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**A PROJECT REPORT  
ON**

**Strategic Market Entry for a New Energy Product**

**FOR**

**Linkwell Telesystems Pvt. Ltd.**

**UNDER THE GUIDANCE OF**

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Team Lead – R&D(SMD)**

**TOWARDS PARTIAL FULFILLMENT OF  
THE REQUIREMENT FOR THE AWARD OF  
MASTER OF BUSINESS ADMINISTRATION IN TELECOM MANAGEMENT**

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## ABSTRACT

This internship report explores the strategic market entry of Linkwell Telesystems into the renewable energy sector, specifically through the launch of on-grid string solar inverters for the residential segment. As a company rooted in electronic metering and embedded systems, Linkwell aims to diversify into solar energy by capitalizing on its existing manufacturing infrastructure and product engineering capabilities. The study evaluates India's solar market potential through Total Addressable Market (TAM) estimation, YoY growth analysis, sector-specific economics, and customer preferences. Using insights from field market surveys and dealer interactions, the report identifies residential solar as the most promising segment for initial rollout due to high consumer adoption, government incentives, and the growing trend of rooftop installations. Competitive benchmarking, technology analysis, and warranty modelling validate the choice of string inverters over central or micro-inverters. Additionally, the report presents an extended warranty cost model, optimal distribution strategies for residential reach, and bundling opportunities with energy meters. A factory visit affirms Linkwell's readiness for inverter manufacturing, requiring minimal retooling. This report concludes with a phased go-to-market plan designed to position Linkwell effectively within India's rapidly growing residential solar energy landscape.

## EXECUTIVE SUMMARY

Linkwell Telesystems, a trusted name in India's innovative metering industry, is poised to strategically enter the renewable energy sector by launching a new line of on-grid string solar inverters targeted at the residential rooftop segment. This report was compiled through intensive market research, competitive benchmarking, field surveys, and operational assessment, laying a roadmap for this transition.

India's residential solar market has seen consistent growth, driven by policy support, net metering reforms, falling solar panel prices, and increased consumer awareness. Among the residential, commercial, and industrial sectors, the residential segment stands out as the most scalable entry point, offering high installation volumes across rooftops, lower technical complexity, and strong alignment with government targets for distributed generation.

Through a technical and market comparison, string inverters were selected as the most suitable technology for residential solar applications due to their balance of cost-efficiency, scalability, and ease of installation. Field-level market surveys with dealers and Engineering, Procurement, and Construction (EPC) contractors revealed a clear preference for brands offering extended warranties, quick service turnaround, and bundled kits (e.g., inverter, meter and monitoring). These insights informed the development of an extended 10-year warranty strategy that remains economically viable while enhancing customer trust.

Linkwell's internal manufacturing strengths were verified during a factory visit. The company's SMT (Surface Mount Technology) lines report over 98% yield, and its

NABL-certified (National Accreditation Board for Testing and Calibration Laboratories) testing facilities can support solar inverter quality requirements with only minor upgrades. The company is thus well-positioned to enter production with minimal capital expense.

The report also details a hybrid distribution strategy, recommending the appointment of non-exclusive dealers in high-potential residential zones, supported by targeted awareness and training campaigns. Additionally, bundling energy meters with inverters is proposed to increase average order value and deliver a differentiated customer experience.

In conclusion, this report presents a comprehensive strategy for Linkwell Telesystems to enter India's booming residential solar inverter market, guided by data-driven insights, field validation, and the company's inherent manufacturing capabilities.

## **COMPANY PROFILE**

### **OVERVIEW**

Linkwell Telesystems, under the brand name VISIONTEK, is a leading provider of innovative products and solutions catering to diverse industries, including E-Governance, Banking, Finance, Energy, Telecom, Utilities, Logistics, and Retail. With over 35 years of industry experience, the company has established a strong foundation of trust, technological excellence, and customer-centric innovation. Linkwell designs and develops high-quality, cost-effective telecom and software solutions that drive digital transformation. VISIONTEK has a global presence, with its products and services deployed in over 50 countries, ensuring seamless connectivity and operational efficiency for its clients. The company follows industry-leading project and program management practices, delivering superior, tailored solutions that meet dynamic customer needs. [1]

### **HISTORY**

Since its inception, Linkwell Telesystems has established itself as a pioneer in the telecom and embedded technology space. Over the years, the company has expanded its portfolio to include manufacturing, research and development, and end-to-end project execution, serving major industries such as BFSI, Telecom, Power Distribution, Retail, and Automation. With a one-star export manufacturer status, VISIONTEK has successfully deployed over one million units in India alone, signifying its strong foothold in domestic and international markets.

The company's growth is driven by its commitment to technological advancements and industry innovations. It has continuously invested in cutting-edge manufacturing facilities, R&D infrastructure, and a skilled workforce to maintain a competitive edge.

With ISO 9001:2015 and 14001:2015 certifications, Linkwell Telesystems ensures its operations' highest quality, sustainability, and efficiency standards. [2]

## **INTRODUCTION**

Linkwell Telesystems is renowned for its product design, development, manufacturing, and customer support expertise. The company offers customized solutions for telecommunications, embedded systems, inventory management, fleet management, financial services, and more. Its dedicated R&D team, recognized by the Department of Scientific and Industrial Research (DSIR), plays a crucial role in innovation, ensuring its solutions remain future-proof and aligned with industry trends.

VISIONTEK's state-of-the-art manufacturing facility spans 100,000 sq. ft. and has automated SMT lines, CNC (computer numerical control) turret punch presses, NC (Numerical Control) bending machines, EMI/EMC (Electromagnetic Compatibility) testing labs, and reliability testing setups. The company boasts a production capacity of one million units per year, supported by a robust distribution network and an experienced workforce of over 500 skilled professionals.

With a commitment to quality and excellence, Linkwell Telesystems continues to expand its global footprint, leveraging advanced technologies like AI, IoT, and M2M communication to drive digital transformation across multiple sectors. Its forward-thinking management and PAN-India service network ensure that customers receive comprehensive support and tailored solutions that align with their operational goals. [1] [2]

## **PRODUCT TECHNOLOGY PROFILE**

Linkwell Telesystems Pvt Ltd offers a diverse range of advanced technology solutions under its VISIONTEK brand, catering to industries such as financial inclusion, energy distribution, industrial automation, and renewable energy. One of its key products, the VISIONTEK GL-11, is a Point-of-Sale (POS) terminal with an in-built fingerprint scanner designed for microfinance and e-governance applications. It features an ARM Cortex A9 @ 1GHz processor, a 3.5-inch TFT colour LCD touchscreen, and a QWERTY keypad. The terminal is tailored for Aadhaar-based transactions and supports applications like NREGA, Micro ATM, NPCI, UID, and PDS. Additional optional features include a magnetic swipe card reader, intelligent card reader, contactless card reader, and a fingerprint scanner. It runs on Linux or Android and offers connectivity options such as GSM/GPRS (2G/3G), Bluetooth, Wi-Fi, and Ethernet, making it a robust solution for secure transactions in banking, financial inclusion, public distribution system (PDS) automation, healthcare, and security access control. [3]

Another critical area of Linkwell's innovation is Automated Meter Reading (AMR), which involves the automatic collection, analysis, alerting, and graphical

representation of energy meter data. The AMR solutions, deployed under the VISIONTEK brand, provide end-to-end Meter Data Acquisition and Management (MDAM) solutions for power utilities and automation industries. Linkwell's AMR technology ensures accurate energy accounting, reduces transmission and distribution (AT&C) losses, and eliminates manual intervention in energy billing. The system supports DLMS and non-DLMS meters, offering push-mode data transfer using GPRS/CDMA technology. Key features include real-time monitoring, energy consumption analysis, over-the-air (OTA) firmware updates, and large-scale deployment capabilities (50,000+ remote locations). The solution caters to acquiring consumer and network meter data, enabling efficient energy audits and utility revenue protection. [4]

In the field of biometric authentication, the IriShield™ MK 2120U provides secure and accurate iris recognition for Aadhaar-based authentication in applications such as public distribution systems (PDS), MGNREGS, pension schemes, Ayushman Bharat Yojana, and biometric attendance systems. It features a high-precision iris matching algorithm, ensuring superior security while preventing false positives. The device supports encryption and digital signatures with a 2048-bit RSA key and is compatible with Android, Windows, Linux, and iOS platforms. Compliance with STQC and RD 2.0 standards makes it a reliable choice for biometric verification in government and financial applications. [5]

The VISIONTEK 82GM GSM modem offers seamless integration with industrial systems through RS-232 connectivity and AT command programmability for industrial and remote data transmission. It supports SCADA, industrial automation, and remote data logging applications with features like circuit-switched data, SMS, and GPRS (Class 10). The modem is designed for reliability in harsh environments, with optional TCP/IP stack support for high-end applications. Its robust metal casing, DIN rail mounting options, and flexible DC power requirements (6-30V) make it ideal for industrial automation and real-time remote monitoring. [6]

Additionally, Linkwell offers innovative energy metering solutions like the VISIONTEK APT-102 single-phase electronic energy meter. This device is designed for residential and commercial energy consumers, providing reliable metering with remote communication capabilities. It adheres to national and international metering standards and integrates advanced anomaly detection for revenue protection. The meter's intelligent communication options allow utilities to monitor and manage energy consumption efficiently, making it a preferred choice for distribution companies. [7]

Expanding into renewable energy, Linkwell has recently ventured into the string solar inverter market and is actively developing micro inverters. This strategic move aims to support the growing demand for solar energy solutions by enhancing energy conversion efficiency and enabling decentralized solar power generation. String solar inverters are widely used in residential and commercial solar installations, ensuring optimal power conversion and grid integration. Meanwhile, microinverters offer

individual panel-level optimization, improving overall system reliability and energy harvest. Linkwell is poised to deliver intelligent, efficient, and scalable solar power solutions by leveraging its embedded systems and IoT expertise.

Overall, Linkwell Telesystems Pvt Ltd continues to innovate across financial transactions, energy management, industrial automation, and renewable energy. With a strong focus on connectivity, security, and sustainability, its VISIONTEK product portfolio is designed to enhance operational efficiency and drive technological advancements across various sectors.

## **PROJECT DETAILS**

### **OBJECTIVE OF THE PROJECT**

The primary objective of this project is to develop a comprehensive strategic market entry plan for Linkwell Telesystems as it ventures into the renewable energy sector with the launch of on-grid string solar inverters, explicitly targeting the residential rooftop segment. To achieve this, the project focuses on analysing the Indian solar energy market by estimating the Total Addressable Market (TAM), studying year-on-year growth trends, and assessing the economics of solar energy generation in residential applications. It further evaluates different inverter technologies to establish the technical and commercial viability of string inverters for Linkwell's product roadmap. The study incorporates competitive benchmarking and customer expectation analysis based on insights gathered from market surveys conducted with dealers and EPC contractors. Additionally, the project aims to design a financially sustainable extended warranty model that aligns with industry standards and strengthens product credibility in the eyes of residential consumers. A key component also involves recommending a scalable and cost-efficient distribution strategy suited to the unique dynamics of the residential solar market. Finally, the project assesses Linkwell's current manufacturing infrastructure to determine its readiness for solar inverter production and outlines integration strategies to enable a smooth transition into this new product category.

### **PURPOSE OF THE PROJECT**

This project aims to guide Linkwell Telesystems' strategic transition into renewable energy by leveraging its legacy in electronics manufacturing and metering. Through structured market research and stakeholder engagement, the project seeks to provide actionable insights that reduce entry risk, ensure product-market fit, and build a foundation for long-term success in the solar sector. The broader goal is to support the company in contributing to India's distributed clean energy mission while establishing a competitive position in the fast-growing residential solar inverter market.



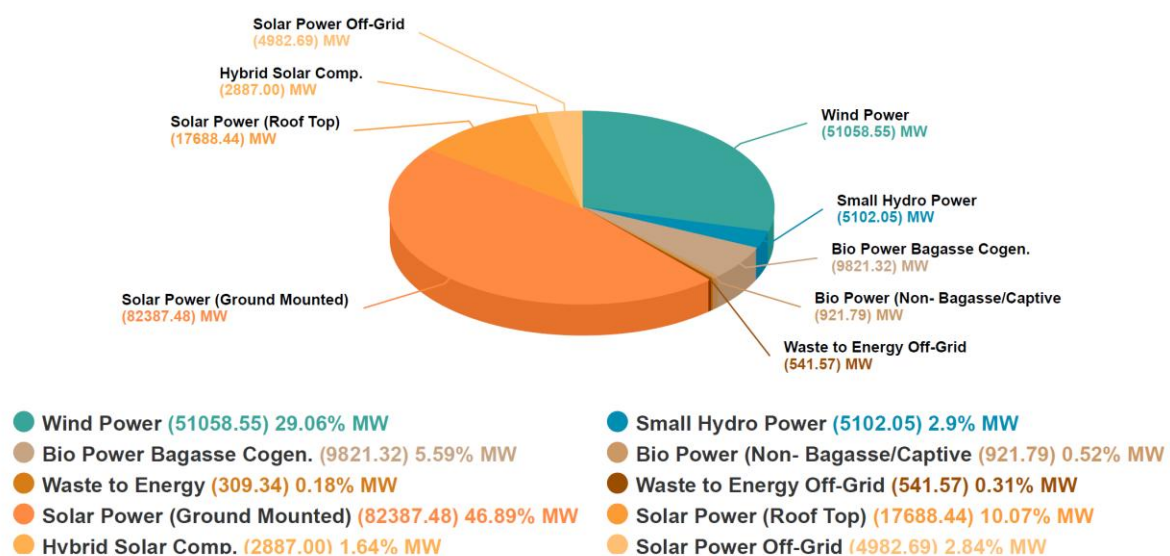
## RATIONALE FOR CHOOSING SOLAR ENERGY

Unlike hydropower, which demands extensive civil engineering work and wind energy, which hinges on large-scale mechanical fabrication and turbine maintenance, solar power is inherently an electronics-driven domain. Solar inverters, power optimizers, and monitoring systems rely heavily on precision PCB (Printed Circuit Board) assembly, embedded control algorithms, and telemetry capabilities that sit squarely within Linkwell's core competencies in electronic metering and embedded systems. By leveraging its mature SMT production lines, NABL-certified testing facilities, and firmware expertise, Linkwell can seamlessly transition into solar inverter manufacturing with minimal capital outlay. This natural alignment allows the company to capitalize on India's booming solar market while avoiding the steep learning curves and infrastructure investments demanded by hydro or wind technologies.

## INDIAN SOLAR ENERGY MARKET DYNAMICS

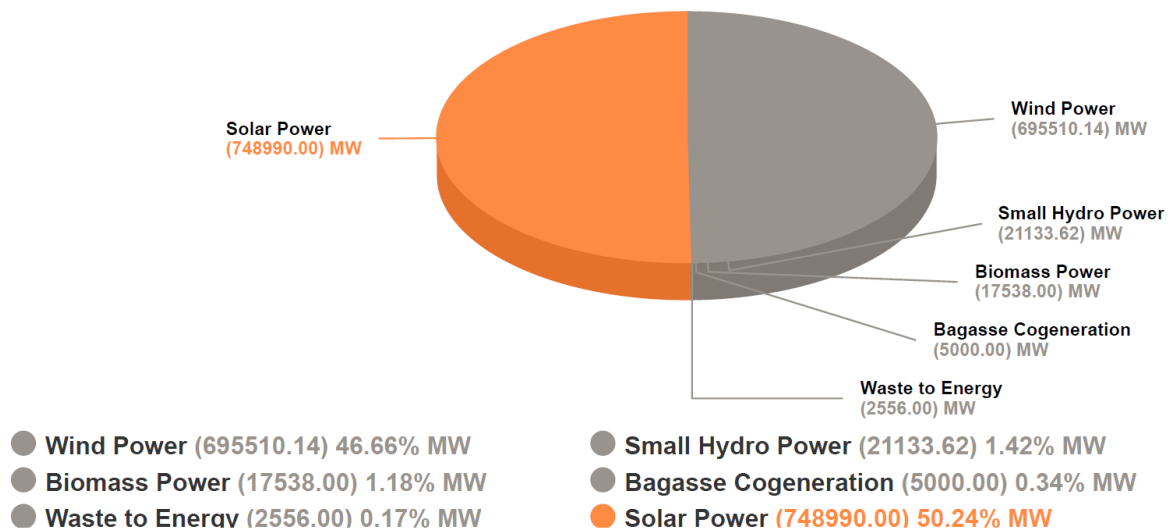
### Renewable Energy Cumulative Capacity

All India Status



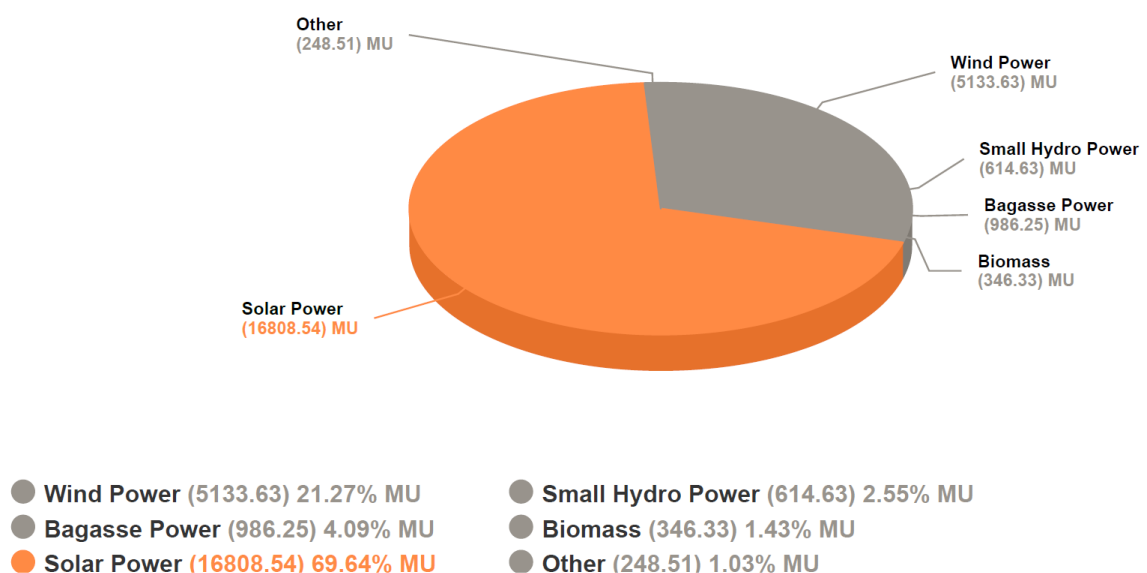
The pie chart illustrates India's renewable energy mix as of April 2025, highlighting that solar accounts for the largest share of 61.44%, followed by wind power at around 29%. Bio-power (bagasse co-generation and non-bagasse) and small hydro comprise 5–6% and 3%, respectively. Together, these figures demonstrate solar's dominant and expanding role, both utility-scale and rooftop, in India's clean energy landscape. [8]

## Market Potential of Solar Power



As per national renewable energy estimates, solar power holds the highest potential, accounting for 50.24% of India's total renewable energy potential, outpacing wind (46.66%) and all other sources by a wide margin. This dominance underscores why solar energy, especially in scalable formats like rooftop and ground-mounted systems, is central to India's clean energy future and a strategic fit for new entrants like Linkwell. [9]

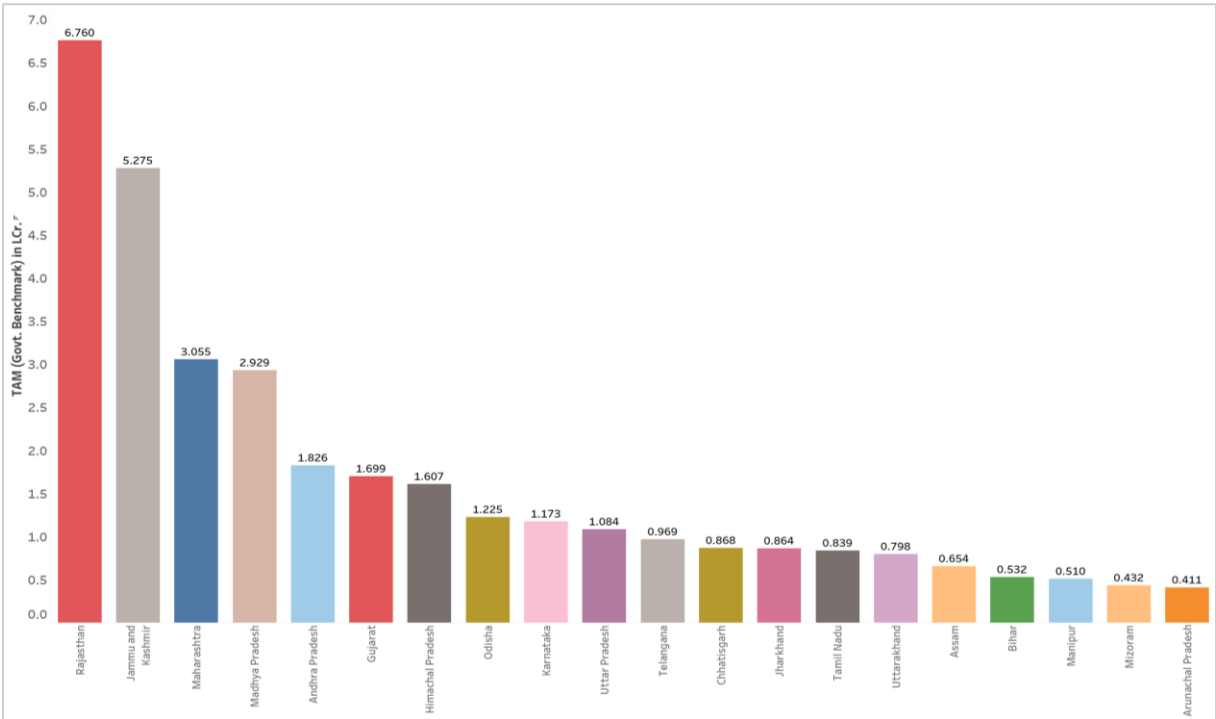
## Energy Generation of Solar Power



Solar power leads India's renewable energy generation with 16,808.54 MU (Million Units), contributing a 69.64% share. In comparison, wind energy follows with 21.27%, while other sources like bagasse, small hydro, and biomass contribute marginally. This

overwhelming share reflects the maturity, reliability, and scale at which solar is deployed nationwide. [9]

State Wise Total Addressable Market (TAM)

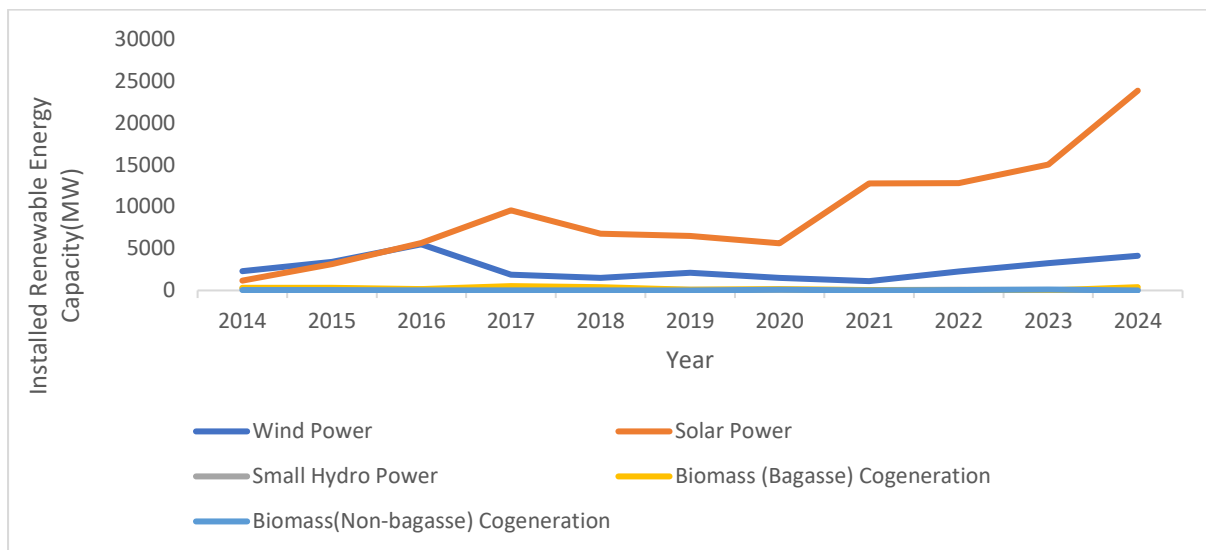


The Total Addressable Market (TAM) data highlights Rajasthan as the most significant opportunity for solar adoption, with a benchmark value of ₹6.76 lakh crore, followed by Jammu & Kashmir and Maharashtra. These high-TAM states indicate strong solar deployment potential, driven by vast rooftop availability, high solar irradiance, and supportive policy environments. States like Madhya Pradesh, Andhra Pradesh, and Gujarat also represent sizable markets, making them key targets for early expansion. The TAM was calculated using the standard formula:

$TAM = ARPU \times \text{Total Potential Customers},$

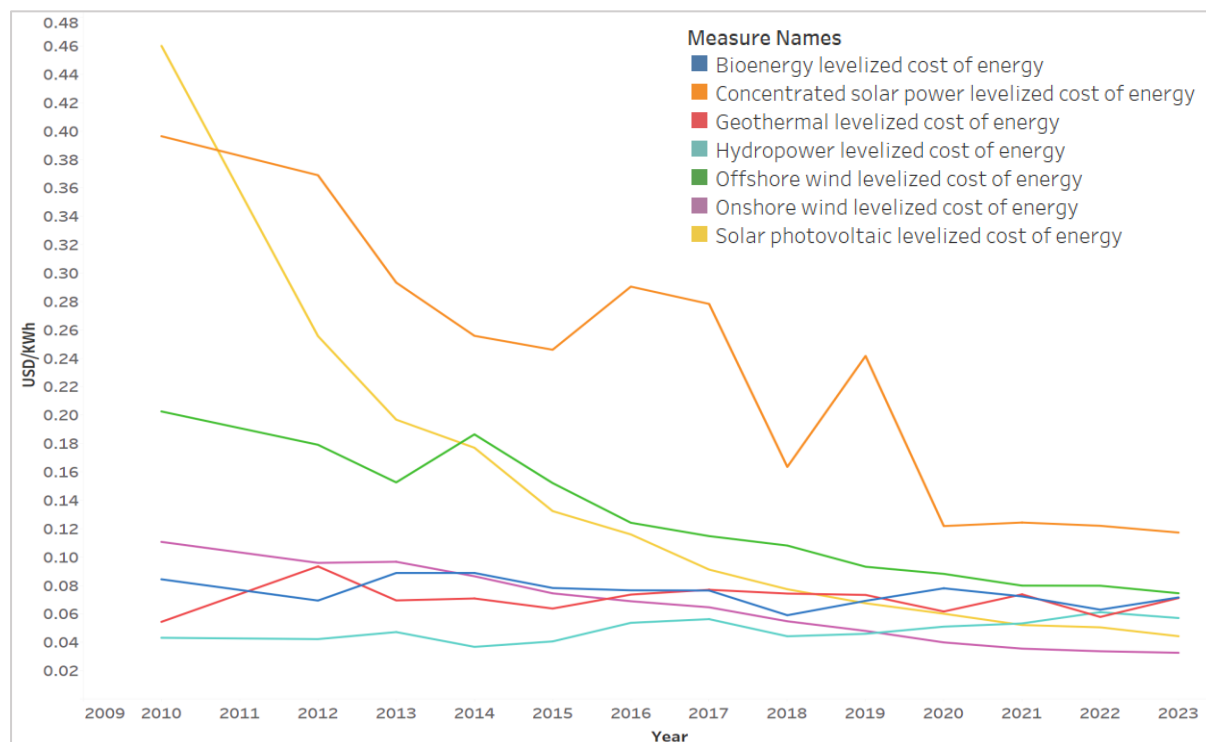
where ARPU refers to the average revenue per user (or installation), and the customer base includes all households or entities with viable rooftop space. This distribution provides a data-backed foundation for Linkwell Telesystems to prioritize high-impact geographies in its solar inverter market entry strategy. [9] [\[TAM Excel\]](#)

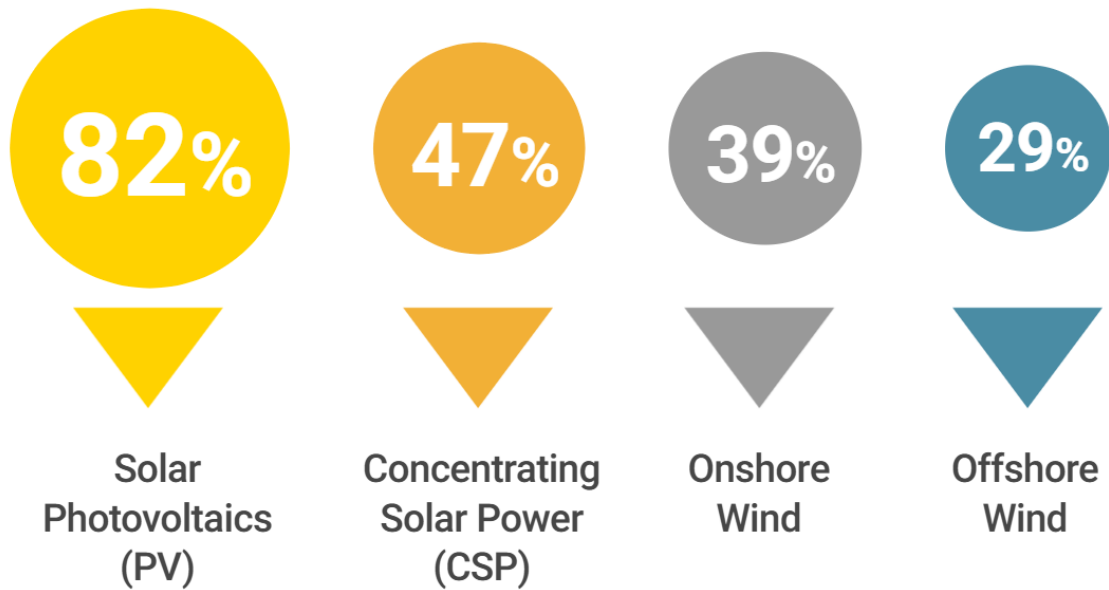
## Year-on-Year Growth of Renewable Energy Installations



The chart highlights the year-on-year growth in India's renewable energy installations, with solar energy rising exponentially, especially post-2017. This sharp acceleration is primarily driven by government initiatives such as the PM Surya Ghar: Muft Bijli Yojana, which aims to support one crore households with free electricity through rooftop solar. Supportive policies like net metering, capital subsidies, and the Production Linked Incentive (PLI) scheme have significantly increased residential solar adoption, making it the fastest-growing renewable energy segment in the country. [10]

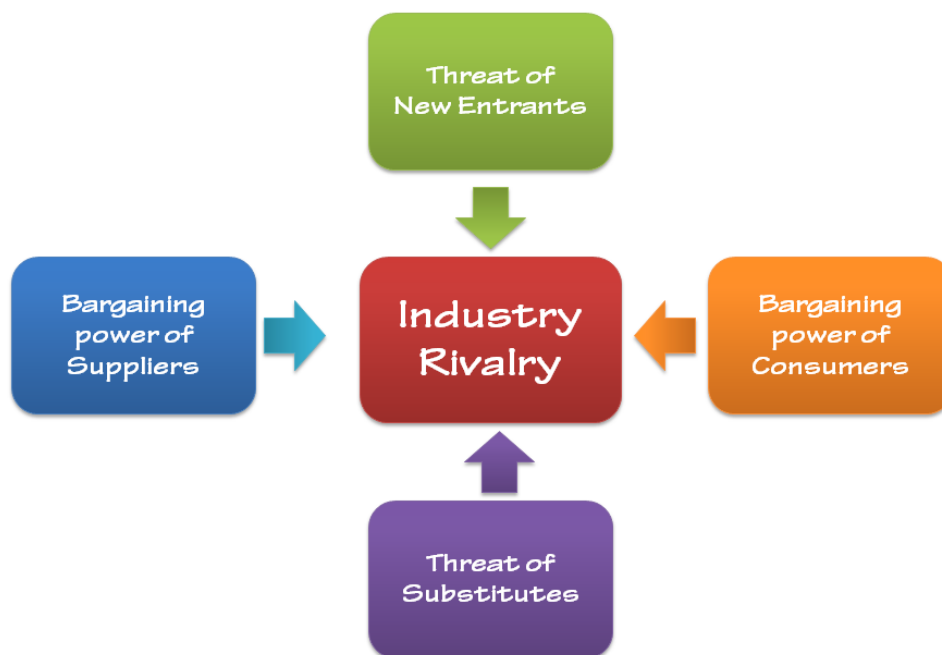
## Levelized Cost of Renewable Energy Generation





The chart illustrates a significant decline in the levelized cost of energy (LCOE) across all major renewable technologies from 2009 to 2024. Solar photovoltaic (PV) has experienced the steepest reduction from over \$0.45/kWh in 2009 to well below \$0.05/kWh in 2024, making it the most cost-effective clean energy source today. In contrast, concentrated solar power (CSP) and bioenergy remain relatively high in cost, while onshore wind and hydropower maintain moderate and stable cost trajectories. This dramatic cost drop for solar PV reinforces its economic viability and justifies its central role in India's renewable energy expansion. [11] [12]

### Porter's Five Forces Analysis



To assess the competitive dynamics of the Indian residential solar sector, Porter's Five Forces model provides a structured view of the industry's attractiveness and the challenges a new entrant like Linkwell Telesystems may face.

**1. Competitive Rivalry – High**

The residential solar market in India is marked by intense competition, with several well-established players such as Tata Power Solar, Waaree, Luminous, Loom Solar, and Havells, as well as numerous regional brands. Since solar panels and inverters are largely commoditized with minimal product differentiation, the primary battleground becomes price and after-sales service. Consumers are highly price-sensitive and often select vendors based on financial offers, warranties, and installation time. This results in significant price wars and service-level competition, making rivalry within the industry extremely high. [13]

**2. Threat of New Entrants – Medium to High**

The barriers to entry in the residential solar segment are relatively low, especially for small-scale EPC (Engineering, Procurement, and Construction) service providers and local dealers. Government subsidies and MNRE (Ministry of New and Renewable Energy)-backed schemes have further eased market entry. However, building a trusted brand with reliable warranty support, certified products, and a pan-India service network is capital and credibility-intensive. As a result, while local entry is easy, scaling sustainably, particularly in manufacturing and long-term support, poses higher challenges. [14] [15]

**3. Bargaining Power of Buyers – High**

Buyers in the residential solar space wield substantial power due to the abundance of options available. Customers are well-informed and cost-conscious, with access to multiple brands, system types (on-grid, hybrid, off-grid), and real-time price comparisons via online platforms. Government awareness campaigns have further empowered consumers to demand favourable financing, transparent pricing, and quick installation. Hence, buyer expectations are high, and their influence over pricing and service terms is strong. [16]

**4. Bargaining Power of Suppliers – Low to Medium**

Although India currently imports a significant portion of its solar modules and inverters primarily from China, domestic manufacturing is on the rise, supported by the Production Linked Incentive (PLI) scheme and import duties on foreign components. The increasing availability of local suppliers gives EPC companies and installers greater flexibility and choice. As a result, supplier power is moderate and generally limited to high-end, Tier-1 imports or specialized components. [17]

## **5. Threat of Substitutes – Low**

There are few viable substitutes for residential solar energy. Traditional grid electricity is becoming less attractive due to rising tariffs, and alternatives like diesel generators are costly and polluting and primarily used for backup in commercial settings. Battery-inverter systems offer storage, but not generation, and hybrid or wind setups are impractical for most households. Given these constraints, solar remains the most feasible and cost-effective self-generation option for residential users. [13] [14]

## **RATIONALE FOR TARGETING THE RESIDENTIAL SOLAR SEGMENT**

Linkwell Telesystems' decision to target the residential rooftop solar segment over industrial or commercial sectors is a strategically aligned move grounded in policy trends, operational advantages, and market potential. A key driver is the government-backed PM Surya Ghar: Muft Bijli Yojana, which aims to install rooftop solar systems for one crore households, offering subsidies and free electricity for up to 300 monthly units. Such large-scale, policy-driven initiatives create a surge in residential demand that is not mirrored in the commercial or industrial space. [18] [19]

From an operational standpoint, residential installations typically range from 1–25 kW, making them more straightforward to deploy and manage. Unlike commercial or industrial projects, which often involve site-specific engineering, permissions, and custom inverter configurations, residential use cases are more standardized, allowing Linkwell to scale production efficiently with limited inverter variants. This aligns well with the company's high-volume SMT manufacturing and embedded electronics strengths. [20]

Furthermore, the residential market offers an ideal platform to build direct brand visibility through localized dealer networks. While industrial and commercial projects are typically acquired through EPCs or large tenders, offering less room for brand engagement and residential solar adoption depends significantly on trust, service support, and product differentiation at the dealer level. Linkwell's field surveys confirmed that dealers and rooftop installers actively seek brands with responsive warranty support, bundled kits, and a strong value proposition, all of which Linkwell is well-positioned to offer. [21]

The scalability of this segment is further enhanced by increasing urbanization in Tier 2 and Tier 3 cities, where rooftops remain largely untapped. Residential consumers are also more likely to make upfront payments or opt for solar financial assistance with minimal risk of default, unlike commercial buyers who often negotiate on credit terms and post-sale conditions. [22] [23]

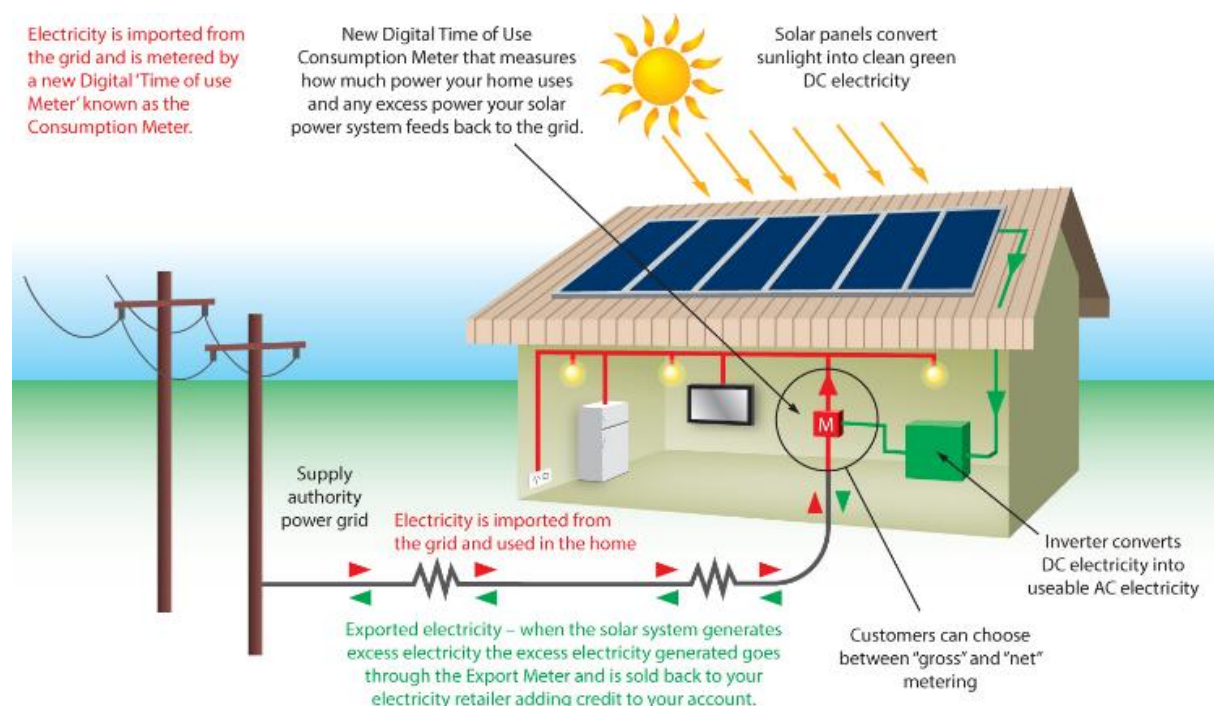
So, targeting the residential solar segment allows Linkwell to build scale with lower technical complexity, ride the wave of government incentives, enhance brand visibility through B2C dealer channels, and align its inverter offerings with predictable and

standardized market needs, making it the most viable entry point for the company's foray into renewable energy.

## CHOOSING ON-GRID STRING SOLAR INVERTERS

### Introduction to Solar Inverters

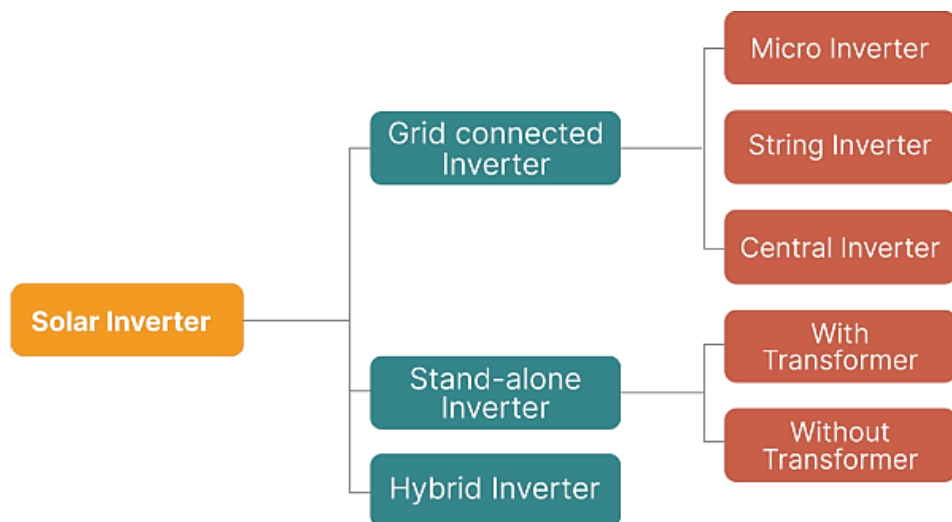
A solar inverter is the core component of any photovoltaic (PV) system, responsible for converting the direct current (DC) generated by solar panels into alternating current (AC) usable by household appliances or for feeding into the grid. Inverters also handle safety shutdowns, grid synchronization, voltage regulation, and maximum power point tracking (MPPT), making them crucial for performance and protection. As Linkwell Telesystems enters the renewable energy domain, selecting the right inverter technology is pivotal to ensuring product-market fit and operational efficiency. [24] [25]



### Types of Solar Inverters and Their Use Cases

On-Grid Solar inverters are broadly classified into central, string, and microinverters. Central inverters are used in large utility-scale solar plants; they consolidate the output of multiple arrays and require large-scale infrastructure. Microinverters, on the other end of the spectrum, are attached to individual panels and offer panel-level optimization, mainly suited for high-shade environments. String inverters, however, strike the optimal balance between cost, scalability, and performance, making them ideal for small-to-mid-size applications such as residential and small commercial rooftops. [25]





### Comparison of Central, String, and Microinverters

Feature	Central Inverter	String Inverter	Microinverter
<b>Cost per Watt</b>	Low (e.g., ~Rs. 3.5/W)	Moderate (e.g., ~Rs.4–15/W)	High (e.g., ~Rs.25/W)
<b>Use Case</b>	Utility-scale projects with uniform panel layouts	Residential and small commercial systems with minimal shading	Residential systems with complex roofs or shading issues
<b>Scalability</b>	High, but less flexible for small-scale installations	Moderate, suitable for small to large installations	High, easily expandable by adding more units
<b>Failure Risk</b>	High, single point of failure can affect entire system	Moderate, failure affects only the specific string	Low, failure affects only the individual panel
<b>Installation Complexity</b>	High, requires specialized equipment and space	Moderate, standard installation procedures	High, requires installation on each panel, increasing labour and time

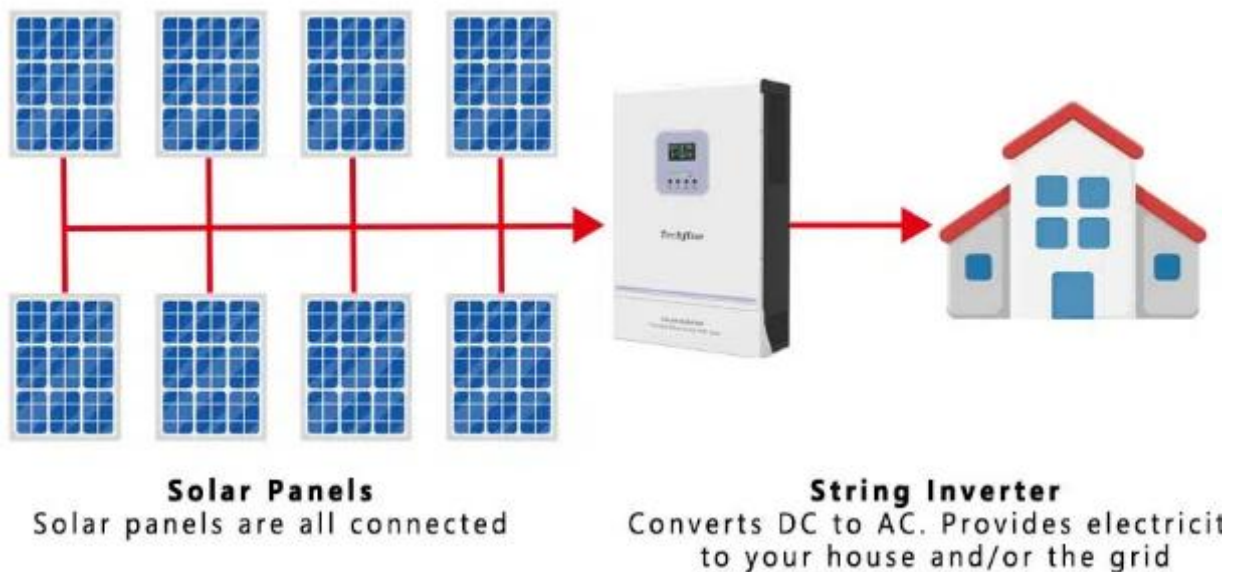
Costs can vary based on system size, brand, and installation specifics. [26] [27]

## Selection of Inverter Architecture

String inverters align seamlessly with Linkwell's target market, focusing on residential rooftop installations ranging from 1 kW to 25 kW. These installations benefit most from string inverter architecture due to their straightforward layout, minimal shading, and uniform module orientation conditions under which string inverters perform efficiently.

Secondly, cost-effectiveness plays a key role. According to internal cost analysis, string inverters offer a competitive cost per watt of approximately ₹3.52–₹8.27, whereas microinverters, though technically advanced, can cost upwards of ₹28.89 per watt. This cost advantage becomes critical in price-sensitive markets like India, especially for residential consumers prioritising upfront cost, payback period, and warranty.

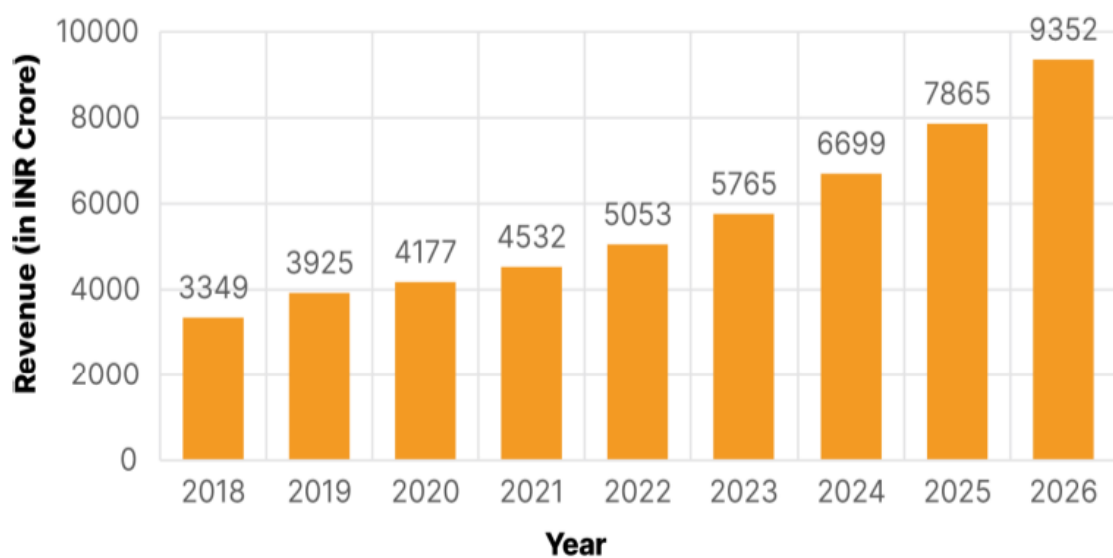
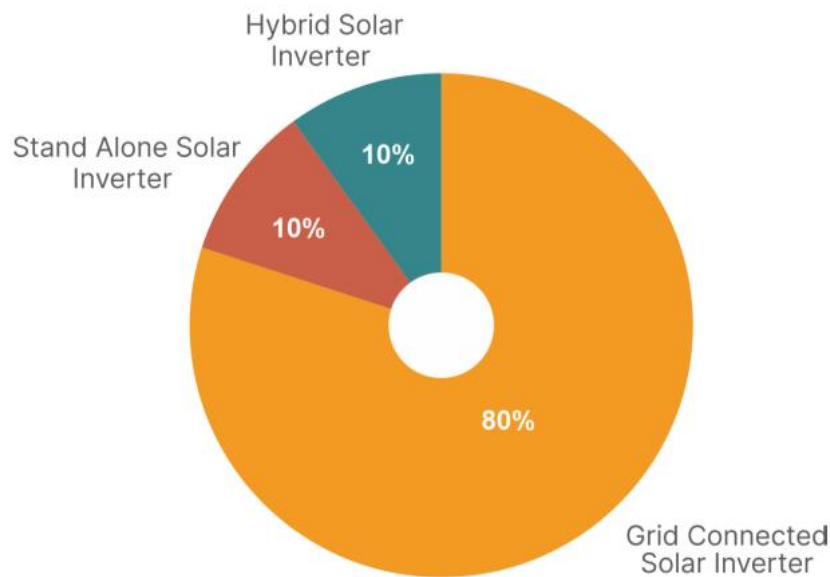
Thirdly, string inverters offer ease of installation and servicing, vital for quick scaling via a regional dealer network. Unlike central inverters that require heavy installation machinery and microinverters that require panel-level deployment and service, string inverters are moderately complex and dealer-friendly, making them ideal for Linkwell's go-to-market strategy.



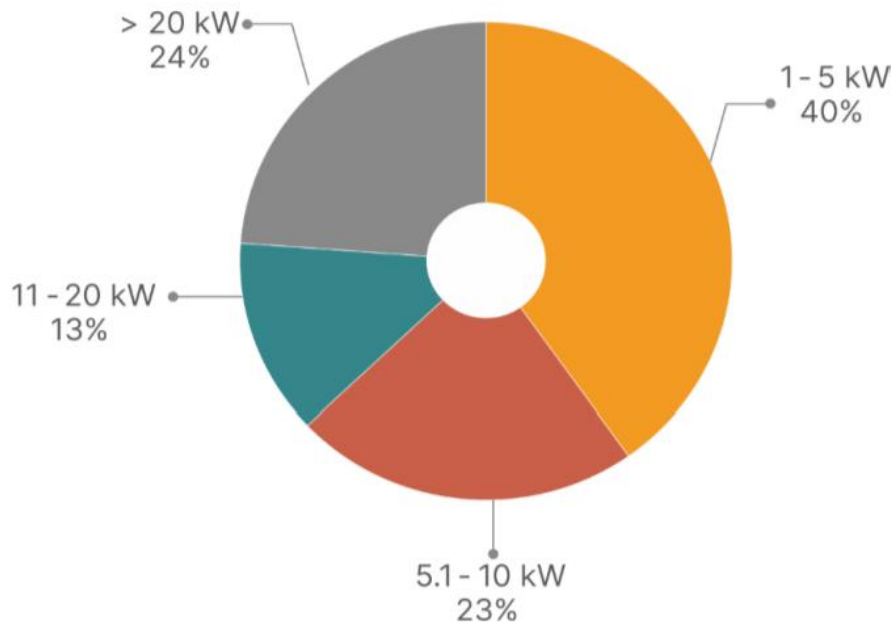
Another significant advantage is risk containment. In a central inverter setup, a single point of failure can shut down an entire system, which is unacceptable for residential use. Microinverters reduce this risk but are costly. String inverters, however, localize production loss to a single array, striking a balance between operational security and affordability. [26]

## Market Justification and Future Outlook

The Indian solar inverter market is experiencing strong momentum, with installed capacity reaching 107,945.61 MW (~108 GW) as of April 2025 and projected to expand at a 20% CAGR from 2024 to 2033. Among various inverter types, string inverters have consistently shown dominance in residential applications, especially with government schemes such as the PM Surya Ghar: Muft Bijli Yojana, which is expected to drive rooftop installations in the 1–3 kW range, precisely where string inverters are most effective. [28]



The solar inverter capacity wise market share is shown in the below donut chart. [28]



Moreover, Linkwell's internal strengths, such as high-yield SMT lines, NABL-certified testing labs, and embedded firmware capabilities, align well with the string inverter design and assembly requirements. Unlike central inverters requiring specialized transformer and heat sink manufacturing, string inverters can seamlessly integrate into Linkwell's current production workflow.

Linkwell's decision to launch on-grid string solar inverters is supported by technical feasibility and market alignment. Their cost advantage, residential segment suitability, compatibility with existing manufacturing capabilities, and scalable service model make them the ideal choice for the company's renewable energy debut. Informed by competitive benchmarking, performance analysis, and field insights, this choice positions Linkwell to effectively compete in India's growing rooftop solar market while maximizing its internal efficiencies.

## MARKET INSIGHTS FROM FIELD SURVEY

To understand the ground-level dynamics of the solar inverter market, field visits were conducted with system integrators and distributors actively engaged in residential rooftop solar installations. Several actionable insights emerged regarding product preferences, pricing trends, feature expectations, and evolving consumer behaviour.

### Brand Preferences and Pricing Dynamics

Brands like Growatt, Waaree, Polycab, Luminous, and Deye dominate the market. Among these, Growatt is the most widely sold due to its affordability, despite Luminous offering superior features at a higher price point. Distributors favour brands like Deye and Solis due to their reliability, innovative features (like Wi-Fi monitoring), and

warranty structures. Extended warranties typically cost 3–5% of the inverter's base price, and customers are showing increasing interest in opting for these.

### **Warranty and After-Sales Expectations**

A standard warranty period of 5 to 8 years is expected by most customers, with AMC (Annual Maintenance Contract) pricing ranging around ₹2,000/year. Dealers report that after-sales service is a key differentiator, with customers often basing their buying decisions on the responsiveness of the support process.

### **Technology Trends and Consumer Features**

The market is shifting toward Wi-Fi enabled inverters, allowing users and dealers to monitor system performance through mobile apps. This feature is increasingly viewed as a value-added differentiator, especially for tech-savvy residential customers.

### **Product Bundling and Kits**

Distributors increasingly sell complete kits, including the inverter, solar panels, earthing rods, ACDB/DCDB (Alternative Current Distribution Board/Direct Current Distribution Board) boxes, and cables (supplied separately based on site requirements). There is a strong preference for kit-based models, especially in the 3–6 kW range, which aligns well with residential rooftop system sizes.

### **Panel and Frame Preferences**

The inverter is often bundled with bifacial solar panels, particularly 560W units, which are becoming standard due to higher efficiency and better energy yield. In addition, Topcon (Tunnel Oxide Passivated Contact) panels are gaining popularity due to their high efficiency, lower temperature coefficient, and better low-light performance compared to conventional PERC (Passivated Emitter and Rear Cell) modules. These panels are emerging as a preferred choice for distributors looking to future-proof their offerings. Frame structure selection is typically based on weight, thickness, and roof type, with in-house warehousing being standard among established distributors.

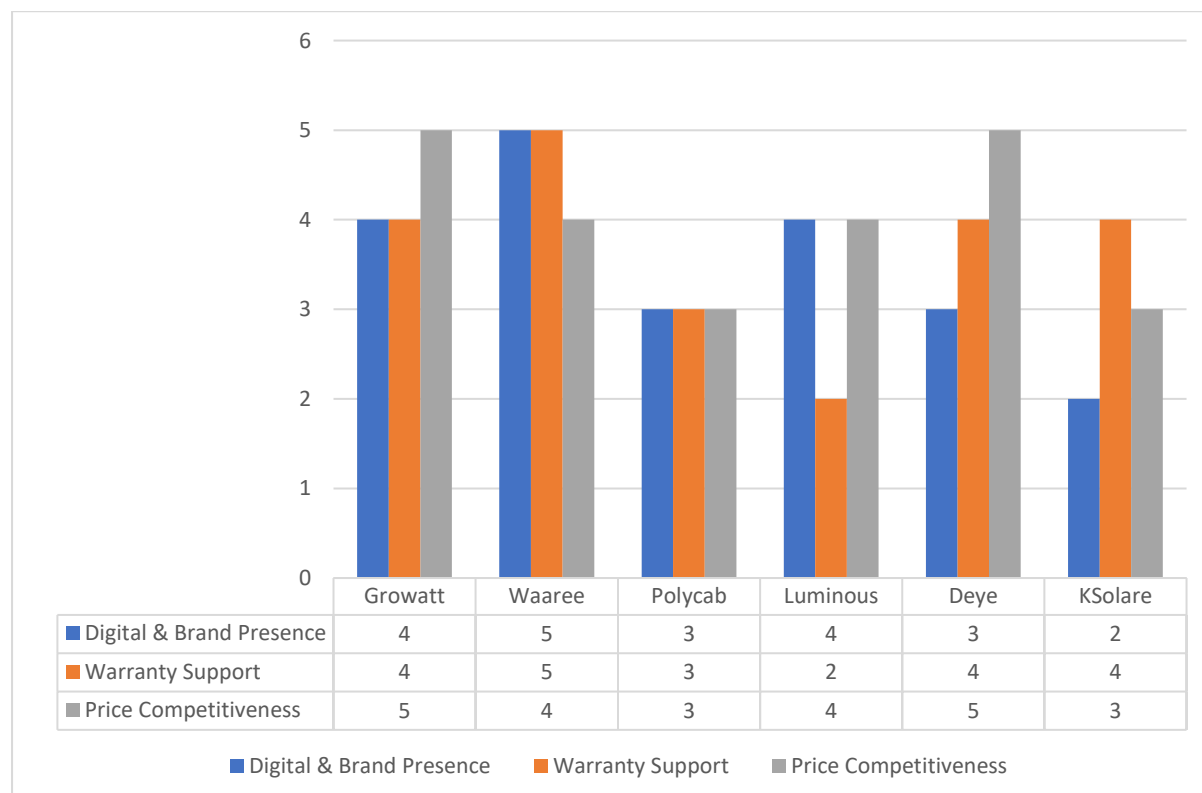
## MARKET EVALUATION AND BENCHMARKING

### Competitive Analysis

Brand	Digital & Brand Presence	Warranty Support	Price Competitiveness
<b>Growatt</b>	Strong global presence with a multilingual website, warranty portal, and active social media. Widely featured in international expos and forums. [29]	5-year standard warranty (from installation date), extendable up to 10 years. Transferable and backed by regional support. [30]	Highly competitive: ~₹4–₹14/W, ideal for budget-conscious residential buyers.
<b>Waaree</b>	Leading Indian solar brand with high domestic recall, strong dealer network, and a user-friendly digital interface for service and warranty. [31]	10-year standard warranty on inverters; up to 30-year performance warranty on panels. Online claim portal available. [32]	Balanced pricing: ~₹9/W (e.g., 3 kW inverter at ₹26,999), offering solid value for quality.
<b>Polycab</b>	Established electrical major expanding into solar; has moderate web presence and EPC network visibility. “Make in India” certified. [33]	7-year standard warranty for residential string inverters; BIS certified. [33]	Mid-segment pricing: ~₹10.4/W (e.g., 3.6 kW inverter at ₹37,490), with slight premium for local manufacturing.
<b>Luminous</b>	Well-known consumer power brand with extensive retail and e-commerce presence. Less solar-specific digital content but strong brand equity. [34]	2-year standard warranty on NXG series (850 VA–1 kVA); comparable to its offline UPS/inverter segment. [34]	Affordable pricing: ~₹9.8/W (e.g., NXG 1150 at ₹8,299), attractive to price-sensitive customers.
<b>Deye</b>	Global OEM (Original Equipment Manufacturer) with a technically rich website, dealer login access, and regular presence	5-year standard warranty, extendable to 10 years. On-site support available for	Very low cost: ₹3.3/W, enabled by large-scale centralized manufacturing.

	at international energy expos. Modest B2C visibility. [35]	higher-capacity systems. [35]	
<b>KSolare</b>	Niche Indian brand with selective digital outreach, warranty claim portal, and presence in regional expos. Lower pan-India visibility. [36]	8-year standard on “5G Pro+”; up to 25 years on “7G Infinity” premium series. Accessories have 1-year coverage. [37]	Competitive range: ₹6–10/W, positioned between value and premium inverter categories.

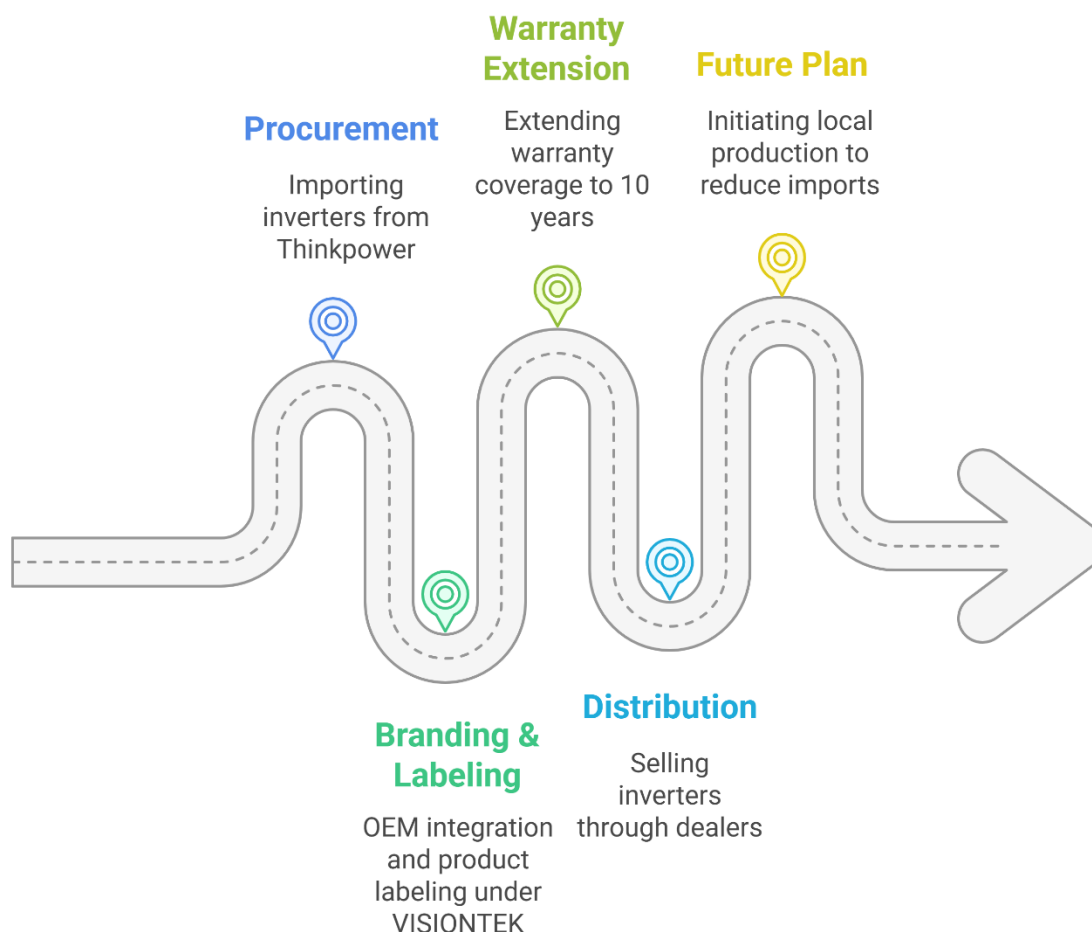
The following visualization presents a Competitor Scorecard for six prominent solar inverter brands in India: Growatt, Waaree, Polycab, Luminous, Deye, and KSolare. Each brand is evaluated on a standardized 1 to 5 scale across three critical dimensions: Digital and brand Presence, Warranty Support, and Price Competitiveness. A score of 1 indicates poor performance, while a 5 reflects industry-leading excellence. This comparative assessment provides a strategic overview of where each brand stands regarding market engagement, customer assurance, and affordability, key factors influencing Linkwell's positioning in the residential inverter segment.



## EXTENDED WARRANTY STRATEGY FOR ON-GRID STRING SOLAR INVERTERS

As part of its entry into the renewable energy sector, Linkwell Telesystems has adopted an OEM-based go-to-market approach, initially by procuring high-efficiency on-grid string solar inverters from Thinkpower (China) and relabelling them under its in-house VISIONTEK brand. To align with evolving market expectations, long-term product reliability is critical. Linkwell has devised a competitive, extended warranty model, enhancing the standard 5-year manufacturer warranty to 10 years to boost consumer confidence while keeping the offering cost-effective. The company plans to transition to a Completely Knocked Down (CKD) assembly model in the next phase, enabling localized manufacturing and integration. This move will help significantly reduce costs, improve supply chain control, and pave the way for scalable production under the Make in India initiative.

### Business Model Flow





## Extended Warranty Cost Calculation for 6kW Three-Phase Grid Inverter

The warranty of the Thinkpower TP series grid inverter is 5 years. The Landed Cost (including taxes, shipping, and freight charges) at which Linkwell Telesystems bought the 6kW 3-phase grid inverter from Thinkpower is Rs. 36,000. [38]

Base Price	₹36,000		
Repair/Replacement Cost per Failure	₹10,000		
Failure Probabilities & Repair Costs	Year	Failure Rate	Repair Cost
	6	2.0%	₹200
	7	2.5%	₹250
	8	3.0%	₹300
	9	3.5%	₹350
	10	4.0%	₹400
Total Additional Warranty Cost	₹1,500		
Contingency Margin (20% buffer)	₹1,800		
New Selling Price with 10-Year Warranty	<b>₹37,800</b>		

## Pricing Structure

Total Cost After Warranty Extension		₹37,800
Profit Margin (15%)		₹5,670
Preliminary Selling Price		₹43,470
Domestic Distribution Costs	Average Transportation Cost per Unit	₹2,000
	Warehousing & Handling	₹800
	Total Distribution Cost	₹2,800
Final Selling Price to System Integrators		<b>₹46,270</b>

This pricing ensures Linkwell Telesystems covers all costs, maintains a 15% profit margin, and accounts for logistics and distribution expenses.

## Market Benchmarking of Competing Inverters

The following table showcases the available 6kW Three-Phase String Solar Inverters in India:

Brand & Model	Price (INR)	Warranty	System Integrator
Polycab	₹64,320	5 years (extendable)	Oryx Solar Energy [39]
Loom Solar Fusion 63	₹58,500	5 years	Nirmal Power [40]
UTL	₹68,470	10 years onsite	Solar World [41]
Growatt	₹55,200	Not specified	EnerzyKart [42]

## Strategic Implication

This warranty strategy strengthens Linkwell's value proposition in a price-sensitive yet reliability-focused market. It also builds trust among installers and end customers, particularly as warranty duration and after-sales support are increasingly seen as decisive purchasing factors. By embedding this model at the entry stage, Linkwell sets a high-service benchmark that can act as a market differentiator while preparing for future in-house manufacturing scalability.

## STRATEGIC DISTRIBUTION PLAN FOR ON GRID SOLAR INVERTERS

### Objective and Approach

As Linkwell Telesystems enters the competitive renewable energy space with CKD (Completely Knocked Down)-assembled on-grid string solar inverters, a strategically phased distribution model is essential to balance market penetration, cost-efficiency, and brand control. Leveraging its existing logistics, CRM (Customer Relationship Management), and warehouse systems, Linkwell aims to scale intelligently, starting with low-cost outreach in South India and gradually building a high-control distribution network across other regions.

## Learning from Global Models

To craft its strategy, Linkwell has evaluated global distribution models:

Company	Distribution Model	Objective	Insight for Linkwell
<b>Tesla</b>	Direct to customer and selective partners	Maintain brand control while scaling regionally [43]	Begin with non-exclusive dealers in South India; add exclusive distributors in North and East India for controlled expansion
<b>Apple</b>	Exclusive stores and authorized resellers	Total control and premium customer experience [44]	Applicable for industrial solar segment (ten kilowatt and above) requiring full service and branding control
<b>Coca-Cola</b>	Non-exclusive distribution through retailers	Achieve deep market penetration and wide accessibility [45]	Suitable for Tier Two and Tier Three residential markets using a broad network of general-purpose dealers
<b>Red Bull</b>	Selective non-exclusive partnerships	Build niche brand visibility in urban markets [46]	Use brand-aligned non-exclusive dealers in metro cities such as Bengaluru and Hyderabad to create early market traction

## Distribution Strategies of Leading Solar Inverter Brands

Company	Distribution Model	Objective
<b>Growatt</b>	Tiered partner network via authorized distributors and service partners	Extend reach through regional technical partners [47]
<b>Luminous</b>	Pan-India distributor and retail channel	Penetrate both rural and urban markets [48]
<b>Waaree</b>	Exclusive franchise network and channel partners	Drive volume through wide partner base [31]
<b>Polycab</b>	Hybrid dealer–distributor network via its electrical legacy	Leverage existing electrical distribution infrastructure [49]

## **Suggested Distribution Strategy Frameworks**

### **Strategy A: Dealer-Led Hybrid Model**

**Phase 1:** Deploy non-exclusive dealers in South India leveraging existing warehousing and CRM tools. Focus on 5–10 rooftop specialists (3–5 kW) for rapid market entry with minimal investment.

**Phase 2:** Onboard exclusive distributors across North, West and Central India. Provide territory rights, onboarding kits, and pricing protection to ensure accountability and reliable after-sales service.

**Phase 3:** Combine exclusive distributors with non-exclusive metro dealers (Hyderabad, Delhi NCR, Ahmedabad, Pune). Roll out a Certified Partner Program featuring tiered incentives, co-branding, and a digital order portal.

### **Strategy B: System Integrator-First Approach**

**Phase 1:** Prioritize partnerships with the top 10 System Integrators (EPCs) in residential and SME (Small and Medium Enterprises) rooftops. Offer volume pricing, technical support, and bundled smart-meter incentives to secure flagship installations.

**Phase 2:** Expand reach by recruiting non-exclusive dealers in adjacent regions where SIs have limited presence. Equip dealers with demo kits, training modules, and lead-sharing via CRM.

**Phase 3:** Introduce exclusive distributors for broad Tier 2/3 coverage. Distributors will supply SIs (System Integrators) and dealers, ensuring depth in reach while maintaining SI relationships at the project level.

### **Strategy C: Vertical Integration into System Integration**

**Phase 1:** Register Linkwell as a licensed System Integrator, enabling direct contracting for residential rooftop projects. Build an internal installation team to deliver turnkey systems under the VISIONTEK brand.

**Phase 2:** Complement in-house SI projects by enlisting non-exclusive dealers to handle smaller installs and maintenance. Provide branded demo units and service dashboards to standardize quality.

**Phase 3:** Scale supply through exclusive distributors responsible for stock management and logistics. Distributors will support the in-house SI team and external dealers, optimizing inventory flow and after-sales support.

# **FACTORY VISIT: INSIGHTS INTO LINKWELL'S ELECTRONICS MANUFACTURING EXCELLENCE**

## **Overview**

On 4 April 2025, a factory visit was conducted at Linkwell Telesystems' manufacturing facilities in Kushaiguda and Cherlapalli, Hyderabad. The visit offered a comprehensive view of the company's electronic metering and POS terminal manufacturing processes, revealing its vertically integrated production setup, advanced quality control infrastructure, and robust testing capabilities. The experience was instrumental in understanding Linkwell's operational readiness to support its diversification into the renewable energy sector, particularly solar inverters.

## **Manufacturing Infrastructure and Unit Functions**

The primary manufacturing facility at Kushaiguda is a vertically integrated plant specializing in Surface Mount Technology (SMT) assembly, calibration, testing, and final product packaging. This unit has high-speed SMT lines, stencil printers, solder paste inspection (SPI), pick-and-place machines, reflow ovens, and 3D automated optical inspection (AOI) systems. The floor is fully ESD-compliant, ensuring safety for sensitive electronics. It also houses NABL-accredited labs and temperature-controlled quality assurance chambers that support rigorous environmental and electromagnetic compliance testing.

The first Cherlapalli unit is dedicated to aluminium nameplate production and PAD printing. This facility manufactures printed labels and brand markings used in energy meters and POS systems. These elements are essential for product traceability, serial number verification, and compliance with regulatory utility standards. The unit directly supports high-volume, precision-driven printing operations into the final assembly stages.

The second Cherlapalli unit focuses on plastic casing production using injection moulding techniques. It manufactures robust enclosures for smart meters and other devices tailored for field durability and weather resistance. After moulding, components are passed through screw-fitting operations to prepare them for integration with electronic assemblies. This modular unit layout allows for efficient sub-assembly handling and seamless coordination with the Kushaiguda facility for final testing and packaging.

## **Smart Meter Manufacturing Process**

The manufacturing process begins with in-house PCB design, while the fabrication is outsourced to external vendors based on Linkwell's specifications. Once the PCBs are received, the SMT (Surface Mount Technology) assembly is carried out at the Kushaiguda plant. The SMT line includes stencil printers, 3D SPI (Solder Paste Inspection), pick-and-place machines, reflow ovens, and 3D AOI (Automated Optical Inspection) systems to ensure precision in component placement. The newer SMT

lines operate at a capacity of 2.5 lakh components per hour, achieving impressive yield rates of 99% for smart meters and 98.5% for POS terminals.

After SMT, the boards are fitted with through-hole components, and the completed electronic modules are moved into mechanical assembly, enclosed in pre-moulded plastic casings. Each unit then undergoes stress testing in Aging Chambers, exposing devices to temperatures up to 50°C to simulate harsh field conditions. Post-aging units pass through calibration labs, where electrical parameters like voltage, current, and power factor are fine-tuned to achieve Class 1 accuracy, maintaining an error margin below 1%.

Following calibration, the meters proceed to the quality control and sealing stage. They are sealed using ultrasonic welding to enhance tamper resistance and field durability. This is followed by final mechanical inspections, barcode validations, and wire sealing, ensuring each unit meets internal quality benchmarks and external regulatory standards before being cleared for dispatch.

### **Testing Infrastructure**

Linkwell operates an NABL-accredited testing laboratory at its Kushaiguda facility, which is critical in ensuring that all manufactured products comply with national and international quality and safety standards. The presence of such a facility reflects the company's emphasis on precision engineering and rigorous quality assurance practices, particularly for electronics deployed in mission-critical environments like energy distribution.

The lab is equipped to perform comprehensive Electromagnetic Compatibility (EMC) testing, which includes Conducted Emissions (CE), Radiated Emissions (RE), and both Radiated and Conducted Susceptibility (RS/CS) assessments. These tests ensure that the devices neither emit nor are unduly affected by electromagnetic interference, a vital consideration for devices operating in dense electrical environments.

In addition to EMC, the lab conducts environmental stress testing using advanced temperature and humidity chambers. These chambers simulate a wide range of climatic conditions, exposing devices to temperatures between 40°C and 180°C and humidity levels reaching up to 98%. This enables Linkwell to certify that its products are reliable under extreme operating conditions.

The facility also conducts extensive safety and ESD (Electrostatic Discharge) testing. ESD gun simulations validate component resistance to static electricity shocks, while surge protection tests verify the inverters and meter's ability to withstand voltage fluctuations. Furthermore, ultrasonic welding tests are performed to ensure sealed devices' physical integrity and tamper resistance. These measures collectively guarantee that every product shipped is technically sound and field-ready.

## POS Terminal Production Capability

Linkwell also manufactures its in-house VA-21 Android POS terminals. These devices include imported touchscreens, in-house fingerprint sensor integration, and casing assembly. The factory manages software flashing, functional checks, and post-assembly QA, demonstrating its capability to scale production beyond energy meters.

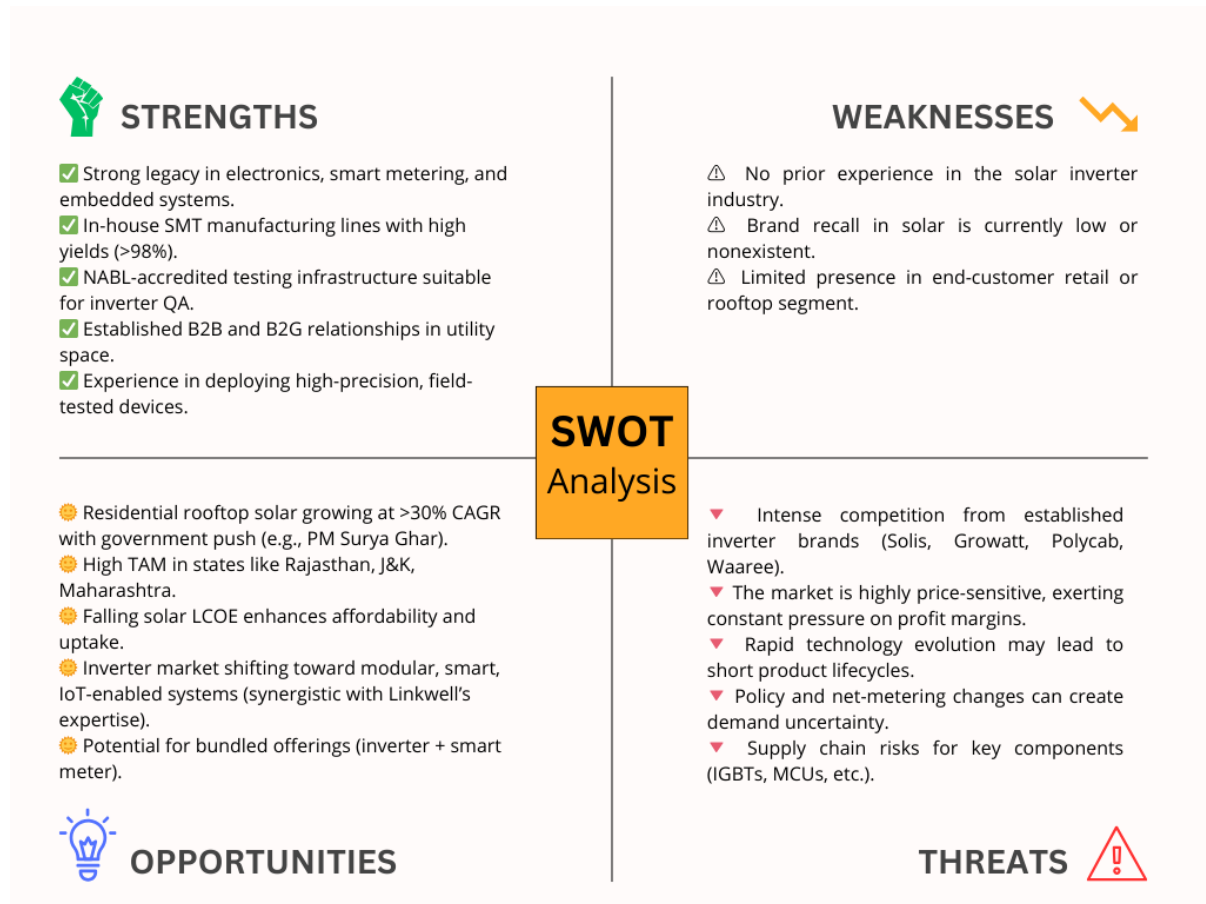
## Production Volume and Business Model

Linkwell Telesystems operates under a B2B and B2G tender-driven business model, primarily supplying its products to government and private energy utilities across India. The company does not engage in direct-to-consumer sales, focusing instead on fulfilling high-volume institutional orders through competitive bidding. In terms of production capacity, the organization manufactures approximately 2,00,000 single-phase smart meters and 50,000 three-phase meters annually, reflecting a scalable and mature manufacturing ecosystem.

The factory visit validated Linkwell's operational excellence and manufacturing maturity, particularly in producing high-precision electronic metering devices. The presence of in-house SMT lines, advanced calibration labs, and NABL-certified testing infrastructure underscores the company's readiness to diversify into solar inverter assembly and testing. These capabilities, combined with proven quality control systems and production scalability, position Linkwell to meet the stringent reliability standards required in the residential solar energy segment, where customer trust and product longevity are paramount.



# SWOT ANALYSIS



## CONCLUSION

Throughout this internship, it has become clear that Linkwell Telesystems possesses the foundational strengths and operational capabilities to succeed in India's residential solar inverter market. Rigorous market analysis identified the rooftop segment as the most attractive entry point, driven by supportive government policies, favourable economics, and standardized installation requirements. Competitive benchmarking and dealer surveys confirmed that on-grid string inverters offer this audience the right balance of cost, reliability, and serviceability. Meanwhile, the extended warranty model, with a ten-year coverage built on a data-driven failure-rate buffer, addresses customer demand for long-term assurance without eroding margins. The proposed hybrid distribution roadmap, inspired by best practices from Tesla, Coca-Cola, and others, provides a clear, phased path from rapid dealer-led market seeding in South India to territory-protected distributorships and a metro-focused certified partner program. Lastly, the factory visit validated that Linkwell's existing SMT lines, CKD processes, and NABL-certified testing labs can be leveraged immediately for solar inverter assembly, ensuring product quality from day one.



## RECOMMENDATIONS

Linkwell should first prioritize the development of a B2C e-commerce platform that offers fully integrated solar kits comprising on-grid string inverters, smart meters, mounting hardware, and all necessary balance-of-system components, backed by a single ten-year, full-kit warranty covering both installation and ongoing service. Combined with this end-to-end online solution, brand awareness and digital marketing will allow Linkwell to capture the growing digital consumer segment, strengthen brand recognition, and forge direct, trust-based relationships through its certified installation and support network.

Alongside the launch of its ten-year extended warranty program, Linkwell should equip dealers and system integrators with updated marketing materials and training to effectively convey its value. Five to ten non-exclusive residential dealers can be onboarded to accelerate market entry in South India, leveraging existing warehousing and CRM systems for efficient fulfilment. Simultaneously, pilot trials of CKD assembly at the Kushaiguda facility should begin to validate production processes and local cost structures. Within three to nine months, exclusive distribution partnerships with defined territories and pricing safeguards should be established in North, West, and Central India. Introducing a Certified Partner Program for metro dealers—featuring tiered incentives, co-branding, and a digital order platform—will enhance channel strength. Additionally, local sourcing of inverter sub-assemblies under the CKD model can help reduce landed costs and align with Make in India incentives.

Over the long term (nine to eighteen months), investments in additional SMT lines and automated testing rigs tailored to solar inverter PCBs will enable full in-house manufacturing capability. By executing this phased strategy anchored by a robust B2C e-commerce offering and supported by strengthened dealer and distributor networks, Linkwell Telesystems will establish itself as a trusted, full-service provider in India's rapidly expanding residential solar energy market.

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