



Ideas For The Vision
VIKSIT BHARAT @2047

“ Today the goal of the country is
Viksit Bharat, Sashakt Bharat!
We cannot stop until this dream of a
developed India is fulfilled.”
-Narendra Modi, Prime Minister



Institution of Engineers, Lucknow
2nd May 2026

Power Vision 2047 – Viksit Bharat

Electricity is really organised lightning
George Carlin

Welcome to this presentation
Rakesh Goel

Where we are , where we want to be.

2047 : Developed Nation .

Manufacturing Economy

Data Centres

Electrical Vehicles

Increasing per Capita income

Population projected 2047 : 161 Crore



Where we are ?

Part 1

e we are
glance

Gujarat
2450 KWh
per capita

BIHAR
400 KWh
per capita

INDIA
515 GW

CHINA
3950
GW

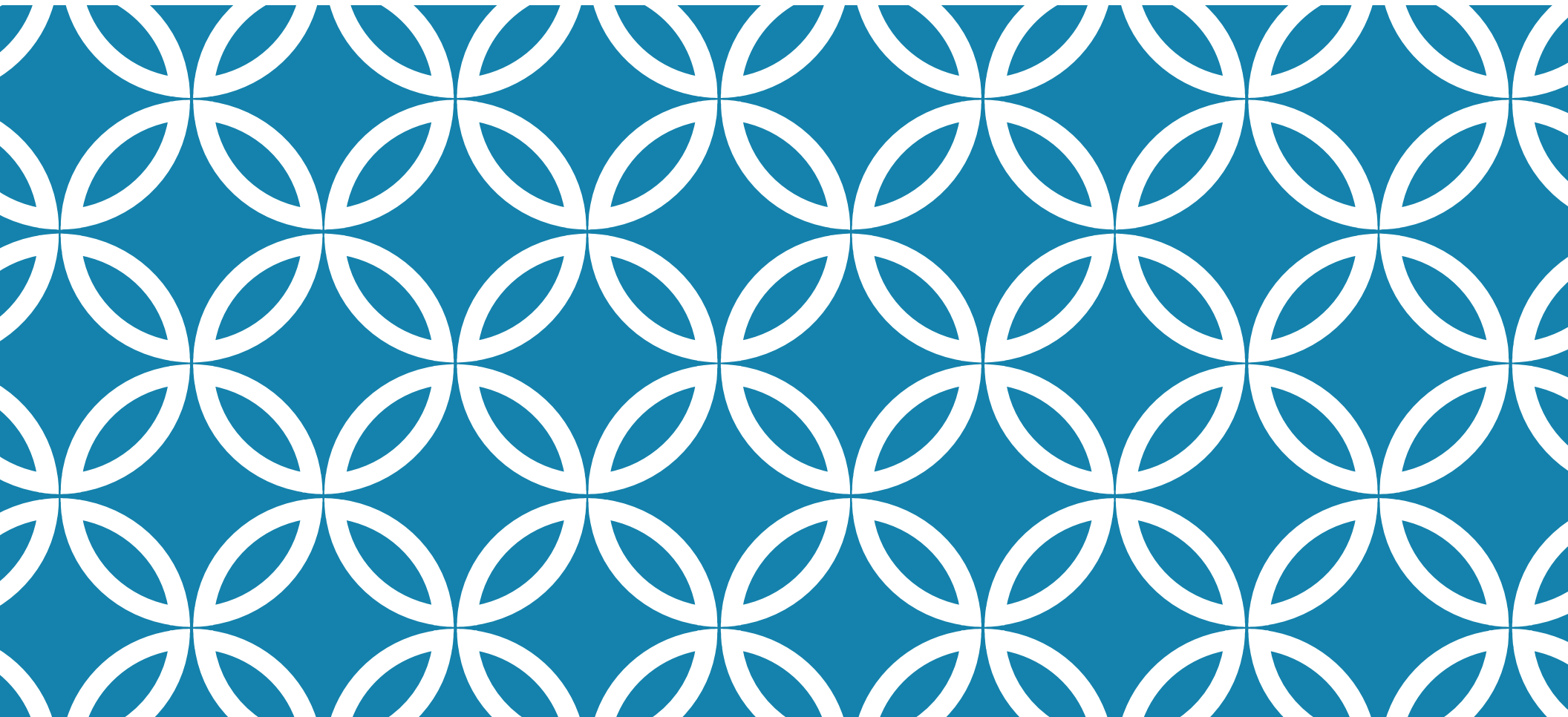


Gujarat	18,528	2,378
Maharashtra	25,576	1,346
Andhra Pradesh	11,193	1,729
Karnataka	14,367	1,002
Tamil Nadu	16,263	1,364
Bihar	5,998	311
Uttar Pradesh	23,797	571
India (National)	1,90,198	1,350

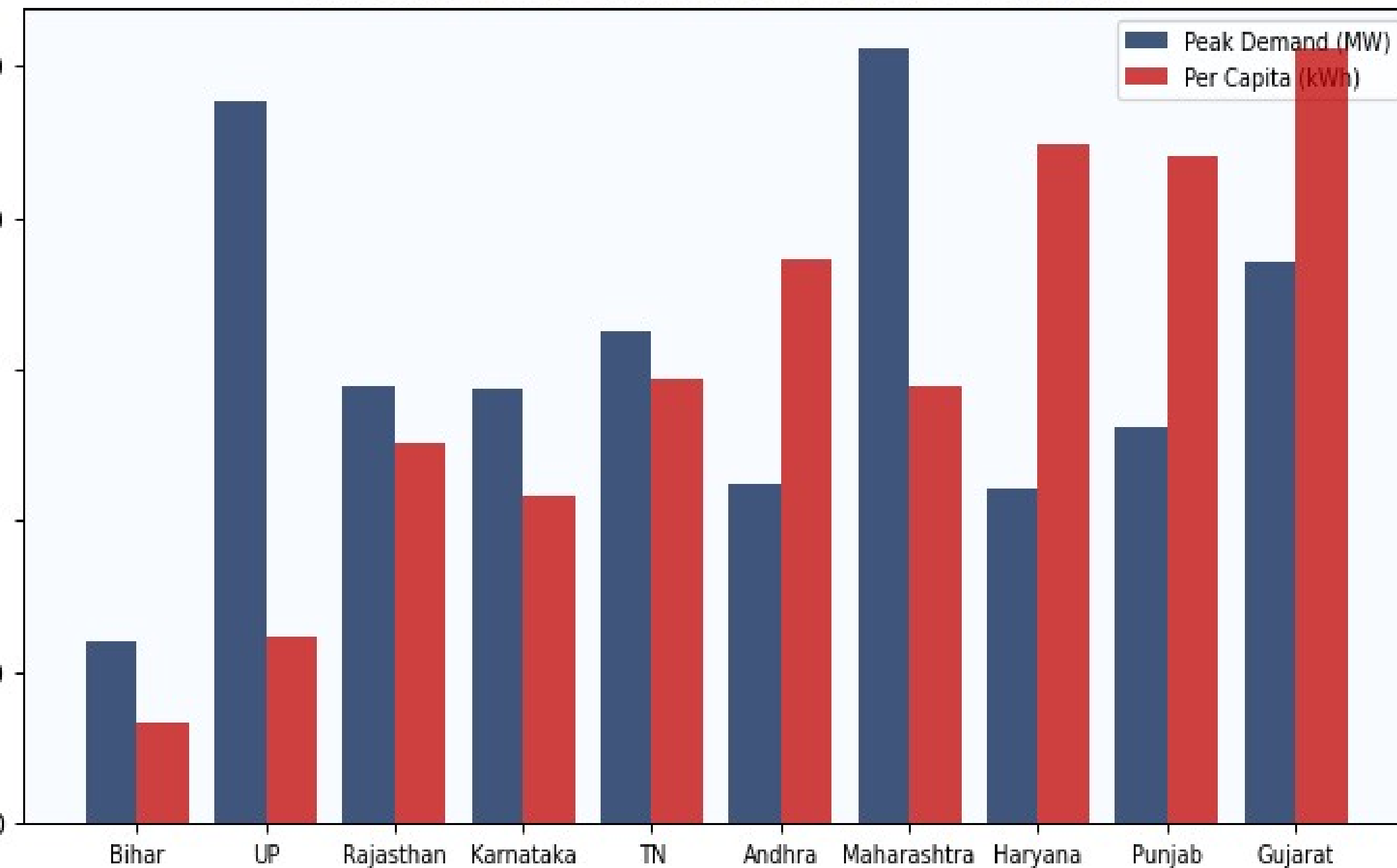
Category	Installed Cap (MW)	Energy Generated (MWh)	ATC Loss (%)	Energy Received (MWh)	Per Capita
Global Average	514,000	2,508,945,386	15.04%	2,131,600,000	1,400

TOP FOUR LEADERS

Regional Performance Analysis: Q3 2023					
Category	Installed Cap (MW)	Energy Generated (MWh)	ATC Loss (%)	Energy Received (MWh)	Per Capita (kWh/yr)
Uttar Pradesh	13,500	75,668,790	21.50%	59,400,000	45,200
Bihar	8,200	45,120,000	23.00%	34,500,000	38,500
Madhya Pradesh	38,000	217,800,000	20.00%	174,240,000	72,100
Rajasthan	15,000	81,000,000	19.00%	65,400,000	51,300
Gujarat	24,000	125,582,822	18.50%	102,350,000	1,14,500
SECTOR BENCHMARK					
National Average	18,700	102,500,000	20.50%	81,400,000	65,800
Factor (Avg)	279,000	901,898,734	5.20%	855,000,000	2,80,000



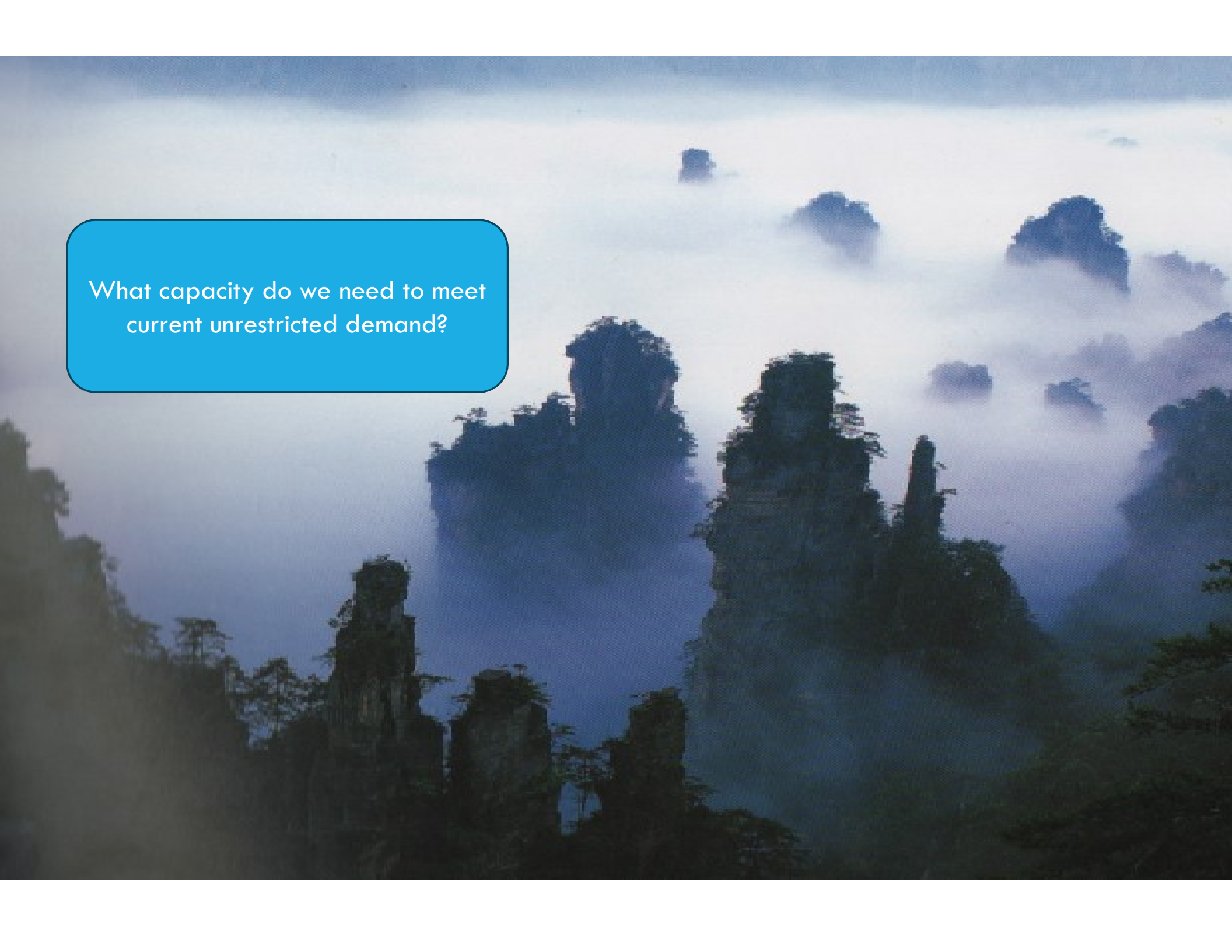
State-wise Peak Demand vs Per Capita Consumption



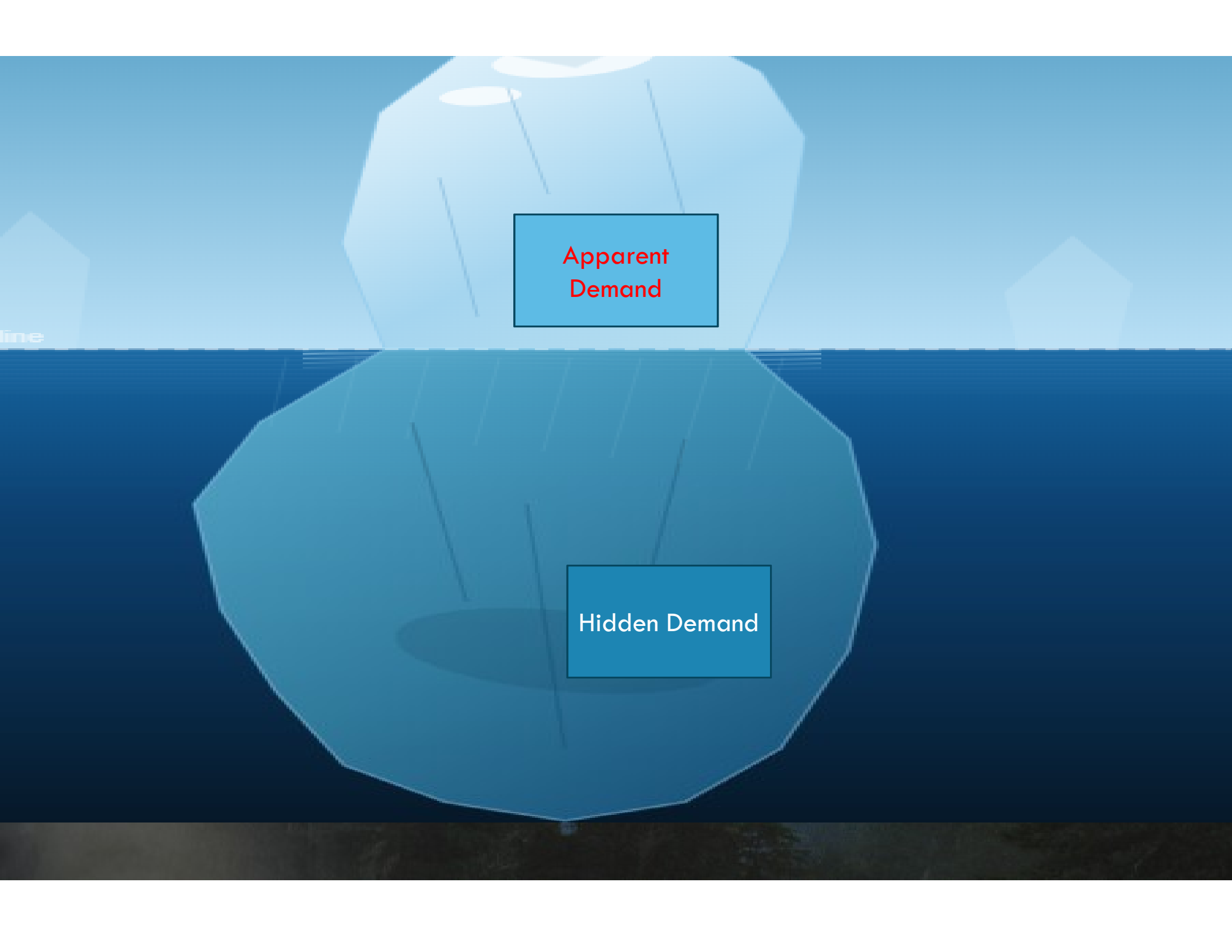
Renewable Energy Capacity and Per Capita Consumption by Country		
Country	Total Installed Capacity (MW)	Per Capita (kW/person)
Canada	140,000	3.6
United States	1,200,000	3.5
South Korea	130,000	2.5
Japan	200,000	1.6
Russia	250,000	1.7
China	3,800,000	2.0
Germany	150,000	1.8
Brazil	180,000	0.8
India	476,000	0.34

TABLE 2: Financial Performance Comparison — Key Indicators (FY 2023–24)				
Financial Metric	State DISCOMs	Private DISCOMs	Year	Remarks
Revenue (₹ billion)	10,207.7	221.9	FY2023–24	State DISCOMs serve base load
Expenditure (₹ billion)	10,430.5	210.1	FY2023–24	State sector spends more than it earns
Operating Gap (₹/kWh)	~0.52 (cash adj: 0.39)	(0.04) to (0.79)*	FY2023–24	Negative = Revenue less operating costs. State sector in deficit
Accumulated Losses/Surplus (₹ Cr)	(6,76,681) [Deficit]	Mostly Surplus	FY2022–23	State sector carries massive legacy losses
Net Worth (₹ billion)	(1,733.65) [Negative]	Positive	Mar 2024	State DISCOMs technically insolvent on paper
Debt Holdings (₹ billion)	7,526.77	Low/Managed	Mar 2024	State borrowings up to ₹6,848 bn in FY23
Collection Efficiency Rate (%)	97.91	>100	FY2023–24	State improved from 95.5 (FY23); private >100

PART 2
Where we need to be to align with
Vision 2047 ?

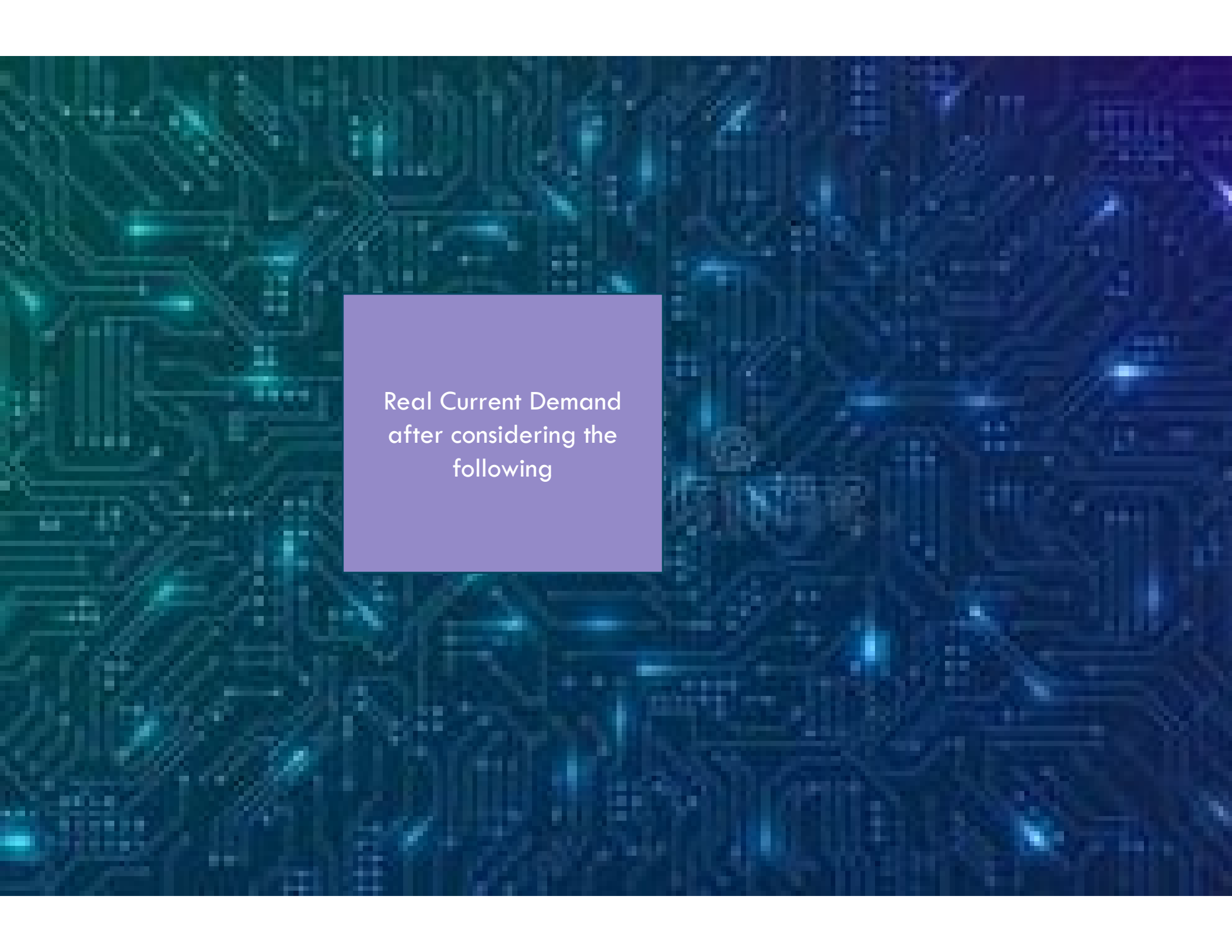


What capacity do we need to meet
current unrestricted demand?

An illustration of an iceberg floating in a dark blue ocean. The tip of the iceberg, which is above the water line, is light blue and contains a rectangular box with the text 'Apparent Demand' in red. The much larger part of the iceberg, which is submerged, is a darker blue and contains a rectangular box with the text 'Hidden Demand' in white. The background shows a horizon line and some distant, faint icebergs.

Apparent
Demand

Hidden Demand



Real Current Demand
after considering the
following

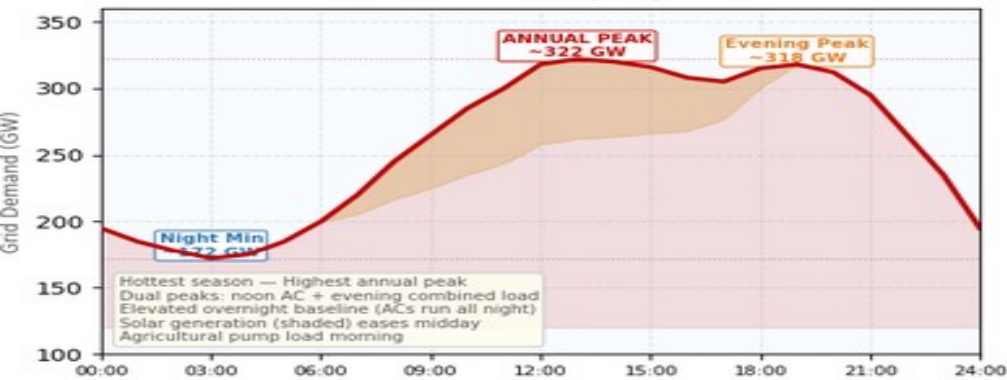
International Adequacy Standards — Comparison Table				
Country / Region	Min. Adequacy kWh/capita	Reserve Margin (%)	AT&C Loss Target (%)	Key Standard / Body
United States	10,000–13,000	15–20% (NERC)	< 6%	NERC — North American Electric Reliability Corporation
European Union	5,000–8,000	≥ 20%	< 8%	ENTSO-E — European Network of TSOs
United Kingdom	5,200	20%	< 7%	National Grid ESO adequacy standards
Japan	7,000–8,000	3–8% (seasonal)	< 4%	METI — Ministry of Economy, Trade, and Industry
South Korea	10,000–11,000	22%	< 4%	KEPCO — Korea Electric Power Corporation
India	6,000–6,500	15–20%	< 5%	NDRC — National Development Reform Commission
Australia	9,000–10,000	≥ 20% (NEM)	< 5%	AEMO — Australian Energy Market Operator
World Bank Benchmark	≥ 4,000 (upper middle)	≥ 15%	< 10%	World Bank Energy Sector Guidelines
China Target	1,460	~12% (below minimum)	15–28% (states vary)	CEA targets: <15% AT&C; <3% deficit

Reliability Metric	Definition	Developed Economy Standard	India 2047 Target
SAIDI	System Average Interruption Duration Index (hrs/customer/year)	< 1 hour/year	< 4 hours/year
SAIFI	System Average Interruption Frequency Index (events/customer/year)	< 1.5 times/year	< 3 times/year
Voltage Variation	Deviation from nominal (230V/415V)	±5%	±5%
Frequency Stability	Deviation from 50 Hz	±0.5 Hz	±0.5 Hz
Capacity Adequacy	Installed capacity ÷ peak demand	≥ 1.25 (25% reserve)	≥ 1.25
India Current	SAIDI ~70 hrs/yr (many states); frequent unscheduled load shedding; voltage outside band in rural areas	Far below standard	Requires structural transformation

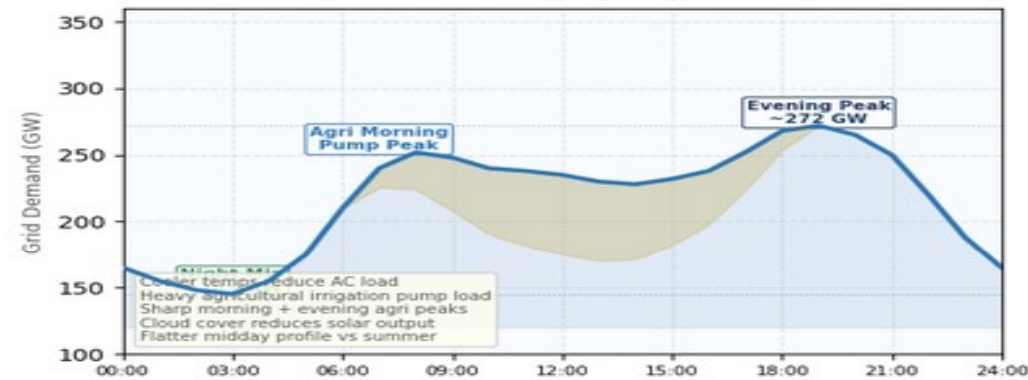
Annual all India average four season load factors

India — Typical 24-Hour Electricity Demand Curves by Season
(National Grid Level — Indicative, ~2024 Baseline ~250 GW Peak)

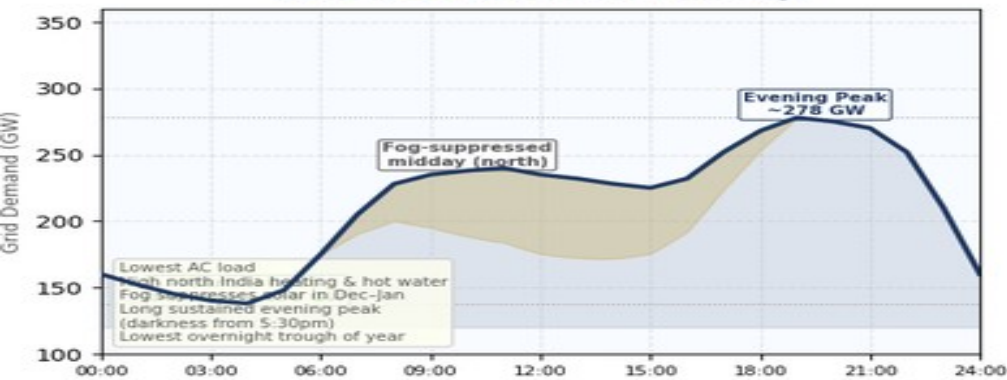
Q1: SUMMER (April-June)



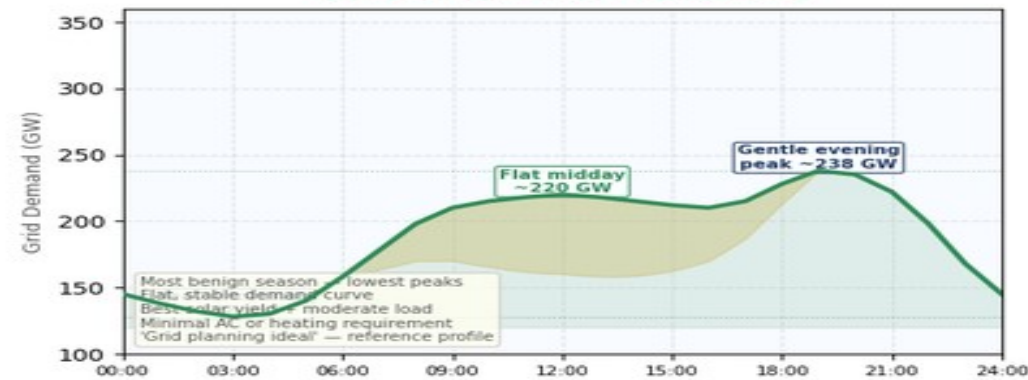
Q2: MONSOON (July-September)



Q3: WINTER (November-February)



Q4: SPRING/AUTUMN (Mar, Oct)



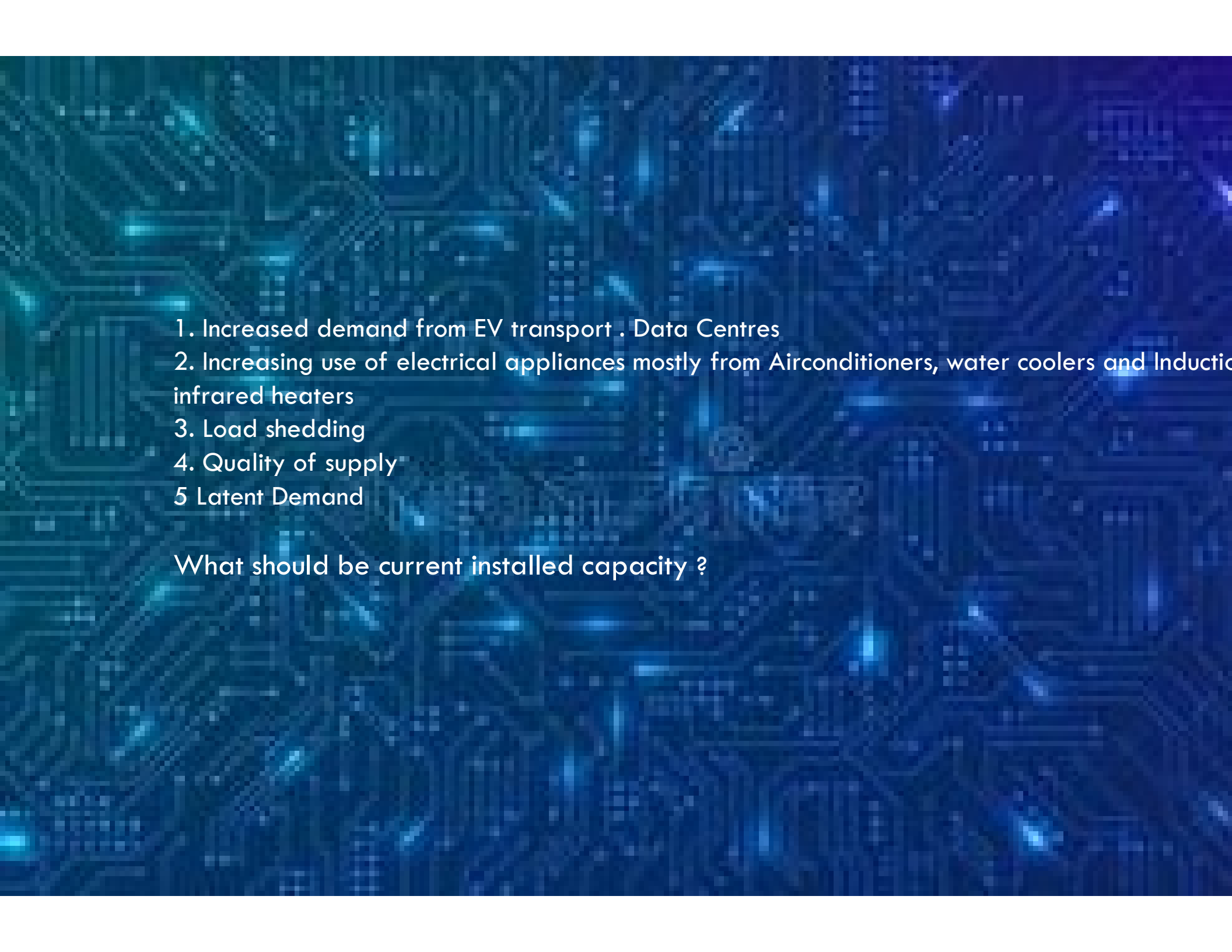
Highest peak, AC-dominated

Monsoon — Agricultural pump-driven

Winter — Heating + long evening peak

Spring/Autumn — Flattest, most benign

Solar contribution

- 
1. Increased demand from EV transport . Data Centres
 2. Increasing use of electrical appliances mostly from Airconditioners, water coolers and Induction infrared heaters
 3. Load shedding
 4. Quality of supply
 - 5 Latent Demand

What should be current installed capacity ?

INSTALLED CAPACITY REQUIRED TO MEET CURRENT DEMAND 913 GW

Parameter	Value	
Per capita consumption	2450 KWh/person/ year	
Average Demand factor	0.65	
Population (India_)	141 crore	
Auxiliary consumption	5%	
AT and C losses	6%	
Reserve capacity	33%	
Coal, Gas, Nuclear	Base stations , not to be backed down	
Remarks	Meeting Adequacy Standards Renewables with storage support	

Global Energy Demand	3,454.5 TWh
Generation Required	3,910 TWh
Power Demand	446.35 GW
Installed Capacity (0.65 LF)	686.69 GW
Available Capacity (incl. Reserves)	913 GW

Projected Installed Capacity by 2047

Year	Installed Capacity (GW)
2030	1100
2035	1700
2040	2500
2047	4000

Proposed Mix

Conventional : Coal : Reducing percentage, but still the base

Nuclear: Increasing contribution to reduce coal

Gas

Hydro (large, small , micro)

EMERGING TECHNOLOGIES WITH LEAD TIME

Solar with storage 2 years

Wind with storage 2 years

Wind plus solar with storage 2 years

Small Modular Nuclear Reactors 5 year

CAPEX — What it actually costs to build

Individual components (India, 2025–26):

Component	Capex
Utility solar (DC)	₹3.0–3.5 crore/MW
Onshore wind	₹6.5–7.5 crore/MW
BESS (LFP, 2-hr)	₹1.00–1.25 crore/MWh
BESS (LFP, 4-hr)	₹0.90–1.10 crore/MWh
Pumped hydro storage	₹6–8 crore/MW (site-dependent)

Summary of battery technology status

Duration	Technology
1–4 hours	LFP (dominant today)
4–12 hours	Sodium-Ion, Zinc-Bromine
12–100+ hours	Iron-Air, Vanadium Flow
Seasonal	Hydrogen (Green H ₂)

Iron-Air most promising

TARIFF (LCOE) — What has actually been discovered in auctions

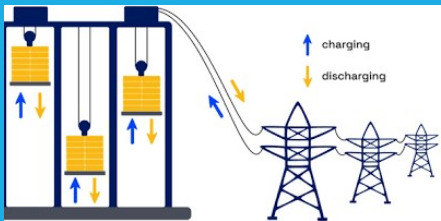
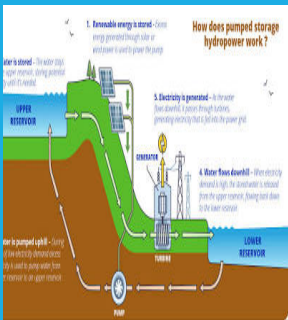
Configuration	Tariff (₹/kWh)	Notes
Plain solar	₹2.20–2.50	Current auction range
Plain wind	₹2.80–3.20	Current auction range
Wind-solar hybrid	₹2.67–3.00	SECI Tranche I & II
FDRE / RTC (80% CUF)	₹4.76–4.91	SJVN, SECI tenders 2024–25
FDRE Peak-Specific (evening hours)	₹6.27–6.74	SECI FDRE VII, SJVN peak tender
Standalone BESS (4 hr/day)	₹0.36 lakh/MW/month	July 2025 discovery

FDRE at discovered tariffs between ₹4.76 and ₹4.77/kWh is already cheaper than the average power procurement cost in 2024–25 of ₹5.38/kWh, and cheaper than new thermal.

The most recent SECI FDRE-VII peak power tender (4 hours assured supply/day) concluded at ₹6.28/kWh — ACME Solar won 301 MW at this tariff, delivering 1,204 MWh of assured peak power daily.

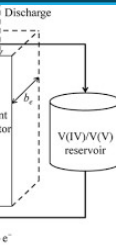


Pimped Storage



Gravity Storage

Modular Nuclear
or(300MW)

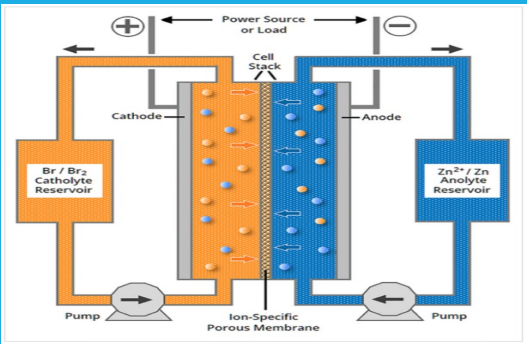


Sodium Ion Battery



Iron Air Battery

Bromide Battery



Lithium Phosphate
Battery

[15.1V]

Battery Voltage
[11.1V]

Battery
Capacity

Discharge R.
[25C]



THANKS FOR
YOUR PATIENCE