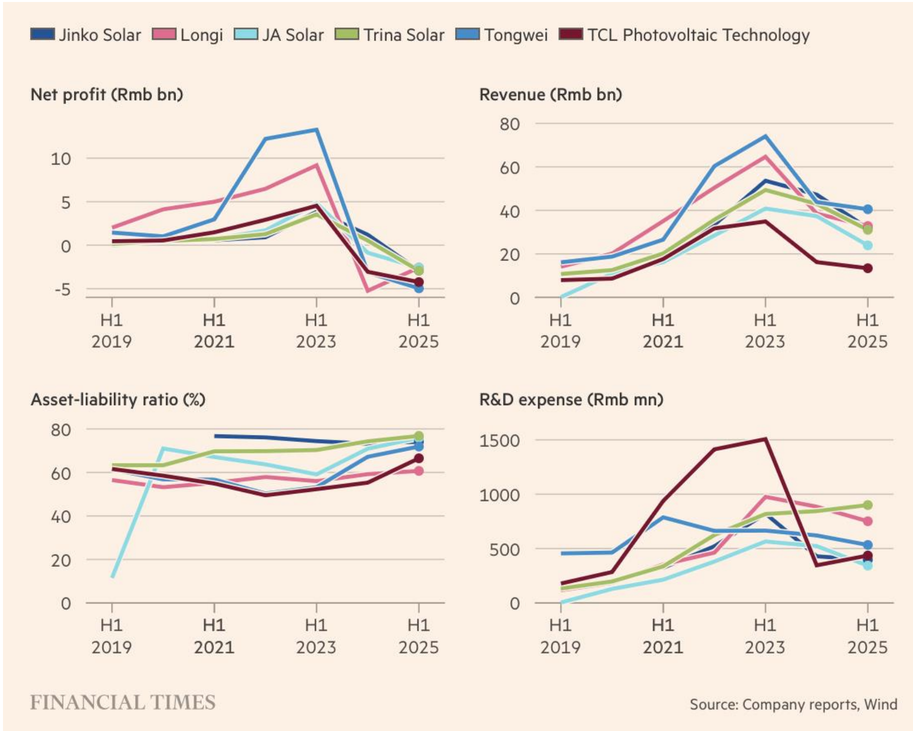

Fig. 3. Financial indicators of China's leading solar companies in the first half, 2019-2025 (source: Financial Times)

Box 3. China's state support for (and recent upheavals in) the solar industry: According to the OECD MAGIC database on industrial subsidies, "the production of solar cells and modules was, on average, the most subsidized between 2005 and 2024, with subsidies representing nearly 3.2% of firms' revenue against and overall MAGIC database average of 0.9%." This has resulted in "sustained imbalances between supply and demand and financial hardship for the industry." Previous research tracking China's industrial policy spending highlighted that this spending came out to at least 1.73% of its GDP in 2019 (using a conservative methodology) at $248 billion at nominal exchange rates. To put this in perspective, this figure is higher than its defense spending for 2019. In addition to expansive government support, leading solar manufacturers in China have engaged in deflationary price wars, with firms selling at below cost to undercut competitors. Leading Chinese solar firms' net income has been in the red since 2023 and the Chinese government has been concerned about "involution" (excess production leading to a race to the bottom in prices). In 2024, China's biggest solar firms (Longi Green Energy, Trina Solar, Jinko Solar, JA Solar and Tongwei) shed around 87,000 staff, or almost one-third of their total workforces, and since then over 40 solar firms "have delisted, gone bankrupt, or been acquired" according to the photovoltaic industry association. In July 2025, executives from the biggest Chinese solar firms were summoned to Beijing where Li Lecheng, the industry minister, said companies "must "resolutely crack down" on disorderly competition and speed up the closure of underutilized factories." Beijing also instituted policies, like placing limits on the energy consumption of polysilicon plants in 2025, that was forcing less efficient capacity to shut down. In 2025, China's five leading PV companies posted deficits, with total losses ranging from RMB28.9-32.8 billion (US$4.1-4.7 billion).

7. Skill building:

- Next generation of technologists: Industry and government need to work together to identify how to train the next generation of technologists for the solar industry. Given the industry's growing importance in India's energy landscape, identifying skill-training curriculum, programs, and institutes is crucial.

8. Key trends:

- RE uptake by C&I: Commercial and industrial (C&I) consumers, and the metals industry in particular, are transitioning toward renewable energy as it becomes increasingly cost competitive. This shift will shape both RE demand and the trajectory of the solar manufacturing industry.
- Transmission challenges: A key challenge over the short to medium term pertains to the grid. Participants noted that RE projects typically take less time to build out than conventional generation (for instance, thermal coal projects take about five years whereas solar projects take roughly 18 months), and this mismatch impacts grid buildout resulting in significant bottlenecks.

Appendix I: Key select policies & initiatives targeting the solar PV industry

Year	Policy	Aim & relevance for manufacturing	Note
2010	Jawaharlal Nehru National Solar Mission (JNNSM)	Establish India as a global leader in solar energy, by creating the policy conditions for its large-scale diffusion. The government aimed to achieve this through the domestic production of critical raw materials, components and products. The policy included Domestic Content Requirements (DCR) to ensure the development of domestic manufacturing capabilities.	Three phases: Phase I (2012-13), II (2013-17) and III (2017-22). A 2013 World Bank study, commissioned by MNRE, to document the implementation of JNNSM found that DCR didn't revive the solar PV manufacturing industry, the existing capacity doesn't cover upstream segments (polysilicon, wafers or ingots), the manufacturing industry faces supply-side headwinds, and that the government requires a comprehensive national policy instead of relying primarily on DCR.
	National Centre for Photovoltaic Research (NCPRE), IIT Bombay	Creation of a dedicated photovoltaic research and education centre to provide R&D support and education for India's solar mission.	MNRE has provided over INR 200 crore in funding to NCPRE from 2010 to 2025. In 2024, IIT Bombay incubated ART-PV India, which developed a tandem solar cell with a conversion efficiency of 29.8% (one of the highest performance levels achieved in India).
2011	Solar-specific Renewable Purchase Obligations (RPO)	The National Tariff Policy was amended in 2011 prescribing solar-specific RPO to be increased from a minimum of 0.25% in 2012 to 3% in 2022.	Obligated entities (distribution companies (DISCOMS), open access consumers, and captive power producers) can meet their RPO by generating green power, power purchase through RE developers, and by purchasing renewable energy certificates (RECs)). In February 2024, NITI Aayog released a study on RE's technical potential and state RPOs.
2013	Green Energy Corridor (GEC) Phase I	Create dedicated transmission infrastructure for large scale solar and wind power plants from RE rich states. By creating the infrastructure for evacuating renewable power, policymakers ensured the requisite hardware was in place while creating a demand pull. As the government notes, the development of the GEC scheme provides the necessary backbone for large-scale RE integration.	Implementation began in 2015.

	National Institute of Solar Energy (NISE)	NISE was set up as the apex national body for research and technology development and related activities in the field of solar energy.	In 2025, NISE began inaugural training programs on solar cell and module manufacturing to build up technical capacity and for workforce development.
2014	Solar Park Scheme	Propose to set up at least 25 Solar Parks and Ultra Mega Solar Power Projects with a total of 20 GW installed capacity. This scheme was devised to encourage project developers and investors, trigger economies of scale, and enable technical improvements. Solar parks will provide suitable developed land with clearances, transmission system, water access, road connectivity etc.	The capacity was enhanced from 20 GW to 40 GW in 2017. The parks are proposed to be set up by 2025-26.
2018	Safeguard duties	Responding to petitions by domestic cell and module manufacturers, the Directorate General of Trade Remedies (DGTR) conducted a study and recommended the levying of safeguard duties on the import of solar cells (whether or not assembled in modules) for two years (2018-2020). The DGTR recommended duties of 25% for the first year, 20% for the following six months, and 15% for the remaining six months (of the two-year period).	The duty impacted cell imports from China, Malaysia and Taiwan. In 2020, the government extended the safeguard duties for another year.
2019	Pradhan Mantri – Kisan Urja Suraksha evam Utthaan Mahabhiyaan (PM KUSUM) Scheme	The scheme aims to add 34.8 GW of solar capacity with three components: i) Renewable energy-based power plants (REPP) set up by a variety of defined agricultural actors; ii) individual farmers in off-grid areas; and iii) individual pump solarization and agriculture feeder solarization. Select components within the scheme mandate deploying domestically produced solar cells and modules.	Scheme extended till March 2026. In 2021, the government estimated that this scheme will create the demand for 20.8 GW of domestically produced solar cells and modules.
	Central Public Sector Undertaking (CPSU) Scheme Phase II	The scheme aims to set up 12 GW grid-connected solar PV power projects, by government producers with funding support for self-use or use by government entities (at the central and state level). The scheme mandates the	The government has sanctioned 8.2 GW capacity of solar PV power plants and as of December 2025, government entities have commissioned 2.87 GW of solar power projects.

		use of domestically manufactured cells and modules.	
2021	Production Linked Incentive (PLI) Scheme	The PLI scheme aims to build up solar PV manufacturing capacity of high efficiency modules and to develop an ecosystem for sourcing local material for solar manufacturing. The scheme is being implemented through Tranche I (with an outlay of INR 4,500 crore wherein 3 firms were selected for setting up 8.7 GW of fully integrated solar PV module manufacturing units) and Tranche II (with an outlay of INR 19,500 crore where 11 firms were selected for setting up 39.6 GW of fully/partially integrated solar PV module manufacturing units).	A study by IEEFA and JMK Research & Analytics found that the PLI scheme attracted strong industry interest, but capacity additions remain below targets. As of June 2025, only 56% of module and 14% of polysilicon capacity was achieved. India's limited polysilicon and wafer capacities have come solely through the PLI scheme.
	Approved List of Models and Manufacturers (ALMM)	The ALMM list was devised to ensure the reliability and veracity of producers and has also led to the promotion of the domestic solar manufacturing industry. Only models and manufacturers listed within the ALMM lists are eligible for use in government projects or projects that receive a specified form of government support. ALMM List-I (issued in March 2021) specifies models and manufacturers for modules, ALMM List-II (effective from June 2026) focuses on solar PV cells, and ALMM List-III (to come into force starting June 2028) is for wafers.	Changes to the ALMM has been identified as a key policy hurdle for the domestic industry. The ALMM order was issued by MNRE in 2019 and became operational in 2021. The ALMM order was held in abeyance for FY2023-24 as leading industry firms claimed there is inadequate domestic manufacturing capacity. In 2024, India reimposed the ALMM, eliminated exemptions for open access and rooftop solar and issued a clarification order stating that the 2019 order won't apply to RE projects that had secured key approvals before October 2022. In 2025, MNRE amended the ALMM order reducing module efficiency thresholds for off-grid projects or select applications.
2022	Basic Customs Duty (BCD)	Imposition of BCD on the import of cells and modules. This was done with the explicit aim of making imports more expensive and to encourage the use of domestic alternatives.	In 2026, the government proposed the exemption of 7.5% BCD on the import of sodium antimonate (used in the manufacture of solar glass). This move was welcomed by industry players and analysts.
	GEC Phase II	Intra-State GEC Phase II was approved by the government in January 2022 with a total target of 10,750 ckm intra-state transmission lines and 27,500 MVA sub-	The scheduled commissioning timeline is till March 2026.

		stations, with these projects set up for the evacuation of approximately 20 GW of RE power from 7 selected states.	
2024	PM Surya Ghar – Muft Bijli Yojana (PMSGY)	This is the world's largest domestic rooftop solar initiative with the aim to provide free electricity to households by facilitating the installation of solar panels.	
2025	GEC Phase III	The government is planning to initiate Phase III of the intra-state GEC.	
	Reduction of Goods and Services Tax (GST) from 12% to 5%	Rationalizing tax rates across the RE value chain, the government reduced GST from 12% to 5% for solar energy devices and certain parts (solar power-based devices, solar power generators, solar lamps, and PV cells (irrespective of their assembly in modules or panels). Lower GST rates will reduce module and component costs by 3-4% according to government estimates and will encourage investments into domestic manufacturing.	The government states that the tax cut will reduce the levelized cost of energy, boost investor confidence and enable faster signing of power purchase agreements.
	Introduction of the Renewable Energy Equipment Import Monitoring System (REEIMS) portal	The REIIMS portal monitors specific items or components imported for the manufacturing of PV modules and wind operated electricity generators which will provide MNRE with the requisite, credible data to formulate domestic manufacturing and supply-chain transparency related policies.	The government has listed the specific HS codes for items that must be mandatorily registered on the REIIMS portal.

Appendix II: India's manufacturing capacity across the solar PV value chain

Value chain stage	2010-2015	2015-2020	2020	2025	2030 (estimated)
Polysilicon	0[9]	0	0[10]	0-3.3[11]	15-38[12]
Ingot/Wafer	0	0	0[13]	4-14[14]	15-56[15]
Cells	1.2[16]	3[17]	3-4[18]	~18-29[19]	59-171[20]

[9] In a JNNSM policy document (p. 5), Solar Energy Corporation of India (SECI) made it clear that India's PV industry is dependent on imports for polysilicon.

[10] A 2022 IEA report (p.19) shows that India has no polysilicon production capabilities. A 2022 JMK Research & Analytics, and IEEFA report (p. 1) also notes the same.

[11] In March 2025, a Minister of State for power stated that at present India didn't have the facilities for the commercial production of polysilicon. A 2025 JMK & IEEFA report (p. 5) noted that India's installed manufacturing capacity for polysilicon stood at 3.3 GW (equivalent capacity from First Solar). IEA's 2025 Renewables report (p. 86) noted that India hadn't established any polysilicon production facilities.

[12] IEA's 2025 Renewables report (p. 86) revised its polysilicon production estimate for 2030 downward to 15 GW (it was initially 30 GW). JMK research estimates (from 2023, p. 6) that India's polysilicon production (nameplate) capacity will reach 38 GW by 2026. An Indian minister stated that as of 2025, 20.7 GW of polysilicon manufacturing facilities are at the planning or under construction stage.

[13] A 2022 IEA report (p.19) shows that India has no wafer production capabilities. A 2022 JMK Research & Analytics, and IEEFA report (p. 1) also notes the same.

[14] At the lower end, the IEA estimates that India added 4 GW of wafer capacity between 2021-2024. One industry estimate expects the capacity to rise to 5 GW by December 2025, and another industry estimate places the figure slightly higher at 5.3 GW (as of June 2025). Sinovoltaics estimates that India's wafer capacity will increase from 14 GW currently to 28 GW by 2030. An August 2025 government press release highlighted the start of a 2 GW ingot-wafer manufacturing unit. IEA's 2025 Renewables report (p. 86) notes that no wafer production facility had been commissioned.

[15] IEA's 2025 Renewables report (p. 86) revised its wafer production estimate for 2030 downward to 15 GW (it was initially 35 GW). Sinovoltaics estimates that India's ingot/wafer capacity till rise to 28 GW by 2030. A 2023 JMK research document (p. 6) estimates that India's capacity will rise to 56 GW by 2026.

[16] The government estimates India's solar cell manufacturing capacity at 1.2 GW (as of 2014).

[17] A 2017 industry estimate placed India's cell manufacturing capacity at 3 GW.

[18] In a journal article (p. 3) India's leading solar PV scientists placed India's cell manufacturing capacity at the end of 2020 at around 3-4 GW. A 2022 JMK & IEEFA study (p. 1) placed India's cell manufacturing capacity (as of November 2021) at 4.3 GW.

[19] At the lower end, ICRA, a leading ratings agency (as of November 2025, p. 2) places India's cell manufacturing capacity (just under ALMM) at 17.9 GW. At the higher end, JMK research places this figure at 29 GW (as of June 2025). MERCOM estimates this capacity to rise to 75 GW by 2026. The IEA estimates this figure to be about 20 GW (as of 2024), the government (as enlisted under ALMM List II) at 24 GW, Sinovoltaics at 24.56 GW, MERCOM at around 27 GW, and JMK research at 29 GW (as of June 2025). As of February 2024, the government (relying on industry feedback) placed this figure at 6 GW.

[20] A 2023 JMK research document (p. 6) estimates that India's cell manufacturing capacity will rise to 59 GW by 2026. IEA's 2025 Renewables report places this figure at 60 GW, Sinovoltaics believes this figure will rise to 65 GW by 2030, ICRA estimates (p. 1) India's cell manufacturing capacity will rise to 100 GW (by December 2027) and MERCOM placed this figure at 171 GW of solar cell capacity to be commissioned by 2030.

Modules	2.3-5.7[21]	5.7-8[22]	10-15[23]	33-210[24]	110-279[25]

[21] The Indian government placed India's module production capacity at 2.3 GW (as of 2014). A CSTEP study (p. 7, 11) placed this figure at 5.7 GW as of 2015.
[22] CSTEP estimated (p. 7, 11) the module production capacity at 5.7 GW (as of 2015) and at 5.8 GW (as of 2016). A 2022 JMK & IEEFA study (p. 12) also placed this figure at 5.8 GW (as of 2016). Sinovoltaics estimated this figure to be at 8 GW (as of 2017).
[23] In a journal article (p. 3), scientists estimated the module manufacturing capacity to be around 10-15 GW. A 2022 JMK & IEEFA study (p. 12) placed this figure at 18 GW (by December 2021).
[24] A 2022 JMK & IEEFA study (p. 15) estimated India's cumulative capacity to hit 33 GW by 2025. The IEA estimates this figure to be 35 GW (as of 2024), the government estimates 50 GW of installed capacity (by February 2024), Sinovoltaics at 68.4 GW (for 2025), government at 74 GW (as of March 2025), ICRA (p. 1) at about 109 GW, JMK & IEEFA (p. 4) at 120 GW (as of June 2025), industry estimates at 125 GW, MERCOM at 150 GW (by 2026) with more recent MERCOM figures placing this at 210 GW (by December 2025).
[25] JMK research estimates (from 2023, p. 5) that India's module manufacturing capacity will hit 110 GW by 2026, Sinovoltaics places this number at 120 GW by 2028-30, IEA's 2025 Renewables report at 125 GW, ICRA (p. 1) at 165 GW (by 2027) and MERCOM at 279 GW module manufacturing capacity by 2030.