

# Solar Equipment: Policy Support to Underpin Growth in Medium Term

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## Synopsis

- India's solar equipment manufacturing capacity is poised for a healthy growth over the next 2-3 years, with module and cell manufacturing capacities of ~80 GW and ~50 GW respectively, in the pipeline. This will entail a capex of nearly Rs 1 lakh crore, with an estimated debt funding of nearly Rs 70,000 crore over the medium term, including investments in polysilicon and wafer capacities.
- The imposition of tariff barriers in the form of BCD on imported cells and modules has increased the cost-competitiveness of domestic cells and modules to an extent. However, the impact is partly offset by international prices languishing at record-low levels.
- The implementation of the Approved List of Models and Manufacturers for solar modules (ALMM-I) is expected to boost demand for domestic modules. This, along with government-aided schemes supporting demand for modules with domestic content requirements (DCR modules), will drive growth. Policy support for progressive backward integration remains crucial for India's solar equipment value chain.
- The introduction of ALMM-II for domestic cells may result in an increase the delivered cost of domestic modules by 6-7 cents/Wp, leading to a rise in solar tariffs by 40-50 paise per unit for the short run till local cell supply scales up.

## India's renewable capacity growth is driven by the solar segment

India's RE capacity stood at 155 GW as of September 2024, with the solar segment being the largest contributor at 91 GW, thanks to significant capacity additions over the past 7-8 years. The rising share of RE capacity is due to strong policy focus, improving tariff competitiveness, and strong investor interest. While India installed 18.5 GW of RE capacity in FY24, CareEdge Ratings expects the annual RE installations to surpass 35 GW over the next two years, primarily supported by a healthy pipeline of more than 100 GW.

The growth in solar capacity in the medium term will be driven by an annual tendering target of 50 GW RE capacity through renewable energy implementing agencies, with the majority expected from solar. Significant capacity additions of ~20 GW will come from rooftop solar, hybrid solar component, and off-grid solar over the next 2-3 years. This apart, solar open access capacities of 4-5 GW are likely to be added annually over the next 2-3 years, aided by ESG commitments of corporates and improving economic viability of C&I projects.

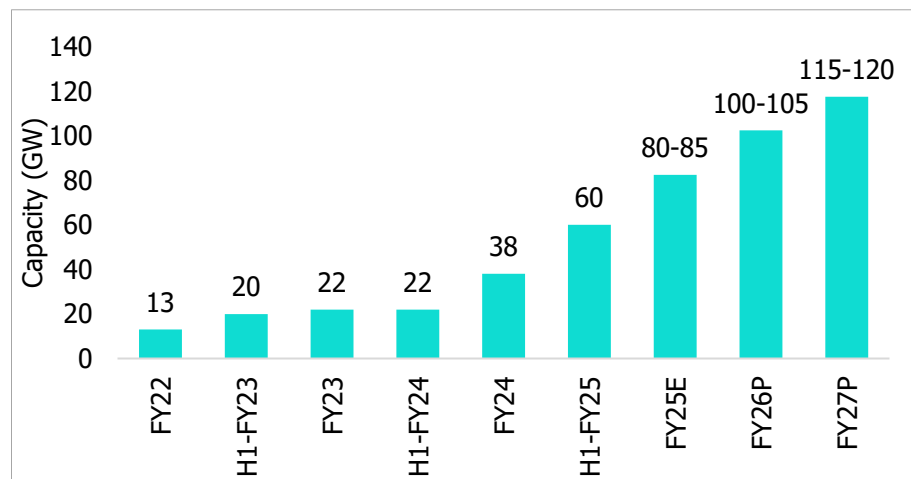
## India's solar equipment manufacturing sector poised for robust growth

The solar equipment manufacturing value chain consists of four stages:

1. Polysilicon production – polycrystalline silicon is made by chemical purification of metallurgical-grade silicon
2. Ingots/Wafers slicing – made by melting highly conductive polysilicon at high temperatures, followed by cooling to stretch into crucibles i.e. ingots, which are then sliced into wafers
3. Cells fabrication – made by cleaning, diffusion, washing, chemical texturing, and coating of wafers to enhance efficiency by increasing electrical conductivity and reducing light reflection
4. Module assembly – by assembling cells into arrays

India’s module and cell capacity stood at ~70 GW and ~8 GW, respectively, as of March 2024, although high-efficiency module capacity is only 50 GW. The capacity listed under the Approved List of Models and Manufacturers for modules (ALMM-I) reached 60 GW as of September 2024, although a large section is in the ramp-up phase, barely sufficing to meet the domestic module requirement. The accelerated growth over the last 12 months has resulted from the growing ESG focus of corporates, buoyant investor interest, proactive policy support, and enhanced availability of financing avenues.

**Exhibit-1: ALMM Enlisted Module Manufacturing Capacity**



Source: MNRE, Industry Sources, CareEdge Ratings

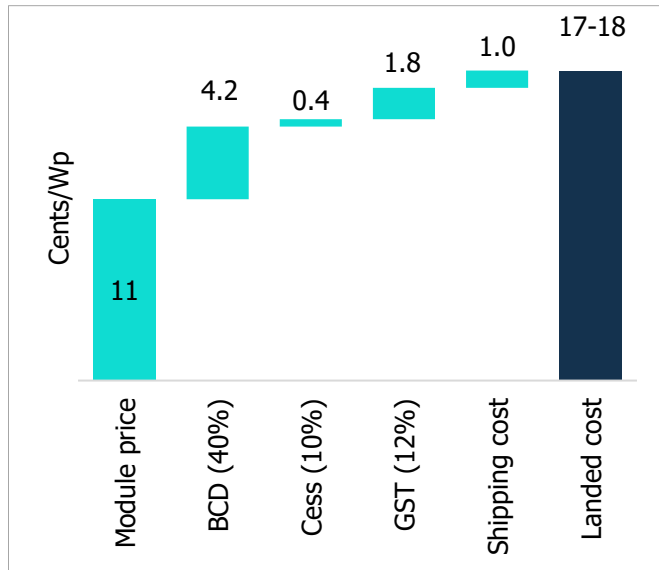
Capacity addition plans of ~80 GW by leading module manufacturers will entail a capex of ~Rs 12,000 crore over the next 2-3 years. Domestic cell capacity is expected to grow correspondently, reaching 60 GW by FY27, with investment of ~Rs 30,000 crore by major players over the next 2-3 years, supported by strong policy measures for progressive backward integration. The resultant capacity growth will make India a surplus market, given the annual module requirement of 40-50 GW, necessitating that the domestic players tap the export markets.

**Proactive policy support through tariff and non-tariff barriers to drive demand for Indian players**

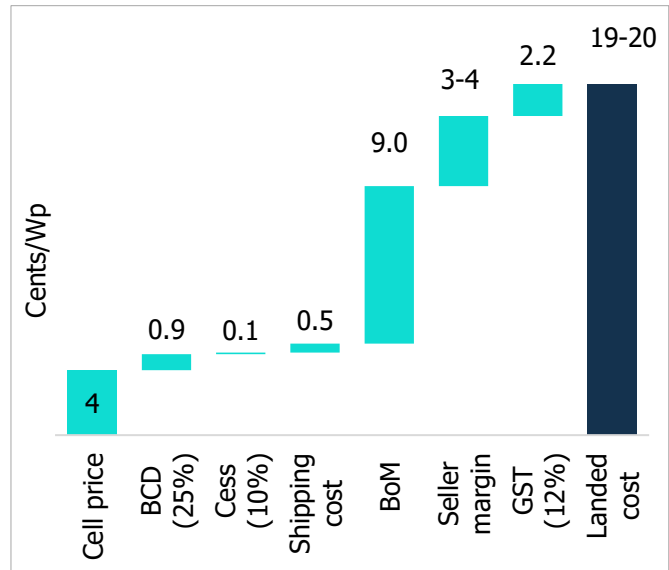
Basic Customs Duty (BCD) on imported cells and modules:

To safeguard domestic cells and modules against the predatory pricing of Chinese counterparts, the government imposed a BCD of 25% and 40% on Chinese cells and modules respectively, effective from April 01, 2022. While BCD increases the landed cost by 4-5 cents/Wp for imported modules and 1-2 cents/Wp for imported cells, DCR modules are pricier than both imported as well as non-DCR modules on a landed basis. This is primarily due to a steep fall in global module prices over the last two years, which partly offsetting the impact of BCD. Nonetheless, the BCD remains a key tool in enhancing the cost-competitiveness of domestic modules.

**Exhibit-2: Imported Modules (with BCD)**



**Exhibit-3: Domestic Modules using Imported Cells (with 25% BCD)**



Note: Cost assumptions based on wafer/cell/module prices as of October 2024; BoM refers to Balance of Materials  
 Source: MNRE, Industry Sources, CareEdge Ratings

**Central government schemes:**

The government has mandated the procurement of DCR modules for capacities under the following schemes:

- CPSU scheme – VGF support outlay of nearly Rs 8,600 crore for setting up 12 GW solar projects by central PSUs, out of which nearly 8 GW capacity has been awarded till H1-FY25
- PM Surya Ghar Muft Bijli Yojana – capital subsidy outlay of Rs 75,000 crore targeting 1 crore households amounting to ~25 GW residential rooftop solar installations over the next 2-3 years
- PM KUSUM Yojana – financial support of Rs 34,400 crore allocated for a decentralised solar capacity of ~9 GW to be set up by farmers under Component-A

**ALMM:**

Initially deferred to March 31, 2024, due to insufficient local module capacity, ALMM-I was brought into effect from 1st April, 2024, in light of the strong module capacity growth in FY24. Under ALMM-I, domestic modules are compulsory for all solar projects in the country, except for utility-scale projects awarded before 10th March 2021, and open access and net metering projects that had secured key approvals before 1st October 2022. Moreover, the government has proposed to implement ALMM-II, which mandates the use of domestic cells in locally assembled modules, from June 2026, effectively making DCR modules mandatory for all solar capacities.

Although the impending implementation of ALMM-I led to a surge in module imports in H2-FY24, resulting in module imports of USD 4.35 billion in FY24, imports moderated to USD 1.02 billion in the first half of FY25, compared to USD 1.14 billion in the same period of FY24. Cell imports gradually increased to USD 1.31 billion in FY23 and USD 1.85 billion in FY24 but dropped to USD 0.74 billion in the first half of FY25, likely due to enhanced domestic cell supply as Indian players continue to scale up cell capacities.

**Production Linked Incentive (PLI) scheme:**

The PLI scheme, with an endeavour to promote domestic manufacturing, has seen allocation amounting to Rs ~18,000 crore under:

- Cell + Module capacity – 7.4 GW
- Deeply integrated capacity – 16.8 GW
- Fully integrated capacity – 27.4 GW

The on-ground progress for these capacities has, however, been affected by issues such as shortage of capital equipment and skilled labour. The pace of implementation remains monitorable as these issues are gradually ironed out.

The upcoming capacity of ~50 GW for cells and ~80 GW for modules necessitates a capex of ~Rs 32,000 crore and ~Rs 12,000 crore, respectively. Coupled with the cumulative capex of ~Rs 55,000 crore envisioned for over 40 GW of wafer and ~25 GW of polysilicon capacities awarded under PLI, the solar equipment sector will witness a capex of close to Rs 1 lakh crore, with an estimated debt funding of nearly Rs 70,000 crore over the next 3-5 years.

**Solar equipment exports an attractive opportunity, however, cost and quality competitiveness will be key**

India's solar module exports to international markets have grown manifold over the FY23-FY24 period, as high-efficiency modules from India have gained acceptance in these markets. However, the USA remains the most lucrative market for Indian exporters, with over 95% share in FY24, rendering its trade policies paramount for India's solar equipment trade.

Owing to China's dumping of modules into the US market, the US government has imposed counter-vailing and anti-dumping duties on Chinese modules starting in 2012, followed by retrospective duties on Southeast Asian nations based on anti-trade investigations. However, the major game-changer has been the sanctions under the Uyghur Forced Labour Prevention Act (UFLPA), which prohibits the import of goods with origins from the Xinjiang region of China due to forced labour issues. The prohibition of modules from China and Southeast Asia, due to deep supply chain linkages to the Xinjiang region, has curtailed US market access for Chinese players.

Trade barriers apart, the US government has implemented investment incentives through the Inflation Reduction Act introduced in August 2022, which provides incentives in the form of either up to 30% capital subsidy or a local production-linked subsidy. Since the implementation of IRA, nearly 35 GW module capacity has been added in the US till October 2024, apart from a module capacity of nearly 41 GW and cell capacity of nearly 43 GW in the pipeline. In a bid to benefit from these local tax incentives, Indian manufacturers have also announced cell and module capacities mostly through joint ventures.

In its latest move to bridge the gap in its domestic solar supply chain, the US government announced a 25% capital subsidy under Section 48D of the CHIPS Act 2022 for ingot and wafer capacities that begin construction before 2027.

Indian module exports to the US surged to USD 1.97 billion in FY24. This was facilitated by the fact that domestic manufacturers were obtaining better margins in the US market while demand for domestic modules remained flat in the domestic market because of a delay in the implementation of ALMM-I. Moreover, India's cell exports to the

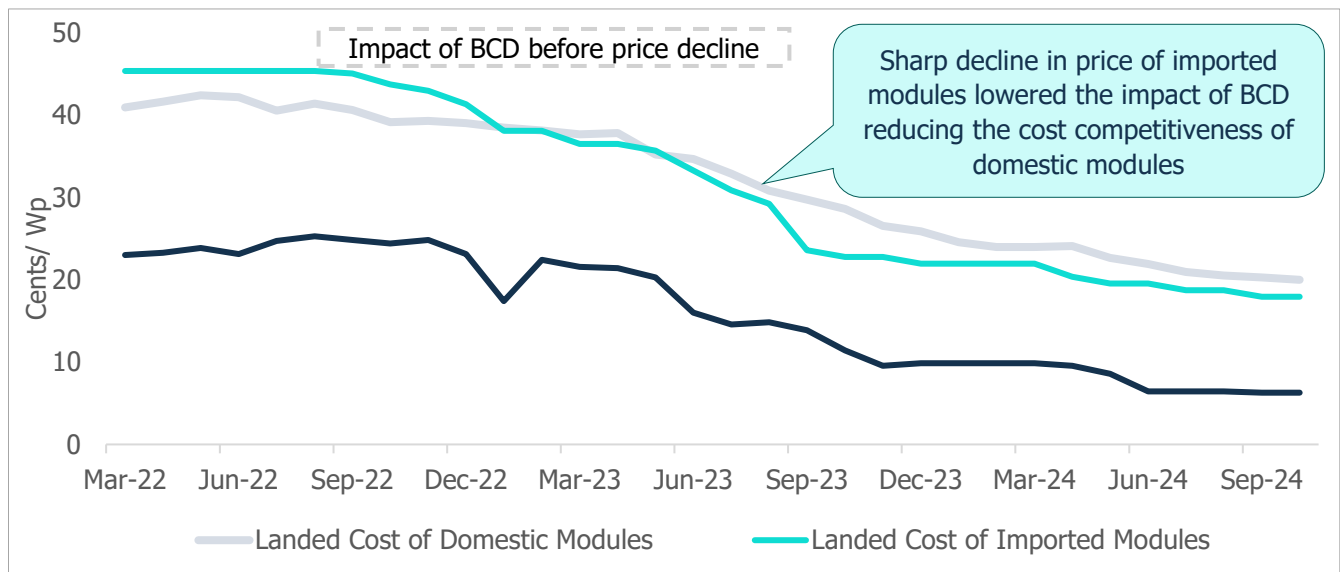
US witnessed a jump to USD 55 million due to growing demand for cells of non-Chinese make. While UFLPA scrutiny on non-DCR modules and the slowdown in solar installations in the US moderated India’s module exports momentum to USD ~650 million in 6M-FY25, Indian cell exports remained unphased at nearly similar levels of USD ~20 million as 6M-FY24.

However, a strong exports order book and progressive decoupling with China keep the prospects bright as Indian players can currently export DCR-compliant modules to the US market at margins nearly 2-3 times of domestic margins.

**Global price crash lowered the landed cost of modules; ALMM-II could raise tariffs in the short run**

Overcapacity has forced Chinese manufacturers to dump products in export markets at very low prices, further exacerbated by UFLPA sanctions, meaning that surplus Chinese production is flooding non-US markets including India. As a result, the landed cost of imported module prices in India has plummeted to ~18 cents/Wp as of September 2024, down from ~45 cents/Wp in March 2022, nearly offsetting the impact of BCD. Similarly, a staggering dip in cell prices has lowered the landed cost of domestic modules from ~41 cents/Wp to ~20 cents/Wp over the same period. Although imported modules remain cheaper than domestic modules by 8-10% despite the applicable duties, non-tariff barriers and government-sponsored schemes are likely to push demand towards domestic modules.

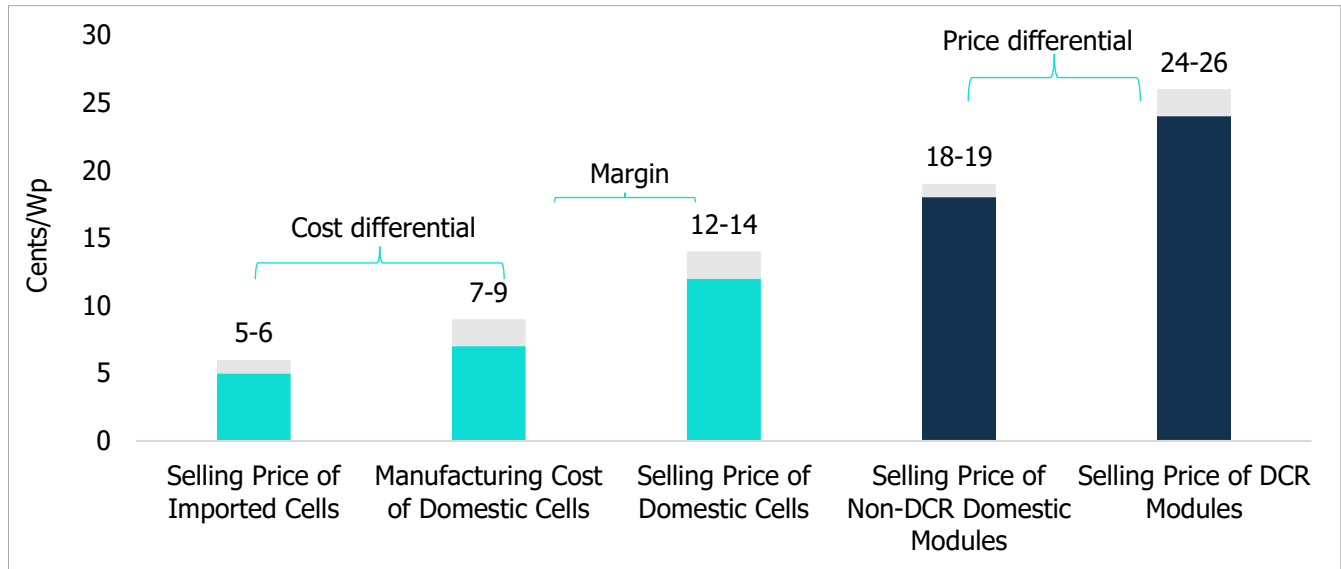
**Exhibit 4: Price Trend of Cells and Modules**



Source: Industry Sources, CareEdge Ratings

With domestic non-DCR modules, which are mandatory post implementation of ALMM-I, being sold at 18-19 cents/Wp, solar tariffs in India have remained range-bound at Rs 2.5-2.7 per unit during H1-FY25. However, DCR modules are witnessing a price differential of 6-7 cents/Wp vis-à-vis non-DCR modules, as domestic cells are currently being sold at a healthy margin of 4-5 cents/Wp over their production cost owing to the paucity of domestic cell supply.

**Exhibit 5: Cell price across value chain**



Source: Industry Sources, CareEdge Ratings

CareEdge Ratings envisages that implementation of ALMM-II for DCR modules could push solar tariffs further up to Rs 3 per unit levels, which were last seen over 2 years ago, in the short run.

**CareEdge Ratings View**

“The solar equipment manufacturing sector has several tailwinds including healthy domestic demand prospects, rising export opportunities, proactive policy support, and improved lenders’ appetite for RE projects. However, lack of integrated solar equipment capacity, supply chain dependence on China, increasing competitive intensity, and delay in RE capacity additions due to systemic issues are some headwinds that remain monitorable over the medium term,” stated Jatin Arya, Director, CareEdge Ratings.

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