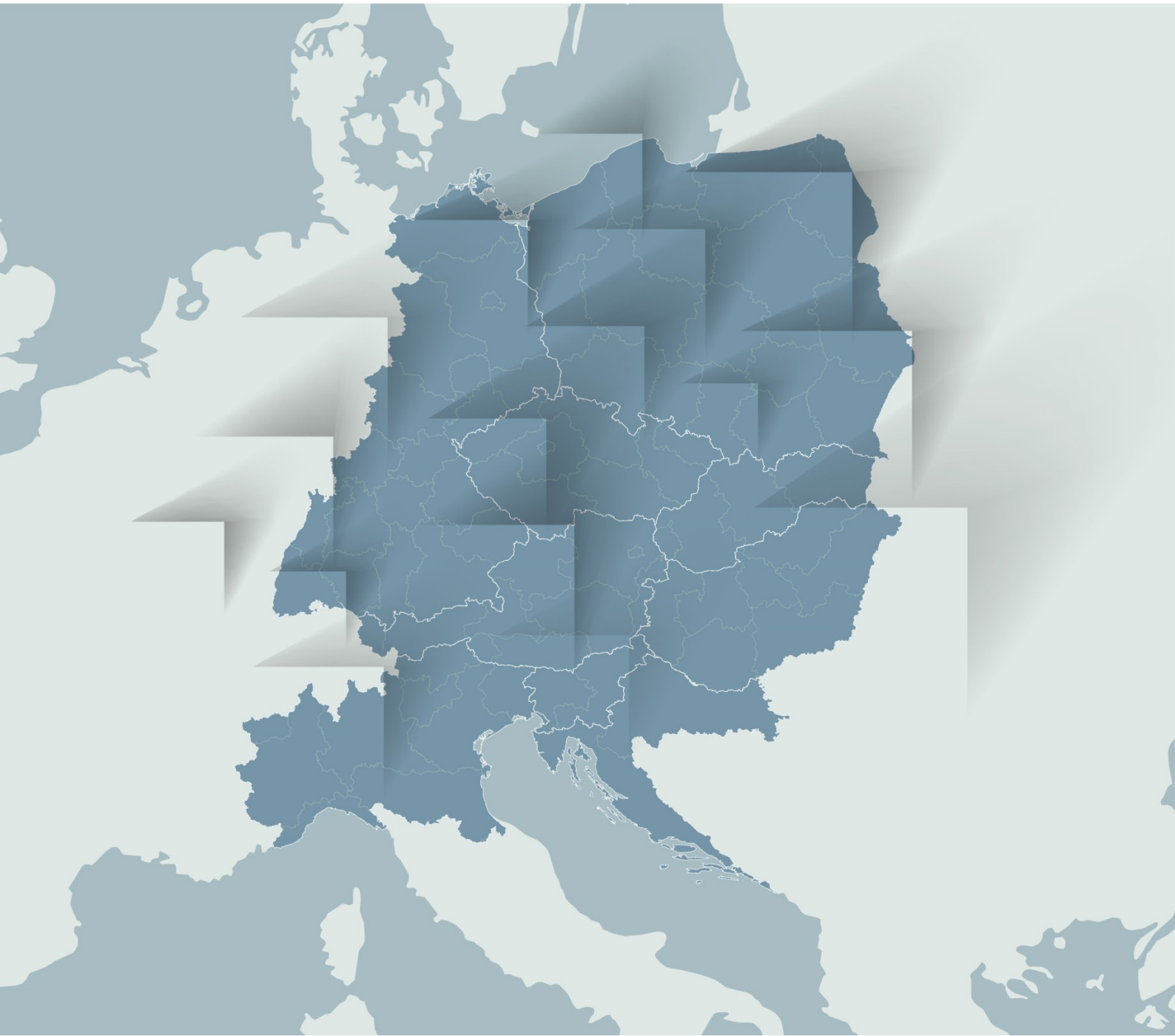
Interreg CENTRAL EUROPE
European Union European Regional Development Fund
Dynamic Light

PRIORITY: LOW CARBON CITIES AND REGIONS

D.T4.2.2 Analysis of the political and legal framework and the examples Country Report Germany



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A. General aspects concerning urban lighting

In Germany, general street lighting is regulated at the federal level by the road and path law (Straßen- und Wegegesetz or StrWG). Accordingly, the municipalities are obligated to maintain the security and order within built-up areas according to their performance and capacity to illuminate public roads.

The lighting of public roads within the district belongs to the municipal tasks set out by the municipal code, based on the Federal Constitution. Moreover, it is an independent public task in the context of services of general interest. The SrtWG specifies street lighting as a legal public duty of the municipalities for maintaining public security and order, which makes clear their security regulations character. Accordingly, the general street lighting is expressly excluded from the tasks of the road-works; this also applies to the federal highways[i].

I. Ownership, maintenance, and operation

Ownership

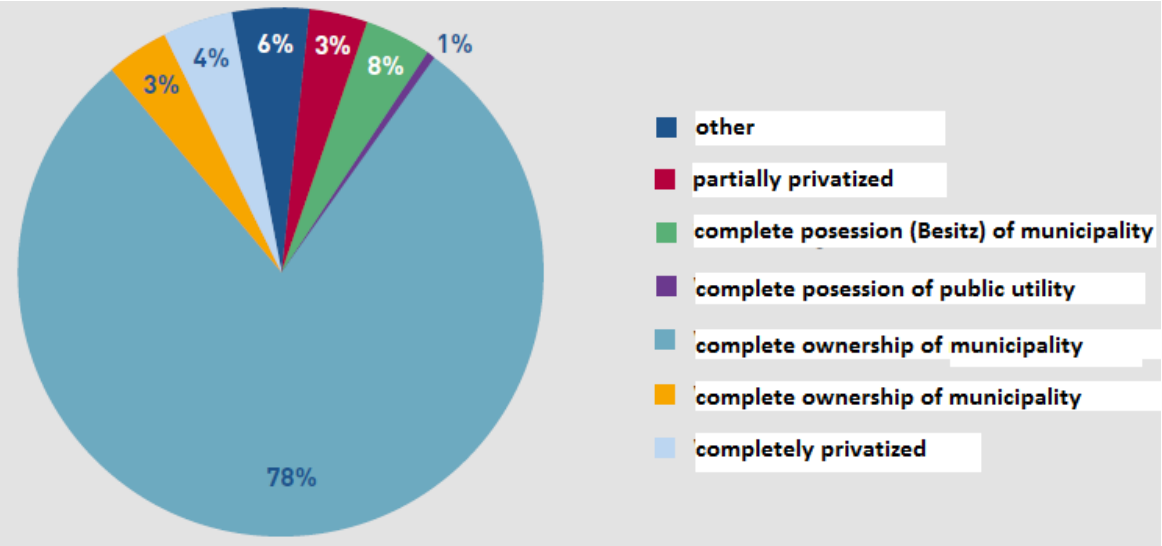
Lighting obligations of others, due to other legal regulations, could let the safety lighting requirements of the municipalities to withdraw.

First and foremost, the duty of public safety must be mentioned. In this civil law-based legal institution, the general idea of law is that anyone who creates sources of danger, such as the opening or condoning of traffic on his property, is obliged to make the necessary arrangements within reason, to prevent damage to third parties as far as possible. The content of the duty of public safety on public roads is, as far as reasonable, to make traffic on the road as safe as possible, to protect or at least warn traffic users against unexpected, resulting from the nature of the road and with appropriate use of the traffic not easily recognizable danger points[ii]. The duty of care therefore does not provide a legal basis for a general lighting obligation. Rather, vehicles must adjust their driving style to the visibility conditions created by their own lighting system in the dark. Only if there is a special danger point despite vehicle lighting and adequate speed is there a duty of lighting for the traffic safety officer (as a rule the road user)[iii]. Incidentally, the street lighting is especially important for pedestrian traffic. However, pedestrians have to adjust their way of walking to these conditions if the lighting is insufficient[iv].

A special traffic law lighting obligation results from §§ 32, 17 road traffic regulations (Straßenverkehrsordnung or StVO). Insofar as objects that endanger traffic are on the carriageway, they must be identified by the responsible person until they are removed. If necessary (during twilight, in darkness or when visibility conditions otherwise require it), traffic obstructions should be illuminated or indicated by other lighting equipment. This applies not only to moving obstacles, but also to traffic barriers set up for traffic calming on the road[v].

The lighting of traffic signs and traffic facilities are determined in accordance with §45 paragraph 3, sentence 2, of the StVO by the road authorities. The authority responsible for road construction is responsible for the lighting according to § 45 paragraph 5, sentence 1, of the StVO. According to §45

(5) sentence 2 of the StVO, this also applies to the lighting of pedestrian crossings ordered by the Road Traffic Authority. The authority responsible for road construction has to bear the costs (see Section 5b (1) sentence 1 of the Road Transport Law (Straßenverkehrsgesetz or StVG)).



In Germany, approximately 61% of lighting systems are owned[vi] by municipalities, while approximately 37% are owned by an energy service company (ESCO) or an energy service provider (ESP), and the rest are owned by others.

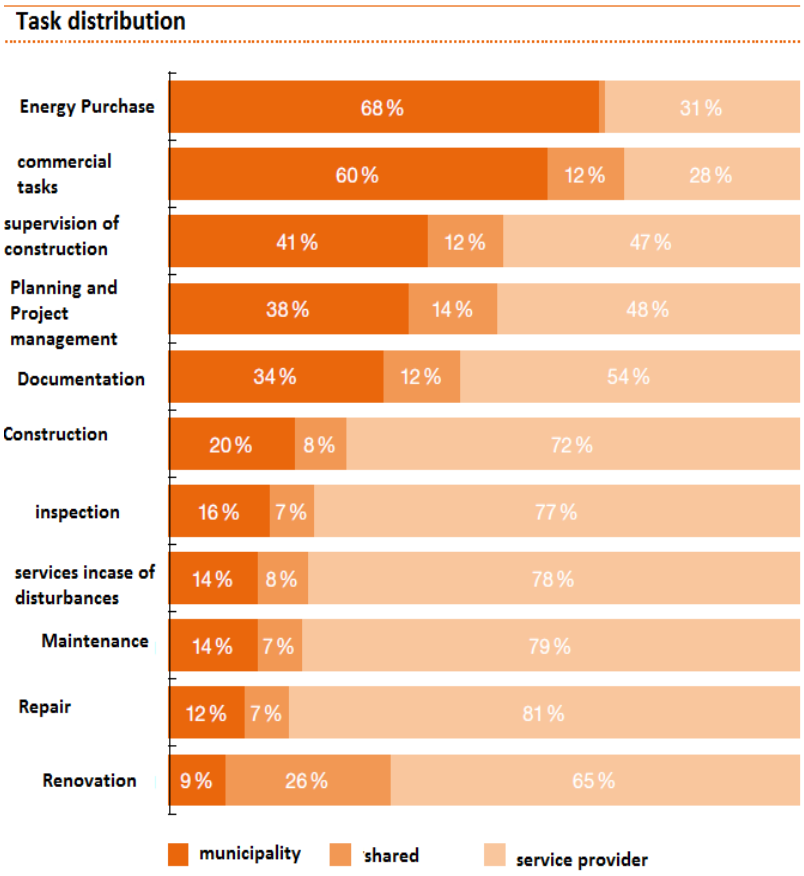
Maintenance

According to Liebaug et. al. (2015) maintenance is provided for by service providers in 79% of cases, and only by municipalities in rare cases (16%)[vii]. As an example in Berlin, Stromnetz Berlin GmBH, a private a company, is the provider on behalf of the Senate Administration for the Environment, Transport and Climate Protection (Senatsverwaltung für Umwelt, Verkehr und Klimaschutz), more precisely, the department for civil engineering, which is a public company.

Operation

In Germany, approximately 45% of lighting systems are operated by municipalities, 28% by other ESPs, 26% by Municipal ESPs, and about 1% by private third parties.

About 60 to 70% of municipalities take over business administrative tasks such as tendering and energy production. Roughly 80% of technical task are outsourced, and municipalities often monitor and manage the operation carried out by external service providers[viii]. The table below describes the distribution of tasks regarding public lighting infrastructure in Germany.



As lighting obligations of others only exist on a case-by-case basis, street lighting is usually provided by the municipalities on based on the StrWG in each federal state. The general lighting of roads, paths and squares open to traffic is seen as a means of promoting community life, of stimulating economic, cultural and social activities, of increasing the comfort of citizens and of the prestige of the city[ix].

The street lighting has therefore outgrown its originally inherent police significance in terms of ensuring security and order to a matter whose regulation is guaranteed on their own responsibility of the local community and their fulfilment within the community, in affairs of self-administration, only in context of legal supervision[x]. There is therefore no claim for reimbursement of the municipality for the lighting of local thoroughfares that are not in the road construction of the municipality[xi]. Moreover, a transfer of the lighting obligation to the residents is - unlike when clearing and spreading - not provided, because it does not require services, but technical arrangements.

The municipal obligation exists for all public roads within the local built-up areas, also for the local crossings of the federal highways[xii]. The built-up areas are the part of the municipality, which are built in a contiguous closed or open construction[xiii]. The level of lighting required depends on local needs and other local conditions, on the importance of each road to traffic, but also on the size of the municipality and its financial capacity. The location of each street in the municipality plays a role. Generally, supra-local roads are safe for traffic and therefore require no lighting. Danger points must be indicated by traffic signs.

Motorists, as part of the public use, should ensure that their vehicles are provided with adequate light sources. According to the federal law, a lighting obligation of the municipalities will only be given if the motorists, even if all care is taken without lighting, pose a serious threat to life, health or other material goods which they cannot control. This assessment must be based on local conditions, so that there may be significant differences, for example between small rural communities and cities. The requirements are not higher in this respect than in the lighting duty, which is based on the traffic safety obligation.

It becomes clear that no general statements can be made about the extent and duration of the municipal street lighting. In addition to the requirements arising from the obligation to provide public safety and the obligation to provide lighting under the federal StrWG, it is largely within the municipal discretion of how and to what extent the roads are illuminated. Depending on the character, size and performance of the communities can be significant differences. Against this background, an hourly shutdown of the street lighting at night can be considered in individual cases. Municipalities then must mark the street lamps within closed towns, which do not burn all night, with a red ring[xiv].

II. Political strategies and targets

This section highlights the political strategies, programs, and action plans on making dynamic public lighting more energy efficient and climate friendly in Germany. Accordingly, and following its federal administrative structure, in the National Energy Efficiency Action Plan (NEEAP) 2014, the Federal Government fulfils its reporting requirements and informs about current framework conditions and achievements in energy efficiency policy in Germany regarding lighting over the past few years.

The Federal Environment Ministry, the UBA and the German government-owned development bank (Kreditanstalt für Wiederaufbau or KfW) launched a federal competition, called "Energy Efficient, Urban Lighting", as part of the Ministry's climate protection initiative. With their concepts for transforming their outdated city lighting, 18 municipalities presented modern, efficient and economical lighting technology. The implementation of their concepts was subsidized via the environmental innovation program.

With the funding program called "Intelligent Lighting", the German Federal Ministry for Education and Research (BMBF) aims at supporting companies in the research and development phases of innovative lighting systems and applications with high market potential. The focus of the funding is on optical systems and their networking, electronic and control aspects of the system and their networking as well as research on the perception and effect of light on humans.[xv] With its LED market initiative, the BMBF wants to pave the way for innovation by developing innovative financing models for the switch to the LED (following a Public Private Partnership approach) for municipalities as well as common industrial standards and quality criteria.

Moreover, since 2008 until 2020, the German government aims at increasing energy efficiency by 20%; the overall goals of this also include transforming the lighting infrastructure.

III. Actors and Stakeholders

In Germany, the main actors and stakeholders in the field of dynamic public lighting are government agencies, like Ministries at the federal level, and regulatory agencies. The following subsections list the actors and stakeholders involved.

Ministries

- **Federal Level**
  - Bundesministerium für Wirtschaft und Energie (Federal Ministry for Economic Affairs and Energy) - central government authority [xvi]
  - Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety) - central government authority [xvii]
  - Bundesministerium für Verkehr und digitale Infrastruktur (Federal Ministry of Transport and Digital Infrastructure) - central government authority [xviii]
- **Regional Level (example of Berlin)**
  - Senatsverwaltung für Stadtentwicklung und Wohnen (Senate Department for Urban Development and Housing)
  - Senatsverwaltung für Umwelt, Verkehr und Klimaschutz (Senate Department for the Environment, Transport and Climate Protection)
  - Senatsverwaltung für Wirtschaft, Energie und Betriebe (Senate Department for Economics, Energy and Public Enterprises)

Regulatory Agencies

- Federal Network Agency for Electricity, Gas, Telecommunications, Post and Railway (Bundesnetzagentur, BNetzA)
- Subordinate authority of the Federal Ministry of Economic Affairs and Energy
- Supervises the grid connection by the responsible transmission system
- Responsible for the assignment of free grid capacity to offshore wind farms in a transparent procedure.
- Conducts Strategic Environmental Impact Studies for new grid projects
- Responsible for the supervision of the Grid Development Plan (O-NEP) and respective public consultations

Operator/Owner

- Municipalities: 45 %
- Other Energy Suppliers: 28%
- Municipal Energy Suppliers: 26 %
- Others: 1 %

IV. General Legal Background

This section details the general legal background in Germany and the relevant guidelines referring to dynamic public lighting.

Road Traffic Law

- Road Transport Law (Straßenverkehrsgesetz - StVG), road traffic regulations (Straßenverkehrsordnung - StVO),
- Rederal Highway Law (Bundesfernstraßengesetz - FStrG; federal level),
- Straßen- und Wegegesetze der Länder zB. Art. 51 Abs. 1 Satz 1 Gemeindliche Beleuchtungspflicht BayStrWG, §§9-10 ThürStrG, StrWG Schleswig-Holstein, StrWG NRW

Criminal Law

- Penal Code (Strafgesetzbuch - StGB);
- Supplementary penal provisions "Nebenstrafrecht": StVG, law on regulatory offences (Ordnungswidrigkeitengesetz - OWiG), etc.

Civil Law

- Civil Code (Bürgerliches Gesetzbuch - BGB), especially Mietrecht (Law of Tenancy)

Public Law

- Act against Restraints of Competition (Gesetz gegen Wettbewerbsbeschränkungen - GWB): Contract on the operation of street lighting is a public contract, § 99 par. 1 GWB
- Energy Economy Law (Energiewirtschaftsgesetz - EnWG) - 46 Abs. 2 Satz 2 EnWG (Konzessionsvergabe)
- Renewable Energies Act (Erneuerbare-Energien-Gesetz - EEG)
- Electricity Tax Law (Stromsteuergesetz - StromStG)
- Regulation for the Implementation of the Electricity Tax Law (Verordnung zur Durchführung des Stromsteuergesetzes (StromStV)
- Energy Saving Ordinance (Energieeinsparverordnung - EnEV)/ Energy Saving Law (Energieeinsparungsgesetz - EnEG)/ Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz - EEWärmeG)
- Ordinance on the charges for the access to electricity distribution networks (Verordnung über die Entgelte für den Zugang zu Elektrizitätsversorgungsnetzen - StromNEV)
- Ordinance on the access to electricity distribution networks (Verordnung über den Zugang zu Elektrizitätsversorgungsnetzen (StromNZV)
- Building Code (Baugesetzbuch - BauGB)
- Federal Emission Control Act (Bundesimmissionsschutzgesetz - BImschG) incl. Federal Emission Control Ordinance (Bundesimmissionsschutzverordnungen - BImschV)
- Further, see B.I.2.
- Ordinance on concession fees for electricity and gas (Verordnung über Konzessionsabgaben für Strom und Gas (§ 3 KAV)

- Regulation on the Award of Public Contracts (§§2-3 Verordnung über die Vergabe öffentlicher Aufträge or VGV)
- Ordninance on the award of concessions (Konzessionsvergabeverordnung or KonzVgV)

B. Public and Private Procurement

According to Valentová, Quicheron, and Bertoldi (2012) the Regulation of January 2008, it is mandatory in Germany for all Contracting Authorities at federal level to use life-cycle-costing in their Public Procurement Procedures to ensure energy efficient and environment-friendly Public Procurement[xix]. On 20 August 2011, a revised Ordinance on the award of contracts came into force (Vierte Verordnung zur Änderung der Verordnung über die Vergabe öffentlicher Aufträge, or VGV). The revised regulation considers aspects of energy efficiency in Public Procurement by implementing the Directives 2009/33/EC and 2010/30/EU.

Der Blaue Engel label (German for Blue Angel) was established in 1977 and covers currently more than 80 product groups. Lamps are covered by the UZ 151[xx]. The document defines requirements for lighting concerning e.g. power consumption index, colour rendering, durability of the lamp and other. For LED lamps, a specific requirement on real power is given, as these are not limited by Regulation 244/2009.

The German Energy Agency (Deutsche Energie-Agentur, or DENA) provides an online guide [xxi] for various energy-efficient product categories (such as ventilation, IT equipment and other). Among the product categories are office lighting and street lighting. On the one hand, for office lighting, the main lamp types are described, including "white" LEDs. LED lighting is described as the lighting of the future; however, it has so far been used mainly in specific installations, such as traffic lights, design, etc. On the other hand, the street-lighting guide leads the procurer through all the four stages of the procurement process, namely: 1) initial analysis; 2) planning; 3) goal setting; and4) selection of technology or financing. The website provides a detailed guide through existing and available technologies for street lighting, including LEDs[xxii]. The fact sheet on LEDs[xxiii] contains general information on LEDs their relatively short presence on the market and the need to pay attention to the operating temperatures of LEDs.

Guidelines on lighting have been published under the European Project Buy Smart[xxiv]. However, they exclude LEDs, because so far they are "meaningfully applicable only for individual applications".

Detailed information and guidelines are available at the website of the Federal Environment Agency[xxv], but without reference to lighting and LEDs. Moreover, the website of the Euro Topten Plus Project[xxvi], provides information on energy-efficient lighting, including tips on LEDs.

I. National Public Procurement

Euro

Germany, as an EU member state, uses the Euro as its currency.

General Aspects

Laws in Germany regarding urban lighting that have been implemented due to a legal act on an EU level include Directive 2014/23/EU – on the award of concession contracts, Directive 2014/24/EU – on

public procurement, and Directive 2014/25/EU – on procurement by entities operating in the water, energy, transport and postal services sectors.

The nationally implemented laws regarding urban lighting include the Following:

- Ordinance on the award of concessions (Konzessionsabgabeverordnung or KonzVgV);
- Act against Restraints of Competition (Gesetz gegen Wettbewerbsbeschränkungen or GWB);
- Regulation on the Award of Public Contracts (Verordnung über die Vergabe öffentlicher Aufträge or VgV);
- General Administrative Regulation for the Procurement of Energy Efficient Products and Services (Allgemeine Verwaltungsvorschrift zur Beschaffung energieeffizienter Produkte und Dienstleistungen or AVV-EnEff);
- Ordinance on concession fees for electricity and gas (§ 3 Verordnung über Konzessuinsabgaben für Strom und Gas or KAV);
- Sectors Regulations (Sektorenverordnung or SektVO);
- below-threshold contract Regulation (Unterschwellenvergabeordnung or UVgO).

All parts of the above-mentioned directives have been implemented, and all rules for procurement above threshold values have been transposed into the GWB.

Relevant National Laws regarding general obligations and procurement

- Mindestlohngesetz (Minimum Wage Law)
- Federal States' minimum Wage Laws
- Certain federal state laws (i.e. Law on promotion of medium-sized enterprises - Gesetz zur Mittelstandsförderung in Baden-Württemberg)
- Labour Contract Compliance Acts of the respective federal states (Tariftreuegesetze der Länder)

National threshold values

Below threshold values, procurement law is purely budgetary ruling, and not legally visible. Thus, there is no legal protection quite like it is ruled in the GWB. Still, it is possible to go before civil courts and sue for damages or "temporary legal protection".

Above threshold values, there are possibilities for review by supervisory authorities, such as a review of the decision of a procurement chamber by a high court (Oberlanesgericht/Vergabesent); sofortige Beschwerde § 171 GWB).

If a tender goes beyond the European thresholds, it is still possible to have "single bids", who can be procured on a national level, if their estimated net worth is below EUR 80,000 for services and below EUR 1,000,000 for building/construction works and together they account for less than 20% of the entire order volume (so-called 20% contingent, § 3 Abs. 8 VgV).

All federal states have threshold amounts which allow the contracting authority to award a tender via restricted procedure with or without competition. The following sections illustrate the above-mentioned thresholds in the example of the Bavarian Federal State.

For example, in Bavaria:

- Services: EUR 100,000 for municipalities – above that, only under special circumstances, § 3a VOB/A / § 3 VOL/A

All federal states that have threshold amounts which allow the contracting authority to award a tender directly without explanation ("freihändige Vergabe").

For example, in Bavaria:

- Works: EUR 30,000 for municipalities; EUR 10,000 for federal state procurement departments
- Services: EUR 30,000 for municipalities; EUR 25,000 for federal state procurement departments
- Below EUR 500, a contracting authority or public agency can directly and simply purchase goods.

Central, National, and Regional Databases for Public Procurement

National databases utilized for public procurement purposes in Germany include the Deutsches Vergabeportal[xxvii] . Federal states also have their own central database known as Landesvergabestelle.

Method of Lighting System Acquirement

The acquirement of lighting facilities is carried out almost exclusively by public procurement.

Regional Procurement

In Germany, every federal state has their own legislation regarding regional procurement, and threshold values may differ by region.

II. International Procurement

As a member of the EU and the World Trade Organization (WTO), Germany has ratified the Agreement on Government Procurement (GPA).

III. Green Procurement

Around EUR 260 billion are spent annually by public institutions on the procurement of goods and services. This is around 13 percent of the gross domestic product[xxviii]. According to a study by the consulting firm McKinsey & Company[xxix], around 51 billion of these are invested in environmentally-oriented future markets. Thus, the public sector is the largest purchaser or buyer in Germany. By

purchasing energy-efficient, resource-saving and health-friendly products, it becomes an engine for sustainable business and the development of sustainable products and innovations.

This in turn makes them an important factor for economic growth and employment. Moreover, green procurement has other positive effects: if the life cycle costs of products are taken into account during procurement, this is often not only a contribution to better environmental compatibility, but also makes purchasing generally more economical. The health of employees is spared, for example by purchasing lower emission or quieter equipment.

In addition, green procurement contributes to the reputation of a public body, which in turn affects employee motivation. After all, the public sector's purchasing decisions also play an important role model towards companies and citizens. In some areas, these effects are already being deliberately used, for example in the "Paper Atlas" competition, which annually honours Germany's "most recycling-paper-friendly city"[xxx].

The importance of the role of public procurement in protecting the environment can also be seen from the large number of publications on this topic. In addition to guides, guidelines and procurement concepts, these include studies, manuals, guides and websites, as well as court decisions. Of particular importance in the case of the latter is the judgment of the European Court of Justice of May 2012, which contributes to greater legal certainty in the environmentally friendly and socially sustainable procurement of the public sector[xxxi]. The study "Municipal procurement in transition" by the Institute for the Public Sector (Instituts für den öffentlichen Sektor e.V.) and the auditing firm KPMG has shown that procurers within administrations often still "only" see themselves as internal service providers[xxxii]. Only rarely are they already involved in higher-level planning and budgeting phases and only a minority sees itself as an innovation-driven body that contributes to the achievement of strategic goals of the municipality.

The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety is developing a Climate Protection Plan 2050 in cooperation with the federal states and municipalities of Germany. In many German states, it is mandatory for the state government to develop a climate protection plan, which describes how the state plans to achieve its climate protection goals. For example, according to the Climate Protection Law (Klimaschutzgesetz or KSG) of Nordrhein-Westfalen (NRW), issued in 2013, the state government must develop a climate protection plan with the participation of stakeholders to achieve their intermediate targets to reduce the total amount of greenhouse gases for the period up to 2050[xxxiii]. Germany also follows the European Green Procurement plans, like Horizon 2020, according to the EU and national procurement laws.

The sections below present two good practice examples in the German context.

Isernhagen – outdoor lighting

During the construction work at the school in Isernhagen[xxxiv] in the summer of 2009, the areas around the school complex were reconstructed and the wiring of outdoor lighting extended for the new building and bicycle stands of the High School.

It turned out that the 30-year-old lights (80W high pressure mercury vapour discharge lamps) were in a bad state. It was therefore decided to replace all 22 luminaires with modern LED systems.

In November 2009, the new energy-efficiency lighting system was launched. Besides a significantly better quality of light, energy savings of almost 70% were achieved. The project plays an exemplary role in the community and has enhanced implementation of further street-lighting modernisation projects.

The project is a part of good practice examples on the website devoted to Green Procurement of outdoor lighting. The authors specifically mention that such good examples are very important, in particular for LEDs, which are a new technology. Careful planning is therefore crucial, because there is often no previous experience with such technology in the community. Such good examples have a strong power to convince the population, or other local players, to support further modernisation projects.

Göttingen: Energy-efficient street lighting

As part of the creation of a climate protection concept in 2010, the city of Göttingen had decided to reduce CO_2 emissions by 40 percent by 2020. In addition, the energetic renovation of the city lighting should contribute. The outdated street lighting consisted mainly of mushroom lights with a low luminary efficiency, high proportion of stray light up and to the side and was equipped with inefficient mercury vapour lamps. In search of standard solutions for the renovation of frontage streets and residential streets throughout the city, three different concepts were developed. Attention was paid to the energy and CO_2 emissions balance, but also to cost-effectiveness. As part of the refurbishment measures, the obsolete mushroom lights were replaced by new metal halide lamps and mushroom lights, depending on the location.

The advantage of metal halide lamps is that they not only have a longer life, but also a much higher light output. As a result, fewer lamps could be mounted and still the luminous efficiency increased. Some lamps were switched off between 10:00 pm and 5:30 am, others equipped with a sensor technology that dims the lighting at rest to 20%. If a person or a vehicle approaches, the full light yield is switched on again. The later is a clear example of dynamic lighting in practice.

The three refurbishment projects saved 91,262 kWh and 54 t CO_2 (at 596 g / kWh) compared to the old lighting. The electrical power was reduced by 25.5 kW to 4.7 kW, the energy costs fell by 13,613 € per year (at 0.15 € / kWh). Spare parts costs also fell by up to 49%, depending on the type of luminaries and the setting (Merkel Street). The reduced operating costs and a 40% subsidy will result in a total investment of € 262,000 over a period of 10.5 years.

When setting up the energy-efficient street lighting, the city of Göttingen was supported by a regional energy supply company, which carried out the lighting calculations for the different variants. The city thus took part in the federal competition "Energy Efficient Street Lighting". In the meantime, Göttingen has converted most of the street lighting in residential and residential streets to LED lighting. The city estimates that the savings in energy consumption at about 80%, but so far there was no detailed evaluation.

C. Development of Lighting Facilities

The following section and its subsections on planning and authorization, refinancing sources/mechanisms, construction, and cost relevant aspects with regard to dynamic public lighting in Germany describes the relevant aspects in respect of law, the general planning process before official administrative processes begin, technical standards, the authorization process, the role of land use plans, opportunities for public, civil and other stakeholders' participation in administrative processes, and the possibilities to review authorizations once they have been granted.

I. Planning and authorization

Relevant aspects in respect of law

- **Duty to keep the road illuminated:**
  - Explicitly in the state road laws (Landesstraßengesetze) of Bavaria, Baden-Wurttemberg, Berlin and Saxony.
  - For the other states, this duty derives from the principle of public safety obligations for roads (Straßenverkehrssicherungspflichten) which is a public duty, according to the respective state's road law.[1]Duty focuses almost exclusively Municipalities (Kommunen oder Träger der Straßenbaulast, meist auch Kommunen)
- Road Traffic Law (various aspects)
- Baugesetzbuch (Building)
- Energiewirtschaftsrecht (see above) (energy)
- DIN-Normen:
  - DIN 67523 – Lighting of pedestrian roads (Beleuchtung von Fußgänger-überwegen);
  - DIN 67524 – Lighting of tunnels and underpasses (Beleuchtung von Straßentunneln und Unterführungen);
  - DIN EN 13201 – street lighting (Straßenbeleuchtung)
  - DIN EN 67528 – Lighting if parking areas (Beleuchtung von Parkflächen).
- European Standards:
  - IEC 60598-1, ED7, ED8: Luminaires - Part 1: General requirements and tests
  - IEC 60598-2-3
    - Part 2-3: Special requirements Luminaires for
    - Road and road lighting
  - IEC 61547
    - EMC immunity requirements
  - IEC 61000-4-2
    - Discharge static electricity ESD
  - IEC 61000-4-3 / 8
    - High-frequency electromagnetic fields
  - IEC 61000-4-4

[1] Ringwald et al., Praxishandbuch Öffentliche Beleuchtung, S. 79.

        - Fast electrical transients
    - IEC 61000-4-5
        - Shock voltages
    - IEC 61000-4-6
        - Conducted high-frequency interference
        - An overvoltage resistance is required in the IEC guidelines
        - From 1 kV to 6 kV, depending on the necessary availability
        - Of the luminaries in the application area. Outside
        - But at least 6 kV.

Technical standards

Public lighting design and location is mainly dependent upon existing lamps, including conversion and modification, and the existing grid. The connection of street lighting to the electrical supply network can be implemented in various ways. The most common connection is a separately installed lighting cable, which is connected to the general power supply via a control box. A control box supplies several roads, and control boxes are controlled by a rotary control receiver which is usually controlled via a switchboard of the local power supply company.

Next to the sublegal DIN standards, there are European standards mentioned above. A DIN standard is a voluntary standard drawn up by a work committee of the DIN (Deutsches Institut für Normung). The creation of DIN standards is initiated by stakeholders, whereby an agreement is established among all stakeholders. The reason for the existence of the standards vary, but the DIN standards on lighting refer particularly to traffic safety.

The compatibility of International and European standards is governed by the Vienna Agreement and the Dresden Agreement; European standards should be transferred directly into international standards and vice versa.

Authorization

Permits necessary regarding the building of lighting infrastructures include the building permit (Baugenehmigung), an emission permit (BimschG-Genehmigung, Umweltvertrählichkeitsprüfung), and a special permit required for equipment which illuminates buildings near roads (Straßenrechtliche Sondernutzungserlaubnis).

In Germany, permit with somewhat of a concentration effect is the authorization according to the Federal Emission Control Act, and it concludes all relevant authorizations required for the respective facility; the advantage of this is a more streamlined process.

Federal state authorities such as the Bauordnungsbehöre and Bauamt are the responsible authorities for issuing building permits, and the Gewerbeaufsuchtsamt is responsible for issuing permits such as an emissions permit.

Land use

The German law distinguishes between the rules for one's property and expropriation when their ownership rights have been seized. Private Property can be expropriated according to § 45 par.1 EnWG and as § 45 par.3 EnWG states state law prescribes the procedure (for example Art. 40 par.1 BayStrWG, § 41 par.1 StrG LSA). In the cases of expropriation the land owner is entitled to a monetary compensation.

Opportunities for public civil and other stakeholders' participation in the administrative process

In Germany, the § 3 of the Federal Building Code (Baugesetzbuch or BauGB) defines that there must be mandatory participation of the public before the developing of building and construction plans. Moreover, the § 4 of BauGB states that municipalities are responsible for monitoring the planning process for environmental impacts, and federal road laws determine the participation of certain authorities in the planning process (§ 22 BerlStrG).

II. Refinancing sources/Mechanisms

According to Flotow et al. (2015)[xxxv] there has been support particularly for LED technology in the German context in the following fields:

- The Federal Ministry of Education and Research (BMBF) awarded funding for pilot projects (of 20 million Euros)
- The KfW Bank offers funding programs (i.e. the 215-IKK scheme - Energetic urban regeneration- city lighting since 2011) with favourable interest rates and financial support for project conceptualization.
- National Climate Protection Initiative (Nationale Klimaschutzinitiative) from the Federal Ministry for the Environment (BMUB) provided funding where 25% (in 2012) and 40% (in 2013) of project costs that were carried to achieve a saving of 60% in street lighting. A total of 2.400 projects where subsidized until 2013 with around 110 million Euros. The total investments costs were 320 million Euros.

According to Saxony's energy agency (Sächsische Energieagentur, or SAENA) there are further support measures at the municipal level provided by the local Energy Agency[xxxvi] or directly by the state[xxxvii]. Some municipal climate protection plans relate directly to energy efficiency in lighting.[xxxviii]

III. Construction

In Germany, the main obstacles faced associated with the constructing of lighting facilities are financial. Due to a lack of funding and resources for municipalities, there is often not enough money planned for lighting infrastructure in the budgets.

Municipalities act as the control and supervision mechanisms in ensuring that compliance expectations are met by the service providers and construction companies. Technical standards,

such as the DIN Norms, are not legally binding. Nonetheless, they are a very strong indicator of if the built equipment is in accordance with minimum standards with respect to liability issues. Depending on the administrative structure of the municipality, the person responsible for surveillance and reporting the execution of works will most likely be a public servant.

Final Notes

[i] See Kodal / Krämer, street legal, 6th edition, ch. 12 para. 22.
[ii] See OLG Dresden, Urteil v. 20.12.2000, NVwZ-RR 2001, 354.
[iii] See Zeitler, Bayerisches Straßen- und Wegegesetz, Stand Oktober 2002, Art. 51 RdNr. 19.
[iv] See OLG Düsseldorf, Urteil v. 08.12.1994, VersR 1995, 1440.
[v] See Hentschel, Straßenverkehrsrecht, 36. Auflage, § 32 StVO RdNr. 12.
[vi] Note: in Germany there is a legal difference between possession (*Besitz*) and ownership (*Eigentum*). Ownership encompasses the legal right or exclusive title to something whereas possession only grants the right of use which may not be exclusive. See Von Flotow, Paschen/Polzin, Friedemann: *Modernisierung der kommunalen Straßenbeleuchtung Erfolgsfaktoren und Hemmnisse der LED-Anwendung sowie von Contracting*. January 2015. p.20
[vii] See *Liebaug et al.,* PwC: Straßenbeleuchtung im Energiesparmodus?, February 2015, p. 25
[viii] See Liebaug et al., PwC: Straßenbeleuchtung im Energiesparmodus?, February 2015, p. 25
[ix] See OLG München, Urteil v. 25.01.1968, NJW 1968, 604 f.
[x] See Kodal/Krämer, Straßenrecht, Kap. 41 RdNr. 43
[xi] See OLG München, Urteil v. 25.01.1968, NJW 1968, 604 f.
[xii] See for example the case of Bavaria, Art. 51 Abs. 6 BayStrWG.
[xiii] See Kodal/Krämer, Straßenrecht, Kap. 41 RdNr. 46.
[xiv] see sign 394 StVO
[xv] http://www.photonikforschung.de/forschungsfelder/beleuchtungled/intelligente-beleuchtung/
[xvi] Please note that in Annex I of Directive 2014/24/EU it is listed under "Bundesministerium für Wirtschaft und Technologie", which is not its correct name.
[xvii] Please note that in Annex I of Directive 2014/24/EU it is listed under "Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit ", which is not its correct name.
[xviii] Please note that in Annex I of Directive 2014/24/EU it is listed under "Bundesministerium für Verkehr, Bau und Stadtentwicklung ", which is not its correct name.
[xix] See http://www.bmwi.de/BMWi/Redaktion/PDF/A/aav-zur-beschaffung-energieeffizienterprodukte,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf and http://www.bmwi.de/BMWi/Navigation/Energie/Energieeffizienz-und-Energieeinsparung/energieeffizientebeschaffung.html for general information.
[xx] RAL-UZ 151 available for download at http://www.blauer-engel.de/en/products_brands/vergabegrundlage.php?id=207
[xxi] http://www.energieeffizienz-im-service.de
[xxii] See http://www.energieeffizienz-im-service.de/webspecial-strassenbeleuchtung/planungfinanzierung/vorhandene-und-verfuegbare-technologien.html (cited in Valentová, Quicheron, Bertoldi, 2012)
[xxiii] http://www.energieeffizienz-im-service.de/fileadmin/InitiativeEnergieEffizienz/webspecial_strassenbeleuchtung/Downloads/Technische_Daten blaetter/LED.pdf
[xxiv] See: http://www.buy-smart.info/media/file/236.BuySmart_Leitfaden_Beleuchtung.pdf
[xxv] http://www.umweltbundesamt.de/produkte/beschaffung/
[xxvi] https://www.ecotopten.de
[xxvii] https://www.dvtp.de/
[xxviii] See: https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/umweltfreundliche_oeffentliche_beschaffung_aktualisierung_2015.pdf
[xxix] McKinsey & Company (Hrsg.): Potenziale der öffentlichen Beschaffung für ökologische Industriepolitik und Klimaschutz, 2008, See: http://www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Produkte_und_Umwelt/mckinseystudie.pdf (Stand 20.02.2015).
[xxx] See: Papieratlas – Städtewettbewerb zur Auszeichnung der recyclingpapierfreundlichsten Stadt Deutschlands, siehe: http://www.papieratlas.de/

[xxxi] Judgment of the European Court of Justice of 10 May 2012 In Case C 368/10, an action under Article 258 TFEU for failure to fulfill obligations, brought on 22 July 2010, see: http://curia.europa.eu/juris/document/document.jsf?text=&docid=122644&pageIndex=0&doclang=DE&mode=req&dir=&occ=first&part=1&cid=1543775

[xxxii] See Institut für den öffentlichen Sektor (Hrsg.): Kommunale Beschaffung im Umbruch – Große deutsche Kommunen auf dem Weg zu einem nachhaltigen Einkauf?, 2013, siehe: http://www.publicgovernance.de/docs/Studie_Kommunale_Beschaffung_im_Umbruch.pdf

[xxxiii] See https://www.landtag.nrw.de/portal/WWW/dokumentenarchiv/Dokument/MMG16-29.pdf?von=1&bis=0

[xxxiv] See http://www.energieeffizienz-im-service.de/webspecialstrassenbeleuchtung/projektstart/schaffung-eines-guten-beispiels.html

[xxxv] Flotow, Paschen/Polzin, Friedemann: *Modernisierung der kommunalen Straßenbeleuchtung Erfolgsfaktoren und Hemmnisse der LED-Anwendung sowie von Contracting*. 2015. p.16

[xxxvi] See: http://www.saena.de; http://www.berliner-energie-agentur.de (cited in: Flotow et al. 2015)

[xxxvii] See: http://kommunen.klimaschutz.de/foerderung/laenderfoerderung.html

[xxxviii] See http://www.dstgb.de/dstgb/Home/Schwerpunkte/EnergiewendeProzent20undProzent20kommunalerProzent20Klimaschutz/ (cited in: Flotow et al. 2015)

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