GUIDELINES ON FINDING A SUITABLE FINANCING MODEL FOR PUBLIC LIGHTING INVESTMENT

Deliverable D.T2.3.4 Guidelines on finding a suitable financing model for public street lighting investment

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DYNAMIC LIGHT

The project in brief

The Dynamic Light project aims to demonstrate the importance of providing light under a variety of circumstances and to examine who uses lighting at what time and for how long. Differences in public lighting systems are examined under conditions typical of European municipalities. The project explores strategies for introducing energy-efficient lighting in urban areas and identifies the steps required to translate strategies into action, from the initial idea through the analysis, use of geographical information systems for spatial data mining, strategy development, financial modelling, procurement process, implementation, and evaluation. Such strategies are intended to improve the quality of dynamic light and adapt it to social needs. Fulfilment of these objectives is expected to facilitate investment in pilot and demonstration projects that bolster acceptance of energy-efficient lighting among end-users and urban planners.

Consortium

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BSC, Poslovno podporni center d.o.o. Kranj	SL	SWARCO V.S.M. GmbH	DE
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DELIVERABLE D.T2.3.4

GUIDELINES ON FINDING A SUITABLE FINANCING MODEL FOR PUBLIC LIGHTING INVESTMENT

Investment in energy efficiency upgrades of street lighting infrastructure reduces energy costs and carbon dioxide emissions. It is also highly cost-effective and has a short payback period. In spite of these advantages, much of the lighting infrastructure in many Central European countries requires refurbishment. As the final deliverable for Project Task 2.3, this report provides guidelines for identifying appropriate financing models for public street lighting and is intended as a resource to assist Central European municipalities (namely, those of Austria, Croatia, the Czech Republic, Germany, Hungary, Italy, Poland, Slovakia, and Slovenia) in developing funding strategies. The report summarises the three preceding deliverables on baseline conditions, funding sources, and potential financing models for street lighting upgrades.

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Abbreviations

CF	Cohesion Fund
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
eeef	European Energy Efficiency Fund
EEOs	Energy Efficiency Obligation Schemes
EFSI	European Fund for Strategic Investments
ELENA	European Local Energy Assistance
ERDF	European Regional Development Fund
ESIF	European Structural and Investment Funds
EIAH	European Investment Advisory Hub
EPC	Energy Performance Contracting
ESCO	Energy Service Company
EU	European Commission
JASPERS	Joint Assistance to Support Projects in European Regions
PPP	Public-private partnership
PP4EE	Private Finance for Energy Efficiency
SPV	Special-purpose vehicle

1. Introduction

Investment in energy efficiency upgrades significantly reduces energy costs and carbon dioxide emissions. It is also highly cost-effective and has a short payback period. In spite of these potential advantages, many areas of Central Europe have not taken measures to improve lighting infrastructure. The Dynamic Light project, funded through the INTERREG Central Europe programme of the European Regional Development Fund, explores strategies for introducing energy-efficient, dynamic lighting in urban areas. The project explores strategies for introducing energy-efficient lighting in urban areas and identifies the steps required to translate strategies into action, from the initial idea through the analysis, use of geographical information systems for spatial data mining, strategy development, financial modelling, procurement process, implementation, and evaluation. The project examines the implementation of public lighting under conditions typical of European municipalities.

The present document, the final deliverable of Project Task 2.3 on financing public street lighting, provides guidelines for identifying appropriate financing models for public street lighting and is intended as a resource to assist Central European municipalities (namely, those of Austria, Croatia, the Czech Republic, Germany, Hungary, Italy, Poland, Slovakia, and Slovenia) in developing funding strategies. The report summarises the three preceding deliverables:

1) Deliverable 1, a baseline inventory (Novikova et al. 2017a), identified the obstacles to infrastructure improvement in Central European areas. A survey of public and private actors examined stakeholder knowledge and past experience relevant to various funding sources and financing models for energy efficiency upgrades of street lighting. The survey identified the existing funding sources in target countries, as well as existing and potential financing models that were the subject of further analysis in subsequent project deliverables. The inventory also provided ideas and recommendations for the development of guidelines to assist municipalities in selecting appropriate models.
2) Deliverable 2, an analysis of funding sources (Novikova et al. 2017b), summarised the results of research into potential funding sources for energy-efficient street lighting projects in the focus countries. It reviewed available EU funding and assistance programmes, national public funding sources, multi- and bilateral financial intermediaries, and private-sector funding. These were assessed using a common framework. The deliverable examined objectives, financial instruments, funded activities, beneficiaries, and the application process for public funding sources.
3) Deliverable 3, a best practice guide (Novikova et al. 2017c), reviewed existing financing models, including self-financing, debt-financing, financing by a private contractor, financing by a private contractor through energy savings, financing by public-private partnerships, financing by utilities, and financing by citizens. The report provided an overview of each model, identified the projects to which it could be applied, specified its advantages and disadvantages, and provided a relevant case study.

2. Key stakeholders and investment barriers

In this section, we examine the reasons for low upgrade rates of street lighting infrastructure. We identify the key public and private actors responsible for providing street lighting, as well as those involved in street lighting asset ownership, operation, maintenance, and investment. Based on the results of two online questionnaires, we examine barriers to investment by these actors and assess their knowledge and past experience relevant to financing models for energy-efficient street lighting.

Key stakeholders in energy efficiency street lighting investment

From the stakeholder survey responses, we conclude that, in the majority of Central European countries, municipalities are legally responsible for providing street lighting. The legal responsibility can often be transferred under a concession agreement. In some countries, it is also possible to transfer the legal responsibility under energy performance contracts (EPCs) and through public-private partnerships (PPPs). In multiple countries, private capital cannot be used to upgrade public street lighting; this is clearly problematic, as it means that other finances must be leveraged for these upgrades.

We also conclude that the fragmented structure of the street lighting supply chain often poses a split-incentive barrier for upgrades. The countries covered by our surveys have a wide variety of policies in place for ownership, maintenance, operation, and upgrades of street lighting assets. The results of the survey show that the legal responsibility to ensure proper public street lighting, ownership of street lighting assets, maintenance and operation, and actual investment decisions are often divided amongst several stakeholders. This creates a split-incentive problem: those required to upgrade street lighting do not accrue the benefits of this investment.

Barriers to energy-efficient street lighting investment

Survey responses showed that the strongest barriers to investment in energy-efficient street lighting upgrades were financial and economic obstacles (specifically, insufficient financial resources). In addition to the shortage of financial resources, municipalities expressed a desire for greater public funding from national and regional budgets. Small municipalities are also more likely than larger municipalities to struggle with small budgets.

Barriers related to policy and awareness were given lower importance than were financial barriers. The greatest barrier identified in the policy category was 'poor enforcement for energy efficiency policies, even though these exist', and the greatest barrier in the awareness category was unfamiliarity with and/or reluctance to introduce new contractual and financing mechanisms. The barriers related to implementation capacity were rated as less significant than were the financial barriers, but greater than those related to policy and awareness.

The perceived relative importance of different barriers varies across respondent groups. For instance, researchers, energy service contractors (ESCOs) and energy service companies, and energy and development agencies most often believe that the lack of skills and experience in municipalities' implementation of street lighting projects presents high or high-medium barriers, whereas municipalities themselves perceive these barriers as less significant. In addition, municipalities see upfront costs as a substantial barrier and do not believe that low energy cost savings are due to low energy prices. By contrast, energy service contractors and ESCOs do not perceive upfront costs as high but recognise low energy cost savings as a more significant problem stemming from low energy prices. These examples show the asymmetry in these actors' perception of the relative significance of various barriers and demonstrate their different experiences.

Table 1 shows the three barriers in each category that were identified as most significant by the survey respondents. It is important to note that the table includes the average perception of barriers among all respondents. Therefore, it does not reflect the variation in the perceived relative importance of different barriers across respondent groups. Of all barriers listed in the table, the most significant (average response: high-medium) are insufficient own funds, a lack of skills and experience among municipalities, insufficient national or regional public funding, and a lack of human resources in the municipality.

Awareness and experience relevant to financing energy-efficient street lighting

We identify a gap in knowledge of existing public and private funding sources. Many respondents from municipalities do not have relevant experience and are not aware of available funding sources from the EU and national budgets, even though they often lack sufficient capital of their own to finance certain

projects. Therefore, there is a need to raise awareness of potential public and private funding sources who may invest in energy-efficient street lighting.

We also recognise a gap in knowledge of potential financing models for leveraging greater private finance. This is critically important because the public budget cannot provide the finances to realise the full energy efficiency potential of the public sector, given that there are also other important economic, social, and environmental priorities.

Table 1: Three most significant barriers to energy-efficient street lighting investment by category

Barrier group			
Financial and economic	Policies and frameworks	Awareness, access to information and past experience	Implementation capacity and procedures
• Insufficient own financial resources • Insufficient national or regional public funding • High upfront investment cost	• Lack of guidance on the national level • Poor enforcement of energy efficiency policies • Energy efficiency is not a priority on the municipal level	• Unfamiliarity and reluctance to introduce new contractual and financing mechanisms • Lack of awareness of potential funding sources • Lack of awareness of potential energy savings	• Lack of skills and experience among municipalities • Lack of human resources in the municipality • Project complexity, including multiple stakeholders

Source: Survey results produced by the authors

3. Funding sources

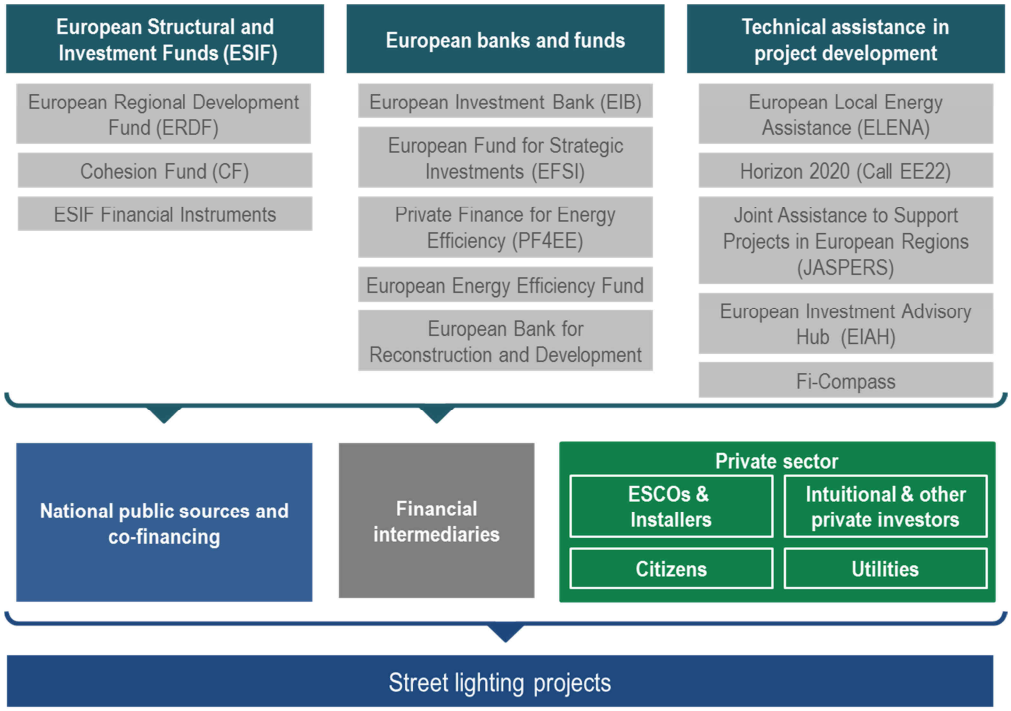
Although upgrading street lighting would cut energy costs, many areas of Central Europe have not yet taken measures to improve their lighting infrastructure. Budgetary constraints on owners (often municipalities) are commonly cited as a reason for this inaction. This report examines potential funding sources that could cover the costs of installing energy-efficient street lighting without depleting municipal resources. Figure 1 identifies available external funding sources from EU institutions, national sources, and the private sector. The subsequent analysis focusses on the countries of Central Europe, namely Austria, Croatia, the Czech Republic, Germany, Hungary, Italy, Poland, Slovakia and Slovenia.

European funding sources

European funds and financial institutions offer substantial funding and technical assistance. The European Structural and Investment Funds (ESIF) channel their resources to the Member States through operational programmes designed by each country according to its policy priorities. The European Regional Development Fund (ERDF) and The Cohesion Fund (CF), both of which fall under the ESIF umbrella, cover multiple energy efficiency measures, including street lighting. In the project deliverable analysing funding sources (Novikova et al. 2017b), sections on individual countries provide a list of national operational programmes relevant to municipal energy efficiency upgrades. Municipalities interested in accessing ERDF and CF resources should review the details of the operational programmes available in their jurisdictions.

ERDF and CF support is offered in the form of grants or loans. However, the European Commission (EC) strongly encourages Member States to use more innovative financing instruments. ESIF provide Member States with technical assistance to reduce the share of grant financing and introduce other financing instruments (including loans, equity, and guarantees) that can mobilise additional private investment.

Figure 1: Funding sources for energy-efficient street lighting in Central Europe



Source: Adapted from Covenant of Mayors for Climate & Energy (2016).

The European Investment Bank (EIB) has identified energy efficiency finance as one of its priorities. It offers multiple instruments to both the public and private sector, including dedicated credit lines through local financial intermediaries or direct framework loans to promote projects. EIB also manages and/or co-finances several funds and facilities, such as the European Fund for Strategic Investments (EFSI), Private Finance for Energy Efficiency (PP4EE), and the European Energy Efficiency Fund (eeef).

The European Bank for Reconstruction and Development (EBRD) has extensive experience in financing energy efficiency and municipal infrastructure projects in transition economies, including in Central and Eastern Europe, with investments in Croatia, Hungary, Poland, Slovakia, and Slovenia. The EBRD channels its support through credit lines to local commercial banks, which ultimately disburse funds to municipal lighting projects.

EU-funded technical assistance in project development is available through the European Local ENergy Assistance (ELENA) programme, the Joint Assistance to Support Projects in European RegionS (JASPERS) initiative, and Horizon 2020 Project Development Assistance (Call EE-22-2016-2017). In addition, the European Investment Advisory Hub (EIAH) and fi-compass advisory service practical support, including expertise and skills training.

National funding sources

Each Member State uses ESIF funding to operate and co-finances multiple support programmes. Many countries offer additional options for support from the national budget, including grants or low-interest rate loans, and channel assistance through national environmental funds, national development banks, or other intermediaries. In some countries, such as Germany, national public funding far exceeds support from EU funds. Subnational governments often administer regional support programmes. Country sections of the project deliverable on funding sources examine national funding options available in greater detail.

Financial intermediaries

Financial intermediaries play a crucial role in financing energy efficiency investments. As energy efficiency objectives are high on the EU and national agendas, many commercial banks have dedicated credit lines or other financial products for funding energy efficiency measures—including street lighting—implemented by municipalities or the private sector. More often, local financial institutions channel and co-finance resources from national and development banks or funds (such as the EIB, EBRD, or eeef), which enable these entities to offer finances at a lower cost. In Hungary and other countries where national and EU funding for street lighting is limited, low-cost credit lines are the main funding source for municipalities.

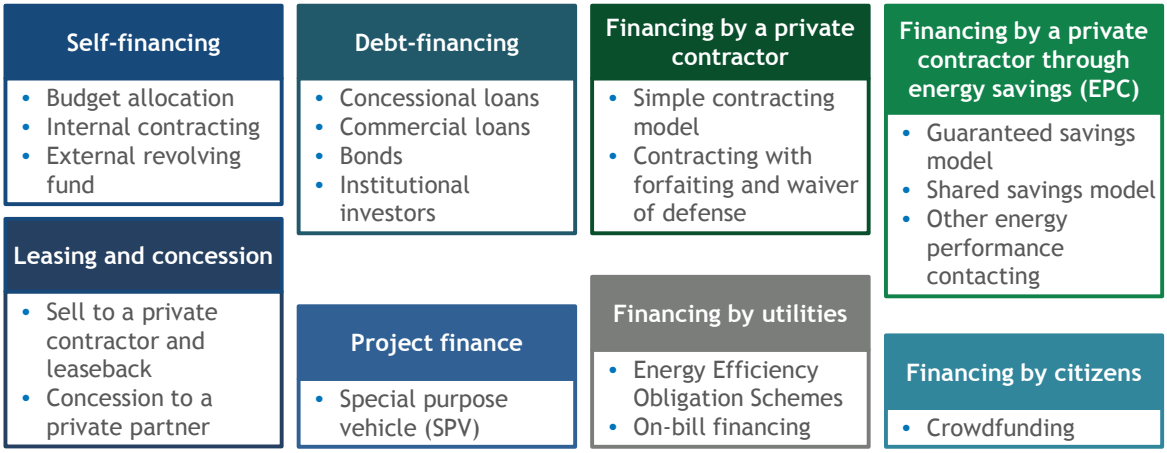
Private sector

Finally, multiple private sources can be utilised for lighting projects. First, energy service companies and contractors that provide upgrades can finance the upfront investment costs, for example through energy performance contracting. In energy performance contracts (EPCs), municipalities repay the upgrade costs over time through energy savings. Second, in countries with utility obligation schemes in place, utilities finance street lighting upgrades and other energy efficiency measures in end-use sectors. Finally, municipalities can raise finances through crowdfunding and engage with institutional investors. The details of private-sector financing models for street lighting upgrades are summarised in the following section and discussed in detail in Project Deliverable 3, the best practice guide (Novikova et al. 2017c).

4. Financing models for street lighting upgrades

There are multiple models for financing street lighting upgrades. These include self-financing, debt-financing, financing by a private contractor, financing by a private contractor through energy savings, financing by public-private partnerships, financing by utilities, and financing by citizens (Figure 2).

Figure 2: Financing models for public street lighting investment



Source: Author's research results

Self-financing. Under most straightforward financing model, municipalities pay for street lighting upgrades from own funds or through grants available from the national or EU programmes. To minimise the burden on taxpayers, the public sector can design and implement additional schemes to help raise funds, for example through internal performance contracting or a designated revolving fund.

Debt-financing. Many municipalities with limited own funds issue debt, which is subsequently repaid from tax revenue and/or saved energy costs. In addition to issuing municipal bonds, municipalities can finance infrastructure projects by obtaining a concessional loan from available public lending programmes or a commercial loan from a commercial bank.

Financing by a private contractor. Perhaps the most promising option for municipal actors is to transfer the responsibility for street lighting infrastructure funding to third parties, e.g., by contracting an energy service contractor. There is considerable variation between such contracts. Under a simple contracting model, the contractor directly receives a contracting fee, which covers the costs of planning, financing, and carrying out the infrastructure retrofit (providing for a profit). In a more complex model with forfaiting and waiver of defence, the roles of the city and contractor are similar to the simple contracting model, but in this case, the bank enters into agreements with the contractor and with the city.

Financing through energy savings. The energy performance contracting (EPC) model can be applied when a municipality or contracted party finances the energy supply. Under this model, street lighting retrofits are financed through the cost savings accrued from reducing energy consumption. Typically, the contracted energy service company guarantees a certain level of energy savings. In shared savings EPC models, the municipality and the contractor share any energy savings in excess of the guaranteed level.

Leasing or concession to a private partner. Leasing models are also used to finance street lighting upgrades. Under a leasing model, a municipality transfers infrastructure ownership rights to a private contractor, which is responsible for upgrading, operating, and managing the assets for the length of the contract period. The municipality then leases the infrastructure from the private contractor for a fixed fee for the contract term, after which the ownership rights are transferred back to the municipality. Under a concession contract, a private partner is granted rights to operate and maintain street lighting and accrue all benefits resulting from the energy efficiency upgrades.

Project finance. The project finance model is often used to raise private capital for large, bankable projects with capital costs over approximately €20 million. Under this model, a special purpose vehicle (SPV) is created that facilitates financial objectives while minimising the parent company's risk exposure. Because the SPV balance sheet documents project expenditures, enabling municipalities and private investors to fund projects off balance sheet.

Financing by utilities. As of October 2017, Energy Efficiency Obligation Schemes (EEOSs) are operational in 11 EU Member States: (Denmark, UK, Ireland, France, Spain, Italy, Latvia, Poland, Bulgaria, Austria, and Slovenia. EEOSs are policy mechanisms that require energy providers and/or distributors included in the scheme to meet certain energy savings targets by investing in eligible end-use energy efficiency measures. Street lighting may be eligible for such funding in certain countries, depending on the provisions of national laws. In the case of on-bill financing, a utility provides a loan to a municipality to cover the upfront investment, and the municipality repays the cost through its energy bills. On-bill financing is more common in the United States than in Europe.

Crowdfunding. Crowdfunding is a relatively new financing option most often used by young, innovative companies and startups for small or medium-scale projects. It refers to the collection of relatively small amounts of money from a large number of individuals or small-scale investors, usually via online platforms, and the subsequent use of those funds to finance a project. Crowdfunding creates a community around the project, as a result, people can become engaged in the process and provide insights and ideas that are useful for project development. Use of this mechanism to finance community and city projects has become more common (European Commission 2016b).

Table 2 summarises the advantages and disadvantages of each model and identifies the models most suitable for specific project types. Deliverable 3, the best practice guide (Novikova et al. 2017c), provides further detail on the key design features of each model and presents relevant case studies.

Table 2: Key features of financing models for energy efficiency upgrades of street lighting

Model	Good for municipalities, as they	Not perfect for municipalities, as they	Projects financed
Self-financing			
Municipal budget	1. own and design the project; 2. pay no interest on capital; 3. receive fully saved energy costs;	1. must finance all upfront costs; 2. bear all investment risks; 3. may lack the capacity; 4. May lack the transparency;	1. any type given the budget availability and expertise;
Internal revolving funds (Intracting)	1. can reuse capital; 2. do not need external capital; 3. cooperate within their units; 4. pay no interest on capital;	1. must finance all upfront costs; 2. bear all project risks; 3. may be less efficient than a private actor in project implementation;	1. any project, including small-scale and not attractive to private investors;
External revolving funds	1. can reuse capital; 2. can design a self-sustaining fund with a long-term orientation; 3. may attract private investment;	1. face high transaction costs for the fund setup; 2. must allocate manpower for the duration of the whole project; 3. may experience tensions if private and public capital is merged;	1. long-term projects with multiple objectives in medium to large size municipalities; if municipalities are small, they can merge their funds;
Debt financing			
Concessional loans from public banks	1. pay low-interest rates 2. can access capital 3. can combine this model with others (e.g., a revolving fund)	1. still pay interest on capital	1. particularly accessible for public energy efficiency projects;
Commercial loans from banks	1. can access capital 2. can combine this model with others (e.g., a revolving fund)	1. obtain conventional debt based on their credit record 2. pay interest at market rates 3. do not have access to special conditions for energy-saving projects	1. financially sustainable infrastructure projects of various sizes;
Municipal bonds	1. can access capital at a lower cost than that available from commercial bank loans;	1. carry costs of extensive preparation 2. needs either a good credit rating or access to a bond agency;	1. medium- to large-scale financially sustainable projects;
Institutional investors	1. enjoy a low cost of capital because institutional investors are long-term orientated and risk-averse;	1. may need to deal with a lack of experience of institutional investors in sustainable projects; 2. carry high transaction costs;	1. large projects are competitive in terms of financial risks and return;
Financing by a private contractor			
Simple contracting model	1.can use off-balance sheet financing; 2.can select specialised companies through a tendering process;	1. may incur higher financing costs than those charged for concessional loans; 2. may have limited access to public support;	1. medium- to large-scale projects;
Model with forfaiting and waiver of defence	1. and 2. are the same as in the previous model; 3. pay lower interest rates than those incurred under the simple contracting model;	1. face higher interest rates than in concessional loans; 2. must contend with highly complex financing arrangements; 3. must provide a guarantee for a bank;	1. medium- to large-scale projects;
Private-partner financing through energy saving			
EPC – guaranteed savings	1. obtain new infrastructure without peaks in their spending; 2. outsource risks to contractors; 3. pay constant bills during the contract, possibly lower than before; 4. enjoy low operating costs once the contract expires;	1. may face a problem to attract private partners if a project is too small; 2. may face low financial performance in case energy prices are low; 3. face a lack of motivation by private partner to reduce energy demand more than guaranteed in the contract;	1. projects with the potential to accrue high energy cost savings; 2. municipalities should have sufficient financial resources to pay the fees specified in the contract;
EPC – shared savings	1., 2., 3., and 4. are the same as in the previous model; 5. receive a share of any excess energy cost savings 6. accrue additional energy savings due to incentives to both sides	1. and 2. are the same as in the previous model;	1. and 2. are the same as in the previous model;

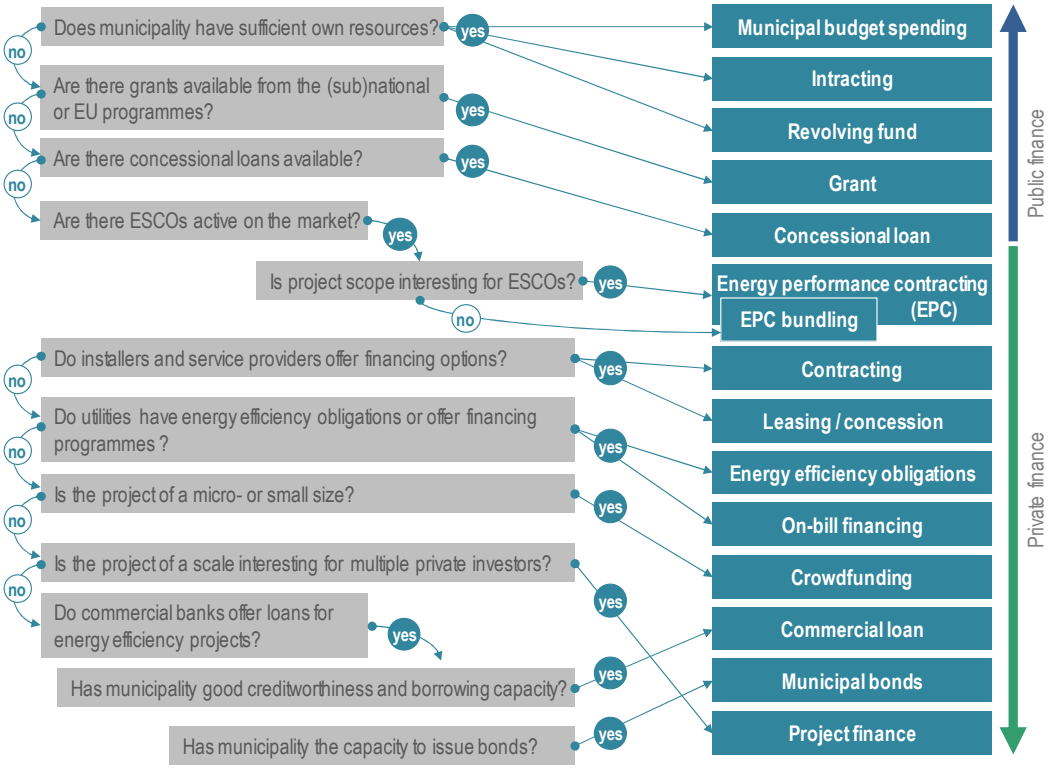
Model	Good for municipalities, as they	Not perfect for municipalities, as they	Projects financed
EPC - related payments	1., and 2. are the same as in the previous model; 3. benefit from a mechanism enabling more accurate quantification and verification of energy;	1., and 2. are the same as in the previous model;	1. and 2. are the same as in the previous model;
EPC - immediate savings	1., and 2. are the same as in the previous model; 3. realise maximum energy savings immediately;	1. and 2. are the same as in the previous model; 3. have relatively old infrastructure by the end of the contract;	1. and 2. are the same as in the previous model; 3. projects with very old and inefficient infrastructure;
EPC - staggered savings	1., and 2. are the same as in the previous model; 3. enjoy relatively modern infrastructure for the length of the contract;	1. and 2. are the same as in the previous model; 3. obtain access to all energy savings at a later stage;	1. and 2. are the same as in the previous model; 3. projects in which age and technology vary among existing luminaires;
Public-private partnership			
Sell to a private partner and leasback	1. spread financial risks and costs over time; 2. outsource technical risks to the private sector; 3. enjoy new infrastructure without increasing their debt;	1. may pay higher costs to lease than to self-finance in the long term; 2. may have less control over assets;	1. projects with high upfront costs;
Concession to a private partner	1., 2., and 3. are the same as in the previous model; 4. can set standards in the concession agreement;	1. must contend with complex setup and administration; 2. must provide adequate project oversight;	1. projects with high upfront costs;
Project finance	1. isolate project risks within a special purpose vehicle; 2. may deduct or withhold a certain amount from payments or impose penalties if private partners fail to deliver agreed services;	1. encounter high transaction costs for the preparation and implementation of the special purpose vehicle;	1. large projects (>€20m); 2. a consortium of several municipalities and investors/financiers;
Financing by utilities			
Energy efficiency obligation schemes (EEOS)	1. benefit from the pressure created by a EEOS on utilities to meet targets through financial penalties; 2. do not bear high upfront investment costs;	1. need a strong regulatory framework; 2. need strong governance;	1. possible in countries that have implemented EEOS;
On-bill financing	1. repay investments through energy bills; 2. enjoy a relatively simple implementation process;	1. may encounter challenges arising from a lack of experience because the model is rarely implemented in Europe;	1. small to medium-sized projects;
Financing by citizens			
Crowdfunding	1. can attract substantial private investment from a large pool of backers;	1. lack a guarantee that sufficient funding will be raised; 2. may encounter problems resulting from investor experience; 3. may encounter investors who wish to exit; 4. must contend with a lack of regulation; 5. may find it challenging to fulfil responsibilities to a multitude of small investors;	1. small to medium-sized projects.

Source: Author's research results

5. Guide to selecting a relevant financing model

Figure 3 presents a decision-making tree to assist municipalities in selecting an appropriate financing model. Key considerations include the availability of public policies and funding, project size and bankability, the maturity of the market for ESCO and energy service providers, the municipality's borrowing capacity, and the availability of financial instruments from commercial financial institutions.

Figure 3: Decision-making tree for selecting a financing model



Source: Authors' own illustration adapted from ESMAP (2014)

Availability of public policies and funding

Many European or national funding programmes offer finances at a lower cost than those available from commercial sources, e.g., through grants or concessional loans. Specific programmes or funds can finance projects that correspond to their funding priorities and application criteria. Projects, whose risk profile or size is not attractive to private investors can often obtain funding from these programmes.

Depending on the funding source, municipalities can use payments to finance project costs directly or to design a revolving scheme to multiply and leverage additional private capital. National incentives and policies like EEOSs are an alternative funding mechanism for street lighting projects that involves the participation of utilities or other actors in the scheme. If available public funding is insufficient, municipalities can consider working with the private sector and commercial finance providers.

Project size and bankability

The larger the project, the greater the need to obtain external funding and private sector engagement. In addition, the complexity of financing arrangements may increase with project size. In contrast to public

funding, private investors have specific risk-return requirements for projects. Street lighting projects offer more advantages than do other energy efficiency investments. Street lighting projects incorporate homogeneous technology, generate high energy savings, and have a short payback period. Therefore, such projects are usually attractive to ESCOs or other private investors. Various financial instruments (including loans, bonds, equity, and models, including EPC, leasing, and concession) are available and widely used.

If the project has high risks and/or does not generate sufficient cash flows, it will be challenging to leverage private capital. This is often the case for small-scale projects. The solution may be to bundle multiple small projects in several municipalities into one investment package. Alternatively, small community-scale projects can explore crowdfunding opportunities to engage citizens.

Maturity of the market for ESCO and energy service providers

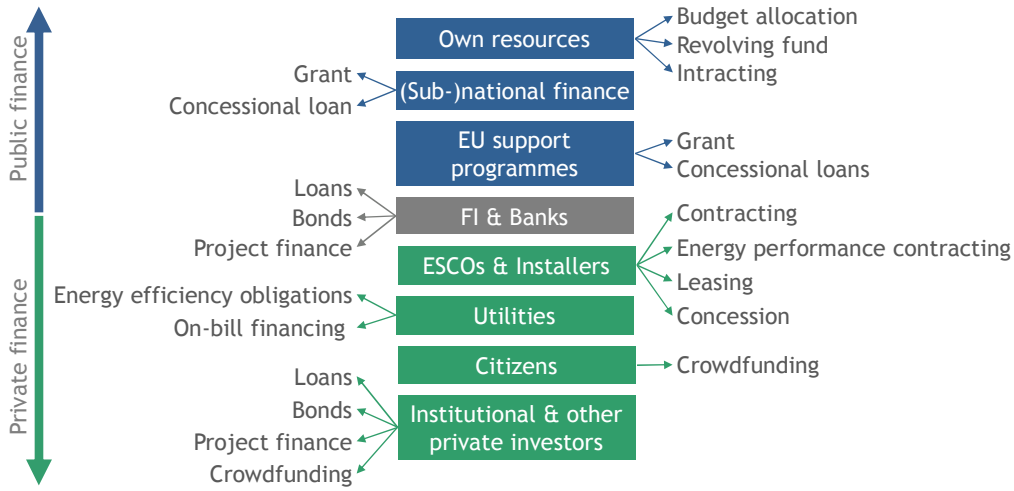
If energy service providers and ESCOs are active on the local market, they can offer advantageous terms for EPC, leasing, and concession models, including options for bundling several small-scale projects. To be attractive for ESCOs, the projects must deliver high energy savings and municipalities must be able to pay contract fees over time. Using ESCOs or other models to outsource services allows municipalities to upgrade street lighting by transferring investment risks to the private partner while avoiding sharp upticks in budget spending. However, if the ESCO market is not mature enough or the project scale, energy savings, or payback period for ESCO interest is unsatisfactory, other debt instruments can be explored.

Municipality's borrowing capacity and availability of commercial financial instruments

Commercial loans, project finance, equity, and other financial instruments are offered by the banks and other investors. To access commercial debt or equity, projects must be financially sustainable. In addition, the municipality should have a credit profile and decision-making authority to issue debt. If the municipality has sufficient technical and institutional capacity or access to a bond agency, it can also issue municipal bonds. The cost of capital will depend of the project profile, type of financial instrument, and maturity of the local banking sector. It is generally higher than the cost of capital available through public support programmes, such as concessional loans and credit lines. Loans are available for projects of various sizes. Equity, bonds, and project finance are normally used for medium-sized and large projects.

Figure 4 summarises the linkage between funding sources and financing instruments and models that provide capital for investment in street lighting infrastructure.

Figure 4: Funding sources, financing instruments, and models for investment in street lighting infrastructure



Source: Author's research results

6. References

Covenant of Mayors for Climate & Energy. 2016. “Quick Reference Guide Financing Opportunities for Local Climate & Energy Actions (2014-2020).” http://www.covenantofmayors.eu/IMG/pdf/Quick_Reference_Guide_-_Financing_Opportunities_updated2016.pdf. Consulted on 10 October 2017.

ESMAP. 2014. "Financing Municipal Energy Efficiency Projects." https://www.esmap.org/sites/esmap.org/files/DocumentLibrary/FINAL_MGN1-Municipal%20Financing_KS18-14_web.pdf. Consulted on 10 October 2017.

Novikova, A., Stamo, I., Stelmakh, K., and Hessling, M. 2017a. *Guidelines on finding a suitable financing model for public lighting investment: Deliverable D.T2.3.1 Baseline inventory*. Report of the EU funded project “INTERREG Central Europe CE452 Dynamic Light”, July 2017. URL: http://www.interreg-central.eu/Content.Node/Dynamic-Light/Guidelines-financial-models.html

Novikova, A., Stamo, I., Stelmakh, K., and Hessling, M. 2017b. *Guidelines on finding a suitable financing model for public lighting investment: Deliverable D.T2.3.2 Analysis of funding sources*. Report of the EU funded project “INTERREG Central Europe CE452 Dynamic Light”, July 2017. URL: http://www.interreg-central.eu/Content.Node/Dynamic-Light/Guidelines-financial-models.html

Novikova, A., Stelmakh, K., Hessling, M., Emmrich, J., and Stamo, I. 2017c. *Guidelines on finding a suitable financing model for public lighting investment: Deliverable D.T2.3.3 Best practice guide*. Report of the EU funded project “INTERREG Central Europe CE452 Dynamic Light”, October 2017. URL: http://www.interreg-central.eu/Content.Node/Dynamic-Light/Guidelines-financial-models.html