

WORLD STANDARDS DAY • 14 OCTOBER 2026

Shared Vision for a Better World

Spotlight on SDG 7 — Affordable and Clean Energy

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How standards enable safe, efficient, connected and sustainable energy systems

A practical perspective for India and Uttar Pradesh's power sector

SAFETY

INTEROPERABILITY

SUSTAINABILITY

Why World Standards Day matters

- Observed on 14 October to recognise the work of standards developers and the value of consensus-based standards.

- The 2026 theme links standards to SDG 7: Affordable and Clean Energy.

It is the 7th of the 17 Sustainable Development Goals (SDGs) adopted by the United Nations.

- **Main objective**

To ensure access to affordable, reliable, sustainable and modern energy for all.

The major components are:

1) Universal energy access – electricity and modern energy services for everyone.

2) Renewable energy – increasing the share of solar, wind, hydro, biomass, etc.

3) Energy efficiency – obtaining more output with less energy.

4) Clean-energy transition – reducing dependence on coal, oil and gas.

5) Affordable energy – keeping energy affordable for consumers and industry.

6) International cooperation – promoting clean-energy technology and investment.

The central message

OPENING

Clean and reliable energy is more than electricity.

PEOPLE

Energy keeps communities connected and supports healthcare, education, livelihoods and digital services.

SYSTEMS

Standards help make generation, grids, storage and end-use equipment safe, efficient and interoperable.

PLANET

Efficiency and clean energy reduce resource waste and support a lower-emissions future.

Standards translate SDG 7 ambition into repeatable technical practices and solutions that can scale.

UP SDG-7 Roadmap

Indicator	2025/26 approximate	2030 direction	2047 indicative requirement
Peak power demand	~31–34 GW	~42–48 GW	~85 GW
Annual electricity requirement	~175–180 BU	~240–250 BU	~450–500 BU
Renewable capacity	Rapidly increasing	Major expansion	Very large renewable base
Electricity access	Nearly universal	100% reliable access	100%
Energy efficiency	Needs improvement	Faster improvement	Highly efficient economy
Transmission	Expansion required	Major expansion	Strong 765/400/220-kV grid
Storage	Early stage	Major requirement	Large-scale BESS + pumped storage

UP Electricity Demand: 2025–2047

Year	Peak Demand	Annual Energy Requirement
2025-26	~31 GW	~180 BU
2030-31	~42 GW	~242 BU
2031-32	~44 GW	~254 BU
2040-41	~64 GW	~355 BU
2047-48	~83–90 GW	~450–500 BU

SDG 7: affordable and clean energy for all

UN SUSTAINABLE DEVELOPMENT GOALS

Ensure access to affordable, reliable, sustainable and modern energy for all.

7.1 ACCESS

Universal access to affordable, reliable and modern energy services.

7.2 RENEWABLES

Increase the share of renewable energy in the energy mix.

7.3 EFFICIENCY

Double the global rate of improvement in energy efficiency.

7.a COOPERATION

Expand clean-energy research, technology and investment.

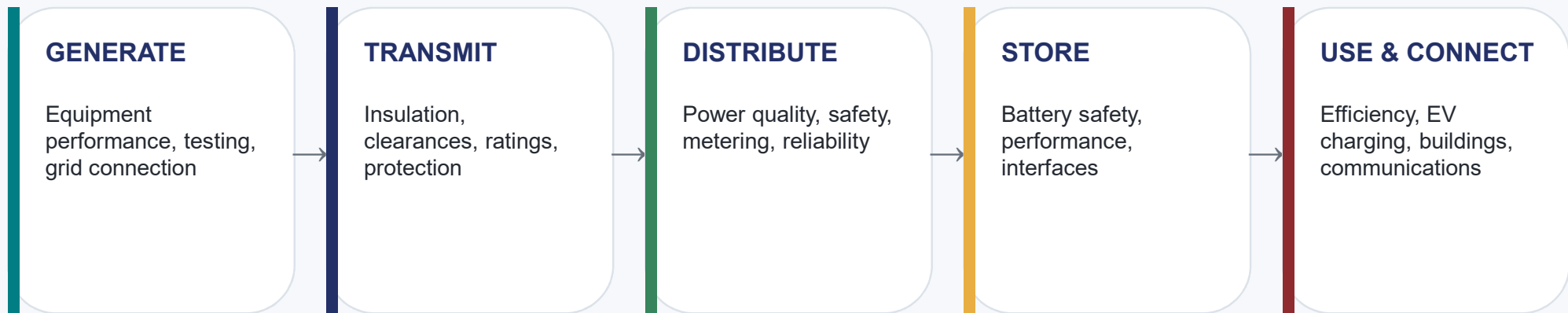
7.b INFRASTRUCTURE

Upgrade infrastructure and technology for sustainable energy services.

Source: United Nations SDG 7 targets and indicators.

Where standards make a difference

STANDARDS VALUE CHAIN



A standards-based interface reduces ambiguity between equipment, systems and organisations.

Standards, regulations and conformity assessment

HOW THE SYSTEM WORKS

STANDARD

Defines agreed technical requirements, methods, terminology or performance criteria.

REGULATION / CODE

Sets legally or contractually applicable obligations for a jurisdiction or project.

CONFORMITY ASSESSMENT

Testing, inspection, certification or verification checks whether requirements are met.

Use the current applicable edition, amendments and utility / CEA / CERC / state requirements. A standard number alone does not prove compliance.

India's standards ecosystem

INSTITUTIONS

BIS

Develops Indian Standards and aligns many standards with international IEC / ISO work.

CEA / CERC / CEA SAFETY RULES

Technical regulations, planning criteria, grid codes and safety requirements (as applicable).

IEC / ISO / IEEE

International standards and technical guidance supporting global consistency and interoperability.

Practical rule: verify the exact standard title, edition, amendments, scope and applicability before using it in a specification or inspection checklist.

Sources: BIS standards portal; BIS Electrotechnical Department; ISO/IEC World Standards Day.

Standards across clean-energy generation

GENERATION

- Solar PV: module qualification, array design, inverter performance, earthing and protection.
- Wind: turbine performance, structural and electrical safety, grid connection and power quality.
- Hydro and pumped storage: rotating equipment, electrical auxiliaries, protection and operational safety.
- Hybrid plants: coordinated control, forecasting, ramping and dispatch interfaces.
- Distributed generation: safe islanding / anti-islanding and clear utility interconnection requirements.

EXAMPLE: PV ARRAY

IS/IEC 62548-1:2023 covers PV array design requirements in the Indian standards catalogue.

WHY IT MATTERS

Consistent design and testing reduce avoidable failures and improve system confidence.

REMEMBER

Use current BIS catalogue and project specifications to confirm applicable editions.

Source: BIS standards catalogue; standard applicability should be verified for each project.

Standards across the transmission grid

TRANSMISSION

- Insulation coordination, clearances, earthing and lightning protection.
- Transformer, circuit breaker, CT / VT, surge arrester and insulator ratings and tests.
- Protection, control, interlocking and dependable fault clearance.
- Substation design, operation, maintenance and personnel safety.
- Power quality, thermal limits, stability, system studies and grid-code compliance.

765 kV

Inter-regional / backbone

400 kV

Bulk transfer

220 kV

Regional network

**132 / 33
kV**

Sub-transmission /
distribution interface

Voltage hierarchy is illustrative; actual network architecture and applicable requirements depend on system studies.

Substations and transformers: standardisation in practice

ASSET RELIABILITY

DESIGN

Ratings, impedance, vector group, insulation, temperature rise and short-circuit withstand.

FACTORY / SITE TESTS

Routine, type and special tests; commissioning checks; documented acceptance criteria.

LIFECYCLE

Oil diagnostics, DGA, furan, SFRA, thermography, bushing monitoring and maintenance history.

For EHV assets, standards should be used with approved drawings, OEM manuals, protection philosophy, operating procedures and site-specific risk assessment.

Field takeaway: a test result is meaningful only when test method, instrument, conditions, limits and acceptance criteria are recorded.

Safety and reliability are non-negotiable

PEOPLE AND EQUIPMENT

- Electrical safety: isolation, earthing, safe clearances, interlocks, PPE and permit-to-work discipline.
- Protection coordination: selective and fast fault clearance with validated settings and end-to-end checks.
- Equipment safety: verified ratings, dielectric performance, mechanical integrity and correct installation.
- Operational safety: approved switching procedures, emergency response and incident learning.
- Cyber and physical security: controlled access, segmentation, backups and change management for digital substations.

Use the latest applicable CEA safety regulations, utility procedures, OEM instructions and site risk controls.

Digital energy: standards connect power and data

INTEROPERABILITY

IEC 61850

Communication networks and systems for power utility automation; supports interoperable substation automation when engineered and tested correctly.

IEC 61968 / 61970

Common information model and interfaces supporting distribution / transmission applications and enterprise integration.

CYBERSECURITY

Security controls, access management, network design, logging, recovery and disciplined patching.

Why it matters: common data models and communication profiles reduce vendor lock-in, integration friction and avoidable operational risk.

Storage and flexibility: enabling more clean power

STORAGE

- Battery energy storage can shift energy, support peak demand and provide fast response.
- Pumped storage can provide longer-duration flexibility subject to site and water constraints.
- Grid-forming / grid-following controls, protection and inverter settings need system-level validation.
- Safety requirements include battery chemistry risks, fire detection, ventilation, emergency isolation and response.
- Planning must specify both power (MW) and energy (MWh), duration, efficiency and degradation assumptions.

POWER ≠ ENERGY

25 GW × 4 hours = 100 GWh of nominal storage energy.

SYSTEM VALUE

Storage is most useful when location, dispatch, duration and network constraints are modelled.

SAFETY FIRST

Apply current standards, fire codes and approved design / operating procedures.

Therefore, for the 2047 scenario:

BESS: 20–25 GW / 80–120 GWh

could be considered as an indicative planning envelope.

For example:

25 GW × 4 hours = 100 GWh

This could help meet evening peak demand.

Pumped-hydro storage would provide an additional source of long-duration storage.

Energy efficiency: the often-overlooked clean-energy resource

EFFICIENCY

SUPPLY SIDE

Reduce technical losses, optimise transformer loading, maintain connections and improve voltage / reactive power management.

DEMAND SIDE

Efficient motors, pumps, cooling, lighting, appliances and building systems reduce energy needed for the same service.

MEASURE & VERIFY

Use metering, baselines, energy audits and transparent performance indicators to verify savings.

The cleanest unit of energy is often the unit that does not need to be generated—provided the same service is delivered.

Reliability and affordability must move together

PUBLIC VALUE

- Reliability: track SAIDI / SAIFI where applicable, outage duration, peak adequacy and restoration performance.
- Affordability: consider lifecycle cost, losses, fuel-price exposure, financing and consumer impact—not only lowest upfront price.
- Quality: measure voltage, frequency, power quality, metering accuracy and complaint resolution.
- Equity: focus on remote communities, low-income households, public services and clean cooking access.
- Transparency: publish consistent definitions and data so progress can be compared over time.

SDG 7 progress: the global challenge remains urgent

GLOBAL CONTEXT

92%

Share of global population with electricity access in 2024.

655 million

People estimated to remain without electricity in 2024.

75%

Global population with access to clean cooking in 2024.

The message is not that progress has stopped; it is that progress must accelerate and reach people and regions still being left behind.

Standards can help scale reliable solutions, but access also depends on investment, affordability, infrastructure and delivery.

Source: UN Sustainable Development Goal 7 page / Sustainable Development Goals Report 2026.

India and Uttar Pradesh: translating SDG 7 into delivery

REGIONAL APPLICATION

INDIA

Large and diverse power system: generation expansion, inter-state transfer, renewable integration, storage and efficiency must advance together.

UTTAR PRADESH

Growing demand from urbanisation, industry, agriculture, cooling, transport electrification and digital infrastructure.

STANDARDS ROLE

Common specifications and acceptance tests help improve asset quality, safety, maintainability and interoperability.

Planning must be based on CEA forecasts, state resource plans, load-flow / stability studies, renewable resource quality, land, costs and reliability criteria.

CEA publishes monthly installed-capacity and power-supply reports; use latest official datasets for current baselines.

Uttar Pradesh: Projected Per Capita Electricity Consumption and Peak Power Demand (2030–2047)

- 1. **Per Capita Electricity Consumption**

Uttar Pradesh's current per capita electricity consumption is approximately 660-750 kWh per person per year (2025–26).

Assuming continued economic growth, industrialization, urbanization, rising household incomes, and improved electricity access, the following projections are reasonable:

Year	Estimated Per Capita Consumption (kWh/person/year)
2026	660-750
2030	1,200 – 1,500
2040	2,000 – 2,800
2047	3,000 – 4,000

Uttar Pradesh: Projected Per Capita Electricity Consumption and Peak Power Demand (2030–2047)

- Uttar Pradesh's total electricity consumption reached about 162.9 billion units (BU) in FY 2025–26, more than double the level of 2012–13.
- At an average of 3,500 kWh per capita by 2047 and a population of around 30 crore, Uttar Pradesh would require roughly 1,050 BU/year of electricity, with peak demand likely in the 130–150 GW range.

Achieving this demand would require massive investments in generation, transmission, energy storage, smart grids, renewable energy integration, and flexible thermal capacity.

Uttar Pradesh: Projected Per Capita Electricity Consumption and Peak Power Demand (2030–2047)

- **Impact of Data Centers**

If Uttar Pradesh develops 3–5 GW of data center capacity by 2047:

Annual electricity consumption: approximately 25–40 BU

Contribution to total state electricity demand: 4–6%

Major data center hubs are likely to be:

- (i) Noida (ii) Greater Noida,
- (iii) Lucknow (iv) Kanpur

Peak Power Demand in UP

STU Plan (FY 2026-27 to FY 2030-31 based on a 6% CAGR from the actual demand of FY 2025-26 (i.e. 31,486 MW)

FY	2025-26	2026-27	2027-28	2028-29	2029-30	Up to 2035-36	Upto 2046-47
Peak Demand of UP Discoms. (MW)	31,486	33,300	35,200	37,200	39,300	56,400	132000
Power Demand(MW) of IMLC & Awas Vikas LDA	-	-	389	1809	661	1600	3000
Peak Power Demand (MW)	31,486	33,300	35,589	39,009	39,961	58000	135000

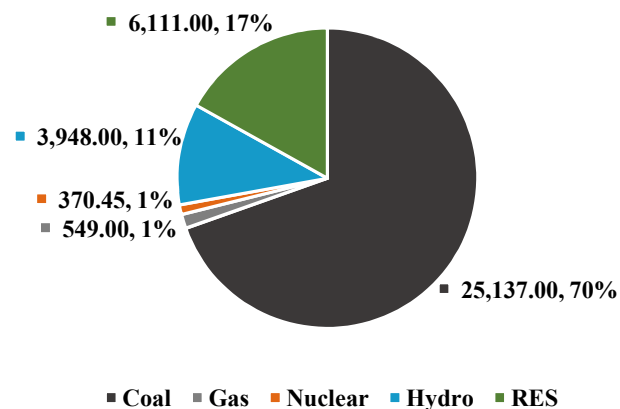
- Peak load of FY 2025-26 is 31,486 MW.

Existing Generation Capacity of U.P.

- The overall Commissioned generating capacity in the state of Uttar Pradesh as on March, 2026 is 36,116 MW.

Resource	Commissioned generating capacity (MW)
Coal	25,137
Gas	549
Nuclear	370
Hydro	3,948
RES	6,111
Total	36,116

Installed Generating Capacity (MW)



Present Contracted/commissioned Capacity of U.P.(in MW)

Source	Thermal	Wind	Hydro	Solar	Bagasse/ Biomass/ Slop/MSW	BESS (NVVN)	Nuclear	Gas	Total
Contracted capacity (MW)	30651.78 (53.39%)	6345.27 (11.05%)	5259.82 (9.16%)	12389.1 (21.58%)	1512.31 (2.63%)	250 (0.44)	451.44 (0.79%)	548.63 (0.96%)	57,408.35
Commissioned capacity (MW)	25136.96 (69.60%)	1676.40 (4.64%)	3948.32 (10.93%)	2936.70 (8.13%)	1498.31 (4.15%)	0 (0%)	370.46 (1.03%)	548.63 (1.52%)	36,115.78

Note-

Solar Contracted Capacity breakup:- 8094.00 (Pure Solar) + 1673.30 (KUSUM C2 Ph-II) + 34.8 (KUSUM C2 Ph-I)
+ 1 (KUSUM- A) + 2406 (FDRE) + 180 (Hybrid) = **12389.1 MW**

Wind Contracted Capacity breakup: - 4621.27 (Pure Wind) + 1604 (FDRE) + 120 (Hybrid)= **6345.27 MW**

FDRE Contracted Capacity (4010 MW) :-

- Solar category considered: 2406 MW (60% of FDRE Contracted Capacity)
- Wind category considered: 1604 MW (40% of FDRE Contracted Capacity)

Wind-Solar Hybrid Contracted Capacity 300 MW:-

- Solar category considered: 180 MW (60% of Wind-Solar Hybrid Contracted Capacity)
- Wind category considered: 120 MW (40% of Wind-Solar Hybrid Contracted Capacity)

Summary of Future Capacity addition (FY 2026-27 to 2035-36 & projected upto 2047)

Sl. No.	Source	Quantum (MW)	Firm Name	Capacity (MW)	PPA Signed Date	Projected upto 2047
1	Solar	5140	NHPC	1525	07.03.2024	40-50 GW
			SECI	1500	1000 MW PPA date 28.12.2023 500 MW PPA date 07.02.2024	
			Adani Renewable Energy holding	400	03.05.2025	
			ReNew Solar Pvt. Ltd	300	06.05.2025	
			NTPC	1000	04.06.2025	
			MB Power Ltd	300	16.07.2025	
			Kanpur Solar Park	110	16.01.2026	

Summary of Future Capacity addition (FY 2026-27 to 2035-36 & projected upto 2047)

Sl. No.	Source	Quantum (MW)	Firm Name	Capacity (MW)	PPA Signed Date	Projected upto 2047
2	Wind	1775	SECI (Tranche-XIV)	1175	30.05.2024	6-8 GW
			SECI (Tranche-XIX)	600	30.03.2026	
3	FDRE	4010	NHPC	1280	27.11.2024	20-22 GW
			SJVN	1200	20.02.2025	
			NTPC	1530	11.04.2025	
4	Wind-Solar Hybrid	300	Wind-Solar Hybrid	300	21.06.2025	3-5 GW

Summary of Future Capacity addition (FY 2026-27 to 2035-36 & projected upto 2047)

Sl. No.	Source	Quantum (MW)	Capacity (MW)	PPA Signed Date	Projected upto 2047
5	Hydro	7500	4000 MW under bidding		10-12 GW
			742 MW PPA, out of 5600 MW installed capacity of Central Hydro Plants, signed. Plant wise Capacity allocated is as below:-		
			a. Kiru HEP– 84 MW	29.07.2024	
			b. Dibang HEP– 385 MW	29.07.2024	
			c. Sawalkot HEP– 241 MW	29.07.2024	
			d. Uri-I Stage-II– 51 MW	29.07.2024	
			e. 456 MW PPA, from 1200 MW of Kalai HEP, signed. (Allocation Awaited)		

Summary of Future Capacity addition (FY 2026-27 to 2035-36 & projected upto 2047)

Sl. No.	Source	Quantum (MW)	Capacity (MW)	PPA Signed Date	Projected upto 2047
6	Pump Storage Plant	5250	· 2750 MW PPA signed.	23.04.2025	18 GW
				30.04.2025	
			· 2500 MW – Under process.		
7	Thermal	10600	· 3200 MW MoU signed.		15 GW
			· 1800 MW PPA signed.	07.12.2024	
			· 1600 MW Bid process is completed and PPA is signed on 16.05.2025	16.05.2025	
			· 4000 MW Tender has been uploaded.		

Summary of Future Capacity addition (FY 2026-27 to 2035-36 & projected upto 2047)

Sl. No.	Source	Quantum (MW)	Capacity (MW)	Projected upto 2047
8	Source Agnostic	5000	1000 MW – Bidding under process. (Medium term)	15-18 GW
			· 2000 MW – Bidding under process. (Long term)	
			· 2000 MW – Bidding under process (Long term)	
9	BESS	625 MW/2500 MWh	· PPA signed for the procurement of 375 MW/1500 MWh of Battery Energy Storage System (BESS) to M/s SJVN Ltd. on dated 15.07.2025.	5 GW /20 GWh
			· PPA signed for procurement of 250 MW/1000 MWh to NVVN.	
10	Kusum C2 Phase – II	1673.30 MW	PPA signed.	
Total		41873.3 MW		135-150 GW

Summary of Cumulative Transmission Substation up-to FY 2046-47

FY	132 kV	220 kV	400 kV	765 kV	Total YoY
Upto 2025-26	489	172	44	7	712
Upto 2035-36	625	267	76	15	983
Upto 2046-47	749	344	99	26	1218

Summary of Year on Year Planned Transmission Network Up-to FY 2028-29

FY	Particulars	132 kV	220 kV	400 kV	765 kV	Total YoY	Cumulative
2025-26	No. of Substation	11	10	5	0	26	712
	Capacity (MVA)	1,781	3,000	5,185	0	9,966	2,09,313
	Line Length (Ckt. Km)	659.73	822.12	33.70	575.00	2,090.55	62,160.36
2026-27	No. of Substation	6	8	2	1	17	729
	Capacity (MVA)	8,771	6,360	6,130	1,500	22,761	2,32,074
	Line Length (Ckt. Km)	1,925.02	960.28	760.40	37.00	3,682.70	65,843.06
2027-28	No. of Substation	23	13	2	0	38	767
	Capacity (MVA)	5,305	5,900	2,760	0	13,965	2,46,039
	Line Length (Ckt. Km)	1,889.66	1,185.77	380.00	0.00	3,455.43	69,298.49
2028-29	No. of Substation	11	23	4	0	38	805
	Capacity (MVA)	2,027	8,400	4,000	0	14,427	2,60,466
	Line Length (Ckt. Km)	120.00	1,099.00	234.00	0.00	1,453.00	70,751.49

Summary of Year on Year Planned Transmission Network Up-to FY 2031-36

FY	Particulars	132 kV	220 kV	400 kV	765 kV	Total YoY	Cumulative
2029-30	No. of Substation	9	11	9	3	32	837
	Capacity (MVA)	3,244	5,520	9,000	9,000	26,764	2,87,230
	Line Length (Ckt. Km)	303.00	1,047.00	1,186.00	932.00	3,468.00	74,219.49
2030-31	No. of Substation	6	8	4	0	18	855
	Capacity (MVA)	1,086	2,740	4,000	0	7,826	2,95,056
	Line Length (Ckt. Km)	198.00	650.00	410.00	0.00	1,258.00	75,477.49
2031-36	No. of Substation	81	32	11	4	128	983
	Capacity (MVA)	6,480	10,240	14,520	16,000	47,240	3,42,296
	Line Length (Ckt. Km)	4,860	2,560	1,760	1,600	10,780	86,257

Summary of Year on Year Planned Transmission Network Up-to FY 2046-47

FY	Particulars	132 kV	220 kV	400 kV	765 kV	Total YoY	Cumulative
2036-41	No. of Substation	54	40	11	5	110	1093
	Capacity (MVA)	4320	12800	14520	20000	51640	393936
	Line Length (Ckt. Km)	3240	3200	1760	2000	10200	96457
2041-47	No. of Substation	70	37	12	6	125	1218
	Capacity (MVA)	5600	11840	15840	24000	57280	451216
	Line Length (Ckt. Km)	4200	2960	1920	2400	11480	107937

Uttar Pradesh 2047: an illustrative planning scenario

FORWARD-LOOKING CASE STUDY

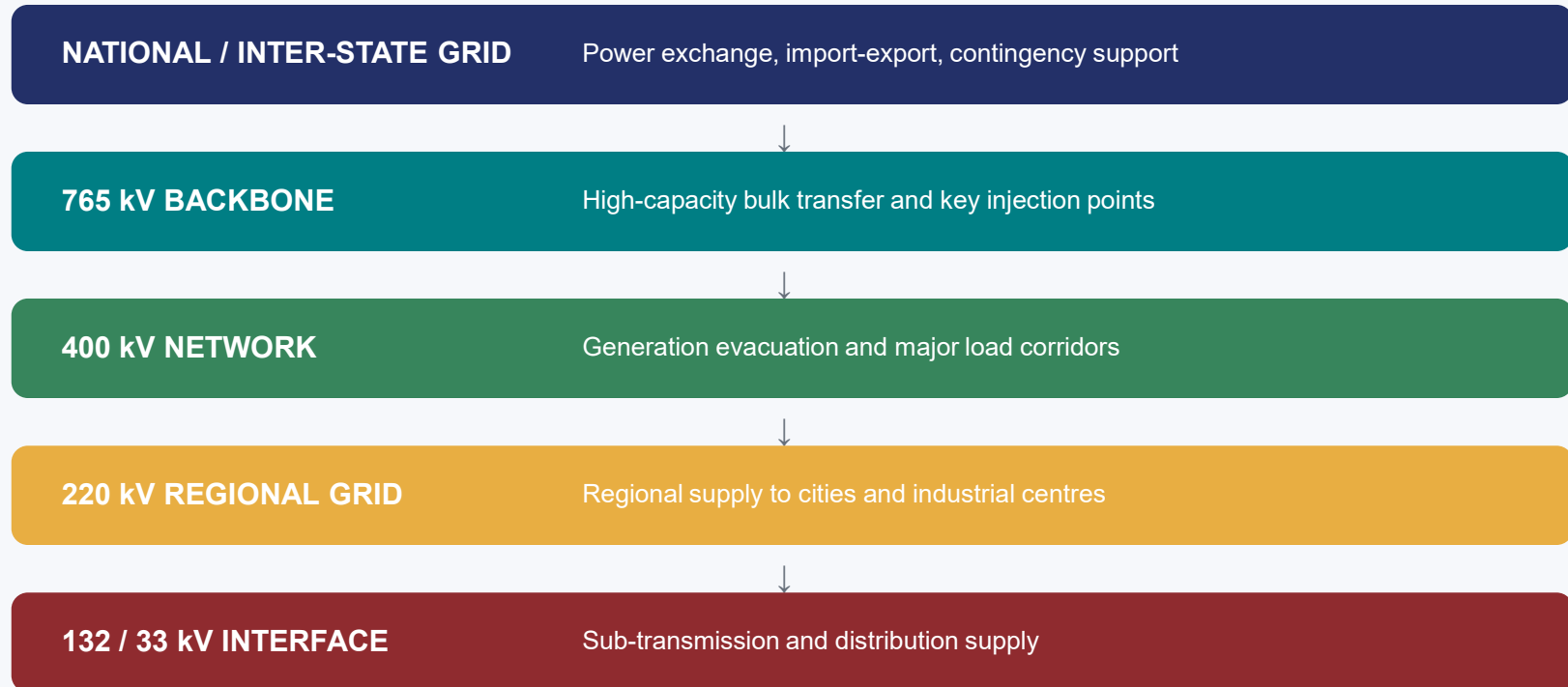
Scenario values for discussion—not official targets or a substitute for CEA / state planning studies.

Peak demand	~83–90 GW	Scenario range
Annual electricity requirement	~450–500 BU	Scenario range
Solar capacity	~50–70 GW	Illustrative
BESS	~20–25 GW / 80–120 GWh	Illustrative
Transmission	765 / 400 / 220 / 132–33 kV	Indicative hierarchy

Priorities: demand forecasting • grid reinforcement • storage • clean procurement • loss reduction • operational capability

A conceptual future grid for Uttar Pradesh

TRANSMISSION ARCHITECTURE



Conceptual hierarchy only; the actual network must follow approved planning and system studies.

What engineers can do now

FROM STANDARDS TO PRACTICE

- Maintain a controlled register of applicable standards, editions, amendments and utility instructions.
- Link each equipment specification to factory tests, site acceptance tests and commissioning records.
- Use calibrated instruments and record environmental conditions, test configuration and acceptance limits.
- Close the loop: trend condition-monitoring data, analyse failures and update maintenance plans.
- Validate relay settings, interlocks, communication mappings and end-to-end operation after modifications.
- Capture lessons from outages and near misses; update procedures and train field teams.
- Treat cybersecurity, documentation and configuration backups as part of asset reliability.

A practical roadmap: standards into measurable outcomes

IMPLEMENTATION

0–3 MONTHS

Baseline

Inventory standards, critical assets, test records and major compliance gaps.

3–12 MONTHS

Standardise

Harmonise specifications, test formats, inspection checklists and data fields.

1–3 YEARS

Digitise

Connect asset registers, condition monitoring, outage analytics and work management.

CONTINUOUS

Improve

Audit results, train people, learn from incidents and revise practices as standards evolve.

Measure outcomes: safety incidents • outage performance • technical losses • asset failures • renewable curtailment • consumer affordability

Key takeaways

CLOSING

- SDG 7 is about affordable, reliable, sustainable and modern energy—not just installed capacity.
- Standards create a shared technical language across the energy and digital ecosystems.
- Safety, interoperability, efficiency and lifecycle reliability are where standards deliver practical value.
- For India and Uttar Pradesh, clean generation must be matched by strong grids, storage, efficient use and capable operations.
- The best standard is one that is current, applicable, understood, implemented and verified.

Shared vision. Common standards. Reliable energy. Better lives.

References and further reading

SOURCES

ISO / IEC — World Standards Day 2026 campaign

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United Nations — Goal 7: Affordable and Clean Energy

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BIS — Electrotechnical Department scope and committees

<https://standards.bis.gov.in/website/technical-departments/department-details>

Central Electricity Authority — Installed Capacity Reports

<https://cea.nic.in/installed-capacity-report/?lang=en>

Central Electricity Authority — Power Supply Reports

<https://cea.nic.in/power-supply/?lang=en>

National Power Portal — published power-sector reports

<https://npp.gov.in/publishedReports?ftag=YHF4eb9d17>

Note: Standard numbers and scenario estimates in this deck are illustrative. Confirm current editions and official planning data before operational or investment decisions.



Thank You

Let standards turn clean-energy ambition into reliable everyday service.

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Affordable energy | Safe systems | Clean power | Shared progress