PLAN Lumière

THE ESSENTIALS

MONTPELLIER MÉTROPOLE LIGHTING MASTER PLAN

A NEW NIGHT BEGINS...

Montpellier Méditerranée Métropole

"A city is beautiful at night," said writer Richard Bohringer in the late 1980s. It's beautiful, and it's when you get so many human activities happening at the same time – leisure and festivities, rest and tranquility, work... Night is also a time when numerous animal species adapted to night life emerge, helping mankind in more ways than one.

Both during the day and at night, a peaceful metropolis benefits from lighting that respects all its residents – active or sleeping, human, insect, or animal – with a harmonious balance that serves the city and nature.

Today's energy and ecological crisis reminds us that reduction is a factor that must be at the very heart of the way we work, make investment decisions, and develop public spaces. Emerging technologies now offer us ways to light less, but to light better, while adapting lighting to specific spaces and times of night, still respecting everyone's needs.

As the latest part of our Joint Territorial Climate Air Energy Plan, this Lighting Master Plan defines Montpellier Métropole's strategy in terms of public lighting, and positions us as one of the pioneers of a new approach to artificial nocturnal lighting that serves and respects us all, from the heart of Montpellier to the surrounding cities and towns that comprise the richness and diversity of our territory.

Lighting is an essential issue for our area in terms of aesthetics, reduction, and safety.

A new night begins...

Michaël DELAFOSSE
President, Montpellier Méditerranée Métropole
Mayor of Montpellier

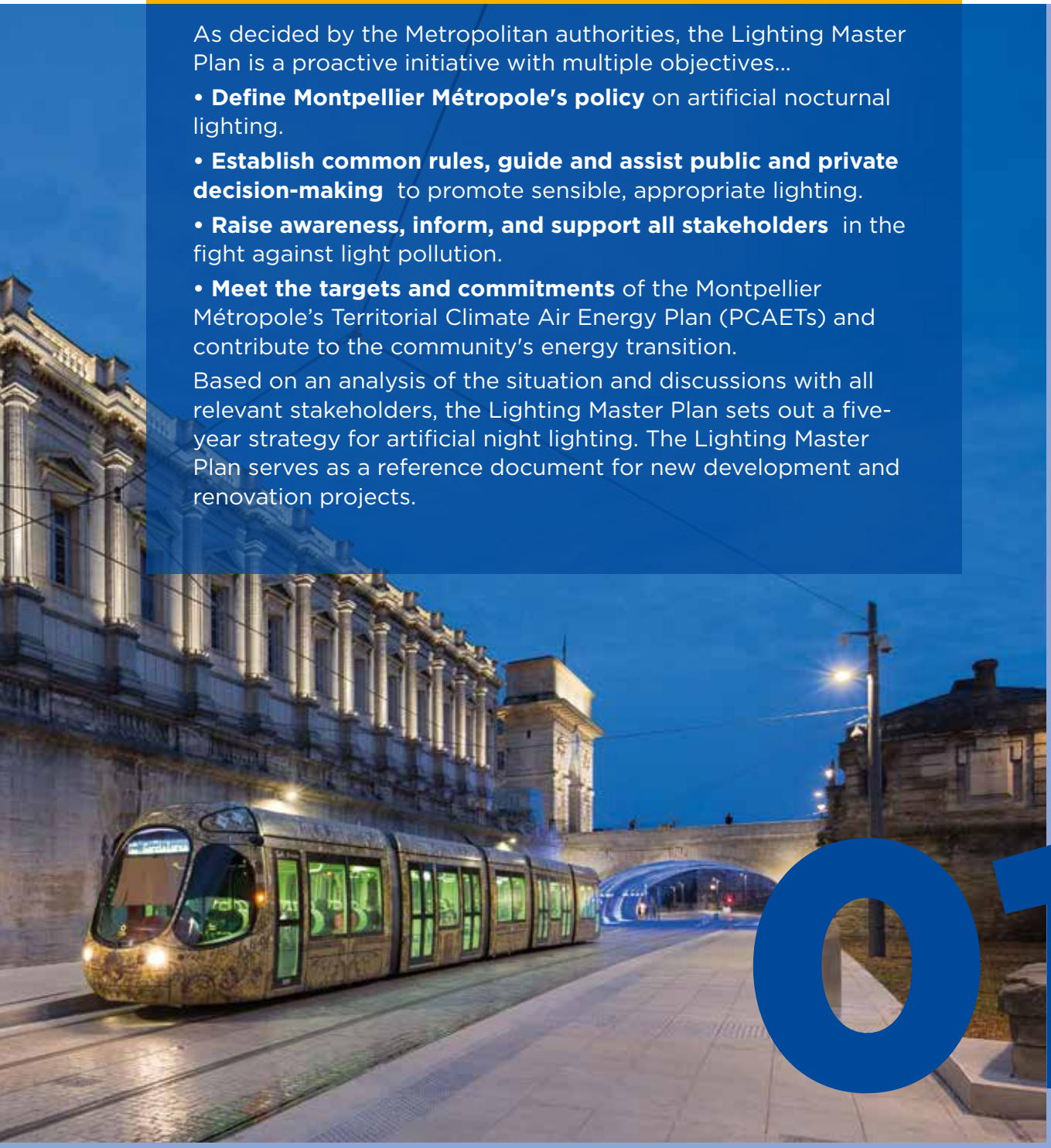
WHY A LIGHTING MASTER PLAN?

Political determination in tune with the region

As decided by the Metropolitan authorities, the Lighting Master Plan is a proactive initiative with multiple objectives...

- **Define Montpellier Métropole's policy** on artificial nocturnal lighting.
- **Establish common rules, guide and assist public and private decision-making** to promote sensible, appropriate lighting.
- **Raise awareness, inform, and support all stakeholders** in the fight against light pollution.
- **Meet the targets and commitments** of the Montpellier Métropole's Territorial Climate Air Energy Plan (PCAETs) and contribute to the community's energy transition.

Based on an analysis of the situation and discussions with all relevant stakeholders, the Lighting Master Plan sets out a five-year strategy for artificial night lighting. The Lighting Master Plan serves as a reference document for new development and renovation projects.



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Understanding the area and the impact

of artificial night lighting

The Lighting Master Plan considers the territory with respect to all its societal and ecological functions, based on the territorial assessments of the SCOT(1), PLUi(2), and PCAETs(3) development plans. By mobilizing its teams and partners, Montpellier Métropole has given itself the means needed to analyze artificial nocturnal lighting, including its history, public and private sources, the state of light pollution, and its impact on the territory, which is distinguished by the great richness and diversity of unspoiled ecosystems. Our findings confirm the need to change our lighting strategy.

A HIGHLY ATTRACTIVE METROPOLITAN AREA, A VARIETY OF NIGHT-TIME FUNCTIONS

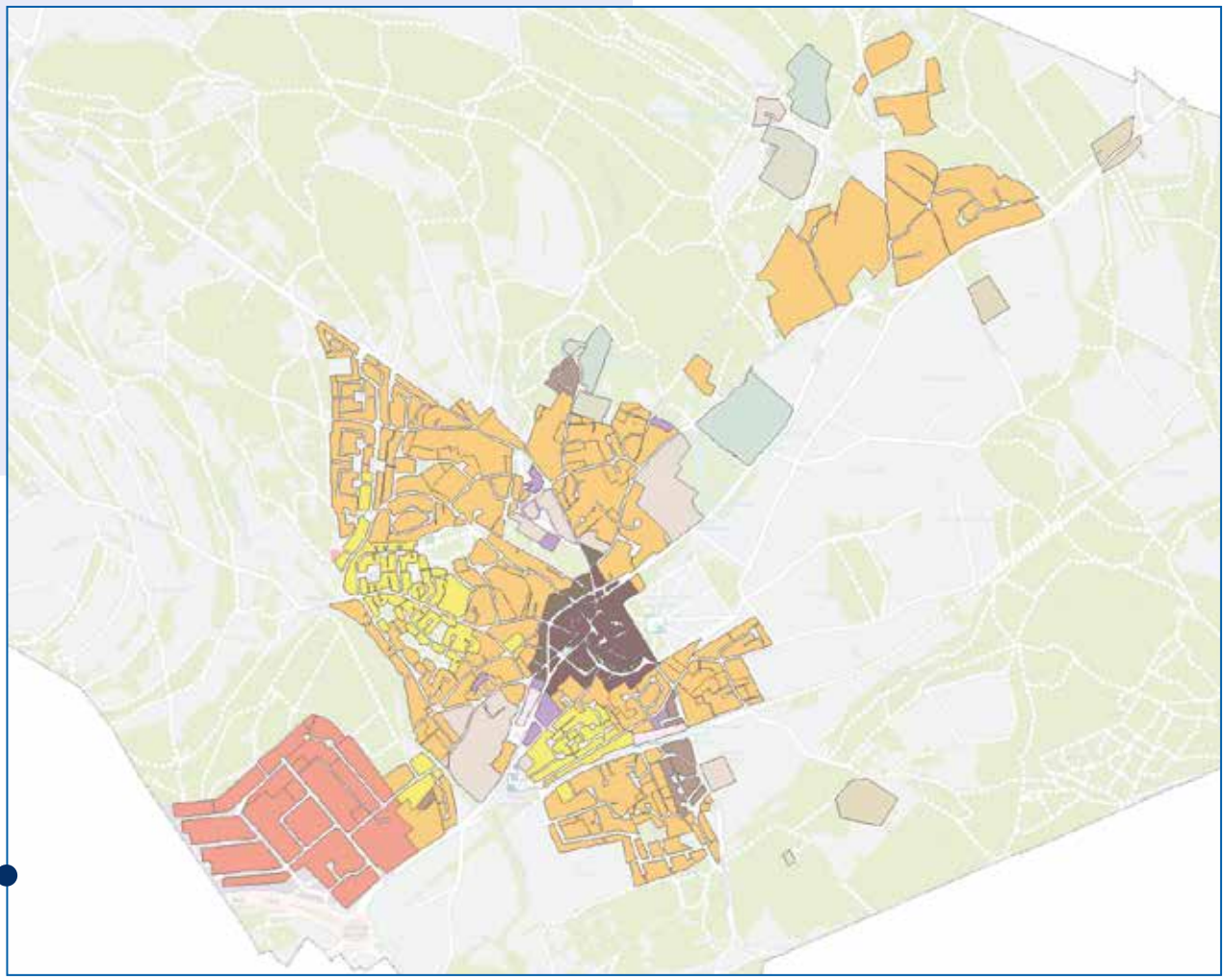
Montpellier Méditerranée Métropole's population has been growing strongly and continuously since the middle of the 20th century. It has now reached 500,000 residents. **The resulting urban development is accompanied by an increase in artificial lighting at night.**

Assessment in the PLUi plan presents a snapshot of the main types of urban infrastructure in each sector within the territory. This analysis pinpoints uses and night-time environments and determines their degree of attractiveness, **so as to identify times of night that warrant urban lighting, as well as lighting management that is best suited** to each area's functionality.

Examples:

- Streets in city centers have different traffic levels at different times, depending on whether or not they have businesses open in the early evening (bars, restaurants, etc.).
- Major public facilities are also distinguished according to whether they are open during the day (schools, universities, government offices, etc.) or at night (auditoriums, hospitals, stadiums, etc.).
- Public parks and gardens may be accessible to the public throughout the night, or they may close at the end of the day.

(1) Territorial Cohesion Plan ("Schéma de Cohérence Territoriale")
(2) Inter-city Local Urban Development Plan ("Plan Local Urbanisme Intercommunal")
(3) Joint Territorial Climate Air Energy Plan ("Plan Climat Air Énergie Territorial Solidaire")



- Historic city center
- Suburb
- Low density collective housing
- Dense individual housing
- Low density individual housing
- Isolated individual housing
- Shopping center
- Agricultural buildings
- Artisans and industry
- School, cultural, sports, leisure, and health facilities
- Sports and leisure fields
- Campgrounds and hotel residences

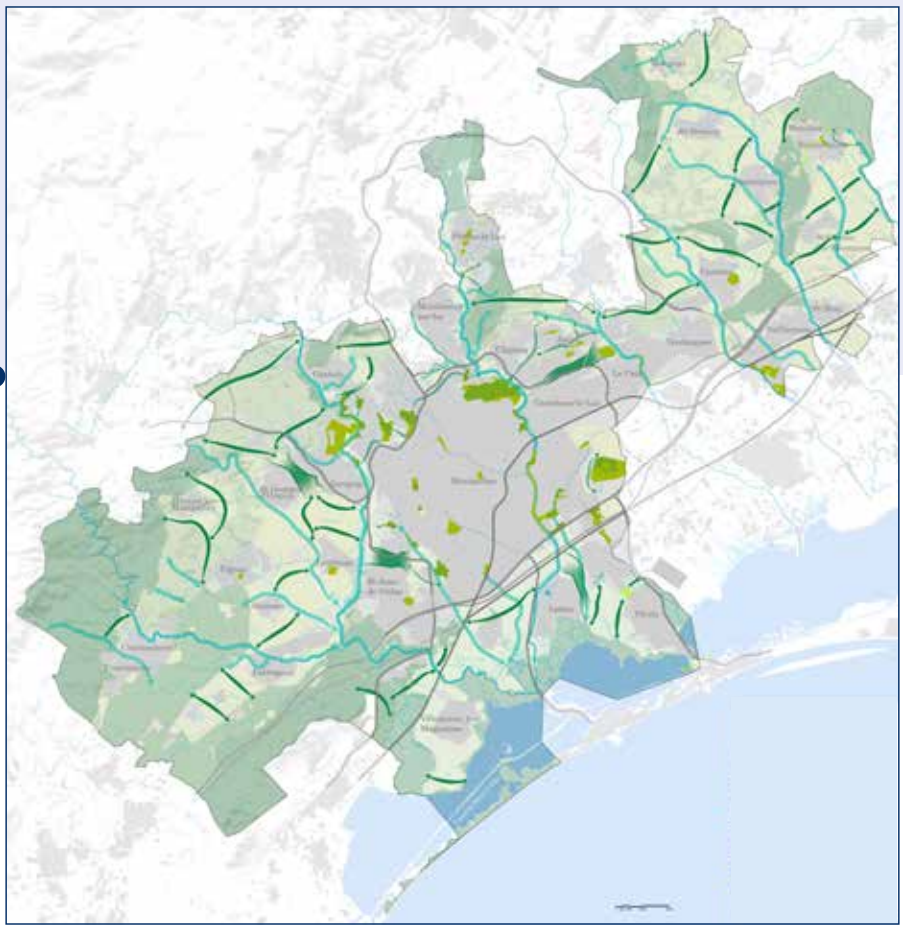
Summary map of the typomorphological analysis of the city of Castries

An analysis of land use enables us to distinguish different types of areas according to their expected use at night.

AN AREA OF EXCEPTIONAL ECOLOGICAL VALUE AND BIOLOGICAL DIVERSITY

Green and blue infrastructure

Map from the revised SCOT plan (Orientations and Objectives document)



The diversity of landscapes found in the metropolitan area highlights the richness of its ecosystems and associated biodiversity.

Our territory is characterized by four types of landscapes: the coastal sandy shores and the vast lagoon complex of the Palavas marshland; the Gardiole hills dominated by forests; the vast agricultural plains from Fabrègues to Saint Geniès des Mourgues; and the northern Montpellier scrublands, offering a transition between the plains and the Causses plateau area. **The metropolitan area's ecological functionality is based on the interdependence of these ecosystems** and on the exchanges provided by their various waterways and rivers.

10,066 hectares of natural spaces – totaling 23% of the metropolitan area – are subject to regulatory protection, management, or control measures.

Situated between the Cévennes mountains and the Mediterranean Sea, **the Montpellier Métropole area is an integral part of one of the world's top 35 biodiversity hotspots**. 60% of the flora, 65% of the nesting birds, 50% of the terrestrial mammals, 50% of the reptiles, and 50% of the amphibians identified in continental France have been observed in our metropolitan area.

Numerous biodiversity reserves and ecological corridors make up the **metropolitan area's "green and blue grid"**, which is integrated into urban planning documents and included in broader ecological continuums central to major national and European migration corridors.

PUBLIC LIGHTING IN THE METROPOLITAN AREA: HISTORY, EXPERTISE, AND AMBITION

Montpellier Métropole has pooled the resources of its towns and cities to centralize management for nearly 80,000 light points, almost half of which have already been upgraded to LED technology.

Modern public lighting appeared in cities towards the end of the 16th century, with the goal of demonstrating that public authorities had the ability to prolong daylight and abolish darkness. On November 20, 1697, 300 oil lamps were installed in Montpellier. Electric lighting came into use in 1887.

An integral part of urban development, street lighting rapidly became more efficient. Originally designed to ensure the safety of pedestrians and to protect people and property, street lighting has since expanded into other applications, such as motor traffic, increased night-time human activities (economic, sporting, and cultural), economic and tourist appeal, and the enhancement of historical monuments.

Public lighting is now a metropolitan responsibility, managed since 2019 by a unified, territory-wide department with a staff of 35 people. Maintenance and operation of lighting systems is managed directly in Montpellier and by service providers in other cities. Illumination of noteworthy buildings is still a municipal responsibility.

At the end of 2022, Montpellier Méditerranée Métropole's "Public Lighting" assets **comprised 79,283 light points (more than half of which were in need of renovation) and 1,544 electrical service panels**. The entire network and all light points are geo-referenced using a dedicated asset management application.

As each town has its own history in terms of deploying public lighting, there is a wide diversity of installed equipment, posing maintenance and operating challenges. Work to harmonize these systems has been underway since 2019, while remote management of assets continues to progress.

More generally, **Montpellier Métropole is conducting an ambitious program to renovate the energy efficiency of its public lighting systems**. The main goal is to replace old-generation light sources with LED technology, mostly by retrofitting (changing electronic equipment and bulbs without replacing fixtures or poles). **By the end of 2022, 47.5% of the lighting installations had been retrofitted with LED systems**.

Replacing an old-generation light source with LED technology directly generates **average energy savings of 70%**. In addition to this, we are systematically lowering power and progressively reducing the duration of lighting in certain towns and cities. As of 2023, 8.4% of the population of Montpellier Métropole had their street lighting switched off in the middle of the night.

Renovation efforts must be pursued, particularly considering today's rising electricity prices. Recognized and honored in 2022 with the signature of ADEME's Public Lighting Renovation Charter, **our renovation program was set to be further stepped up starting in 2023** as part of our plan to reduce energy consumption and accelerate the energy transition of our metropolitan assets.

Public lighting represents more than 40% of the energy consumed locally. LED technology offers significant potential for reducing energy consumption.

INDEPENDENTLY OF MONTPELLIER MÉTROPOLE, MANY PUBLIC AND PRIVATE PARTIES CONTRIBUTE TO ARTIFICIAL LIGHT EMISSIONS.

Public lighting is not the only source of artificial light at night. Many different types of players, from real estate and business to health, education, transportation, and more, install and manage lighting equipment that has a major impact on public spaces. Using satellite images taken in the middle of the night (the “La TeleScop” study), we can distinguish the main contributions of private lighting, as shown in the above image showing only light sources from private housing.

Exterior lighting for private homes

Artificial light is now considered tobe a major source of pressure on biodiversity.

Long underestimated, **artificial light is now considered by ecologists to be a major factor contributing to the decline in biodiversity** due to its significant impact on the natural biological rhythms of various species.

With regard to flora and fauna, light pollution:

- **Disrupts diurnal biodiversity** adapted to the alternation of day and night (nychtemal rhythm), where the dark phase is essential for rest and the proper development of organisms.
- **Disturbs biodiversity adapted to nocturnal life**, that is, 30% of vertebrates and 60% of invertebrates (source: Holker 2010), not only with recognized metabolic and physiological impact, but also with behavioral effects, notably disorientation for species attracted by points of light (including migratory birds) and repulsion or avoidance for lucifugous species, repelled by light.

THE IMPACT OF LIGHT POLLUTION ON LIVING ORGANISMS

Fragmentation by repulsion

Fragmentation by attraction

- **Fragments nocturnal wildlife territories**, just like roads, railroads, etc., creating impossible obstacles for species that are blocked or repelled, thus hindering the movements necessary for their life cycle.
- **Alters intraspecific communication** related to the reproductive activities of some species, but also the relationship with other species, such as by attracting certain prey (mainly insects) to illuminated areas, leading to over-predation and excess mortality that are detrimental to species renewal and flower pollination.
- **Disrupts the plant cycle**: artificial lighting can bring forward or delay bud opening and leaf fall.

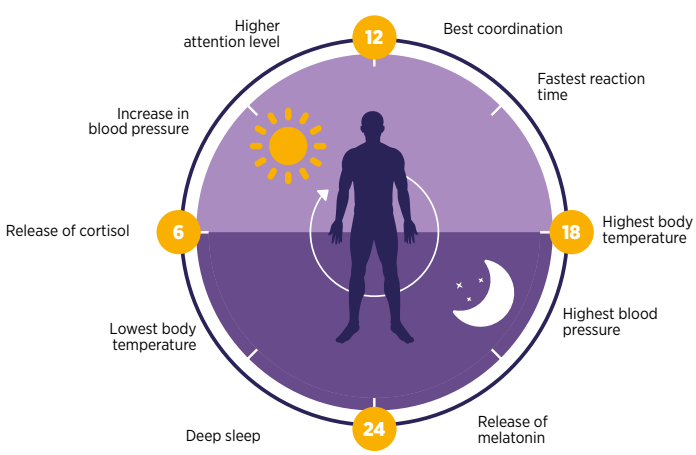
With regard to human beings, light pollution:

- **Disrupts circadian rhythms by inhibiting the body's natural production of melatonin***, resulting in consequences ranging from difficulty falling asleep to an increase in certain forms of cancer. In a report published in 2019, the French National Agency for Health, Food, Environmental, and Occupational Safety (ANSES) recommends actions to limit intrusive lighting in the home and help reduce risks. In addition, there is evidence of photo-toxicity caused by certain types of lighting on retinal cells.
- **Reduces the number of visible stars and prevents their observation**, contributing to a disconnection of individuals and societies from their environment. Today, only around twenty stars are visible in the heart of major urban areas, compared with over 3,000 in dark sky reserves. 60% of the European population is no longer able to observe the Milky Way (source: Kyba et al 2017).

*Sometimes referred to as the sleep hormone, melatonin is secreted by the epiphysis gland in the brain. It is produced when there is no light, starting in the evening and decreasing during the night, until wake-up time.

According to ANSES, exposure to blue light in the evening or at night can disrupt circadian rhythms.

Normal human circadian cycle



THE STATE OF LIGHT POLLUTION IN THE MONTPELLIER MÉTROPOLE AREA

Because of its urban, coastal, and Mediterranean characteristics, our region cumulates several environmental vulnerability factors, including climate change, air quality, natural hazards, availability of water resources, biodiversity, and more.

Map models of night sky luminance values in the Montpellier metropolitan area show a ranking of between 4.5 and 9* on the Bortle scale, a numeric scale that measures nine levels of night sky luminosity at a given location.

This deterioration in night sky visibility is due to the **light halo, which has grown continuously over recent years** because of the proliferation of light points, unmanaged radiance, obsolete or incorrectly oriented light points, and light reflection on illuminated surfaces. Visible from considerable distances, **the metropolitan area's halo has an impact on neighboring areas and their biodiversity**, such as regional natural parks and the Cévennes National Park, which boasts the prestigious "International Dark Sky Reserve" label.

*9 being the least favorable level

INRAE and La TeleScop have analyzed the area's light pollution as part of a partnership agreement to draw up a "dark grid".

In particular, the study...

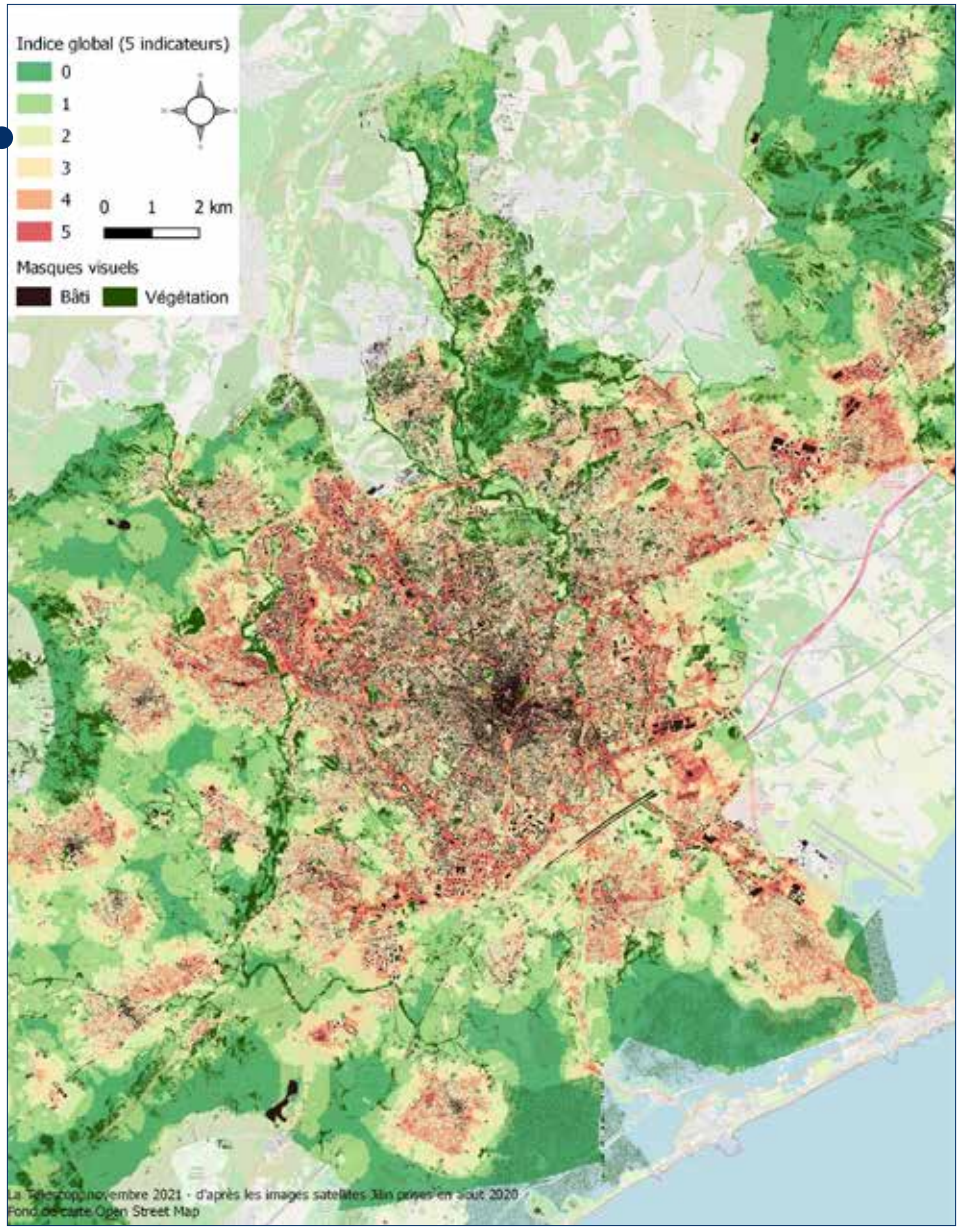
- **Identifies public and private lighting sources** (in both quantitative and qualitative terms) using very high spatial resolution (VHSR) night-time satellite images, lighting data, and other available databases.
- **Developed pressure indicators to measure and monitor the characteristics of artificial lighting that affect biodiversity**: number of sources visible to species at three different heights, contribution to the light halo, quantity of blue light emissions, which are harmful to most living creatures.

The study led to the definition of a **global light pollution index** based on the average of three other indicators. It was found that **only 1% of the metropolitan area's natural spaces are currently affected by this type of pollution**, whereas city centers have the highest levels. Outlying residential areas are the biggest contributors to light pollution.

The vast majority of the metropolitan area's natural and agricultural areas are not impacted by light pollution, unlike built-up urban sectors.

Languedoc coastal area from Mont Aigoual. ©Guillaume Cannat

Summary map: global light pollution index



NIGHT LIGHTING AND SAFETY: A FEELING TO EXAMINE OBJECTIVELY

People's fear of the night is rooted in the ancestral fear of attacks by wild animals. The idea of community lighting, then public lighting, was born during the darkness of medieval times. Even today, night is still associated with insecurity in the collective imagination. This feeling is a barrier to public acceptance of changes to street lighting, which is why **our Lighting Master Plan is also based on comprehensive data on traffic and road safety, as well as on crimes and offenses documented by the police.**

For example, **65% of the 1,925 accidents occurring on public roads from January 1, 2017 to January 15, 2023 took place during the day**.

In addition to turning off the lights in the downtown areas of 11 cities, Montpellier Métropole is also experimenting with turning off street lights on seven road sections with similar characteristics.

- Main bypass and access roads.
- Absence of sidewalks or bike paths in the immediate vicinity of roadways.
- No conflicting areas or particularly "accident-prone" sectors.

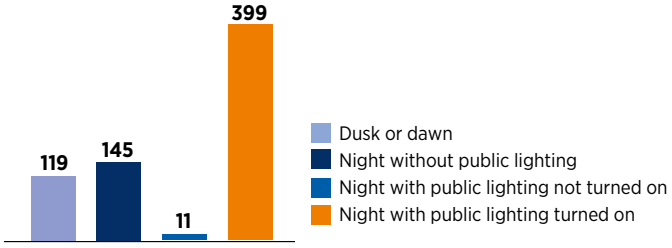
More than 700 light points are affected, handled in two phases: lights turned off in the middle of the night (10:00 p.m. to 5:00 a.m.) between October 2021 and April 2022, followed by complete extinction of the corresponding sectors starting in May 2022.

No accidents were reported in the switched-off sectors of those cities that decided to turn off all or part of their lighting network.

(according to a study on accident data since 2017)

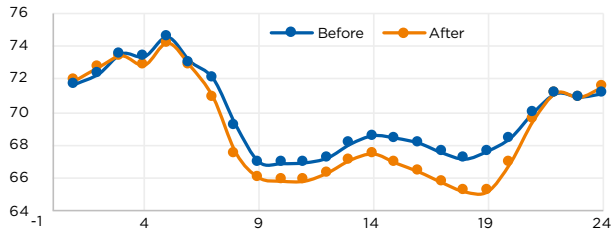
We have already observed that **switching off lights has not led to an increase in accident rates or vehicle speeds**. Monitoring this data annually will enable us to confirm the impact of turning off lights with respect to night-time safety on the roads in question.

Night-time accidents between January 1, 2017 and January 15, 2023 in the metropolitan area



Source: ONISR - National database of bodily injury accidents (unofficial database).

Speed trends on Boulevard de la Recambale before and after turning lights off at night

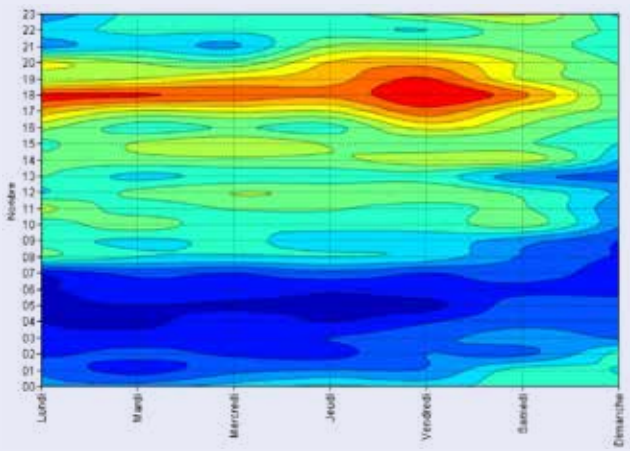


Concerning feelings of insecurity, the work carried out by psycho-sociologists Cynthia Cadel and Hélène Chiron in 2021 ("Taking psychosocial issues into account to address light pollution") provides a clearer picture of the relationship between lighting and crime, and concludes that **premises lighting is not what influences crime, but rather the way premises are used and occupied.**

In two studies conducted in 2022 by Montpellier's "Local Observatory of Public Tranquillity" (OLTP), the 1,700 professionals and residents surveyed indicated that, apart from criminal offenses, the main factors increasing their sense of insecurity in the city degradation of the living environment were incivility, wanderers, and the infrequency of public transport use. **Poor lighting is not considered to be a major factor.**

Data on crimes and offenses recorded in Montpellier by the National Police also shows that **most incidents take place before dark, between 5:00 p.m. and 9:00 p.m., as shown in the illustration below.**

Heat map showing the hourly and daily crime pattern in Montpellier.



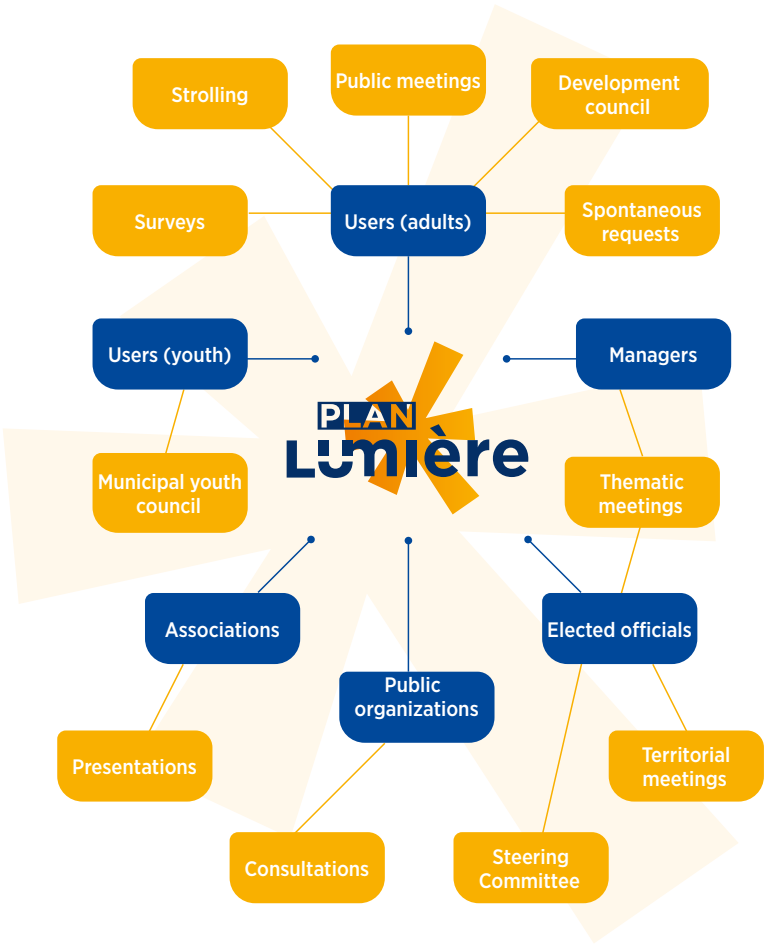
Listening to the needs
of all users

The Lighting Master Plan introduces changes to public lighting systems that will be part of people's everyday lives. We therefore involved all possible stakeholders to help them understand the issues and allow them to express their opinions and propose solutions, enabling them to take part in the decision process and become active contributors for implementation.

THIS WAS A SHARED PLANNING APPROACH INVOLVING A WIDE RANGE OF STAKEHOLDERS.

Montpellier Métropole's public lighting strategy is of interest to many of the area's public and private players and institutions.

- **Public players:** Hérault Prefecture, Occitanie Region, Hérault Department, neighboring metropolitan and inter-community authorities, local towns and cities, ADEME, Regional Biodiversity Agency, INRAE, Local Energy and Climate Agency, Altemed, TaM, public hospitals, universities, SDIS, Gendarmerie Nationale, Police Nationale.
- **Private players:** shopping centers, independent businesses, private clinics, SNCF, environmental associations, neighborhood associations, residents, subsidized housing representatives.



MANY USES AND POINTS OF VIEW TO CONSIDER

A large majority of adult users are in favor of switching off lighting in the middle of the night, with maximum acceptance between 1:00 a.m. and 5:00 a.m.

Color temperature does not seem to be a point of disagreement, even for people with impaired vision, who are more concerned about perceiving contrasts and are bothered by the glare of overly powerful light sources. Insecurity remains a concern, particularly for single women, who often request more lighting in terms of brightness and covered zones.

Young users have limited autonomy (such as going home from school or to activities), as their parents do not give them permission to go out at night due to feelings of insecurity.

Contacted environmental associations advocate the widespread adoption of lighting cut-offs to promote biodiversity and preserve the night sky.

The issue of lighting reduction is a matter of consensus among the **region's elected officials**, though with different priorities: economic issues, biodiversity, highlighting architectural heritage in local communities, and maintaining a sense of security and video surveillance capabilities. The main issues of the Lighting Master Plan were first validated by Montpellier Métropole's president before being presented and debated by local, municipal, and metropolitan authorities.

Managers of public spaces (municipal and metropolitan services) and public services operated by Montpellier Métropole (TaM, water utility, etc.) insist on the **need to maintain lighting services related to their services**: public transportation, trash pick-up, etc.

After the Metropolitan Council adopted the Lighting Master Plan, **new forms of public involvement were launched in the various towns and neighborhoods** to work with residents and users of public spaces on the practical details of implementing the Lighting Master Plan, including scenarios, time-frames, and scope for modifying public lighting.

INPUT FROM EXPERTS AND THE RESEARCH COMMUNITY

Montpellier Métropole's Lighting Master Plan is part of an ongoing process of cooperation and experimentation with researchers from various disciplines, such as law, history, geography, social sciences, and ecology, so that we can benefit from the latest research findings on a complex and fast-changing topic. This includes:

- **The LUNNE research project** which addresses various scientific barriers associated with reducing artificial night lighting.
- **"Light Seminars"**, a conference series at Paul Valéry University on topics such as light pollution and light planning.

In addition, Montpellier Métropole is actively involved in several expert professional networks whose role is to share practices and information about experiments to help support the decision-making process.

Dialog enables us to design and implement a shared action plan that best meets the needs of the area and its occupants.

WHAT ABOUT SOCIAL ACCEPTANCE OF CHANGES TO PUBLIC LIGHTING?

In cooperation with Montpellier Métropole, INRAE conducted a survey (1,703 responses, of which 1,148 Montpellier Métropole residents). Here are the key results:

- Residents are generally **in favor of making changes to public lighting.**
- The easiest criteria to apply is **changing the light color from white/ blue to orange tones.**
- **Turning lights off from 1:00 a.m. to 5:00 a.m. seems to be easy to implement in residential areas,** but a large part of the population is strongly opposed to expanding the time to 11:00 p.m. to 6:00 a.m..
- **It seems possible to reduce light intensity without encountering much opposition.** Residents who are not in favor are not strongly opposed.
- **Progressive implementation of new measures can help support acceptance**. Residents in towns that already turn off lights at night are more inclined to take further steps to reduce light pollution.
- Results show **strong division** between two types of residents.

	GROUP 1 80%	GROUP 2 20%
Orange color	+	Indifferent
Reduce intensity	+	−
Off from 1:00-5:00 a.m.	+++	Indifferent
Off from 11:00 p.m. - 6:00 a.m.	++	−−−

Preferences of two groups of people regarding lighting in the Montpellier Méditerranée Métropole area:

GROUP 1

- Lower density residential area (suburban zones)
- Bicycle usage
- Awareness about environmental issues

GROUP 2

- Residential area (urban zones)
- More frequent use of public spaces at night
- Stronger feeling of insecurity

People are in favor of changing public lighting, but do not necessarily agree on the methods.

Taking coherent action with

strategic, regulatory, and operational considerations

ARTIFICIAL NOCTURNAL LIGHTING AT THE HEART OF ISSUES IN AN UNPRECEDENTED CONTEXT

- **Economy:** in 2023, the cost of electricity for public lighting increased by 75% due both to generally rising energy costs and pressure on strategic raw materials, particularly the materials required for new technologies.
- **Environment:** light pollution is rising continuously on a global scale, accompanied by accelerating climate deregulation and massive biodiversity deterioration.
- **Society:** night-time personal and professional uses are on the rise. In the Montpellier Métropole area, introducing free public transportation will stimulate ridership, while soft mobility (walking, scooters, bicycles) is growing massively.
- **Urban development:** the metropolitan context is marked by strong attractiveness for shopping centers and zones in outlying areas, with denser urbanization, a policy goal of Zero Net Surface Artificialization, and new public transportation lines.

REGULATORY FRAMEWORK TO RESPECT

Even though its application is voluntary and non-regulated, the Lighting Master Plan represents a convergence of a group of rules and standards seeking to **manage and regulate artificial nocturnal lighting.**

The most recent law is the French Ministry decree of December 27, 2018 concerning the prevention, reduction, and limitation of light-related nuisance. Mayors are the administrative authorities in charge of overseeing this law, except for community facilities, which are the responsibility of the national government. If a merchant fails to comply with the order, the mayor is empowered to record the violation under the authority of his or her general police powers.

PLAN IN PERFECT HARMONY WITH REGIONAL PLANNING STRATEGIES

The Lighting Master Plan supports Montpellier Métropole's challenges as set forth in the:

- **Territorial Cohesion Plan ("SCOT")**
- **Inter-city Local Urban Development Plan ("PLUi-Climat")**
- **Joint Territorial Climate Air Energy Plan (PCAETs")**

5-YEAR ONGOING IMPROVEMENT PROCESS, SUPPORTED BY POLITICAL AND TECHNICAL STEERING

- **The Lighting Steering Committee** is in charge of governing Montpellier Métropole's public lighting strategy, as well as Lighting Master Plan assessment and continuity. The committee is comprised of four elected officials from the Metropolitan Council, based on their responsibilities: roads and public space, ecological transition and solidarity, biodiversity, energy, lighting aesthetics, and visual environmental quality.
- **A follow-up committee** meets at least once a year to summarize actions that were carried out (each subject to a detailed tracking report) and approve the future action program.
- **The Lighting Strategy Manager,** involved with the Department of Proximity and Public Spaces (PEP'S), ensures proper execution of the Lighting Master Plan.
- **A milestone report for Montpellier Méditerranée Métropole's Lighting Master Plan is elaborated every year.** After 5 years, a version of the report will be created for presentation before the voting assembly deliberating a second Lighting Master Plan before the end of 2028.

Regulatory constraints for turning off lights following the 2018 decree

LIGHTING INSTALLATIONS covered by the decree		TURNING ON (Icon = no earlier than sundown)	TURNING OFF (at night) No later than:	TURNING ON (morning) No earlier than:
	Outdoor lighting related to a business activity and located in a closed space		1 hr. after the end of the activity	at 7:00 a.m. or 1 hr. before the start of the activity
	Lighting to accent historical monuments and parks and gardens		at 1:00 a.m. or 1 hr. after closing of parks and gardens	
	Lighting of non-residential buildings		at 1:00 a.m.	
	Outdoor lighting of professional facilities		1 hr. after the end of use of the facilities	at 7:00 a.m. or 1 hr. before the start of business
	Lighting of store and exhibition windows		at 1:00 a.m. or 1 hr. after the end of business	at 7:00 a.m. or 1 hr. before the start of business
	Lighting for parking lots adjacent to a business site or zone		2 hrs. after the end of business	at 7:00 a.m. or 1 hr. before the start of business
	Lighting of outdoor construction sites		1 hr. after the end of activity	

Source: CEREMA's AUBE summary file – "Understanding the Ministry Decree of December 27, 2018 concerning light-related nuisances"

WHAT ARE GOALS OF THE LIGHTING MASTER PLAN?

Issues and priority actions

We can take appropriate action by clearly understanding the impact of artificial lighting at night and listening carefully to the various stakeholders, users, and operators of public lighting systems. The Lighting Master Plan strategy covers **5 main issues** of equal importance: lighting aesthetics for different spaces, security of people and property, environment and health, energy performance, and societal uses. Based on these issues, **15 objectives** are embodied by **36 concrete actions** rooted in the reality of our territory and needs of residents.

02

Aesthetic issues

Low-impact lighting to beautify cities and towns

For many decades, public lighting was implemented based on a functional approach to increase security for people, goods, and traffic. The time has come to consider more than just quantitative criteria, but also the quality and harmony of lighting for the aesthetic illumination of various spaces. The Lighting Master Plan addresses this issue, which is key to people's feeling of well-being and safety in public places, while enhancing economic and tourist attractiveness for every city in the Montpellier Métropole area.

OBJECTIVE #1

Help cities with renovation to highlight their historical and architectural heritage

Every city in the Montpellier Métropole area has its own architectural heritage, with lighting that often dates back several decades not taking generated light pollution into account. In some cases, the equipment can be considered obsolete. Though most systems are operated by the metropolitan public lighting department, they still fall under the responsibility of each city.
The Lighting Master Plan leverages a wide range of engineering skills and expertise to help with modernization.

ACTIONS

- Assess the buildings and monuments that implement lighting.
- Establish and implement a multi-year renovation program to update lighting.
- Encourage low-energy usage when revisiting historical centers.

The general idea is to follow three main guidelines for lighting: Less - Better - Marvelous. This involves offering finely-tuned lighting that fits the exact purpose, by finding consistent, overall aesthetics that take into account all lighting points. We need to successfully combine practical and concrete requirements for roadways with light-related engineering, biodiversity requirements, energy cost and consumption, and aesthetics. This point should be considered on equal footing as the other two core guidelines.

Bruno Paternot
Deputy mayor of Montpellier, in charge of the city's light and acoustic aesthetics, and Montpellier Métropole council member in charge of visual environment quality

Computer-generated image of the lighting design on the Montpellier opera house facade after renovation

OBJECTIVE #2

Improve the lighting aesthetics of public areas while protecting the community's identity

In the interest of improving the quality of life for everyone, the Lighting Master Plan's actions are designed to help residents and users make the most of their cities at night, helping them feel that they are free to move around at any time. This objective also involves maintaining the aesthetic cohesion of street equipment, which includes lighting.

ACTIONS

- Include light aesthetics in urban renovation operations.
- Set up light-oriented itineraries with the Montpellier Méditerranée Métropole Tourist Office.
- Establish a common reference for public lighting equipment to meet each desired function.

Security issues

Safe and secure lighting to reassure users

As important as they may be, the energy, environmental, and health aspects related to public lighting cannot be addressed without taking into account the security and safety of people, property, and traffic. Covering the greater metropolitan area with highly diverse night-time activities, the Lighting Master Plan ensures that decisions on light reduction are adapted to the realities of each area and neighborhood.

OBJECTIVE #3

Ensure electrical compliance and proper system operation

Public lighting equipment is part of the urban infrastructure, in direct contact with people and connected to the public electrical network. The first factor for safety – and the primary mission of the Montpellier Métropole department in charge of system maintenance – is to ensure the robustness of equipment and to protect people from the risk of electrocution.

ACTIONS

- Ensure compliance for all installed electrical systems.
- Provide optimal maintenance for the public lighting network.

OBJECTIVE #4

Ensure safe mobility for everyone throughout the entire territory

No measures for reducing public lighting can be allowed to jeopardize this safety. It is important for metropolitan authorities to help cities with their decisions to turn off lights and set up compensating measures as necessary.

ACTIONS

- Study the impact on road safety of making changes to public lighting.
- Provide safe signage in cases where lighting is turned off.

It is important for the Lighting Master Plan to take territorial specifics into account, notably by considering the different rural and urban zones, and making sure to adapt lighting recommendations accordingly. Light reduction measures should not be regarded as fixed, isolated practices, but as instruments that evolve and adapt based on people's feedback. Increasing urban density means that cities must be managed differently, redesigned and rebuilt to ensure the comfort and safety of residents. Lighting is very clearly part of this effort.

Frédéric Lafforgue
Mayor of Castelnau le Lez, and Montpellier Méditerranée Métropole
Vice President in charge of roads and public spaces

Experimenting with photo-luminescent paint on pedestrian and bicycle paths

OBJECTIVE #5

Reinforce the public's sense of security

Reducing the level and duration of artificial lighting at night is often a source of concern for residents. However, to date, there have not been any studies demonstrating a correlation between turning off street lighting and an increase in acts of aggression or break-ins. Various studies at a national level even reject such a link. To ensure the social acceptability of adaptive measures, we must therefore address preconceived ideas and social representations, while at the same time proposing public lighting measures in areas where a sense of safety needs to be reinforced.

ACTIONS

- Consult with the public and inform people about light limitation projects.
- Study the link between artificial illumination and local crime.
- Improve lighting in places that generate feelings of insecurity.

Environment and health issues

Lighting that respects biodiversity and health

The increasing number and power of artificial sources of light at night may have a negative impact on both human and non-human life (flora and fauna). If it is not controlled, the massive deployment of LED technology could indirectly contribute to increasing impact. In a metropolitan area that is located in the middle of an exceptional natural environment, the Lighting Master Plan is committed to implementing exemplary public policy and mobilizing all private contributors to artificial night lighting.

OBJECTIVE #6

Fight against light pollution

There are ways to fight light pollution, and they all immediately eliminate or reduce nuisance for nocturnal and diurnal biodiversity as well as for human health. This is a factor that must be systematically included in development impact studies, just as importantly as flood prevention and protecting air quality.

ACTIONS

- Eliminate non-essential light points.
- Ensure exemplary lighting of public facilities.
- Include fighting light pollution in city planning documents.
- Monitor the evolution of light pollution over time.

OBJECTIVE #7

Develop a “starry grid”

Building on the example of the area's green and blue grids, we must identify the spaces in which nocturnal species can fully satisfy their vital needs. The “starry grid”, also referred to locally as the “dark grid”, will be made up of existing and potential biodiversity reserves, along with corridors for passage to be preserved or re-established.

ACTIONS

- Conduct a diagnostic study and highlight areas where there is a conflict between the public lighting network and zones that are important for nocturnal biodiversity.
- Define and support the elaboration of a multi-year plan to implement the starry grid in our cities.

As a topic, light is becoming a veritable common thread for explaining issues related to health, well-being, and peace-of-mind.
By revealing its inconsistencies, light also points us towards a virtuous circle, enabling us to rediscover some of life's simple pleasures, such as watching the stars and (re)discovering night-time biodiversity.
The lighting Master Plan also represents an important project for our Climate Plan, involving shared challenges such as energy savings and biodiversity preservation.

Isabelle TOUZARD
Mayor of Murviel lès Montpellier, and Montpellier Méditerranée Métropole Vice President in charge of the ecological transition and solidarity, biodiversity, energy, agroecology, and food

OBJECTIVE #8

Raise awareness about the fight against light pollution

It is essential to engage with all audiences – public and private players, residents – to foster a cultural change in our relationship with light and darkness, and thus support acceptance of new public lighting practices, such as turning lights off, lowering wattage, and changing color temperature.

ACTIONS

- Organize public events to raise awareness.
- Develop pedagogical tools to raise awareness about light pollution issues.
- Obtain labels and charters that showcase collective actions.

OBJECTIVE #9

Encourage private-sector partners

In order to take global action, the Lighting Master Plan must involve all the organizations that manage private facilities generating artificial light at night for functional or business purposes. This implies leveraging pedagogical rules and tools to boost awareness and implement corrective actions.

ACTIONS

- Increase awareness among major operators regarding the pollution generated by their outdoor artificial lighting.
- Inform retailers and businesses about compliance with the Decree of December 27, 2018.
- Enforce compliance with the lighting reduction rules in Local Inter-city Advertising Regulations.

Economic issues

Economical and efficient lighting

A major contributor to a city's energy bill, street lighting can leverage new technologies to become a vector for considerable gains in energy efficiency, modularity, and sustainability. With the support of partners in research and innovation, the Lighting Master Plan coordinates the investment effort to renew and modernize our existing lighting systems, make them more energy-efficient and effective, while also making management easier.

OBJECTIVE #10

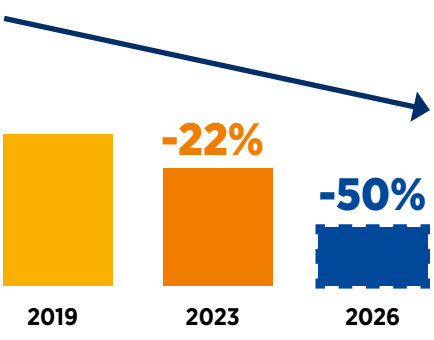
Improve the energy performance of our assets

Renovating the metropolitan area's public lighting network involves the widespread use of LED fixtures, which deliver a drastic reduction in energy consumption, improved lighting efficiency, and lower maintenance. In 2022, the overall energy performance of our lighting installations was 348 kWh per light point per year, compared to 467 kWh in 2019.

ACTIONS

- Continue to renew lighting equipment using energy-saving technologies.
- Enforce application of the metropolitan technical standard for street lighting by public and private developers.
- Increase remote management of installed equipment.

Decrease in energy consumption



The Lighting Master Plan must become a tool that everyone can make their own, as a way to coordinate various departments and uses. It must also be fully integrated into social policies, notably with regard to the risks of rising costs of living and energy. We therefore need to engage companies in innovation to support the Lighting Master Plan and meet the energy challenge in two main areas: efficiency and reduction. Lastly, we should not hesitate to reach out to other major cities around the world to address these issues and increase the number of opportunities for exchanging information and sharing experience.

Agnès Saurat
Deputy Mayor of Montpellier in charge of municipal assets and energy reduction, and Montpellier Méditerranée Métropole council member

OBJECTIVE #11

Manage equipment sustainably

Responsible management of public lighting involves implementing a policy of equipment maintenance and management designed to extend service life and minimize operating costs, while maintaining optimum quality of service.

ACTIONS

- Maintain equipment to extend its lifespan.
- Prioritize retrofitting by changing the light source to LED while keeping the pole and fixture.
- Promote recycling and the circular economy for the materials used.

OBJECTIVE #12

Support research and innovation

Ever since it was first introduced, public lighting has been subject to constant innovation, driven by advances in electronics and now digital technology. The Lighting Master Plan leverages the scientific community, in both technical and social fields, to help test and evaluate the strategies and technologies of the future, which will become increasingly economical, efficient, and adapted to the needs of residents and users.

ACTIONS

- Pursue experiments with solar lighting and other new lighting technologies.
- Further develop partnerships with the research community.
- Participate in specialized professional networks.

Societal issues

Lighting adapted to different uses

Public lighting has been deployed on a massive scale indiscriminately, according to a standard focused on automobile traffic. The Lighting Master Plan changes this paradigm by differentiating public lighting management: adapting light intensity, timing, color temperatures, and more, to the uses of all public spaces, their level of use, the type of facilities they serve, and the proximity of natural areas to be preserved.

OBJECTIVE #13

Adapt lighting levels in public spaces

Continuous improvements in lighting equipment performance, over-interpretation of standards, and the proliferation of private lighting sources have led to a steady rise in illumination levels in public spaces. Strict application of the NF EN 13201 road lighting guidelines will result in less intense lighting that is nonetheless perfectly adapted to users for their various travel habits.

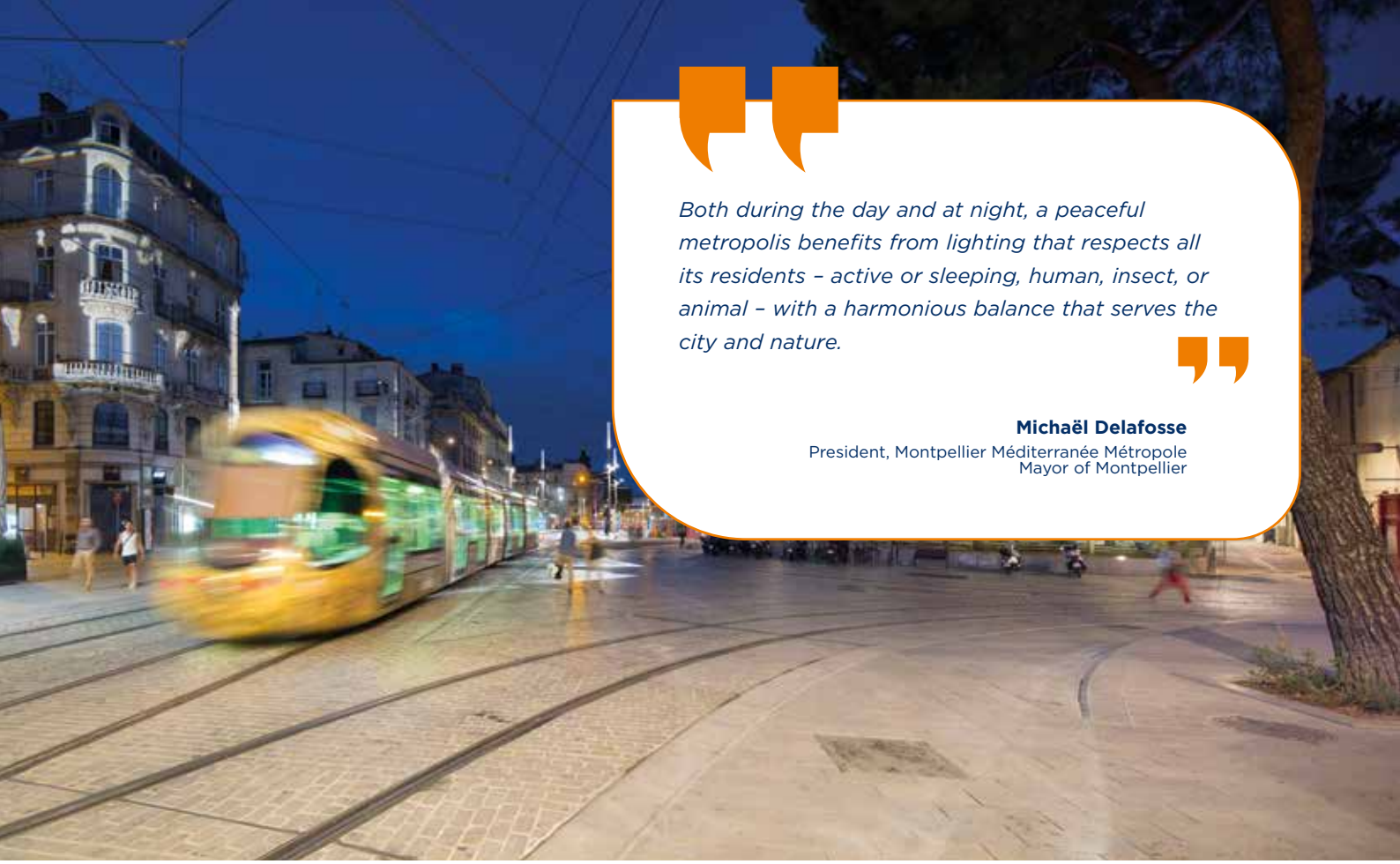
- The brightest values (15 lux on average) are reserved for areas with potentially conflicting uses, such as intersections, pedestrian crossings, presence of pedestrians or alternative modes of transport in the immediate vicinity of the roadway, in the area's main thoroughfares.
- Lower lux values are to be used in residential and commercial zones, and parks and gardens located on local roads and some inter-city and inter-neighborhood links.

OBJECTIVE #14

Establish the time-factor for public lighting

In addition to experiments involving turning off street lighting in the area, and variations already optimized by luminosity detectors and astronomical clocks, the Lighting Master Plan provides a general, shared framework for differentiated management of street lighting, with proposals to:

- Adapt lighting levels to usage
- Lower power across the entire system
- Turn off lights in areas with very low levels of night-time activity, such as commercial zones, day-use public areas, residential areas, and parks and gardens, with a timing schedule elaborated in coordination with residents and users of those areas.



Both during the day and at night, a peaceful metropolis benefits from lighting that respects all its residents – active or sleeping, human, insect, or animal – with a harmonious balance that serves the city and nature.

Michaël Delafosse
President, Montpellier Méditerranée Métropole
Mayor of Montpellier

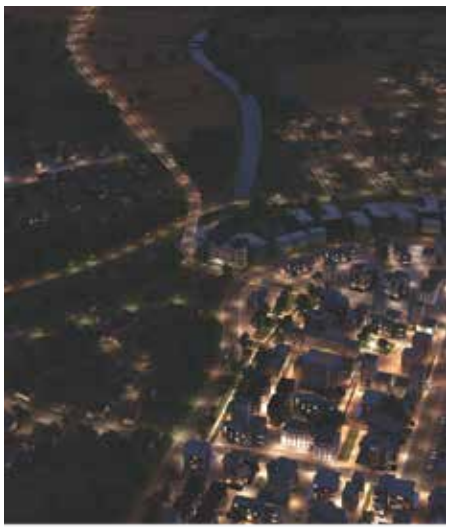
OBJECTIVE #15

Adapt light color temperature

LED technology can be deployed with nearly any desired color temperature. Considering the impact of blue light on biodiversity and human health, any new or refurbished public lighting fixtures installed outside biodiversity hotspots will have a color temperature of 2700 °K.
In biodiversity hotspots, as determined by the area's starry grid, artificial lighting will be adapted (if essential for user safety) in order to minimize harm to species identified in the vicinity.

COMMON ACTIONS

- **Define differentiated management rules for lighting for each town and city in the metropolitan area.**
- **Consolidate a multi-year program to deploy differentiated management for public lighting.**



Computer-generated image showing an example of differentiated lighting management

A new night begins...

THE 15 EVERYDAY LIGHTING MASTER PLAN OBJECTIVES

1. Help cities with renovation to highlight their historical and architectural heritage
2. Improve the lighting aesthetics of public areas while protecting the community's identity
3. Ensure electrical compliance and proper system operation
4. Ensure safe mobility for everyone
5. Reinforce the public's sense of security
6. Fight against light pollution
7. Develop a "starry grid"
8. Raise awareness about the fight against light pollution
9. Encourage private-sector partners
10. Improve energy performance for our assets
11. Manage equipment sustainably
12. Support research and innovation
13. Adapt lighting levels in public spaces
14. Establish the time-factor for public lighting
15. Adapt light color temperature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