SUPREME AUDIT INSTITUTION OF INDIA
लोकहितार्थ सत्यनिष्ठा
Dedicated to Truth in Public Interest

A Snapshot of India's LED Programmes Contribution Towards Energy Efficiency & Sustainability

Director General's Message

India's journey toward a low-carbon future is defined by a multilevel policy framework balancing the rapid economic growth with the necessity of environmental stewardship. India has remained steadfast in its commitments under the UNFCCC and the Paris Agreement, translating international goals into domestic action through robust institutional mechanisms. Central to this commitment is the National Action Plan on Climate Change (NAPCC), which serves as the strategic anchor for our country's climate resilience. Within this framework, the National Mission for Enhanced Energy Efficiency (NMEEE) is playing a critical role driving market transformation and focusing on reducing the energy intensity of our economy.

This publication presents a literature-based assessment of these programmes, drawing upon data from authoritative government sources and examining their design, implementation, and impact. A primary focus of this assessment is the remarkable impact of the Unnat Jyoti by Affordable LEDs for All (UJALA) Scheme and the Street Lighting National Programme (SLNP), playing a transitioning role from baseline of minimal LED adoption to a global leader in energy efficiency and achievement of original NDCs (Nationally Determined Contributions) well before targets.

It is our hope that the insights contained herein serve as a blueprint for future interventions as we continue to pursue a greener, more energy-secure India. By incorporating an audit-oriented perspective, it attempts to strengthen transparency, accountability, and evidence-based decision-making in public policy.

Author's Note

This publication presents an assessment of India's energy efficiency transition in the lighting sector through the UJALA Scheme, Street Lighting National Programme, and Gram UJALA Scheme. It examines their design, implementation, and outcomes within the broader framework of national energy efficiency and climate policies.

The study attempts to combine policy analysis and audit-oriented perspectives to highlight key achievements, challenges, and measurable impacts. It aims to serve as a reference for policymakers, auditors, and stakeholders in strengthening future energy efficiency initiatives in India.

Author's Disclaimer

This publication is prepared for academic, analytical, and knowledge-sharing purposes. The views, interpretations, and conclusions presented are those of the author and do not necessarily represent the official position of any government, institution, or organisation. The analysis is based on publicly available information and secondary sources; while due care has been exercised to ensure accuracy, no responsibility is accepted for any errors, omissions, or use of the information. This document should not be interpreted as an official audit opinion or policy recommendation, but as an independent analytical assessment of India's LED programmes and their role in advancing energy efficiency and sustainability objectives.

Author's Declaration

I hereby declare that this publication is an original work carried out by me and has not been submitted, in part or in full, for any other publication or purpose. The analysis presented is based on information gathered from credible and publicly available sources, which have been duly acknowledged wherever used. To the best of my knowledge, the work does not contain any material that infringes upon the intellectual property rights of any individual or institution.

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Chapter 1 — India's Global Climate Commitments: The Policy Landscape

India's journey toward global climate leadership is one of remarkable transformation — from a developing nation prioritizing economic growth to a proactive champion of sustainable development. As one of the world's fastest-growing major economies and home to nearly one-sixth of humanity, India occupies a unique position in global climate diplomacy, balancing development imperatives with environmental stewardship.

1.1 Early Climate Diplomacy: UNFCCC and CBDR-RC

India's formal climate engagement began with ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1993. The Ministry of Environment, Forest and Climate Change (MoEFCC) was designated as the nodal agency. India's early participation was anchored in the principle of Common but Differentiated Responsibilities and Respective Capabilities (CBDR-RC), which recognizes that developed nations bear greater historical responsibility for cumulative greenhouse gas emissions.[1]

1.2 NAPCC and the National Mission on Enhanced Energy Efficiency

The foundation of India's domestic climate architecture was laid through the National Action Plan on Climate Change (NAPCC), launched in June 2008. The NAPCC comprises nine national missions covering solar energy, enhanced energy efficiency, sustainable habitat, water conservation, Himalayan ecosystem protection, green India, sustainable agriculture, strategic knowledge for climate change, and human health.[2]

2008 ▶	NAPCC launched with 8 National Missions including NMEEE. Mandates market transformation for energy efficiency across all sectors.
2011 ▶	NMEEE made operational. Perform Achieve & Trade (PAT), Standards & Labelling, and DSM programmes[3] initiated under BEE.
2015 ▶	UJALA launched (January). India signs Paris Agreement (December). INDC submitted targeting 33–35% emissions intensity reduction by 2030.

[1] Annual Report 2023-24 MoEFCC
[2] Press Information Bureau 21 July 2025
[3] Demand Side Management (DSM): These programs are aimed at optimizing energy consumption by influencing consumers to use electricity more efficiently, thereby balancing demand and supply.

2021 ▶	Gram UJALA extended to rural India. Panchamrit announced at COP26: Net Zero 2070, 500 GW renewables by 2030.
2022 ▶	Updated NDC submitted: enhanced target of 45% emissions intensity reduction; 50% non-fossil electricity capacity by 2030.
2025 ▶	UJALA distributes 36.87 crore LEDs; SLNP covers 1.33 crore streetlights. Combined CO_2 savings: ~44.98 Mt/year.

Of particular relevance to LED programmes is the National Mission for Enhanced Energy Efficiency (NMEEE), whose mandate is to accelerate market transformation for energy efficiency and create sustainable mechanisms to reduce energy intensity nationally. As of July 2022, thirty-three States and Union Territories have prepared State Action Plans on Climate Change (SAPCCs) aligned with the NAPCC framework.[4]

1.3 Paris Agreement and India's Nationally Determined Contributions

India's submission of its Intended Nationally Determined Contribution (INDC) in October 2015 marked a significant step towards proactive climate action. The original targets included reducing emissions intensity of GDP by 33–35% from 2005 levels by 2030 and achieving 40% cumulative electric power capacity from non-fossil sources by 2030. Both targets were achieved ahead of schedule, prompting an upward revision. In August 2022, India enhanced its commitments to a 45% reduction in emissions intensity and 50% non-fossil power capacity by 2030. The updated targets are currently under implementation[5]. (UNFCCC, 2022).

Table 1.1 *Evolution of India's Nationally Determined Contribution (NDC) Targets — Comparison of 2015 INDC and 2022 Updated Commitments*

NDC Target	Original (2015 INDC)	Updated (August 2022)
Emissions Intensity Reduction	33–35% below 2005 levels by 2030 (MoEFCC)	45% below 2005 levels by 2030
Non-fossil Power Capacity	40% of cumulative capacity by 2030 (PIB)	50% of cumulative capacity by 2030
Net Zero Target	Not specified	Net Zero by 2070 (Panchamrit, COP26) (UNFCCC)

[4] Press Information Bureau 28 July 2022
[5] Annual Report 2023-24 MoEFCC

Achievement Status	Both 2015 targets met ahead of schedule	Updated targets under active implementation

Note: Sources: UNFCCC (2022); MoEFCC (2023); PIB (2024a).

1.4 Panchamrit, LT-LEDS, and Long-term Vision

At COP26 in Glasgow (2021), Hon'ble Prime Minister Shri Narendra Modi announced the 'Panchamrit' commitments: reaching 500 GW non-fossil energy capacity by 2030, meeting 50% energy requirements from renewables by 2030, reducing total projected carbon emissions by one billion tonnes by 2030, reducing the carbon intensity of the economy by 45%, and achieving net zero emissions by 2070.[6]

India submitted its Long-Term Low-Carbon Development Strategy (LT-LEDS) to UNFCCC in November 2022, covering seven transitions including low-carbon electricity, sustainable urbanisation, clean transportation, and decoupling economic growth from emissions. Energy efficiency — particularly demand-side measures like LED programmes — is explicitly recognised as a core mitigation lever in the LT-LEDS.[7]

1.5 SDG Integration — SDG 7 and SDG 13

India has aligned its climate commitments with the UN Sustainable Development Goals, particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action). The SDG India Index 2023–24 has shown significant progress on clean energy access and climate action goals, demonstrating the synergistic relationship between India's development and climate objectives[8] (UNFCCC, 2020).

SDG 7 — Affordable & Clean Energy

Target 7.3: Double global rate of energy efficiency improvement by 2030.

LED programmes directly advance this target — India's lighting sector efficiency improved dramatically, with LED market share rising from <1% (2014) to >80% (2019).

SDG 13 — Climate Action

Target 13.2: Integrate climate change measures into national policies.

UJALA and SLNP are explicitly embedded within NAPCC/NMEEE, and their verified savings are counted in India's NDC reporting to UNFCCC.

[6] Press Information Bureau 28 September 2023
[7] India's LT-LEDS
[8] Press Information Bureau 12 July 2024

1.6 International Leadership: ISA and G20

India's climate leadership extends beyond national boundaries. The International Solar Alliance (ISA), launched jointly by India and France at COP21 in Paris in 2015, brings together 120 member and signatory countries and follows the 'Towards 1000' strategy — aiming to mobilise USD 1,000 billion in solar investments, deliver energy access to 1,000 million people, install 1,000 GW of solar capacity, and mitigate 1,000 million tonnes of CO_2 annually by 2030. Headquartered at Gurugram, ISA represents India's most significant multilateral climate initiative.[9]

India's G20 Presidency in 2023 further showcased its climate leadership through the Environment and Climate Sustainability Working Group, achieving the inception of a Global Alliance on land restoration, the Resource Efficiency Circular Economy Industry Coalition, and High-Level Principles for a Sustainable Blue Economy.[10]

[9] Press Information Bureau 07 November 2024
[10] Annual Report 2023-24 MoEFCC

Chapter 2 — LED Programmes: Design, Governance and Implementation

2.1 Background

Before 2015, India's residential lighting sector was overwhelmingly dominated by incandescent bulbs and compact fluorescent lamps (CFLs). Research by ELCOMA (2013), NITI Aayog (2012), and PwC (2011) found that lighting accounted for roughly 18–27% of residential electricity use. PwC (2011) estimated approximately one billion lighting points in Indian homes — comprising 46% CFLs, 41% tube lights, 13% incandescent bulbs, and barely 0.4% LEDs (Energy Efficiency Services Limited[11], 2015).[12]

LED bulbs existed but were priced at ₹300–₹400 per unit in 2013–14, placing them far beyond the reach of the majority of India's households. The electricity consumption of lighting was a significant share of household demand, contributing directly to peak demand stress on the grid and higher coal-based generation. Three barriers blocked mass LED adoption: affordability, trust in quality, and absence of market scale (PIB, 2015).[13]

2.2 UJALA — Programme Architecture and Design

The Unnat Jyoti by Affordable LEDs for All (UJALA) programme was officially launched on 5 January 2015 by the Ministry of Power. It was designed as a market-transformation initiative rather than a traditional subsidy programme — a distinction that proved critical to its financial sustainability and replicability (PIB, 2015).

2.2.1 Strategic Objectives

- Replace inefficient incandescent and CFL bulbs with energy-efficient LED bulbs at scale.
- Reduce household electricity bills by lowering lighting energy consumption.
- Reduce peak demand on the national grid — a major concern for grid operators.
- Lower greenhouse gas emissions, supporting India's Paris Agreement and NDC commitments.
- Boost domestic LED manufacturing capacity (aligned with Make in India initiative).

[11] Energy Efficiency Services Limited (EESL) is a joint venture of Indian public sector undertakings under the Ministry of Power, acting as a leading energy service company (ESCO) to facilitate energy efficiency projects
[12] https://eeslindia.org/en/ourcompany/annual-reports/
[13] https://pib.gov.in/PressReleasePage.aspx?PRID=1398789

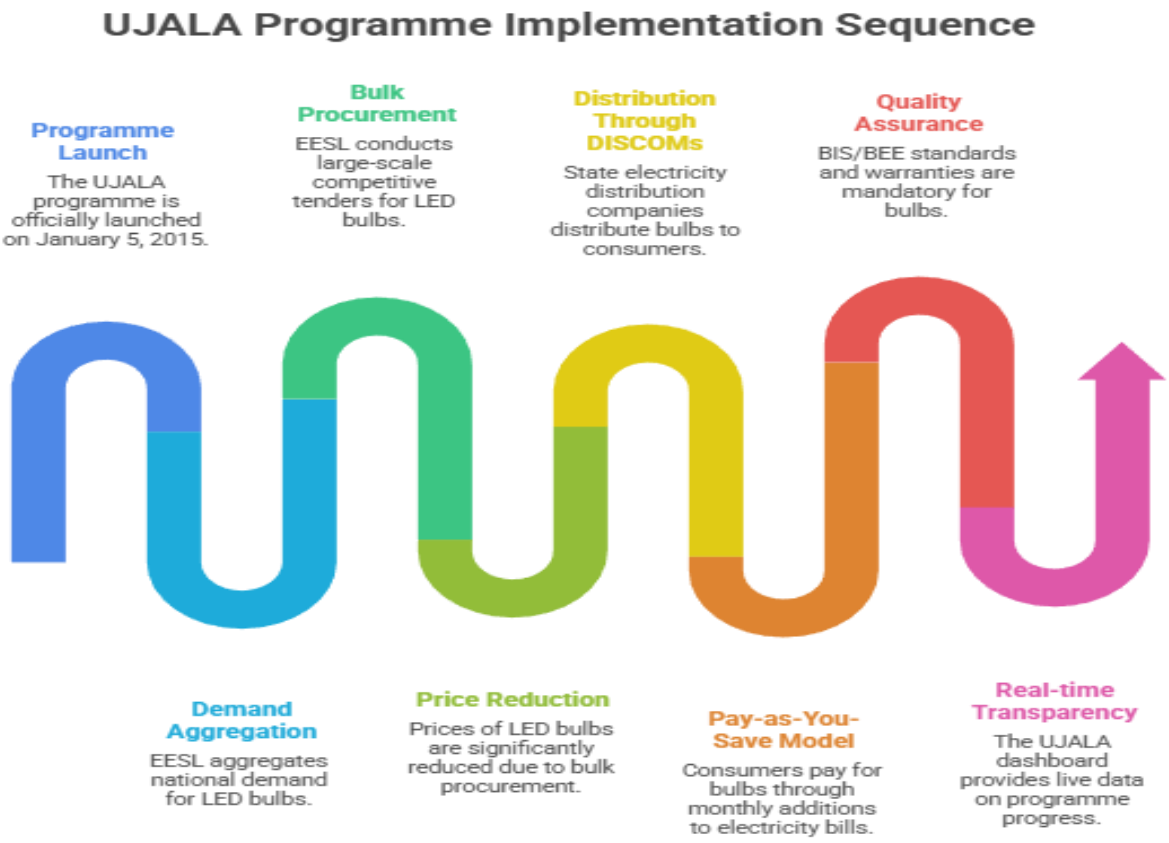

Figure 1 Ujala programme implementation sequence

2.2.2 Key Design Features

- **Demand Aggregation and Bulk Procurement**: Energy Efficiency Services Limited[15] (EESL) aggregated national demand and conducted large-scale competitive tenders. This drove prices from ₹310 per bulb (2014) to below ₹40 (post-2020) — an 85%+ reduction in six years.[16]
- **Distribution Through DISCOMs**: State electricity distribution companies (DISCOMs) served as the last-mile delivery channel, leveraging existing customer relationships and billing infrastructure.
- **Pay-as-You-Save Model**: Consumers could pay for bulbs through small monthly additions to electricity bills, eliminating the upfront cost barrier and providing immediate net savings.

[15] Energy Efficiency Services Limited (EESL) is a joint venture of Public Sector Undertakings under India's Ministry of Power, acting as a premier Energy Service Company (ESCO) to drive energy efficiency.
[16] Press Information Bureau 05 January 2022

- **Quality Assurance**: BIS/BEE standards and specifications were mandatory; suppliers provided warranties of at least three years; quality control mechanisms were embedded in procurement contracts.[17]
- **Real-time Transparency**: The UJALA dashboard (ujala.gov.in) provides live, publicly accessible data on distribution, energy savings, CO_2 reductions, and monetary savings at national and state levels.[18]

Table 2.1: *Comparative Overview of Lighting Technologies in India — Efficiency, Cost, and Market Share (Pre- and Post-UJALA)*

Technology	Typical Wattage	Lifetime (hrs)	Cost (2014)	Market Share (2014)
Incandescent Bulb	60–100 W	1,000	₹10–15	13%
CFL	15–20 W	6,000–10,000	₹100–150	46%
Tube Light	40 W	~8,000	₹80–120	41%
LED (Pre-UJALA)	7–9 W	25,000–50,000	₹300–400	0.4%
LED Under UJALA ★	7–9 W	25,000–50,000	₹70–80	>80% (by 2019)

Source: Bureau of Energy Efficiency (2016); ELCOMA (2013); PIB (2015)[19].

2.3 SLNP — Street Lighting National Programme ('Prakash Path')

The Street Lighting National Programme (SLNP), branded as 'Prakash Path,' was launched in 2015 to modernise India's municipal street lighting by replacing conventional sodium-vapour and CFL fixtures with energy-efficient LED luminaires. Implemented by EESL under an Energy Service Company (ESCO) financing model, SLNP directly targeted municipalities and Gram Panchayats.[20]

The Street Lighting National Programme has been designed as a comprehensive intervention to improve energy efficiency in public lighting through innovative financing, robust technical standards, and coordinated institutional mechanisms. The programme ensures minimal upfront burden on municipalities while delivering measurable energy and cost savings. It also integrates smart technologies and multi-stakeholder partnerships to enhance operational efficiency and sustainability. The key design features and implementation framework of the programme are summarised as shown in the table below.

[17] Bureau of Energy Efficiency
[18] http://ujala.gov.in/
[19] https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/jan/doc20231121514O1.pdf
[20] Press Information Bureau 06 January 2025

Table 2.2: *Key Design Features and Implementation Framework of the Street Lighting National Programme (SLNP)*

SLNP Design Element	Description
ESCO Financing Model	EESL covers 100% upfront investment for LED installation; municipalities repay over 5–10 years from verified energy savings. Eliminates initial capital constraints for urban local bodies.
Technical Standards	BEE-certified LED streetlights; minimum efficacy 90 lm/W; surge protection; durability standards for outdoor deployment.
Smart Controls	Remote monitoring systems track luminaire status and power consumption; allow proactive maintenance; reduce downtime by up to 30% compared to conventional streetlights.
Stakeholder Partnership	Coordinated execution between EESL, Urban Local Bodies (ULBs), state nodal agencies, and private service providers. Formal MoUs govern responsibilities and payment schedules.
Coverage (2025)	1.34 crore streetlights across municipalities and gram panchayats; annual energy savings: 9.0 billion kWh; annual CO_2 avoided: 6.2 million tonnes.[21]

2.4 Gram UJALA — Rural Extension

Launched in 2021 and initially piloted in the states of Bihar, Uttar Pradesh, Andhra Pradesh, Karnataka, and Telangana, Gram UJALA Scheme extended the LED revolution to rural India through a pioneering carbon-credit financing model. The programme offered LED bulbs to rural households at just ₹10–20 per bulb (against a market price of ₹70–80) by monetising verified carbon emission reductions through VERRA[22]-registered carbon credits.

Gram UJALA has distributed one crore LEDs in its first phase, achieving 2,025 GWh/year in energy savings and 1.65 million t CO_2/year in emission reductions. In the first verification cycle, three

[21] http://ujala.gov.in/
[22] Verra is a carbon credit registry that manages the Verified Carbon Standard (VCS), the biggest standard in the carbon market based on market share

registered projects generated 0.97 million Verified Carbon Units (VCUs) demonstrating the viability of carbon finance as a vehicle for rural energy access. [23]

2.5 Governance Framework and Stakeholder Roles of LED Schemes

The implementation of LED Schemes in India involve a multi-tiered governance structure with clearly defined roles and responsibilities across central agencies, implementing bodies, utilities, and private stakeholders. This institutional framework ensures effective coordination, accountability, and monitoring of programme outcomes. Each stakeholder contributes to different aspects of policy formulation, implementation, service delivery, and compliance, supported by specific accountability mechanisms. The key stakeholder roles and corresponding accountability tools are summarised as shown in the table below.

Table 2.3: *Stakeholder Roles and Accountability Framework in Implementation of LED Programmes (UJALA and SLNP)*

Stakeholder	Key Responsibilities	Accountability Tools
Ministry of Power (MoP)	Policy oversight; budget allocations to BEE; EESL governance; Parliamentary accountability	Demand for Grants; Parliamentary Standing Committee scrutiny; Cabinet approvals
Bureau of Energy Efficiency (BEE)	NMEEE coordination; Standards & Labelling; M&V protocol development; annual impact assessment	Official Impact Assessment Reports; BIS/BEE standards; gazette notifications
EESL (Implementing Agency)	Bulk procurement; logistics and distribution; warranty management; UJALA dashboard management	Procurement contracts; UJALA real-time dashboard; Annual Reports
State DISCOMs	Last-mile distribution; bill-linked instalment recovery; consumer grievance handling	MoUs with EESL; billing integration; delivery challans; state audit

[23] CONVERGENCE ENERGY SERVICES LIMITED(CESL)

Urban Local Bodies (ULBs)	Streetlight adoption under SLNP; O&M oversight; annuity repayment to EESL	ESCO contracts; SLA-based performance monitoring; annuity agreements
Manufacturers/Vendors	Supply LEDs meeting BIS/BEE specs; warranty obligations; quality compliance	Competitive bidding; BIS certification; warranty registers and claims

2.6 Financing Innovations

The success of India's LED programmes is underpinned by a set of innovative financing mechanisms that enabled large-scale deployment without imposing significant upfront costs on consumers or public institutions. These mechanisms—ranging from bulk procurement and pay-as-you-save models to ESCO-based investments and carbon financing—have played a critical role in driving affordability, scalability, and sustainability. The key financing instruments, their operational mechanisms, and resulting outcomes are summarised as shown in the table below.

Table 2.4: *Financing Mechanisms and Outcomes of LED Programmes (UJALA, SLNP and Gram UJALA)*

Instrument	Mechanism	Outcome
Bulk Procurement (EESL)	Aggregated national tenders; drove per-unit price from ₹310 to <₹40	Permanent 85%+ price reduction; quality assured through specs
Pay-as-You-Save	Instalment recovery via monthly electricity bills	Immediate net household savings; no upfront barrier
International Concessional Finance	Loans & grants: KfW, AFD, ADB, World Bank (P151038)	De-risked large-scale procurement without fiscal strain
ESCO/Annuity (SLNP)[24]	EESL funds streetlights; municipalities repay from verified savings over 5–10 years	Removed upfront municipal burden; embedded performance guarantees

[24] The Street Lighting National Programme (SLNP), implemented by Energy Efficiency Services Limited (EESL), primarily utilizes an Energy Service Company (ESCO) model paired with an Annuity-based payment structure to upgrade conventional streetlights to LED lights across India.

Carbon Credit Finance (Gram UJALA)	VERRA-registered carbon credits cover the cost gap; consumer pays only ₹10–20	Ultra-low pricing for rural poor; 0.97 million VCUs generated

Sources: PIB (2025a); World Bank (2018); CESL (2022); EESL (2025).

2.7 Awareness, Behaviour Change and Market Transformation

EESL, DISCOMs, and local bodies invested heavily in outreach campaigns through television, radio, newspapers, and grassroots kiosks. The messaging aligned LED adoption with energy security, climate action, and patriotism (PIB, 2016).

The instalment model provided a behavioral nudge. Consumers experienced lower monthly electricity bills, which reinforced trust and accelerated adoption. In rural and semi-urban areas, village camps, school demonstrations, and panchayat outreach linked LED adoption to social development narratives — better study lighting, reduced mercury exposure from CFLs, lower household expenditure (Shakti Foundation, 2021).

The results were transformational. Annual LED sales grew from fewer than 5 million units (2014) to approximately 669 million units (2018), and LED bulbs captured over 80% of the residential lighting market by 2019 (ELCOMA, as cited in EESL, 2015; BEE, 2019). Independent consumer surveys indicated 86% awareness of UJALA branding and high product satisfaction[25].

[25] https://www.teriin.org/sites/default/files/2020-01/2017EF35.pdf

Chapter 3 — Quantifying the Impact and State-wise Performance

This chapter presents an assessment of the measurable outcomes of India's LED programmes, focusing on their impact in terms of energy savings, emission reductions, and financial benefits. It outlines the standard methodology and assumptions used for calculating these impacts, followed by a preliminary analysis of year-wise progress under UJALA and the trajectory of the Street Lighting National Programme. Further, it provides a national impact summary and a comparative state-wise performance analysis, highlighting regional variations and key drivers of success.

3.1 Calculation Methodology and Official Assumptions

The savings reported are derived from a standard per-bulb methodology using officially approved parameters. The estimation of energy savings, emission reductions, and monetary benefits under LED programmes is based on a set of standard parameters and officially accepted assumptions[26]. These parameters, derived from authoritative sources such as EESL, BEE, and CEA, ensure consistency and reliability in impact assessment. The key parameters and their respective sources are summarised as shown in the table below:

Table 3.1: *Key Parameters and Official Assumptions for Estimation of Energy Savings, CO_2 Reduction, and Monetary Benefits under LED Programmes*

Parameter	Value	Official Source
Baseline wattage (replaced lamp)	60 W incandescent	EESL Programme Design Documents
LED wattage	9 W average	BEE Standards; EESL Procurement Specifications
Net saving per bulb	51 W per bulb	Derived: 60W − 9W
Operating hours	4.5 hours/day; 1,642.5 hours/year	Assuming average operating hours to be 4.5 hours per day

[26] Standard Calculation Formulas

Energy Saved (kWh/year) = (W_baseline − W_LED) × Operating hours per day × 365 ÷ 1,000

CO_2 Avoided (tonnes) = Energy Saved (kWh) × Grid Emission Factor (0.82 kg CO_2/kWh) ÷ 1,000

Monetary Saving (₹) = Energy Saved (kWh) × Average Tariff (₹/kWh)

Total National Savings = Per-bulb savings × Number of operational bulbs

Energy saved per bulb per year	51 × 1,642.5 ÷ 1,000 ≈ 83.77 kWh	This can be calculated as per BEE Standard guidelines in kilowatt-hour (kWh)[27];
Grid Emission Factor (CO_2)	0.82 kg CO_2/kWh[28]	BEE (2017); CEA Emission Factor Database
Average electricity tariff	Tariff rate may be calculated as per the average rate for particular year	CEA National Tariff Data

Note - *All data presented in this chapter has been sourced from official government publications, including PIB, EESL, and BEE. Independent recalculation of energy savings or CO_2 reductions has not been undertaken. Variations in parameters such as tariff rates and emission factors across years have not been incorporated.*

3.2 Year-wise Impact: UJALA (2015–2025)

The table below presents the year-wise progress and impact of the LED distribution programme under the UJALA initiative, highlighting key performance indicators such as the number of LEDs distributed, estimated annual energy savings, and corresponding reduction in CO_2 emissions. The data, sourced primarily from official releases of the Press Information Bureau and Energy Efficiency Services Limited, demonstrates the significant contribution of large-scale LED adoption in reducing electricity consumption and mitigating greenhouse gas emissions over time.

Table 3.2: *Year-wise Progress and Impact of UJALA Scheme (2015–2025) — LED Distribution, Energy Savings, and CO_2 Reduction*

Year	LEDs Distributed (crore)	Energy Saved (Million kWh/yr)	CO_2 Avoided (Mt/yr)	Source
2015	—	—	—	Baseline
2016	13.50	17,489	14.34	Ministry of Power PIB/EESL

[27] https://beeindia.gov.in/content/standards-labeling
[28] https://moef.gov.in/uploads/2017/06/Low-Carbon-Lifestyles_0.pdf

2017	25.28	32,840	26.60	Ministry of Power PIB (2017)
2018	31.68	41,140	33.32	Ministry of Power PIB
2020	36.13	46,920	38.00	Ministry of Power PIB (2020)
2022	36.86	47,879	38.78	Ministry of Power PIB (2022)
2025 ★	36.87	47,883	38.785	Ministry of Power PIB (2025a)

Sources: Press Information Bureau (PIB) Press Releases 2016–2025; EESL Official UJALA Programme Data; BEE Grid Emission Factors.

The data in Table 3.2 indicates a rapid increase in annual energy savings under the UJALA Scheme during the initial years, followed by a gradual stabilization after 2020. Energy savings grew significantly from 17,489 million kWh in 2016 to about 47,883 million kWh by 2025, reflecting large-scale LED adoption and near-saturation of the programme. The plateauing trend in later years suggests consolidation of gains and limited scope for further expansion under the existing coverage.

3.3 SLNP Impact Trajectory

The impact of SLNP programme showed steady expansion of LED streetlight retrofitting under the Street Lighting National Programme, with cumulative installations rising from 1 lakh in 2016 to approximately 13.3 lakh by 2025. This growth translated into proportional gains in energy efficiency, with annual energy savings increasing from 70 GWh to 931 GWh over the same period. Correspondingly, CO_2 emission reductions improved significantly from 60 kilotonnes per year to nearly 799 kilotonnes per year. While the pace of expansion moderated after 2022, the continued incremental gains reflect sustained efficiency benefits and consolidation of earlier large-scale deployments.

Table 3.3: *Year-wise Progress of Street Lighting National Programme (SLNP) — Streetlight Retrofitting, Energy Savings, and CO_2 Reduction (2016–2025)*

Year	Cumulative Streetlights Retrofitted	Annual Energy Savings (GWh)	CO_2 Reduction (kt/year)
2016	1,00,000	70	60
2018	5,50,000	385	330
2020	10,50,000	735	630
2022	13,00,000	910	780
2025 ★	13,30,000	931	799

Source: EESL Annual Reports 2016–2025; PIB (2022a) https://eeslindia.org/en/ourcompany/annual-reports/.

3.4 National Impact Summary (2025)

The UJALA Scheme and Street Lighting National Programme have collectively transformed India's lighting ecosystem by delivering substantial economic, energy, and environmental benefits. As per PIB (2025), UJALA has facilitated the distribution of 36.87 crore LED bulbs, resulting in annual consumer savings of about ₹19,153 crore, along with significant reductions in electricity consumption and carbon emissions. Complementing this, SLNP has enabled the installation of over 1.34 crore LED streetlights, leading to annual energy savings of more than 9,001 million units (MUs), peak demand reduction exceeding 1,500 MW, and CO_2 emission reduction of around 6.2 million tonnes per year (Fig. 2 below). Together, these programmes have driven large-scale market transformation, improved energy efficiency across households and public infrastructure, and contributed meaningfully to India's climate and sustainability goals[29].

[29] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2090639&reg=3&lang=2

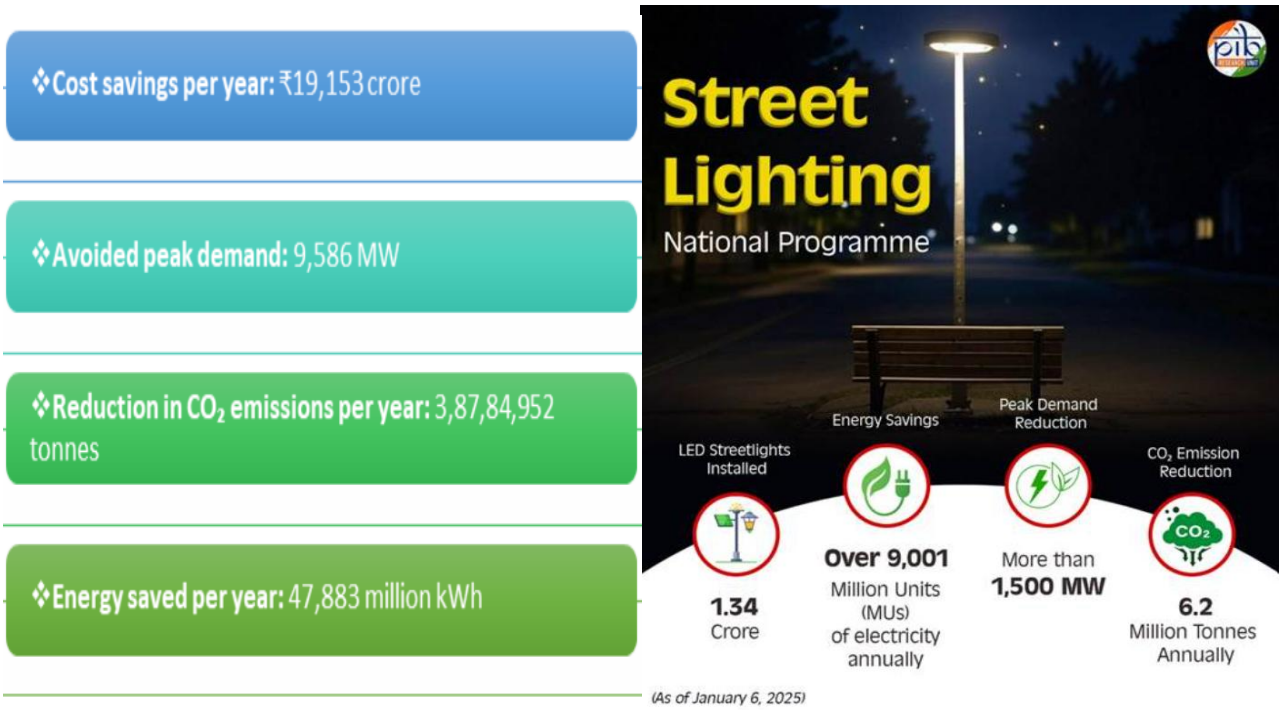

Figure 2 National impact of UJALA and SLNP Scheme Source: PIB (2025a); EESL (2025)

3.5 State-wise Performance

The UJALA programme spans all 28 states and 8 Union Territories of India. Performance varies significantly across geographies — driven by population size, administrative efficiency, DISCOM capacity, early adoption timelines, and the effectiveness of state-level partnerships.

Table 3.4: *State/UT-wise Impact of UJALA Scheme — Energy Savings, Cost Benefits, Peak Demand Reduction, CO_2 Mitigation, and LED Distribution (as on 01 October 2025)*

State/UT	Energy saved per year (in MWh)	Cost saving per year (in Cr)	Avoided Peak Demand (in MW)	CO2 Reduction per year (in ton)	Total LEDs distributed as on 01 Oct 2025
Odisha	6788222	2715	1359	5498460	52270570
Gujarat	5382820	2153	1078	4360084	41448713
Uttar Pradesh	3414953	1366	684	2766112	26295772
Karnataka	3151156	1260	631	2552436	24264486
Andhra Pradesh	2862298	1145	573	2318461	22040227
Maharashtra	2855330	1142	572	2312817	21986569

Bihar	2446511	1019	510	2062674	19608609
Madhya Pradesh	2282297	913	457	1848661	17574110
Rajasthan	2249431	900	450	1822039	17321034
Haryana	2026980	811	406	1641853	15608119
Kerala	2003837	802	401	1623108	15429919
Jharkhand	1772148	709	355	1435440	13645874
Delhi (UT)	1744279	698	349	1412866	13431273
Chhattisgarh	1405464	562	281	1138426	10822335
West Bengal	1198572	479	240	970843	9229228
Himachal Pradesh	1123153	449	225	909754	8648483
Jammu and Kashmir (UT)	1102127	441	221	892723	8486579
Assam	934052	374	187	756582	7192375
Uttarakhand	736486	295	148	596845	5673850
Tamil Nadu	566633	227	113	458973	4363183
Punjab	391775	157	78	317338	3016739
Telangana	373378	149	75	302436	2875082
Nagaland	142729	57	29	115610	1099038
Tripura	136937	55	27	110919	1054437
Goa	130632	52	26	105812	1005890
Mizoram	79910	32	16	64728	615332
Puducherry (UT)	79122	32	16	64088	609251
Chandigarh (UT)	71983	29	14	58306	554283

Arunachal Pradesh	64867	26	13	52543	499498
Meghalaya	56334	23	11	45631	433789
Andaman and Nicobar Islands (UT)	51947	21	10	42077	400000
Manipur	38952	16	8	31551	299934
Ladakh (UT)	29951	12	6	24260	230630
Lakshadweep (UT)	25973	10	5	21038	200000
Sikkim	21298	9	4	17252	164000
Dadra and Nagar Haveli and Daman and Diu (UT)	21273	9	4	17231	163808

Source: EESL UJALA Dashboard http://ujala.gov.in/state-dashboard/odisha — State-wise Data, As on 01 October 2025.

Lower absolute numbers in smaller states/UTs reflect limited populations rather than programme failure. Source: EESL UJALA Dashboard, As on 01 October 2025.

As per table provided above, the data under The UJALA Scheme has contributed substantial energy, economic, and environmental benefits across States and UTs. The UJALA Dashboard discloses the performance of various states in India. Odisha and Gujarat emerge as the top performers, recording the highest annual energy savings, cost savings, and LED distribution, reflecting effective implementation and wider adoption. Large states such as Uttar Pradesh, Karnataka, Andhra Pradesh, and Maharashtra also demonstrate significant contributions due to higher population coverage and strong DISCOM participation. Overall, the scheme has led to considerable avoided peak demand and CO_2 emission reductions nationwide, highlighting its role in enhancing energy efficiency and supporting India's climate commitments. However, relatively lower performance in smaller States/UTs suggests the need for targeted interventions, increased awareness, and strengthened distribution mechanisms to ensure more uniform outcomes across the country.

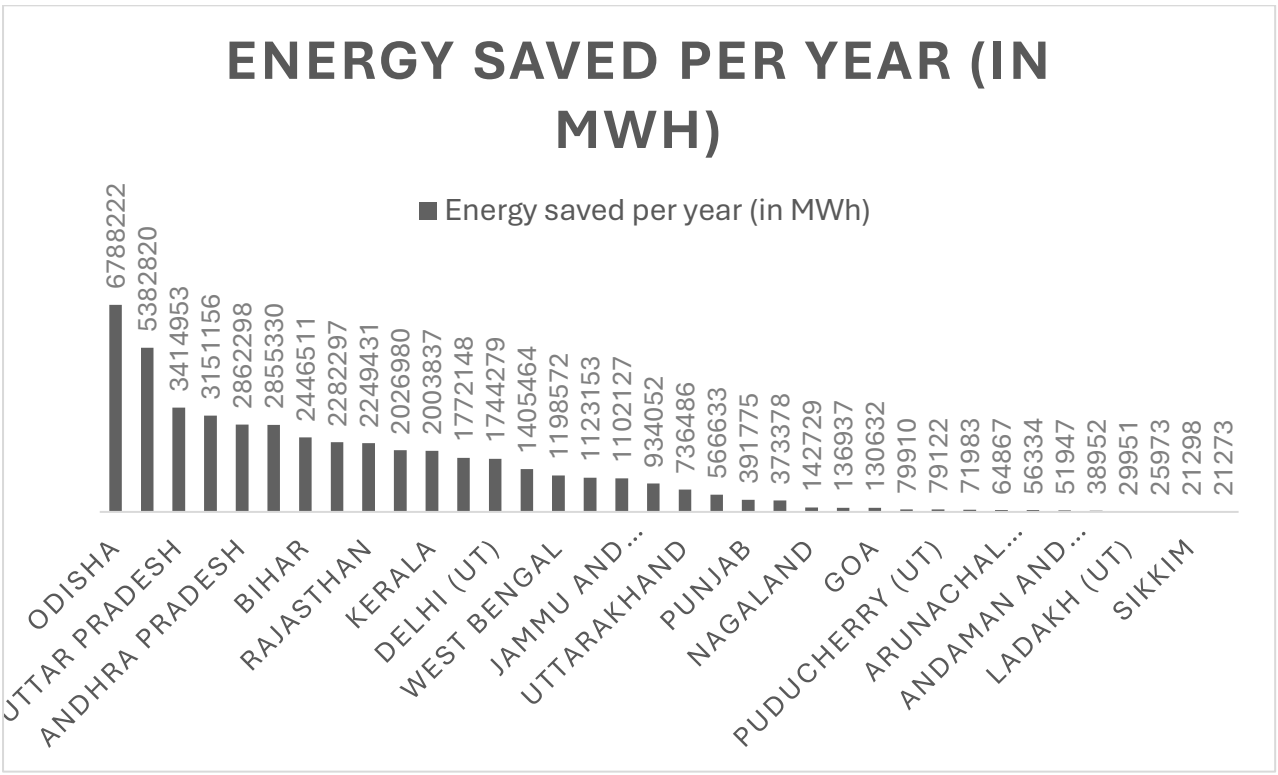

Figure 3: State/UT-wise Annual Energy Savings under UJALA Scheme (in MWh)

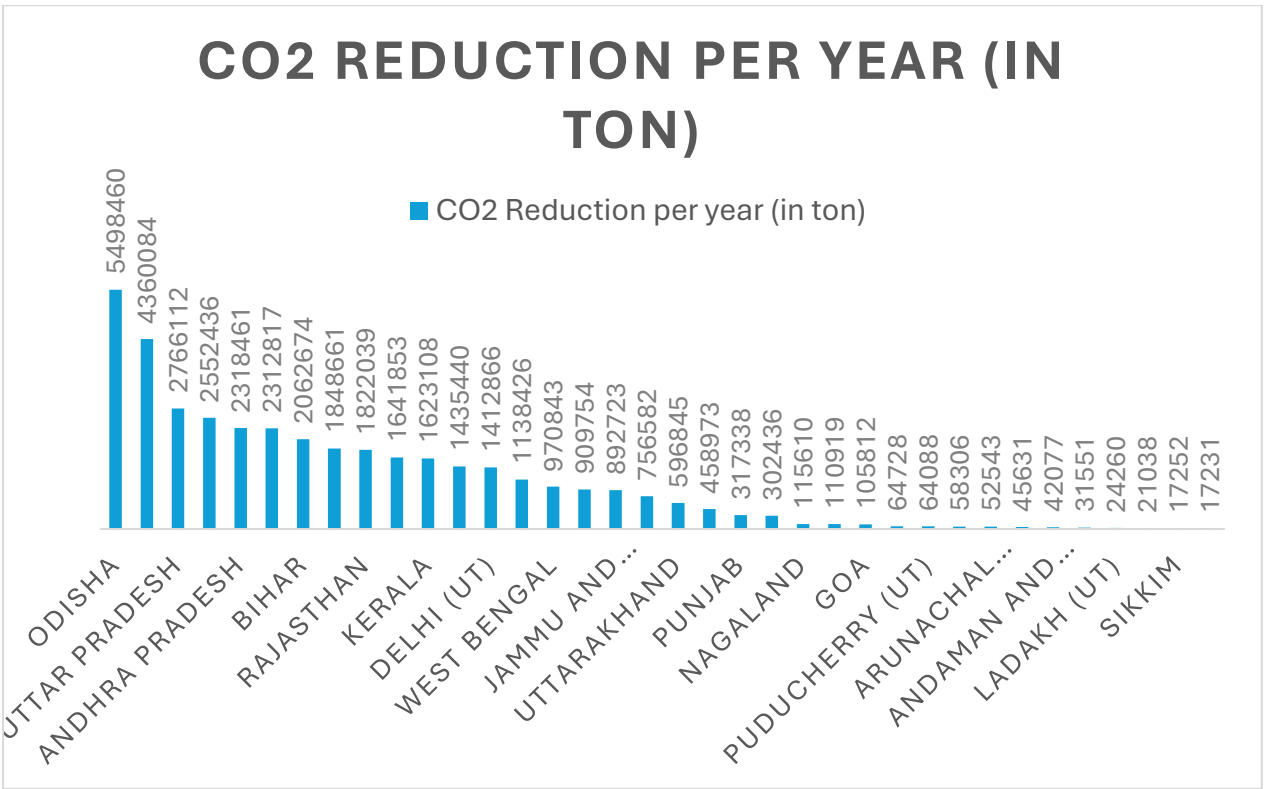

Figure 4: State/UT-wise Annual CO_2 Reduction under UJALA Scheme (in Ton)

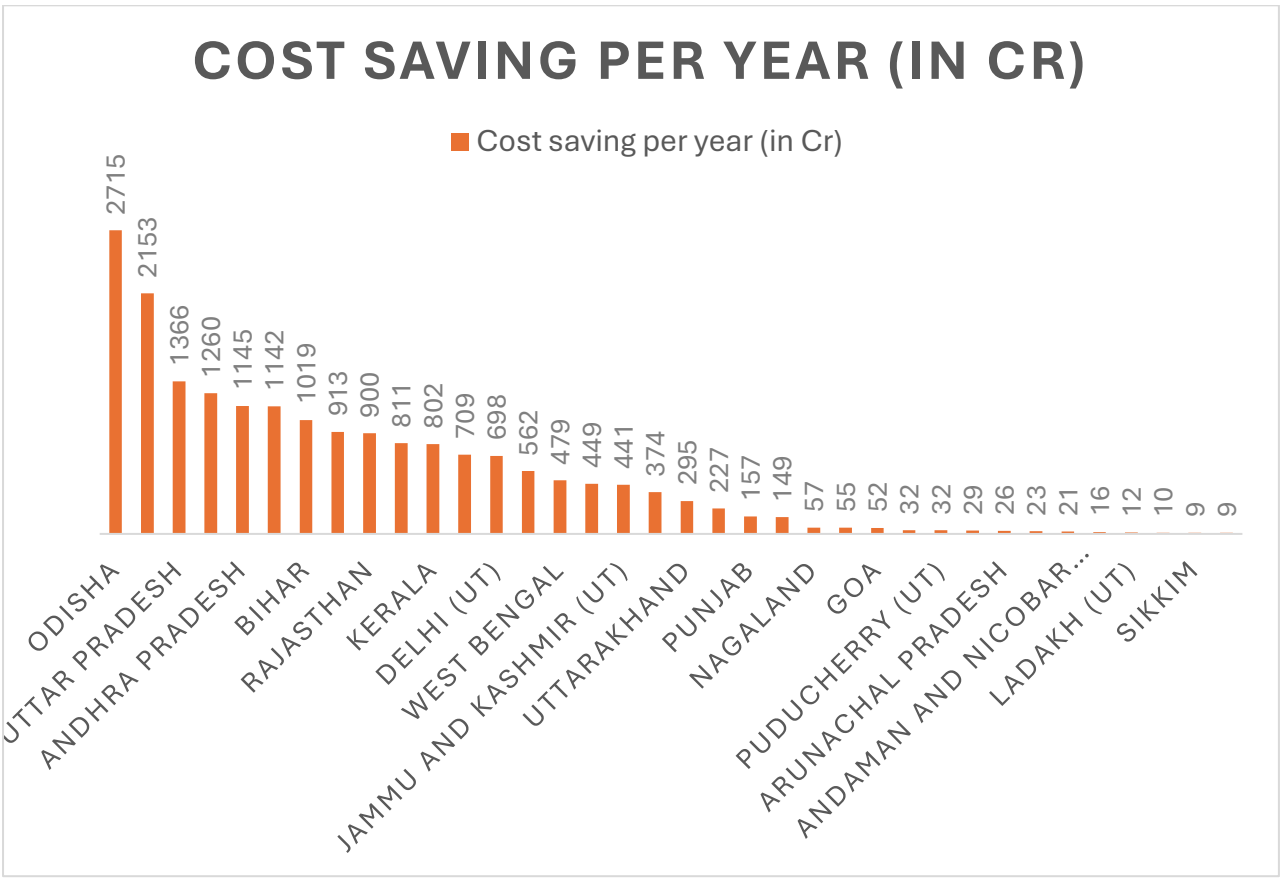

Figure 5: State/UT-wise Annual Cost Savings under UJALA Scheme (Rs. in Crores)

Top 6 States — LEDs Distributed (lakh)	
Odisha	**522 lakh**
Gujarat	**414 lakh**
Uttar Pradesh	**262 lakh**
Karnataka	**242 lakh**
Andhra Pradesh	**220 lakh**
Maharashtra	**219 lakh**

Figure 6: State-wise LED distribution comparison. Source: EESL UJALA Dashboard, October 2025.

Per-capita Analysis

The per-capita LED distribution across smaller regions such as Lakshadweep and Himachal Pradesh demonstrates near-saturation levels, while larger states show comparatively lower per-capita

coverage. This reinforces that programme effectiveness is influenced not only by scale but also by governance efficiency, outreach strategies, and last-mile delivery mechanisms.

Table 3.5: *State/UT-wise Per-Capita LED Distribution under UJALA Scheme (Based on Census 2011 Population)*

State/UT	Total LEDs Distributed	Population (Census 2011)[30]	LEDs per Capita
Odisha	52,270,570	41,974,218	**1.25**
Gujarat	41,448,713	60,439,692	0.69
Uttar Pradesh	26,295,772	199,812,341	0.13
Karnataka	24,264,486	61,095,297	0.40
Andhra Pradesh*	22,040,227	49,386,799	**0.45**
Maharashtra	21,986,569	112,374,333	0.20
Bihar	19,608,609	104,099,452	0.19
Madhya Pradesh	17,574,110	72,626,809	0.24
Rajasthan	17,321,034	68,548,437	0.25
Haryana	15,608,119	25,351,462	**0.62**
Kerala	15,429,919	33,406,061	**0.46**
Jharkhand	13,645,874	32,988,134	0.41
Delhi (UT)	13,431,273	16,787,941	**0.80**
Chhattisgarh	10,822,335	25,545,198	0.42
West Bengal	9,229,228	91,276,115	0.10
Himachal Pradesh	8,648,483	6,864,602	**1.26**
Jammu & Kashmir (UT)**	8,486,579	12,541,302	0.68
Assam	7,192,375	31,205,576	0.23
Uttarakhand	5,673,850	10,086,292	0.56
Tamil Nadu	4,363,183	72,147,030	0.06
Punjab	3,016,739	27,743,338	0.11
Telangana*	2,875,082	35,193,978	0.08
Nagaland	1,099,038	1,978,502	**0.56**
Tripura	1,054,437	3,673,917	0.29
Goa	1,005,890	1,458,545	**0.69**

[30] https://tribal.nic.in/ST/Statistics8518.pdf

Mizoram	615,332	1,097,206	**0.56**
Puducherry (UT)	609,251	1,247,953	0.49
Chandigarh (UT)	554,283	1,055,450	0.53
Arunachal Pradesh	499,498	1,383,727	0.36
Meghalaya	433,789	2,966,889	0.15
Andaman & Nicobar (UT)	400,000	380,581	**1.05**
Manipur	299,934	2,855,794	0.10
Ladakh (UT)**	230,630	274,000 (approx)	0.84
Lakshadweep (UT)	200,000	64,473	**3.10** ★
Sikkim	164,000	610,577	0.27
DNH & Daman Diu (UT)	163,808	585,764	0.28

Note: **Andhra Pradesh & Telangana split derived from Census 2011 data*

***J&K and Ladakh values adjusted based on pre/post reorganisation estimates*[31]

*Per-capita values are **indicative for comparative analysis***

Key Insights from Per-Capita Analysis of LED Distribution

The per-capita analysis of LED distribution under the UJALA Scheme reveals significant inter-state variations in programme penetration, providing important insights into implementation effectiveness and equity of coverage.

- States such as **Himachal Pradesh** (1.26 LEDs per person) and **Odisha** (1.25 LEDs per person) demonstrate near-saturation levels of LED distribution. This indicates that a substantial proportion of conventional lighting has been replaced, reflecting effective last-mile delivery, strong administrative coordination, and high levels of consumer adoption.
- Among Union Territories, **Lakshadweep** exhibits exceptionally high per-capita distribution (3.10 LEDs per person), while Andaman and Nicobar Islands also records distribution exceeding one LED per person. These figures suggest a saturation-driven approach, where distribution may have extended beyond basic replacement needs, possibly to ensure universal coverage in geographically constrained regions.
- Several states, including Delhi, Haryana, and Kerala, demonstrate relatively high per-capita distribution levels. This reflects efficient implementation mechanisms, including strong

[31] State of Jammu & Kashmir, the population of Ladakh has been computed by aggregating the populations of Leh and Kargil districts (approximately 2.74 lakh). The remaining population has been attributed to the Union Territory of Jammu & Kashmir.

DISCOM networks, effective urban outreach, and higher consumer awareness, contributing to improved adoption rates.

- In contrast, large states such as Uttar Pradesh, West Bengal, and Tamil Nadu exhibit relatively low per-capita distribution despite high absolute numbers of LED deployment.
- Hence, programme outcomes are significantly influenced by governance efficiency, implementation strategy, and last-mile delivery mechanisms. While the scheme has achieved substantial national-level impact, addressing regional disparities remains essential for ensuring equitable and comprehensive coverage.

Case Studies:

High-Performance and Innovative Models Gujarat — The Integrated Utility Partnership Model

Gujarat emerged as a leading performer under the UJALA Scheme, achieving one of the highest LED distributions (over 4 crore units), as reported by Energy Efficiency Services Limited and Bureau of Energy Efficiency. The state's success is attributed to early adoption, strong policy support, and effective implementation through DISCOM-led distribution models. Integrated utility partnerships facilitated efficient logistics and ensured last-mile delivery across urban and rural areas, while adherence to BEE quality standards and consumer awareness initiatives enhanced acceptance and sustainability of the programme.

Himachal Pradesh — Overcoming Geographic Barriers

Himachal Pradesh achieved the highest per-capita distribution among larger states through mobile distribution units specifically designed for hilly terrain, rural electrification synergies leveraging existing utility relationships, community engagement through local government partnerships, and targeted outreach in remote hill communities. The state's approach is cited as a replicable model for other hilly and geographically challenging regions (PIB, 2016).

Andhra Pradesh — Early Adopter with Policy Integration

Andhra Pradesh has been a leading performer under the UJALA Scheme, with distribution of over 2.2 crore LED bulbs in recent years. The state is recognised as an early adopter with strong implementation through DISCOMs and Energy Efficiency Services Limited. It has also achieved large-scale transformation in public lighting, with over 23–29 lakh LED streetlights installed under the Street Lighting National Programme (SLNP)[32].The state explicitly embedded LED programmes

[32] https://sansad.in/getFile/loksabhaquestions/annex/175/AU4978.pdf?source=pqals

into the AP State Energy Efficiency Policy 2023–28, ensuring institutional continuity beyond individual programme cycles. First-mover advantages included learning curve benefits, stronger supplier relationships, and institutional capacity built before programme saturation (APSECM, 2023)[33].

[33] https://www.apsecm.ap.gov.in/SITE%20RELATED/AP%20State%20EE%20&%20EC%20Policy%202023-28.pdf

Chapter 4 — SDG Alignment of LED campaigns

This chapter further maps the programmes' linkages with key Sustainable Development Goals (SDGs), highlights environmental safeguards such as e-waste management, and evaluates the broader financial, economic, and social co-benefits arising from large-scale LED adoption.

4.1 SDGs Alignment — Mapping[35] of LED Campaigns

The table highlights how India's LED programmes (UJALA and SLNP) align with key targets of the United Nations Sustainable Development Goals (SDGs). It demonstrates their contribution to energy efficiency, climate action, and improved access to affordable energy, reflecting their broader role in achieving sustainable development outcomes.

Table 4.1: *Alignment of LED Programmes (UJALA, SLNP, and Gram UJALA) with Sustainable Development Goals (SDGs) and Specific Targets*

SDG	Specific Target	LED Programme Contribution
SDG 7	7.3: Double rate of global energy efficiency improvement by 2030	India's lighting sector efficiency improved dramatically — LED market share from <1% to >80% in five years; 47,883 million kWh saved annually (BEE, 2019; PIB, 2025a)
SDG 7	7.1: Ensure universal access to affordable, reliable, modern energy	Gram UJALA Phase-1 (launched in 2021) targeted distribution of 1.5 crore LED bulbs by March 2022 under the "Project Crore" initiative; however, about 1 crore LEDs were distributed across selected states as part of the pilot phase (PIB, 2021–23). Gram UJALA extended affordable LED access to rural poor at ₹10–20/bulb; 1 crore rural LEDs distributed in phase one (CESL, 2022)[36]
SDG 13	13.2: Integrate climate change measures into	UJALA and SLNP embedded in NAPCC/NMEEE; savings counted in NDC reporting; 33 states/UTs have SAPCCs (MoEFCC, 2023; PIB, 2024a)[37]

[35] https://pandr.py.gov.in/sites/default/files/SDGs%20Mapping%20of%20Goals%20with%20Department.pdf
[36] https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1896069&reg=3&lang=2
https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1707220&reg=3&lang=2
[37] https://www.pib.gov.in/PressReleasePage.aspx?PRID=2090639&reg=3&lang=2#:~:text=Beyond%20economic%20benefits%2C%20the%20scheme,in%20urban%20and%20rural%20areas.

	national policies and planning	
SDG 11	11.6: Reduce cities' adverse environmental impact	The Street Lighting National Programme supports SDG 11.6 by reducing urban energy consumption and emissions through LED streetlighting, while lowering municipal costs and improving sustainable urban infrastructure and public safety.(EESL, 2025; PIB, 2022a)
SDG 1	1.4: Access to basic services for all	₹19,153 crore/year in household savings; average ₹200–400/month saved per beneficiary household (PIB, 2025a)

4.3 Environmental Safeguards in LED campaigns for E-Waste disposal

An important but often overlooked dimension of the LED programme's environmental footprint is the management of replaced lamps — particularly CFLs, which contain approximately 3–5 mg of mercury per lamp. With 36.87 crore bulbs replaced, the programme generated a significant volume of e-waste that requires careful handling under the E-Waste (Management) Rules, 2022 notified by MoEFCC[38].

Under the E-Waste (Management) Rules, 2022 notified by the Ministry of Environment, Forest and Climate Change, Extended Producer Responsibility (EPR) forms the core regulatory principle, wherein producers are made responsible for environmentally sound management of end-of-life electrical and electronic equipment (Rule 3(23) – definition of EPR; Rule 5 – EPR obligations). In the context of the UJALA Scheme, Gram UJALA Scheme and the Street Lighting National Programme, Energy Efficiency Services Limited acts as the programme implementer and procurement agency; however, the legal responsibility for collection, recycling, and disposal of LED lamps rests with the producers (manufacturers/importers), who are required to meet annual EPR targets through registration on the portal of the Central Pollution Control Board (Rule 13 – registration; Rule 5 – fulfilment of EPR targets)[39].

[38] MoEFCC (Ministry of Environment, Forest and Climate Change). (2022). E-Waste (Management) Rules 2022. Government of India. https://moef.gov.in

[39] https://tgpcb.cgg.gov.in/Uploads/PcbDocumentAllUploads/E-Waste%28Management%29Rules2022%28English%29.pdf

Operationally, EESL incorporates EPR compliance within its procurement and vendor agreements by mandating take-back arrangements and linkage with authorised recyclers, thereby acting as an intermediary ensuring compliance. At the field level, DISCOMs function as collection points for used CFL/incandescent bulbs under UJALA and Gram UJALA, facilitating aggregation of e-waste. However, as per Rule 5(1) and Rule 7, such entities are not responsible for final disposal; instead, the collected waste must be channelised to authorised dismantlers/recyclers registered with CPCB[40] or State Pollution Control Boards, ensuring environmentally sound processing. In the case of SLNP, where assets are owned by Urban Local Bodies, similar responsibilities are embedded in ESCO/vendor contracts, with producers/vendor entities ensuring take-back and recycling in compliance with EPR provisions[41].

Thus, while DISCOMs and local bodies act as front-end collection facilitators, the ultimate responsibility for recycling and disposal lies with producers (often operationalised through PROs) and authorised recyclers, as mandated under the Rules. Notwithstanding these provisions, the absence of publicly available consolidated data on disposal and recycling of replaced lamps indicates a potential gap in monitoring and transparency, relevant for audit scrutiny.

4.4 Financial, Economic and Social Co-benefits

The large-scale deployment of LED lighting under the UJALA Scheme, Street Lighting National Programme, and Gram UJALA Scheme has generated wide-ranging co-benefits extending beyond energy savings. These programmes have delivered measurable financial gains to households, municipalities, and the national power system, while also driving broader economic transformation through market development, cost reductions, and domestic manufacturing growth. In addition, significant social benefits have emerged in terms of improved quality of life, enhanced public safety, and better health outcomes. Collectively, these impacts demonstrate that energy efficiency initiatives in the lighting sector serve as a multi-dimensional policy tool contributing to economic efficiency, fiscal sustainability, and social welfare.

4.4.1 Consumer and Municipal Fiscal Savings

The financial benefits of India's LED programmes are realised across multiple levels, including households, municipalities, rural local bodies, and the national power system. These programmes have reduced electricity costs, improved fiscal efficiency, and lowered infrastructure investment

[40] https://eprewastecpcb.in/
[41] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1881761&reg=3&lang=2

requirements through energy savings and peak demand reduction. The key savings mechanisms and quantified benefits at different levels are summarised as shown in the table below.

Table 4.2: *Multi-level Financial Savings and Economic Benefits under LED Programmes (UJALA, SLNP and Gram UJALA)*

Beneficiary Level	Savings Mechanism	Quantified Benefit
Household (UJALA)	50–60% reduction in lighting electricity costs; average ₹200–400 saved monthly per household	₹19,153 crore/year total household savings (PIB, 2025a)
Municipality (SLNP)	45–60% reduction in streetlight electricity costs; freed municipal budgets for other infrastructure	₹6,178 crore/year total municipal savings (EESL, 2025)
Gram Panchayats	SLNP extended to gram panchayats; reduced rural local body expenditure on lighting In Gram UJALA, one crore fifty lakh LED bulbs will be distributed in phase 1 resulting in energy savings of 2025 million kWh/year and CO_2 reductions of 1.65 million T CO_2/year.	Included in SLNP municipal figure; separate disaggregation not publicly available Convergence Energy Services Limited implemented the Gram UJALA Scheme as a pilot initiative, under which energy-efficient 7W and 12W LED bulbs were distributed in rural areas at a subsidised price of ₹10 per bulb, in exchange for 60W and 100W incandescent lamps. The programme covered five states—Bihar, Uttar Pradesh, Andhra Pradesh, Karnataka, and Telangana—with the distribution of approximately 1 crore LED bulbs[42].

[42] https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=1897767&reg=3&lang=2

National Grid / Utilities	9,586 MW peak demand avoided reduces generation and transmission infrastructure requirements.[43]	The avoidance of 9,586 MW in peak demand translates to a total deferred capital investment of ₹79,947.24 crore, calculated based on the CEA's benchmark cost of ₹8.34 crore/MW for new generation capacity (Sources: BEE & CEA)[44].

4.4.3 Social Co-benefits

The LED campaign's social impact extends well beyond kilowatt-hours and rupees:

Education & Productivity Improved indoor lighting supports longer study hours and home-based productivity, supported by near-universal electrification under Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya). LED streetlighting further enhances safety and visibility in urban and peri-urban areas under the Street Lighting National Programme[47].	**Health Benefits** Replacement of CFL bulbs — which contain mercury and are a health risk when broken — with safer LED technology reduces household mercury exposure. In rural areas, better lighting reduces dependence on kerosene lamps, directly lowering indoor air pollution and associated respiratory illness.
Public Safety SLNP's 1.34 crore LED streetlights have improved visibility on public roads and residential streets, with smart control systems further enhancing reliability. Studies on street lighting and public safety consistently find correlations between improved nighttime illumination and reduced crime and road accidents (EESL, 2025).	

[43] http://ujala.gov.in/
[44] https://cea.nic.in/wp-content/uploads/document_upload/2023/06/NEP_2022_32_FINAL_GAZETTE.pdf
[47] https://powermin.gov.in/en/content/saubhagya

Chapter 5 — Key Audit Considerations for LED Schemes

This chapter outlines a structured audit framework for assessing LED programmes, focusing on key dimensions such as economy, efficiency, effectiveness, governance, and compliance. It identifies key audit questions, potential risk areas, and appropriate verification procedures. The chapter also highlights risk areas and audit approaches, including field verification, data reconciliation, and monitoring and evaluation checks.

5.1 Key Audit Questions as per various dimensions

The audit covers key dimensions of Economy, Efficiency, Effectiveness, Governance, and Compliance. The audit questions under each dimension are outlined below:

5.1.1 Economy

• Whether programme targets were justified and aligned with national commitments such as NAPCC, NMEEE, and NDC

• Whether procurement of LED bulbs/streetlights was transparent, competitive, and economical in line with GFR and EESL procurement policy

• Whether financing arrangements (including ESCO/concessional models) ensured value for money and were in public interest

5.1.2 Efficiency

• Whether the delivery, distribution, and implementation model (including streetlight retrofitting) was cost-effective

• Whether programme execution was carried out without delays, duplication, or avoidable wastage

• Whether distribution records are accurate and verifiable, ensuring absence of leakages or irregularities

• Whether invoices, payments, and financial flows were processed efficiently and in accordance with prescribed procedures

5.1.3 Effectiveness

• Whether the programme achieved intended outcomes in terms of energy savings, CO_2 emission reduction, and financial savings

• Whether Monitoring and Verification (M&V) systems are robust and capable of producing reliable and verifiable savings data

• Whether product quality (LED performance, efficacy, warranty compliance) meets prescribed BIS/BEE standards

• Whether operation and maintenance (O&M) systems for streetlighting ensure functionality, uptime, and sustained performance

5.1.4 Governance

• Whether adequate oversight, accountability, and institutional arrangements were in place among implementing agencies

• Whether IEC activities and grievance redressal mechanisms were effective in addressing stakeholder concerns

• Whether roles and responsibilities among stakeholders (MoP, BEE, EESL, ULBs, DISCOMs) were clearly defined and implemented

5.1.5 Compliance

• Whether procurement, financial management, and implementation complied with GFR, EESL guidelines, and contractual provisions

• Whether environmental safeguards, including e-waste management and disposal, complied with E-Waste Management Rules, 2022

• Whether adherence to applicable BIS standards, BEE labelling requirements, and regulatory norms was ensured

Note: *Certain audit questions (e.g., beneficiary-level distribution and IEC effectiveness) are more relevant to household lighting programmes (UJALA) and may require contextual adaptation when applied to streetlighting-focused schemes (SLNP).*

5.2 Risk Areas and Possible Audit Procedure

The implementation of LED programmes involves multiple operational and financial processes, which may be exposed to risks affecting accuracy, efficiency, and compliance. Identifying these risks is essential for designing appropriate audit procedures to ensure reliability of outcomes and adherence to guidelines. The key risk areas and corresponding audit procedures are summarised as shown in the table below.

Risk Area	Audit Procedure
Ghost distribution / overstated output — duplicate entries, dashboard manipulation	**Field verification** with beneficiary interviews; primary document reconciliation against dashboard
Procurement irregularities — collusion, inadequate competition, spec manipulation	**Procurement audit**; market price benchmarking; supplier background verification
Quality and warranty lapses — inferior products, short lifetime, vendor default	**Physical product testing** at NABL lab; QC certificate analysis; warranty claim review
Weak Monitoring & Verification— dashboard aggregation without raw logs; no independent verification	**Systems audit;** independent energy recalculation; emission factor source verification
Inadequate O&M — non-functional streetlights reducing realised savings	**Physical inspection; uptime data analysis**; SLA contract compliance review
Financial misstatements — unsupported payments, wrongful incentive claims	**Financial attestation audit-** Statistical sampling of invoices; vouching; bank reconciliation testing
Environmental non-compliance — improper disposal of replaced CFLs/e-waste	**Audit of E-waste collection records**; recycler authorisation check; site visits to disposal facilities
Equity gap — urban bias; remote/NE regions left out of distribution	**Per-capita distribution analysis** by state/UT; targeted interviews in underserved areas

Overstatement of Emission factor as grid decarbonises (static 0.82 kg CO_2/kWh since 2017)	**Cross verification** - Cross-check all CO_2 calculations with current CEA emission factors; quantify sensitivity

Table 5.1: *Key Risk Areas and Suggested Audit Procedures for LED Programmes (UJALA and SLNP)*

5.3 Verification Techniques

This section outlines the key verification techniques required to assess the accuracy and reliability of reported outcomes under LED programmes. It focuses on monitoring and verification, recalculations, and field-level validation to ensure that physical deployment, operational performance, and reported savings are consistent and verifiable. The approaches detailed below aim to strengthen audit assurance through systematic checks of distribution records, asset functionality, and performance data.

5.3.1 Distribution and Deployment Verification

- Verify physical distribution/installation records of LED bulbs/streetlights with EESL dashboards, DISCOM/ULB records, and primary documentation (delivery challans, work completion reports).
- Conduct sample-based field verification to confirm actual installation and functioning of assets.
- Reconcile distributed quantities with operational units to identify cases of non-installation, duplication, or discrepancies.
- Assess whether assets reported as deployed are in active use and not lying idle or non-functional.

5.3.2 Operational and Performance Verification

- Verify operating conditions such as average usage hours (household/streetlighting) through field visits and stakeholder interactions (ULBs, DISCOMs, beneficiaries).
- Examine operation and maintenance (O&M) records to assess uptime, failure rates, and replacement mechanisms, particularly under SLNP.

- Review monitoring and reporting systems of EESL to ensure that reported energy savings are based on verified operational data.
- Cross-check consistency between physical deployment, operational status, and reported savings to identify any overstatement or data gaps.

Conclusion

India's approach to climate action and sustainable development has evolved through a well-structured policy framework that balances economic growth with environmental responsibility. Anchored in international commitments under the UNFCCC and the Paris Agreement, and operationalised through national initiatives such as the National Action Plan on Climate Change (NAPCC), the country has placed significant emphasis on energy efficiency as a key mitigation strategy. The National Mission for Enhanced Energy Efficiency (NMEEE) has also played an important role in driving market transformation and reducing the energy intensity of the economy.

In this context, the Unnat Jyoti by Affordable LEDs for All (UJALA) Scheme and the Street Lighting National Programme (SLNP) represent important interventions in the lighting sector, demonstrating how policy intent can be translated into measurable outcomes. From a baseline of minimal LED adoption, these programmes have enabled the distribution of over 36.87 crore LED bulbs and the installation of more than 1.34 crore LED streetlights. This large-scale transition has resulted in annual energy savings of approximately 47,883 million kWh and significant reductions in carbon emissions, further contributing to India's commitments under its Nationally Determined Contributions.

The financial and economic benefits arising from these initiatives are substantial. Households have realised annual savings of about ₹19,153 crore through reduced electricity consumption, while municipalities have benefited from considerable reductions in streetlighting expenditure. At the system level, the reduction in peak demand has contributed to optimising generation capacity requirements and improving overall efficiency of the power sector.

These programmes also illustrate the effectiveness of innovative implementation models. The use of demand aggregation, bulk procurement, performance-based financing, and institutional partnerships has not only ensured cost efficiency but has also catalysed a broader transformation in the lighting market. Furthermore, the alignment of these initiatives with national missions and state-level action plans reflect the importance of integrated policy design in achieving sustainable outcomes.

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