Eurogia Call25 - PO Hearing

SMARTLIGHT

Flexible and Scalable AI-Driven Adaptive Street Lighting for Safer and More Energy-Efficient Urban Spaces

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Project Partners:
Istanbul Technical University
Istanbul Metropolitan Municipality
İsttelkom
Ecolant
Lotec
Electricity Distribution Company

MOTIVATION

Population Growth

The share of people living in cities will grow from 55% in 2018 to 68% by 2050, pushing cities to develop smarter and more sustainable infrastructure. (UN World Urbanization Prospects)

Public street and area lighting account for up to 40% of the electricity consumed by municipalities (Clean Energy Ministerial).

Sodium Vapor Lamps Drawbacks

- Limited remote control.
- Inconsistent light output as they age.
- Limited directional lighting.
- Compatibility issues with modern control systems.
- Energy inefficiency compared to LEDs

LED Advantages

- 50-70% energy savings,
- Reduced maintenance,
- Improved brightness.
- LED conversion alone saves 50-70% of energy.
- SMARTLIGHT System saves an additional 30-35%
- Total energy savings of 60-80%

Advantages of Intelligent Lighting

Cut energy use by 60-80%.

Boost safety with adaptive lighting.

Allow remote fault detection and fast repairs.

Lower carbon footprint and light pollution.

Motivation

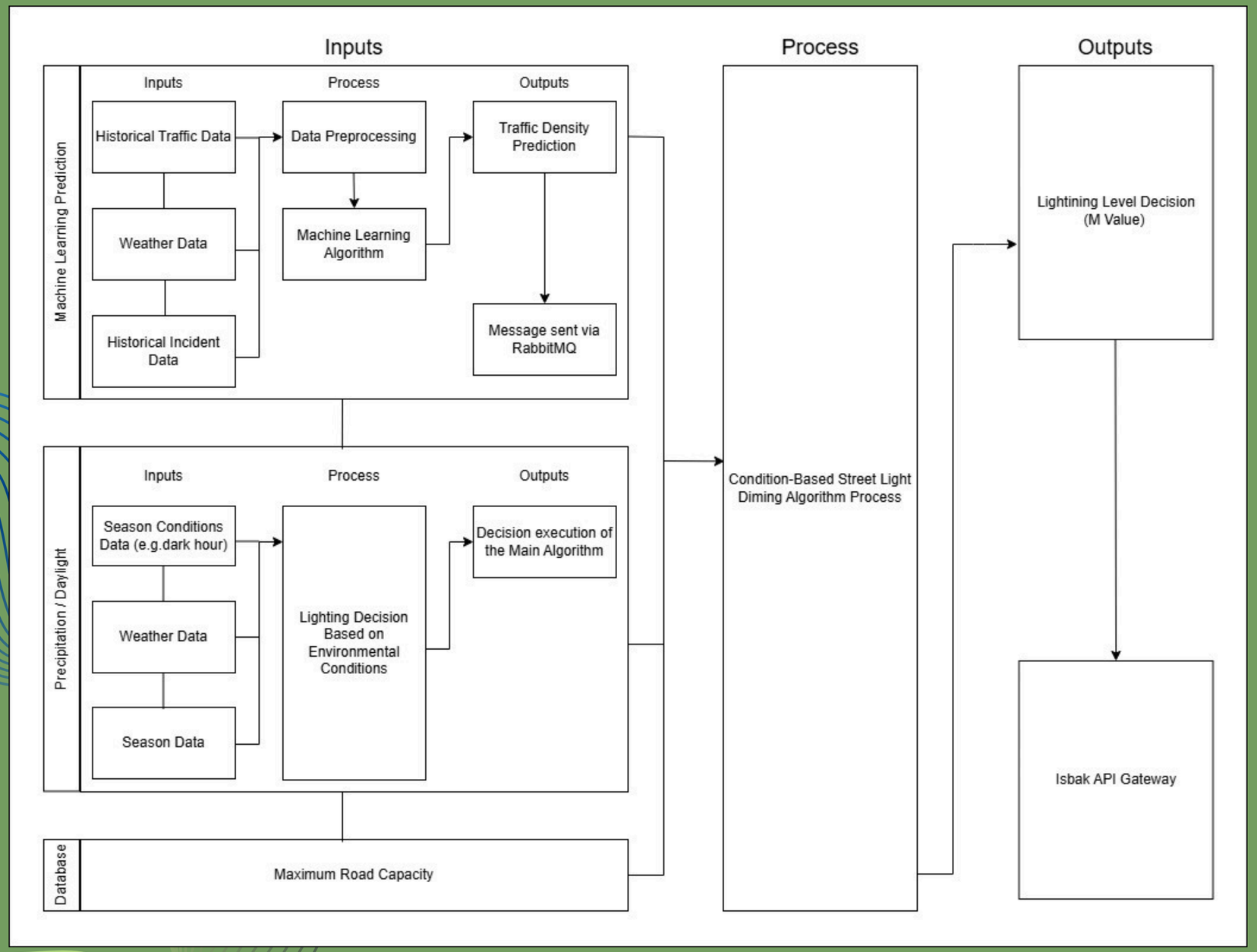
Energy distribution operators highlight the need for smart lighting solutions that are flexible, scalable, and easily deployable.

Building on our previous success in developing advanced smart lighting technologies, we are now taking a new approach that doesn't rely on sensors. This makes the system easier to install, more flexible, and much easier to scale across cities.

SMARTLIGHT

- Reduces energy consumption and CO_2 emissions through an AI-powered adaptive lighting system, supporting decarbonization and energy efficiency.
- Utilizes Floating Car Data and other sources to optimize urban energy management, promoting digitalization and decentralization.
- Offers an innovative and scalable low-carbon solution for various cities.
- Complies with EN 13201 road lighting standards, ensuring regulatory alignment.
- Fosters multinational collaboration among public authorities, academia, and industry, exemplified by the Türkiye-South Korea partnership.

Project Summary



Project Description & Project Objectives

Objective

Develop a cost-effective, AI-powered adaptive street lighting system using Floating Car Data (FCD) instead of roadside sensors.

Pilot Implementation

Deploy the complete system in a 2 km pilot area in Istanbul for real-world testing.

Monitor and collect data to evaluate:

- Energy savings
- System performance
- Scalability

Key Activities

- Validate the accuracy of Floating Car Data (FCD).
- Design the overall system architecture.
- Develop machine learning algorithms for real-time traffic prediction and dynamic lighting control.
- Ensure compliance with EN 13201 lighting standards.
- Create a map-based IoT dashboard for real-time remote monitoring and control.
- Develop and integrate smart luminaires and lighting control units with wireless communication modules.

CONSORTIUM

ISBAK

Smart City Technologies Provider

Leads the project, oversees system architecture, and develops the AI-powered traffic prediction and lighting control logic.

ECOLANT

AIoT-Based Smart Lighting Company

Designs and implements the IoT platform and map-based control panel for real-time monitoring and system management.

LOTEC

Lighting Hardware Manufacturer

Provides smart lighting hardware components, including lighting control units and IoT modules.

ITU

Istanbul Technical University

Guiding and consultancy of an adaptive lighting control algorithm, laboratory and field tests, data analysis and validation, dissemination of the project results.

ISTTELKOM

Municipal Telecom and Infrastructure Operator

Supplies the database infrastructure and secure data connectivity for the IoT platform's operation and scalability.

IBB

Istanbul Metropolitan Municipality

Provides real-time and historical traffic data to validate Floating Car Data.

ELECTRICITY DISTRIBUTION COMPANY

Urban Grid Operator

Deployment and integration of smart lighting with the city's power infrastructure, provides LED luminaires, and facilitates field testing under real grid conditions.

WP1 – Project Management and Coordination

Overall coordination and effective implementation of the project's technical and administrative activities, ensuring alignment with timelines and budget constraints.

Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
WP1 - Project Management and Coordination																									
WP2 - Validation of Floating Car Data (FCD) Accuracy with Field Sensor Data		M1																							
WP3 - System Requirements Analysis and Architecture Design				M2																					
WP4 - Development of Adaptive Lighting Control Algorithm							M3																		
WP5 – IOT Platform Integration and Control Panel Development															M4										
WP6 – Hardware Supply, Integration, and Testing of Lighting Infrastructure Components																									
WP7 – Pilot Implementation and Testing in Istanbul																				M5					
WP8 – Impact Assessment and Scalability Analysis																								M6	
WP9 – Dissemination and Communication																									
WP10 – Exploitation and Business Planning																									

WP2 – Validation of Floating Car Data (FCD) Accuracy

Objective:

Validate the accuracy and reliability of Floating Car Data (FCD) from platforms like TomTom.

Pilot Setup:

Conduct comparative analysis on a 2 km road section in Istanbul equipped with existing traffic sensors.

Approach:

Test if sensor-free traffic monitoring using FCD is accurate enough to replace traditional roadside sensors.

Outcome Expected:

A proven, cost-effective alternative that enables easier deployment and wider replication of adaptive lighting.

Traffic data accuracy comparison

WP3 – System Requirements Analysis and Architecture Design

- Define functional and non-functional requirements for data input, prediction, and lighting control.
- Plan data integration for FCD, weather, and traffic data collection and processing.
- Design the system architecture, including edge devices, servers, AI, and lighting hardware interaction.
- Set secure communication protocols (e.g., MQTT, REST APIs) for reliable data exchange.
- Link each system requirement to specific hardware and software modules (luminaires, controllers, AI).
- Ensure the design complies with EN 13201 standards for street lighting.

isbak · ECOLANT Lighting Application & Technology · İTÜ · Lotec Light Of Technology · Electricity Distribution Company

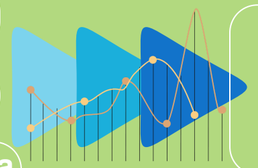
WP4 – Development of Adaptive Lighting Control Algorithm (ITU, ISBAK)

WP4 focuses on developing an adaptive lighting control algorithm that uses AI-driven traffic prediction models to dynamically adjust street lighting based on traffic (speed and flow rate) and environmental data, enhancing energy efficiency and road safety in line with EN 13201 standards.

Traffic Flow Data

Weather Data

Traffic Incident Data



Adaptive Lighting Control Algorithm

Development and training of the traffic prediction model using FCD, weather, and traffic incident data.

Guiding and consultancy of an adaptive lighting control algorithm.

Table 1 — Parameters for the selection of lighting class M

Parameter	Options	Description [a]		Weighting Value V_w [a]
Design speed or speed limit	Very high	v ≥ 100 km/h		2
	High	70 < v < 100 km/h		1
	Moderate	40 < v ≤ 70 km/h		-1
	Low	v ≤ 40 km/h		-2
Traffic volume		Motorways, multilane routes	Two lane routes	
	High	> 65 % of maximum capacity	> 45 % of maximum capacity	1
	Moderate	35 % - 65 % of maximum capacity	15 % - 45 % of maximum capacity	0
	Low	< 35 % of maximum capacity	< 15 % of maximum capacity	-1
Traffic composition	Mixed with high percentage of non-motorised			2
	Mixed			1
	Motorised only			0
Separation of carriageway	No			1
	Yes			0
Junction density		Intersection/km	Interchanges, distance between bridges, km	
	High	> 3	< 3	1
	Moderate	≤ 3	≥ 3	0
Parked vehicles	Present			1
	Not present			0
Ambient luminosity	High	shopping windows, advertisement expressions, sport fields, station areas, storage areas		1
	Moderate	normal situation		0
	Low			-1
Navigational task	Very difficult			2
	Difficult			1
	Easy			0

[a] The values stated in the column are an example. Any adaptation of the method or more appropriate weighting values can be used instead, on the national level.

WP5 – IoT Platform Integration and Control Panel Development

- Development and integration of an IoT platform and map-based control panel for the SMARTLIGHT system.
- Establishment of secure and scalable communication between lighting devices and the central system.
- Delivery of a user-friendly control interface accessible on desktop and mobile platforms for real-time monitoring and management.

SMARTLIGHT DASHBOARD

Real-Time Fault Detection & Public Safety

- In the current system, lighting faults are detected only through public complaints or manual inspections.
- This delays response times and poses risks to public safety.
- Smartlight Dashboard enables real-time fault monitoring and alerts.

Benefits: Enhances public safety, reduces downtime, and lowers operational costs.

Fault & Distribution Report
Analyzes the type and location of equipment failures.

Energy Consumption Reports
Tracks total energy usage daily, weekly, and monthly.
Compares historical and current consumption trends.

WP6 – Hardware Supply, Integration, and Testing (LOTEC, ISBAK, ITU)

WP6 focuses on procuring, integrating, and testing the hardware for the SMARTLIGHT system, including IoT modules (Lighting Control Units (LCUs)), Gateways and LED luminaires .

Led by LOTEC, with support from ISBAK:

LOTECs' Core Role:

- Designing and manufacturing the Lighting Control Unit (LCU), the key IoT component of the SMARTLIGHT system with compitable DALI protocols.
- Ensuring seamless interoperability with the AI-based adaptive lighting algorithm (developed in WP4)
- Procuring and integrating gateway devices and IoT communication modules
- Delivering a fully validated and pilot-ready hardware infrastructure

ITU (Photometric & Electrical Testing)

- Measures LED luminaires' photometric and electrical characteristics
- Analyzes performance under various dimming levels to ensure compliance and consistency

ISBAK (System Compatibility & Grid Integration)

- Supports hardware testing and validates the integration of LOTEC's LCU with the adaptive control system
- Ensures compatibility with the existing energy distribution infrastructure
- Assists with on-site system validation and testing

WP7 – Pilot Implementation and Testing in Istanbul

Objective:
Validate the SMARTLIGHT system in real-world conditions by integrating and testing the hardware, software, and AI algorithms developed in previous work packages.

Deployment Area:
A 2 km stretch in Istanbul equipped with 100 smart LED luminaires at 40 m intervals.

Activities:

- Install smart lighting with IoT modules.
- Connect to the adaptive control system via central and edge devices.
- Ensure grid integration with the Electricity Distribution Company.
- Operate with real-time control via a map-based dashboard.
- Monitor energy savings, responsiveness, and reliability under real-world conditions.

Electricity Distribution Company

isbak

İTÜ

Lotec

Led by the Electricity Distribution Company with support from ISBAK, ITU and LOTEC:

installing infrastructure, integrating hardware and software, and validating system performance for different adaptive road lighting scenarios with field measurements. The goal is to ensure energy efficiency, adaptive lighting control, and compliance with safety standards, while providing valuable insights for scalability and future implementation.

ISBAK & Istanbul Technical University (ITU) - Urban Street Lighting Calculations

WP8 – Impact Assessment and Scalability Analysis

Objective: Prove the system's benefits and support wider deployment for smarter, greener cities.

What We Will Assess:

- Energy savings from adaptive lighting
- Reduction in carbon emissions
- Cost-effectiveness of the system
- How easy it is to scale the solution to other parts of the city or to other cities

Electricity Distribution Company

WP9 – Dissemination and Communication

Objective: Boost awareness, foster collaboration, and support adoption of SMARTLIGHT across cities.

- **Communicate progress and results to municipalities, energy companies, and industry partners**
- **Publish scientific papers and present at conferences**
- **Organize workshops, pilot demos, and stakeholder meetings**
- **Promote the project through online channels, press, and events**

WP10 - Exploitation and Business Planning

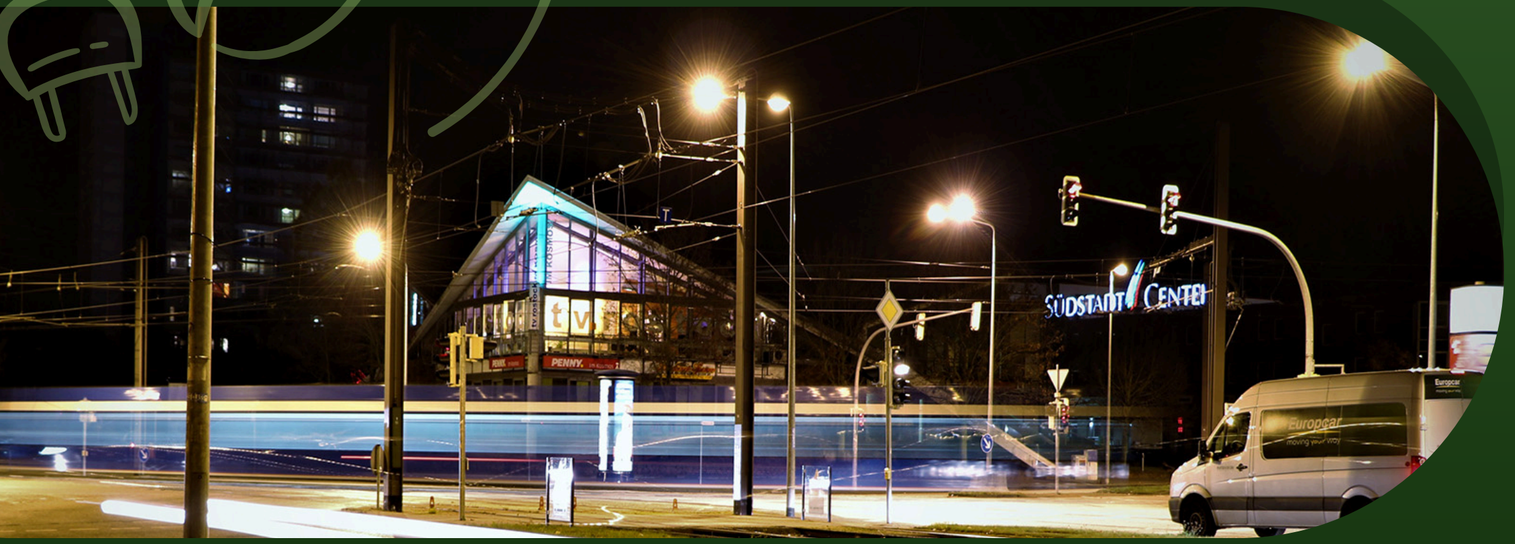
Objective: Turn SMARTLIGHT into a scalable, cost-effective product ready for commercialization across Europe and beyond.

Key Activities:

- **Develop a business model tailored for cities and utility companies**
- **Conduct market research and competitor analysis**
- **Create financial projections and identify revenue streams**
- **Align with EU energy and sustainability goals**

Successful market entry and growth in the smart lighting sector, aligned with EU sustainability goals.

Innovative Side



Sensor-Free Adaptive Lighting

The system uses real-time traffic data instead of expensive roadside sensors to adjust street lighting, offering easy replication across different urban environments, making it suitable for wide-scale adoption in cities of all sizes.

AI-Driven Predictive Control

Advanced machine learning algorithms forecast traffic patterns and adjust lighting accordingly, ensuring energy efficiency and safety under varying traffic conditions.

Compatibility with Existing Systems

The system is fully compatible with current energy distribution networks and smart city platforms, allowing smooth integration without disrupting existing services.

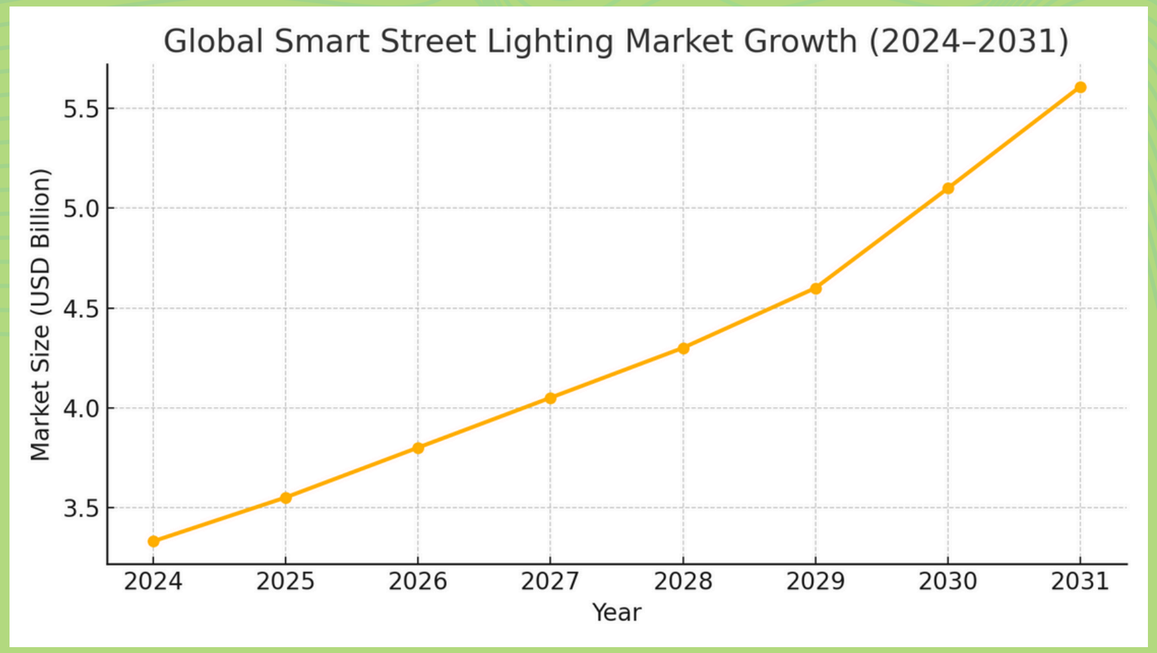
- Mi***nimal Infrastructure Investment***

Market

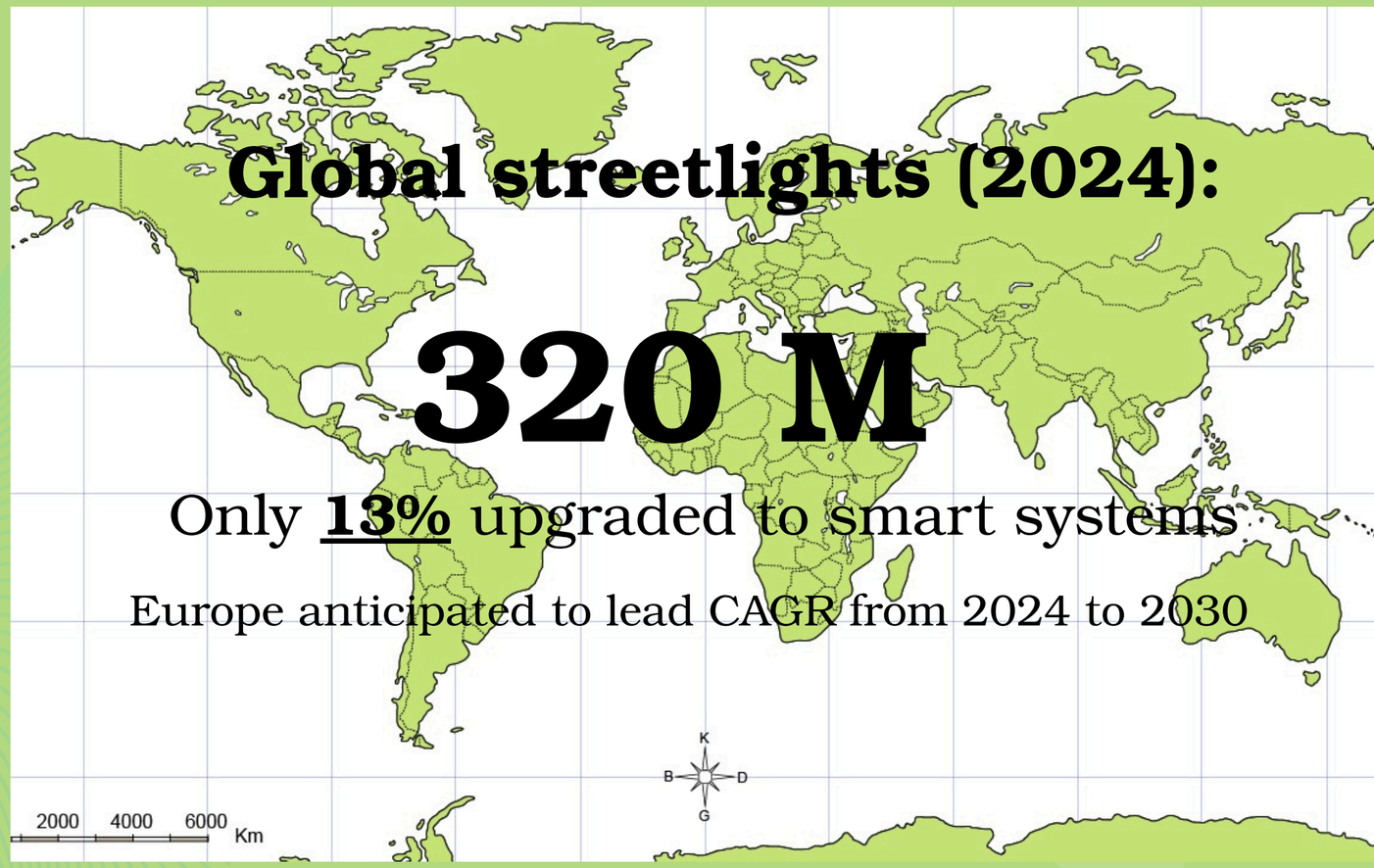
Global smart street lighting market:

USD 3.3 B (2024) → USD 5.61 B (2031), CAGR > 5.2%.

Source: Persistence Market Research 2024



https://www.persistencemarketresearch.com/market-research/smart-street-lightning-market.asp



Source:

-Persistence Market Research 2024

-https://www.iea.org/news/empowering-smart-cities-toward-net-zero-emissions

Go-to-Market Phases & KPIs

Phase I: Market Validation (Pilot + Showcase

- Implement pilot installations (2–3 km lighting demo routes)
- Monitor KPIs: energy savings, failure rates, maintenance frequency
- Deliverables: success story, technical report, local media visibility

Phase II: Strategic Partnerships

- Agreements with utilities and municipalities
- API integrations and smart city compliance demos

Phase III: Replication & Commercial Expansion

- Minimum viable rollout in 3 cities (e.g. İzmir, Ankara)
- Native integration with smart city platforms

Success Metrics (KPIs)

METRIC	Evidence
≥ 30% energy savings	Electricity monitoring system
ROI ≤ 6 years	Financial feasibility report
At least 3 cities onboarded	Signed deployment agreements

Business Edge

Many governments and municipalities face tight budget constraints.

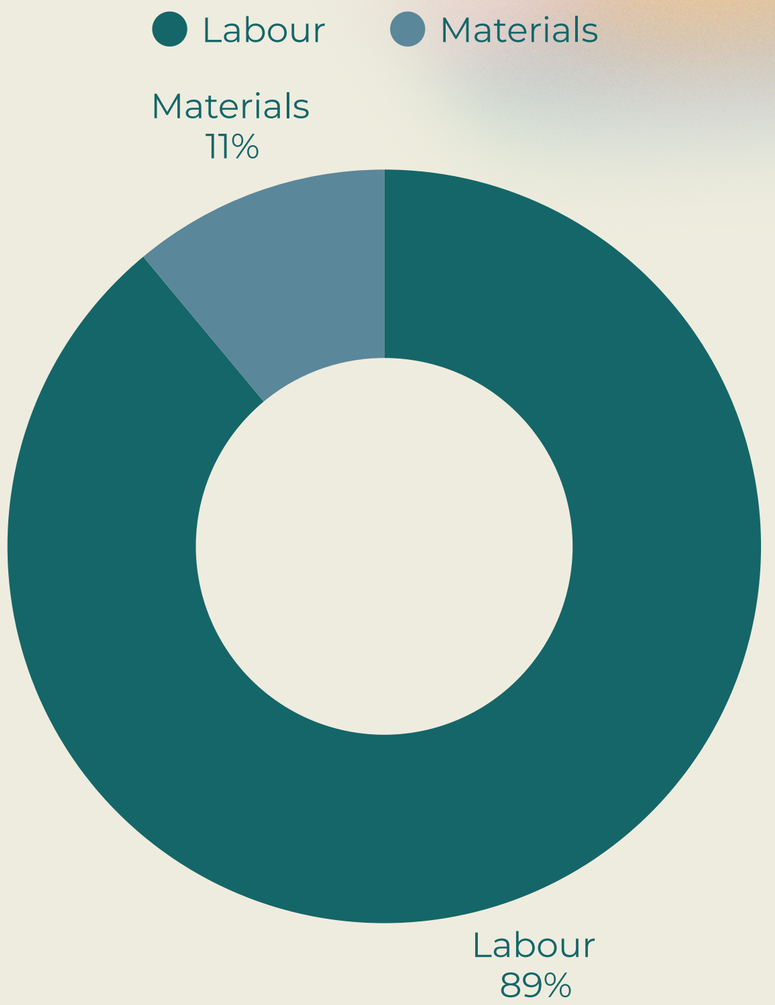
- This financial challenge often limits their ability to modernize infrastructure.
- Our competitive edge lies in offering cost-effective smart lighting solutions that significantly reduce both investment and operational costs—making smart city implementation feasible, even with limited funding.

Financial Plan

Total Project Budget: €1.245 million
Project Duration: 24 months
Total Manpower: 321.6 person-months

Main Cost Categories:
Labour: €1.103 million
Materials: €0.142 million

Lead Partners' Cost Breakdown:
İSBAK: €350,000
Ecolant: €380,000
LOTEC: €200,000
ITU: €85,000
Electricity Distribution Company: €150,000
İSTTELKOM: €35,000
İBB Traffic Department: €45,000



Thank You