How to Structure a Solar Manufacturing Project in Andhra Pradesh for PLI Scheme Success

Strategic Entry Framework for Vertically Integrated Wafer-to-Module Production

Content Partner: J. v. G. technology GmbH

Turnkey solar module production lines — since 1997

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Technical Overview: Structuring Solar Projects for Andhra Pradesh's PLI Scheme

Created as part of the PVKnowHow Knowledge Network

Prepared by J.v.G. Technology GmbH

European specialists in turnkey solar module production lines

Key Project Data

⩾1GW	$150–2…	Multi-…	AP / In…
Minimum Scale	**Investment Range**	**Ramp-Up Model**	**Target Region**
Target manufacturing capacity to be eligible for PLI bidding under Tranche-II scoring	Estimated capital requirement (USD) for vertically integrated wafer-to-module greenfield facility	Phased implementation across wafer, cell, and module production stages	Andhra Pradesh — primary location under analysis

Line type: Vertically integrated wafer-to-module production · Region: Andhra Pradesh / India · Source: PVKnowHow / J.v.G. Technology GmbH

India PLI Scheme — Policy Context

Programme Structure

- Launched 2021 under Atmanirbhar Bharat (Self-Reliant India) initiative
- Total outlay: ₹24,000 crore (~$2.7B USD) across two tranches
- Tranche I: 8,737 MW awarded to 3 fully integrated manufacturers
- Tranche II: 39,600 MW awarded to 11 manufacturers (April 2023)
- Incentive disbursement: 5 years post-commissioning

Strategic Objective

- Reduce import dependence — China held 90%+ of cell imports (FY2022–23)
- Build domestic high-efficiency solar PV manufacturing ecosystem
- India targets 500 GW non-fossil capacity by 2030
- Module capacity: 38 GW (Mar 2024) → 74 GW (Mar 2025)
- Cell capacity tripled in same period to 25 GW

PLI Eligibility — Scoring Framework

Integration Level (50 pts)

- Polysilicon → Module (full chain, 3 years): 50 pts
- Wafer → Module (2 years): 35 pts
- Cell → Module (1.5 years): 20 pts
- Minimum: cell + module commitment required

Capacity Scale (50 pts)

- ⩾4,000 MW: maximum 50 pts
- 1,000–1,499 MW: 20 pts
- Minimum viable bid: ⩾1,000 MW
- Scale determines PLI disbursement quantum

Module Performance

- Minimum efficiency threshold: 19.5%+
- Temperature coefficient requirements apply
- High-efficiency technologies (TOPCon / HJT) preferred
- BIS certification mandatory for Indian market access

⚠ Performance Bank Guarantees (PBGs) required at signing with IREDA/SECI. Missed commissioning timelines result in forfeiture of proportional PBG.

Andhra Pradesh — Strategic Location Rationale

Policy Environment

- AP Integrated Clean Energy (ICE) Policy 2024 — 5-year operative period
- Target: 160 GW RE capacity; ₹10 trillion investment attraction goal
- Single-window clearance system for manufacturing projects
- Speed of Doing Business framework — fast-track approvals

Infrastructure Advantages

- 6 operational ports (4 under development) — critical for equipment import
- Naidupeta / southern AP belt: emerging solar manufacturing cluster
- Premier Energies, Tata Power, Websol, ReNew — active installations
- 80,000 acres surveyed for industrial/RE use

Solar Resource Base

- >5 kWh/m^2/day solar irradiation across the state
- ~38.5 GW solar power potential
- Captive renewable power essential for low-cost manufacturing operations
- PLI projects receive priority energy banking capacity for 25 years

AP State Incentive Stack for Manufacturing

Incentive Category	Details	Duration
Capital Subsidy	Up to 25% of Fixed Capital Investment (solar/wind mfg.)	One-time
SGST Reimbursement	100% net SGST on product sales	5 years
Electricity Tariff Subsidy	₹1/unit (kVAh) reduction on power tariff	10 years from COD
Electricity Duty	Full reimbursement on total energy consumption	10 years
Open Access Charges	Transmission, wheeling, cross-subsidy surcharge exempt	10 years
Water Charges	25–75% subsidy on industrial water charges	10 years
Land Conversion	Deemed non-agricultural status; conversion fees waived	One-time

PLI-allocated projects with vertical integration (Mine to Module) receive priority energy banking allotment for 25 years from COD of captive generating project.

Vertical Integration Strategy

1

Wafer Production

Entry point for Tranche-II maximum scoring; establishes upstream independence from China-sourced wafers

2

Cell Manufacturing

TOPCon or HJT cell technology; minimum 19.5% efficiency threshold; core PLI qualification requirement

3

Module Assembly

Full lamination, framing, junction box; IEC-compliant process; BIS certification required for domestic sale

Wafer-to-module integration scores 35/50 on the PLI integration criterion — sufficient for competitive bidding without requiring polysilicon capacity in Phase 1.

Technology Benchmarks: TOPCon vs. HJT

TOPCon

- Tunnel Oxide Passivated Contact technology
- Module efficiency: typically 22–23%+
- Compatible with existing c-Si production equipment base
- Lower capex step-up from PERC lines
- Currently dominant in new greenfield investment
- Meets PLI efficiency threshold with margin

HJT (Heterojunction)

- Amorphous silicon passivation on crystalline wafer
- Module efficiency: typically 23–24%+
- Lower temperature processing — energy cost advantage
- Higher equipment capex than TOPCon
- Bifacial performance advantage for utility-scale projects
- Tighter lamination temperature tolerances required

Both technologies exceed the PLI minimum module efficiency requirement of 19.5%. Technology selection impacts total capex, equipment sourcing, and ramp timeline.

Factory Planning Framework

1 Phase 0 — Feasibility & Site

Land acquisition in AP industrial zone; grid connection assessment; captive solar plant planning; regulatory pre-clearances

2 Phase 1 — Module Line (0–12 months)

Commission module assembly first; establish PLI commissioning date; begin BIS certification process; initial revenue generation

3 Phase 2 — Cell Line (12–24 months)

TOPCon or HJT cell line installation; process qualification; yield ramp; activate higher PLI integration scoring tier

4 Phase 3 — Wafer Line (24–36 months)

Wafer slicing and wiring; full upstream integration; maximum PLI scoring position; domestic supply chain independence

Investment & Compliance Requirements

Capital Deployment

- Greenfield wafer-to-module, 1 GW scale: $150M–$250M USD estimated range
- Technology (TOPCon/HJT) and automation level are primary capex drivers
- AP capital subsidy (up to 25% FCI) reduces net investment requirement
- Captive solar power plant (~100–300 acres) recommended for cost competitiveness

Regulatory Compliance

- BIS certification: mandatory for all modules sold in India
- Laboratory testing, factory inspection, and periodic audits required
- IEC compliance for lamination process (module certification prerequisite)
- Performance Bank Guarantee lodged with SECI at Letter of Award stage

Timeline Discipline

- 5-year PLI incentive window runs from planned commissioning date
- Delays shorten the eligible incentive collection period directly
- Only 19% of Tranche-II's 39,600 MW was operational by Oct 2024 — sector-wide execution risk
- AP policy: 6-month maximum delay grace period; beyond that, incentive eligibility lapses

Risks & Execution Challenges

Supply Chain Risks

- India still imports most wafers and polysilicon — price volatility exposure
- China's share of cell imports: 90%+ in FY2022–23 → 56% in FY2024–25 (improving)
- Upstream equipment sourcing predominantly China-dependent
- Domestic ancillary industry (glass, EVA, frames) still maturing

Operational & Policy Risks

- PLI disbursement delays: only 20.63% of total outlay drawn by Dec 2023
- Minimum 1,000 MW capacity threshold excludes smaller entrants
- Technology ramp (TOPCon/HJT) requires skilled workforce — limited local pool
- Rework near-impossible post-lamination — quality must be locked upstream

⚠ Execution risk is the primary differentiator between PLI-eligible projects and those that fail to claim incentives. Multi-stage ramp with experienced turnkey support reduces this exposure.

Long-Term Strategic Positioning

Domestic Market Access

- India's module capacity: 74 GW (Mar 2025); still well below 500 GW 2030 target demand
- DCR (Domestic Content Requirement) schemes create captive offtake for local manufacturers
- Vertically integrated producers benefit most from "Make in India" procurement preference

Export Opportunity

- India solar exports: grew 23-fold FY2022–23 to FY2024–25; reached ~$2B USD
- US accounts for 97%+ of exports — trade route diversification needed
- EU (Germany, Netherlands, Spain), UAE, and Africa: emerging demand centres
- India-manufactured modules benefit from non-China origin for tariff-sensitive markets

Competitive Positioning

- AP cluster (Naidupeta belt) offers supplier ecosystem: Premier Energies, Tata Power, Websol, ReNew
- GST on solar equipment reducing from 12% → 5% (effective Sep 2025) — lowers project capex ~5%
- Proven turnkey manufacturing concept reduces learning curve for new market entrants

About the Content Partner

J. v. G. technology GmbH — The DESERT Company

Founded in 1997 in Bavaria, Germany. Family-owned engineering company specializing in turnkey solar module production lines.

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Key areas:

Turnkey PV manufacturing lines | DESERT Technology® | TÜV-certified module designs | Factory planning to production

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Source:
https://www.pvknowhow.com/countries/india/solar-manufacturing-project-structure-andhra-pradesh-2/

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