FACTSHEETS

Key facts on public lighting, energy and non-energy services, and financing models.

SMART EPC

Contents

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Executive summary

This deliverable provides a comprehensive overview of the Smart EPC project's objectives, activities and outputs. The project aims to facilitate the transition to smart and sustainable cities by leveraging energy efficiency through emerging technologies.

The project's key activities include upgrading public lighting systems with IoT technology and Smart City components, which includes integration of energy-related services (e.g. EV charging) as well as non-energy-related services (e.g. 5G communication) into public lighting infrastructure, the development of standardised Energy Performance Contracting (EPC) documentation, and testing of the Smart EPC concept through pilot projects in three European countries.

This deliverable outlines the structure of public lighting systems, emphasising the need for their upgrade due to outdated technology and inefficiency. The benefits of modernised systems include enhanced safety, reduced operational costs and readiness for Smart City applications.

EV charging points integration into public lighting system is highlighted as a commercial energy-related service. The challenges are addressed such as infrastructure limitations, legal and financial barriers. Despite these challenges, the integration of EV charging into public lighting system is presented as a space-saving and scalable solution.

Additionally, the document explores the role of public lighting in Smart City initiatives, emphasising its potential to host various IoT applications. Communication technologies, including licensed 5G and unlicensed options like LoRa, are discussed in the context of their integration into public lighting infrastructure as most recognised commercial non-energy related service. The challenges and potential revenue streams associated with these technologies are outlined.

The financing model of Energy Performance Contracting (EPC) is introduced as a key mechanism for implementing energy efficiency measures. EPC projects in public lighting are emphasised as simpler than those in buildings, offering a steppingstone for broader implementation in general.

In conclusion, the Smart EPC project addresses critical aspects of urban development, energy efficiency, and Smart City initiatives. The integration of advanced technologies into public lighting system infrastructure serves as a cornerstone for realising the project's objectives, with potential benefits ranging from enhanced safety to innovative revenue streams.

1. Smart EPC project introduction

Next generation of energy performance contracting

The main objective of the Smart EPC project is to enable the transition towards Smart, sustainable cities and municipalities by utilizing energy efficiency as a key potential of new, emerging technologies and services.

Refurbishment of old and inefficient public lighting units with the integration of IoT technology and Smart City components will pave the way for a wide range of energy and non-energy related services and applications, including public safety ensuring, traffic management, EV charging, environmental monitoring and next generation of cellular communication. The project's objective is to develop standardized energy performance contracting (EPC) documentation for integrating energy and non-energy related services.

Key Smart EPC project activities:

a. **Integration of energy related services** (e.g. EV charging) **and non-energy related services in the public lighting system infrastructure** (e.g. communication services such as 5G and Smart City infrastructure);

b. **Development of standardized EPC** that includes a pay-for-performance scheme - real time data on performance of public lighting system infrastructure;

c. **Testing of the Smart EPC concept**: piloting reconstruction of existing public lighting systems by using standardized EPC that integrates other energy and non-energy related services).

Smart EPC project outputs are structured around three specific objectives:

- **First project objective** is development of standardized Smart EPC documentation for integration of energy and non-energy related services in energy performance contracting (EPC). The project will test reconstruction of public lighting systems by including other energy and non-energy related services (e.g. Smart City components like EV charging points, 5G relays for data transfer and communication, etc.) thus making EPC more attractive and financially viable to local authorities.
- **Second project objective** is demonstration of replication potential of Smart EPC documentation by piloting reconstruction of public lighting systems. Project goal is to demonstrate viability and effectiveness of project outputs (e.g. developed standardized processes and documentation). This demo actions will be done in three pilot countries across Europe (ES, FR and PL) with different market and regulatory circumstances.
- **Third project objective** is capacity building, replication and strong facilitation/dissemination service. Project will design and deliver a capacity-building program addressed to local authorities and consultants not being part of the project aiming to improve knowledge and skills in the EPC.

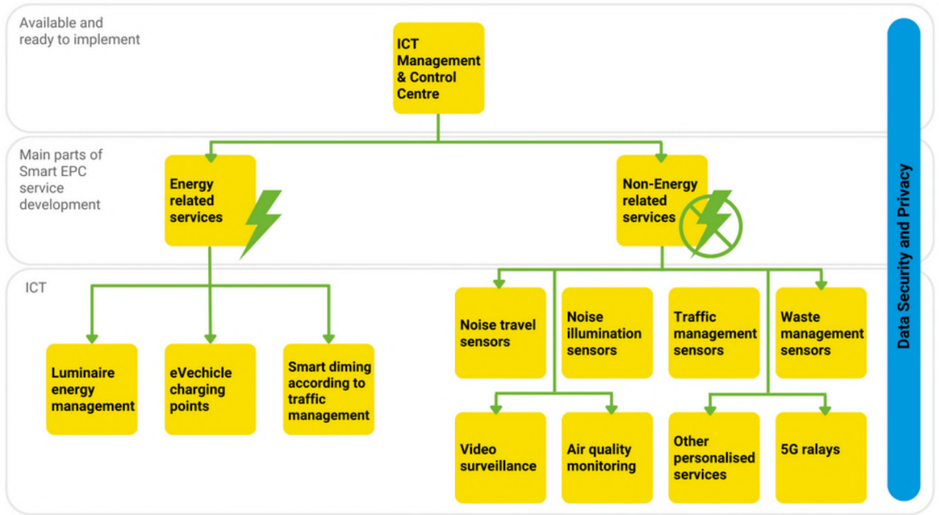


Figure 1 Smart EPC concept with integration of energy and non-energy related services

2. Public lighting system infrastructure fundamentals

Public lighting in general

Public lighting is a utility service provided by local authorities to illuminate public spaces. It ensures the safety and comfort of users (pedestrians and drivers) and also a safe and pleasant atmosphere in public spaces. The quality of a public lighting system should be expressed in terms of photometric criteria (influencing visual performance and comfort). Most frequently used photometric parameters are average road-surface luminance, overall and longitudinal uniformity, surround ratio and threshold increment. Recommendations regarding minimum photometric parameters are defined in European Standards such as CEN/TR 13 201-1:2014, EN 13 201-2:2015, EN 13 201-3:2015, EN 13 201-4:2015, EN 13 201-5:2015. Public lighting system supply power cables could provide electricity while lampposts could provide place for installation of additional infrastructure suitable for providing energy and non-energy related services.

Most of the existing infrastructure used today is outdated and energy inefficient. Upgraded and modern public lighting system has many advantages, where some of them are:

- enhanced road traffic safety and improved night-time visibility (resulting in decreased criminal activity and an improved sense of security among citizens);
- a reduction in operational costs due to reduced electricity consumption and prolonged life span;
- “Smart City ready” infrastructure for enrolment of advanced IoT applications.

Public lighting system infrasctructure

Figure 2 shows the disposition of the basic elements of public lighting system. The basic elements of the public lighting system are:

a. lighting distribution cabinets and supply cables
b. lampposts
c. luminaires with a light source, optics and additional parts (e.g. Smart City components)

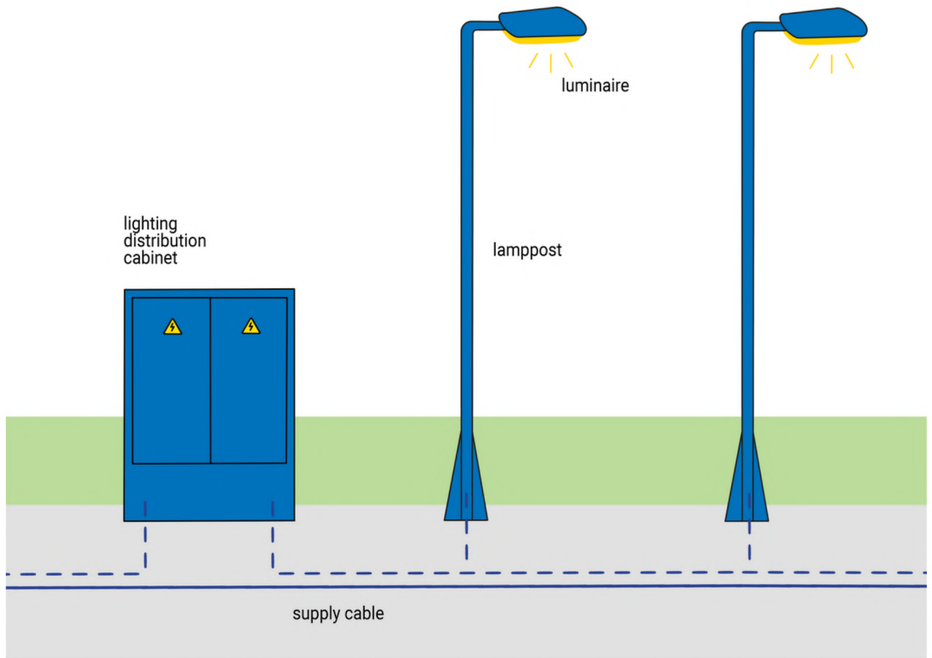


Figure 2 Disposition of the basic elements of public lighting system

Public lighting - challenges

Public lighting can make a positive contribution to safety and security. However, uncontrolled illumination of surrounding surfaces is an undesirable phenomenon. The term used to describe this negative aspect of public lighting is the **light pollution**.
Public lighting contributes to several forms of light pollution: skyglow (a dome-like shield of light pollution over inhabited area), glare (direct visual discomfort caused by excessive brightness), light trespass (light that escapes from source, falling where it is not intended) and clutter (excessive grouping of light sources). Light pollution implies significant energy waste, unnecessary costs and greenhouse gas emissions, damage to ecosystems and negative affect to human health.

The measures to prevent light pollution refer to installing fully shielded and properly directed luminaires, but also implementing new lighting technologies including dimmers, motion sensors and timers.

The following principles for efficient public lighting should be taken account – it should have a clear purpose, directed only to where needed, no brighter than necessary, controlled to be used only when it is useful and to limit the amount of shorter wavelength light to the least amount needed (to use warmer colors).

In most EU countries protection against light pollution is regulated, which usually determines the maximum permissible photometric values, restrictions and prohibitions on lighting, conditions for planning, construction and maintenance of public lighting system. Mostly used restrictions are regarding corelated color temperature (CCT) of the light source (e.g. must be below 3000 K), upward light output ratio (e.g. ULOR = 0%) and maximum average illuminance.

Public Lighting - key takeaways

- Utility service provided by local authorities with main role to illuminate public spaces and additional role in ensuring public safety and comfort.
- Older light source technologies are cause of significant electricity consumption, greenhouse gas emissions and light pollution.
- Efficient public lighting has a clear purpose, direction and level of brightness, it is controlled to achieve full usefulness while the amount of shorter wavelength light is limited to the least amount needed (warmer colors are used).
- Besides lower operational costs, prolonged life span, enhanced road traffic safety and improved night-time visibility, upgraded public lighting systems offer infrastructure suitable for Smart City components.
- Possible source of revenue streams (from additional energy and non-energy related services integrated into public lighting system) with great visibility potential.

3. Additional energy and non-energy related services in public lighting

3.1 Smart City introduction

Smart City in general

Cities are growing at a staggering rate. As per the United Nations, currently, over half the total world's population lives in urban areas. This number is expected to jump to 68% by 2050. With the growing population, however, new challenges are also emerging for the city administration relating to public services. To overcome these challenges, cities are considering digital transformation. In other words, they are looking to become "Smart Cities". In a nutshell, a Smart City is a city that is able to collect and analyse all sorts of data from a variety of sectors, ranging from urban planning to waste management. **To become a Smart City, a city needs to build and maintain a streamlined network of interconnected sensors, systems and feature-rich software.** Today, most public lighting systems are still reliant on outdated technology based on traditional light sources. Replacing the existing public lighting systems infrastructure with innovative LED solutions and cutting-edge technologies results in saving energy and money, making public spaces safer and improving the life quality.

Smart City – public lighting system infrastructure

Modern public lighting system infrastructure offers an ideal point from which a diverse range of Smart City IoT applications and collecting an array of data can be fostered. Smart lampposts don't just offer instant energy savings and maintenance cost reductions but also play an important role as one of the IoT infrastructures. It can be equipped with a weather station, wireless AP, camera, LED display, helpdesk or advertisement terminal, online speaker, EV charging point and other devices. **Smart lamppost becomes the data-collecting sensors of Smart City, ultimately achieving more efficient and integrated city.**

Public lighting system offers numerous infrastructure benefits, which make them a perfect base for hosting Smart sensors and systems:

- Power source – lampposts have access to an uninterrupted power supply and can easily be adapted to secure power supply to other IoT devices, sensors and systems;
- Location – lampposts are uniformly spread across local authority area. In addition, the height of each lamppost is consistent. Both the

coverage and height of lampposts make them ideal for hosting all sorts of IoT sensors and communication technologies, eliminating the need to set up ad hoc Smart City infrastructures;
- Safety – High above the ground, luminaires are normally out of the reach of pedestrians. In addition, due to the height, data collection (over-the-air) also becomes efficient.

Smart City – challenges

Moving to an integrated lamppost model, there are few major regulatory or policy barriers. However, across Europe, there can be a number of challenges that have to be overcome. Barriers can be summed up to:

- legal barriers: public concerns regarding misuse of collected data and abuse of people-related privacy right / data protection and cybersecurity issues / ownership of the lampposts and operational contracts / legal liability of local authorities if traffic accidents occur when public lighting is dimmed or the equipment malfunctioning;
- policy barriers: conflict between incentives to reduce energy consumption and the promotion of the Internet of Things (IoT) solutions like Smart infrastructure which drives up consumption;
- financial barriers: city budget limitations prohibiting the investment in the transition to Smart connected lighting or integrated Smart lampposts, high costs due to need for additional networks (internet, additional power supply);
- technical barriers: existing infrastructure outdated which requires new lampposts installation to host Smart technologies / structural integrity of lampposts to take the additional equipment / provision of 24-hour power supply / the availability of installed power for EV charging points on lampposts / difficulties in installing new sensors (e.g. noise sensors) / more technical and safety training required for workers.

Smart City - key takeaways

- A Smart City is able to collect and analyze all sorts of data from a variety of sectors through a streamlined network of interconnected sensors, systems and feature-rich software.
- Modern public lighting system infrastructure plays an additional role as part of the IoT infrastructure when equipped with additional devices.
- Smart public lighting system results in energy and maintenance cost savings when operated and controlled to be adjusted in light levels based on the specific times and events, at the same time providing the near real-time status information of each luminaire.
- Besides light pollution decrease, Smart lamppost could have positive effect on air pollution, when equipped to monitor environmental factors (e.g. fine particulate matter concentration, temperature and humidity).
- Smart lampposts could also have positive effect on city traffic when equipped with traffic management system providing traffic monitoring, traffic guidance, vehicle monitoring and parking guidance.
- Smart lampposts could improve life quality by enabling EV charging, Wi-Fi hot spots, helpdesk or advertisement terminals and security cameras.

3.2. Smart City - EV charging as commercial energy service

EV charging in general

EV charging infrastructure is unevenly developed across EU countries, especially when it comes to fast chargers and installed capacity. Development of EV charging infrastructure is not following the uptake in share of electrical vehicles on roads and for the EU goals to be met EU Commission proposal on Alternative Fuels Infrastructure Regulation (AFIR) suggests that 3.9 million EV charging points are needed by the end of 2030. On the other hand, European Automobile Manufacturers' Association (ACEA) suggests more ambitious goal of at least 7 million new EV charging points across EU by 2030.[1] Additionally, Trans-European Transport Network (TEN-T) significant fact for future EV uptake is that approximately 50% of EU habitants don't have access to private parking.[2] **This results in huge need for development of public operated EV charging points in following years.**

EV charging – public lighting system infrastructure

At-home or near-home EV charging is recognized as the most desired EV charging location for EV drivers. However, in most cities, convenient off-street EV charging is largely unavailable to residents. **Using existing public lighting infrastructure, local authorities can play an important role in the rapid expansion of public EV charging infrastructure.** The need for public EV charging points and the fact that approximately 50% of EU inhabitants have no access to private parking is stressing the need for easy and feasible solutions for providing public EV charging points. Residential urban areas with multiapartment buildings present examples of locations where the lack of private parking spaces (or private garages) leads to limited access to EV charging infrastructure. This problem could be solved through public lighting system infrastructure, as it is already developed throughout urban areas and relatively close to public parking spaces. However, the lamppost upgrade for adoption of EV charging components is needed.

EV charging integration on lampposts – challenges

Not all public lampposts are suited for EV charging. The most recognized technical barriers that present significant obstacles in EV charging infrastructure development are:

- the distance between lampposts and parking lots;
- the pedestrian pathways between lampposts and parking lots;

1. According to ACEA
2. ACEA Position Paper, November 2021

- the state and available power reserve of existing power supply cables which can limit the number and power of EV charging points that can be implemented on some parts of public lighting system infrastructure;
- public lighting power supply contracts;
- public lighting management;
- public lighting power supply (e.g. round-the-clock power availability);
- influence or possible disturbance in the power network caused by EV charging point integration.

Another major challenge for EV charging integrated in public lighting system infrastructure derives from different ownership and management structures of public lighting systems infrastructure across different EU countries that in some cases generates needs for rather complex technical interventions.

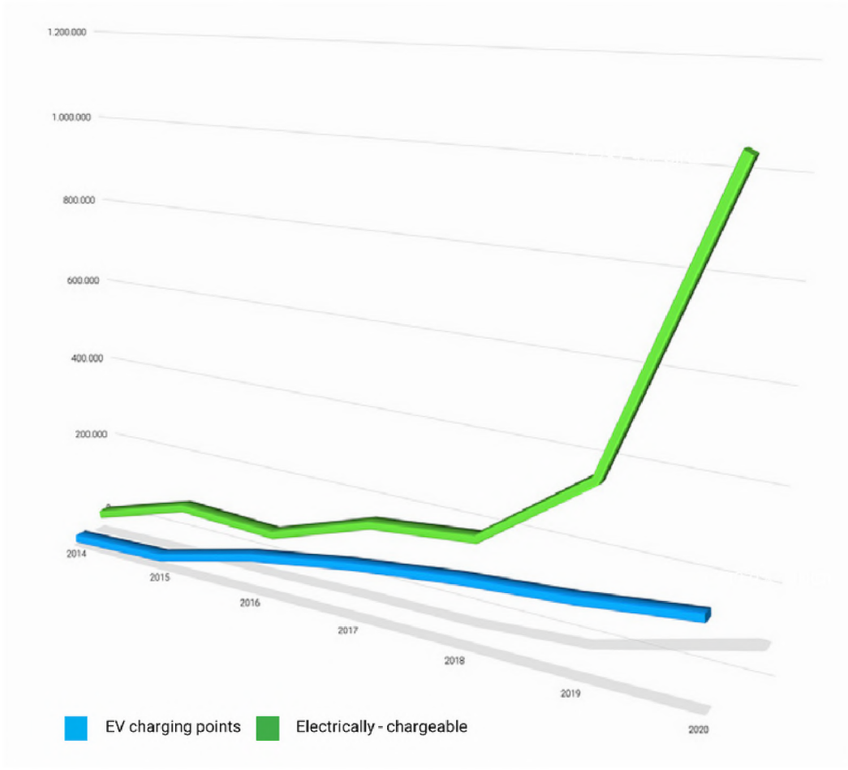


Figure 3 EV charging – need for development
Source: ACEA (presentation on EU Auto industry perspective on AFIR proposal, October 2021)

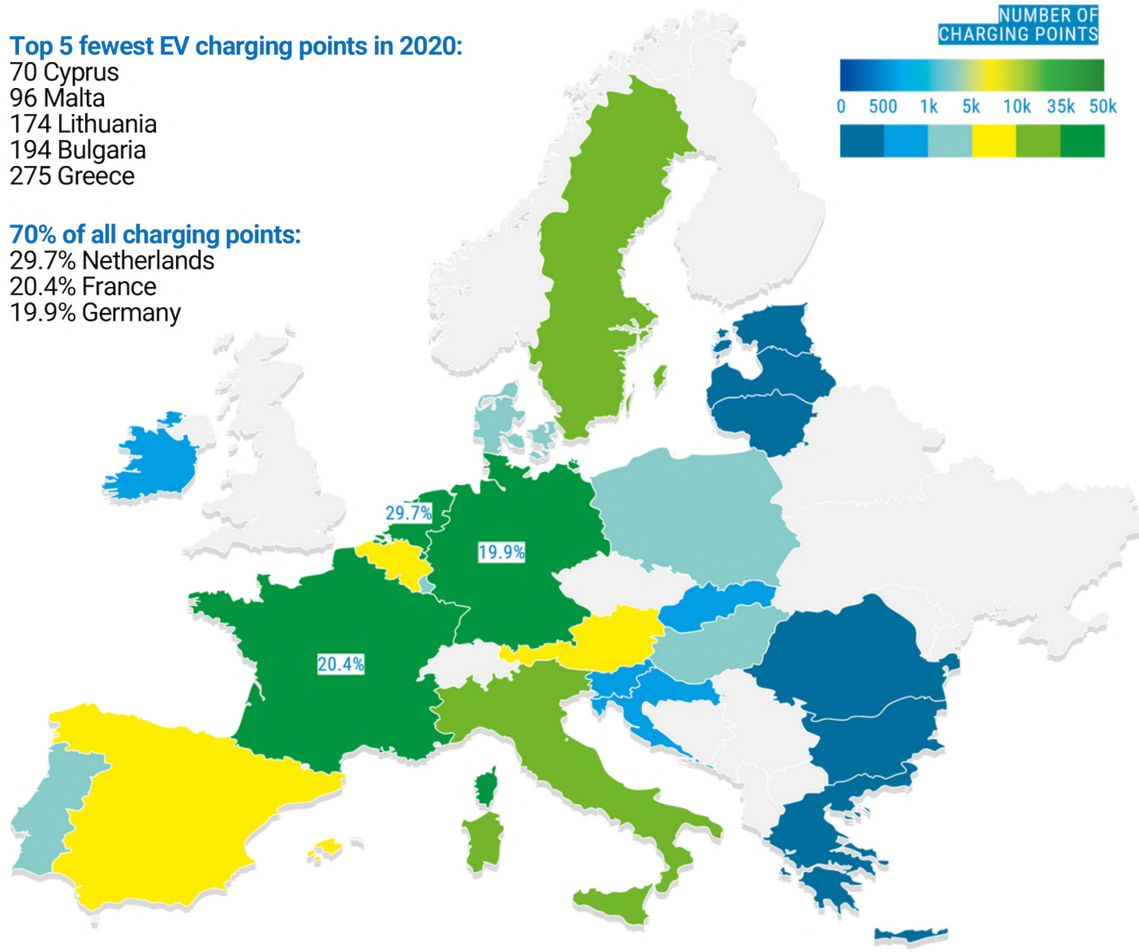


Figure 4 Distribution of EV charges across EU
Source: ACEA Position Paper, November 2021

Integrated EV charging points – key takeways

- EV charging points integrated in public lighting system infrastructure provides space-saving solution with no need for extra "street furniture" and additional infrastructure.
- Public EV charging points are intended to be mostly used by drivers without private parking spaces or personal EV charging spots (e.g. multiapartment areas).
- Integration of EV charging points in existing public lighting system is a relatively fast process without extensive infrastructure works.
- Low investment in EV charging points integration into public lighting system results in highly scalable solution.
- Integrated EV charging points are recognized as market-ready solutions, due to presence of great number of technology providers and different models.

3.3. Smart City - Communication technologies as commercial non-energy service

Communication technologies today

Communication between different types of equipment and central management systems is essential in managing complex systems. To efficiently use equipment such as luminaires, sensors and other Smart City components, communication is essential. Most communication technologies that are present on the market today come with a certain cost for the users. In the Smart EPC project framework, the research will be conducted to investigate if public lighting system infrastructure can be used for licenced or unlicenced communication services to local authorities at no cost or to even provide additional revenue. **Of all communication technologies present on the market today (e.g. LoRa, SigFox, NB-IoT, etc.) licenced 5G communication technology that is still under development shows best potential in industry applications.** On the other hand, technologies like LoRa or SigFox operating on unlicenced spectrum seem to lead the way in providing communication services today.

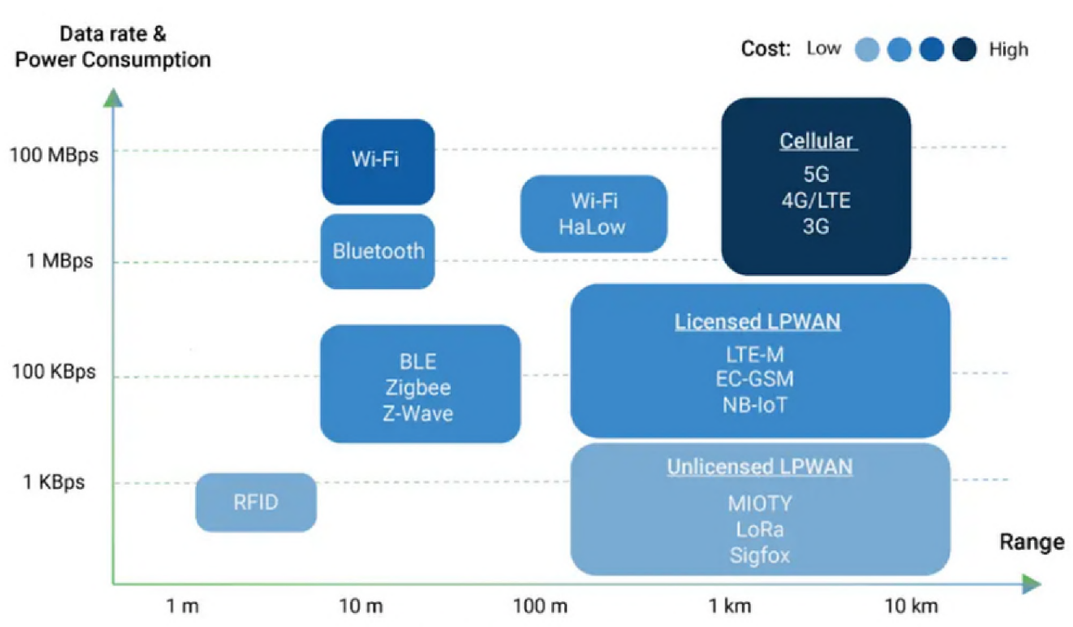


Figure 5 Communication technologies – comparison
Source: https://www.mokolora.com/lora-and-wireless-technologies

LoRa network technology in general

LoRa (short for long range) is wireless communication technology that can be operated on the license free sub-gigahertz bands. LoRa is best suited for applications where there is no need for continuous big data transfers with high bit rates. LoRa provides data transmission at longer ranges compared to technologies like WiFi, Bluetooth or ZigBee. Due to its features, LoRa is well suited for sensors and actuators that operate in low power mode.

5G network technology in general

5G (short for fifth generation of cellular network technology) delivers higher speeds, wider bandwidth, lower latency and more advanced capabilities than its predecessors (4G or 3G). Mobile Network Operators (MNOs) began rolling out 5G networks in 2019 and it is expected to become the primary cellular network in the coming years. 5G networks are vastly improving high-speed Internet connectivity around the globe and opening the door to a revolution on the Internet of Things (IoT).

Communication technologies on lampposts – challenges

Not all public lampposts are suited for 5G application. Barriers can be summed up to:

- legal barriers: deployment depended on national 5G strategies and concession rules
- financial barriers: bankability of a larger scale 5G deployment can prolong the wider market presence
- technical barriers: non-existing infrastructure (power and optic communication cable) for 5G relays can present one of the major obstacles in 5G development.

Based on the above, other communication technologies suitable for Smart City applications (e.g. LoRa, NB-IoT etc.) should be developed in parallel on the same infrastructure, at a cost effective way.

Communication technologies – key takeways

- Public lighting can accommodate different communication technologies (e.g. 5G and LoRa) for delivering different services to the market (mobile communication network and communication network for implementation of Smart City solutions).
- ‘Street furniture’ such as lampposts will play a key role in deployment of high-frequency bands (as this requires smaller antennas that could be fitted to lampposts) but also in deployment of unlicenced communication technologies mostly used for Smart City applications.
- 5G network slicing concessions for owners/operators of public lighting system infrastructure could bring new revenue streams.
- LoRa is the most used communication technology today for public lighting system management and is a cost-effective solution for developing early-stage Smart City applications.

4. Financing models - energy performance contracting (EPC)

Energy performance contracting in general

There is a range of financing models in place from traditional city ownership and operation to concessions for lighting and Smart services. Local authorities must consider different business models, financing and funding options to ensure most appropriate one for each service they are providing. **Energy performance contract (EPC or EnPC) presents a contractual model where provider of service** also known as energy service company (ESCO) delivers energy efficiency service to its client. Energy efficiency service can include delivery of works, replacement of equipment, management of energy systems and other actions that are usually collectively called energy efficiency measures. Energy efficiency measures must result in energy savings without influencing “normal” use of the facilities or infrastructure by client.

Energy performance contracts are essentially performance-based contracts since payment to the energy service company is linked to the level of energy savings they have provided to the client during contractual period and not to the direct costs of energy measures they have implemented.

All implemented measures are financed by ESCO and are repaid through regular payments to ESCO by client for energy savings provided during contractual period. This type of contractual model efficiently links desired outcomes to provided payments ensuring that client “pays only what he gets” and allocates performance risks on ESCOs. For efficient transfer of performance risks to energy service company a robust monitoring system needs to be implemented. Measurement and verification of achieved energy savings is crucial to every energy performance contract. Possibility of treating EPC projects as Maastricht-neutral or “off balance sheet” is widely seen as one of the key benefits of energy performance contracting.

EPC – challenges

Energy performance contracting is often seen as complex model for realization of energy efficiency projects. EPC could be complex and hard to implement due to:

- mixture of financing problems;
- need for sound and detail analysis of existing state of facility or infrastructure;
- need for detailed energy audit;
- legal issues regarding ownership of facilities or infrastructure vs users of that facilities or infrastructure;
- future use of facilities or infrastructure;
- external factor regarding need for energy consumption such as climate changes.

These problems are especially highlighted in EPC projects in building sector. On the other hand, implementation of EPC projects in public lighting is seen as much simpler and can be a steppingstone for broader implementation of EPC. Predefined operating hours of public lighting system, automated or centralized management of operation, relatively easy and simple ways of monitoring energy consumption, clear and concise specifications on required functional characteristics are some of the key factors why EPC in public lighting is easier to implement than EPC in buildings.

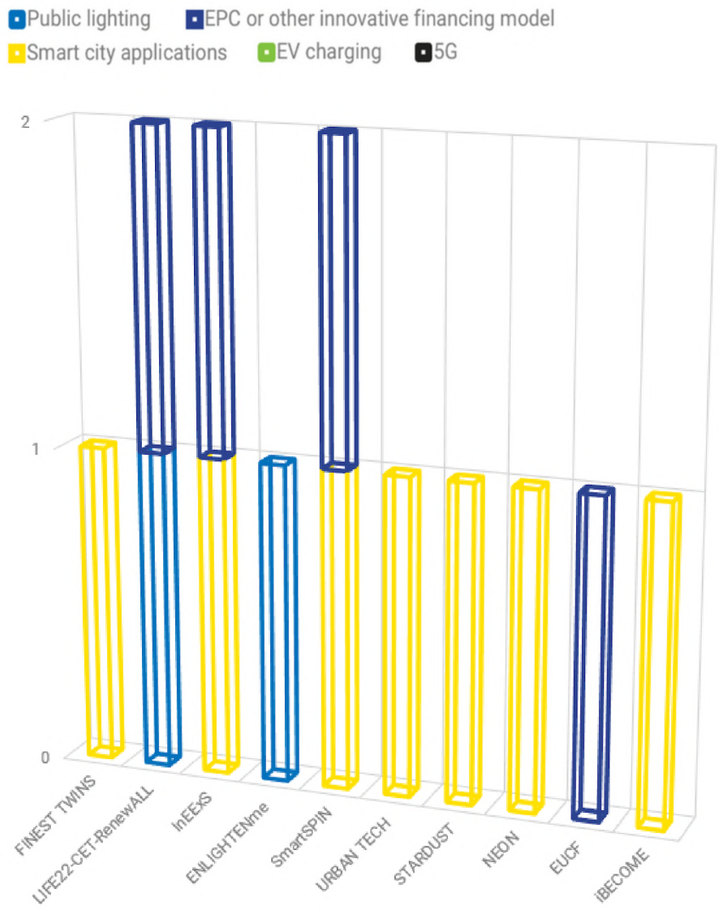
EPC – key takeways

- EPC enables energy efficiency reconstructions with no need for upfront investment.
- EPC model provides guaranteed energy savings, while energy savings are regularly measured and monitored.
- Provided payments are linked to desired outcomes, ensuring that local authority “pays only what it gets” and allocating performance risks on ESCOs.
- EPC projects can be developed as “off balance sheet” investments for local authorities.
- EPC in public lighting is simpler than EPC in buildings.

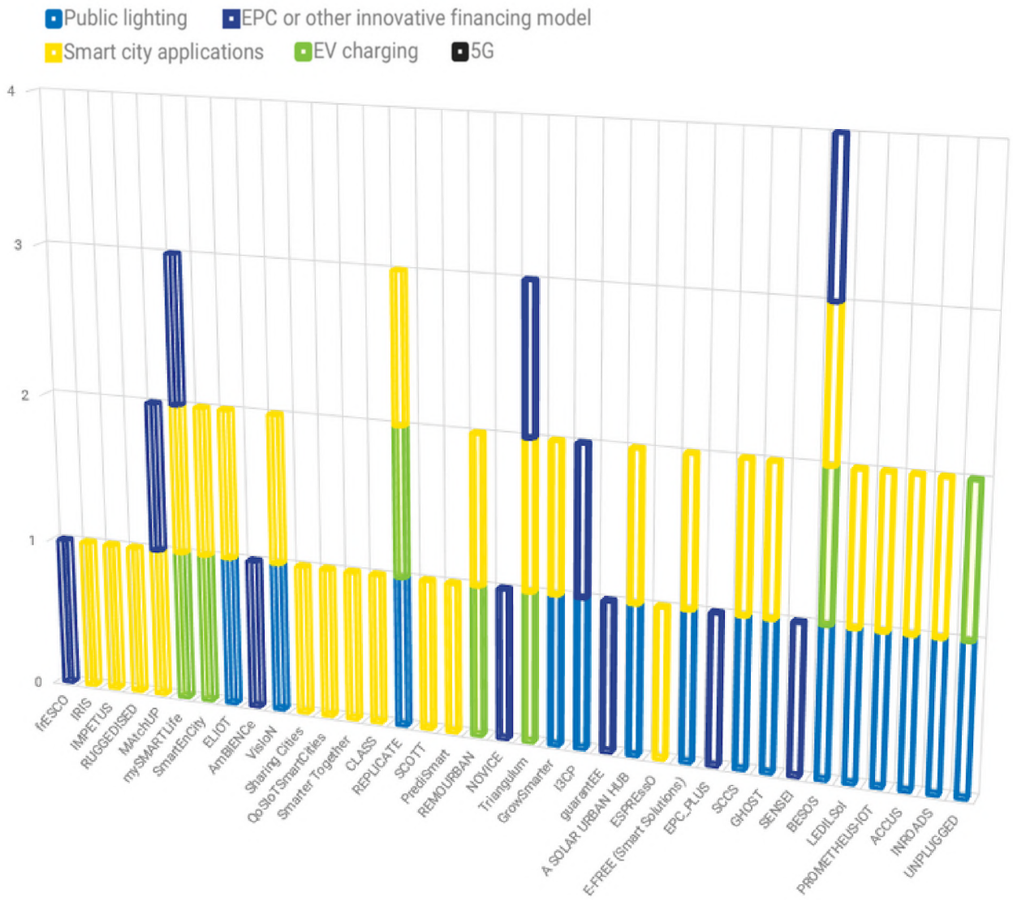
5. Smart EPC related EU projects and initiatives

The projects related to Smart EPC were divided in two categories: ongoing and completed projects.

Related EU projects (ongoing)



Related EU projects (completed)



Regarding the five main subjects selected (Public lighting, EV charging, 5G cellular network technology, Smart city application and Financing models (EPC)), there are several ongoing H2020 and other projects Smart EPC project could relate to.

There are few ongoing projects related to SmartEPC in two selected subjects, such as SmartSPIN, InEExS, and LIFE22-CET-RenewALL.
The base of already completed projects provides more projects Smart EPC could build upon, highlighting the following projects: **REPLICATE** (Public lighting, EV charging, Smart city application), **Triangulum** and **mySMARTLife** (EV charging, Smart city application and Financing models (EPC)), **BESOS** (Public lighting, EV charging, Smart city application and Financing models (EPC)), while multiple lessons could be also learned from MAtchUP, SmartEnCity, ELIOT, VisIoN, REMOURBAN, GrowSmarter, I3CP, A SOLAR URBAN HUB, E-FREE (Smart Solutions), SCCS, GHOST, LEDILSol, PROMETHEUS-IOT, ACCUS, INROADS and UNPLUGGED.

PROJECT NAME			ENERGY AND NON-ENERGY RELATED SERVICES IN PUBLIC LIGHTING						
Acronym	Full name	Objective	Public lighting	EV charging	5G cellular network technology	Smart city applications	Financing models (EPC)	Duration	
FINEST TWINS	Establishment of Smart City Center of Excellence	A globally unique focus on developing user-driven clean and sustainable smart city solutions that are "cross-border-by-default" in the context of emerging twin city between Tallinn and Helsinki				•		1/12/19 - 30/12/26	
LIFE22-CET-RenewALL	Neighbourhood RenewALL Financed with Energy Performance Contracting	Focus on modernising whole neighbourhoods, approach part of a strategy to trigger the interest of homeowners in a deep renovation project. In parallel with the deep renovation of buildings facing this yard, the public sector takes care of renovating inner infrastructures, including public lighting.	•				•	1/09/23 - 31/08/26	
InEExS	Innovative Energy (Efficiency) Service Models for Sector Integration via Blockchain	Development of business models and contractual schemes to facilitate the implementation of sector-integrating smart energy services and the deployment of a wide range of sustainable technologies, such as RES, EVs, heat pumps, IoT controls and other energy efficiency measures.				•	•	1/11/22 - 31/10/25	
ENLIGHTENme	Innovative policies for improving citizens' health and wellbeing addressing indoor and outdoor lighting	To develop a dedicated Decision Support System and guidelines and recommendation on the impact of lighting on health and wellbeing, proposing innovative lighting policies, measures, technologies and interventions aiming at improving citizens' health and wellbeing in cities	•					1/3/21 - 28/2/25	
URBAN TECH	Value chain innovations in emerging Health Tech, Smart City and Greentech industries addressing the challenges of smart urban environment	To support the acceleration of competitive success of European SMEs through market launch of new or significantly improved products and services with higher value in Health Tech, Smart City and Greentech industry sectors				•		1/9/21 - 31/8/24	
STARDUST	HOLISTIC AND INTEGRATED URBAN MODEL FOR SMART CITIES	To develop urban technical green solutions and innovative business models, integrating the domains of buildings, mobility and efficient energy through ICT.				•		1/10/17 - 31/3/24	
NEON	Next-Generation Integrated Energy Services fOr Citizen Energy CommuNities	To deliver next-generation integrated energy services for citizen energy communities to enhance the quality of life of building occupants, save energy along the value chain, and improve grid operation				•		1/9/21 - 29/2/24	
EUCF	European City Facility	To build a substantial pipeline of sustainable energy investment projects across cities in Europe					•	1/8/19 - 31/1/24	

PROJECT NAME			ENERGY AND NON-ENERGY RELATED SERVICES IN PUBLIC LIGHTING						
Acronym	Full name	Objective	Public lighting	EV charging	5G cellular network technology	Smart city applications	Financing models (EPC)	Duration	
frESCO	New business models for innovative energy service bundles for residential consumers	To develop innovative business models on the basis of novel integrated energy service bundles that properly combine and remunerate local flexibility for optimizing local energy performance both in the form of energy efficiency and demand side management.					•	1/6/20 - 30/12/23	
IRIS	Integrated and Replicable Solutions for Co-Creation in Sustainable Cities	To deliver energy and mobility services in the cities that are cheaper, better accessible, reliable, and that contribute to a better and more sustainable urban quality of life by demonstrating smart solutions that integrate energy, mobility and ICT				•		1/10/17 - 31/3/23	
IMPETUS	Intelligent Management of Processes, Ethics and Technology for Urban Safety	To address the growing security and ethical threats on smart cities, via developing an integrated toolkit that covers the complete physical and cybersecurity value chain (detection, simulation & analysis, intervention)				•		1/9/20 - 28/2/23	
RUGGEDISED	Ruggedised Rotterdam, Umea and Glasgow: Generating Exemplar Districts In Sustainable Energy Deployment	To create urban spaces powered by secure, affordable and clean energy, smart electro-mobility, smart tools and services				•		1/12/16 - 31/10/22	
MAtchUP	MAximizing the UPscaling and replication potential of high level urban transformation strategies	To transform cities by deploying novel solutions and technologies, focusing on the energy, mobility and ICT sectors				•	•	1/10/17 - 30/9/22	
mySMARTLife	Smart Transition of EU cities towards a new concept of smart Life and Economy	To develop an Urban Transformation Strategy to support cities in the definition of transition models, as a suitable path to reach high level of excellence in its development process, addressing the main city challenges and progressing to the smart people and smart economy concepts		•		•	•	1/12/16 - 30/9/22	
SmartSPIN	Smart energy services to solve the SPlit INcentive problem in the commercial rented sector	To develop a new business model leading to greater uptake of Smart Energy Services deployed via performance-based contracting in the commercial rented sector. Removes the split incentive barrier through an Energy Efficiency-as-a-Service (EEaaS) concept.				•	•	1/09/21 - 31/08/24	
iBECOME	intelligent Building Energy Assets Control for Comfort, Energy and Flexibility Optimisation	To increase intelligence, decarbonisation and decentralisation of the energy system by transforming building and operation data into products that can be profitable in the innovative business framework				•		1/6/20 - 30/12/23	

PROJECT NAME			ENERGY AND NON-ENERGY RELATED SERVICES IN PUBLIC LIGHTING						
Acronym	Full name	Objective	Public lighting	EV charging	5G cellular network technology	Smart city applications	Financing models (EPC)	Duration	
SmartEnCity	Towards Smart Zero CO2 Cities across Europe	To develop a highly adaptable and replicable systemic approach towards urban transformation into sustainable, smart and resource-efficient urban environments in Europe through the integrated planning and implementation of measures aimed at improving energy efficiency in main consuming sectors in cities, while increasing their supply of renewable energy, and demonstrate its benefits		•		•		1/2/16 - 31/7/22	
ELIOT	Enhance Lighting for the Internet Of Things	To provide an open reference architecture for the support of IoT in the lighting infrastructure, build consensus reflecting the best architectural choices, contribute to standardization of lighting and telecom infrastructures in IEC, IETF, IEEE and ITU-T and provide a roadmap for IoT until 22 and beyond	•			•		1/1/19 - 30/6/22	
AmBIENCe	Active managed Buildings with Energy performaNce Contracting	To provide new concepts and business models for performance guarantees of active buildings, combining savings from energy efficiency measures with additional savings and earnings from the active control of assets, leveraging, for instance, price-based incentive contracts				•		1/6/19 - 31/5/22	
VisIoN	European Training Network on Visible light based Interoperability and Networking	To train a new generation of early-stage researchers (ESRs) in the emerging area of VLC. Targeted application areas include indoor and outdoor VLC access, smart transportation, and medical and manufacturing environments.	•			•		1/9/17 - 28/2/22	
Sharing Cities	Sharing Cities	To achieve scale in the European smart cities market, To adopt a digital first approach which proves the extent to which ICT integration can connect up existing infrastructure, To accelerate the market and trial business, investment, and governance models, to Share and collaborate and enhance mechanisms for citizens' engagement				•		1/1/16 - 31/12/21	
QoSIoTSmartCities	Quality of Service for the Internet of Things in Smart Cities via Predictive Networks	To enable the delivery of Quality of Service (QoS) for the Internet of Things (IoT) in smart cities				•		1/4/19 - 29/10/21	

PROJECT NAME			ENERGY AND NON-ENERGY RELATED SERVICES IN PUBLIC LIGHTING						
Acronym	Full name	Objective	Public lighting	EV charging	5G cellular network technology	Smart city applications	Financing models (EPC)	Duration	
Smarter Together	Smart and Inclusive Solutions for a Better Life in Urban Districts	To develop ICT solutions for the energy transition in urban areas. A special focus will be on residential housing renovation, production and consumption of renewable energy and mobility				•		1/2/16 - 31/7/21	SMARTER TOGETHER
CLASS	Edge and CLoud Computation: A Highly Distributed Software Architecture for Big Data AnalyticS	To develop a novel software architecture to help big data developers to combine data-in-motion and data-at-rest analysis by efficiently distributing data and process mining along the compute continuum (from edge to cloud) in a complete and transparent way, while providing sound real-time guarantees				•		1/1/18 - 30/6/21	CLASS
REPLICATE	REnaissance of Places with Innovative Citizenship and TEchnolgy	To demonstrate Smart City technologies in energy, transport and ICT	•	•		•		1/2/16 - 31/1/21	REPLICATE
SCOTT	Secure COnnected Trustable Things	To provide efficient solutions of wireless, end-to-end secure, trustworthy connectivity and interoperability to bridge the last mile to the market				•		1/5/17 - 31/10/20	SCOTT Secure Connected Trustable Things
PrediSmart	AN INTELLIGENT PREDICTION SYSTEM FOR THE SMART EFFICIENT USE OF RESOURCES IN CITIES	An integrated scalable solution suitable for a broad range of end users such as Building Owners, FM companies, ESPCs & ESCOs, IoT platform suppliers and Utilities delivering Energy, Water and Waste collection services				•		1/12/17 - 31/7/20	https://cordis.europa.eu/project/id/745493
REMOURBAN	REgeneration MOdel for accelerating the smart URBAN transformation	To develop and validate a sustainable urban regeneration model that leverages the convergence area of the energy, mobility and ICT sectors in order to accelerate the deployment of innovative technologies, organisational and economic solutions to significantly increase resource and energy efficiency, improve the sustainability of urban transport and drastically reduce greenhouse gas emissions in urban areas		•		•		1/1/15 - 30/6/20	REMOURBAN
NOVICE	New Buildings Energy Renovation Business Models incorporating dual energy services	Introducing new actors (aggregators) in building energy upgrade projects and fosters their collaboration with ESCOs, financing institutions, facilities management companies, engineering consultants to facilitate the roll out of the dual (grid services and energy efficiency) energy services model				•		1/6/17 - 31/5/20	NOVICE

PROJECT NAME			ENERGY AND NON-ENERGY RELATED SERVICES IN PUBLIC LIGHTING						
Acronym	Full name	Objective	Public lighting	EV charging	5G cellular network technology	Smart city applications	Financing models (EPC)	Duration	
Triangulum	Triangulum: The Three Point Project / Demonstrate. Disseminate. Replicate.	To demonstrate how a systems innovation approach based around the European Commission's SCC Strategic Implementation Plan can drive dynamic smart city development		•		•	•	1/2/15 - 31/1/20	triangulum DEMONSTRATE·DISSEMINATE·REPLICATE
GrowSmarter	GrowSmarter	To demonstrate smart integrated solutions for a wider market rollout	•			•		1/1/15 - 31/12/19	GrowSmarter
I3CP	Industrial and Infrastructure Investor Confidence Project	To extend the successful standardization approach of the Investor Confidence Project beyond buildings and into Industry and Infrastructure	•				•	1/5/17 - 31/10/19	I3CP
guarantEE	Energy Efficiency with Performance Guarantees in Private and Public Sector	To develop innovative business and financing models addressing and overcoming the split incentives dilemma in performance based ESCO projects					•	1/4/16 - 31/3/19	guarantEE Building Energy Services in Europe
A SOLAR URBAN HUB	A SOLAR URBAN HUB with integrated lighting and information system for optimal Smart Cities efficiency	A new concept of solar urban furniture which converts smart street lighting into an IoT enabling smart city tool	•			•		1/9/18 - 31/1/19	https://cordis.europa.eu/project/id/828485
ESPREssO	Enhancing Synergies for disaster PRevention in the EurOpean Union	To develop conceptual Smart Cities Information Framework, which consists of a Smart City platform and a number of data provision and processing services to integrate data, workflows, and processes in applications relevant for Smart Cities within a common framework				•		1/5/16 - 31/10/18	ESPRESSO
E-FREE (Smart Solutions)	Towards a more ECO, HEALTHY and SAFE environment in every single lighting scenario.	Solar Street Lights and add-on Systems on-line connected to Smart Cities and their frameworks	•			•		1/4/18 - 30/9/18	https://cordis.europa.eu/project/id/816397
EPC_PLUS	Energy Performance Contracting Plus	To overcome existing barriers and to simplify EPC models by creating and testing sample documents and finding new financing models					•	1/3/15 - 31/3/18	EPC Energy Performance Contracting Plus
SCCS	Smart City Control System (SCCS) For Green Lighting	To develop and commercialize an innovative, universal, multi-application Smart City Control System (SCCS) to be integrated with existing urban infrastructure	•			•		1/6/17 - 30/12/17	https://cordis.europa.eu/project/id/773360

PROJECT NAME			ENERGY AND NON-ENERGY RELATED SERVICES IN PUBLIC LIGHTING						
Acronym	Full name	Objective	Public lighting	EV charging	5G cellular network technology	Smart city applications	Financing models (EPC)	Duration	
GHOST	Galileo EnHancement as BoOster of the Smart CiTies	To design, develop and validate at an operational environment a GALILEO-based intelligent system for vehicles	•			•		1/1/15 -31/12/16	https://cordis.europa.eu/project/id/641495
SENSEI	Making Sense of Human-Human Conversation Data	To design concepts and business models that will help: (a) generate new sources of benefits that increase the value of an energy retrofit project by enabling the compensation of energy efficiency as an energy resource, and (b) turn the project's value into an investable asset to attract private financing					•	1/12/13 - 31/10/16	{SENSEI}
BESOS	Building Energy decision Support systems fOr Smart cities	To enhance existing neighborhoods with decision support system to provide coordinated management of public infrastructures in Smart Cities, and at the same time provide citizens with information to promote sustainability and energy efficiency	•	•		•	•	1/10/13 - 30/9/16	BESOS Building Energy Decision Support Systems for Smart Cities
LEDILSol	Multipurpose Cloud-Based Control Platform High Performance LED Lighting Solution for Smart Cities	To offer a smart and efficient control system to path the way towards more efficient cities and a power grid that improves the quality of life of citizens always targeting to achieve customer's loyalty through our management services	•			•		1/12/15 - 31/3/16	LEDilSol
PROMETHEUS-IOT	a versatile Platform foR delivering incremental, scalable and cOst-effective ad-hoc services froM hETErogeneoUS and collaborating objects in the Internet Of Things	The most used versatile WSAN platform available on the market	•			•		1/9/15 - 29/2/16	https://cordis.europa.eu/project/id/698534
ACCUS	Adaptive Cooperative Control in Urban (sub) Systems	To investigate requirements and defines a reference architecture for the integration of urban systems, based on semantic descriptions	•			•		1/6/13 -31/1/16	https://cordis.europa.eu/project/id/333020
INROADS	INtelligent Renewable Optical ADvisory System	To develop Intelligent Road Studs (IRS) combining LED lighting, sensor systems and communication technologies	•			•		1/12/11 - 31/5/15	https://cordis.europa.eu/project/id/285343
UNPLUGGED	Wireless charging for Electic Vehicles	To investigate how the use of inductive charging of Electric Vehicles (EV) in urban environments improves the convenience and sustainability of car-based mobility	•			•		1/10/12 - 31/3/15	https://cordis.europa.eu/project/id/314126

Conclusion

In summary, the Smart EPC project is positioned as a transformative initiative aimed at advancing urban development through the integration of energy efficiency and emerging technologies. The core objective revolves around upgrading public lighting systems, incorporating IoT technology and Smart City components to unlock a spectrum of energy and non-energy related services. The outlined activities, including the integration of services, standardized EPC documentation development and pilot testing, underscore the project's practical approach.

The document emphasises the need for the overhaul of existing public lighting infrastructure, citing outdated technology and inefficiency. Modernization is depicted as not only enhancing safety and reducing operational costs but also positioning the infrastructure as "Smart City ready."

Significant attention is devoted to the integration of EV charging points into public lighting, presenting it as a space-saving and scalable solution, albeit with acknowledged challenges. The broader role of public lighting in supporting Smart City initiatives, acting as an ideal host for various IoT applications, is highlighted. Communication technologies, particularly licensed 5G and unlicensed options like LoRa, are explored in the context of their potential integration into public lighting infrastructure.

The financing model of Energy Performance Contracting (EPC) is introduced as a pivotal mechanism, and the document asserts that EPC projects in public lighting are comparatively simpler than those in buildings. This simplicity is positioned as a facilitating factor for broader EPC implementation.

In conclusion, the Smart EPC Project emerges as a multifaceted endeavour addressing critical facets of urban development, energy efficiency, and Smart City progression. By leveraging public lighting infrastructure, the project seeks to bring about tangible benefits, ranging from improved safety to the creation of innovative revenue streams.