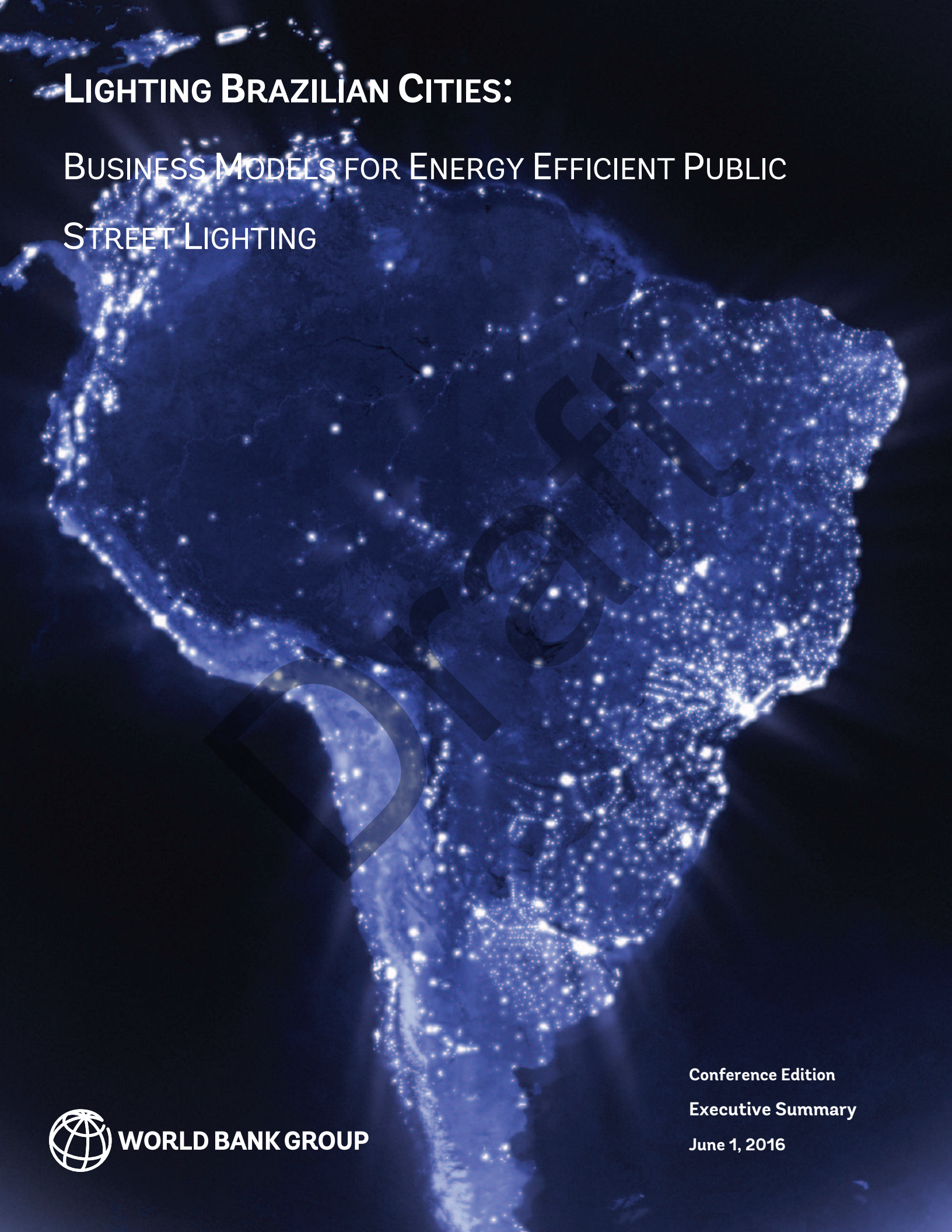

Lighting Brazilian Cities:

Business Models for Energy Efficient Public Street Lighting

WORLD BANK GROUP

Conference Edition

Executive Summary

June 1, 2016

FOREWORD

The public lighting sector in Brazil is undergoing through a transformation. LED technology is now being used at a large scale by several cities throughout the world, offering significant savings in energy and maintenance costs. In Brazil, since the end of December 2014, all cities assumed full responsibility for public lighting complex maintenance, giving them incentives to reduce rising energy costs. Nevertheless, this new technology is capital intensive, which naturally leads municipalities to the following questions: (i) is this technology already proven and will it realize the expected lifecycle and energy savings?, (ii) how can public lighting investments be compared to other municipal social priorities?, and (iii) what are the options to structure and finance a wide retrofit lighting complex project?

In order to answer these (and other key questions) the World Bank Group, as part of its green-agenda, examined the benefits, risks and financing models of public lighting LEDs projects. This work began in late 2013 by offering technical support to the cities of Rio de Janeiro and Belo Horizonte to identify areas within the municipal sphere with energy efficiency potential, and public lighting was identified as one of the most promising areas. The work evolved into an analysis of possible financing mechanisms, where PPPs via Administrative Concessions was identified as offering several advantages to big cities.

However, Brazil has 5,570 municipalities with wide diversity of needs, per capita income, technical knowledge and access to financings. The World Bank Group recognized that the PPP model, although attractive to a privileged group of big and medium sized cities, would be difficult for smaller cities or those cities with a weaker credit profile. With the intention to cover a broader spectrum of cities, we launched this study to identify business and financing models that could be applicable to a wider range of Brazil's municipalities, so that all cities can benefit from energy savings and improvement of lighting services that LEDs can offer to a city's population.

This report by Meyer, Freire & Maurer is a first effort in this sense. We hope that this report is useful to government officials, mayors, financial institutions and equipment manufacturers, among others. We would like to emphasize the need to define a clear strategy at country level with coordination efforts among the different players, agencies and government spheres providing support to municipalities to achieve these objectives.

The World Bank Group reiterates its ongoing interest in working with these key players in the search for solutions that fit the needs of the diversity of Brazil's regions and municipalities.

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Errors or omissions are the exclusive responsibility of the authors.

ESMAP

The Energy Sector Assistance Program (ESMAP) is a global knowledge generation and technical assistance initiative administrated by the World Bank. It provides analytical and advisory services to low and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Denmark, Finland, France, Germany, Iceland, Lithuania, Holland, Norway, Sweden, Switzerland and United Kingdom, as well as by the World Bank.

BRAZEEC

The Energy Efficiency Program for Brazilian Cities (BRAZEEC) is an initiative financed by ESMAP with the objective to foster energy efficiency (EE) actions through feasible business models identification and replicable in Brazilian cities in the following areas: public lighting, public buildings, urban industries and transportation. The work includes a focus on institutional frameworks strengthening in order to improve energy efficiency management at municipal level.

The project general objectives are: (i) to draw up business models to improve EE in the four sectors hereinbefore mentioned that can be implemented through several cities of Brazil; (ii) to increase interested parties capacity (municipal and private sectors) to implement EE identified business models; (iii) to create a demonstration effect that, on the long term, can expand EE initiatives within a cities' wider context.

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I – EXECUTIVE SUMMARY

I. Introduction

Cities are among the biggest consumers of electric energy in the world, being accountable for two thirds of the total consumption and for more than 70% of greenhouse gases emissions. Public lighting services represent an important energy consumption source for cities. In fact, in Brazil, public lighting represents more than 4% of the country's total energy consumption, and the energy cost for public lighting already represents the second most expensive item of most municipalities' budget, surpassed only by payroll expenditures. Therefore, energy efficiency projects in public lighting sector can play an important role for cities' emission reductions, in addition to offer benefits for the municipality.

Within global scope, participant countries of the 21st Conference of Parties (COP-21) held in November 2015, submitted their contribution proposals for the climate change issue, known as INDCs - Intended Nationally Determined Contributions. Among other objectives, Brazil committed itself to increase energy efficiency in the electric sector by 10% by 2030. Near one-fifth of this goal could be obtained by implementing energy efficient technologies in the Brazilian municipal street lighting sector.

Lamps using the new technology LEDs or *Light-Emitting Diodes* emerge as a feasible technical and commercial option for investments in energy efficiency in the public lighting sector. LEDs lamps are 40% to 60% more efficient in terms of energy consumption than the current technologies installed in the Brazil, in addition to offering important reductions in operational and maintenance costs and the capacity to integrate efficient lamps infrastructure with smart monitoring systems, creating the 'backbone' infrastructure for "smart cities". In addition to this, the higher quality of LEDs has the positive effect of reducing criminality and increasing citizens' perception of safety.

Although more energy efficient, LEDs are much more capital intensive than existing technologies. Municipalities are analyzing the possibility of attracting private capital – for example, via PPPs – to carry out this retrofit project, releasing city halls from the burden of using their budgetary resources to do the necessary investments. PPP projects present a more feasible option for big and medium sized cities with lower credit risk; however, this is not the case for most of Brazil's municipalities. For this reason, it is necessary to identify business and financing models that allow a universal modernization of the wide diversity of all Brazilian municipalities' public lighting sector.

This main purpose of this report is to identify business and financing models that, taking into account the existing institutional environment and market characteristics, allow the execution of sustainable modernization projects of the public lighting sector, bringing benefits for city halls, citizens and the environment as soon as possible.

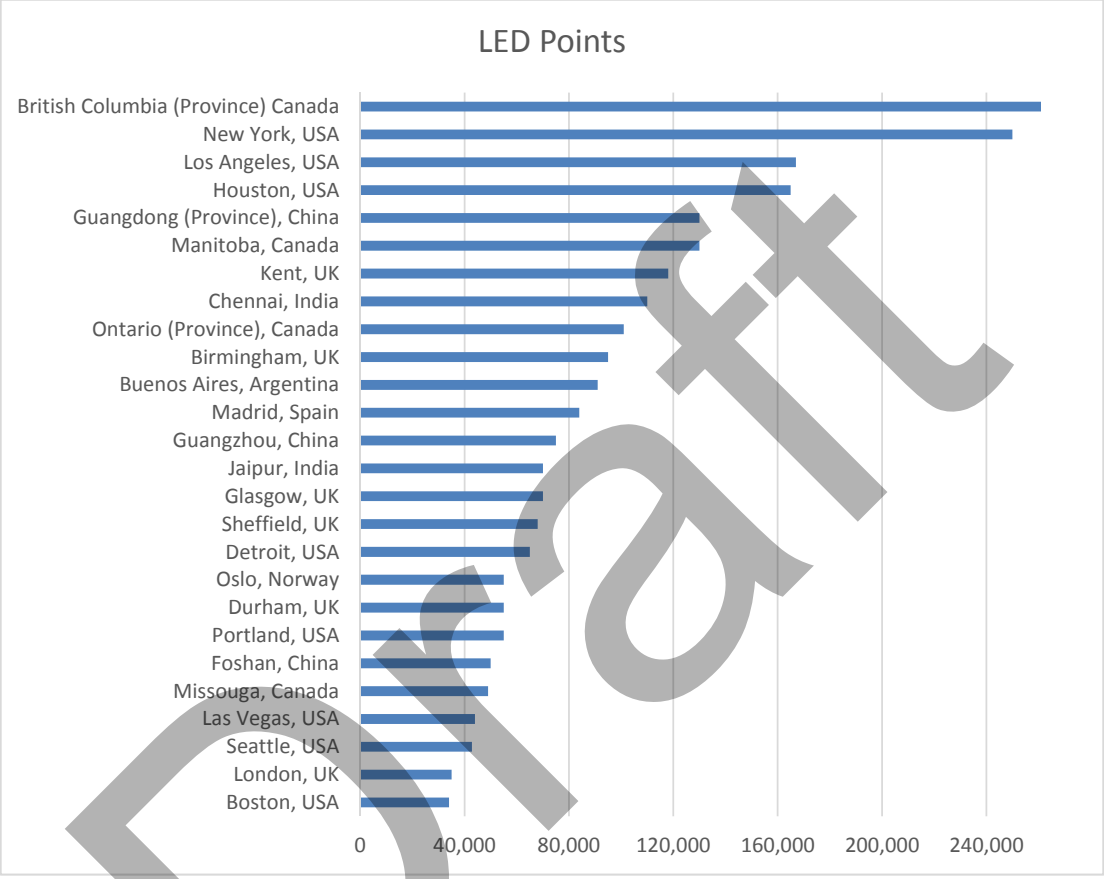
II. General view of public lighting trends with LEDs technology.

In 2012, the international NGO The Climate Group, was one of the first organizations to conduct studies in cities with public lighting projects with LEDs technology to confirm the performance and acceptance of this new technology. Using the example of twelve cities the study showed that the technology based on LEDs reaches levels of energy savings ranging from 50% to 70% reaching up to 80%, when combined with smart systems of management and control. In addition to energy savings and reduced maintenance costs, LEDs lighting resulted in a wide range of socioeconomic benefits, such as improvement in lighting quality, improve security and increased

local economy activity. Moreover, the adoption of smart control systems allowed greater flexibility in terms of lighting options with increased focus on people.

Currently, many cities around the world of varying size, geographic location, climate, etc., have started to implement retrofit projects using LEDs, as shown in the Table below.

Figure 1–The largest public lighting retrofit projects using LEDs



Source: The Climate Group (note: projects at various stages of implementation)

LEDs' luminaires prices are falling fast - at approximately 10% per year - and pieces of equipment benefit from both the technologic dynamism and gains in scale. For this reason, a revolution towards LEDs technology will be almost unavoidable during the next years. Although unavoidable, the global public lighting retrofit pace will depend on available financing mechanisms for cities in addition to political will to give priority to these projects. With the purpose of increasing LEDs lamps adoption pace, in 2015 The Climate Group urged all cities around the world to implement LED lighting technologies (or more efficient technology) by 2025.

III. Brazil's public lighting market: Overview

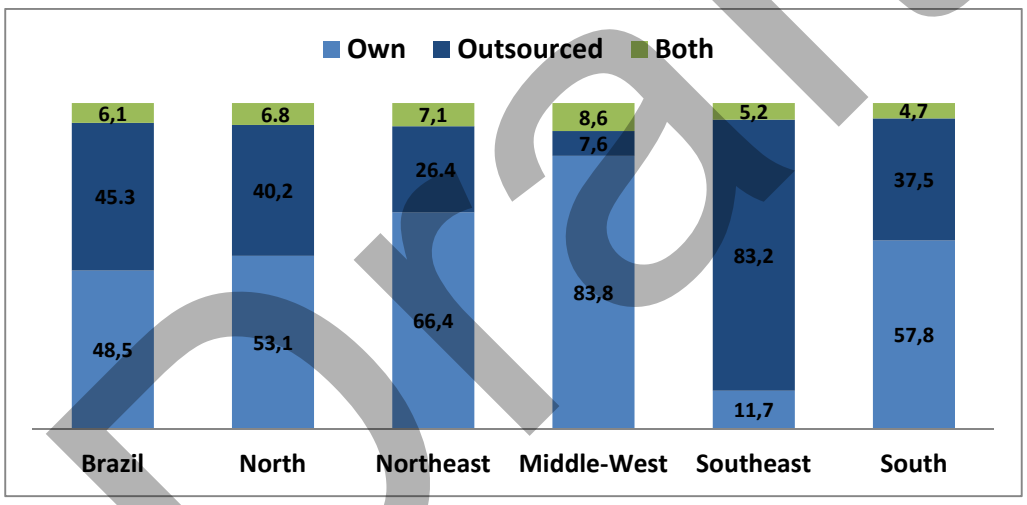
One can estimate that in Brazil public street lighting has more than 18 million points of light, with a service penetration of approximately 95.5% of households. The installed luminotechnical complex is predominantly comprised by high-pressure sodium lamps and, to a smaller degree,

by mercury vapor lamps. LEDs technology penetration is quite low, although many cities have pilot projects in the pipeline to implement this technology.

Recent regulatory changes brought an important impact on Brazil's public street lighting. In 2013, ANEEL (National Agency of Energy Electricity) implemented regulation requiring that, by the end of 2014, all public lighting assets that were previously owned by electric utilities must be transferred to municipalities. This change affected approximately 42% of Brazil's municipalities.[1] Thus, all municipalities now hold full ownership of services as well as the obligation to manage assets and render proper services to the population.

Pursuant to this legislation, all public lighting services shall be rendered by city halls, either directly or through outsourcing. Currently, many municipalities are outsourcing maintenance services to the private sector, in compliance with the legal framework set forth by Law 8.666 or Bidding (Law 10.520/01). According to a sampling research carried out by the World Bank Group more than half of Brazil's cities outsource, all or part of it, maintenance services, as shown in Figure 2 below.

Figure 2 – Responsibility for public lighting maintenance, % of municipalities



Source: Research by the World Bank Group

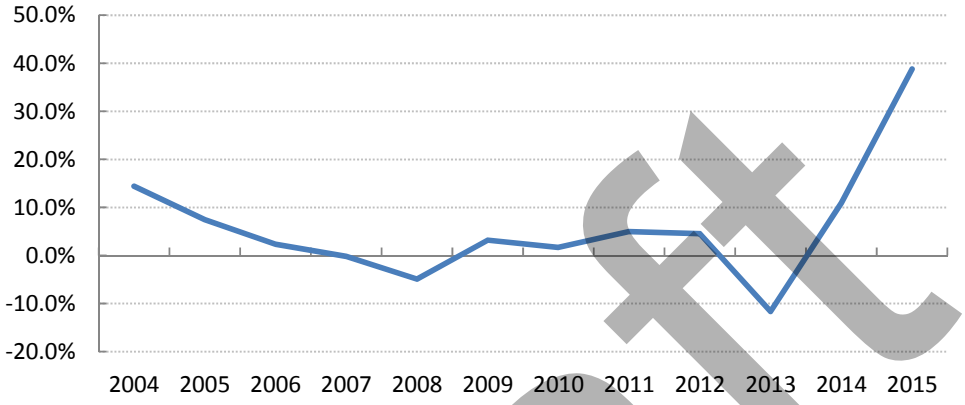
A new modality available for city halls to outsource the investment, operation and maintenance of its public lighting sector is an administrative concession, or Public Private Partnership (PPP), according to Law 11.079/04. As the granting authority, city halls have full power to define the PPP business model, as long as it complies with legislation. Some public street lighting concessions have recently been awarded to some medium-sized municipalities, and examples of larger concessions are under preparation for some of the capital cities of Brazil. While the PPP/concession model offers many benefits that will be further discussed, this model is not feasible for many Brazilian cities due to scale, credit worthiness, capacity, amongst other reasons.

[1]Resolution 587/2013,

IV. Opportunities and Challenges in the Brazilian Market

Opportunity 1: High cost of energy and decreasing costs for LEDs technology.
The average energy tariff for public lighting jumped from 38.8% in 2015, after already realizing a substantial increase of 10.9% during the previous year. High energy costs, combined with the declining cost of LEDs, can be directly translated into a huge economic and financial opportunity for Brazil's municipalities if LEDs are installed. Modernization with LEDs also contributes to the national objectives in the area of climate changes.

Figure 3 – Electric energy average tariff for public lighting, % change



Opportunity 2- Incentives for the municipalities to invest in their assets
Over 40% of the Brazilian municipalities benefitted from the recent transfer of street lighting assets. Compared to the electric utilities, the municipalities have an incentive to run the system as efficiently as possible in order to reduce its costs, despite the additional costs in the short term. This recent change has created a critical mass in terms of the number of municipalities looking after a solution for the same problem, for which most of them have a dedicated source of revenue (see text below). This situation creates a large potential market for both manufacturers and companies dedicated to the installation and management of public lighting systems.

Opportunity 3 –Source of specific resource to pay for public lighting
In December 2002, a constitutional amendment allowed the collection of a 'contribution' (similar to a tax) for public lighting services defrayal (CIP or COSIP, hereafter called COSIP) by municipalities and the Federal District with the exclusive purpose of paying for public lighting services. This ring-fenced resource must be used to pay for electricity supply, as well as its maintenance, installation and public lighting equipment improvement. Moreover, the legislation allows COSIP's collection from consumers through their electricity bill. A sample survey carried out by the World Bank on 300+ Brazilian municipalities showed that most of these (81.6%) already collect COSIP and, for a large share of the other municipalities, a legislative bill to implement COSIP is underway.

The implementation of COSIP creates increased assurance that the resources needed to pay for the public lighting services will be generated. As such, COSIP flows can be used as collateral in business models with private sector financing (e.g., loan payments, payments paid to the concessionaire in the case of PPP, etc.).

Opportunity 4 – Alignment with National Climate Policies
As explained in the introduction, in the COP-21, participant countries – including Brazil – submitted the INDCs. Among other objectives, Brazil committed to make the transition of its

energy matrix to renewable energies, with the goal that the matrix shall have 45% of renewable sources of energy by 2030. In order to reach this goal, the country also set a target for electrical sector efficiency gains of 10% by 2030. Approximately, one-fifth of this goal could be reached only with the conversion of public lighting to LEDs technology, bearing in mind that this new technology efficiency would represent an additional saving in electrical energy consumption in the country of 2%.

In spite of the existing huge opportunities, challenges of institutional nature still persist in the modernization of the public lighting sector in Brazilian cities, including:

Challenge 1 – High cost and scarcity of government resources
The main challenge to the public lighting complex is the relatively high cost of upfront of the project. This challenge remains even when the equipment conversion project presents economic-financial feasibility because of savings in the generated energy and cost reduction with maintenance.

The federal government of Brazil established two energy efficiency programs - PROCEL-Reluz, administrated by Eletrobrás and PEE – *Programa de Eficiência Energética* (Energy Efficiency Program), administrated by electric utilities and managed by ANEEL; however, neither program is currently disbursing substantial resources for investment in energy efficiency of Brazil's public lighting complex.

Procel-Reluz is a federal fund established with energy sector resources (known as RGR) with the purpose of funding public lighting systems retrofits. PROCEL-Reluz makes loans to utilities, which on-lend these amounts to the municipalities. Between 2000 and 2014, Procel-Reluz made possible the replacement of 2.78 million points of public lighting. The amount funded by Eletrobrás was BRL 521 million, while utilities invested BRL 173 million. Since January 2014, no funding releases from RGR were made to Procel-Reluz. As a result, the the program is currently at a standstill.

The *Programa de Eficiência Energética (PEE)* is an investment obligation included in the electric utilities concession contracts as of 2000 and sets forth that utilities shall invest, at least, 0.5% of their Net Operational Revenue in activities earmarked for energy efficiency. According to the PEE regulation, utilities must select energy efficiency projects within the applicable law scope and submit them to ANEEL for approval. Recently, ANEEL established a competitive selection of energy efficiency projects for part of PEE resources, with the purpose of pushing utilities to select energy efficiency actions with the best cost-benefit ratios.

Challenge 2 – Access limits to other funding sources
Currently there are important funding restrictions imposed on Brazilian municipalities because of Fiscal Responsibility Law[2]. As an example, for the law imposes a debt limit of 16% of the Net Revenue (*Receita Corrente Líquida - RCL*) on municipalities. There are some exceptions, such as financing from multilateral bodies or federal institutions of credit or development banks, as long as it is for investment projects to improve administration of revenues, taxes, financial and of assets management. This exception is also applicable to PROCEL-Reluz transactions for public lighting projects. Presumably, the rationale for the exceptions is that – similar to those resources earmarked to tax modernization – investments in energy efficiency improve the municipality's fiscal situation, since - in the long term – the outcome is a reduction of municipal expenditures.

[2]Law 101/2001, Resolutions by the Federal Senate (40/2001 and 43/2001) and Ordinances by National Treasury Secretariat (396/2009, 138/2010 and 306/2012).

Challenge 3 –Risk of municipal credit

The risk of municipal credit is one of the toughest challenges to overcome for attracting private sector capital to public street lighting projects, not only in Brazil, but in municipal financing projects worldwide. Given that municipalities in Brazil own their public lighting assets are the agent ultimately responsible for the payment of costs related to investment, investors in public lighting projects will be exposed to municipal credit and political risk, even if only residual in some cases.

As previously explained, the existence of COSIP provides a source of earmarked resources for exclusive use in public lighting, a situation not found in most of the other municipal sectors. Nonetheless, the mere existence of COSIP does not entirely remove the risk perception of a project. COSIP can face fragilities, such as the possibility of these revenues being frozen or reduced by supervision/control agencies, or design of COSIP that is insufficient to make required investment payments. For example, according to data from the WBG municipal survey, 44.1% of cities surveyed indicated that COSIP is sufficient to cover municipal expenses for public lighting. However, for 31.3% of municipalities, the contribution is considered insufficient, and 24.6% of municipalities were unsure of the sufficiency of COSIP.

Thus, the municipal law defining COSIP must be well formulated. For example, COSIP's collection should be designed so that it is sufficient to cover commitments incurred for supplying public lighting services, ensuring minimal risk of a future imbalance between COSIP's collection and these commitments (through proper indexation, for example). Nevertheless, depending on municipality's profile, even when there is a well formulated COSIP, it is possible that lenders or utilities demand some form of guarantee in order to invest in public lighting projects, especially those cities with reduced financial capacity.

Additional recommendations regarding COSIP's formulation are presented in the conclusions of the Executive Summary and in the full version of the report.

Challenge 4 –The macroeconomic scenario

Brazil's macroeconomic scenario during the last years has precipitated an unfavorable environment for infrastructure investments. Some factors are particularly relevant for public lighting projects.

First, borrowing costs, which were already high, have further increased: by the end of 2015, the prime interest rate reached 14.25%, two times the rate in force at the beginning of 2013. Second, the Brazilian Real has significantly depreciated compared to the USD in recent years. This depreciation raises the cost of imported equipment and results in a challenge because of the lack of domestic production of luminaires with LEDs, and increase the risk faced by potential international investors.

V. Mapping of Brazil's municipalities for public lighting

Brazil has 5,570 municipalities with a high level of heterogeneity, both in terms of socioeconomic characteristics (income level and development), as well as physical characteristics and demographics. Consequently, it is not possible to have one universal business model for public lighting projects. Therefore, the first challenge is to group municipalities based on their similarities and to develop solutions more customized to each type of municipality.

This study took into account a group of characteristics including economic capacity, street lighting network size and density, socioeconomic development level, fiscal situation, and

coverage of the existing network[3]. In order to take into account this group of characteristics, the statistical methodology of clustering was chosen. For additional information regarding the clustering methodology, please refer to Annex I of the full report.

The procedure for grouping municipalities was divided in two phases: statistical cluster analysis, followed by homogenous clusters identification. This strategy allowed to consider relevant multiple dimensions (size, development, tax situation, network density, sectorial indicators), and ultimately identifying a manageable number of six municipal groups.

For the statistical analysis phase, clusters were developed base on the variables presented in the following table.

Table 1– Municipal Variables for Clustering Analysis

Objective / proxy	Variable	Unit	Information Year
Size	GDP – Gross Domestic Product	Million Reais	2012
Level of development	GDP per capita	Reais	2012
Urban density	Savings by water connection[4]	Ratio	2013
Tax management	IFGF[5]	Index	2013
Municipal indebtedness	DCL/RCL[6]	Ratio	2015
Lighting network size	Number of point of light[7]	Number	2014
Efficiency of existing lighting inventory	Use of Mercury vapor lamps in a proportion greater than 20%[8]	Indicator	2014
Lighting network coverage	Municipality percentage not covered by public lighting[9]	Percentage	2014

Data source: IBGE; FIRJAN; National Treasury; Ministry of Cities, World Bank Group.

[3] It is worth mentioning that a classification of municipalities that considered only its size would exclude factors that are essential to business models selection.
[4] For the approximation of public lighting networks, it was used a public service that basically runs the same geography, the general water supply network. In this way, the water supply network density was perceived, which also reflects the urban space virtualization (savings by connection). One connection is one branch connected to the distribution network. One saving is one consumer unit. For example, a building with ten apartments can have only one connection servicing ten savings and, for this building, the economy ratio by connection would be 10.
[5] The Firjan Tax Management Index's (IFGF) objective is to measure how taxes paid by society are administrated by city halls and it has five indicators: Own Revenue, Expenditures with Personnel, Investments, Liquidity and Debt Cost.
[6] The ratio between DCL (Net Current Debt = Consolidated Debt deducted from receivables) and RCL (Current Net Revenue. There are cases where the municipality may have a negative DCL/RCL, this is, cash availability is higher than its financial obligations. In this case a negative DCL/RCL index indicates how much cash the municipality has in relation to the Current Net Revenue.
[7] Estimated value.
[8] The network technology was approximated by the use of mercury vapor lamps in proportion greater than 20%.
[9] The municipality percentage not covered by public lighting was used. In these variables, sampling research data by the World Bank Group was used together with Brazil's municipalities, there was no data available for the universe of municipalities.

As a result of the cluster analysis, 18 clusters were obtained (homogenous groups). Subsequently, these groups were reorganized into six groups by a qualitative assessment of characteristics strongly related to the business model design, including scale (points of light) and fiscal management. The results of this analysis are shown in the following table.[10]

Table 2 –Main Characteristics of Municipal Groups

Group	Municipalities Number		Scale (Points of light)	Tax Management
	total	%		
A	47	1%	++++	+++
B	88	2%	++++	+++
C	329	6%	+++	+++
D	887	16%	++	+++
E	3,406	61%	+	++
F	813	15%	+	+

Classification: light blue = good; dark blue = moderate; gray= limited

Table 3 – Municipal Groups Statistics

Group	Population			Points of light			Necessary Investments (BRL)		
	Total (Million)	%	Average	Total (Million)	%	Average	Total (Billion)	%	Average (Million)
A	59.9	29%	1,274,015	5.1	27%	107,499	7.7	27%	161.3
B	23.8	12%	270,041	2.8	15%	31,490	4.2	15%	47.2
C	14.7	7%	44,701	2.1	11%	6,303	3.2	11%	9.5
D	23.0	11%	25,967	2.2	12%	2,437	3.3	12%	3.7
E	64.4	32%	18,921	5.1	28%	1,493	7.7	28%	2.2
F	18.6	9%	22,894	1.2	7%	1,533	1.8	7%	2.3
TOTAL	**204.4**	**100%**	**36,704**	**18.4**	**100%**	**3,302**	**27.8**	**100%**	**5.0**

Source: estimative made by the World Bank Group and Pezco. Equipment prices based on assessment by the World Bank Group teams in June 2015. Pieces of equipment prices are estimated at BRL 1,500 per point (excluding smart controls), based on assessment by the World Bank Group teams in June 2015. Prices do not include the potential impact in the procurement scale. The official exchange rate of May 13, 2016 at BRL 3.5/US$ was used.

Note: results of the grouping of cities – including the estimated number of cities, population, points of light, etc. – should be considered as indicative, with limited purpose of creating a general market view.

The tables above demonstrate that municipalities from Groups A and B have a good scale (> 20,000 points) as well as strong fiscal management. These two groups represent only 3% of municipalities in the country, although they represent 41% of the population and 42% of the national points of light. Group C has a relative good scale (typically> 20,000 points) and relatively good tax management. This group represents 6% of Brazil's municipalities, 7% of the population and 11% of points of light. Group D is characterized by relative low scale (typically<5,000 points) with relatively good fiscal management. Group D includes 16% of Brazilian municipalities, 11% of the population and 12% of the points of light of the country. Cities from Group E have smaller scale (< 2,000 points of light) and moderate fiscal management. This group includes the highest

[10] The list was obtained at http://wbg-eficienciaip.com.br/

number of cities and population among all groups – representing 61% and 32% of the country, respectively – and approximately 28% of Brazil's points of light. Finally, cities from Group F are characterized by having smaller scale (< 2,000 points of light) and limited fiscal management, representing 15% of the cities, 9% of the population and 7% of the country's points of light.

VI. Business Models for Brazil's public lighting

The analysis above demonstrate the wide diversity of Brazilian municipalities. Based on these characteristics, this study proposes eight business models that can be deployed to serve the needs of these six municipal groups, described in Table 3 below.

Table 4–Business Models Summary

Model	Brief Description
M1 - Municipal PPP	Establishment of a concessionaire to whom the municipality grants a wide range of responsibilities through an administrative concession to retrofit of the public lighting assets and to render efficient lighting services.
M2 –PPP with Municipal Consortium[11]	Municipalities from the same state form a consortium as well as SPV, which then tenders a PPP on behalf of the municipal consortium. The PPP concessionaire provides the same services as described in M1 above.
M3 – Municipal Finance	Issuance of municipal bonds or loans to municipalities, allowing those municipalities that do not want or lack capacity (technical or financial) to tender a PPP to finance the necessary investments for the conversion into LEDs.
M4 –Electric Utilities Programs	Electric utilities leverage resources arising from electricity payments by consumers to finance LED procurement by municipalities (scaling up of PEE).
M5 –Energy Service Companies, ESCO(s)	ESCOs would secure financing in the market and make the necessary investments for municipalities retrofit; both the operation and maintenance would be the responsibility of the municipality.
M6 –Municipal Consortium or Central Procurement Agent	Establishment of a municipal consortium to centralize LEDs procurement and benefit from economies of scale for the cost of equipment.
M7 – Self-Funding	Municipalities use surplus revenues for street lighting in any given year to fund investments in LEDs over time without securing any upfront financing.
M8 –Transfer of Luminaires	Interim solution consisting of deploying the sodium vapor (or metal vapor) equipment left over after a city converts to LEDs to other municipalities without little prospects to convert to LEDs in the near future.

The following section offers a summary of the business models characteristics, applicable municipal groups, advantages and disadvantages, as well as risks and mitigation factors. For additional details regarding the models, including key-players for each project phase, please refer to the Section VII of the full report.

[11] Note that while the establishment of a municipal consortium is a necessary condition for the M2 model, the aggregation (with the purpose of creating scale, reducing transaction costs, etc.) could be employed via a municipal consortium in several other models.

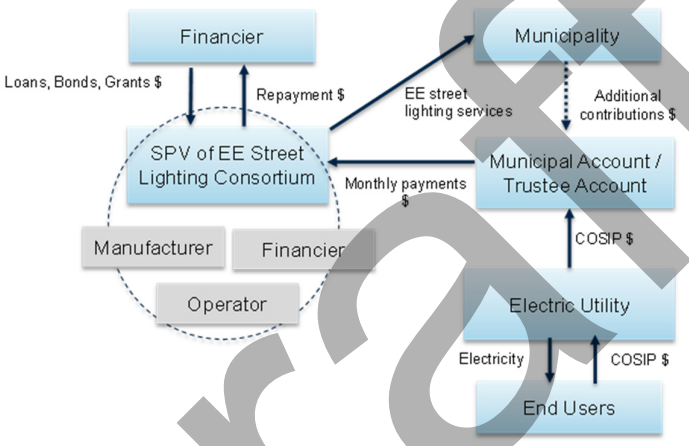
Model M1: Public-Private Partnership (PPP)

In Brazil, some of the public lighting projects are capable of attracting private capital through a PPP, particularly large cities with good credit standing. Below is a summary of the PPP model.

Main Characteristics

- Presence of a concessionaire to whom the municipality grants a concession to deploy a wide range of responsibilities (installation, O&M) of the system over the PPP contract life.
- SPV is formed by the winning consortium (for example, an operator, lender and manufacturer), which is responsible for raising the financing for the project.
- The city remunerates the concessionaire through monthly payments using COSIP (or, if non-existent or insufficient, municipal budget).
- COSIP is collected by the electricity utility and flows to a municipal account or an escrow account.

Figure 4 –Example structure of the PPP model



Groups

- Most applicable to Groups A and B, equal to 135 municipalities (2.4% of Brazil's municipalities), representing 40.9% of the total population and BRL 10.1 billion of investment (42.4% of the required investment for the entire country).

Advantages

- The public sector transfers most of the performance risk to the private sector, which has better ability to manage this risk.

Disadvantages

- Transaction costs involved in a PPP preparation can be significant.

Risks

- Lack of capacity by the municipality.
- Municipal credit risk, lack of funding.
- Lack of regulatory framework.

Mitigating Factors

- Capacity building for municipalities, standardization of contracts.
- Implementation of COSIP and provision of credit guarantees, if needed.
- Public Audit Court engagement in the initial phases of the project.
- Performance guarantees provided by the manufacturer and/or concessionaire.

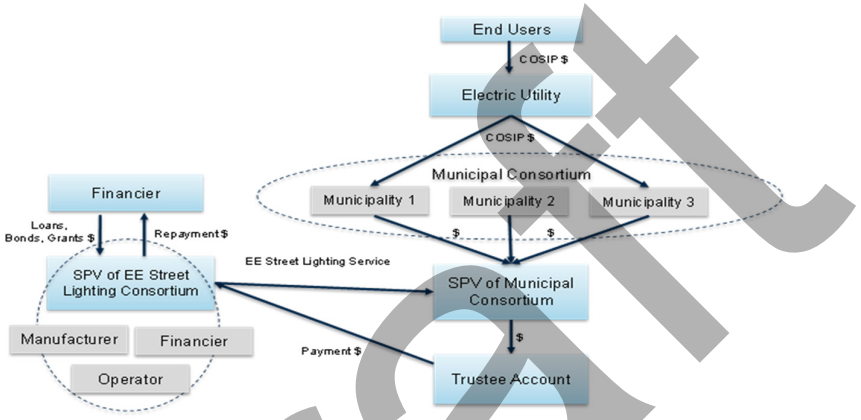
Model M2: PPP with Municipal Consortium

Because it is not feasible for a large number of municipalities to individually grant concessions using the PPP model, municipal consortia are a possible solution to generate the scale necessary for implementation of a PPP. International experience indicates that there are huge economies of scale for procurement of LEDs. Below is a summary of this model.

Main Characteristics

- Municipal consortium formed by small or medium size municipalities, with the creation of a SPV.
- Municipal consortium is the granting authority for the PPP.
- Other aspects similar to M1.

Figure 5 –Example structure for the PPP with Municipal Consortium model



Groups

- Most appropriate for municipalities in Group C, due to small scale but good credit standing.

Advantages

- Expands the feasibility of the PPP model to a larger number of municipalities.
- Diversification of municipal credit and political risk.

Disadvantages

- Consortium governance is complex; transaction costs and perception of risk can be high.

Risks

- Lack of capacity by the municipal consortium.
- Lack of clear governance for the municipal consortium.
- Municipal credit risk, lack of funding.
- Lack of regulatory framework.

Mitigating Factors

- Capacity building for municipalities, standardization of contracts.
- Implementation of COSIP and provision of credit guarantees, if needed.
- Public Audit Court engagement in the initial phases of the project.
- Performance guarantees provided by the manufacturer and/or concessionaire.

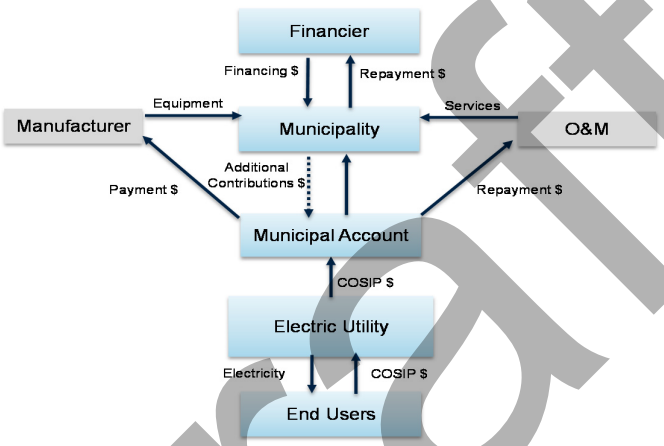
Model M3: Municipal Finance

The high level of upfront capital to implement LEDs technology is the main challenge to the conversion of public lighting complex. In Model M3, the municipality itself is responsible for raising financing and making investments. Below is a summary of the model.

Main Characteristics

- The municipality takes on loans or issue debentures.
- The municipality reimburses the lender(s) through monthly payments using COSIP (or, if non-existent or insufficient, the municipal budget), collected by the electric utility and passed to a municipal or escrow account.
- The municipality is responsible for performing O&M services, on its own or outsourced.

Figure 6 –Example of municipal financial model structuring



Groups

- Applicable to the relatively small number of municipalities in Group B (88 total) and Group C (329 total), due to their good fiscal management and scale, but perhaps without sufficient scale to justify the transaction costs associated with structuring a PPP.

Advantages

- Less complexity of project structuring (fewer players, routine bidding process of Law 8.666/93).

Disadvantages

- Municipal indebtedness restricted limits disqualify many municipalities
- Municipalities could use their available tax resources for investments that could not be made by the private sector.
- The public sector assumes most of the responsibility for the project performance.

Risks

- Technical and human capacity risk to manage the process.
- Municipal credit risk, investors lack of interest

Mitigating Factors

- Training in the best national/international practices; competitive biddings; adequate technical performance guarantees; specialized advisory services to municipalities.
- Take advantage of the experience from the consortia in the solid waste treatment sector.
- Implement COSIP, credit guarantees.

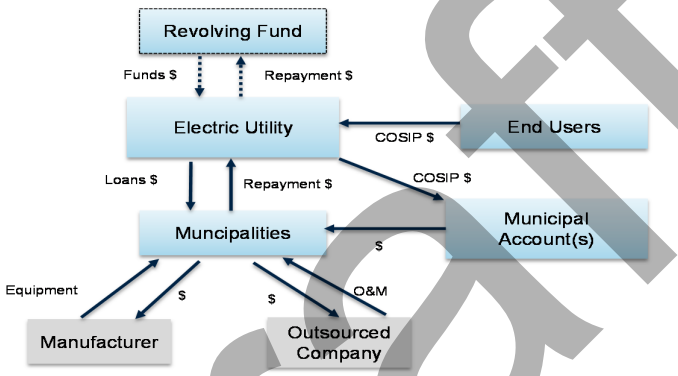
Model M4: Electric Utility Programs

As previously described, in both of the national funds earmarked for the public lighting sector - PROCEL-Reluz and PEE - the electric utility performs an important role in the financing of public street lighting projects. Despite the fact that these programs currently offer only a small amount of financing to cities, it is possible to envision a scenario where utilities play an important role in the modernization process of Brazil's Public Lighting sector. Below is a description of the model.

Main Characteristics

- Represents an expansion of the PEE program, with some design changes.
- Electric Utility grants loans to municipalities and recover loans from the municipality as well as consumers through a small electricity tariff increase (the latter similar to PEE).
- Program's profits would flow to a revolving fund for additional EE street lighting projects.
- Municipality is responsible for O&M services execution (on its own or outsourced).

Figure 7 —Example of Utilities Program model structuring



Groups

- Municipalities from groups D and E (>4.200 municipalities; 75% the population) representing BRL 9.4 billion in investment (in some cases, some municipalities from groups C and F).

Advantages

- Funding costs below the capital market levels
- Benefits from funding centralization and better risk diversification
- Option for those municipalities with few options to raise funds

Disadvantages

- Requires regulatory change by ANEEL in an environment where the trend is to reduce the Electric Utility involvement in the sector.

Risks

- Lack of interest by Electric Utilities, or program concept non-approval by ANEEL.
- Resources demand by municipalities exceeds the offer.
- Municipalities lack of capacity to implement the project.

Mitigating Factors

- Strong engagement with the program benefits; or, in the short run, Utilities would earmark more PEE resources for the public lighting sector[12].
- Restrict eligible municipalities (e.g., small-medium size) and offer training.

[12]Perhaps this would be possible for those utilities located in areas with few low income consumers. There is the regulatory imposition to invest 60% of PEE resources in this group of consumers, but in some concession areas the market is already saturated and utilities do not find enough demand in this sector to disburse resources with these obligations. Recently, legal changes set forth a PEE investment cap of 80% in low income, but eliminated the obligation of a floor.

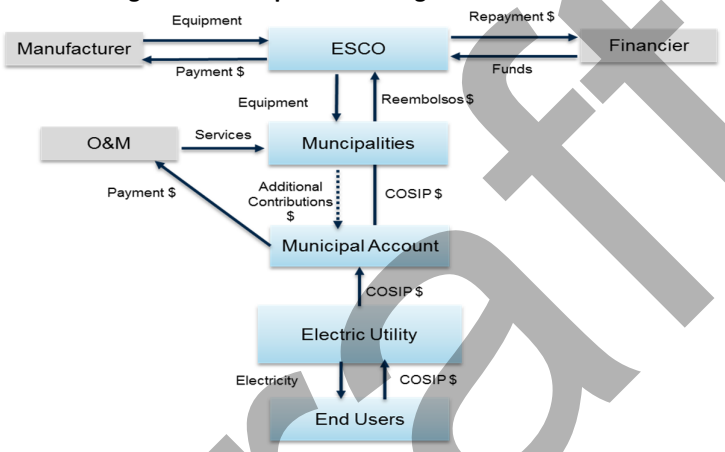
Model M5: ESCO Model

This model involves off-balance sheet financing for the municipality, where the investment is made by an energy services company (ESCO); therefore, the investments do not affect municipal indebtedness limits. Below is a summary of the ESCO model.

Main Characteristics

- ESCO raises funds, procures and install LEDs luminaires, in exchange of regular payment by the municipality using COSIP and /or municipal budget.
- Municipality is responsible for O&M services (on its own or outsourced).
- There are two modalities: (1) ESCOS share efficiency gains, (2) ESCOS receive a fixed payment for the investment made and give a technical guarantee for product performance.

Figure 8 – Example structuring with ESCO model



Group

- This model is applicable to group C, which totals 329 municipalities, characterized by a relatively small scale, but good fiscal management.

Advantages

- Offers off-balance sheet financing option for smaller size municipalities, without requiring the same level of involvement by the regulator or political changes as model M4.

Disadvantages

- Smaller coverage in comparison with M4 (ESCO smaller balance)
- Higher costs for municipalities than M4 given that ESCOs would perceive higher credit risk than the electric utility, which has a longer history of payments from the municipality.

Risks

- Municipal credit risk; lack of municipal capacity to manage the O&M aspect of projects.
- ESCOs may have limited balance sheets, making it difficult to secure financing, reducing coverage and program scale.

Mitigating Factors

- Capacity building for municipalities.
- Increase ESCOs available financing lines; focus on ESCOs that are subsidiary companies of Electric Utilities; limit to small-scale projects.
- Implement COSIP as well as credit guarantees, if needed.

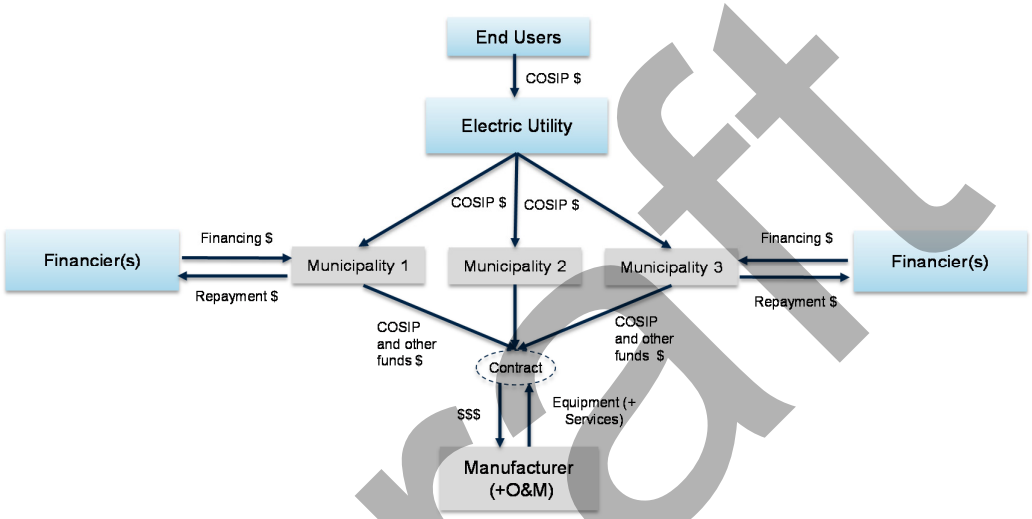
Model M6: Centralized Procurement

This model tries to capture gains of scale related to aggregated equipment contracting across multiple municipalities (possibly also aggregating O&M services) without aggregating financing. Below is a summary of the centralized procurement model.

Main Characteristics

- Establishment of a consortium or other agent (or process) to undertake centralized procurement.
- Municipalities would be responsible for raising financing individually, unless an SPV and consortium are formed to raise financing on behalf of municipalities. .
- Municipality is responsible for O&M services (on its own or outsourced).

Figure 9 – Example of Centralized Contracting model structuring



Groups

- This model is applicable to municipalities from Groups C and D (1.216 municipalities; 21.8% of the population).
- In some cases it could be applicable to groups E and F.

Advantages

- Potential for transaction lower costs in comparison with model M2, if the SPV is not established.

Disadvantages

- If a SPV is not established, municipalities' difficulty to raise financing is not solved.

Risks

- Municipalities lack of capacity to prepare SPV technical specifications.
- Complex coordination to raise financing for several municipalities.
- Municipal credit risk; investors lack of interest.

Mitigating Factors

- Training for municipalities.
- Legal issues standards for municipalities consortia financing.
- Implement COSIP, credit guarantees.

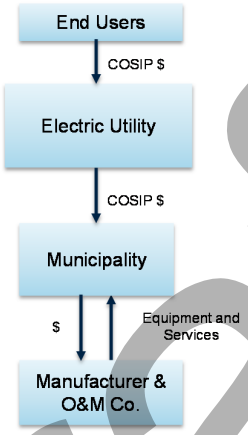
Model M7: Self-Funding

When municipalities lack other option to raise resources for their projects, one available option is simply the project self-funding throughout a longer period of time, governed by financial availability. Below the model summary.

Main Characteristics

- Municipalities make modernization investments using public lighting revenues using annual surplus from COSIP or municipal budget.
- Requires no financing but Implies slow pace of investment and longer retrofit process.

Figure 10 –Example of Self-Funding model structuring



Groups

- Applicable to municipalities from Groups C and D (1.216 municipalities; 21.8% of the population). In some cases it could be applicable to groups E and F.

Advantages

- Fewer transactions costs because it does not require financial or institutional arrangements.
- It might be one of the few feasible options for some of the cities if there are no alternatives for public sector support.

Disadvantages

- Cities with low capacity and small scale also may have a difficult time establishing COSIP at an adequate level to create surplus for investment.
- Municipalities assume majority of performance risk.

Risks

- Lack of municipal capacity to prepare LED technical specifications.
- High cost per lamp because of small scale purchases.
- Lack of resources to implement the project.

Mitigating Factors

- Capacity building for municipalities.
- COSIP implementation in a robust way with surplus forecast to fund the retrofit.

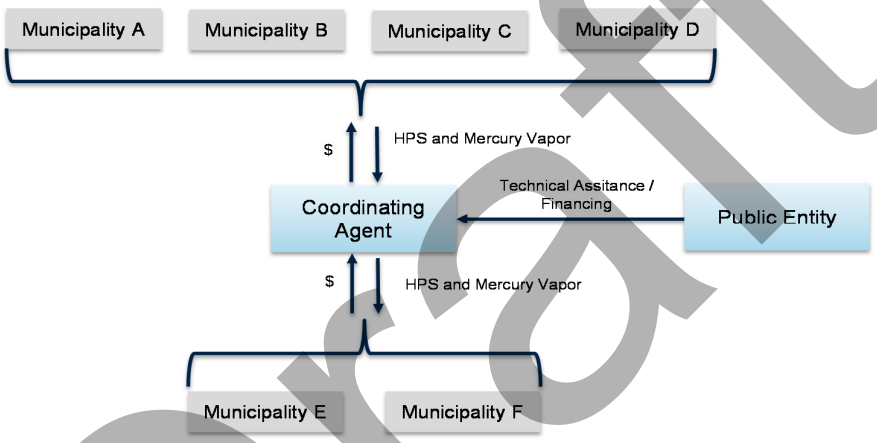
Model M8: Transfer of Luminaires

This model consists in the transfer of HPS (or multi-vapor metallic) lamps, together with complete luminaires, from cities modernized with LEDs to other municipalities with less efficient lamps. The model assumes a massive conversion in the coming years of HPS (and mercury vapor) lamps to LEDs[13], resulting in a large inventory of second-hand HPS lamps that, after being replaced, will be available to be transferred to cities still using less efficient technologies.

Main Characteristic

- Interim transfer system of HPS inventory of municipalities retrofitted with LEDs to municipalities without capacity to purchase LEDs in the short or medium term.
- A coordinating agent is responsible for managing bilateral transactions using auctions in a transparent way (made by a public or private agent).
- Buyers would be city halls or outsourced companies; sellers would be municipalities or private entities who had acquired assets from municipalities.

Figure 11 —Example luminaires Transfer model structuring



Groups

- Groups E and F, with 4.219 municipalities (approximately 1.6 billion Reais)

Advantages

- Offers an opportunity to improve energy efficiency and service for municipalities with few other options in the short term.

Disadvantages

- The implementation of a sale/exchange/donation system may be operationally complex.
- Possibly reduced service life of exchanged equipment.

Risks

- Complex coordination, resulting in high transaction costs.
- Lack of interest or capacity by public/private agents in the scheme.
- Lack of municipal resources and/or capacity.

Mitigating Factors

- Involve public sector to supervise process; identify private sector actors interested in rendering services.
- Prices must compensate municipalities for the technical risk associated with used lamps.
- COSIP implementation consistent with creating a surplus to financing HPS purchase.

[13] In 2012 Sodium- vapor lamps installed complex corresponded to 11.4 million units, significantly higher than 1.2 million points of light currently existing in municipalities from Group F. Metallic multi- vapor lamps total was 201 thousand and mercury-vapor lamps, candidates for replacement, 3.8 million. There still exist a public lighting operational complex using incandescent lamps (188 thousand), mixed (283 thousand), fluorescents (160 thousand) and halogens (10.9 thousand).

Table 5 below summarizes the correspondence among groups and business models. For many groups, multiple business models could apply, depending on situation and preference by each municipal government.

Table 5– Mapping of business models to each group

Group	*M1* *PPP Municipal*	*M2* *Municipal Consortium with PPP*	*M3* *Municipal Funding*	*M4* *Electric Utility Programs*	*M5* *ESCO (s)*	*M6* *Centralized Procurement*	*M7* *Self-Funding*	*M8* *Transfer of Luminaires*
A	■							
B	■	▒	■					
C		■	■	▒	■	■	▒	
D				■		■	■	
E				■		▒	■	■
F				▒		▒	■	■

Source: World Bank Group, elaborated by Pezco ***Legend****: Black = Suggested; Gray = Possible*

VII. Financing Mechanisms and Credit Improvement

Each one of the previously described business models have specific charateristics that affect options for financing model as shown in Table 5 below. Some models, such as M1 and M5, can be attractive for the private sector. Other models, such as M3, where the municipality has an important role in financing the modernization, will likely depend on the existence of credit lines from the public sector.

Table 6: Financial Instruments Customization Mapping to the Business Models

Financial Insrument / Business Model	M1 - Municipal PPP	M2 - PPPs for Municipal Consortium	M3 - Municipal Financing	M4 - Electric Utility Program	M5 - ESCOS	M6 - Centralized Procurement	M7 - Self-financing	M8 - Transfer of Luminaires
COSIP or Municipal Budget	●	●	●	◔	●	●	●	◔
Private Equity	●	●	○	○	●	○	○	○
Loans from Private Banks	◔	◔	◔	○	◔	◔	○	○
Bonds, FIDC, FIP, Green Bonds	◔	◒	◔	○	◔	○	○	○
Development Banks (domestic, multilateral)	◔	◔	◒	○	◔	◔	○	○
BNDES - FINEM	◔	◔	◒	◒	●	◒	○	◔
Loans from Public Banks (BB, CEF)	◒	◒	◔	◒	◔	◔	○	◔
Sector Financing Lines (PEE, RELUZ, PROCEL)	○	○	◔	●	◔	◔	○	◔
FI-FGTS	○	○	◔	○	○	○	○	○
Credit enhancements (e.g. World Bank)	◔	◔	◔	◔	◔	○	○	○

Legend: Full Circle = more adequate or indicated; Empty circle = not applicable or not indicated

Below is a description of each of the financial instruments shown in Table 6 , as well as its applicability to the various business models.

1) COSIP – This is a "contribution", or tax, collected by utilities through consumers' electricity bill and passed to the municipality to cover current expenses and expansion costs of its public lighting system. It is an earmarked fund, meaning it cannot be used for any other purpose. COSIP can function as a type of partial guarantee for investments in public lighting sector retrofit, offering a unique advantage to attract private capital to invest in the modernization of the public street lighting sector, either through PPPs under the model of administrative concession, or by simpler mechanisms like ESCOs. Most of Brazil's municipalities have already implemented COSIP and the trend is for others to do the same.

2) Private Equity. This entails private capital investment as equity as a shareholder in an SPV, whose objective is to finance the public lighting system retrofit. There are several models under which an SPV will be formed, , ranging from administrative concession grant by a municipality (M1) to simpler structures, where an ESCO is in charge of replacing the lamps for LEDs technologies and the operation and maintenance are completed by the municipality (M5).

3) Loans from Private Banks. This is a modality where private commercial banks (domestic or international) provide loan directly to municipal governments (M3, M6, M7) or to agents acting on their behalf for the lighting sector retrofit (M1, M2, M5). For loans to the public sector, municipalities are subject to the applicable indebtedness limits.

4) Debentures, FDIC, FIP, Green Bonds. These are ways that allow raising resources in the national or international capital market in higher volumes and at more competitive costs. These instruments are applicable for large-scale projects. A brief description of each instrument is presented below.

    a. Debentures are debt instruments (bonds) issued by a SPV (M1), by a consortium (M2) or even by a municipal government (M3). The same grant to investors credit rights. It is a securitization instrument well accepted by Brazil's capital market.

    b. FIDCs are mutual funds that invest, at a minimum, 50% of its net assets in credit rights. FIDCs are a tool to securitize future cash flows of infrastructure projects – such as COSIP. FIDCs can acquire debentures issued by SPVs (M1, M2 and M5) or municipalities (M3).

    c. FIPs (Equity Investment Funds)are closed funds that invest in stocks, debentures and convertible debt instruments of any publically or privately held Brazilian company, as long as it is a corporation. This is most applicable to more applicable to M1 and M2 models.

    d. Green Bonds. These are debt instruments that can be issued by private agents, government or multilateral institutions. They are issued to raise resources for projects that support the climate agenda, i.e., projects related to environmental improvement. This instrument is most applicable to large scale projects led by the private sector (M1) or by large municipalities (M3).

5) BNDES – Infra, DesenvolveSP, AgeRio, BDMG and Multilateral Financing Institutions. These institutions provide several instruments focused on financing energy efficiency projects, including public lighting projects. The BNDES has given signals about its interest in supporting PPP projects for public lighting modernization, such as those from São Paulo and Belo Horizonte (M1). The agencies Desenvolve SP, AgeRio and BDMG on-lend BNDES resources and offer their own financing lines. These sources are most appropriate for models M1 and M3, also with some potential for models M2 and M5. In principle, the World Bank could finance investments for large municipalities. Its private arm, the IFC, can finance private companies and can take a minority share in public-private partnerships. These institutions can also provide technical assistance and help municipal governments in project design and structuring of public-private partnerships.

6) BNDES-FINEM. This is a line dedicated to energy efficiency projects, replacing the previous PROESCO line from BNDES. BNDES-Finem[14] accepts transactions with values equal to or greater than BRL 5 million, covering up to 70% of financeable items. BNDES-Finem may also be applicable to retrofit projects of smaller size where there is an ESCO (M5) or even projects carried out by the public sector (M3, M4 and M6).

7) Loans from Public Banks (BB, CEF). The institutions of Banco do Brasil (BB) and Caixa Econômica Federal (CEF) enjoy an extensive network with municipal city halls, many of which are their active clients for infrastructure investments. Furthermore, CEF has a decentralized corps of technicians that could provide assistance smaller municipalities in the preparation of their public lighting modernization projects. Furthermore, both BB and CEF may be able to collaborate in a meaningful way in projects financing by the public sector (M3) and with municipalities in a procurement consortium (M6).

8) Sector Financing Lines (PEE, Reluz, PROCEL). As explained, sector-specific funds have an important role in the public lighting systems retrofit. Nevertheless, changes in regulation has reduced the amount of available resources for these financing lines. There are several changes under way that will influence PROCEL's role, PEE resources allocation under Eletrobrás management and, in the future, the legal criteria for the allocation of PEE resources. Therefore, the future is uncertain. Electric utilities (M5) may facilitate or coordinate those resources allocated to energy efficiency of the segment.

9) FI-FGTS. FGTS resources have supported several projects in the urban infrastructure area. Bearing in mind recent institutional changes, it may make sense to consider public street lighting modernization projects as part of urban infrastructure. The allocation of FI-FGTS resources requires approval by the Fund Managing Board. Potentially the the Ministry of Cities (Ministério das Cidades) could propose this change to allow FI-FGTS resources to fund public street lighting projects to the Board. However, for the time being, these funds are not available for any of the business model.

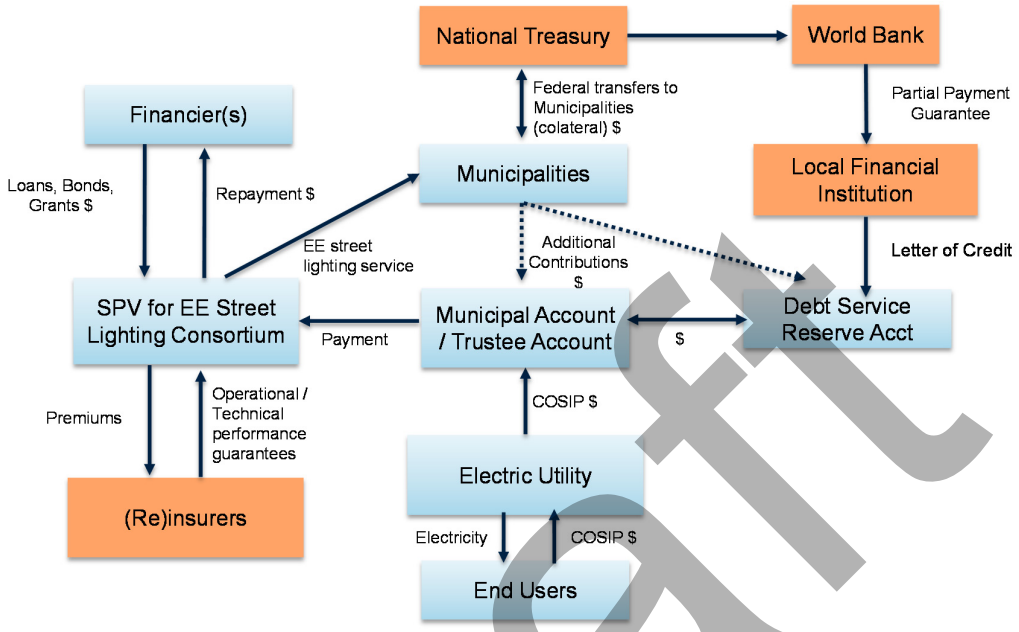
10) Credit Enhancement Mechanisms – (i.e., World Bank Partial Credit Guarantee). Credit enhancement mechanisms can be essential for financing public lighting modernization projects. Even when COSIP is well formulated and offers a strong guarantee for lenders, there might be a perception of residual risk of insufficient COSIP resources and, thus, exposure to municipal credit risk.

    Figure 12 below shows a potential scheme for the use of guarantees in a public lighting modernization PPP scheme (M1) to mitigate the above-mentioned risks, including the establishment of a reserve account as partial payment guarantee for the municipal

[14]The BNDES line earmarked to finance enterprises. In general, the BNDES Finem, finance projects above BRL 20 million with a 50% coverage of financeable items, but these parameters are not the most favorable (BRL 5 million and 70%) in the case of energy efficiency projects.

payment obligation towards the public lighting consortium (SPV) of the PPP. Usually, this mechanism is formulated to cover obligations from the Escrow Account during a term of three to six months. The mechanism includes a sovereign guarantee by the National Treasury.

Figure 12 – Example Guarantee use in the PPP model



VIII. Other Risks and Mitigation Mechanisms

Public lighting projects must pay attention to several other risks, including LEDs technology risk, operational performance risk, political risk, among others. Guarantees and other means of mitigation are particularly important to support projects that count with the private sector participation, either as a concessionaire of a PPP, ESCO, or as private financial institutions. The situations where these risks may need to be mitigated are present in most of the models where the private sector is involved, from M1 to M5.

Table 7, below, shows several mechanisms to manage these risks in public lighting projects

Table 7 – Other risk mitigation mechanisms

Mechanism	Mitigated Risks	Remarks
Manufacturer Guarantee!	Technical Performance Risk	Many manufacturers offer these guarantees (cost imbedded in the price of the LEDs)
Insurance Guarantee !	Technical and/or operational performance risk	Reinsurance companies, (i.e.: MunichRe). .
Multilateral Financial Institutions Insurance !	Political Risk	MIGA

Federal Government Guarantee for Infrastructure (ABGF)!	Non-manageable Risks	Infrastructure Guarantee Fund (FGIE) tends to focus on large scale projects; thus this won't be applicable for most municipalities

Source: Pezco, based on interviews with stakeholders and public sources

IX. Conclusions and next steps

Brazil's municipalities find a relatively favorable context for investments in energy efficiency in the public street lighting sector, including increasing energy prices, declining technology costs and, in most municipalities, the existence of ring-fenced resources through COSIP.

Through a first characterization of Brazil's municipalities in terms of size, tax management and lighting network characteristics, it is possible to identify groups with different capacities and needs.

The eight business models presented in this report take into account the characteristics identified by groups of municipalities, proposing structures and financing sources to make the modernization of the entire national public lighting network feasible . These models span across a wide range of financing sources, from models operated and financed directly by the private sector up to national development programs or projects self-funded by municipal budget.

It is important for municipalities to do their own assessment regarding their needs and capacities for the design and/or management of operations associated with the business model they would like to employ. The following step is to identify the best financing source to ensure the feasibility of the operation. This may, include, if necessary, credit enhancing mechanisms, such as municipal credit risk guarantees. The report presents ten financing instruments and credit enhancement mechanisms and includes a mapping of the compatibility of these instruments with the business models.

Most of these models and instruments require some type of institutional support to speed up implementation at national level. The outcome of this study points out that the probable scenario would be the use of the self-funding business model for more than 90% of the cities, corresponding to 50% of the total points of light (i.e., Model M8; Groups D, E and F). This would imply a very slow retrofit of Brazil's public street lighting sector, therefore reducing economic and social benefits that LEDs technology can provide (e.g., energy savings, public safety, improvement of services rendered to citizens, etc.). Because of this, it is imperative to identify gaps and find solutions to include the highest number possible of Brazilian cities in this technological revolution.

Identified gaps and proposed solutions

The following table presents barriers and gaps preventing the full development of proposed models and instruments, as well as some recommendations based on this report content.

Gaps / Barriers	Recommendations	Key-Players
Insufficiency of efficient national policies for public lighting. Absence of a national level strategy.	Design a national strategy, including implementation targets. Foster specific legislation; identify and appoint responsible player(s)	Ministry of Mines and Energy; Ministry of Cities; Ministry of Industry and Commerce.
Insufficiency of public or sectorial subsidized financing lines.	Establish new lines and/or instruments earmarked to municipalities that are not able to attract private investments.	Eletrobrás; Electric Utilities and FGTS Curator Board.
Insufficiency of technical and/or managerial capacity of public lighting at municipal level.	Establishment of national /state programs for technical assistance. Creation of tools to assess projects. Standardization of contracts for public lighting projects.	Eletrobrás; Development Banks, Public Banks, Development State Banks; SENAI; Brazilian Institute of Municipal Administration.
High cost of LEDs because of the low nationalization level.	Establishment of an industrial policy for nationalization (reduced import taxes etc.)Financing lines for national production of LEDs.	Ministry of Industry and Commerce; Ministry of Treasury; BNDES
High transaction costs of PPPs.	Standardize business models and contracts/financial instruments.	Development Banks; Public Banks
High transaction costs associated with financing and operation of municipal consortia	Improve legislative framework for public consortia. Allow municipal consortiums to directly take on financing obligations to public consortium legal entity.	Ministry of Cities; Brazilian Association of Municipalities.
Perception of municipal credit risk reduces private investments	Establishment of instruments to mitigate municipal credit risk.	Federal Government; Multilateral Bodies.
Perception of LED performance risk	Standardization/certification of equipment. Standardization of guarantees offered by manufacturers; other guarantee products, such as insurance.	Brazilian Association of Technical Standards; INMETRO; Insurance Companies; Ministry of Industry and Commerce.
Lack of standardization/certification of LEDs to allow products comparison	Equipment Standards/Certification	Brazilian Association of Standards, Techniques; INMETRO; Certification Companies.
Lack of standardization of COSIP design	Establishment of guiding lines to implement/adjust COSIP	Brazilian Institute of Municipal Administration (Instituto Brasileiro de Administração Municipal)
Fiscal Responsibility Law limits municipal finanancing (16% of Net Current Revenue).	Exclude investments without energy efficiency that improve municipal tax efficiency in time.	Federal Government.

Given the importance of COSIP's standardization to move forward public lighting projects, the table below presents some recommendations of standards in COSIP design that could be considered by municipalities when implementing or reviewing COSIP design.

Table 8: Recommendations for COSIP's design

Indexation Mechanism	•COSIP should to be indexed to electricity prices and other costs related to O&M, so that O&M tariff and /or services increases do not place municipalities at deficit risk. •If COSIP is indexed only to consumers' consupmtion, the budget for public lighting will be vulnerable to electric price variation.
Regular Reajustment Mechanism	• Municipalites should to establish in their own Municipal Law, a clear readjustment mechanism (potentially automatic) for all consumption ranges. This may mitigate (although it will not completely avoid) political intereference risks regarding COSIP's collection.
Possibility forecast of escrow account	• Earmarking COSIP's resources to an escrow account substantially reduces municipal credit risk perception. • Therefore, it is recommended that municipalities considering to atract investments for a modernization project include this possiblitiy in the law defining COSIP.
To explain the Purpose of COSIP's resources	•There are some legal debates regarding the acceptable uses for COSIP's resources, for example, questioning its use only for O&M, or if it would be applicable for retrofit investments. Municipal legislation must be clear in this sense to avoid future problems.
Rules for COSIP's collection	• It is important for the municipality and the electric utility to implement a robust agreement that makes clear COSIP's collection and passthrough mechanism (executed by the electric utility on behalf of the municipality). Futhermore, municipalites should have capacity to supervise this process.

Next Steps

This report identified several challenges and opportunities related to energy efficient investments in the public lighting sector in Brazil. The next step is to hold a wider consultation with public and private players, encouraging a dialogue among the parties. The World Bank Group has the goal of offering tools and data for decision makers from the public and private spheres so that that concrete proposals can materialize, leading to an effective agenda for the modernization of the public lighting sector in Brazil.