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India Flipped the Switch

From load-shedding to some of the world's most competitive clean power — and not, as everyone assumes, because of the sun.

For thirty years, India has told itself three stories about electricity. Through the 1990s and 2000s there was not enough of it. In the 2010s there was enough, but industry paid too much. Today India is called one of the cheapest places to buy clean power. This note checks whether that is true, and why.

EXHIBIT 1

India's scorecard at a glance

Test	India	Verdict
Solar price	$33/MWh (₹3.12 a unit)	Third cheapest of 13 markets; only the Gulf's state-backed awards are lower. Uses the last plain-solar auction — a conservative choice
Wind price	$40/MWh (₹3.78–3.85 a unit)	Fourth cheapest of 11, and below China's $48 despite China's better wind
Round-the-clock power	$55/MWh (₹5.26–5.27 a unit)	Among the first competitively discovered 24×7 renewable prices anywhere
Distance to demand	300–1,500 km	Plants sit near industrial demand, unlike China, Chile or Australia
Cost of capital (Part Three)	10–11% a year	Roughly double China's and Europe's. India wins in spite of this, not because of it

The verdict: The new story is right. But almost none of the usual reasons are.

PART ONE · THREE DECADES, THREE STORIES

The Shortage Era: Not Enough Power

From the 1990s to the late 2000s***, power was rationed and factories took the hit***. States announced 'power holidays' — fixed weekdays when industry could not draw electricity. In 2012, Andhra Pradesh put about 1.61 lakh small factories on a two-day weekly holiday; with evening load-shedding as well, production stopped for roughly 120 hours a month.

Nationally, the Central Electricity Authority (CEA) recorded double-digit shortfalls for most of the two decades to 2010 — about 11% of energy and 12% of peak demand in 2008–09, and a record monthly peak shortfall of 19.5 GW in February 2008.

> **Read the deficit numbers carefully.** The CEA counts demand as reported by distribution companies (discoms). Where a discom was already rationing, the suppressed demand never entered the count, so the real shortage was larger.

Allcott, Collard-Wexler and O'Connell (American Economic Review, 2016) found shortages cut the average factory's revenue and producer surplus (broadly, profit) by 5–10%. Small factories suffered most: only larger ones could afford generators, and Indian manufacturers made about 35% of their own electricity against 15.8% in the US. Power did not drive industry away; it made it expensive to be small.

The 2010s: Enough Power, Wrong Price

As supply caught up, the ***complaint changed to 'power costs too much'***. The cause is a cross-subsidy: industry and commerce pay more than their supply costs so that farmers and households can pay less. Industry paid roughly 12% above the cost of supply while agriculture paid 55% below. Industry ended up paying ₹7.5–9 per unit (a unit is a kilowatt-hour, as on your bill), about 8–9 US cents at today's exchange rate — the reverse of the global norm, where industry

usually pays less. Abeberese (2017) found Indian industry paid up to fifteen times the agricultural price, driven by politics rather than cost of service.

The 2020s: The Story Flips

Today the story has flipped. In May 2026, Commerce and Industry Minister Piyush Goyal told the American Chamber of Commerce in Delhi that India offers twenty-four-hour clean energy at globally competitive rates. That is a claim by an interested party, so we tested it. New plants are now mostly renewable, so we use renewable prices as a stand-in for new industrial electricity costs, comparing prices developers actually signed up to deliver. For cross-country comparison we use US dollars per megawatt-hour (MWh, or 1,000 units) at 30 September 2026 exchange rates.

PART TWO · IS INDIA'S POWER ACTUALLY CHEAP?

A · Solar

India's benchmark solar price is ₹3.12 a unit (a unit is one kWh), or about $33 per MWh. That is ₹3.05 a unit, the weighted average of the last plain-solar auction held by the Solar Energy Corporation of India (SECI) in December 2024, plus SECI's ₹0.07 trading margin.

Earlier auctions went lower: ₹2.57 in March 2024, and ₹1.99 at the 2020 low. We use the higher, later figure deliberately. It is the most recent genuine plain-solar auction (SECI has since stopped holding them) and was bid under ALMM List-I: domestic modules, imported cells allowed. A stricter rule, List-II, also requires domestic cells but applies only to bids after August 2025. CareEdge estimated it would add 30–40 paise a unit, but the evidence suggests less: SECI's August 2026 round-the-clock auction, bid under the new rule, cleared at ₹5.26 for firm, storage-backed power — out of reach if its solar cost ₹3.35 or more — and Saatvik Green Energy's recent award announcement indicates domestic-cell module prices have fallen 15–20% in rupee terms over the past year.

EXHIBIT 2

Utility-scale solar prices by market, US$ per MWh

Country	US$/MWh	Basis	Local-currency price	Auction or source
Saudi Arabia	11–17	Auction	$0.0110–0.0168/kWh	NREP R6 Oct-2025; Al Henakiyah
UAE	13–17	Auction	$0.0135–0.0170/kWh	Khazna Jan-2026; Al Dhafra
India	33	Auction	₹3.05 +₹0.07 margin	SECI ISTS Tranche-XVIII (Dec-2024)
Spain	37	PPA index	€32.50/MWh	LevelTen Q4-2025; auctions lapsed
China	34–49	Auction	RMB 0.225–0.33/kWh	Shandong auction Aug-2025
South Africa	41	Auction, levelised	R0.46 base → R0.67 lev.	REIPPPP Bid Window 7, Dec-2024
Australia	35–52	PPA proxy	A$50–75/MWh	CIS strike price undisclosed
Vietnam	39–53	Regulated ceiling	VND 1,012–1,383/kWh	MOIT DPPA ceiling 2025
Chile	38–65	Auction	$38–65/MWh	CNE supply tender 2025/01
United States	61	PPA index	P25 percentile	LevelTen Q2-2026
Germany	53–70	Auction	4.66–6.15 ct/kWh	Bundesnetzagentur 2025
Thailand	65	Regulated FiT	THB 2.168/kWh	ERC FiT, 2022 round
South Korea	115	Regulated ceiling	KRW 155,742/MWh	MOTIE ceiling 2025

Not every price is discovered the same way, so Exhibit 2 states the basis: an auction is true competitive discovery, an index averages private contracts, a regulated price is set by the government.

On the auctions, only the Gulf's state-backed awards undercut India. South Africa looks cheaper at R0.46 a unit ($28), but its price rises with inflation for twenty years while India's is fixed for twenty-five; as a flat-price equivalent (4.5% inflation, 9% discount rate) it is about $41, above India's $33. Brazil and Mexico are omitted because neither now holds public solar auctions; Chile and South Africa stand in for Latin America and Africa.

B · Round-the-Clock Power

A factory cannot run only when the sun shines; what matters is firm power, available every hour as coal plants once provided. Many products sold as 'firm' are really solar with a few hours of battery, or a solar-plus-wind bundle with no promise to deliver. A genuine 24×7 product must commit to supply in every time slot. SECI's recent tenders do (see Exhibit 3). The latest cleared at ₹5.26–5.27 a unit, about $55 per MWh. **To our knowledge, India is the only country to have competitively auctioned genuine 24×7 round-the-clock renewable power (RE RTC).** *The UAE has awarded one by negotiation, with the tariff undisclosed.*

> **Does China do this too? Not in the same way.** China required new renewable plants to add batteries equal to 5–20% of capacity until February 2025; the national rule has been dropped, though some provinces keep it. Either way it is a rule about equipment, not a promise to supply power, and far too little storage to guarantee 90% supply.

At $55, **India's firm price is below new coal in India and China and new gas globally, and is locked in for 25 years**. It also caps what the solar inside it can cost — the cross-check behind the ₹3.05 above.

EXHIBIT 3

Genuine 24×7 renewable power: a very short list

Country	Product	US$/MWh	What is promised
India	SECI firm round-the-clock auctions, ₹5.26–5.27 a unit	55	Behaves like a coal plant: at least 90% supply in peak hours, 70–80% off-peak, ~90–95% across the year, enforced over a 25-year contract
UAE	Masdar/EWEC project: 5.2 GW solar + 19 GWh batteries	Undisclosed	Genuine 24/7/365 supply, but one negotiated project rather than an auction; due to start in 2027.
US · EU · Australia · Brazil · Chile · SE Asia · Korea	No true 24×7 auction	n/a	Renewables and storage are bought separately; US 'blended' and German 'innovation' auctions carry no round-the-clock delivery promise

C · Wind

Firm power is solar plus wind plus storage, so India's result implies competitive wind — and for new plants it has it. The usual figure hides this: India's installed fleet runs at a 22–25% 'capacity factor' (the share of its maximum output a turbine delivers in a year), near the bottom of the world table, because small, low-tower turbines from the 1990s weigh it down. New projects bid against a better resource: the National Institute of Wind Energy certifies 132 GW at 32% or better on 120-metre towers, and far more on taller ones.

EXHIBIT 4

Ordinary wind resource, competitive wind price

Country	Capacity factor	Price, $/MWh	Note
Saudi Arabia	—	13–16	Dawadmi $13.38 — world record
Spain	25%	29	MITECO auction average
Brazil	45%	35	Best onshore resource on earth
India	22–25% fleet; low-to-mid 30s new build	40	Fourth of eleven on price; fleet average reflects old turbines
China	28%	48	Global leader on resource, dearer on price
Vietnam	—	61	MOIT ceiling
Germany	20%	66–69	Onshore barely reaches 20%
United States	34%	79	Great Plains belt; rising on tariffs
Chile	—	78–95	CNE tender
Thailand	—	92	ERC feed-in tariff
South Korea	20%	126	Predominantly offshore — not like-for-like
Reference	Global avg 36%; offshore Europe 47%	—	India ~0 GW offshore installed

India's wind auctions cleared at ₹3.78–3.85 a unit, about $40 per MWh: fourth of eleven markets, and below China's $48 despite China's better wind. Three things explain it: new plants outperform the fleet average, the same cheap construction as solar, and the same 25-year contract.

D · Distance to Demand

A generation price is not the delivered price: plants are built where the resource is best, often far from demand, and moving power costs money. We put no number on that cost, because it varies route by route and published figures are national averages or single projects. What can be observed, and what drives the cost, is distance.

EXHIBIT 5

India's resource sits near its demand; its rivals' does not

Country	Typical resource-to-load distance	Resource vs demand
UAE	<100 km	Al Dhafra ~35 km from Abu Dhabi
Vietnam / Thailand	100–300 km	Resource near coastal load
Spain	100–400 km	Well distributed
Germany / EU	300–800 km	North wind, southern industry; plus subsea cable for offshore
India	300–1,500 km	Rajasthan/Gujarat belt overlaps industrial west; inter-state fee waiver being withdrawn
Saudi Arabia	500–1,000 km	Interior desert; grid expanding ~60% by 2030
US · Australia	500–1,500 km	Plains and outback resource, coastal load
Brazil · Chile	1,000–2,000 km	North-east and Atacama resource, southern load
China	1,500–3,000 km	Xinjiang and Tibet resource, eastern load

Why ending India's transmission-fee waiver is not a risk here. Until June 2025, India charged no inter-state transmission fees on competitively bid renewables; the waiver is being withdrawn. This note compares generation prices and every country pays for transmission, so the waiver was a bonus on top, not part of the comparison. India is now on the same footing as others, with resource still close to demand.

The **contrast is sharpest with China**, whose competitive prices come from sites 1,500–3,000 km from the cities that use the power, bridged by over 500,000 km of transmission including ultra-high-voltage lines. India's Rajasthan–Gujarat solar belt sits beside its biggest power-consuming states.

The verdict: India's new-age industrial power, i.e. renewable power, is one of the cheapest in the world.

PART THREE · WHY INDIA'S POWER IS AMONG THE CHEAPEST IN THE WORLD

1 · Adequate Resource, Not Exceptional

Start with the strength of the sunlight: the solar energy falling on a square metre of ground in a year, known as global horizontal irradiance (GHI). India has three world-class regions — Ladakh (about 2,340 kWh per square metre a year) and the Jaisalmer and Kutch belts (2,200–2,260) — but they cover only a small part of the country, and the national average is about 1,825–2,000. Outside those belts, India's sunlight is weaker than the best of China, the Middle East, most of North and Southern Africa and much of the American Southwest.

EXHIBIT 6

India's three best belts flatter it; the rest of the country does not (GHI, kWh/m² a year)

Region	Best	Typical	What limits the average
Atacama (Chile)	~2,700	~1,800	Coastal fog below 1,100 m; south is temperate
Sahara / North Africa	~2,600	~2,400	Grid and finance, not resource
Arabian Peninsula	~2,400	~2,200	Uniformly excellent
India	~2,340	~1,825–2,000	Only Ladakh, Jaisalmer, Kutch top-tier
— Ladakh (Leh, Pang)	~2,340		Highest intensity in India; 320+ clear days
— Jaisalmer / Jodhpur	~2,230–2,260		Jodhpur 6.11 kWh/m²/day
— Kutch (NW Gujarat)	~2,010–2,190		5.5–6.0 kWh/m²/day
— Southern / central	~1,800–1,900		Monsoon-affected
— Eastern India	~1,550–1,650		Below the western belts
— North-east India	~1,400		Weakest; high cloud
Australia	~2,300	~2,100	Arid interior, far from demand
United States (SW)	~2,300	~1,700	Southwest strong; average far lower
Southern Africa	~2,264	~2,100	Dry Karoo, Northern Cape
Equatorial W/C Africa	~2,140	~1,600	Monsoon and rainforest cloud
China	~2,000	~1,600	Best sun remote; east hazy
Spain	~1,950	~1,700	Europe's best; Atlantic weaker
Vietnam	~1,850	~1,500	South good; north cloudier
Thailand	~1,700	~1,550	Tropical monsoon
South Korea	~1,450	~1,300	High latitude, monsoon
Germany	~1,200	~1,050	High latitude, persistent cloud

The Atacama Desert has the highest GHI due to high altitude, proximity to Tropic of Capricorn and extremely dry climate.

Africa divides on rainfall, not latitude: its dry belts hold the best solar resource on earth, but equatorial Africa loses most output to cloud — northern Nigeria gets 5.86 kWh per square metre a day, southern Nigeria 4.37 — and Nigerian solar costs ten times India's.

2 · Enough Hours, in the Right Place

Strength is half the picture; the other half is hours of sunshine. West Rajasthan and adjoining Gujarat record over 3,100 hours a year, with 300+ clear days. The rest of India holds up better on hours than on strength — Delhi 2,796, Varanasi 2,846, Ahmedabad 3,015, Bengaluru 2,393 — ahead of competing markets, though short of the Sahara and Arabia.

EXHIBIT 7

How many hours the sun actually shines (bright sunshine hours a year)

Region	Sunshine hrs/yr	Anchor city	Note
Atacama (Chile)	~4,350	Calama 4,353	World's sunniest; Chile avg 2,841
Sahara / North Africa	4,000+	—	Sunniest on earth
Arabian Peninsula	3,000–4,000	—	Minimal rainfall and cloud
Australia	2,400–3,600	—	Interior above 3,000
United States (SW)	~3,000–4,000	Yuma 4,015	Yuma sunniest US city; average lower
Spain	2,500–2,950	Seville 2,920	Madrid 2,712; Galicia 1,600–2,000
India	2,300–3,200	Ahmedabad 3,015	West Rajasthan and Gujarat above 3,100; Varanasi 2,846, Delhi 2,796, Bengaluru 2,393
Thailand	2,624	Bangkok 2,624	Jan 273 hrs; Sep 155 on monsoon
Vietnam	1,550–2,500	HCMC 2,507; Hanoi 1,554	Hanoi barely half of HCMC
Equatorial W/C Africa	1,800–2,300	Abidjan 2,296	Gagnoa 1,823; July ~80 hrs
China (populated east)	1,800–2,200	Chongqing 983	Least sunny major city on earth
South Korea	2,148	Seoul 2,148	May 225 hrs; Jul 124 on monsoon
Germany	1,600–1,700	Prague 1,668	UK ~1,390–1,420

What the two exhibits show together. India is top-tier on neither measure; the Sahara, the Atacama, the Gulf and the American Southwest beat it on both. It wins against the markets competing for the same factories — China's populated east, Vietnam's industrial north, South Korea, equatorial Africa and Europe — which get materially fewer hours. So the cost advantage lies elsewhere.

3 · Double the Module Price, a comparable plant cost

A solar plant's biggest component is the solar module *(In India, ~50% cost of solar plant is module, ~25% balance of system and ~25% is engineering and labour cost.).* **Chinese modules sell at 9–10 US cents per watt; India's cost 17–18, nearly double** — led by China's scale, government support and over-capacity in manufacturing.

And yet the finished plant costs same in India as China: Engineering, Procurement and Construction (E + P + C) cost of solar plant (DC plant) ₹3.35 crore per MW (about $350,000) in India, against roughly ₹3.32 crore ($346,000) in Western China, China's cheapest region.

India has leveraged its low cost of engineering and labour to offset the higher module prices over China.

EXHIBIT 8

India builds solar plant at China's cost despite paying double for modules

Build cost per MW, US$ thousand; DC = measured on panel capacity

Country	US$k per MW (DC)	Local currency	Source
India	350	₹3.35 cr/MW DC	ACME Solar, Jan-2026 call
China (West)	346	RMB 2.9mn/MW in AC terms i.e. RMB 2.32mn/MW in DC terms	UBS Jun-2026
Saudi Arabia	506–559	SAR 1.9–2.1m/MW	Bloomberg Research Apr-2026
Spain	510–555	€0.45–0.49m/MW	BloombergNEF Dec-2025
China (National)	522–596	RMB 3.5–4.0/W	UBS Jun-2026
South Africa	617	$148m / 240 MW AC	Sterling & Wilson award
Thailand	745	THB 25m/MW	Maybank IBG Jul-2026
Australia	~973–1,042	A$1.4–1.5m/MW	CSIRO/AEMO GenCost 2025-26
United States	1,000–1,200	$1.00–1.20/W	BofA Securities Nov-2025

One caveat: these costs assume List-I. Under List-II, build costs should first rise by 5–7 cents a watt ($50,000–70,000 per MW), fading as domestic cell making scales; as most large List-II projects are yet to be built, we stay with List-I.

The module gap is borrowed, not permanent; the construction advantage is harder to copy. Panels are a global commodity, so US build costs of $1.00–1.20 per watt, three times India's, reflect labour, land, permits and import tariffs.

4 · Expensive Money, Long Contracts

A **solar plant is almost all upfront cost**; once built, the fuel is free. So its **price depends heavily on the weighted average cost of capital (WACC, the blended yearly cost of the money tied up)** — and India's is high. Borrowing for new renewable projects costs 8.5–9.5%, against 3–5% in Europe and 3–4% in China, and shareholders expect about 12%. Blended at 70% debt and 30% equity, the WACC is about 10–11%, roughly double China's and Europe's.

EXHIBIT 9

India pays roughly twice what its rivals pay for capital

Market	Cost of debt	Cost of equity	WACC (70:30)
Europe	3–5%	7–8%	~4–5%
China	3–4%	~8%	~5%
Saudi Arabia / UAE	5–6%	9–10%	~6–7%
United States	7–8%	10–11%	~8%
India	8.5–9.5%	~12%	~10–11%
Indonesia	9–10%	~14%	~11%
South Africa	9–11%	~14%	~11%
Vietnam	9–13%	~15%	~12%
Brazil	10–12%	~15%	~12%

So India competes on expensive money, but the **cost of capital is only half the story; the other half is how many years you have to earn it back**. SECI contracts renewable plants for 25 years at a flat price on all their output — the longest in our comparison. That helps twice: more years to spread the capital, and a creditworthy buyer cuts borrowing costs by an estimated 1–2 percentage points.

EXHIBIT 10

Twenty-five years, flat, on all output: India's contracts are the world's most bankable

Market	Tenor	Price basis	Output covered
India	25 years	Flat nominal, fixed	100%
Saudi Arabia	25 years	Fixed, sovereign-backed	Full
Thailand	20–25 years	Feed-in tariff	Full
South Africa	20 years	CPI-indexed	Full
Brazil	20 years	Auction contract	Full
Germany	20 years	Market premium	Full
Vietnam	20 years	Fixed; buyer is state utility EVN	Full
China	20 years, now provincial	Grid-parity contract; now contract-for-difference	70–85% since Jun-2025
United States	10–15 years	Corporate contract, escalating	Contracted volume
Spain	12 years	Auction contract	Contracted volume

The sums that resolve the paradox. Take the share of a plant's cost recovered each year. At India's 10.5% cost of capital over twenty-five years, it is 11.4%. At Spain's 4.7% over twelve years, it is 11.1% — almost identical, so India's long contract nearly cancels a cost of money more than twice as high. The US (8.4% over thirteen years) needs 12.9%; only China (5% over twenty years, 8.0%) keeps a real financing edge. Add build cost — $350,000 per MW against Spain's $533,000 and America's $1.0–1.2 million — and the ranking in Exhibit 2 stops being surprising.

Why China chose differently — and it was not a mistake. China moved from a feed-in tariff (2014) to twenty-year grid-parity auctions, then to full market pricing in June 2025, as the funding surcharge lagged capacity growth and costs fell enough to end support. It traded revenue certainty for fiscal relief — a fair bargain with cheap state credit. India, borrowing at 9% or more, needs bankability more, and kept the long contract.

The right comparison is not India versus China. China has the deepest supply chain and cheap state credit; matching its cost is the achievement. Against everywhere else a manufacturer might choose, India's solar prices run around half of Germany's, Thailand's and America's and under a third of South Korea's.

5 · Wind That Fills Solar's Gaps

Wind does not make power cheaper to build; it makes it more valuable to a system that must deliver firm supply. **India's timing is good**: in the four monsoon months (June–September), when cloud cuts solar to its yearly low, India generates 62% of its annual wind output, and through the evening wind strengthens as solar fades.

This is measured, not modelled: in July 2025 India's wind generated 45% more than solar (17,573 against 12,101 million units) from less than half the capacity, and in July 2026 it edged ahead again (18,505 against 18,082), though solar's fleet was nearly three times larger.

EXHIBIT 11

Monsoon inversion: wind out-generates solar from a third of the capacity (million units, MU)

Month	Solar (MU)	Wind (MU)	Solar GW	Wind GW	Comment
Jul 2025	12,101	17,573	110.8	51.5	Wind +45% from less than half the capacity
Jun 2026	20,307	15,256	162.2	57.4	Solar higher on 45.9 GW added YoY
Jul 2026	18,082	18,505	162.2	57.4	Wind again ahead, solar fleet ~3× larger

Wind–solar complementarity exists elsewhere (Europe's winter wind, the US Great Plains' night wind), but **India's is exceptional**: the seasonal swing is strong, it comes from one predictable monsoon, and both wind peaks fall on India's

peak demand. That is why India could price firm power before building a battery industry: less storage is needed to meet a 90% promise.

PART FOUR · WHAT IT IS WORTH, AND WHAT COULD BREAK IT

E · The Circle Closes

Return to where this began. **In the 2010s industry subsidised agriculture through its tariff; now commercial and industrial buyers can contract renewable power directly.** Leaving the grid used to be a privilege of size, needing rationed coal, years of construction and scale; renewable self-supply needs no fuel chain, starts at a few megawatts and commissions in months. The model must be reformed, not refinanced — and cheap power becomes reachable by a mid-sized manufacturer, not only a steel major.

> **The honest risks.** There are four. **Contract length:** the 25-year flat contract is the mechanism, and the Ministry of Power has proposed cutting standard tenor to 15 years. **Discom credit:** cheap capital rests on the creditworthiness of the distribution companies signing the contracts. **Module imports:** the low build cost still relies partly on imported Chinese cells. **Curtailment:** rising solar will test the grid's ability to absorb midday surpluses in the west.

CONCLUSION: AN ADVANTAGE TO BE USED

The story is right; almost none of the usual reasons for it are. **India has neither the best sunlight, nor the best wind, nor cheap capital. It has built a system: enough sun beside industrial demand, a plant cost same as China**'s cheapest region despite double-priced modules, **wind that fills solar's gaps, and a contract long enough to offset expensive money**. Against everywhere else a factory might go, the advantage is large and hard to copy.

The advantage exists. The question is whether India builds on it fast enough to matter.

EXHIBIT 12

Where the advantage should be spent

Priority	Why India's power edge applies	What it requires
Power-intensive manufacturing	Aluminium, steel, chemicals, cement, glass and green hydrogen compete globally on electricity cost	Easier 'open access' to auction-priced power
Solar cells and modules	Domestic manufacturing turns a borrowed advantage into an owned one	Scale into cells, wafers and polysilicon
Data centres	US grid queues hold over 2,000 GW, Europe has high power costs and Singapore restricts new data centres. India offers a competitive firm tariff and capacity	Faster connection approvals and transmission build-out
Protect: contract credibility	The 25-year flat contract is the mechanism doing the work	Resist shorter tenors, which raise prices
Protect: discom balance sheets	Weak buyers would raise the cost of the cheap capital	Sustained reform, not repeated refinancing

India has solved generation. What its factories pay is now set by distribution-company arithmetic, not by sun, wind or capital — which is where the next decade of this story will be written.

> *The factory owner who once watched a two-day weekly power holiday can now sign a twenty-five-year contract for firm, clean power at a price unthinkable a decade ago — at a scale small enough that he need not be a giant to qualify. The line item that was India's handicap has become its edge.*

Authors' profile



Deepesh Agarwal is Vice President - Fund Manager and Research Analyst in the domestic Equity Division of UTI Asset Management Company Ltd. He manages UTI Infrastructure Fund and acts as Investment Advisor for UTI International's Infrastructure fund. As analyst he tracks the Capital Goods, and Oil & Gas sectors. Deepesh joined UTI AMC in its equity team in 2017, prior to that he worked with Ambit Capital as equity research analyst for 4 years. He has also worked with Hexaware Technologies in Corporate Finance for 2 years. He is a Chartered Accountant from the Institute of Chartered Accountant of India and has cleared the Level 3 exam of the CFA program conducted by The CFA Institute, USA.

EXHIBIT NOTES AND SOURCES

Exhibit 1. Each line is established in the section that follows. Prices come from competitive auctions or, where stated, market indices and government-set prices, converted at the exchange rates shown at the end of this note.

Exhibit 2. India: SECI ISTS Tranche XVIII auction, December 2024 — ReNew 250 MW at ₹3.04, ACME 300 MW at ₹3.05, Adani 50 MW at ₹3.10; weighted average ₹3.05 on 600 MW awarded of 1,000 MW offered; plus SECI's ₹0.07 trading margin; bid under ALMM List-I. Tranche XIV cleared at ₹2.57 on 15 March 2024. Saudi Arabia: NREP Round 6, October 2025, 1.097 US cents/kWh; Al Henakiyah $16.84/MWh. UAE: Khazna (financial close January 2026), Al Dhafra, DEWA Phase 5. Spain: LevelTen Energy index, Q4 2025; no successful Spanish solar auction since the 2022 round closed with no awards against a €45.12/MWh reserve price. China: Shandong auction, August 2025. South Africa: REIPPPP Bid Window 7, December 2024, converted to a flat-price equivalent as described in the text. Australia: Capacity Investment Scheme prices are undisclosed; merchant PPA proxy shown. Vietnam: government ceiling price. Chile: CNE tender 2025/01. United States: LevelTen Energy Q2 2026, 25th-percentile offer. Germany: Bundesnetzagentur 2025. Thailand: ERC feed-in tariff. South Korea: MOTIE ceiling. Sources: SECI; SaurEnergy; Mercom India; Renewable Watch; Chambers; SPPC; PV Tech; The National; REGlobal; MITECO; Shandong DRC via TaiyangNews; Green Building Africa; RenewEconomy; DCCEEW; Vietnam Briefing; Strategic Energy; Bundesnetzagentur; Green Energy Thailand; Enerdata. Domestic-cell commentary: CareEdge Ratings (September 2025) and Saatvik Green Energy's award announcement.

Exhibit 3. India: SECI firm and dispatchable renewable awards, latest round ₹5.26–5.27/kWh, August 2026, delivery obligation per the tender documents (PV Tech; ESS News). UAE: Masdar and EWEC Al Azeezah project, 5.2 GW solar with 19 GWh storage delivering a steady 1 GW, commissioning 2027; tariff undisclosed, and IRENA's benchmark for the project type is $54–82/MWh. China is excluded: it required co-located storage at 5–20% of capacity until the national rule was dropped in February 2025 (NDRC Document 136; some provinces keep it), rather than contracting output, and IRENA's $30–46/MWh describes project economics at modelled reliability, not a contractable price. New coal in China is $70–85/MWh and new gas globally above $100 (IRENA, 24/7 Renewables, 2026). Storage-rule status: Carbon Brief; Ember; InfoLink..

Exhibit 4. Capacity factors from Thunder Said Energy and the Energy Institute Statistical Review; global average from IRENA via Statista; US fleet from the US Energy Information Administration; China, Spain and offshore from WeMake Consultores and Ørsted. India potential from NIWE: 132 GW at a minimum 32% and 695 GW at 25%, both at 120 metres, and 1,164 GW at 150 metres, mostly in Rajasthan, Gujarat, Maharashtra, Karnataka and Andhra Pradesh. Prices: Saudi Dawadmi $13.38/MWh and Al Ghat $15.66 (RenewablesNow); Spain MITECO €25.31/MWh average; Brazil R$179/MWh (Climate Policy Hub); India SECI ISTS Tranche XX, 2026; China Shandong, August 2025; Germany Bundesnetzagentur, November 2025; Vietnam MOIT ceiling; US LevelTen Q1 2026; Thailand ERC; Chile CNE; South Korea MOTIE, predominantly offshore and not directly comparable.

Exhibit 5. Typical resource-to-load hauls for each market's principal renewable zones, used as a proxy for transmission burden. No cost figure is given: transmission cost depends on line type, terrain, utilisation, losses, ownership and charge allocation, all of which vary by route. Resource geography and grid build-out from the IEA's Building the Future Transmission Grid (China's 500,000-plus km of transmission), Chambers (Saudi Arabia expanding its grid by about 60% by 2030) and DCCEEW (Australian renewable energy zones); European offshore wind requires subsea cables. India's inter-state charge is about ₹0.07–0.20 per unit and was waived for competitively bid renewables, a waiver now being withdrawn (CERC; Prayas Energy Group).

Exhibit 6. World Bank and Solargis Global Solar Atlas. India from the NIWE Solar Atlas and MNRE: national average 4.5–5.5 kWh/m²/day, Gujarat north-west 5.5–6.0, range 1,400 kWh/m²/year in the north-east to 2,260 in Rajasthan; Santra (CAZRI) puts the average horizontal-surface figure at 5.6 with Jodhpur at 6.11. Ladakh from the Ladakh Renewable Energy Development Agency (LREDA): the highest radiation intensity in India, with over 320 clear days; Indian sources quoting 7–7.5 kWh/m²/day for Ladakh cite peak-season or direct-normal values, not annual GHI. Africa from the University of Tehran Journal of Solar Energy Research; Nigerian solar cost of roughly $387–475/MWh from PV Know-How. South Africa from Climatebiz. Atacama altitude and fog from Cordero et al., Scientific Reports (2016). Spain, Vietnam, Thailand and South Korea are indicative regional values, as are the intermediate Indian figures.

Exhibit 7. Sunshine duration records hours of bright sunshine, a different measure from the energy total in Exhibit 6. City figures from Weather & Climate 30-year normals, 1990–2020: Seville 2,920, Madrid 2,712, Barcelona 2,530, Bangkok 2,624, Seoul 2,148, Ho Chi Minh City 2,507, Hanoi 1,554, Prague 1,668, New Delhi 2,796, Varanasi 2,846, Ahmedabad 3,015, Bengaluru 2,393. Also The Sunshine Map (Calama 4,353), William Russell (Yuma 4,015; Chile national average 2,841; Chongqing 983), national meteorological records for Ivorian cities (Abidjan 2,296; Gagnoa 1,823, July 80 hours) and GOV.UK via Statista. Spanish city ranges from Meteorología en Red (cities above 2,800 hours; Galicia and the Cantabrian coast 1,600–2,000). Regional ranges from Vivid Maps and Seasia Stats. The figure above 3,100 hours for west Rajasthan and adjoining Gujarat is from the Indian meteorological literature; Ladakh's 320-plus clear days from LREDA.

Exhibit 8. India from ACME Solar's January 2026 earnings call: ₹3.35 crore/MW with trackers, DC basis, corroborated by CERC benchmark capital-cost orders. China from UBS, June 2026: Rmb 2.9m/MW in Xinjiang and Inner Mongolia, including VAT and on an AC basis (UBS assumes a 23% plant load factor), converted to a DC basis at an assumed DC-to-AC ratio of 1.25 (Rmb 2.32m/MW). That is 20–25% below the eastern and national average of Rmb 3.5–4.0/W, which is shown as quoted by UBS and has not been converted. Spain from BloombergNEF, December 2025. Saudi Arabia from Bloomberg Research, April 2026. South Africa from a disclosed Sterling & Wilson award of $148m for 240 MW AC. Thailand from Maybank IBG, July 2026. United States from BofA Securities, November 2025, before the 48E tax credit worth up to $1,086/kW. Australia from CSIRO and AEMO's GenCost 2025-26, which covers completed or contracted projects on an overnight basis; an earlier Bloomberg Research figure of A$1.7–2.3m/MW was a blended rate skewed by co-located batteries. Module prices from PV InfoLink. Figures are as reported by each source and include indirect taxes: GST in India, where developers cannot claim input tax credit, and VAT in China. India and western China are stated on a DC basis; South Africa is quoted per MW of AC capacity. Domestic-cell premium of 5–7 cents per watt as estimated by UTI Research from the compliant-versus-non-compliant module price gap.

Exhibit 9. Cost of debt from the IEA Cost of Capital Observatory (2023–2025), IRENA, The Cost of Financing for Renewable Power (2023), BloombergNEF (2025) for India, and Oxford Sustainable Finance (2025) for the US rise from below 2% in 2022 to about 8% in 2024, from 8,144 project-finance transactions. WACC is computed on a consistent 70:30 structure so markets are comparable; equity costs are indicative market levels, and a different gearing assumption would move every row without changing the ranking. Nominal rates embed local inflation, so India's real gap to Europe is narrower than shown. IRENA's 7.08% for Indian solar is a real, inflation-adjusted figure corresponding to roughly 11–12% nominal. Operating Indian assets carry lower capital costs once construction risk has passed: IndiGrid's published valuations show 7.30–8.42% nominal post-tax, and BofA puts the hurdle rate for new Indian energy infrastructure at about 11% nominal. The annual capital-recovery comparison in the text is a UTI Research calculation using these WACCs and the contract tenors in Exhibit 10. Africa–Europe onshore wind comparison from IRENA, Renewable Power Generation Costs in 2024.

Exhibit 10. India: SECI tender documents and standard PPA terms; more than 90% of India's power is bought on long-term contracts; the 100–200 basis-point reduction in borrowing cost from a creditworthy buyer is an industry estimate (Optenpower; Heaven Green Energy). Saudi Arabia: 25-year PPAs on NREP awards. Thailand: ERC feed-in tariff terms. South Africa: REIPPPP 20-year Eskom PPAs, CPI-indexed, with bidders required to submit both fully and partially indexed prices (Eberhard and Naude; Finergreen). Brazil, Germany, Vietnam: 20-year auction, market-premium and MOIT terms. United States: corporate PPA practice, shifting to shorter tenors. Spain: REER contracts run twelve years; Chinese law separately defines a short-term PPA as one not exceeding a year and caps long-term agreements at twenty (CMS). China: grid-parity auction winners received 20-year contracts from 2019, but since NDRC Document 136 took effect on 1 June 2025 all renewable output must be sold through the market, provinces set durations, and the mechanism price covers 70–85% of output through a contract for difference — in Shandong, 85% of solar and 70% of wind. The guarantee is conditional on generation and gives no protection against curtailment, which exceeds 30% for solar in Gansu; by 2030 generators must sell all output on the market (Oxford Institute for Energy Studies; Carbon Brief; pv magazine).

Exhibit 11. Central Electricity Authority, Monthly Renewable Energy Generation Reports (cea.nic.in), as carried by SaurEnergy. Published solar and wind figures only: wind cannot be derived by subtraction from the non-hydro renewable total, which also contains small hydro, biomass and bagasse. Seasonal context from Gulagi, Ram and Breyer (2020), IET Renewable Power Generation, finding 62% of India's annual wind energy generated June to September; diurnal context from Ember Energy. The global comparison is from IOPscience (2022).

Exhibit 12. US interconnection queue: Lawrence Berkeley National Laboratory, Queued Up 2026 Edition (data to end-2025) — about 2,060 GW of generation and storage, of which 1,312 GW generation and 749 GW storage. Singapore's restrictions on new data-centre capacity and European power-cost levels from industry reporting.

Sources for the text. Power holidays and load-shedding in Andhra Pradesh: Deccan Herald. Energy and peak deficits: CEA series as compiled in CSEP, On India's Electricity Consumption (2023), the CEA Load Generation Balance Report 2016–17, Lawrence Berkeley National Laboratory (2008–09) and CEIC (February 2008 peak shortfall). Cost of shortages: Allcott, Collard-Wexler and O'Connell, American Economic Review (2016). Industrial cross-subsidy: Abeberese, Review of Economics and Statistics (2017), summarised at VoxDev. Minister's remarks: Piyush Goyal, address to the American Chamber of Commerce annual leadership summit, New Delhi, May 2026. Domestic-cell cost estimate: CareEdge Ratings (September 2025). Brazil and Mexico: Energy Tracker, Rio Times, pv magazine, Windpower Monthly and S&P Global.

EXCHANGE RATES USED

All figures in this note are converted at the closing rates below, as at 30 September 2026. One fixed set of rates is used throughout so that every figure is reproducible and comparable; currency moves alone can change a cross-country comparison materially.

Currency	Code	Rate	Basis
Indian Rupee	INR	95.8275	per US$
Chinese Renminbi	CNY	6.7060	per US$
Thai Baht	THB	33.557	per US$
Vietnamese Dong	VND	25,964	per US$
South Korean Won	KRW	1,356.75	per US$
South African Rand	ZAR	16.4226	per US$
Chilean Peso	CLP	974.17	per US$
Saudi Riyal	SAR	3.7549	per US$ (pegged)
UAE Dirham	AED	3.6730	per US$ (pegged)
Euro	EUR	1.1330	US$ per €
Australian Dollar	AUD	0.6947	US$ per A$
Brazilian Real	BRL	5.1748	per US$

Figures are as reported through September 2026 unless stated. Auction prices differ in design, tenor, indexation and storage obligation and are not perfectly like-for-like. Where a figure is a UTI Research calculation rather than a published number — the flat-price equivalent for South Africa, the annual capital-recovery comparison, the balance-of-system inference and the domestic-cell premium — it is labelled as such. Prepared by UTI Research for educational purposes. This note is not investment advice, and any companies or securities referenced are illustrative and not recommendations.

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