



T.A.R.A

Trans-departmental Authority for Regulated ALAN

Background Paper: Maharashtra Dark Sky Policy Framework

AstronEra

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Executive Summary

Light pollution is operationally defined as 'the human-made alteration of outdoor light levels from those occurring naturally'. Artificial Light at Night (ALAN) is no longer a peripheral environmental concern; it is a scientifically established pollutant with direct and compounding consequences for public health, biodiversity, climate resilience, infrastructure efficiency, and long-term state expenditure [1].

Maharashtra's rapid urbanisation and infrastructure expansion currently proceed in the absence of any statutory or regulatory framework governing ALAN, creating avoidable ecological damage, fiscal inefficiency, and legal exposure under binding national law and obligations arising from international commitments.

Global experience across more than forty jurisdictions demonstrates that ALAN regulation is administratively viable, legally robust, and economically accretive, delivering substantial energy savings, measurable revenue through dark-skyed tourism, and durable protection of high-value ecological and cultural assets.

This document consolidates the evidence base, legal precedent, and fiscal rationale for action; defines clear department-specific policy measures within existing mandates; and presents a phased implementation pathway that manages risk while delivering early returns.

The administrative decision required at this stage is focused and executable: constitute a cross-departmental steering committee, issue interim dark-sky lighting guidelines under existing environmental authority, and integrate dark-sky conservation into the Tourism Policy framework.

These steps enable Maharashtra to meet its legal obligations, prevent irreversible loss, and exercise national leadership in sustainable lighting governance, transforming the night from an unmanaged liability into a protected public asset.

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Widespread Harm From Unregulated Light

Global night sky brightness is increasing 9.6% annually [1], with 93.9% of India's population living under light-polluted skies [2]. **Maharashtra has no legal framework to address ALAN.** The evidence below establishes the scope and scale of impact, providing the evidentiary foundation for regulatory intervention and fiscal prioritisation.

Domain	ALAN's Impact
Economic	<ul style="list-style-type: none">Energy: \$50B annually on light escaping to space, 30-70% savings achievable [3,4]Healthcare: Up to £34B/year sleep disturbance (UK) Projected \$4.32T global obesity burden by 2035 [5,6,7]Agricultural: 62% nocturnal pollination reduction, up to \$729B projected global loss [8,9]Tourism: Global dark sky market \$1B (2025) → \$3B (2032) with growth trend [10]
Ecological	<ul style="list-style-type: none">60% invertebrates, 30% vertebrates are nocturnal; 83% of Earth's land surface affected [11,12]Over 1+ billion birds die annually from building collisions in the US [13,14]Predator-prey dynamics disrupted; ecosystem rewiring restructures food webs [15,16]Agricultural: Livestock reproduction/milk yield affected; crop flowering disrupted [17,18]
Health	<ul style="list-style-type: none">Infants: Circadian establishment in the first months is critical for lifelong health [19]Adolescents: ALAN linked to anxiety, mood disorders, brain region damage [20]Elderly: Weak circadian rhythms → 2.5x dementia risk; 55M globally → 139M-152M by 2050 [21,22]Pregnant women: Increases preterm delivery, preeclampsia; offspring chronic disease risk [23,24]Shift workers: 40% increased cardiovascular disease; elevated diabetes, cancer risk [25,26]
Climate	<ul style="list-style-type: none">Lighting contributes 5% of global GHG (~2.5B tons CO2e annually) [27]Maharashtra lighting emissions: ~20-25 million tons CO2/year (combined margin FY 2023-24 0.757 tCO2/MWh grid factor) estimated based on typical municipal/outdoor lighting shares and CEA grid factor [28,29]Urban heat island: ALAN exacerbates temperature rise, increasing cooling demand [30]Reduction potential: 1.7-4.7M tons CO2/year with comprehensive dark sky policy modelled potential, e.g., 60-70% savings on targeted outdoor lighting [31]

These impacts compound over time and across systems. Maharashtra's current regulatory gap exposes the State to ongoing fiscal leakage, preventable health burdens, and ecosystem degradation with irreversible thresholds. The global policy frameworks that follow demonstrate proven administrative pathways to abate these costs while generating positive economic returns.

Established Global Legal Frameworks

ALAN regulation is an established global practice. Over forty countries across five continents have formally recognised ALAN in law and implemented enforceable controls through planning, environmental, and sectoral frameworks. In parallel, more than 250 regulated dark-sky sites operating across multiple jurisdictions demonstrate that such controls are practical, scalable, and routine.

Relevant approaches that can be adapted to Maharashtra's regulatory and governance framework.

Country	Legal Status	Controls / Enforcement
I. EXPLICIT NATIONAL RECOGNITION		
<i>Countries where ALAN is legally defined as pollution.</i>		
Croatia 2019	Env. harm (statute)	Illumination limits, zoning, protected areas, planning controls Mandatory compliance [1]
France 2010 2018	Pollution (decree)	<1% upward light, CCT ≤3000K, lumen caps, skybeam ban, curfews Public + private binding [2]
Slovenia 2007	Pollution (decree)	0% upward light, 4-zone system, lumen caps, full shielding Strict zoning enforcement [3]
South Korea 2012 2019	Harmful lighting (act)	4-zone classes, CCT ≤3000K, 10pm curfews, 5-year local plans Mandatory local planning [4]
Chile 2022	Pollution (decree)	Full shielding, CCT ≤3000K, observatory buffers, phased retrofits Phased compliance [5]
Mexico 2021	Pollutant (LGEEPA)	Special zones, CCT/intensity limits via permits Permit-based control [6]
II. IMPLICIT NATIONAL RECOGNITION		
<i>Countries where ALAN is regulated through general environmental law.</i>		
Niue 2007	Dark Sky Nation	Nation-wide dark-sky lighting standards Ministry + Dark Sky Committee oversight [7]
Pakistan 1997	Air pollutant (PEPA)	National Environmental Quality Standards + EIA Case-by-case requirements [8]
Switzerland 1983	Non-ionising radiation	Precautionary principle Non-binding guidance [9]

Country	Legal Status	Controls / Enforcement
III. REGIONAL LEADERSHIP		
<i>Sub-national models directly relevant to Indian states.</i>		
Italy 2000, 2021	Statutes & UNI standard	Low/zero upward, shielding, lumen caps, observatory buffers Regional mandatory [10]
Austria 2024	landscape protection	10pm–6am switch-offs, warm lighting, beam limits, retrofits Provincial enforcement [11]
IV. INTEGRATED POLICY		
<i>Astrotourism-Led Dark Sky Governance Models</i>		
South Africa 2024	Astro-tourism strategy	Dark-sky + science infrastructure linkage Cabinet-approved strategy [12]
New Zealand 2023, 2025	Protected resource (RMA)	Starlight protection, shielding, low CCT, lumen caps (reserves) District plan binding [13]
V. PARTIAL / SECTOR-SPECIFIC		
<i>Targeted approaches applicable via departmental mandates.</i>		
Spain 1988, 2008	Observatory + energy efficiency	No light above horizon (Canaries), glare limits Site-specific mandatory [14]
USA <i>Decentralised</i>	Local ordinances	Shielding, spectrum limits, lumen caps (municipal) Municipal enforcement [15]
Germany 2021	Biodiversity statute	Insect-friendly lighting, nature reserve restrictions Sectoral (nature only) [16]
UK 2006	Statutory nuisance	Case-by-case enforcement, planning guidance Complaint-driven [17]
Malta 2016, 2020	Ecosystem + advertising	Lumin caps, CCT ≤3000K, shielding, Natura sites 2000 zero spill Dual regulation [18]
Netherlands 2024	Duty of care	Prevent nuisance (no numeric caps) General duty only [19]

These precedents eliminate implementation risk. Maharashtra can adopt tested frameworks, adapt proven standards, and leverage two decades of international regulatory experience. Beyond compliance, these frameworks demonstrate low-risk, high-return governance intervention.

Proven Economic Returns

Dark sky policy delivers quantifiable returns through tourism revenue, energy efficiency, and long-term asset protection. Conservative projections from comparable sites establish the fiscal basis for investment.

The table below consolidates real-world outcomes that demonstrate regulation improves fiscal performance rather than burdening it.

Country	Impact Category	Key Metric
USA Utah	Revenue Multiplier	\$5.8B revenue over 10 years (Colorado Plateau) 10,000+ jobs annually [1]
UK Northumberland	Revenue Multiplier	£25M annual revenue from dark sky tourism 450 direct jobs supported £1.93 ROI per £1 spent on dark sky-friendly lighting [2,3]
South Africa	Revenue Multiplier	10% annual growth target for rural astro-tourism by 2030 [4]
DSI Certified Sites Global	Revenue Multiplier	30-40% increase in tourist footfall post-Dark Sky Place certification [5]
France	Efficiency Dividend	€200M+ annual savings via midnight curfews (2 TWh energy, 250K tons CO2 reduced) [6,7]
Chile	Asset Preservation	\$2B+ astronomical infrastructure protected (30-year utility) [8,9]
UK/Ireland	Asset Preservation	Heritage nightscape preservation (Kerry Reserve, statutory nuisance protections) [10]

These returns scale with ambition. Maharashtra's ALAN regulation would position the state to capture tourism multipliers, realise immediate energy savings, and protect assets with multi-decadal utility.

Department-Specific Actions

Effective regulation of ALAN requires coordinated, cross-departmental action, with each department addressing distinct but interconnected aspects of governance.

The measures below assign clear responsibility, define actionable scope, and link interventions to proven international precedents, enabling parallel implementation without legislative dependency.

Policy Area / Department	Focus Areas
Legal & Regulatory <i>Environment & Climate Change</i>	<ul style="list-style-type: none">Notify ALAN under the Environment Act, 1986Adopt DarkSky lighting principlesEnable compliance, enforcement, and penalties
Zoning & Technical <i>Urban Development</i>	<ul style="list-style-type: none">Classify Core Dark, Buffer, and Regulated Urban AreasMandate lighting principles in Urban, Rural, Forest, Tourism, and Coastal Zones
Environmental <i>Forest</i>	<ul style="list-style-type: none">Integrate ALAN into EIAs and project appraisalsStrict controls in forests, wetlands, coasts, and wildlife corridors
Cultural & Community <i>Tribal Development</i>	<ul style="list-style-type: none">Document and promote traditional sky knowledgeSupport community-led stargazing and outreachIssue culturally sensitive lighting guidelines
Economic & Tourism <i>Tourism</i>	<ul style="list-style-type: none">Pursue International Dark Sky Place certificationsDevelop dark-sky tourism circuitsLink conservation with tribal/rural income generation
Energy & Climate <i>Energy</i>	<ul style="list-style-type: none">Statewide public dark-sky-compliant lighting retrofitsTrack energy and carbon savings
Institutional Coordination <i>Environment & Climate Change</i>	<ul style="list-style-type: none">Establish an inter-departmental committeeFund training, awareness campaigns, and researchMonitor compliance and outcomes

By grounding action in this framework, the State is positioned to meet its regulatory and climate commitments while leveraging proven global practices.

Policy Obligations and Alignment

Maharashtra's current approach to ALAN lacks regulatory oversight, leaving it unaddressed despite enforceable national/international commitments and climate/sustainability objectives.

Table 1: ALAN obligations under national and international frameworks

Framework	Obligation	Alignment
CMS International Light Pollution Guidelines (Resolution 13.5 Rev.COP14, COP14 2024)	Where important habitat for affected species is within 20 km of a project, conduct species-specific EIA... Develop Artificial Lighting Management Plan (LMP); use lowest intensity; avoid blue/UV-rich lights (prefer <2,700 K spectra). [1]	Mandates EIAs & LMPs (shielded/low-intensity lighting, curfews) near habitats of migratory species (turtles, seabirds, shorebirds, landbirds, bats)
CMS Samarkand Strategic Plan for Migratory Species 2024–2032	Goal 2 / Target 7 — “Multiple anthropogenic pressures have been reduced to levels that are not detrimental to... migratory species or... their habitats.” [2]	Light pollution is recognised as a key anthropogenic pressure; guidelines serve as the main tool to reduce it on migratory species & habitats.
National Action Plan for Conservation of Migratory Birds (CAF, 2018–2023)	Action 1.6 — “Evaluate the impact of increasing night light during migration... and recommend mitigation measures”; Action 2.5 — “Integrating CAF species and habitat conservation objectives in PA Plans”. [3]	Directly addresses night light as a threat (1.6) and requires integration into Protected Area plans (2.5) for sites like Thane Creek/Nandur Madhameshwar.
National Marine Turtle Action Plan (2021–2026) & CRZ Notification 2019	Action Plan: “Manage and regulate... use of artificial lighting... in nesting areas” (Obj. 2, Act. 2.1, p.16). [4] CRZ Notification 2019, Annex I Section 1.5: “No activities shall be permitted in and around turtle nesting grounds, including those causing light and sound pollution, except for conservation and protection.” [5]	CRZ legally prohibits light pollution in/around nesting grounds (Ratnagiri, Raigad); Action Plan provides management guidance. Olive Ridley (Schedule I) disturbance punishable under Wildlife (Protection) Act, 1972.
Wildlife (Protection) Act, 1972	Sec. 9: Prohibits hunting (includes disturbing Schedule I species habitats); Sec. 39: State property; harm punishable. [6]	ALAN disturbance/mortality (turtles, tigers, bats) enforceable.
NGT Directives on ALAN (OA 1380/2024)	ALAN is recognised as a pollutant; adverse effects on ecology/health; no statutory framework; CPCB/MoEFCC directed to formulate standards (ongoing). [7]	Urges MPCB/state framework; litigation risk if ignored.

Moved into Framework column for instant reference

Bulleted, concise, one bullet per key effect

Cleaned and standardised across all rows

Trimmed, included only if verification needed

Readable, scannable, high-level actionable

Framework	Obligation	Alignment
CMS International Light Pollution Guidelines (Resolution 13.5 Rev.COP14, COP14 2024) [1]	Conduct species-specific EIA where important habitat for affected species is within 20 km; develop Artificial Lighting Management Plan (LMP); use lowest intensity; avoid blue/UV-rich lights (<2,700 K).	Mandates EIAs & LMPs near habitats of migratory species (turtles, seabirds, shorebirds, landbirds, bats). Requires shielding, low-intensity lighting, and curfews
CMS Samarkand Strategic Plan for Migratory Species 2024–2032 (Goal 2 / Target 7) [2]	Reduce multiple anthropogenic pressures to non-detrimental levels for migratory species and their habitats	Light pollution recognised as a key anthropogenic pressure. Guidelines are a tool to reduce it on migratory species and habitats
National Action Plan for Conservation of Migratory Birds (CAF, 2018–2023) (Action 1.6 & 2.5) [3]	Evaluate impact of increasing night light during migration and recommend mitigation; integrate CAF species and habitat conservation objectives into PA plans	Explicitly recognises night light as a threat (1.6). Requires integration into Protected Area management (2.5), e.g., Thane Creek / Nandur Madhameshwar
National Marine Turtle Action Plan (2021–2026) & CRZ Notification 2019 (Obj. 2, Act 2.1, p.16; Annex I, Section 1.5) [4][5]	Manage and regulate use of artificial lighting in nesting areas	CRZ legally prohibits light pollution in/around nesting grounds (Ratnagiri, Raigad). Action Plan provides management guidance. Olive Ridley (Schedule I) disturbance punishable under Wildlife (Protection) Act, 1972
Wildlife (Protection) Act, 1972 (Sec. 9, Sec. 39) [6]	Prohibits hunting and disturbance of Schedule I species habitats; state property; harm punishable	ALAN disturbance/mortality (turtles, tigers, bats) enforceable
NGT Directives on ALAN (OA 1380/2024) [7]	Recognises ALAN as a pollutant; adverse effects on ecology/health; no statutory framework; CPCB/MoEFCC directed to formulate standards	Urges MPCB/state framework - Litigation risk if ignored

Table 2: ALAN alignment with climate and sustainability objectives

Commitment	Goal	Alignment
43 AMRUT Cities Climate Action Plans	Mandatory city plans via Climate Action Cells (GR 2024) [8]	Integrate ALAN standards for urban resilience.
India Net Zero by 2070	LT-LEDS (2022); 500 GW non-fossil by 2030. [9]	Contribute to energy-demand reduction and emissions mitigation consistent with national climate targets.
Under2 Coalition	Paris-aligned subnational action (Maharashtra joined 2021). [10]	Global low-carbon lighting standards enhance leadership.
SAPCCHH & Majhi Vasundhara	Health resilience; green spaces/solar initiatives. [11]	Reduces circadian disruption Dark corridors aid biodiversity.

These obligations carry legal, financial, and institutional significance. The distinction between binding compliance (Table 1) and strategic alignment (Table 2) clarifies immediate regulatory responsibilities versus longer-term leadership, forming the foundation for coordinated, phased implementation.

What's weak right now (diagnosis)

1. **Alignment column is vague**
Phrases like “integrate ALAN standards” or “enhance leadership” don’t tell administrators **why this matters operationally**.
2. **No institutional hook**
The table doesn’t show *where ALAN fits into existing machinery* (cells, plans, reporting).
3. **Outro overexplains**
It repeats distinctions already obvious from headings.

Table 2:

Commitment	Existing Mechanism	Relevance to ALAN Governance
AMRUT Climate Action Plans (43 Cities)	Mandatory Climate Action Cells and city-level plans (GR 2024) [8]	Provides an existing institutional platform to incorporate outdoor lighting efficiency, controls, and night-time resilience measures.
India Net Zero by 2070	Long-Term Low Emissions Development Strategy (LT-LEDS, 2022); 500 GW non-fossil capacity by 2030 [9]	Outdoor lighting efficiency and demand management contribute to electricity demand reduction aligned with national mitigation pathways.
Under2 Coalition	Paris-aligned subnational climate commitments (Maharashtra joined 2021) [10]	Enables adoption of internationally consistent low-emissions lighting practices as part of subnational climate action.
SAPCCHH & Majhi Vasundhara	State health and sustainability programmes [11]	Supports reduction of night-time light exposure and protection of ecological corridors, consistent with public health and biodiversity objectives.

Implementation: A Three-Phase Pathway

This pathway sequences actions across pilot validation (2026–2029), statewide scaling (2029–2035), and consolidation phases (2035–2047), managing implementation risk while establishing early proof points for administrative and fiscal performance.

Phase	Objective	Critical Milestones
I: Pilot 2026	Pilot sites feed policy creation	<ul style="list-style-type: none">• Broader Guidelines for Dark Sky Policy by Environment Department• Constitute an inter-departmental steering committee• Amend Tourism policy to include dark sky conservation through astrotourism• Launch DSI Certified pilot projects
I: Pilot 2027	Findings guide policy amendments	<ul style="list-style-type: none">• Finalise area classifications (core, buffer, urban)• Notify ALAN under Environment Act
I: Pilot 2028/29	Pilots drive standardised systems	<ul style="list-style-type: none">• Capacity-building for all stakeholders• Track ecological, energy, health, and economic outcomes
II: Scaling 2029-35	Statewide rollout and monitoring	<ul style="list-style-type: none">• Expand to urban, rural, forest, tourism, and coastal zones• Strengthen enforcement and monitoring systems• Integrate ALAN into EIA processes• Statewide public dark-sky-compliant lighting retrofits
III: Consolidation 2035-47	Maharashtra guides the National ALAN Policy	<ul style="list-style-type: none">• Monitor statewide compliance and outcomes• Track statewide energy and carbon savings

This phased structure enables risk-managed deployment with defined decision gates. Pilot phase delivers certification-driven revenue and technical validation by 2029; scaling phase operationalises statewide compliance and energy savings by 2035; consolidation phase positions Maharashtra as a national reference model. The pathway delivers early returns while building institutional capacity systematically.

Why AstronEra

International experience demonstrates that successful ALAN governance depends on a dedicated entity capable of standards interpretation, inter-departmental coordination, scientific dataset management, and long-term certification oversight.

AstronEra (AEII Pvt. Ltd.), led by Ms. Shweta Kulkarni (FRAS), has been operating at this intersection of policy, science, and implementation within India's governance context. Ms. Kulkarni's recognition as Dark Sky Defender (Asia 2024) was acknowledged by the Honourable Chief Minister of Maharashtra in his National Space Day (23rd August 2025) announcement of the forthcoming Dark Sky Policy.

With guidance from MITRA, AstronEra has supported the identification of eleven pilot dark-sky sites across the State and has already been appointed as the Technical Secretariat for DarkSky Certification in multiple districts. This positions AstronEra to support the State as a neutral, technically competent partner for coordinated policy execution.

- Only Indian entity with a direct, formal relationship with DarkSky International [1]
- Member of the DSI working group updating Dark Sky Places guidelines
- Organised DST-funded international Conference on dark sky preservation and astrotourism [2]
- AstroGuide Training Project funded by the IAU's Office of Astronomy development [3,4]
- Published a scientific report dark sky policy roadmap for Maharashtra [5]
- 15+ years building global network and outreach

Scope

- Act as technical secretariat for the Steering Committee
- Research, analyse, and contextualise global dark sky conservation and astrotourism models to inform state-level policy design, guidelines, and regulatory frameworks.
- Act as a liaison between DSI, international experts and the Government
- Coordinate Dark Sky Place certification and long-term sustainability within India
- Cultivate localised AstroGuides and technical capacity
- Establish and process night-sky quality, light pollution, and ecological impact datasets
- Technical liaison between research institutions, universities, and government departments
- Translate scientific findings into policy briefs, technical notes, and public-facing content

AstronEra partner capacity to government will align policy expertise, interdepartmental coordination, international certification pathways, global recognition, and localised implementation experience to support dark-sky governance at the State level.

DarkSky International (DSI) is a United States-based, non-governmental, non-profit organisation that functions as a global technical and standards reference body for responsible outdoor lighting and night-sky protection. Its role in this framework is limited to providing internationally recognised technical criteria, certification protocols, and best-practice guidance. Engagement with DSI does not entail policy delegation, regulatory authority, or funding dependency; all policy decisions, enforcement powers, and institutional control remain exclusively with the Government of Maharashtra.

Action Recommendations

Based on the phased roadmap outlined in the previous section, the following immediate actions are required to establish Maharashtra as India's leader in ALAN regulation for dark sky conservation and astrotourism development.

I. Establish Steering Committee

Chair: Chief Secretary

Members: Environment, Tourism, Forest, Urban Development, Energy, Tribal Development

Technical Secretariat: AstronEra (via MoUs)

II. Publish Broader Guidelines for Dark Sky Policy

The Environment and Climate Change Department provides an operational framework to establish baseline standards pending formal policy legislation; Align with the EPA 1986 amendment pathway.

Scope

- ★ Follow Five Principles of Responsible Outdoor Lighting and global lighting best practices [Annexe B2]
- ★ Site selection criteria, zonal and area classification system, and enforcement mechanisms
- ★ Integration with existing eco-tourism and relevant guidelines
- ★ Stakeholder engagement mechanisms
- ★ Metric benchmarking, collection, and reporting frameworks

III. Amend Maharashtra Tourism Policy 2024

Publish broader guidelines to develop a dedicated astrotourism section with a Non-infrastructure approach, prioritising ecological preservation through Dark Sky Certification

Scope

- ★ Dark sky conservation as a tourism asset
- ★ Experiential offerings: Astronomical events, observations and tours
- ★ Revenue generation model through programs such as astroguide training and homestays
- ★ Astrotourism circuit connecting certified Dark Sky Places across the state

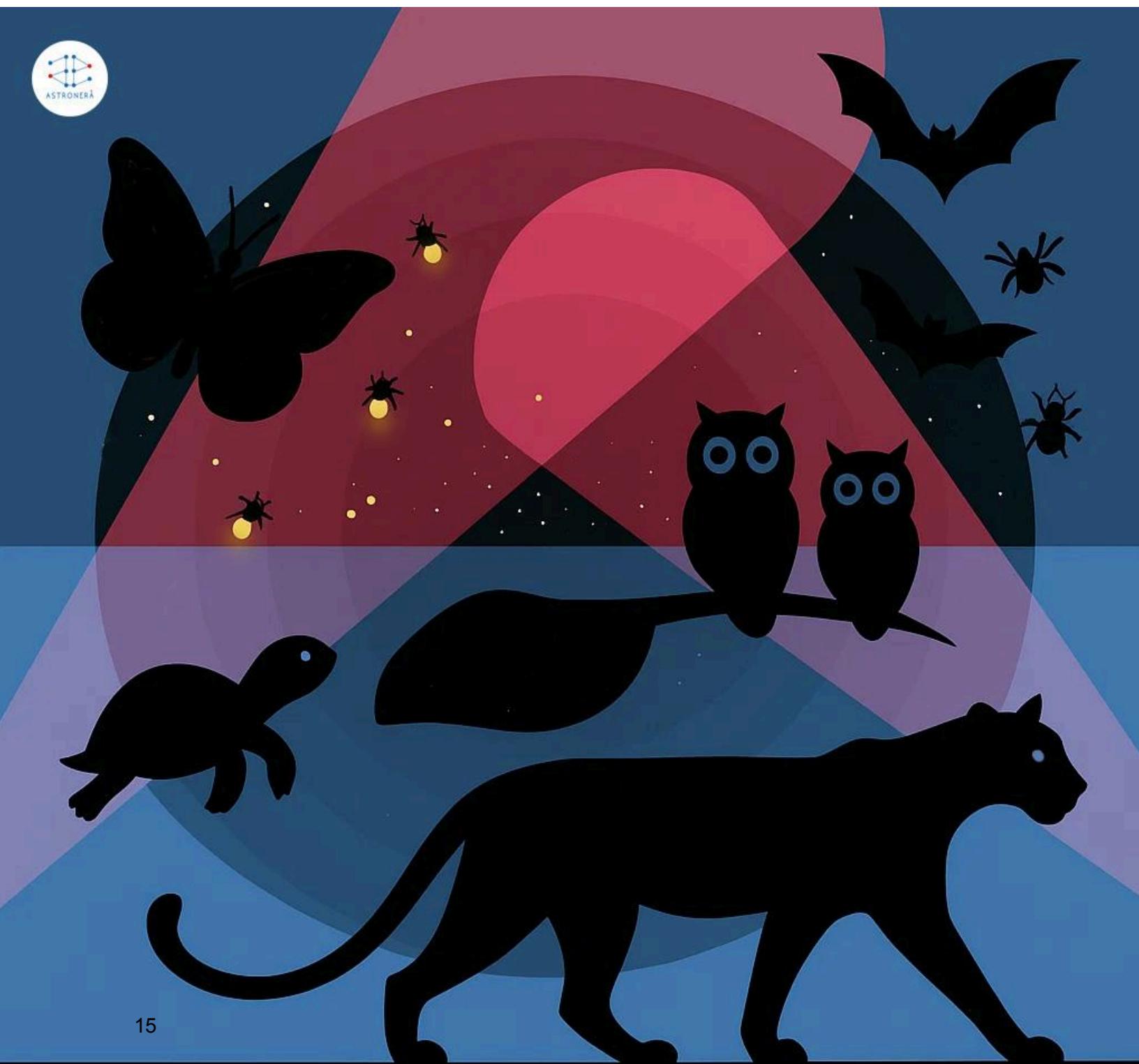
IV. Commission Detailed Policy Research and Drafting

This document outlines the proposed dark-sky policy framework. Further commissioned research, technical studies, and consultations will be required to generate the evidence base, implementation tools, and draft regulatory inputs necessary for policy formulation.

These actions establish legal, technical, and programmatic foundations. They can be executed within existing departmental authority, deliver measurable outputs, and position Maharashtra to capture first-mover advantage in India, while meeting binding environmental compliance requirements.

Dark Skies: A Right, Not A Privilege

The night sky is not a lost heritage; it is a recoverable public asset. With focused executive action, Maharashtra transforms lighting from an unmanaged liability into a governed resource, meeting legal obligations while capturing economic opportunity. The state that acts first establishes the regulatory standard, captures the tourism market, and positions itself as India's reference model for sustainable governance. **The decision point is now.**



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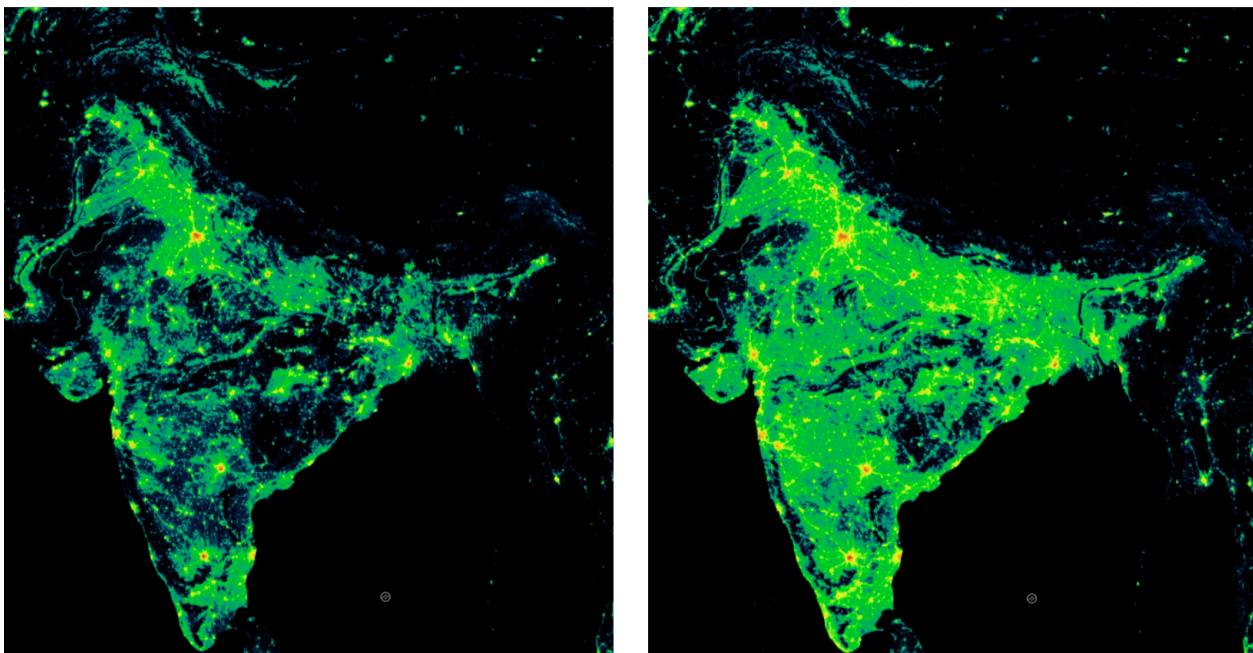
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Annexe A: Definitions and Terminology

Term / Abbreviation	Definition
Artificial Light at Night (ALAN)	Outdoor artificial illumination occurring between sunset and sunrise
Core Dark Area	Areas requiring the highest level of night-sky protection, where lighting is restricted to essential safety and operational needs
Buffer Area	Transition areas surrounding Core Dark Areas where lighting is permitted under controlled intensity, spectrum, shielding, and curfew
Urban Area	Built-up areas where lighting is regulated primarily for efficiency, shielding, and spectral control
Zones	Government-declared functional areas (Urban, Tourism, Forest, Tribal, Coastal) used for sector-specific governance and enforcement
Steering Committee	Inter-departmental body constituted by the State Government for policy oversight, coordination, and approvals
Technical Secretariat	Designated technical body providing scientific, regulatory, and implementation support to the Steering Committee
Shielded Lighting	Lighting fixtures designed to prevent light emission above the horizontal plane
Correlated Colour Temperature (CCT)	Measure of light colour expressed in Kelvin (K), used to regulate spectral impact on ecology and human health
Lighting Curfew	Time-based restriction requiring dimming or switch-off of non-essential outdoor lighting
Dark Sky Place	Site formally recognised under an international dark-sky certification framework based on lighting standards, monitoring, and long-term management
Artificial Lighting Management Plan (LMP)	Site or area-specific plan defining lighting design, operation, and mitigation measures
Night-Sky Quality Monitoring	Measurement and documentation of night-sky brightness and light pollution using approved scientific methods

Annexe B: Visual Evidence and Technical Illustrations

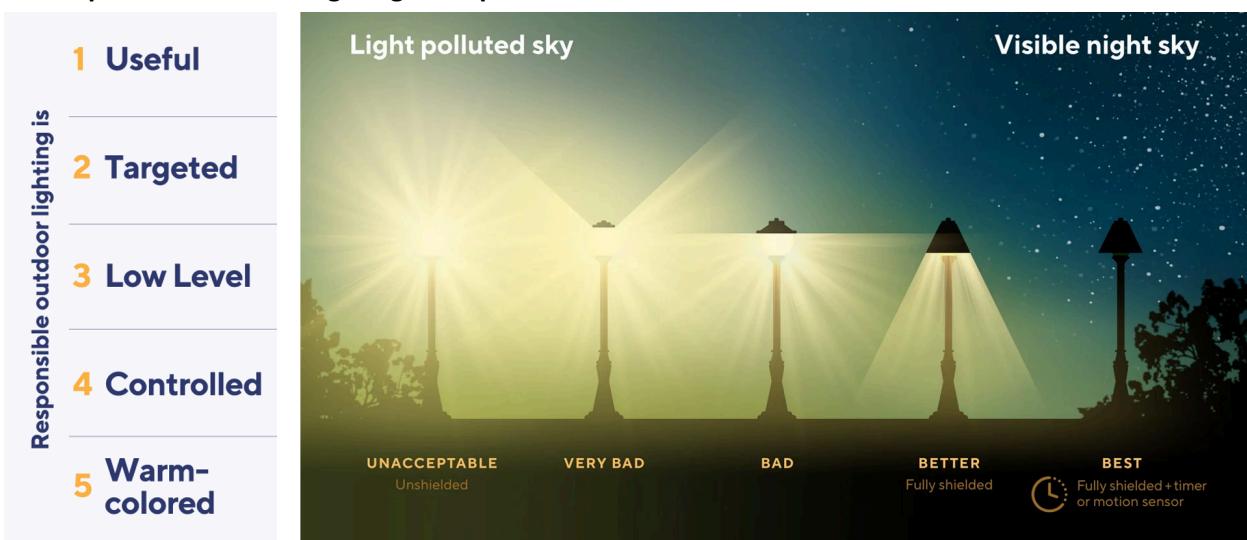
B1. India Night-Time Light Pollution (2013 vs 2023)



Night-time radiance across India, showing the growth and spatial expansion of artificial lighting over a decade. Brighter areas correspond to urban centres and high-density development.

Data source: Visible Infrared Imaging Radiometer Suite (VIIRS), lightpollutionmap.info, 2013 & 2023.

B2. Responsible Outdoor Lighting Principles



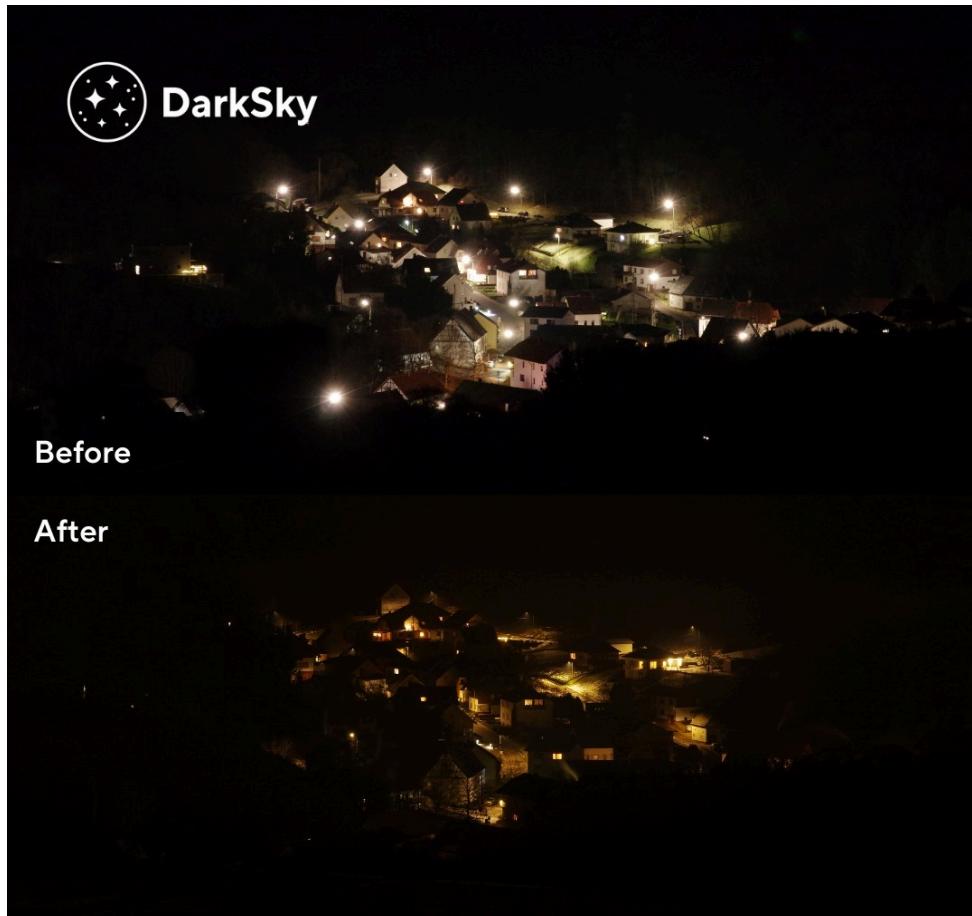
Responsible outdoor lighting reduces skylight, saves energy, and protects wildlife and the night sky by following five principles: light only when needed, direct light downward, use minimum brightness, employ timers or motion sensors, and maintain correlated colour temperature (CCT) <3,000 K. Source: DarkSky International.

B3. Correlated Colour Temperature (CCT) Spectrum



CCT spectrum, measured in Kelvins, showing that warmer light <3,000 K reduces ecological disruption and skyglow compared to cool blue-rich sources >5,000 K. *Source: Luke-Roberts Smart Lighting.*

B4. Eiweliler, Germany: Dark Sky Community Certification



Lighting retrofit demonstrating implementation of Dark Sky Responsible Outdoor Lighting principles. All public lights were converted to shielded, low-intensity, warm-coloured fixtures, reducing light pollution and preserving visible night sky. *Source: DarkSky International, 2024.*

B5. Before and After: Light Pollution Mitigation Practices



Comparative imagery illustrating the effect of implementing night-sky-friendly outdoor lighting practices recommended by the McDonald Observatory Dark Skies Initiative. The initiative seeks to *keep light on the ground and out of the sky*, preserving dark night skies for astronomy and ecology.

Source: McDonald Observatory Dark Skies Initiative (University of Texas at Austin).

B6. Dunedin, New Zealand – Sodium to Shielded LED Retrofit



Night-time view showing the reduction in light pollution after city-wide replacement of unshielded sodium lamps with shielded LED luminaires. Demonstrates measurable improvement in skyglow and local night environment.

Photo credit: Brad Phipps, Dunedin, New Zealand, 2021.