Energy Efficiency and Public Safety Improvements Through Street Lighting in Bishkek

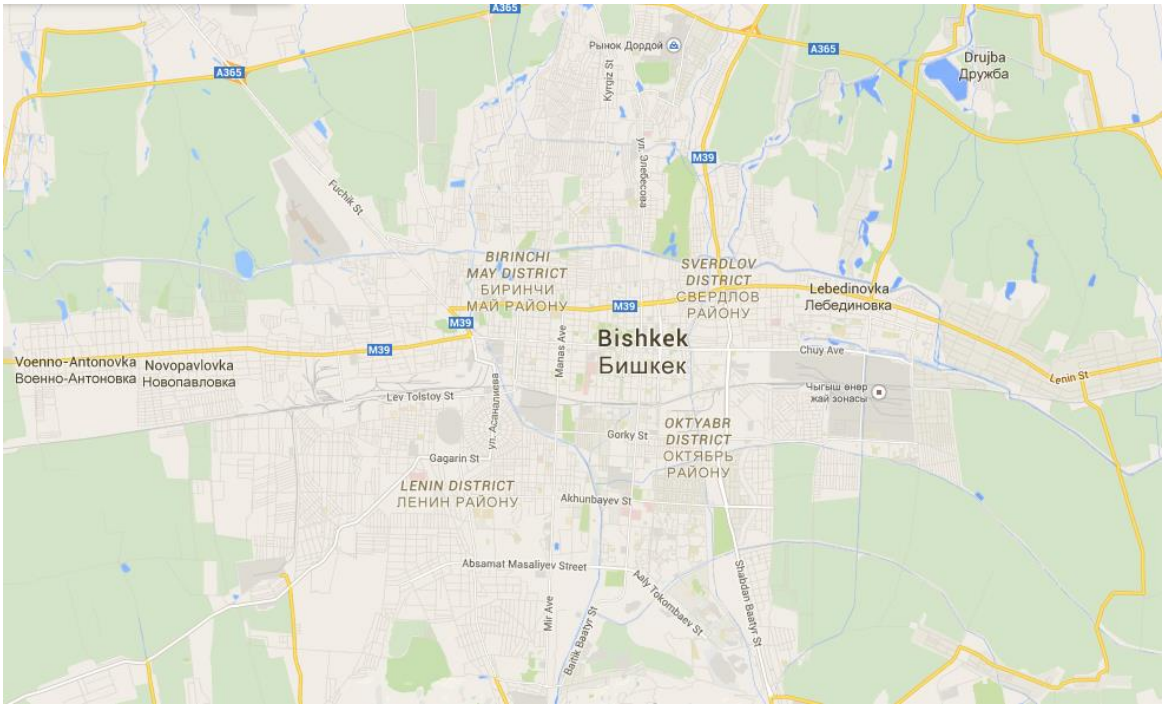
Pre-Feasibility Study

FINAL REPORT

Report prepared by Cities Development Initiative for Asia (CDIA)

for the Bishkek City Development Agency, Kyrgyz Republic

20 August 2015



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List of acronyms/abbreviations

ADB	Asian Development Bank
ASLM	Automatic Street Lighting Maintenance
BCFO	Bishkek City Finance Office
BCFD	Bishkek City Finance Department
CCTV	Closed-circuit television
City Council	Bishkek City Council
CDA	Bishkek City Development Agency
CDIA	Cities Development Initiative for Asia
CHP	Combined Heat and Power Plant
FS	Feasibility Study
IFI	International Financial Institution
GDIA	General Department of Internal Affairs
GIZ	Gesellschaft für Internationale Zusammenarbeit (German bilateral development agency)
GDP	Gross Domestic Product
GRP	Gross Regional Product
CAGR	Compound Annual Growth Rate
HU and LSSD	Housing and Utilities and Life Support System Department of Bishkek Mayor's Office
ICT	Information and Communications Technology
IP	Inclusion Point (also known as switch-on point)
KCPSRI	Kyrgyz City Planning Science and Research Institute
KR	Kyrgyz Republic
KfW	Kreditanstalt für Wiederaufbau (German government owned development bank)
LED	Light-Emitting Diode
LMP	Lighting Master Plan
MCD	Municipal Construction Department
MPD	Municipal Property Department

PFS	Pre-Feasibility Study
PMCD	Public Municipal Construction Department
PPP	Public Private Partnership
PV	photovoltaic
SSIW	Self-Supporting Insulated Wires
ToR	Terms of Reference

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Executive summary

A. Rationale

1. Bishkek is the capital and the largest city of Kyrgyz Republic (KR). It is located in the northern part of the country in the Chuy Province, at the foothills of Tien Shan mountain range. The city's population of 900,000 (based on 2009 census) is increasing at an alarming rate, and the current population of Bishkek is estimated between 1.2 to 1.5 million. However, the condition of street lighting in Bishkek is poor, with only 47% of the existing lighting points are operational. Existing infrastructure services are outdated and require massive refurbishment work. As a result, the poor visibility of the City compromises upon safety and security of its inhabitants, especially during evening and night hours.

2. The vision of the Street Lighting Project is for Bishkek to become a well-lit city where safety and security is ensured for all. In addition, the City has also targets to reduce its energy consumption of street lighting. This project has a strong possibility of having participation from the private sector as well as linkage towards climate change mitigation.

3. Bishkek's latest comprehensive street lighting development plan dates back to the 1980s. Since then, there is no new direction as to how the street lighting system of Bishkek should be expanded in accordance to the existing City's expansion plans. The Bishkek's General Plan developed by the Kyrgyz City Planning Science and Research Institute from 2002 to 2006, which encompasses the planning period until 2025, did not include the development plan for Bishkek's street lighting network, and was only partially open for public consultations in January 2015. The overall slowdown of the KR's economy and the unstable political situation has resulted in the major lack of financial resources for Bishkeksvet to address urgent infrastructure needs of the City. It is estimated that 90% of the projects require financing from the private sector.

4. Taking into the consideration that there are a number of high-level infrastructure development priorities of the City, there is a need for strong political will for the City to prioritize this street lighting project over other infrastructure needs. Bishkek's urban infrastructure development and the engagement in public-private partnership (PPP) received strong support from the Prime Minister Office of KR as well as the Ministry of Economy of KR, as the implantation of these development projects are seen a pilot for the entire country for future execution of infrastructure projects nationwide.

B. Impact and Outcome

5. The project's impact is enhanced personal security and public safety in Bishkek, with the outcome of improving the quality of outdoor lighting in the streets, educational and medical institutions, as well as courtyards of the city to reduce the number of street crimes.

C. Current Situation of Bishkek's Street Lighting

6. As of October 2014, the inventory record of Bishkeksvet indicates that there are approximately 31,000 lighting points throughout the city. Out of which only 59% of the street lighting network are operational, while the remaining 41% are not (19% long-term non-operational and 22% short-term non-operational). Street lighting in Bishkek is concentrated in the city centre, and the quality as well as availability of lighting in outer lying suburbs of Bishkek are visibly poorer or absent. It is estimated that an additional 15,000+ street lights is required to be installed in Bishkek, which also encompass the installation of lighting poles, lamps as well as electrical infrastructures.

7. Bishkeksvet's maintenance record indicates that the replacement rate of current street lamps is at approximately 100% annually. Street lamps installed in Bishkek have shorter lifespan compared to its supposed standards. This is due to the poor quality of lamps sourced, based on the city's criteria of least-cost procurement without any rigid technical specification and standards for the procured equipments. In addition, the poor conditions of power lines in Bishkek lead to voltage fluctuation, which causes the power lines, throttles or street lamps to break down, as well as other technical failures. At such, replacement of all existing lamps with LED lamps will likely to result in major damages on the replaced LED lamps.

8. With regard to power lines, Bishkek city's street lighting network covers 733 streets in the city and is equipped with 3,318.1 km of Bishkeksvet-operated power lines. Out of which 3,166.7 km are aerial power lines (only 1,703.5 km are operational) while the remaining 151.4 km consist cable power lines (only 141.7 km are operational). These power lines are deteriorating at an estimated rate of 60% - 65%. Out of the existing power lines, 1,472.9 km of it are reparable while the remaining 1,845.1 km need to be replaced by SSIW. However, to date Bishkeksvet has no sufficient financial resources to replace these power lines. The challenges faced by Bishkeksvet are further compounded by the fact that they were only given a printed copy of the map outlining the power lines of Bishkek's city street lighting network, developed by the Bishkek Contemporary Company in 2012. The electronic copy of the map was unavailable as Bishkeksvet did not have sufficient funds to acquire it.

9. The current conditions of street poles in Bishkek are in very poor shape. It is observed that many of the street poles are leaning, cracked, or being propped up by smaller poles as an interim measures. This is a severe safety hazard in the city of Bishkek. It is estimated that approximately 43% of the existing 24,975 poles require replacements. However, Bishkeksvet cannot perform major repairs and installation work as the authority for such engagement lies in the Municipal Construction Department (MCD) and the Public Municipal Construction Department (MPCD).

10. Currently, Bishkek city's street lighting network is operated through switch-on points (control pillars), and the centralized control panel of the city's street lighting network was built in the 1980s. However, the control panel went out of order by the early 2000s. As of 1 October 2015, there are 449 switch-on points, out of which 333 are operational while the remaining 116 are non-operational. 293 switch-on points are operated manually through stage-by-stage; 30 are operated through time relay; while the remaining 10 switch-on points are operated through the ASLM Systems, which was procured through local tender. Subsequent plans of purchasing ASLMs were not accomplished due to the City's lack financial resources.

11. Assessment on Bishkek's current street lighting situation substantiated the need for major refurbishment of the street lighting network. However, Bishkeksvet is limited by its competences and this prevented them from engaging in the much-required comprehensive development of street lighting network, major repairs as well as the construction of new infrastructures. The lack of adequate funding is also a major hindrance for Bishkeksvet to carry out these necessary refurbishments.

D. Regulatory, Financial, Social and Environmental Challenges

12. There are a number of provisions under the laws of the KR currently in place for individuals and legal entities to adhere to, which encompass standards for energy performance, energy efficiency audit, energy efficiency requirements as well as the establishment of non-state funds for the promotion of energy savings and innovations. However, it is noted again that the City is suffering from the lack of financial resources to carry out these initiatives. In addition, most of the requirements that are currently in place are deemed unworkable and are unenforced.

13. Furthermore, there is no mechanism in place for the City to foster energy savings and to introduce energy efficient technologies. This coupled with the lack of energy efficiency standards in the KR for other sectors of the economy to adhere to (with the exception of energy efficiency standards for residential buildings). In relation to the installation of LED lamps in Bishkek, the lack of national technical standards for LED lamps is an obstacle for Bishkek in its effort to modernize its street lighting network. In lieu of KR developing its own regulations and standards on this matter, it is recommended that Bishkek can adopt standards that are in practice in other countries, such as the US LED standards for the implementation of this project.

14. With regard to the financial health of Bishkeksvet, this Study concluded that current revenue is insufficient to finance the installation of proper street lighting in the City. However, it is also noted that Bishkeksvet has a healthy balance sheet without any existing debt which potentially allows the company to borrow to finance the capital costs. However, as noted later in the Report, Bishkeksvet would likely find it difficult to service any such debt.

15. The lack of street lighting in Bishkek has resulted in social insecurities, such as house thefts and street robberies. A social survey developed in December 2014 by this Study found that 69% of the surveyed population chosen street lighting as the priority public service desired, with almost half of the respondents consider the quality of present street lighting service to be below average. While 70% of street lighting in Bishkek consists of secondary street lighting, it has the largest number of dysfunctional lamps. Women, children and elderly are primarily affected by the situation, as it is unsafe for socio-economic life during dark evening hours. The survey also found that the respondents perceived quality street lighting in the City to be significant in improving the safety of the community. However, the criminal statistics provided by the General Department of Internal Affairs (GDIA) were not conclusive in linking the occurrence of crimes versus the quality of street lighting in Bishkek.

16. Poor road safety is also a major concern arises from the lack of street lighting in Bishkek. The number of road accidents in the City increased by 62.5% from 2012, with 2.898 accidents registered in the year of 2013. 60% of the accidents (1,736 registered) involved hitting of pedestrians. Number of injuries rose by 75%, while number of fatalities rose by 23.2% during the same time frame indicated.

17. In relation to the street lighting project, mercury lamps that are currently in use have the most harmful effects and the lowest energy efficiency compared with other lighting options. Faulty mercury lamps are being disposed in open waste container, and this resulted in severe health consequences and emissions of Green House Gases (GHG) in the City. Hence, provisions for recycling of mercury lamps are essential for Bishkek, to ensure that disposal of mercury lamps according to environment and health standards.

18. The main source of electricity generation in KR is from large hydropower stations across the country. There is one coal-fired CHP plant operating in Bishkek located in the centre of the city, which is a major source of air pollution. However, the City has not specified whether the source of electricity consumed in Bishkek, and particularly for street lighting is generated by the CHP, but it is unlikely that the coal plant makes a significant contributor to meeting the city's street lighting energy needs.

E. Targeted Project Benefits

19. Major social improvements can be expected from this project, such as increased visibility for drivers and pedestrian hence reduction in numbers of road accidents, increase sense of security in the City, improve the safety for children, women and the elderly, better control of unwanted spill lights and reduce light pollutions in residential areas, as well as intangible benefits (such as more livable cities, increased urban desirability and enhanced civic pride).

20. Emissions of CO2 are expected to be reduced over 50% from the current emissions. Other environmental benefits from this project also included carbon reduction, reduce petrol and fuel consumption due to less maintenance call outs, replacement of mercury lamps and reduce light pollution by controlling spill light.

F. Proposed Technical Solutions

21. There are several key considerations that need to be included in the proposal for the Bishkek's street lighting project. The proposal should encompass the following constraints:

    24.1. The current street lighting solution is inadequate for the City with high level of lamp failures, high number of short-term as well as long term non-operational lamps;
    24.2. Bishkeksvet is currently struggling to deliver their chartered responsibility of operating and maintaining a street lighting network for Bishkek;
    24.3. Significant remedial work is required on existing infrastructure to modernized the system up to an acceptable standards, including lamp units, wiring to lamp units, street poles and IP boxes;
    24.4. Proposed solutions will need to be able to cope with severe voltage fluctuation of up to (-) 40%;
    24.5. Technical specifications used to calculate project parameters be strictly tendered so that the solution will deliver the benefits evaluated by the project;
    24.6. Technical specifications that are tendered will need to be guaranteed by supplier; and
    24.7. Reduction in energy consumption including maintenance and operational costs by Bishkeksvet.

22. Given these highlighted constraints, LED street lighting will be the most appropriate solution for Bishkek's street lighting project. This involves the reparation and modernization of the existing street lighting network, replacing the existing 31,000 street lights in Bishkek with LED street lighting, remedial work to repair existing infrastructure, as well as the expansion of the network with additional 15,300 LED street lighting points installed at the outer suburbs of Bishkek.

23. The usage of LED street lighting will have a significant impact in reducing the consumption of electricity for Bishkek's street lighting network, as LED lighting technology is an energy saving product. It is expected to lower the operational expenditure of Bishkeksvet as well, where currently the City is spending half of its annual budget on electricity. LED lighting also have a longer product lifecycle of 50,000 operation hours (approximately 12 years), uses environmentally friendly materials and have an excellent colour rendering properties. These technical properties add to the long-term sustainability impact for Bishkek in using LED street lighting.

24. Usage of LED street lighting for this project will vastly increase the lifespan of street lights. The current lifespan of Mercury street lights of an approximately 1 year could be lengthen to an approximately 12 years with the usage of LED street lights. Energy consumption for Bishkek's street lighting will decrease for an approximately 55% from the current consumption rate. To achieve these estimated improvements and energy savings, the following are the technical specifications of the LED street light recommended by this Study:

    24.1. Input Voltage AC (85~265V);
    24.2. Frequency (50Hz);
    24.3. Life Span >50,000hrs;
    24.4. LED Lighting Efficiency 110lm/W;
    24.5. Luminaire Efficiency >90%;
    24.6. Power Supply Efficiency >90%;
    24.7. Power Factor >0.98;
    24.8. Colour Rendering Index Ra>80;
    24.9. Colour Temperature 2700K~5700K;
    24.10. Ambient Temperature 700K~5700TempeIP Rating IP65;
    24.11. Ecoting IP65ng IP65 700K~5700K;
    24.12. Materials LM06 equivalent Aluminium;
    24.13. 316 Stainless Steel fasteners;
    24.14. High intensity toughened glass.

G. Project Investment Cost

25. The overview of an estimated project costs is provided in the Table a below:

Table a - Project Cost Overview

		Qty	Unit Cost (av. USD)	USD
1.0	**Existing network**			**24,222,121**
1.1	Replacement of 31,000 with high quality LED street lighting units	30,967	578	17,898,926
1.2	Installation costs (local labour)	30,967	6	185,802
1.3	Installation support	16	1,600	25,600
1.4	Installation support overheads	1	8,000	8,000
1.5	Replacement of IP points (including wiring)	120	610	73,200
1.6	Replacement of 2343 street lighting poles	2,343	429	1,005,593
1.7	Remedial work on 16,750 lighting points	16,750	300	5,025,000
2.0	**Automation system**			**2,731,000**
2.1	Upgrade of 110 IP points	110	2100	231,000
2.2	Control automation system	1	2,500,000	2,500,000
3.0	**Expansion of the network**			**15,908,924**
3.1	Addition of 15,000 LED street lighting points, with luminaire, mounting arm, lighting pole, electrical works, installation, IP points	15,000	1,035	15,519,000
3.2	Addition of 350 LED street lighting points, with luminaire, mounting arm, electrical works, IP points	350	741	259,210
3.3	IP points for new network	214	610	130,714
	SUBTOTAL			**42,862,045**
4.0	**Engineering, Planning, Safety**			**2,143,102**
	5% of subtotal			2,143,102
	TOTAL			**45,005,148**

26. In order to reduce the initial amount of capital investment required for this project, this Study recommends for the project to be completed in three stages. **Table b** provides the financial expenditure breakdown for the 3 stages proposed for this street lighting project in Bishkek:

24.1. Stage 1 involves replacement and upgrade of the existing lighting network of 19,600 street lights, represents 63% of the remedial work required to restore the existing network and would have an energy cost saving returns of over 50%. Stage 1 also includes the upgrading of the automation control system.

24.2. Stage 2 involves the conversation of the remaining 11,367 lighting points on the existing networking, which represents 37% of the remaining required remedial work.

24.3. Stage 3 involves the expansion of the existing network by 15,350 lighting points in the outer suburban areas of Bishkek that do not yet to have street lighting service. This encompasses 350 lighting points to be installed on 14km of existing roads, as well as 15,000 lighting points for roads on an area of 600km that will need to be installed in Bishkek's outer suburbs.

Table b - Project Staging Summary

Stage	Description	Total (USD)	Cumulative Total	
Stage 1	Replacement of 19,600 street lights with new LEDs; Remedial electrical work (wiring) on 10533 street lighting point; Remedial work on 1476 street lighting poles; Installation of automation control system; Labour cost	**19,685,111**	**Stage 1**	**19,685,111**
Stage 2	Replacement of 11,367 street lights with new LEDs; Remedial electrical work (wiring) on 6198 street lighting point; Remedial work on 867 street lighting poles; Labour cost	**9,662,595**	**Stage 1 + 2**	**29,347,707**
Stage 3	Additional of 15,350 new street lights in suburban areas	**15,908,924**	**Stage 1 + 2 + 3**	**45,256,631**
Total		**45,256,631**		

H. Project Implementation Scenario

27. This project will be prioritizing improvements of street lightings in the most densely populated areas as well as the poorest areas of the City. Such implementation strategy will be done in three stages, in order to generate wider acceptance from the local population with tangible social impact experienced. This Study recommends the project to be stage in 3 phases, as follows:

    24.1. Phase 1 - Fully functional street lighting network;
    24.2. Phase 2 - Network expansion to densely populated residential areas and in most vulnerable/poor areas;
    24.3. Phase 3 - Network expansion in line with the city expansion plan.

28. The Chuy-Bishkek Regional Environmental Protection Agency has also offered to cooperate with Bishkeksvet to help achieve the environmental benefits of this project. Under the Agency, the Environmental Protection Fund could contribute about KGS 10-15 million (USD 160-250,000) for this street lighting project, for the strengthening of its ecological component and/or to contribute to the capacity building of Bishkeksvet.

Upon request, the Agency can also offer its ecological expertise without any charges to Bishkeksvet. In addition, the Agency could engage in the assessment of the viability of reviving the mercury lamp disposal section of a worsted cloth factory for proper disposal of the replaced mercury lamps.

I. Financial Implementation Options

29. The Study constructed a financial model which is incorporated with a Free Cash Flow calculation for the analysis of Bishkeksvet's financial standing and profitability from its operations. The timeframe adopted for the calculation is from 1 October 2014 to 31 December 2044, and is based on the financial data provided by Bishkeksvet. The Forecast period is selected for purpose of providing flexibility in the model.

30. This study produced three financial options that Bishkeksvet can engage in for the implementation of the street lighting project. These three scenarios reflect a mixture of different financing sources from concessional, commercial debts, grants and etc, based on the following assumptions:

30.1. The parameters of concessional and commercial debt are depicted below.

Concessional debt		
Item	Unit	Value
Start year	year	2015
Loan Tenor	year	13
Grace period	year	3
Interest rate	%	Libor + 1%
Front fee	%	0%
Commitment fee	%	0%

Commercial debt		
Item	Unit	Value
Start year	year	2015
Loan Tenor	year	13
Grace period	year	3
Interest rate	%	Libor + 4%
Front fee	%	1.2%
Commitment fee	%	0.6%

30.2. The Grant does not require principal and interest repayment;

30.3. Used cash flow is Free Cash Flow to Equity;

30.4. Discount rate (cost of equity) is 20.4%;

30.5. The amount of Capital Expenditures is equal to USD 45 million;

30.6. The Company's revenue represents reimbursement of operating expenses and inflows from ancillary services;

30.7. Savings from operating efficiency remains at the Company disposal.

31. **Table c** exhibits the results of the three scenarios based on the financial model for the street lighting project in Bishkek city. The results show that Bishkeksvet would potentially be able to finance this project. However, the current electricity tariff is low and there is a considerable amount of expenditure that falls under Capital Expenditure. Consequently, Bishkeksvet would not be able to repay any debts incurred via the financial savings achieved from lower energy consumption arising from the installation of LED street lightings in Bishkek.

Table c - Results of Financial Model for Street Lighting Project

	Concessional Debt	Commercial debt	Grant	CAPEX	Cost of Equity	IRR	NPV, KGS ths
Scenario 1	0.0%	55.2%	44.8%	45 mln. USD.	20.4%	20.4%	0
Scenario 2	34.0%	0.0%	66.0%		20.4%	37.0%	525,296
Scenario 3	77.9%	22.1%	0.0%		20.4%	-	820,461

J. Legal and Institutional Implementation Options

32. This study identifies two legal mechanisms – trust management and public-private partnership – that may be applied for the management of Bishkeksvet for the implementation of this street lighting project in Bishkek.

33. Trust management mechanism involves the Municipality of Bishkek to transfer the property complex of Bishkeksvet into the trust management, which have the necessary professional knowledge and skills required to manage Bishkek's street lighting network. The best way to procure the trust management service is through a two-stage bidding process. This process allows flexibility for the Municipality to reevaluate the terms of bids and decision-making process upon the completion of the first stage. The estimated time of completion is 4 to 6 months,

34. The Municipality may also engage a private partner for the financing, designing and building of new street lighting facilities, as well as the rehabilitation, reconstruction and management of street lighting networks in Bishkek. The preparation and holding of the tender and signing of the PPP agreement can take from several months to one year and more. However, the use of PPP might involve a number of complexities related to the imperfection of legislation and the lack of PPP practice in the KR. More importantly, as discussed further below, while a PPP arrangement may potentially be legally feasible (if difficult) it is unlikely to be financially attractive to any private party.

Table d - Risk and Solution of Legal and Institutional Implementation Options

Implementation Option	Risk(s)	Solution(s)
Trust Management	• Lack of experience of the Mayoralty in transferring municipal assets into trust management • Little incentives for private investors due to short term agreement (up to 5 years) • Risk of disputing the tender procedures	• To ensure the properly drafted tender documents • To ensure the open and transparent tender process • To ensure the properly executed agreement between the Mayoralty and the private investor.
Public-Private Partnership	• Lack of experience in initiating and carrying out PPP projects • Complexities of preparing tender documents and the PPP agreement	• To ensure the properly drafted tender documents • To ensure the open and transparent tender process

	due to lack of experience • Risk of disputing the tender procedures, etc.	• To ensure the properly executed agreement between the Mayoralty and the private investor.

H. Financial Mechanism

35. Within the framework of the above proposed management mechanisms, this Study examined the different financial mechanisms that the Mayoralty / Bishkeksvet / private investors could consider for the implementation of this project. **Table e** below presents with the analysis on the feasibility / viability of the different financing mechanisms available, risk as well as solutions for each option.

Table e - Risk and Solution of Financial Mechanisms

Financing Mechanism	Feasibility / Viability	Risk(s)	Solution(s)
Grant Scheme	• Only limited amount of grant could be obtained from National government • Consideration of obtaining grant from foreign States or international/foreign/local organization instead.	• Complexity / difficulty of securing a grant	• To start grant search through international partners working in KR
Loan / Credit	• Problematic in receiving loan/credit due to full budgetary dependence as well as lack of revenues and liquid assets.	• Complexities of loan seeking for a non-profitable project (when all costs are included)	• To start negotiations with IFIs working in KR
Finance Lease	• Only an insignificant part of the capital expenditure that is necessary for this project.	• Tax and customs consequences arising from import of equipment	• To explore tax and customs consequences arising from import of the equipment acquired under finance lease.
Energy Service Contract	• Current electricity tariffs are too low to ensure technical feasibility and economic viability of the project and correspondingly to attract private partners.	• Lack of legal regulation of relationships arising from energy service contracts and unattractive to a private party	• To stipulate details in the agreement with the private investor
Involving Citizens in Co-Financing	• Require supports from the Mayoralty, the City Council and the general public and amendments to the laws of the KR, which may deemed it unpopular	• The lack of legal regulation • Public opposition to introduction of street lighting fees	

Increasing Bishkeksvet's Budget	• Not feasible due to the necessity of envisaging these amounts in the republican budget and the obligation to repay the loan within the budgetary year.	• The lack of funds in the Mayoralty • The City Council's refusal to increase the budget	• To make a well-substantiated and feasible technical and financial proposal stating the need and reasonableness of increasing the budget of Bishkeksvet

I. Recommendations

36. The Bishkek's Lighting Master Plan will need to be developed in line with the expansion projections of the General Plan by the Kyrgyz City Planning Science and Research Institute (General Plan developer) and Bishkek Head Architecture Department (General Plan implementer).Emphasis should be place on the new settlements in the City (*novostroiki*) as it is estimated to cover 1/3 of Bishkek's territory which is poorly equipped with infrastructure services as well as absent of street lightings.

37. Bishkek city is unlikely to afford to modernize its street lighting network with high quality LEDs unless it can secure high financial sourcing from an International Financial Institution (IFI). A review on non-LED lighting options at the Feasibility Study (FS) stage should be included, which would be a more affordable option and likely to reduce the pollution level of current usage of mercury lamps.

38. Further data gathering and analysis on the impact of poor quality of street lighting in Bishkek city on the overall safety of the City, particularly on road safety as well as social integration of vulnerable groups (women, children and elderly) should be conducted at the FS stage.

39. Street lighting is seen as an important part of the City's development, yet not viewed as a top priority. Bishkek's street lighting project will only receives strong political backing at the higher political level if it brings about visible and tangible improvements to the City's population, in the mean time does not consume significant portion of the available funds of the City.

40. Implementation of this project should be implemented in three (3) stages (Point 26) in order to reduce the initial amount of capital investment required for this project.

41. A detailed investment proposal on artistic street lighting to promote Bishkek's cultural and touristic attractiveness can be included in the future to improve the City's attractiveness, develop a City's identity as well as raise the City's profile regionally and internationally.

42. The FS of this project should further examine into the energy security of KR in lieu of the overdependence on hydropower stations, which provides solid ground for energy efficiency measures. Energy efficiency target of this project should be further examined with regard to its overall contribution towards reducing the air pollution in Bishkeksvet. Provision for the disposal of mercury lamps needs to be address in the FS as well.

43. Further exploration should be done into the potential cooperation with the Chuy-Bishkek Regional Environmental Protection Agency for this project (Point 28).

44. The CDA and Bishkek municipality shall draw the attention of the Government of KR to the lack of legal and regulatory framework in regulating street lighting. This encompasses the absent of technical standards for street lighting and LED lamps, as well as energy performance and efficiency standards. Technical regulations of the Eurasian Economic Union shall be considered in correspond to KR's international obligations.

45. Current institutional and structural systems are limiting the competences of Bishkeksvet in managing the operations of the street lighting network in Bishkek city. Amendments into the local acts that govern interactions between municipal bodies could be considered to provide more independence to Bishkeksvet in decision-making, in conducting its economic activities as well as eliminating the barriers to participate in state/municipal procurement.

46. The City can consider the following the two mechanisms of Trust Management and Public-Private Partnership (Point 33, 34) to the management of Bishkeksvet, along with the applicable financial mechanism options for this street lighting projects (Point 35).

1. Introduction

1.1 Background Information

CDIA is a regional initiative established in 2007 by ADB and GIZ, with additional support of the governments of Sweden, Spain and Austria. The Initiative provides assistance to medium-sized Asian cities to bridge the gap between their development plans and the implementation of their infrastructure investments. CDIA uses a demand driven approach to support the identification and development of urban investment projects in the framework of existing city development plans that emphasize environmental sustainability, pro-poor development, good governance, and climate change.

The long-term aim of CDIA is to contribute to the promotion of sustainable and equitable urban development, leading to better living conditions for all in Asian cities.

In August 2012, CDIA received a preliminary letter of enquiry from Bishkek city. In September 2012 CDIA fielded a fact-finding mission, which was followed by a formal application by Bishkek city in October 2012. CDA, the lead city institution responsible for developing and introducing city development programs, sent to CDIA the application signed by the First Deputy Mayor and supported by an endorsement letter of the national government. The application stressed the need for support in preparing three PFSs. From the three, CDIA has decided to **support a PFS for 'Energy efficiency and public safety improvements through street lighting in Bishkek'**. The street lighting project has a **strong linkage to possible private sector participation and climate change mitigation**. The Prime Minister Office of KR and the Ministry of Economy of KR both strongly support urban infrastructure development and PPP arrangements of the city as a pilot for the entire country.

Street lights in Bishkek are in poor shape. Only 59 per cent of the existing lighting points are operating. This context compromises safety and security in evening and night hours. On June 25, 2014, the City Council approved the Bishkek Socio-Economic Development Program for 2014 – 2018 "Open Opportunity City"

Estimating the condition of street lighting in the city, the Program states the following: «*Most of city streets today remain unlit, while outdoor lighting of multi-apartment residential buildings leaves much to be desired. Street lights in new-built areas of the city are almost absent. Deficient street lighting is not only making the living conditions of city residents uncomfortable but is also negatively affecting the crime situation in the city and traffic safety during the night time. … Lack of a centralized management system and systematic theft of electrical equipment negatively affects the efficient maintenance of the city's street lighting network. Inadequate financing*

prevents the use of modern technologies in the field of street lighting including LED-based lighting. New design for light fixtures to be installed in public parks and squares is not in place».[1]

One of the key objectives of the Program is to enhance personal security and public safety in Bishkek.[2] One of the ways to achieve this objective is to improve the quality of outdoor lighting in the streets, educational and medical institutions, and courtyards of the city to help reduce street crime.

The PFS goal is to provide Bishkek city authorities with research and recommendations which can help to achieve the indicated Program's objective.

The vision for the project is for Bishkek to become a well-lit city by providing for an appropriate lighting system, where people feel safe on their night-time journeys. At the same time, the city has set a target for reducing energy consumption for lighting. The PFS will define strategies for the design and engineering of street lighting. Important criteria taken into consideration are safety and security for vehicles and pedestrians on the roads and in the public spaces; reducing crime and increasing safety and security, especially for women and children; environmental protection; urban design; lighting engineering; economic efficiency and energy consumption. The challenge is to identify affordable investments while providing for an economically beneficial long life cycle of the proposed system.

1.2 PFS objectives

The **PFS objective is based on the socio – economic, financial, institutional, technical and legal analysis of the** Bishkek street lighting system, to provide Bishkek city officials with recommendations related to:

- **Modernization/ replacement of the street lighting system**, improvement of energy efficiency and potential integration of the street lighting infrastructure with other services such as information and communications technology (ICT), closed-circuit television (CCTV) and advertisement;
- **Options for project structuring** with a preliminary assessment of the potential for private investment and financing opportunities; and
- **Institutional development**.

The PFS report includes a project description on a conceptual basis, an assessment of potential project impacts - environmental, institutional, social, gender, economic and financial analysis, a risk assessment and recommended implementation arrangements. The PFS report ensures that proposed investments contribute to environmental sustainability, climate change adaptation/mitigation, poverty reduction, inclusiveness and good urban governance. The PFS report identifies issues to be further studied in a Feasibility Study.

[1] Bishkek Socio-Economic Development Program 2014-2018, Section I – Key Bishkek city development targets. Current situation analysis. Street Lighting.
[2] Bishkek Socio-Economic Development Program, Section 1 – Key public safety objectives.

1.3 Team of consultants

The PFS team of consultants (further referred to as the Team of Consultants) consisted of CDIA coordinators, financial consultant (individual through firm), legal consultant (firm), social, environmental and urban development consultant (individual), and technical consultant (individual).

The PFS was implemented from May 2014 to March 2015, with most consultants joining the Team in November 2014.

Table 1. Team of Consultants

Organization	Expert	Function	Contact details
CDIA	Sasank Vemuri Stuart King	Team leader	sasank.vemuri@giz.de stuart.king@cdia.asia +63 2 631 2342
Ernst & Young	Jannat Salimova-Tekay	Financial consultant	jannat.salimova-tekay@kz.ey.com +7 727 259 6228
Kalikova & Associates	Gulnara Kalikova Magomed Saaduev Albina Rakhmidinova Azima Bokoshova	Legal consultant	gkalikova@k-a.kg msaaduev@k-a.kg arakhmidinova@k-a.kg abokoshova@k-a.kg +996 312 66 60 60
Independent consultant	Olga Chepelianskaia	Social, Environmental and Urban Development consultant	olga.chepelianskaia@ergterra.org +91 98 1085 9185
Independent consultant	Pauline Muscat	Technical consultant	muscat_pauline@hotmail.com

1.4 City Focal Point

The Mayor's Office designated the CDA a municipal institution responsible for developing and introducing city development programs, as the focal point for the project. The CDA plays a

central role in coordinating the PFS development with the Team of Consultants and assisting the Team of Consultants with scheduling meetings during city visits and officially requesting information from relevant stakeholders when required. The Team of Consultants regularly liaises with the CDA, informing the CDA on progress and sharing all concerns of importance to the project.

Table 2. City Focal Point

Organization	Expert	Function	Contact details
CDA	Azamat Usubaliev	Director	ausubaliev@meria.kg +996 312 32 53 25
	Marat Alymkulov (up to October 2014 focal point was Munarbek Omarov)	PPP Expert	alymkulov.m.ch@gmail.com +996 558 85 05 05

1.5 Project Approach

The PFS was developed through the following steps:

- **Data and documentation gathering:** Information requests have been addressed to the CDA and/or directly to relevant organization during consecutive city visits. Most city organizations shared documentation only upon official request from the municipal authorities. Therefore, CDA's assistance in formally soliciting data from relevant organizations has been essential for successful data collection, although each consultant is responsible for providing CDA with the data list relevant for their part of the PFS and additionally liaising with concerned organizations.
- **Documentation review and analysis:** Consultants have established an internal documentation database, to which collected documents and data are uploaded on a regular basis and thoroughly analyzed;
- **City visits:** Data collection, detailed discussions with relevant stakeholders and site assessments. Three city visits were undertaken between May and December 2014;
- **Regular conference calls and electronic communication** between the consultants to coordinate work, share collected information and discuss findings;
- **Interim report preliminary outcomes presented to the city stakeholders** in January 2015;
- Interim report shared with CDA in March 2015;
- Interim report translated into Russian at the request of CDA;
- CDA collected comments and questions to the Interim report in June 2015;
- Final report presented in August 2015.

2. Bishkek Urban Development Context

2.1 Socio-Economic Parameters

2.1.1 Introduction

Bishkek is the capital and the largest city of KR, located in the northern part of the country, in Chuy valley at the foothills of the Tien Shan. Administratively, Bishkek is divided into 4 districts. According to the census conducted in 2009, the population of Bishkek is divided as follows:

- Oktiabrskiy district – 242,382 people
- Pervomaiskiy district – 171,500 people
- Sverdovsk district – 231,801 people
- Leninskiy district – 201,626 people

According to the 2013 Bishkek Investor's Guide, as of 1 January 2013 the total population stood at 924,400 people.

Climate is continental with long hot dry summers and cold short winters. The average annual temperature is about +11.3 °C. The coldest month is January (-2.6°C), the warmest – July (+24.9°C). Bishkek is located on the extreme southern position of the continental climate of temperate latitudes and is located at an altitude of 790 meters above the sea level

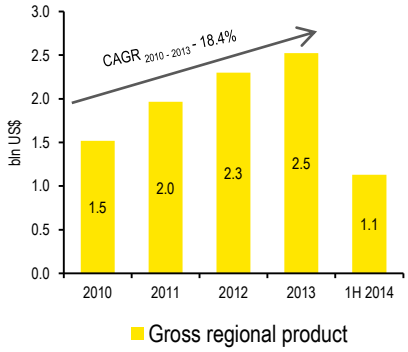
Area – 169.9 sq. km

Emblem of Bishkek

Bishkek is the economic center of KR contributing 38% to the country's GDP. The volume of GRP of Bishkek city amounted USD 7.55 billion in 2013.

Over past 5 years the CAGR of GRP was equal to 21%. In 2013, GRP per capita was equal to USD 2,500, which is 7.4% more than in 2012.

2.1.2 Macroeconomic overview



Source: CDA, public sources

Table 3. Main Economic Indicators

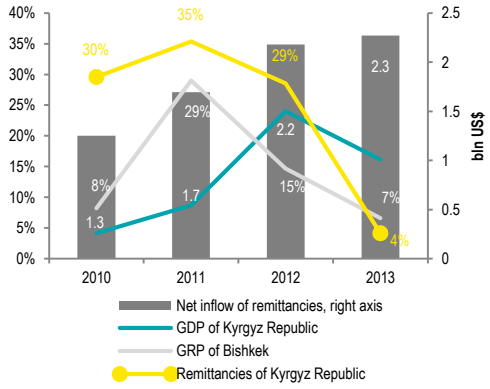
Indicators	2010	2011	2012	2013	CAGR 2009-2013
GRP, billion US$	1.52	1.97	2.3	2.53	18.4%
The volume of market services rendered, million US$	3,057	3,761	4,102	4,595	14.6%
Trade turnover, repair of vehicles, household goods and personal items, million US$	2,004	2,475	2,726	3,016	14.6%
The volume of industrial products (excluding supplied raw materials), million US$	449	536	575	568	8.2%
Investments in fixed capital, million US$	238	236	294	375	16.4%
Average monthly nominal wage, US$	197	239	274	292	13.9%
Sources: City Development Agency					

Industrial activities of Bishkek are declining as most factories were built during the Soviet times and have not been refurbished since. Economic growth currently comes from two main sources: remittances and unorganized trade.

Remittances: Funds received from migrant workers abroad (remittances) were equal to USD 1.9 billion, which comprises 26% from GDP of KR. Bishkek city is a major target of remittances from abroad due to a high outflow of external migration over the past years.

The stability of inflows depends on access to financial services of senders and recipients, economic and immigration conditions of countries where they migrate, etc.

Changes of GRP, GDP and remittances inflow



Source: City Development agency, public sources

Wholesale and retail trade: In 2013, the volume of market service rendered accounted for USD 4,595 million, which is 12% more compared to previous year. Approximately 64.4% of services (by trade turnover) is auto and motorcycles services. The main wholesale buyers are foreign citizens from Kazakhstan, Russia and other CIS countries, who purchase goods in

Dordoy bazaar from inside

Bishkek markets at wholesale prices and transport across the border. Dordoy market is considered to be the main source of wholesale and retail trade. Most of goods arrive from China, with the second largest source, which is around 20-25% of all imports, being Turkey.

Dordoy is the largest market in Central Asia, comparable to Bangkok's Chatuchak week-end market, with an average annual turnover reaching USD 2.8 billion over the past years. However, recently it started facing decrease in trade volumes.

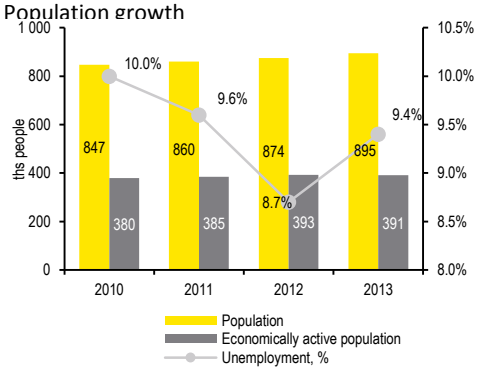
Production: In 2013, the volume of industrial products, excluding supplied raw materials, was equal to USD 568 million, or 25% of GRP. Main segments of industrial production are the following: mechanical engineering and metals, light and food industry and energy.

The largest production enterprises in Bishkek:

- Dastan corporation, production of medical technical equipment;
- Worst and wool factory;
- Coca-Cola Bishkek Bottlers;
- Bishkek Dan-Azyk, flour mill;
- Bishkeksyut drinks and beverages;
- Bishkek Machine Engineering Plant.

Demography

As of January 2014, the population of Bishkek was equal to 915,700 people, which is a 2.4% growth from the previous year. The population density is equal to 5,307 people per sq. km. In 2013, natural growth rate of population in Bishkek was equal to 6.9%. There are about 80 ethnicities registered in Bishkek, with Kyrgyz ethnicity composing 70%, Russian – 19% and other – 11%.



Source: City development

A decline in the share of Russian citizens tends to is observed over the past few years. In 2013, the number of Russians was equal to 173,800 people, compared to 188,100 in 2009, with 1.5% of average annual decline. The negative effect of Russian and other nationalities could be related to unstable political situation in Bishkek since 2005.

Bishkek has one of the lowest fertility rates in KR. In 2012, the birth rate was equal to 25 infants per 1,000 inhabitants.

As per the census of 2009, men accounted for 46.6% (426,300) from total population of Bishkek and women – for 53.4%. Population below working age is about 27 % from total, working age – 65%, retired – 8 %. Unemployment rate was equal to 8.7%, similar to the country's unemployment rate, which is equal to 8.4%. **From total number of unemployed, the highest proportion comprises women – 65.4%**.

Table 4. Demographic Characteristics

Indicators	2010	2011	2012	2013	CAGR 2009-2013
Birth rate, %	103.4	99.2	105	100	(1.1%)
Number of births per year, thousand people	87.5	85.3	91.8	89.5	0.7%
Mortality rate, %	96.9	98.4	93.4	93.1	(1.3%)
Number of deaths per year, thousand people	82.0	84.6	81.7	83.3	0.5%
Natural growth rate of population, %	6.5	0.8	11.6	6.9	2.0%
Economically active population, thousand people	379.9	385.1	392.8	391.3	1.0%
Sources: CDA					

Internal migration gain in Bishkek accounted 4,388 people in 2013, while external migration outflow – 2,781, and this figure fell by 24.4% compared with 2010. From 2010 – 2013, due to the establishment of a political and economic situation in KR, the reduction in both indicators was indicated. Nevertheless, a high migration outflow to other countries was observed. Generally, migrant workers, who temporarily work abroad, are included into this category.

2.1.3 Social overview and poverty level

Bishkek poverty rate is estimated at 5,2% of the population. The poverty threshold is about twice higher than the national threshold: a monthly pension of KGS 4,709 for a retired person living in a household of two or more people versus KGS 2,886 at the national level. Indicatively, retirement pensions rose to KGS 6,244 in October 2014. Minimum monthly income remains however very low, at KGS 705, or about USD 12.

Bishkek's budget is socially oriented: Health and education are primary areas of the city budget and take about 70% of total municipal expenses.

2.2 Urban planning and infrastructure

Analysis of urban planning and infrastructure development plans shows that the city currently faces a number of high-level priorities. In such context, it is important to understand and keep in mind those priorities when selecting the best financing option for the street lighting project. First, the section below shows that a **strong political decision is required to prioritize the street lighting project over other urban infrastructure development needs**. Second, the technical and financing option selected should be such that the project brings tangible and visible benefits to the citizens while the cost does not undermine the Municipality's ability to conduct other activities of importance for the citizens.

At present, there is no comprehensive street lighting development plan. **A lighting Master Plan (?) will need to be developed at the feasibility study stage**.

General Plan and city infrastructure development plans

Description

Kyrgyz City Planning Science and Research Institute worked on developing Bishkek's **General plan** (equivalent of a Master plan) from 2002 to 2006, on the basis of an earlier version of the General Plan dating back from 1990. The General plan covers the period up to 2025. It has been partly open to public consultations in January 2015.

The General plan is a national level document, approved by the KR government upon agreement with the Municipality. Its implementation falls under the responsibility of **Bishkek Head Architecture Department**. The General plan is not confined to administrative territory borders of Bishkek city, but on its basis borders can be revised when required. While this approach provides positive flexibility for the city's expansion, lack of clear municipal boundaries at the same time makes infrastructure planning more difficult.

The General plan contains an assessment of Bishkek's urban conditions, a development strategy and provisions for future city development. However, infrastructure networks' planning (roads, distribution lines, street lighting, sewage and drainage networks, etc.) is not included in the General plan and was left to further detailed **micro-planning**. The city was divided into **9 areas** for that purpose. As of December 2014, one out of nine areas' detailed planning was under review and the central area's detailed planning was under preparation.

As a result, **the latest comprehensive street Lighting Master Plan dates back from 1980**. **There is no vision on how street lighting should be expanded in accordance with the city expansion plans. Both the street light planning and estimates of additional voltage capacity required are absent** while rapid construction puts an increasing load on the existing capacity.

Another major challenge to implementing the General plan is an overall slow down of the economy and an unstable political situation. **A major lack of financial resources prevents the Municipality from addressing urgent infrastructure needs**. Indeed, 90% of required financing is expected from the private sector. For this reason, potential PPPs are highly regarded in urban infrastructure development.

Challenges

Landscape conditions carry relative natural risks and require adequate attention during the city's infrastructure services planning phase

Bishkek is located above the sea level, at an altitude that varies from 600 to 1000 meters. The city is surrounded by mountains, particularly prominent in the South. **The whole country is located in an active seismic zone**: there is an average of 100 vibrations a day, usually not felt as they measure below 2.0-3.0 on the Richter scale. **Issyk-Ata seismic fault is located near Bishkek.** Taking into consideration the outdated city infrastructure, a major earthquake would represent a serious danger. Construction norms prohibit high-rise buildings, but new technologies make it possible to build higher than 10 floors.

The Big Chuy Canal crosses the city in the middle from West to East, and two smaller Chuy canals run from West to East in the Southern part of the city. Two streams, Ala-Archa and Alamedin,

cross the city from North to South. These **water bodies play an essential role in preventing flooding**, in particular during the snow melting time. Strengthening measures take place every year. In 2012, water overflew into the Osh market, located near the Ala-Archa stream. Canals and streams' water is also used for irrigation.

Fast population increase is hardly supported by adequate infrastructure development

The General plan assumes the city's population to be 900,000 inhabitants and commends that it should not cross the threshold of 1,2 million people, which is the maximum that natural landscape conditions allow. However, the latest population census conducted in 2009 showed that the population had already reached 900,000 people and, since 2005, the increase has taken alarming rates. At present, most modest estimates assess the population to between 1,2 and 1,5 million and the migration process remains very active.

The General plan recommends **city expansion** to avoid further increase of the population density. City expansion plan is indicated in red in Figure 1. Expansion is ultimately expected to enlarge the city's territory from up to 150 km2 to almost the full Chuy region. Expansion is particularly recommended to the **East** and to the **West**: up to the town of Kara-Balta (60km West from Bishkek) and the town of Tokmok (60km to the East from Bishkek). The **city center** has seismic conditions of up to 8.0 on the Richter scale: it requires urgent reconstruction of those buildings that do not correspond to seismic standards. The city plans to replace private houses with new high-rise buildings responding to those standards. The **South** expansion is limited by the mountain range and additional construction is now prohibited as it is the most densely populated part of the city along with the city center. At the same time, it has better soil conditions to take additional constructions compared to the other parts of the present city area. The **North** has bad soil conditions and ground water is as close as 10 meters below ground, construction is therefore limited. Extension of public transportation networks is planned in line with the city's expansion: electrifying parts of the railway and starting electric trams to the neighboring areas in order to facilitate commuting for work are the main General Plan's provisions.

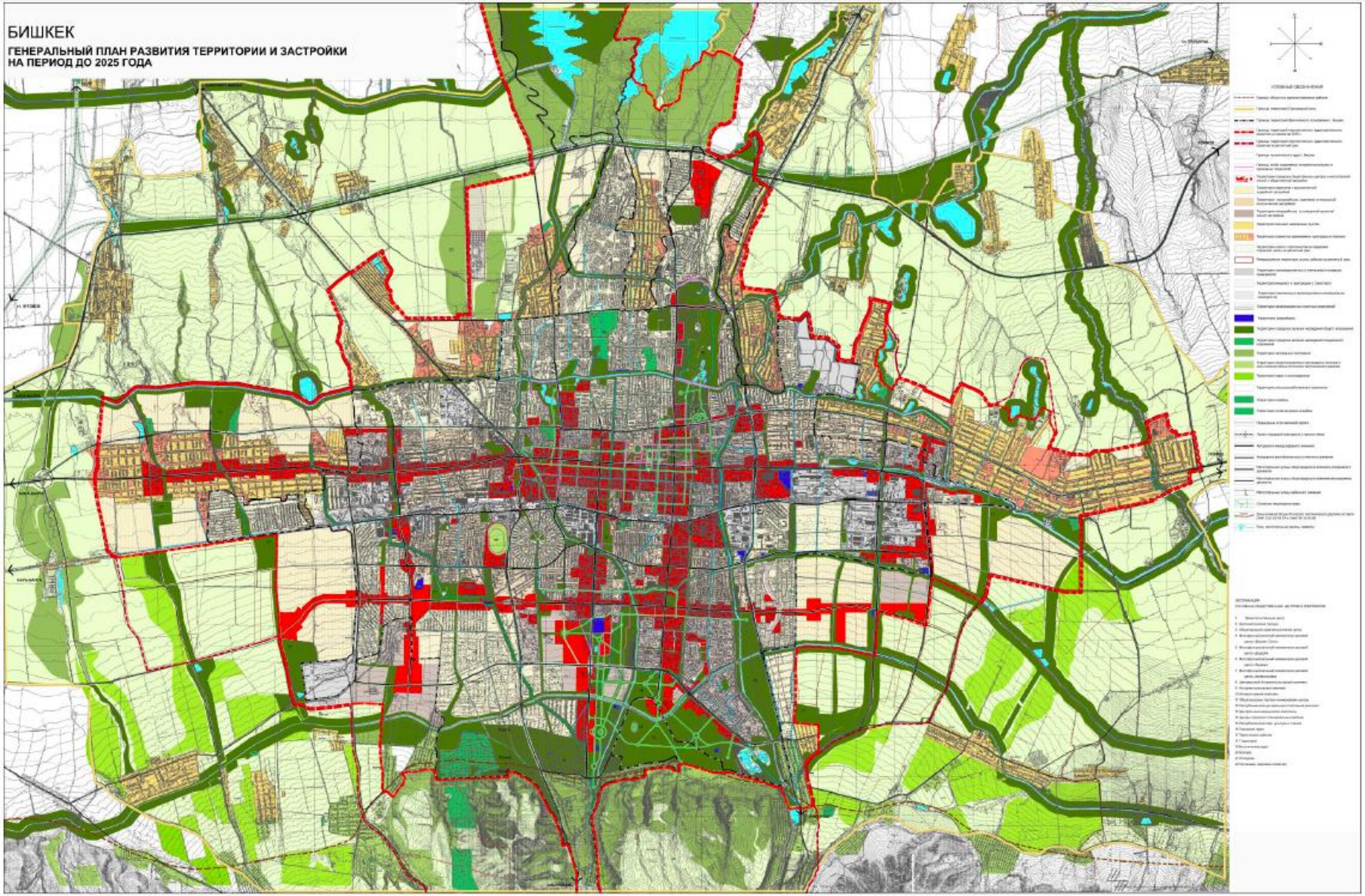
Encroachments have been massively practiced since the early 1990ies and resulted in **1/3 of the city's territory being covered with illegal settlements, commonly referred to as *novostroiki*, or *new settlements*. Geographically, these areas form a ring around the city and are composed by 47 residential areas.** They are mostly one-floor residential houses, hardly connected to the city's infrastructure services. A dedicated department, the *Public State Capital Construction Department*, is in charge of infrastructure services in these areas. **Street lighting is absent in most of the areas**, except in selected ones that requested the local elective representative to intervene.

As the city is rapidly growing, construction development happens at a much faster pace than the development of infrastructure networks. This puts unbearable pressure on infrastructure networks such as substations, distribution lines, gas supply pipes, central and local heating and water supply pipes submitted to high stress, or overloaded sewage and drainage networks.

Legal void for construction development

REQUEST FROM THE MUNICIPALITY: Land-use planning and legal zoning need financial resources to be developed. The City Lead Architect and the KCPSRI have formally requested CDIA's assistance with those activities.

Figure 1. General Development Plan of Bishkek City by 2025



2.3 Bishkek City Development Directions

All infrastructure services are outdated and require massive renovation, replacement and/or extension. At the same time, rapid construction continues and new settlements, covering about 1/3 of the city's territory, mostly stay out of those network coverage.

The Municipality has therefore important challenges in both improving on the existing networks and on extending them. These challenges will require a significant financial contribution.

The **Socio-Economic Development Program for 2014-2018: City of Open Opportunities** (below referred to as Program) was developed jointly by all relevant municipal stakeholders taking into consideration results of public consultations and approved by the City council. The Program has three directions:

1. **Safe city**

   In order to increase safety, the city increased the number of local militia points from 71 to 113 in 2013. The project Safe City is currently under a feasibility study. Among implementation steps, the program plans to increase the municipal budgetary contribution to safety and to provide access to street lighting on primary and secondary streets, in residential areas, as well as near buildings of public importance, such as schools and hospitals.

2. **Comfortable city**

   This part of the Program sets targets to reach in providing infrastructure services. Overall, **infrastructure networks require large investments for modernization**. Targets for selected key areas are provided below:

   Heating

   The only **cogeneration plant** operating in the city covers for about 80% of high-rise buildings (2 floors and above) or about 1/3 of the city. It already operates at full capacity and cannot provide heating to the newly constructed residential buildings. Its pipes operate with losses of about 20%. There are discussions about potential Chinese investment into the refurbishment of the cogeneration plant.

   The municipal enterprise **Bishkekteploenergo** provides the remaining 20% of heating with about 135 km of heating pipes and 62 boilers. Most of its equipment and pipes haven't been replaced since the installation. The Program recommends a replacement of at least 20 km of heating pipes per year.

   Private one-floor houses are mainly heated by the inhabitants themselves: they buy coal or wood.

Solid waste management

The solid waste management chain suffers challenges at every step, from collection to landfill disposal. One non-sanitized landfill is located near the city and is overloaded. EBRD assisted the city with developing a feasibility study and a project addressing the issues, including the establishment of a new sanitized landfill and a partial waste recycling. **However, there are no provisions for mercury lamps disposal and recycling in the project.**

Awareness building among the population is considered one of the key components of the project success.

Water supply and wastewater treatment

Raw water's only source is ground water. Water pipes system is overloaded and cannot take on an additional load with new constructions. EBRD is making an assessment of the sector and will provide recommendations in the near future.

Vodokanal operates city's sewage lines, of a combined length of 660 km, which cover the city except for the new settlements (30% of the city). **One single sewage treatment plant** is operating: it performs primary and secondary treatment with no tertiary treatment available. Treated water is then discharged in the Chuy Canal. Sewage pipes mostly do not cover the new settlements.

The program includes a staged replacement and enlargement of water and sewage pipes.

Roads

According to the General Plan, roads are designed for 50-60,000 vehicles, while all together about 400,000 are in circulation[3]. Building (or repairing?) a highway crossing the city is considered as a priority. Once it is finalized, a number of existing roads should be enlarged and additional roads should be made. The city has received a grant from the Chinese government or the Chinese private sector to renovate three major roads.

Public transport

Public transportation service covers 100% of the city, including the new settlement areas. Buses have 15 trajectories and 160 units, while trams have 9 trajectories and 105 units. However, 85% of buses are microbuses run by private individuals and the tram coverage has significantly decreased from the Soviet Union times.

[3] Source : Interview with Chuy-Bishkek Environment Protection Agency

3. Successful city

The third direction of the Program targets making Bishkek an attractive destination for investments, highly educated human resources and tourists. The objective is to overcome the city's relatively locked geographic position and boost its attractiveness.

2.4 Bishkek – City of Tourism and Culture

Bishkek city Tourism Development Strategy was developed by the City Department of Culture and Tourism in 2014. The Strategy emphasizes on strong sides of the city, such as its strategic position to reach other places of tourist significance (ex. Issyk-Kul), availability of historical monuments and museums, green avenues and parks, developed hotel infrastructure, center of business conferences, large variety of restaurants, a number of annual events of national and international significance.

At the moment, 80% of tourists stay in Bishkek less than 24 hours, the next 10% stay for about 1,5 days. The Strategy is planning to increase the average duration by 2,5 times and move Bishkek from the status of a transit city to a tourist destination. To achieve this objective, the city plans to focus on:

1. Branding of Bishkek;

2. Promoting the tourist image of Bishkek;

3. Developing tourist infrastructure.

The Strategy's implementation hasn't yet started due to a lack of financial resources. There are, however, a number of activities that require a political will more than financial investments. Such options will be looked at below.

2.5 Environmental Parameters

Fast population increase, combined with natural landscape conditions of the Bishkek area, has led to a series of ecological concerns. High air pollution derives from an air basin semi-locked by the mountain range and benefitting from limited wind. Green areas disappear with rapid construction coupled with a lack of legal zoning. Natural reconstitution of the environment is slowly degrading.

Ecological situation in Bishkek

Air pollution in Bishkek is three times higher than the country's average. If per capita CO2 emissions amount to 6,5kg in average, they reach 19,5 for a Bishkek citizen[4].

About 80-90% of the city's emissions come from the transportation sector. In fact, about 90% of transportation means are over 15 years old and the city car circulation is almost 10 times higher than recommended by the General Plan. While each car had to undergo a technical pollution level control until 2007, this practice has been abandoned since. Electric transportation (trams) is encouraged to reduce the pollution level and make roads less congested, but in practice public transportation is essentially provided by private mini-buses and all buses operate on a low-quality diesel.

As a common practice, different harmful additives are used to artificially increase petrol's octane number and make it cheaper. A **Clean Air Program** is under development and a new transportation strategy targets making the city center less congested and less polluted through, among other measures, acquiring only LNG new public buses. It was planned to finalize it in 2015.

Another source of emissions is winter heating from coal and wood in the new settlements related to lack of connection to a heating system.

The city hasn't started any specific pollution preventing activities. A few programs have been developed for sustainable transportation and for environmental protection, but they are not integrated and not supported by financial resources.

Water resource is decreasing, leading to an electricity supply crisis

In 2014, water level went down in the Toktogul reservoir, which decreased the country's electricity production. Kyrgyzstan traditionally exported electricity to its neighbours, however at present there is a **gap of 2,4 GW between domestic power demand and available capacity**, out of which 1GW capacity equivalent is imported from Kazakhstan at KGS 5/kWh. This price is over 5 times higher than the cost of local production. Due to this situation, electricity tariffs have increased in December 2014.

As the city draws raw water from ground water, **ground water pollution** becomes an increasingly important matter. New settlements are not connected to the sewage system, which results in sewage polluting the ground water. The issue needs to be addressed at the earliest, starting with a monitoring of the ground water quality and of the quantity of sewage contaminating it.

[4] Data 2012

Overall, **Kyrgyzstan has an active international position on environmental issues**. It takes an active role in the preparation of COP 2015. Energy efficiency is a priority due to the unstable electricity supply resulting from an overwhelming dependence on large hydropower stations.

2.6 City's social, infrastructural and cultural priorities

Each of the below mentioned priorities are partly being addressed, however, it remains to be further assessed to what extent there is sufficient political, administrative and public will to direct investments into the street lighting before other infrastructure challenges have been addressed.

2.6.1 City infrastructure priorities as seen by lead municipal stakeholders

During prioritization discussions at the municipal level, street lighting was seen as an important part of the city's development, but not quoted as a top priority activity.

- **Vice-Mayor of Bishkek, Department of Social Development**, stated that at the city level, **infrastructure development should be a priority over other matters.** While social issues are a mixed responsibility of the national and municipal governments where the Municipality only provides additional services, infrastructure is a dedicated responsibility of the Municipality and plays a determining role in providing high-quality social services. For example, reduced street lighting generates an overall perception of insecurity, high pollution levels affect citizens' health or improperly paved pedestrian paths generate hazards, in particular for the elderly and children.

  Urban infrastructure services were for the first time included in the new Socio-Economic Development Program. This program is ambitious, but resources are mainly expected from non-budget investments. For example, the Chinese government invested USD 30 million for repairing 60km of roads. In 2015, a holistic solid waste management is expected to be put in place with the financial assistance of EBRD.

- According to **Bishkek Head Architecture Department**, infrastructure action priorities are listed in the following order:

  1. Sewage and heating networks refurbishment and expansion;

  2. Roads enlargement, but requires to conduct relocations;

  3. Monorail project;

  4. Solid waste management;

5. Road construction (with the Chinese grant).

- The **Kyrgyz City Planning Science and Research Institute** emphases on the necessity of creating legal zoning, developing detailed infrastructure networks micro-plans and mitigating the rapid population increase in the city.

2.6.2 City priorities as seen by civil society

Civil society is very active in Bishkek. The city has about 14,000 registered NGOs. Public consultations are part of common practice: regular meetings are held between representatives of civil society and government representatives. All major projects and the annual municipal budget are to be approved by the City council. Public prioritization of municipal government's actions is therefore particularly determinant for the formulation of a political will towards a specific project. In the case of street lighting, while the citizens widely agree that the quality of the present service is poor, they are equally concerned about a number of other social and infrastructure issues. This means that the **street lighting project will be widely supported by the public opinion at the condition that it does not significantly reduce availability of funds for other areas of concern**.

It is difficult to assess the exact priority gradation between different challenges faced by Bishkek citizens since the general perception is that challenges high concern and in need to be addressed urgently are numerous. In particular, the following priority areas have been quoted:

- **Low salaries and pensions** are considered to be the main problem;
- **Health facilities** and their quality provision free of charge come next;
- **Heating** in winter is expensive, which leads to people switching it on and off continuously. For example, a gas based heating system can reach KGS 5,000 per month while KGS 7,000 is considered to be a high level retirement pension;
- **Education:** there is an acute lack of schools and kindergartens;
- **Roads and pedestrian paths**: repairing works have taken place in the city center, yet other roads leading to residential areas are not taken care of. Pedestrian paths, in particular, require renovation.
- **Safety**: lack of safety is attributed to a number of factors, among which massive migration of unemployed persons, lack of street lighting in secondary streets and residential areas, properly executed roads.

3. Bishkek street lighting: Current Situation

3.1 Bishkeksvet' assets and property rights

Bishkeksvet is a municipal enterprise. The property on the books of Bishkeksvet (movable and immovable) belongs to it by right of economic management.[5] The owner of this property is the Municipality, represented by the Municipal Property Unit (MPD).[6] Under the laws of the KR, the right of economic management means that:[7] (i) in respect of the immovable property (two buildings and poles), Bishkeksvet is authorized to possess and use, but not dispose of such property (including by way of lease, or pledge, or otherwise) without the consent of the owner, i.e. the Municipality/MPD; and (ii) in respect of the movable property (power lines, lighting points, switch-on points, Automatic Street Lighting Maintenance (ASLM), etc.), Bishkeksvet is authorized to possess, use, and dispose of such property at its own discretion without the consent of the Municipality/MPU.

On July 1, 2012, MPD and Bishkeksvet executed the Standard Agreement № 44 for transfer of municipal property into economic management or operative administration. Under this agreement, MPD transferred to Bishkeksvet the immovable and movable property pursuant to a transfer deed attached to the agreement. The property was transferred into economic management of Bishkeksvet for the term until December 31, 2016.

To date, Bishkeksvet has the following property assets on the books:

- lighting points: about 31,000 units;
- poles used for street lighting: 9,388 units;
- power lines: 3,318.1 km (including 3,166 km of aerial lines, 151.4 km of cables);
- inclusion points (IPs) : 449 units;
- Automatic Street Lighting Maintenance (ASLM) Systems : 10 units;
- vehicles: 13 units;
- buildings where Bishkeksvet offices are located: 2 units;
- furniture and other property.

[5] The property is assigned to Bishkeksvet under the standard agreement № 44 for transfer of municipal property into economic management or operative administration executed between MPU and Bishkeksvet on July 1, 2012. The property was handed over by MPU to Bishkeksvet under the transfer deed being an integral part of the agreement. The property is transferred for the term until December 31, 2016.

[6] Article 1 of the Regulation on Municipal Property Unit of Bishkek Municipality.

[7] Article 230 of the Civil Code of the KR.

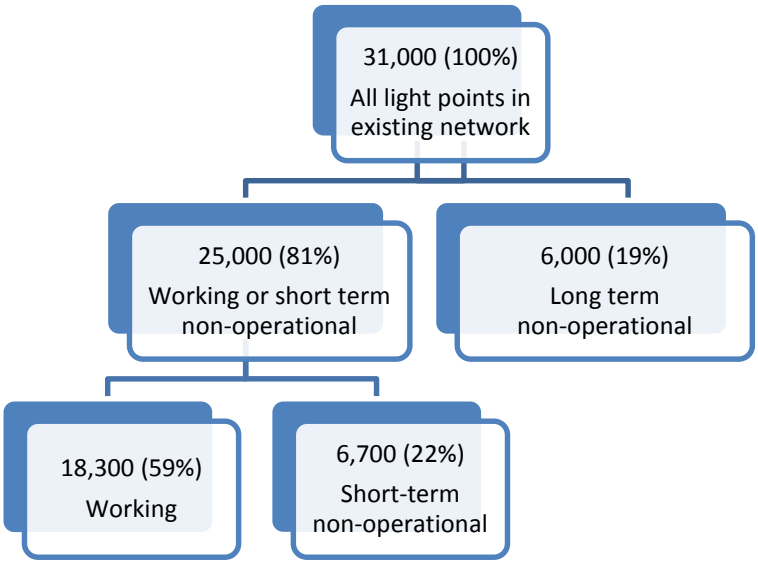
Bishkeksvet is required to annually make/update the register (keep inventory) of the property assigned thereto and to submit the appropriate data to MPD responsible for keeping the general register of municipal property of the city.[8]

3.2 Street lighting technical parameters

3.2.1 Lighting Points

Number of existing lighting points: According to oral clarifications of the specialists of Bishkeksvet, before 1990 Bishkeksvet had approximately 50,000 lighting points. In 1990s, the major part of the lighting points became unusable. As of October 2014 Bishkeksvet's inventory records indicate approximately 31,000 lighting points. Approximately 6,000 lighting points out of 31,000 have not been operational since Bishkeksvet's establishment in 2007. To be operational they need to be restored through major remedial work. Of the remaining 25,000 lighting points, it is deduced from technical analysis, calculations, energy consumption records and interviews (and reinforced by observation) that approximately 73% of these, that is 18,300 lights, are operational. This represents 59% of the total network, and leaves 41% of the total network not operational (19% long term non-operational, and 22% short-term non-operational). This is shown in Figure 2 below.

Figure 2. Bishkeksvet's Lighting Points in Existing Network



[8] Point 19 of the Regulation on Municipal Property Unit of Bishkek Municipality.

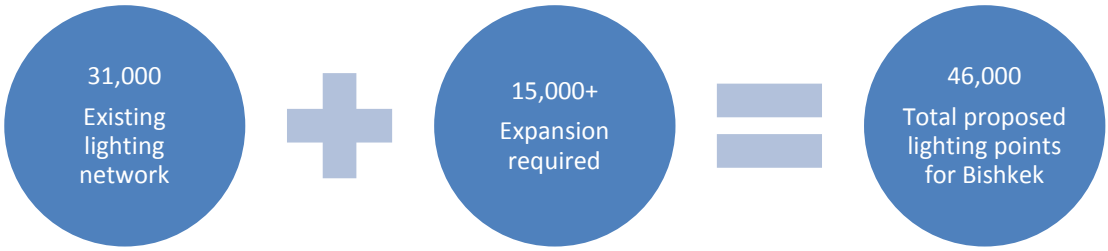
Lighting point categories: The lighting points can be categorized according to the street types that they light, which in turn determines the luminance or brightness required for the lighting points. Category A covers central and main streets, with a lumen range of 30,000 - 48,000 Lm. There are approximately 4,400 Category A lighting points, which makes up 14% of the total network. Category B covers secondary and residential streets, and with 22,100 lighting points, makes up approximately 71% of the total lighting network. The lumen range for these lights is between 5,000 and 28,000 Lm. Category C covers parks and squares, with a luminance of about 4,000 Lm. This makes up 15% of the lighting network, with 4,631 lighting points.

Table 5. Lighting Points Categories

Key	Quantity	%	Lumen Range (Lm)
Category A: central and main streets	4,400	14%	30,000 - 48,000
Category B: secondary streets / residential	22,100	71%	5000 - 28,000
Category C: parks / squares	4,631	15%	~4000
	31,131	**100%**	

Need for additional lighting points: Bishkek's street lighting is concentrated in the city centre, with lighting quality and lighting availability noticeably poorer or absent in outer lying suburbs of Bishkek. Based on data obtained from the PMCD that is responsible for providing infrastructure to approximately 50 residential suburbs of Bishkek, it is estimated that additional 15,000+ street lights will need to be installed in Bishkek's urban areas for Bishkek to be sufficiently lit. The vast majority of these areas currently do not have roads, electricity or street lighting. The expansion will need to include installation of street lighting poles, lamps and all electrical infrastructure.

Figure 3. Required City Street Lights



The lamp types: The lighting points are made up of a collection of lamp types including high pressure mercury, high pressure sodium, incandescent, metal halide and energy saving lamps. Existing replacement strategies are focused on utilizing available spare parts and installing the least cost option; and varying lamp types and wattage can be observed on the same street. Table 6 below presents the quantity and wattage of each lamp type.

Table 6. Lamp Types (out of 24,354 operational lamps)

	Lighting Type	Category	Qty	W
1a	Arc high pressure sodium	B	8500	250
1b	Arc high pressure sodium	A	2100	400
2a	Arc high pressure mercury	B	3700	400
2b	Arc high pressure mercury	B	1600	250
3a	Incandescent	B	2300	500
3b	Incandescent	C	1600	100
4	Energy saving lamp	C	2867	36
5	Metal halide	A	2300	400
6	Reflectors	C	164	
7	Long term non-operational	B	6000	250
	Total number of lamps		**31,131**	

Replacement of lamps: Bishkeksvet's maintenance records show that lamps are replaced at a very high annual rate. In 2013, nearly 25,000 lamps were replaced. In 2012, 18,148 lamps

were replaced, and in 2011, 18,917 lamps were replaced. Though there are different lamps installed which have varying life spans, the average replacement rate of approximately 100% per year indicates that the lamps are not reaching their recommended lifespan, and some lamps are in fact being replaced more than once per year. This is mainly due to two reasons:

1. Poor quality lamps are sourced due to a sole least-cost procurement criteria without rigid technical specifications and standards for the equipment; and
2. Lamps installed are not suitable for the conditions and therefore expire prematurely.

Procurement of lamps: Procurement of lamps and electric materials is made annually by way of tender conducted in accordance with the State Procurement Law. The main criterion for procurement is the price of the lamp. As a rule, the supplier offering the least price becomes the winner of the tender. In 2014, Bishkeksvet spent KGS 6,528,200 (about 10% of 60,000,000 KGS annual budget allocated by the Municipality in 2014) for procurement of lamps, spare parts and electric materials. Primarily, Bishkeksvet procures lamps and electric materials of the Chinese and Russian origin. As observed by Bishkeksvet personnel, over recent few years, the life span of procured lamps has reduced from 2 years to 6 months. This could be due to being provided poor quality stock at a reduced price by the tendered in order to win the bid. Voltage fluctuations, discussed below, are another contributing factor.

Voltage fluctuation: The street lighting network is supplied by 220 V AC voltage, with 50 Hz frequency. **Bishkeksvet report that voltage fluctuates as much as 30%, that is down to 154V AC**. Interviews and anecdotal evidence suggests the fluctuation might be even greater, up to 40% in the winter months[9]. This is likely to be due to a number of reasons, including deteriorated transmission and distribution infrastructure of SeverElectro, deteriorated electrical components in the street lighting network, poor quality equipment, and contact with trees and other obstructions.

Energy consumption: Bishkeksvet operates the majority of street lights switching operations manually, following a switching schedule that provides on and off times for the different weeks of the year[10]. From the schedule, it can be seen that Bishkek street lights operate for approximately 3972 hours per year. This translates to an average of 10.9 hours of lighting per day. Energy consumption calculations have been made on this basis.

Table 7 below shows the yearly energy consumption by each street lamp type. It shows that Bishkeksvet's network of 31,000 street lighting points would consume approximately 34.5 million kWh per year if it were to be fully operational. Due to the long-term failure of

[9] Data manually collected by Bishkeksvet from IP box No. 240 between 11-18 December 2014 reports voltages of between 189 and 209V AC over a one week period.

[10] Approximately 10% of street lights (10 Ip boxes) are operated automatically using the Russian control system call Kolon-S.

approximately 6606 lamps, the actual energy consumption is deduced to be approximately 28.5 million kWh per year.

Table 7. Current Situation of Energy Consumption: Kwh per Year

	Lighting Type	Qty	kW	kW	hrs/day	kWh/d	kWh per yr
1a	Arc high pressure sodium	8500	0.25	2125	10.9	23125	8,440,500
1b	Arc high pressure sodium	2100	0.4	840	10.9	9141	3,336,480
2a	Arc high pressure mercury	3700	0.4	1480	10.9	16106	5,878,560
2b	Arc high pressure mercury	1600	0.25	400	10.9	4353	1,588,800
3a	Incandescent	2300	0.5	1150	10.9	12515	4,567,800
3b	Incandescent	1600	0.1	160	10.9	1741	635,520
4	Energy saving lamp	2867	0.036	103.21	10.9	1123	409,958
5	Metal halide	2300	0.4	920	10.9	10012	3,654,240
6	Reflectors (excluded from totals)	164		0	10.9	0	-
7	Long term non-operational lamps	6000	0.25	1500	10.9	16323	5,958,000

	Not including long term non-operational lamps	24967				78,115	28,511,858
	With long term non operation lamps fixed	31131				94438	**34,469,858**

The electricity tariff: The electricity tariff applicable to Bishkeksvet's street lighting operations is 2.47KGS/kWh inclusive of taxes (2.19KGS/kWh before taxes) as of December 11, 2014. This was increased from KGS 1.56/kWh in 2014, and represents a further increase from the tariffs that were projected in the Medium-Term Tariff Policy of the KR for Electricity for 2014-2017[11]. At this tariff rate, yearly expenditure for electricity for a fully operational existing network of 31,000 lamps is calculated at KGS 91.3 million per annum, a dramatic increase of existing rates of approximately KGS 30.0 million per annum, and a value that exceeds the current total budget for Bishkeksvet's annual operations. Analysis of Bishkeksvet's expenditure shows that energy tariffs currently make up approximately half of their annual budget. The tariff increase will therefore place increased burden to Bishkeksvet's budget, which is already struggling to cover operations and maintenance of the existing network.

3.2.2. The Poles

Types and number of the poles: Street lights are mounted on poles, which vary in height from approximately 2.5 to 15 m. Broken down into categories the poles are 9 to 15m (Category A), 7 to 9m (Category B), 2.5 to 5m (Category C). Bishkeksvet reports to have 9388 poles in their inventory. The poles are made from iron reinforced concrete, metal or wood, their shape are eight, six or four-sided. Most of the poles were installed before the 1990s. The prevailing number of poles (around 90%) were made by a local manufacturer (an iron reinforced concrete factory). For the purposes of street lighting / placement of lighting points, Bishkeksvet uses 24,975 poles which are owned by three entities as shown in Table 8 below.

[11] As of June 16, 2015 the rate amounted to 1.97 KGS/kWh. However, starting from August 1, 2015 the tariff will be increased up to 2.24 KGS/kWh. This information was obtained after the financial model has been designed and is therefore not reflected.

Table 8. Poles Inventory

Owner/Possessor	Number of Poles	Purpose of Use
Bishkeksvet	**9,388**	for installation of Bishkeksvet power lines; •
BTU	4,156	for joint installation of trolleybus power lines and Bishkeksvet power lines
SeverElectro	11,431	for joint installation of Severelectro and Bishkeksvet power lines
Total	24,975	

All three entities use poles pursuant to an oral arrangement on joint installation and generally accepted practices. The written document on procedure of joint use of poles is not in place.

Street poles conditions: Reports as well as visual observation reveal that the condition of the street poles is poor. Many of the poles are leaning, some being propped up by smaller poles as an interim measure. Other poles are cracking. These deteriorated poles represent a severe safety hazard. According to oral clarifications of the specialists of Bishkeksvet, it is estimated that approximately 20% of 9,388 poles owned by Bishkeksvet will need replacement[12].

Major repair/replacement/installation of poles*:* Bishkeksvet is entitled to perform minor repair of poles, but cannot perform their major repair and installation. The power to engage in major repair and construction works is vested in Municipal Construction Department (MCD) and Public Municipal Construction Department (PMCD).

Since Autumn 2014, efforts are underway to install along Bokonbaev Street approximately 70 poles of the Chinese origin, which differ in their configuration from the locally manufactured pylons. Despite the better outer look of poles, Bishkeksvet engineers express concern that Chinese pylons are less steadfast and robust than local ones. Another concern is the replaceability of Chinese pylons in case of damage or breakdown.

[12] A detailed inspection and reporting of the condition of each pole will determine the magnitude of the problem with greater accuracy.

Lease out of poles: Currently, Bishkeksvet leases out approximately 3,000 poles to 3 private internet providers (Megaline, Aknet, Saima Telecom) for the installation of a fibre-optic cable. Poles are leased out under the lease agreement executed in 2010 with three companies and valid for the term of one year. As of today, the terms of all agreements have expired. In addition, as described below, all three agreements have been and still are legally invalid from the date of their signing.

Legal invalidity of all three contracts is explained as follows: On August 1, 2005 Mayor's office leased out all 9,388 poles owned by Bishkeksvet to Express service LLC for the term of 49 years[13]. During the lease term Express Service LLC uses the poles for commercial purposes and establishment of advertising constructions. Mayor's office files a suit on declaring such a contract invalid, according to the information provided by the specialists of Bishkeksvet as of June 16, 2015 Mayor's office won a suit in two instances, however, Express Service LLC filed a supervisory appeal to the Supreme Court. Proceedings at the Supreme Court were scheduled for July 6, 2015.

Despite the legal invalidity, Bishkeksvet continues to maintain contractual relationships with all three companies and receives lease payments from each company charged at 30 KGS per pole per month (including VAT and sales tax) of which, after payment of all taxes, only 7 KGS or 30% goes to Bishkeksvet, and 23 KGS or 70% goes to MPD).[14] The rate of 30 KGS was established by the decision of the municipal property commission of the Mayor Office of March 17, 2010.[15] Neither MPD nor Bishkeksvet representatives have documents substantiating such valuation. To date, this rate might be substantially lower than the market rates. If the rate of the lease payment is revised upwards and Bishkeksvet is authorized to dispose of the lease proceeds, Bishkeksvet will be able to raise additional revenue to fund operations.[16]

Apart from lease of poles to the internet providers, currently, Bishkeksvet offers services related to illumination of advertisement facilities. In the opinion of CDA, poles can also be used for other commercial purposes (for example, for banner advertisement).

Legal status of poles: Based on the provisions of the Civil Code of the KR, poles refer to immovable property.[17] Accordingly, the agreements on transfer of rights over poles

[13] Apart from the poles owned by Bishkeksvet Mayor's office leased out the poles of BTU and Severelectro.

[14] This distribution procedure is set forth in Point 117 of the Regulation on procedure of awarding limited real rights over real estate facilities held in municipal ownership of Bishkek city approved by the decision of the City Council of May 22, 2002 No. 127.

[15] Pursuant to Point 29 of the Regulation on procedure of awarding limited real rights over real estate facilities held in municipal ownership of Bishkek city, the decision on the amount of lease payment is made by decision of the commission for municipal property of Bishkek city with participation of Municipality subdivisions concerned.

[16] Severelectro as well as Bishkeksvet lease out their pylons to the Internet providers and the amount of lease payment is 40 KGS per pylon and all lease proceeds belong to Severelectro.

[17] This opinion is disputable. Some people think that pylons refer to movable property.

(including the rights of lease and other types of uses) are required to be registered with the State Registry. In practice, the State Registry does not perform, nor can it technically perform such registration due to absent pylon identification registration numbers. These circumstances may affect the structure and consequences of transactions involving disposal and transfer of rights over poles.

3.2.3 Power Lines

Number of power lines: Bishkek city street lighting network covers 773 streets equipped with 3,318 km of Bishkeksvet-operated power lines, of which:

- 3,167 km are aerial power lines, of which only 1,704 km are operational; and
- 151 km are cable power lines, of which only 142 km are operational (approximately 90% aerial and 10% underground).[18]

Power lines map: In 2012, at the initiative of Mayor's office and at Bishkeksvet's expenses, Bishkek Contemporary Company created a map of power lines of Bishkek city street lighting in print and electronic formats. However, the map has not been updated since. Bishkeksvet was given one printed copy of the map free of charge, but the electronic copy of the map was available at a charge and due to lack of funding Bishkeksvet was unable to acquire it. Having up to date mapping of the electrical network is an important operations, maintenance and safety issue, not only for Bishkeksvet, but also other municipal institutions, enterprises and private companies.

Abnormalities (short circuit / spikes / fluctuations) occurring during power supply via Severelectro-operated power lines result in breakdowns of street lighting power lines causing failure of lamps, lighting points and IPs (ie. switch-on points).[19] Bishkeksvet is not reimbursed for damages incurred; furthermore, it performs remedial works at its own cost[20].

Major repair/replacement/installation of power lines*:* Similarly to poles, Bishkeksvet is entitled to do minor repair of power lines, and also major repair/replacement/installation of power lines, however, due to having permanent arrears in their fiscal payments, Bishkeksvet cannot participate in tenders, and perform such work accordingly. The right to do major repair and construction works is vested in MCD and PMCD.

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[18] The document of Bishkeksvet «Existence of elements of street lighting of Bishkek city» of October 1, 2014.

[19] Bishkeksvet purchases power from Severelectro. The quality of power supply is very low, but since Severelectro is currently a monopolist, Bishkeksvet has no choice but to cooperate with Severelectro.

[20] In the opinion of Bishkeksvet personnel, of existing 3.318 km of power lines, 1,473 km are reparable and 1,845 km need to be replaced self-supporting insulated wires (SSIW). To date, Bishkeksvet has no enough financial resources to replace power lines by SSIW, which costs 1,500 KGS per 1 meter, including cable and clips, in the local market.

3.2.4. Inclusion Points (IPs) / switch-on points / control pillars

Number of IPs (switch-on points): At present, Bishkek street lighting network is operated through IPs used for acceptance and redistribution of power from transformer substations owned by Severelectro to the Bishkek street lighting network. As of October 1, 2014, Bishkeksvet had 449 IPs on the books, of which:

- 333 are operational, i.e. connected to Severelectro transformer stations; and
- 116[21] are non-operational for lack of need in serving non-working light points.

10 IPs are operated (i.e. switched on/off) through Automatic Street Lighting Maintenance (ASLM) Systems. 30 IPs are operated through time relays, the remaining 293 IPs are operated manually stage-by-stage, i.e. in chain order. The IPs that are not automatically controlled are operated manually by the on-call teams of the emergency dispatch unit.

Overhaul /replacement of switch-on points: As for poles and power lines, major repair of IPs is performed by MCD.

3.2.5 ASLM Systems

Centralized control panel: The centralized control panel of the city's street lighting network was built in 1980s, but by the early 2000s and since Bishkeksvet was established in 2007, the centralized control panel has not been functional. Communication between the dispatch unit and the cascades were made manually.[22]

Existing ASLM and their condition: In 2011, Bishkeksvet procured through tender from a local company 10 ASLM systems, to serve 10 Ips. Bishkeksvet planned to purchase extra ASLMs to cover all IPs. However, due to lack of financing, the plan of purchasing ASLMs was not accomplished. Now, ASLM systems perform only switch on/off functions and not any other functions such as metering, current loads, lamp failures, etc.

The purchase and installation of a comprehensive control and automation system is a top priority to achieve more efficient management and operation of the street lighting network which in turn is essential to ensuring material savings of electricity used in service delivery.[23]

[21] Some minor variatiosn exist between figures provided by different Bishkeksvet staff.

[22] Bishkeksvet Information as of November 2014.

[23] In 2012, Bishkeksvet was considering the purchase of the Russian ASLM Systems which were offered at 45 million KGS at that time, but could not do this due to lack of funding.

3.2.6. Vehicles

Bishkeksvet maintains 13 specialized vehicles equipped with a telescopic crane. The years of manufacture of these vehicles vary from 1978 to 1991. Only 10 vehicles are actually working, three vehicles are irreparable over the last five years. The working vehicles are used for current maintenance, operation and repair works. The vehicles repair is performed by Bishkeksvet personnel.

Due to shortage of transport vehicles, since 2010 Bishkeksvet has been engaging eight private hire vehicles to perform light switching operations and to transport repair personnel called out to fix breakdowns.[24]

3.2.7. Buildings

Two buildings are transferred into economic management of Bishkeksvet along with other property under the Standard Agreement № 44 for transfer of municipal property into economic management or operative administration signed on July 1, 2012 between MPD and Bishkeksvet.

Under the laws of the KR, immovable property rights must be registered with the State Registry; failure to register entails invalidity of transferred rights.[25] The above agreement was not registered with the State Registry, therefore, the rights of Bishkeksvet over both buildings (and poles which refer to immovable property) are not valid.

3.3 Institutional Structure and Stakeholder Analysis

3.3.1 Bishkek City Street Lighting Management

The foundation of the Bishkek street lighting network was laid in the 1960s and 1970s. Until 2000, the street lighting network was managed and operated by Frunzegorsvet electric network municipal enterprise, later renamed into Bishkekgorsvet.[26] In 2001, Bishkekgorsvet was liquidated,[27] after which the management of street lighting was transferred to four district providers of urban amenities.[28]

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[24] Municipality Ordinance № 502 of August 11, 2010 on measures to ensure timely switch-on and switch-off of street lighting network.

[25] Article 181.1 of the Civil Code of the KR, Article 7.3 of the KR Law on State Registration of Immovable Property Rights and Transactions.

[26] B.O. Oruzbaeva, Frunze Encyclopedia, Bishkek, 1984.

[27] Bishkek Municipality and Bishkek City Council Resolution № 162/16 of November 2 on liquidation of Bishkekgorsvet ENE.

[28] There are four administrative districts in Bishkek: Prevomaisky, Leninsky, Sverdlovsky and Oktyabrsky.

On April 4, 2007, due to poor performance of district providers of urban amenities and bad condition of street lighting,[29] the Mayor's Office decided to establish Bishkeksvet municipal enterprise, which was given all street lighting facilities and duty to manage them.[30]

Pursuant to Bishkeksvet Charter, the main tasks of Bishkeksvet are:

- To ensure comprehensive development of city economy and to strengthen control and coordination of the proper use of budgetary funds;
- To restore and develop the centralized street light management system.

To accomplish the above tasks, the Charter provides for a number of functions of Bishkeksvet, including:

- Maintenance and major repair of street lighting network;
- Scheduled preventive repair and maintenance of minimum light intensity depending on availability of funds to pay for street lighting works;
- Construction and installation of outdoor and indoor lighting networks under direct contracts with legal entities and individuals;
- Other functions provided by the Charter.

In practice, Bishkeksvet copes with its tasks and functions only partially. Thus, the primary activity of Bishkeksvet is to maintain the street lighting system inherited in 2007, and is mainly concentrated on replacing lamps, performing minor repair of cable and aerial lines, and addressing emergency situations and requests from residents.[31] The tasks and functions provided in the Charter such as: comprehensive development of street lighting networks; major repair of street lighting networks; and (construction and installation of street lighting networks, are not actually accomplished. The reasons for this are the inadequate level of financing and existing system of distribution of powers in the structure of municipal bodies, institutions and enterprises of the city

[29] Municipality Resolution № 262 «On establishing Bishkeksvet municipal enterprise of April 4, 2007 stated that the reason for reorganization was the inadequate level of street lighting, in particular, only 80% of central and main streets were covered by street light while secondary streets, micro-districts and residential areas were practically unlit.

[30] On June 5, 2007, Bishkeksvet was registered in the state register of legal entities as a municipal enterprise based on the right of economic management. The Municipality acted as the sole founder of Bishkeksvet and as such was the highest governing body thereof.

[31] Certificate of Bishkeksvet of November 2014.

3.3.2 Stakeholders Involvement

In its activities, Bishkeksvet communicates with a number of different stakeholders including municipal governing bodies, institutions and enterprises (as in more detail described below and reflected in the scheme attached hereto as Annex 2). Below is a description of the stakeholders and their interactions with Bishkeksvet.

City Council: Bishkek City Council is an elective representative body of the local self-government elected for the term of 4 years.[32] The powers of the City Council include, among other things, control over efficient operation of city institutions, approval of city budget, approval of use and disposal of municipal property, approval of register of municipal services, tariffs and charges for provided municipal services, procedure for use of municipal property, expression of distrust in heads of municipal institutions.[33] In practice, Bishkeksvet communicates with the City Council in two instances: when submitting performance reports at sessions of its members and when addressing certain requests of its members.

Mayor's Office: Pursuant to the Bishkeksvet Charter and KR legislation, the Mayor's Office is the sole founder and the highest governing body of Bishkeksvet, the owner of the property transferred to Bishkeksvet into economic management and the main customer of the works performed by Bishkeksvet and respectively the main source of revenue.

The Mayor's Office consists of about 20 offices, departments, divisions and services.[34] In its activities, Bishkeksvet primarily communicates with:

Bishkek City Finance Department (BCFD) is the city governing body responsible for financial matters of the Mayor's Office, on behalf of the Mayor's Office exercises control over financial and economic performance, writing off of bad debts, deficiencies, losses; ensures control and audit of state-funded institutions, enterprises and organizations of municipal economy. BCFD exercises control over financial and economic activities/budget execution by Bishkeksvet.[35]

Housing and Utilities and Life Support System Department of Bishkek Mayor's Office (HU and LSSD) which is responsible for coordination and control over performance of municipal enterprises providing housing and utilities services (including street lighting). HU and LSSD exercises control over consumption by Bishkeksvet of energy resources including control

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[32] Articles 9 and 10 of the KR Capital Status Law.

[33] Article 15 of the KR Capital Status Law, Article 31 of the KR Local Self-Government Law.

[34] http://meria.kg/index.php?option=com_content&view=category&layout=blog&id=43&Itemid=58&lang=ru&limitstart=0 (of February 11, 2015); municipal services of the Municipality: http://meria.kg/index.php?option=com_content&view=category&layout=blog&id=36&Itemid=60&lang=ru&limitstart=10 (of February 11, 2015).

[35] Regulation on Bishkek city finance office approved by Ministry of Finance Order No. 100-r of March 30, 2000.

over amounts of electric energy consumed by the city street lighting network.

MPD is responsible for maintaining the single register of municipal property, exercising the powers of the Mayor's Office with respect to management, disposal and control over safety and proper use of municipal property, and may withdraw unused or improperly used municipal property, or dispose of it in any legal way. In relation to Bishkeksvet, MPD exercises the rights of the owner on the basis of the agreement executed between MPD and Bishkeksvet on July 1, 2012 according to which Bishkeksvet is not allowed to sell or otherwise transfer the property (including for lease or pledge) or to write off the property without the written consent of MPD.[36]

MCD a single municipal customer of major repair[37] and construction of municipal facilities including street lighting facilities. MCD conducts tenders for procurement of major repair and construction works. Bishkeksvet is not involved in the planning major repair and construction works of new street lighting facilities. Annual forming of the itemized (title) lists for major repair of street lighting facilities is made on the basis of Bishkeksvet's request, however, according to oral clarifications of the specialists of Bishkeksvet in practice not all of the submitted requests/proposals included into the itemized (title) lists.

PMCD which performs the functions of the customer and technical supervision over design and construction of infrastructure facilities (including power lines and street lighting devices) in the individual housing construction areas. Bishkeksvet is not involved in the planning and construction of new street lighting facilities.

CDA which is a municipal institution responsible for developing and introducing city development programs, including programs for Bishkeksvet development.

Zelenstroy is a municipal enterprise (there are 9 municipal enterprises in Bishkek) responsible for maintaining plantings in the city. Bishkeksvet communicates with Zelenstroy on limbing trees during maintenance of lighting points; Zelenstroy performs works at its own cost upon request by Bishkeksvet.

Bishkeksvet communicates with various state bodies on various reporting and licensing issues. Bishkeksvet operations are also subject to audits by a number of state bodies.

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[36] Point 19 of Regulation on awarding limited real rights over real estate assets held in municipal ownership of Bishkek city.

[37] In its activities, MPD is guided by the Operation Guidelines for maintaining and major repair of street lighting facilities in cities, villages and rural settlements, adopted by the Ministry of Housing and Public Utilities of the RSFSR, Moscow, 1990. According to the Guidelines, major repair works refer to: replacement of existing lights, cables, wires, communication equipment to the extent exceeding the scope of the minor repair; replacement of lines and fittings to the extent exceeding the scope of the minor repair; installation of additional lights and lamps on wire-hanger to the extent of 10% of the total amount in the definite street or facility; replacement of pylons to the extent of up to 20% of the total number of pylons in the definite street, passway or facility per year; etc.

As far as the reporting issues are concerned, Bishkeksvet (in addition to reports submitted to local self-government bodies) communicates with the tax authorities of the KR, the Social Fund of the KR: in respect of compliance with social insurance payment requirements, the statistical bodies of the KR: in respect of compliance with mandatory statistical reporting requirements;.

As far as the licensing issues are concerned, Bishkeksvet communicates with the State Agency for Architecture and Construction under the KR Government: in respect of obtaining and maintaining in force the license to perform construction and installation works (the license is issued on April 25, 2008, is valid perpetually, but currently, is not used) and the Executive Board of the State Department for Regulation of Fuel and Energy Sector under the Ministry of Energy of the KR: in respect of obtaining and maintaining in force the license to sell or distribute electric energy (the license is issued on March 10, 2010, is valid for the term of 2 years, but currently, is expired).

Bishkeksvet operations are subject to audit by a number of state and other bodies, including the State Inspectorate for Environmental and Technical Safety ("SIETS"): in respect of compliance with the occupational safety requirements; periodicity of audits vary depending on the issue being audited (for example, in respect of technical condition and safe operation of energy equipment, the audit is conducted biannually; and the Counting Chamber of the KR: in respect of compliance with the financial discipline requirements; the audit is conducted annually.

To date, Bishkeksvet is a party to the contracts with Severelectro and National Networks (for power supply), three private Internet providers (for lease of pylons for installing fibre-optic cables) and number of Individuals and legal entities owning advertisement facilities (for illumination of advertisement facilities).

3.3.3 Institutional Challenges Related to the Present Street Lighting Management

As a municipal enterprise whose sole founder and highest governing body is the Mayor's Office, Bishkeksvet is fully accountable to and controlled by the Mayor's Office. Under the existing system of distribution of competences among municipal bodies, institutions and enterprises, the competence of Bishkeksvet to manage its operations are limited. In particular, the competences of Bishkeksvet are limited in the following ways: (a) it cannot plan its spending other than within the limits of the approved budget and with the detailed breakdown of the funds requested; (b) it cannot dispose of the property given to it (this power is vested in MPD); (c) it cannot perform major repair and construction of new facilities (this power is vested in MCD and PMCD); (d) it cannot create development programs (this power is vested in CDA).

The limited competences of Bishkeksvet along with the lack of adequate funding prevent Bishkeksvet from engaging in comprehensive development of street lighting and major repair and construction of new facilities.

Like any other legal entity in the KR, Bishkeksvet is required to submit reports to tax, Social Fund and statistics authorities; in addition, Bishkeksvet, as a municipal enterprise, is required to submit reports to the governing bodies of the Mayor's Office (HU and LSSD, Urban Amenities Division of the Mayor's Office), local district and local territorial offices.

As an enterprise performing specialized power supply works, operations of Bishkeksvet are regularly inspected by SIEG and SIETS; in addition, as a municipal enterprise, Bishkeksvet is annually audited by the Counting Chamber of the KR.

The major part of agreements of Bishkeksvet is made up of the contracts for supply of electricity to the city street lighting network; the minor part of agreements is made up of commercial transactions generating income for Bishkeksvet.

In general, the existing system of communication between Bishkeksvet and other entities demonstrates the prevalence of administrative hierarchy-based relationships between Bishkeksvet and other municipal bodies and inspecting state authorities as well as the limited competence of Bishkeksvet to engage in economic (commercial) activities.

3.4. Legal and Regulatory Framework

3.4.1 Technical regulations relative to Bishkeksvet

Technical regulations and standards: In the course of operating street lighting networks, Bishkeksvet must ensure compliance with minimum necessary requirements for products and related processes (designing, production, construction, installation, adjustment, storage, transportation, sale, operation and recycling).[38] These requirements refer to technical regulatory policy contained in technical regulations and standards.

In the course of its operations, Bishkeksvet follows the technical regulations and standards establishing mandatory requirements for products consuming or transforming energy from one form into another, and the processes related to such products. Standards apply, among other things, to the following: safety and certification of equipment (lamps, lights, electric cables, electricity meters, etc.); light intensity and designing of street lighting; light intensity of public roads; operation of street lighting networks, duration and scope of repair; rules on

[38] Article 7 of the KR Law on Fundamentals of Technical Regulation in the KR of May 22, 2004 No. 67.

setting fees for installation of equipment; parameters of urban landscaping in settlements; technical operation of electrical installations and street lighting networks and rules on safe operation, maintenance and repair of electrical installations. The list of technical regulations and standards applicable to Bishkeksvet operations is attached as Annex 2.

It should be noted that **no national technical regulations and standards that would apply to street lighting are currently in place in the KR** (for example, technical regulation on safety of electrical equipment with voltage above 1000 V or technical regulation on safe operation of electrical installations of power stations and networks). Therefore, in practice, Bishkeksvet follows the standards and technical regulations of the former USSR or, in their absence, those of the Russian Federation, which is permitted under the laws of the KR.[39]

State metrological control and certification: Under the laws of the KR, the production, consumption and certification of energy are subject to mandatory state metrological control and supervision. The state metrological assurance of energy efficiency involves a complex of measures and regulatory documents aimed at assurance of measurements' uniformity during production and consumption of such energy. State metrological control and supervision applies to objects falling within the scope of metrology standards and rules. For example, to comply with legal requirements, a measuring instrument (electricity meter) to be used by Bishkeksvet should undergo appropriate testing and certification as well as initial and (or) subsequent verification. The state metrological supervision in the field of state regulation is exercised by the State Inspectorate for Metrological Control under the Ministry of Economy of the KR.

In relation to Bishkeksvet operations, metrological control and certification apply to electricity meters, cables, wires, incandescent lamps, as well as sodium, mercury and metal halide lamps. Verification of compliance with safety and certification requirements, as well as metrological services such as calibration, verification of measuring instruments, accreditation of test and diagnostic equipment, etc. are provided by the Center for Standardization and Metrology under the Ministry of Economy of the KR or private testing laboratories holding accreditation certificates issued by the Kyrgyz Center for Accreditation under the Ministry of Economy of the KR. Verification results are stated in test and measurement reports. It should be noted that there are no metrological control regulations and equipment in the KR in respect of LED lamps; therefore, no metrological control and certification of LED lamps occur in practice.

[39] Under Article 18 of the KR Law on Fundamentals of Technical Regulation in KR of May 22, 2004, if no international, regional, or national standards are in place, the legislation of the KR permits applying previously enacted technical regulations (for example, in the former USSR) or regional or foreign technical regulations.

Workplace safety and health: In the course of operating street lighting networks, Bishkeksvet must ensure compliance with workplace safety and health (WSH) regulations. The list of the WSH regulations applicable to Bishkeksvet is attached as Annex 2. State control over compliance with the WSH regulations is exercised by SIETS.[40]

As required by law, Bishkeksvet has in place WSH policies and procedures.[41] In addition, every month Bishkeksvet conducts WSH training for its personnel. Every year, a commission composed of the engineering staff of Bishkeksvet, conducts evaluation of the operator's performance in the workplace to ensure that the operator has the knowledge and skills needed to operate electrical installations safely.[42]

3.4.2. Challenges relative to technical regulations

- Bishkeksvet street-lighting operations are subject to technical regulation contained in the technical regulations and standards enacted and/or effective in the territory of the KR.

  If no national technical regulations and standards are in place, **Bishkeksvet practices applying the former USSR and the Russian Federation standards**, which is permitted by the KR Law on Fundamentals of Technical Regulation in the KR as mentioned above. Nevertheless, the practice of applying the former USSR standards contradicts the KR Law on Acts and Regulations of the KR stating that the acts and regulations of the USSR shall be effective in the territory of the KR only until December 31, 2009 to the extent not inconsistent with the laws of the KR. Considering the current practice of applying the former USSR technical regulations and standards that are no longer in force, as well as the absence of necessary regulatory acts in the KR it is proposed that, for the purposes of removing contradictions between the KR Law on Fundamentals of Technical Regulation in the KR and the KR Law on Acts and Regulations of the Kyrgyz Republic, necessary

[40] SIETS exercises control by holding scheduled and unscheduled inspections of Bishkeksvet. Additionally, every three years, SIETS conducts evaluation of knowledge and skills needed to operate electrical installations safely among the engineering staff of Bishkeksvet (chief engineer, heads of Eastern and Western RES, safety engineer), after which SEITS issues permits to the engineering staff. These permits allow the engineering staff of Bishkeksvet to conduct internal evaluations of the operator's performance in the workplace (for wiremen, tower vehicle operators).

[41] Bishkeksvet has in place job descriptions, workplace safety rules, etc. approved by the director of Bishkeksvet and coordinated with the chairman of the trade union of Bishkeksvet, including job descriptions for operators of emergency dispatch service, as well as instructions for fixing problems in street lighting, ensuring prompt switching-on of street lighting, and WHS rules for electricians, tower vehicle operators and hydraulic crane operators.

[42] Those employees who successfully passed the examination are issued the appropriate operator permit while those who failed are given time to prepare for reexamination (around 2 weeks).

amendments should be made to the KR Law on Acts and Regulations of the KR authorizing the application of regulatory acts of the former USSR.

- **The lack of national technical standards for LED lamps might become an obstacle to street lighting modernization** since there are no uniform safety requirements for such product, including its use, maintenance and recycling, as well as criteria for evaluating the quality of LED lamps.[43] Nevertheless, until the appropriate standards of the KR are enacted, in relation to LED lamps, the KR allows applying standards of foreign states, for example, the Russian Federation where such standards are in place.

3.4.3 Energy savings and energy efficiency regulations

KR policies related to energy saving/energy efficiency: In 2012, the Government of the KR approved the Medium-Term Development Strategy for the Energy Sector of the KR for 2012-2017.[44] Among other things, the strategy set the task of developing energy efficiency standards for various sectors of economy and programs designed to facilitate reduction of energy losses occurring during the production, distribution and consumption of energy.

In 2013, the Government of the KR approved the Program of Transition to Sustainable Development for 2013-2017.[45] The Program is introduced for the purposes of implementing the tasks set by the National Strategy for Sustainable Development of the KR for 2013-2017, approved by the President of the KR. In relation to energy sector development, both documents mention the need for creating conditions to foster energy saving and introduce energy efficient technologies.

At present, the Ministry of Energy and Industry of the KR is in the process of developing the Energy Saving Program and Energy Efficiency Policy in the KR until 2017 to be approved by the Government of the KR.[46] The Program also includes the Action Plan until 2017. According to the information provided by the ministry, the Program proposes to introduce requirements for reducing the annual energy consumption by 5% for all state-funded organizations in the KR and to introduce the mandatory energy efficiency audit for all

[43] According to the available information, Kazakhstan has no technical regulations on LED lamps in place as well. However, in the opinion of the specialists involved in the Almaty street lighting improvement project, the lack of technical regulations is not an impediment to the installation of such lamps in Almaty.

[44] The Medium-Term Development Strategy for the Energy Sector of the KR for 2012-2017 approved by the Government of the KR on May 28, 2012.

[45] KR Government Program of Transition to Sustainable Development for 2013-2017 approved by KR Parliament Resolution of December 18, 2013.

[46] According to the information of the Ministry of Energy and Industry of the KR, the Program is in the process of coordination.

electricity consumers. Based on the outcomes of the above Action Plan until 2017, the Government of the KR plans to develop the long-term Action Plan for Energy Saving and Energy Efficiency until 2025.

Despite the goals, programs and plans declared by the Government of the KR, at the moment, with the exception of energy efficiency standards for residential buildings, there are still no energy efficiency standards for various sectors of economy and no mechanisms for fostering energy saving and introducing energy efficient technologies.

It should be noted also that the KR is a party to a number of international agreements on energy efficiency. However, in practice, the provisions of these agreements remain unfulfilled.[47]

Energy consumption measurement: Under the laws of the KR, energy consumption is subject to mandatory measurement.[48] Liability for the accuracy of data on production and consumption of energy resources rests with the chief executives of organizations concerned.[49]

Bishkeksvet measures the amount of energy consumed by the city street lighting networks using the measuring instruments installed at switch-on points. Monthly control over amounts of energy consumed by each lighting point is exercised by the HU and LSSD Office (with the completion of inspection reports).

Energy performance standards

Under the laws of the KR, legal entities and individuals are required to comply with energy performance standards which must be mandatorily included in manufacturer's certificate, repair cards and parameter tables, equipment and product operating manuals.[50] Energy performance standards are subject to revision and modification every three years based on the latest achievements in the use of advanced technologies.

[47] European Energy Charter Conference Final Act, Energy Charter Treaty and Protocol on Energy Efficiency and Related Environmental Aspects, ratified by the KR Law of July 26, 1996. The Cooperation Agreement of CIS member states on enhancing energy efficiency and energy saving of October 7, 2002, approved by the KR Government Resolution of March 3, 2003. Decision of the CIS Economic Council on enhancing energy efficiency and energy saving approved by the KR Government Resolution of January 30, 2006.

[48] KR Law on Energy Saving of July 7, 1998, Electricity Rules approved by KR Government Resolution of August 22, 2012.

[49] Article 11 of KR Law on Energy Saving.

[50] Article 15 of KR Law on Energy Saving.

However, in practice, these requirements prove unworkable and unenforceable due to lack of energy performance standards in the KR. In practice, Bishkeksvet is not controlled by any state or municipal bodies as to compliance with energy performance standards.

Energy performance surveys / energy performance certificate: Under the laws of the KR, mandatory energy performance surveys are required for all individuals and legal entities engaged in the generation, transmission and consumption of energy resources.[51] Surveys are conducted by SIETS to assess energy efficiency and reduce energy costs. Based on initial survey results, the surveyed facility is issued an energy performance certificate. The data in such certificate are updated on the basis of subsequent survey results. At the moment, the survey procedure is not legally regulated (there is no effective act or regulation governing the survey procedure). SIETS conducts surveys under the provisions of the regulation that is no longer in force.[52] Bishkeksvet received the energy performance certificate on March 20, 2009 after the initial energy survey. The energy performance certificate, among other things, describes technical specifications of the object, specifications of public utilities supplied to Bishkeksvet (heating, water, etc.). The energy performance certificate must also contain the information about existing systems of measurement and consumption of energy resources, completed or planned energy saving activities, installation of measuring instruments and other energy saving equipment, and officials responsible for energy saving matters. However, there is no such information in the energy performance certificate of Bishkeksvet due to lack of any energy saving equipment and energy saving activity. The last planned survey of Bishkeksvet was conducted in 2013.

Energy efficiency audit: Under the laws of the KR, energy efficiency audit is required for all draft programs on development of sectors of economy, schemes of energy supply to administrative-and-territorial units and settlements, energy technology sections of feasibility studies and design-and-planning documentation for construction of new buildings and structures and extension of existing buildings and structures (reconstruction, remodeling, modernization) to assess compliance with energy efficiency standards and evaluate energy saving activities.[53] However, in practice, these requirements prove unworkable and unenforceable due to lack of procedure for holding the energy efficiency audit.

Under the laws of the KR, energy-using products must comply with energy efficiency

[51] Under Article 9 of KR Law on Energy Saving, surveys are divided into planned and unplanned (extraordinary) inspections. Planned inspections include periodic (recurring) and technical inspections. Unplanned (extraordinary) inspections include initial surveys, investigation of accidents, investigation of malfunctions of energy equipment, etc.

[52] Regulation on energy performance surveys of business entities conducted by the State Inspectorate for Energy and Gas approved by the order of the Ministry of Industry, Energy and Fuel Resources of the KR of July 31, 2008. At the moment, this regulation is no longer in force.

[53] Article 10 of KR Law on Energy Saving.

requirements established by the Government of the KR.[54] However, in practice, these requirements prove unworkable and unenforceable due to lack of energy efficiency standards.

Energy saving and energy innovation fund: Under the laws of the KR, it is required to establish a non-state fund for the promotion of energy saving and energy innovation under the Ministry of Energy and Industry of the KR (the «Fund»).[55] The purpose of the Fund is to facilitate financial support for the promotion of state policy for rational use of energy, including by way of KR Government grants. The Fund is financed with proceeds resulting from energy saving programs and charges collected from generating, transmitting, distributing and other energy companies in the KR. The Fund proceeds may be used, among other things, to invest in increased energy efficiency and energy saving in residential buildings, industrial enterprises and transport sector. However, these provisions remain unfulfilled and the Fund is not in place so far.

3.4.4 Challenges relative to energy savings and energy efficiency regulations

- Under the laws of the KR, legal entities and individuals are required to comply with energy performance standards. However, in practice, these requirements prove unworkable and unenforceable due to lack of energy performance standards in the KR.
- Under the laws of the Kyrgyz Republic, mandatory energy performance surveys are required for all individuals and legal entities engaged in the generation, transmission and consumption of energy resources. At the moment, there is no effective act or regulation governing the survey procedure. SIETS conducts surveys under the provisions of the regulation that is no longer in force.
- There is no information in the energy performance certificate of Bishkeksvet about systems of measurement and consumption of energy resources and about energy saving activities due to lack of regulation and, correspondingly, practice of energy saving and energy efficiency.
- Under the laws of the Kyrgyz Republic, energy efficiency audit is required for all draft programs on development of sectors of economy, schemes of energy supply to administrative-and-territorial units and settlements, energy technology sections of feasibility studies and design-and-planning documentation for construction of new buildings and structures and extension of existing buildings and structures (reconstruction, remodeling, modernization) to assess compliance with energy

[54] Article 16 of KR Law on Energy Saving.

[55] Article 20 of KR Law on Energy Saving.

efficiency standards and evaluate energy saving activities. However, in practice, these requirements prove unworkable and unenforceable due to lack of procedure for holding the energy efficiency audit.

- Under the laws of the KR, energy-using products must comply with energy efficiency requirements established by the Government of the KR. However, in practice, these requirements prove unworkable and unenforceable due to lack of energy efficiency standards.
- Under the laws of the KR, a non-state fund for the promotion of energy saving and energy innovation must be in place to facilitate financial support for the promotion of state policy for rational use of energy. However, the Fund is not in place so far.

3.5 Financial situation of Bishkeksvet

This section summarizes the results of the analysis focusing on the financial performance of Bishkeksvet as of 30 September 2014 (hereinafter, the "Analysis Date") based on Bishkeksvet's financial statements and management accounts for the years 2011 - 2013 and the 9 months of 2014 (hereinafter, the "Analyzed Period").

Bishkeksvet keeps separate accounting based on source of financing:

- The Budget reflects financial results associated with main activities (providing street lighting) and is financed from Housing and community amenities and Environmental support systems authority of Bishkek (hereinafter, the "City").
- Ancillary services – this account is used for reflection of proceedings and outflows related to ancillary activities (advertising, lease etc.) on self-financed basis.

The quality of provided data needs to be improved. For instance, Bishkeksvet prepares incomplete financial statements on a yearly basis without explanatory notes or other disclosures to them. As the result of poor quality of the provided information, the financial consultant consolidated data from trial balance and other sources and reassembled financial statements for 9 months of 2014. Also financial consultant prepared notes to accompany the reassembled financial statements.

Bishkeksvet uses funds from ancillary services to cover the lack of financing from the city needed for its main activities. This results in violation of main accounting rule according to which total assets must be equal to the sum of total liabilities and equity. This in particular can be found in the balance sheet of 2014 as Bishkeksvet did not make reversal entries to adjust the abovementioned accounting errors. Absence of replies to follow-up questions in combination with above mentioned issues created some challenges for analysis and financial modeling.

Conclusions of the financial analysis

Proceedings from the city do not cover Bishkeksvet's expenses. Its revenue under the Budget in 2013 is KGS 49,021 thousand, while operating expenses are equal to KGS 61,124 thousand which implies that operating expenses exceed the revenue by more than 32%.

During a number of question and answer sessions, the Bishkeksvet's representatives said that the amount of revenue is insufficient for proper street lighting of the City, which is confirmed in the model result description sections.

Cash proceeds are lower than what is invoiced which adds to the insufficient financing of the Bishkeksvet. The analysis revealed a low institutional capacity of the Bishkeksvet in matters of availability and provision of data and information. It may be the result of lack of the accounting policy or skilled bookkeeper. Solving of this issue may require institutional strengthening to improve accounting practices.

The historical threshold of additional revenue from ancillary services is at KGS 3,745 thousand This coupled with expenses and surcharge of the City (70%) do not provide an opportunity for any material reforms.

The company has a healthy balance sheet, which means they do not have debt. This allows them to raise money and to use advantage of leverage such as a probable future decrease of pressure on the City budget and so on, provided however, that they are paid in full and on time by the City.

Analysis of financial position

Bishkeksvet's balance sheets prepared as of 31 December 2011, 2012, 2013 and as of 30 September 2014 are presented in the Appendix A.

Assets of Bishkeksvet

Accounts receivable under the budget system accounted for 7% on average of Bishkeksvet's current assets in 2011 -2013. The City is the single debtor. As of 30 September 2014 this account decreased to the lowest level of the analyzed period as the result of receivables' collection. Accounts receivable from the ancillary services averaged at 2 % of Bishkeksvet's current assets.

Fixed assets are represented by buildings, constructions, furniture etc. Bishkeksvet does not make investments into acquisition of fixed assets as they are transferred from Municipal Property Administration. As the result of changes in Bishkeksvet's accounting policy there was a write-off in year 2012 in an amount of KGS 23,192 thousand which led to the

reduction in fixed assets. In 2013 FA increased as Bishkeksvet added back previous write off and reported accrual depreciation of 12,566 KGS thousand

During 2011 Bishkeksvet depreciated buildings and constructions at the rate of 36 % which implies the useful life of these assets to be about 3 years while generally such assets are depreciated over 30 years,

The structure of fixed assets is presented in the table below.

Table 9. Fixed Assets, KGS, thousand

Item	Book value				Accumulated D&A for period			
	2011	2012	2013	9m 2014	2011	2012	2013	9m 2014
Buildings & Constructions	94,839	71,660	82,285	82,178	53,325	(12)	12,566	107
Machinery and equipment	580	562	504	461	159	58	58	43
Furniture & materials	123	113	102	94	45	11	11	8
Vehicles	-	-	290	248	585	-	110	43
Total	95,543	72,334	83,182	82,981	54,114	56	12,744	201

Source: Company data, EY analysis

Liability and Equity of Bishkeksvet

In the analyzed period, Bishkeksvet has only current liabilities. In 2012 the increase in current trading payables was mainly due to late payment for electricity and raw materials resulting from a delay in payment made by the City. A decrease in current liabilities during 2013 – 9 months 2014 is due to repayment of debt to JSC “SeverElectro” (electricity supplier), LLC “Lotar” (electrical material supplier) and other creditors.

According to the latest balance sheet Bishkeksvet does not have any arrears to JSC “Severelectro”. However, it contradicts to generally known fact that Bishkeksvet actually bears short term debt owed to the abovementioned company. It should be noted that the Financial Consultant has requested information regarding this issue, but Bishkeksvet did not provide any explanation. Historical breakdown of arrears to JSC “SeverElectro” is shown below:

Table 10. Arrears to JSC :SeverElectro", KGS, thousand

Item	2012	2013	As at 31 May 2014
Principal debt	10,145	7,755	5,266
Interest fine	1,745	1,580	1,580
Presumptive damages	2,413	1,124	3,537
Total arrears	14,303	10,459	10,383

Source: Company data, EY analysis

Advances received have a debit balance (a negative sign). This may occur due to overpayment of those advances. Sharp increase in advances in 2014 probably resulted from payment received in Q 4 of 2014 from the City. The company did not provide any comments regarding these issues.

Salaries payable in the balance sheets of Bishkeksvet reflects salaries expenses accrued over the last month of the relevant reporting period. The Company pays salaries regularly.

The balance sheet contains misleading items such as reserves in current liabilities. They represent liability to Municipal Property Administration for the transfer of fixed assets. The decrease and increase in reserves reported in 2012 and 2013 respectively were due to acceptance and following cancellation of changes in Bishkeksvet's accounting policy. To comply with accounting standards such reserves need to be reported as part of Bishkeksvet's equity.

Equity capital includes retained loss and reserve capital. As of the end of 2013 the sharp increase in retained loss was due to net loss as the result of lack of financing from the City.

Analysis of Profit and loss statement

Revenue

Revenue represents payments received from the City. During the Analyzed period Bishkeksvet uses cost-based approach to price their services. They issue an invoice to the City based on acceptance bill on a monthly basis in an amount of incurred expenses. Regarding ancillary services Bishkeksvet has following main sources of additional revenue:

1. Poles rental;
2. Advertising;
3. Technical services.

The breakdown of additional revenue from ancillary services is provided below:

Table 11. Additional Revenue from Auxiliary Services, KGS, thousand

Item	2011	2012	2013	3Q 2014
Inspection of poles	31	118	-	40
Payment for electricity	53	343	-	643
Joint suspension on poles outdoor lighting	143	418	-	461
Connection	80	24	-	2
Technical services	46	17	-	2
Elevated work platform services	18	31	-	17
Certificate of completion	1,048	1,315	-	25
Other and unrecognized items	1,082	1,619	-	(49)
Total additional revenue	2,501	3,885	3,745	1,142

Source: Bishkeksvet data, EY analysis

Expenses

Cost of services rendered is mainly represented by the utility payments (53% of cost of services in 2013), including to JSC “SeverElectro”. Also Bishkeksvet makes payments to operating personnel and for social contribution (social cost in Kyrgyzstan– 17.25%). The third largest part of expenses is cost of raw materials such as bulbs, chokes, conductors etc. (22% during 2013).

In 2012 general and administrative expenses are mainly presented by utility expenses and payment to administrative and managerial personnel. A spike in 2013 is due to sharp increase in depreciation of fixed assets.

Bishkeksvet's profit and loss accounts for the year ended 31 December from 2011 to 2013 and for the period ended 30 September 2014 are presented in Appendix B.

Analysis of cash flow statements

Bishkeksvet-prepared cash flow statements show positive net change in cash, which may be misleading. Ending cash positions do not match during the Analyzed Period, except for Ancillary services in 2012. The following items are missing in the company-prepared cash flow statements for 2013:

1. payroll payment outflows in amount of KGS 6,163 thousand;
2. budget settlement outflows in amount of KGS 6,163 thousand

In summary, the data in the statements do not match. While net cash flows are positive, the ending cash is declining.

The cash flow statement has been reconstructed based on available information using indirect method. With absence of investment and financing activities, most of the cash movements relate to their operating activities. Bishkeksvet’s net cash flow is almost neutral. This is most likely due to their cost management driven by payments from the City. They spend only the amount that will reliably be received. Based on our 2013 calculations, reserves, the decrease of accounts receivable and the depreciation charges were the main sources of cash. The reconstructed statement is presented in the table below.

Table 12. The Reconstruction Cash Flow Statement of Bishkeksvet, KGS thousand

Item	2013
Profit before income tax	(11,757)
Adjustments for:	
Depreciation	12,744
FA Reserve	(23,592)
Working capital adjustments:	
Current trading receivables	2,714
Other receivables	42
Inventories	1,090
Advances paid	668

Current trading payables	(5,227)
Advances received	26
Taxes payable	361
Employee benefit	(384)
Reserves	23,192
Unexplained variance	46
Net cash from operating activities	(77)
Cash and cash equivalents at the beginning of the year	87
Net change in cash and cash equivalents	(77)
Cash and cash equivalents at the end of the year	9

Bishkeksvet's cash flow statements for the years ended 31 December from 2011 to 2013 and for the period ended 30 September 2014 are presented in Appendix C.

3.6. Social and Environmental Implications of the Current Street Lighting Supply

3.6.1 Social survey: objectives and results

The Team conducted a social survey to understand citizens' perception of the street lighting quality and its impact on their daily lives.

The social survey, comprised of 10 separate questions, was developed in December 2014 by the Urban Development Consultant and conducted in March 2015 by Kalikova & Associates law firm. It covered 52 people[56]. A wider coverage would have been desired to, among a number of reasons, have a sufficient pool of answers to analyze responses by macro-districts, occupation and family composition. Respondents were divided relatively equally by age tranches, except for an under-representation of the elderly category: 31% of respondents belong to 18-25 years old; 25% to 26-35; 31% to 36-55, and only 12% to 56 and above.

Four major objectives were targeted by the survey:

1. Understand the comparative priority citizens attribute to street lighting versus other problematic infrastructure areas. This is important to help the Municipality decide on prioritization of its potential investments and indicates whether a priority investment into the street lighting project is likely to be approved by the citizens;

2. Assess to what extent citizens relate their perception of general safety and road safety to street lighting;

3. Understand which areas of daily life and which parts of the population would be most positively impacted by installation of quality street lighting. In particular, understand to what extent women and children are more affected by current street lighting;

4. Find out which macro-districts and, possibly, micro-districts, are perceived to have lowest street lighting quality.

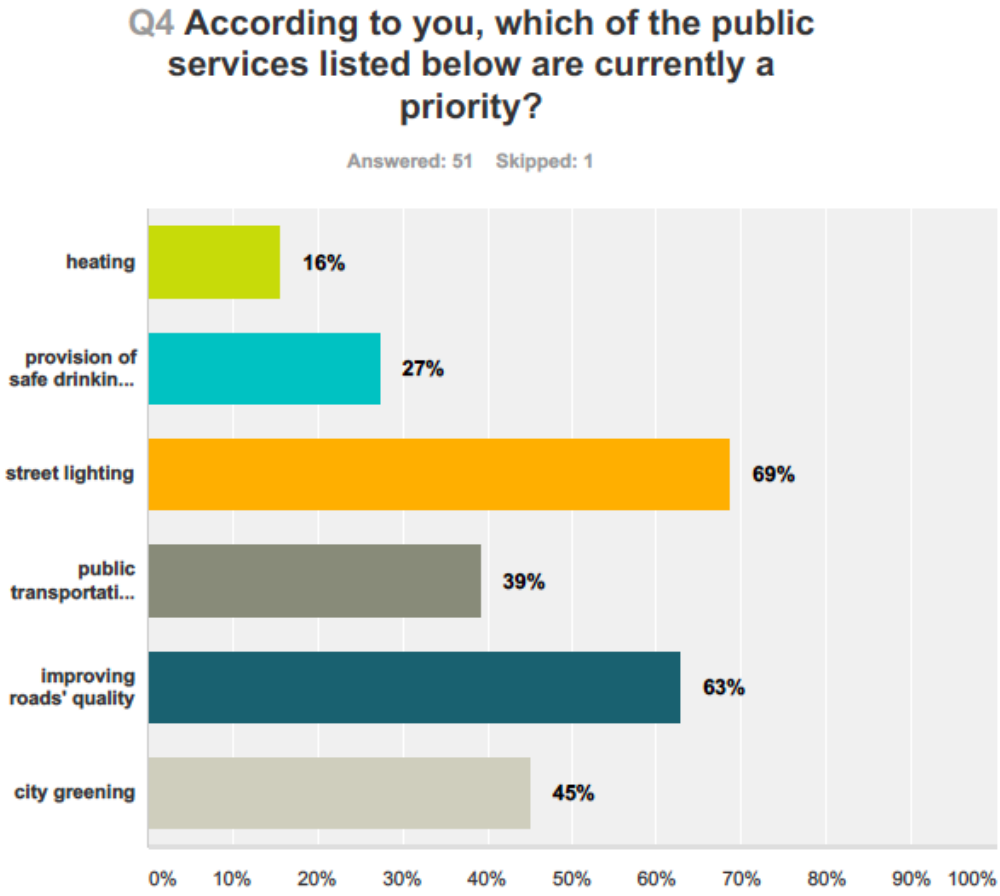
<u>Findings to each objective are presented below</u>:

[56] Detailed results of the survey are available in Annexes.

1. Understand the comparative priority citizens attribute to street lighting versus other problematic infrastructure areas.

Respondents were offered to choose priority areas among the following suggestions (several options could be chosen by one respondent), selected on the basis of an initial assessment of the city's major infrastructure challenges[57]:

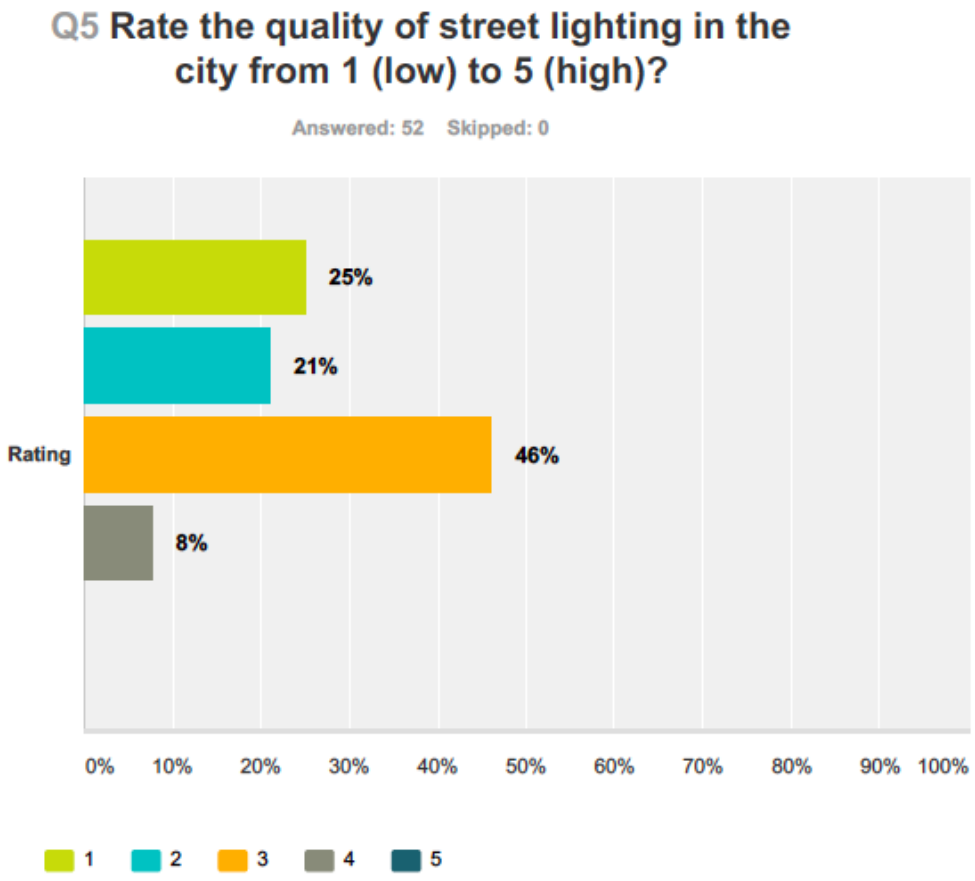
- heating,
- provision of safe drinking water,
- street lighting,
- public transportation,
- quality of roads,
- city greening.



[57] Solid waste was not included on purpose given the fact that the solid waste management project was already under way in cooperation with EBRD by the time of assessment.

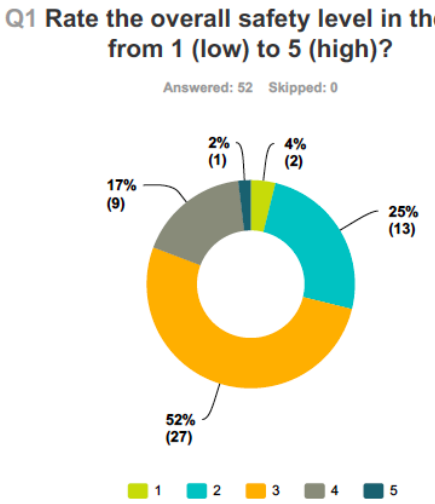
Answer Choices	Responses	
heating	16%	8
provision of safe drinking water	27%	14
street lighting	69%	35
public transportation system	39%	20
improving roads' quality	63%	32
city greening	45%	23
Total Respondents: 51		

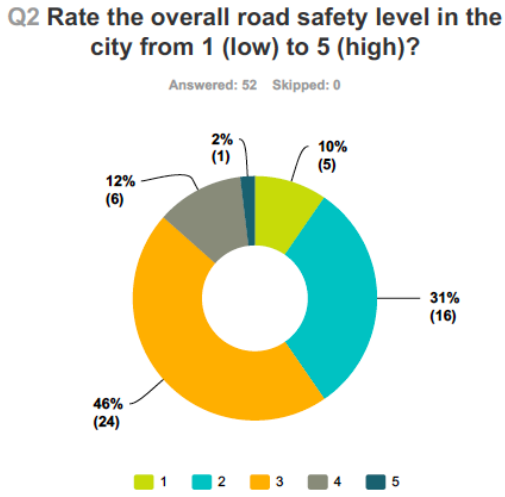
Street lighting was clearly given priority over other areas (69% of respondents), closely followed by improvement of roads' quality (63%). Those were interestingly followed by city greening (45%), then by public transportation system (39%). **Street lighting quality assessment showed a general non-satisfaction**. To the request to rate from 1 (low) to 5 (high) the present quality of street lighting, 1/4 of respondents rated it as low (1), 21% as medium low (2) and 46% as medium (3). In other words, **almost half of the respondents consider present street lighting quality below or significantly below the average**, and almost another half rates it as average. Only 8% gave a medium-high rating (4), and no respondent gave a high (5) rating.



2. Assess to what extent citizens relate their perception of general safety and road safety to street lighting.

Over half of the respondents consider the overall safety level in Bishkek average (52% attributed a score of 3 on the scale of 5 where five is a high level of safety). The share of those who attributed a score of 1 to 2 is by 1/3 bigger than the share of those who ranged themselves to the score of 4 to 5, which means that **the overall feeling of safety in the city according to the respondents is from medium to medium low**.



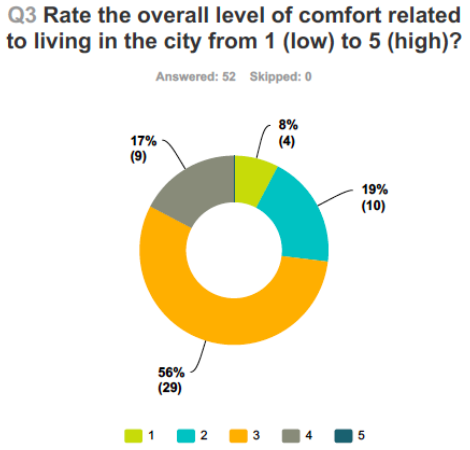


When it comes to road safety, the situation was assesses as even more unsatisfying. While 46% of the respondents judged road safety as average (score of 3 out of 5), 10% consider it low and 31% consider it medium low. Only 14% see road safety as high (2%) or medium high (12%).

Open responses collected to the question 'What factors contribute to lowering road safety?' did indicate that street lighting quality was one of the factors, however only five respondents mentioned street lighting in this context over 37 who provided open responses. Overwhelming reasons quoted were corruption within the road safety related authorities, quality of roads, lack of a driving culture (non-respect of traffic rules) and lack of clear traffic signs (non functioning traffic lights, unclear pedestrian paths, unclear road lines, etc). **Street lighting would therefore, to some**

extent, contribute to improving road safety, however it would not be effective without a set of parallel soft and infrastructure measures[58].

Finally, when asked to rate their **level of comfort related to living in Bishkek**, respondents expressed medium to low satisfaction. Over half (56%) consider the level of comfort to be medium, 19% consider it to be medium low and 8% consider it low, while only 17% consider it medium high and no one rated it as high.



Here, open answers to the question **'What factors contribute to lowering the comfort of living in the city?'** did not give priority to street lighting. Only 6 respondents out of 34 quoted it as a factor. A few respondents specifically mentioned lack of street lighting on pedestrian paths.

The overwhelming majority was concerned with a lack of solid waste management and a lack of cleanliness, followed by poor quality of roads. Next in the list were unsatisfying public transportation system, lack of basic infrastructure services in micro-districts, over-population and, punctually, low quality of drinking water, lack of recreational areas and low level of performance of municipal enterprises.

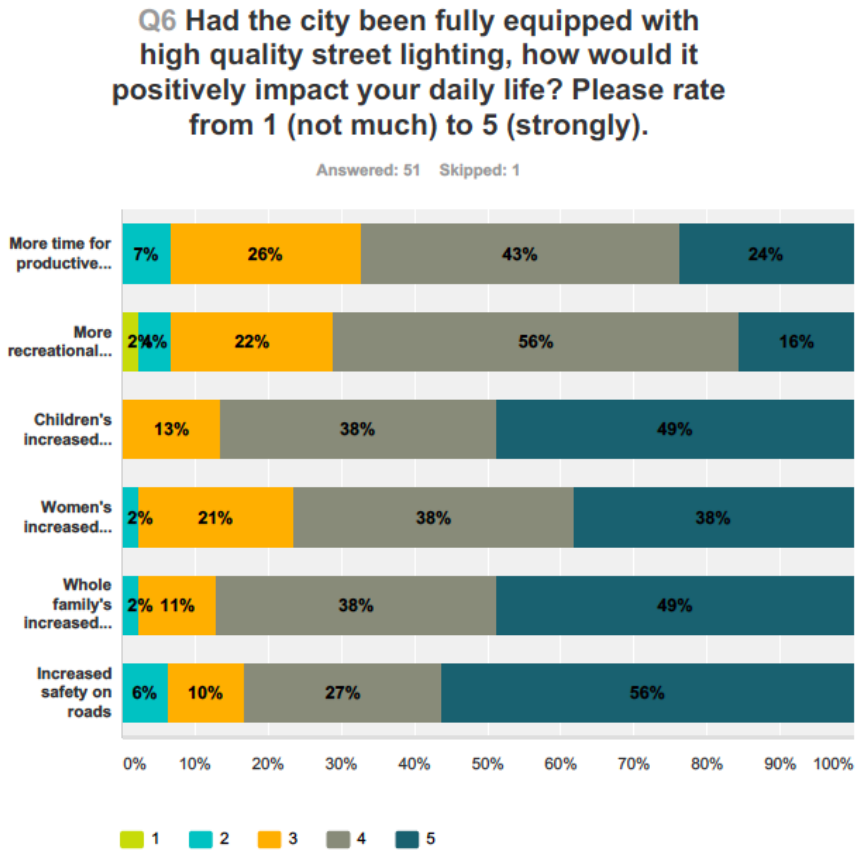
In conclusion, both the overall safety and the road safety are a concern to respondents. Road safety is considered to be a comparatively bigger concern than the overall safety. At the same time, the overall safety was much more connected to the present street lighting quality than road safety. Relatively low satisfaction about the level of comfort in the city is mostly related to lack of cleanliness and bad quality of roads.

[58] See Recommendations for details

3. Understand which areas of daily life and which parts of the population would be most positively impacted by installation of quality street lighting. In particular, understand to what extent women and children are more affected by current street lighting.

	1	2	3	4	5	Total
More time for productive professional activity	0% 0	7% 3	26% 12	43% 20	24% 11	46
More recreational time outdoors	2% 1	4% 2	22% 10	56% 25	16% 7	45
Children's increased safety	0% 0	0% 0	13% 6	38% 17	49% 22	45
Women's increased safety	0% 0	2% 1	21% 10	38% 18	38% 18	47
Whole family's increased safety	0% 0	2% 1	11% 5	38% 18	49% 23	47
Increased safety on roads	0% 0	6% 3	10% 5	27% 13	56% 27	48

Answers to the question below show that the **impact of quality street lighting is perceived to be significant in all considered areas**, namely increased time for productive professional activity, more outdoor recreational time, increased safety of children, women and the whole family, and increased safety on roads. The rating of 5 has been used widely in this question's assessment.



Highest number of respondents who gave a rating of 5 was attached to the impact of quality street lighting on **road safety** (56%), closely followed by **safety of children** and **safety of the whole family** (both 49%). It is interesting to note that such a rate was achieved despite only 33% of respondents said to have children under 18 years old. Strong impact on **safety of women** was pointed out by 38%. Its lower share comparatively with the one attached to the safety of the whole family could be attributed to the fact that there was no separate mention for safety of the elderly, whose safety was indirectly assessed as part of the whole family. It may also be attributed to the fact that criminality is most prominent in the fields of robbery and attached potential physical damages rather than women often being premeditated crime targets.

Criminality statistics provided by the General Department of Internal Affairs (GDIA), in fact, show that men are in general much more affected by crimes than women, at least when in comes to declared cases. For example, in the Pervomaiskiy macro-district, 1,344 criminal cases touched men while 240 cases touched women. It is however difficult to make more specific conclusions since more detailed statistics on the nature of crimes were not provided.

Additional time for productive work and for outdoor recreation received less high ratings, 24% and 16% respectively. One would therefore conclude that **respondents consider safety in all its aspects to be the outmost priority in relation to street lighting**.

4. Find out which macro-districts and, possibly, micro-districts, are perceived to have lowest street lighting quality.

This objective could not be met due to the insufficient number of respondents. Out of 54 respondents, only 37 indicated their location, of which about half said to be located in the Pervomaiskiy macro-district and a few people in each of the other three macro-districts: Leninskiy, Oktiabriskiy and Sverdlovskiy.

3.6.2 Social Implications

General perception of insecurity due to insufficient street lighting: Limited street lighting generates an overall feeling of insecurity during dark hours, which limits social and economic opportunities for the population. A number of factors contribute to this situation:

- Poor lighting on secondary streets and inside residential areas leads to a reduced socio-economic life during dark evening hours.

- Analysis of Bishkeksvet has shown that, while secondary street lighting represents 70% of the system, it has the biggest number of dysfunctional lamps. A similar situation takes place inside residential areas, most particularly in the new settlements. Further, a number

of streets have light points on the road, but lack light points or have dysfunctional light points covering pedestrian paths.

- As a result, house thefts and street robberies are facilitated and citizens tend to avoid going out at evening hours since this would imply reaching home through non-lit areas. The Public Transport Department reported that public minibus drivers tend to refuse covering dark residential areas in the evenings as a number of robbery attacks have affected them.

- **Women, children and elderly** are primarily affected by the situation. A discussion with representatives of Fomova Public Association of Social Protection of the Population and discussions with selected representatives from each of those groups have shown high concern over limited street lighting in the evening hours in fall, winter and spring. Women tend to avoid outdoor evening activities. Similarly, children are reluctantly let attending outdoor activities. Elderly people are particularly vulnerable to injuries related to falls due to a lack of street lighting coupled with a bad quality of pedestrian paths as well as improperly covered culverts and ditches.

Criminality analysis

The General Department of Internal Affairs (GDIA) was requested to provide criminality statistics by time slots to determine whether a significant portion of crimes takes place during evening hours, at which street lighting is required.

Statistics were provided for the four macro-districts of the city for 2013 and 2014 and helped identify macro-districts with highest criminality rate. At the same time, **provided data does not allow tracing a factual connection between crimes and street lighting quality** since data was provided by large, unequally divided timeslots. Similarly, differentiating between the winter and the summer time would have been extremely important to determine the role of street lighting.

Number of reported crimes by macro-district, in 2013 and 2014.

Macro-district	2013	2014	2014/2013
Leninskiy (total)	**10,727**	**10,489**	**-2%**
08:00-12:00	1,687	1,493	-11%
12:00-18:00	2,816	2,252	-20%
18:00-24:00	2,487	2,887	16%
24:00-08:00	3,737	3,857	3%
Oktiabriskiy	**8,009**	**7,937**	**-1%**
08:00-12:00	1,650	1,602	-3%
12:00-18:00	2,009	1,956	-3%
18:00-24:00	2,110	2,310	9%
24:00-08:00	2,240	2,069	-8%
Sverdlovskiy	**2,543**	**2,186**	**-14%**
08:00-16:00	314	316	0%
16:00-24:00	1,716	1,436	-16%
24:00-08:00	513	434	-15%
Pervomaiskiy	**1,980**	**1,945**	**-2%**
06:00-12:00	406	390	-4%
12:00-20:00	776	828	7%
20:00-06:00	798	140	-82%

The four macro-districts have a comparatively similar population, although Oktiabrsikiy is most populated[59] and Leninskiy is the largest in territory. **Leninskiy and Oktiabrskiy districts are significantly more affected by criminality than Sverdlovskiy and Pervomaiskiy districts**. Such statistics could be explained by a more dynamic industrial and commercial situation of the two most affected districts. In addition, Leninskiy district also comprises one part of the airport zone and two peri-urban areas Chon-Aryk and Orto-Sai.

Statistics by timeslots in Leninskiy district show that, in 2013, nighttime crime cases (midnight to 8am) are overall 50% more frequent than between 6pm and midnight. This could be explained by a larger number of apartment robberies taking place at night. The difference dropped to 35% in 2014. It is however difficult to draw solid factual conclusions regarding the role of street lighting. In fact, the numbers of criminal cases are comparable between the timeslots of 12pm to 6pm (timeslot where street lighting is not needed except for the last 1 hours in winter) and between 6pm to 12am (timeslot where street lighting is needed starting from 5 to 9pm depending on the season).

Across the city, the number of criminal cases seems to have dropped slightly in 2014 comparatively with 2013, by 1 to 2% in each district except for Sverdlovskiy, where a significant drop of 14% was noted. At the same time, in Leninskiy district the number of cases dropped

[59] According to the population census of 2009

between 8am and 6pm, but increased between 6pm and 12am. Sverdlovskiy district achieved a decrease in crime cases through an important improvement during dark hours: -15,5% cases compared to 2014 between 4pm and 12am.

Provided statistics do therefore not support the idea of a strong influence of street lighting over the criminality scene in Bishkek. At the same time, the social survey conducted in the frame of the project showed that respondents are strongly concerned about safety and about half of them noted that street lighting contributes to the lack of safety.

Finally, **provided statistics showed that women were less affected by committed crimes than men in all the four macro-districts**. For example, in Pervomaiskiy, which is the least criminal district of Bishkek, 1,344 men were affected by crimes in 2014 against 240 women and in Leninskiy, the most criminality affected district, 6,185 men were affected against 4,304 women. Data for 2013 is comparable to the results of 2014. Little conclusions can be made in absence of detailed statistics on the nature of crimes however, combining provided statistics with an interview conducted with GDIA in December 2014, one could conclude that the **major motive of crimes is robbery and affects men and women proportionately to their potential exposure**.

In conclusion, crime statistics provided by GDIA do not testify of a strong relationship between the street lighting quality and crimes in Bishkek.

Limited road safety:

Over 2013, the Road Safety Service registered 2,898 accidents, in which 123 people were killed and 3,546 people were injured. Compared to 2012, an alarming increase in the number of accidents took place: while the number of road accidents increased 62.5%, the number of received injuries rose by 75 % and the number of deaths by 23.2%.

In 2014, however, the number of recorded accidents decreased by 11% to 2,575 and the number of deaths related to road accidents decreased by 21%. The Road Safety Service did not provide detailed data for 2014 to make more specific comparisons with 2013, except for data on the number of accidents by street, which shows a very similar classification of streets in order of decreasing number of accidents.

Table 13. Comparative Road Accidents Statistics occured in Bishkek, 2013/2012

By districts, 2013/2012	Accidents in 2013/2012					
	Accident		Killed		Injured	
Pervomayskiy district	784	507	38	33	975	554
Sverdlovskiy district	676	451	34	20	834	499
October district	527	356	18	22	665	497
Lenin district	911	457	33	24	1072	539
Total:	**2898**	**1782**	**123**	**99**	**3546**	**2089**
	+62.6%		**+24,2%**		**+69.7%**	

Road accident statistics collected for 2013 show that **over half of accidents take place during hours requiring street lighting and are followed by more severe consequences.** Out of 2,898 registered accidents, 1736 include hitting a pedestrian. Pedestrians are hit both on the pedestrian crossing paths and while crossing the road in non-pedestrian areas.

Poor street lighting is quoted as one of the causes of this situation:

- Absence or near absence of street lighting makes it **difficult to see a pedestrian** crossing the road, assess the right distance between two cars and avoid road imperfections ;
- Similarly, **traffic signs are hardly visible** in poorly lit areas, which leads to violation of traffic rules ;
- **Lack of light continuity** (disfunctionnal light points) is equally affecting the driver's ability to see the road. The eye automatically adjusts to high light intensity, which creates a dark spot for the subsequent non lit area and prevents the driver from seeing a pedestrian or an obstacle.

Table 14. Road Accidents by time Slots and Type of Accidents, 2013

Type of accident				Time of accident			
Hitting a pedestrian	1736	50	1846	00.00-05.59	382	37	527
Collision	863	47	1358	06.00-11.59	704	24	835
Hitting a bike	22	0	22	12.00-17.59	869	20	1003
Hitting an obstacle	132	18	176	18.00-23.59	943	42	1181
Hitting a stationary vehicles	26	2	29	**Total:**	**2898**	**123**	**3546**
Rullover	24	3	23				
Passenger falling	95	3	92				
Total:	**2898**	**123**	**3546**				

- At the same time, statistics of road accidents by street show that **over half of accidents occur on major city streets**[60]. For example, Deng Siaoping street faced 17 accidents over the last 3 months of 2013 due to poor street lighting combined with heavy transport (trucks) running on the street.

According to the Road Safety Service, most prominent causes of accidents are:

1. Bad driving culture and lack of respect of traffic rules: high speed in unauthorized areas, turns and U-turns in prohibited parts of the road, etc.

[60] It is recommended that the feasibility study connects the street lighting map with the areas of major road accidents to further explore to what extent those accidents may be related to the present quality of street lighting.

2. Outdated state of transportation means leading to inability of fully controlling them: bad breaks, etc. Technical inspection of cars is no longer compulsory since 2007;
3. Infrastructure related issues: bad road, bad street lighting, etc;
4. Behaviour of the pedestrian.

Table 15. Statistics of Road Accidents by Street, 2013

Streets	Accidents	Killed	Injured
Chuy pr.	**357**	**24**	**358**
Deng Siaoping str.	263	22	283
Sovetskaya str.	196	22	240
Mira pr.	157	18	166
L.Tolstogo str.	115	5	124
Akhunbaeva str.	114	6	122
M.Gorkogo str.	90	4	96
Kievskaya str.	61	3	75
M.Gvardiya	58	0	63
Y.Fuchika str.	57	6	62
Gagarina str.	48	0	57
Suerkulova str.	13	1	15

Ankara str.	11	2	12
Y.Magistral	9	0	12
Total	**1549**	**113**	**1685**
Other streets:	1349	10	1861
Overall total:	**2898**	**123**	**3546**

3.6.3 Environmental Implications

Bishkek combined heat and power plant (CHP): While an overwhelming part of electricity is generated from large hydropower stations in Kyrgyzstan, a CHP coal fired plant is located in Bishkek. The city has not specified whether Bishkek's electricity in general, and for street lighting in particular, was generated by the CHP. The plant has an installed capacity of 666 MW[61] and 10 operational units, each ranging from 25 to 100 MW capacity. The first unit was commissioned in 1961. It is operated by Electric Stations Open Joint Stock Company (OJSC). Its location in the very center of the city, on the Chuy Avenue, makes it an important source of air pollution, intensified by out-dated plant facilities.

Figure 4. Location of Bishkek CHP in the City

[61] Data as of 10.01.2015, OJSC

At the same time, the street lighting related electricity consumption is estimated to about 3% of the total CHP electricity production, or 28,5 GWh out of estimated 885 GWh[62] (verify data and get more technical information on the plant). The impact of reducing electricity consumption in the field of street lighting will therefore have a comparatively small impact.

In 2014 the Kyrgyz Parliament ratified a loan agreement with Export-Import Bank of China to finance two new units of 150 MW capacity each with the view of using those units instead of the existing ones and hence reduce air pollution. The project operations are scheduled to start in 2016.

Mercury lamps disposal: Until early 1990s, a mercury lamps disposal section was operating at a worsted cloth factory. Since then, mercury lamps are being disposed in open waste containers, which has severe health and GHG emissions consequences.

While the factory is now out of order, the Chuy-Bishkek Regional Environmental Protection Agency says its revival could be examined at the request of Bishkeksvet. Mercury lamps are recommended to be the first replaced during the street lighting project implementation due to their harmful effects and low energy efficiency. At present, these lamps compose 21% of the operating lamp park, or 5,300 units. Provisions for their recycling are therefore essential to avoid their free disposal after their replacement.

[62] http://www.energo-es.kg/?page=news&read=773

4. Proposed Technical Solution and Targeted Benefits

The objectives of the project include modernisation of the existing street lighting system with an energy efficient solution that will reduce energy consumption in Bishkek, with consideration to climate change mitigation. The solution is to be compatible with potential integration with other services such as information and communications technology (ICT), closed-circuit television (CCTV) and advertisement. The project is to improve public safety for Bishkek, with a preference for private sector participation in the project if deemed viable.

4.1 Consideration of Technical Options

Having undertaken investigation of the current street lighting system in Bishkek, the key considerations for the proposal of a solution are:

- The current street lighting solution is not performing adequately for the City. The current system has a high level of lamp failure, a high number of short-term non-operation and a high number of long-term non-operational lamps.

- Bishkeksvet are currently struggling to deliver on their chartered responsibilities of operating and maintaining a street lighting network for Bishkek.

- Significant remedial work is needed on existing energy infrastructure to bring the system up to an acceptable standard. Remedial work covers the lamp units, wiring to the lamp units, street poles, and IP boxes.

- The proposed solution will need to be able to cope with severe voltage fluctuations of up to (minus) 40%. The case for an off-grid solution should be considered. The factor of high voltage fluctuation limits technical options and invariably drives up the cost as more sophisticated technology is required. Suppliers of street lighting may be reluctant to guarantee their products in a system with this instability in voltage.

- It is imperative that technical specifications used to calculate project parameters be strictly tendered so that the solution will deliver the benefits evaluated by the project. Compromising the quality of components will have a marked impact on the performance of the project and will result in a failure to meet the project outcomes.

- Technical specifications that are tendered will need to be guaranteed by the supplier.

- Energy costs equate to half of Bishkeksvet's budget. Tariffs current in January 2015 represent a 60% increase from tariffs from 2013 with a strong indication that electricity

tariffs will continue to rise, in order to reflect the true cost of supply. A reduction in energy consumption (and maintenance and operational costs) will produce positive impact on the lighting system for Bishkek.

A summary table of street lighting options including mercury vapour, high pressure sodium, LED, induction technology and metal halide in included in Annexes.

Driven by the constraints above, the main technologies evaluated on their suitability to meet the technical demands of the system were:

- Light emitting diode (LED), grid connected street lighting
- Solar powered, stand-alone street lighting, with grid connection for back-up supply
- Solar powered, stand-alone street lighting
- High pressure sodium lamps, grid connected street lighting
- Wind powered street lights

LED street lighting was selected as the most appropriate technology that meets the criteria for the project, with consideration to the governing constraints. The solution proposed involves the repair and modernisation of the existing network of 31,000 street lights in Bishkek City with LED street lighting, remedial work to fix existing infrastructure, and an expansion component involving the additional of 15,300 LED street lighting points for Bishkek's outer suburbs. Annexes provide an overview of lighting terminologies and key technical features for traditional and LED lighting.

High-pressure sodium grid connected street lighting: High-pressure sodium street light specifications were reviewed for technical suitability to the Bishkeksvet network. High-pressure sodium lights offer reasonable energy efficiency compared to metal halide and high-pressure mercury lamps and have a reasonable lifespan. However they have poor colour rendering properties, and low efficiency compared to LED solutions. Specifications of the Phillips MASTER SON-T APIA Plus Xtra 100W E40 1SL high-pressure sodium lamp indicate a lifespan of 24,000 hours. However, input voltage specified is 220 - 240 V AC (compared to 85 - 265V AC for the LED lights that are being proposed). Therefore, it is technically unsuitable for the conditions presented by Bishkek's lighting network[63].

Off-grid solar powered street lights: A high level assessment of solar PV potential for Bishkek is provided in Annexes. Though off-grid solar photovoltaic (pv) generation provides the benefit of being independent of the existing electricity network, forgoing the need to remediate the existing system, relatively poor solar irradiation experienced in Bishkek's winter months, with

[63] Though a high pressure sodium street lighting solution appears to be unsuitable for Bishkek, should a private company be willing to design, install, maintain and operate a high pressure sodium street lighting solution for the CIty under an ESCO model, it would be imperative that contract payment is tied to performance and performace is guaranteed for the current conditions of Bishkek's street lighting network, including its severe voltage fluctuations .

significant snow cover, means additional battery power will need to be added to provide uninterrupted supply, driving up per unit costs to above USD 2,000 per street light in order to ensure the street lighting can continue to be delivered during poor weather.

Grid-connected solar powered street lights: A solar powered street lighting system that is also grid-connected, drives up costs further, for though the need for an additional battery is avoided, remedial costs required to upgrade the network will be necessary driving up prices in excess of USD 2,500 per street light.

Wind powered street lights: A high level assessment of the suitability of a wind powered solution was assessed but deemed unsuitable due to inadequate wind speeds experienced in Bishkek. More details for the analysis are provided in Annexes.

As assessment of renewable energy street lighting solutions is further discussed in Section 4.5.

4.2 LED Performance and Technical Specifications

4.2.1 Energy Efficiency, Efficacy

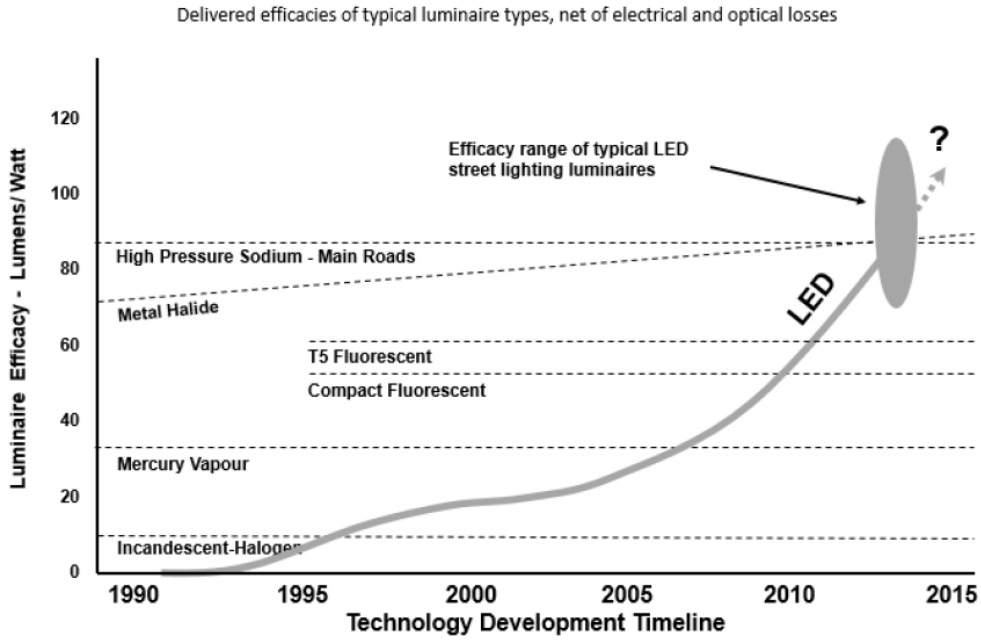
The street lighting industry shows a strong trend towards LED lighting technology, which is advancing at a rapid rate. LED lighting efficacy[64], reflecting energy efficiency, and measured in lumens per Watt (lm/W), has increased exponentially over the past 15 years, and is set to continue to improve as enabling technologies continue to advance.

Currently LED products with an efficacy of 110 lm/W are commonly available, with some vendors supplying LED street lights with 150 lm/W efficacy. It is not uncommon for a manufacturer to release three new improved products in the one year. Vendors claim to have developed products with 300 lm/W output which are currently being tested in laboratories, though could be commercially available in the medium term future. All this equates to more energy efficient products and greater energy savings. With the cost of electricity making up half of Bishkeksvet's annual budget, the conversion to energy saving products, will have a significant impact in reducing operational expenditure, allowing funds to be directed into other areas. Projections for the project have been based on 110 lm/W[65].

[64] Efficacy is a measure of the effectiveness of a light source to convert electrical energy into light. It is generally measured in lumens per Watt (lm/W).

[65] 110 lm/W is based on currently available technology. This should be reviewed at the time the project proceeds to feasibility stage, to incorporate market development progress made to that point.

Figure 5. Delivered Efficacies of Typical Luminaire Types



Source: IPWEA, 2014. PN 11: Towards More Sustainable Street Lighting (July 2014). Practice Note prepared by Next Energy and Strategic Lighting Partners for the Institute of Public Works Engineering Australasia Limited (IPWEA) and the Australian Centre of Excellence for the Local Government (ACELG) at the University of Technology, Sydney (UTS).

The other technical properties of LED lights, such as their long product lifecycle, their use of environmentally friendly materials and excellent colour rendering properties also add to their suitability for the Bishkek.

4.2.2 Product Life Span

The product lifecycle of LED lights is continually being improved and extended. The life of LEDs is generally claimed as 50,000-100,000 operating hours (or approximately 12-22 years for street lighting). Due to the nature of the LED street light industry being an emerging market, it is yet to be seen if manufacturer claims for lifespan on lights is substantiated. However, many cities in the world are rapidly converting their street lighting systems to LEDs, and results of LED street lighting projects that have been undertaken to date align with the manufacturers' claims. Annexes show the 30 largest current LED street lighting projects[66], which have been committed to China, India, Mexico, Costa Rica, Argentina, USA, Canada and the UK. The projects range from 15,000 to 250,000 light points. A lifespan of 50,000 hrs has been used for the basis of calculation based on what is currently readily available in the market. With Bishkek's street lighting demand,

[66] As of July 2014

this equates to approximately 12.5 years[67]. This represents a vast improvement on the current system, which has per light lifespan at approximately 1 year. This will afford benefits such as reduced operations and maintenance costs and delivery of a more reliable network.

4.2.3 Voltage Fluctuation Tolerance

The supply voltage for Bishkek street lights is 220V AC. However, it is reported by Bishkeksvet that voltage drops to 160-180V AC in the winter months, and anecdotal evidence indicates voltages dip as low as 130V AC during the winter months. Most LEDs on the market specify a +/- 5% fluctuation in supply voltage. The voltage fluctuation reported in Bishkek is -30%, and the fluctuation suggested by household monitors is in excess of -40%. The reduced voltage has the effect of raising current in a circuit, which will reach a point where it exceeds the equipment rating, causing burning and malfunction. Some manufacturers of street lighting offer a tolerance of 20% voltage fluctuation, though it should be noted these products are considerably more expensive.

In view of this, the Team examined other potential technical solutions to handle voltage fluctuations challenge, such as addressing them at the transformer level. It was however identified that transformers are in Severelectro's jurisdiction. During discussions with the Team, Severelectro did not express willingness to address voltage fluctuations from its side. The solution proposed hence works within these constraints.

Some manufacturers claim their LED street lights can withstand a supply voltage between 85-265V AC (for example Eco Light). Products with these specifications are recommended and critical to the success of Bishkek's street lighting solution. **It is essentially important that the specifications for the street lighting solution specify the minimum characteristics that the project costing and saving projections were calculated on, and that the specifications are guaranteed by the supplier.**

4.2.4 Colour temperature and rendering properties

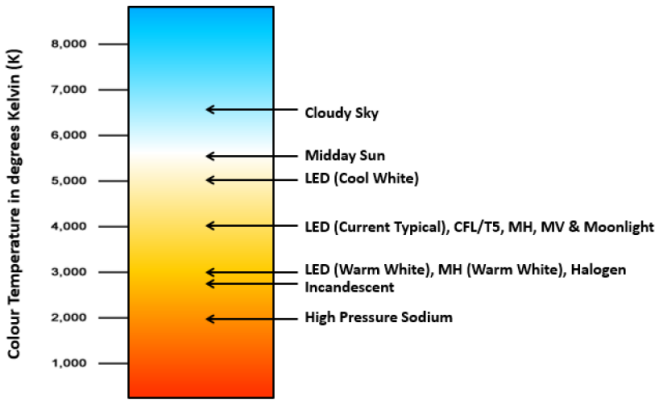
Colour temperature is the scale by which colour temperature is measured in degree Kelvin (K). A depiction of the scale is shown in the figure below.

The colour temperature of yellow high-pressure sodium lighting is 2000K and the colour temperature of a regular incandescent lamp is approximately 2800K, while the colour temperature of the midday sun is 5500K. Newer technology LEDs come in cool white, which has

[67] Lifespan of the street lights should be reviewed at the time the project proceeds to feasibility stage to incirporate market development progress made to that point.

a colour temperature of 5000K, very close to the midday sun. Figures 6 and 7 show the impact of replacing yellow light with white light.

Figure 6. Colour Temperature



Source: IPWEA, 2014. PN 11: Towards More Sustainable Street Lighting (July 2014). Practice Note prepared by Next Energy and Strategic Lighting Partners for the Institute of Public Works Engineering Australasia Limited (IPWEA) and the Australian Centre of Excellence for the Local Government (ACELG) at the University of Technology, Sydney (UTS).

Figure 7. Bowman Street, Sydney before and after LED Deployment

High quality white light, with high colour rendering properties[68], such as those produced by LEDs, has been shown to effectively improve road safety by improving driver reaction times, therefore averting accidents. Recent studies (e.g. Gibbons 2014[69]) show that the same reaction times can be achieved with LEDs rated at one quarter of the energy used by similar levels of high pressure sodium lighting. For example, a 100W LED light produced the same reaction time as a 400W high-pressure sodium light.

[68] Colour rendering refers to the visibility measure of how accurately a light source renders colour.

[69] Dr Ron Gibbons, VTTI, Road Lighting & Road Safety Presentation, Sydney, March 2014

For pedestrians, white light can enhance the detection of hazards and thus reduce risk of accidents. Additionally, white light improves human facial feature recognition thus improving perceptions of night-time security.

For policing, white light provides better visual conditions for suspect recognition, better CCTV capture and improved crime-scene incident and reporting conditions. The City of Los Angeles experienced a 10.5% reduction in crime and vandalism when the city converted 140,000 high pressure sodium yellow lights to LED white lights, and cited the improved street lighting as a major contributor to reduced crime levels[70].

In Bishkek, some stakeholders reported a preference for yellow light, while others had no preference. It was suggested by some stakeholders that white light reduces visibility in the cool Bishkek winter climate, with the surrounding mountain ranges and associated snow and fog. In response, the issue was researched and investigated. Though some anecdotal evidence of discussion on the issue exists, not clear findings on the topic have been identified. It is important that the solution selected for the project will be trialled to ensure suitability for the physical conditions in Bishkek.

4.2.5 Technical Specifications

Key technical specifications proposed for the Bishkek street lighting solution are provided below. The financial models produced for the project are based on these properties. Any change to the specifications of the street lighting equipment could have a marked impact on the performance of the equipment, and significantly impact the financial projections provided for the project, in effect nullifying the outcomes. It is critical detailed modeling be undertaken during the project feasibility stage, to determine the specific technical specifications that will be required by the successful tenderer. In the case that the project delays before reaching procurement stage, the specifications ought to be revised against the availability of market products that are available at that time.

Technical Specifications of LED Street Lights Recommended Solution

- Input Voltage AC (85~265V)
- Frequency (50Hz)
- Life Span >50,000hrs
- LED Lighting Efficiency 110lm/W
- Luminaire Efficiency >90%

[70] US Dept. of Energy, *"The City of Los Angeles LED Streetlight Program"* http://www1.eere.energy.gov/buildings/ssl/text-alt_consortium-la_video.html

- Power Supply Efficiency >90%
- Power Factor >0.98
- Colour Rendering Index Ra>80
- Colour Temperature 2700K~5700K
- Ambient Temperature 700K~5700TempeIP Rating IP65
- Ecoting IP65ng IP65 700K~5700K
- Materials LM06 equivalent Aluminium,
- 316 Stainless Steel fasteners,
- High intensity toughened glass

4.2.6 Summary of Lamp Characteristics

A summary of traditional and LED lamp characteristics including luminous efficacy, colour rendering properties and lamp life cycle is provided in Annexes. The table demonstrates the superiority of LED lights across all categories. This affords the benefits of high energy savings, low maintenance costs, reduced land fill, and elimination of harmful materials such as mercury and lead. However, high investment costs are required.

4.3 Proposed LED solution and impact on energy consumption

The proposed LED lighting solution will return energy consumption savings of approximately 55%. The calculation of the saving is provided in Annexes.

Table 16. Energy Consumption Cost Saving (KGS/USD)

	Cumulative Energy Saving	2014	2015	2016	2017
KGS	Not including long term non-operational light points	23,667,214	49,304,151	76,513,049	105,801,608
	With long term non-operational light points fixed	29,208,154	60,847,180	94,426,193	130,571,755
USD	Not including long term non-operational light points	411,100	856,413	1,329,032	1,837,774

	With long term non-operational light points fixed	507,346	1,056,916	1,640,183	2,268,031

Note 1: Calculations are based on the new Medium-term Tariff Policy 2014 - 2017

Note 2: Bishkeksvet has budgeted 31,700,000 KGS for energy in 2014. The cost of predicted consumed energy is 32,500,000 KGS and the average amount paid between 2011 and 2013 is 23,500,000 KGS

4.4 Maintenance Requirements

All luminaires, including LEDs, require some basic routine servicing and inspection. Servicing may include periodic replacement of photocells, the reliability of which greatly increases in importance as luminaires like LEDs with longer service intervals and lower spot failures are used. A move to much higher reliability photocells needs to accompany LED deployments to secure the full maintenance cost benefits. Lower surface temperatures of LED optics attract less dirt than traditional lamps, however periodic cleaning is required to protect against decreased luminance. A basic cleaning and inspection cycle of four-five years is recommended[71].

4.5 Assessment of Renewable Energy Street Lighting Solutions

Kyrgyzstan's electricity is generated from hydropower for over 90%[72]. The World Energy Council study Electricity in Central Asia: Market and Investment Opportunity Report[73], identifies a strong potential for the development of solar power and wind power for the nation. Potential for biofuel power and geothermal power are rated moderate and low respectively.

Generally, where grid electricity is available, solar power street lighting solutions are not financially justifiable. It is usually in the absence of grid-connected electricity, for remote locations, and where solar energy intensity is viable that a solar powered option could be considered. In the case of Bishkek, the city does have a grid network that extends to 31,000

[71] IPWEA, 2014. PN 11: Towards More Sustainable Street Lighting (July 2014). Practice Note prepared by Next Energy and Strategic Lighting Partners for the Institute of Public Works Engineering Australasia Limited (IPWEA) and the Australian Centre of Excellence for the Local Government (ACELG) at the University of Technology, Sydney (UTS).

[72] MGN Capital, Kalikova & Associates, 2009, Kyrgyzstan Electricity Sector Market Research Report.

[73] World Energy Council, July 2007, 'Electricity in Central Asia, Market and Investment Opportunity Report'.

street lights. It is estimated that an additional 15,350 lights and associated infrastructure is required for Bishkek to be a well-lit city. A high level analysis of the potential for solar power or wind power street lights for the project was conducted. In summary neither option are considered viable for the project at this stage. More detailed assessment of solar and wind energy potential for street lighting in Bishkek is provided in Annexes.

4.6 Targeted project benefits

4.6.1 Social benefits: Road Safety, Personal Safety, Better Access to Activities

From the analysis of the city's priorities, both at the decision-making and at the citizen's level, it is apparent that citizens' perception of safety and comfort at dark hours is the main target of the project. While benefits related to energy savings and connected GHG emissions reduction cannot be underestimated, **the project would only be supported at high level if it brings visible and tangible improvements to the population of Bishkek**.

This conclusion is important as it will invariably influence the choice of the technical solution for the project implementation. In fact, given the large number of social and infrastructure priorities in the city, an effort from the municipal budget is likely to be done within reasonable boundaries, in order not to undermine other key municipal activities, and in such a manner that the perception of a well lit city is reached at the earliest.

In line with analysis conducted in section 4.5, major expected social improvements would be:

- Better driver and pedestrian safety due to increased visibility, reduction of the number of road accidents, better avoidance of severe consequences of the road accidents;
- Increased feeling of security in the city when walking during dark hours, which will provide an increased access to activities, for example attending extra-curricular activities for children, expand geographic areas in which women can work and return home after dark without fear, etc;
- Improved safety for children and elderly subject to injuries related to poorly lit pedestrian paths;
- Intangible benefits such as a more liveable city, increased urban desirability and enhanced civic pride;
- With the use of LED (if chosen), better control of unwanted spill light means less light pollution in residential areas as the light is directed to the areas (road and roadside) promoting healthy sleep patterns.

4.6.2 Increased Touristic Attractiveness

A well-lit city would strongly contribute to improving visitors' experience. A number of foreign visitors have shared concerns: they experienced discomfort and a feeling limited safety due to

the darkness level in the city. **A widespread street lighting combined with an artistic lighting would allow Kyrgyz and foreign nationals to feel comfortable and to better appreciate their stay when visiting Bishkek either for business, for transit or for touristic purposes.**

Street lighting and artistic improvement would very much support the implementation of the third major action listed under the Tourism Development Strategy: Developing Tourist Infrastructure. It would also significantly contribute to the first and second targeted actions: branding of Bishkek and promoting the tourist image of Bishkek.

4.6.3 Environmental improvements

Environmental benefits include:

- Carbon reduction;
- Reduced petrol and fuel consumption due to less maintenance call outs;
- Replacement of lamps that use mercury that normally end up in landfill;
- Reduced light pollution by controlling spill light.

CO2 emission reduction related to the project implementation would amount to over 50% of current emissions:

Table 17. CO2 Emissions Reduction

Existing	**Kwh/yr**	**Electricity specific factor (kg CO2/kWh)**	**kg CO2**	
Total Energy consumed per year (excluding 6000 missing lights)	28,511,858	0.091404	2,606,106	per year
Total Energy consumed per year (incl 6000 missing lights)	**34,369,858**	**0.091404**	**3,150,692**	**per year**
Total Energy consumed if all 31,000 old lamps were working	36,666,667	0.091404	3,351,490	per year
Proposed				
Total Energy consumed per year (excluding 6000 missing lights)	13,242,688	0.091404	1,210,438	per year
Total Energy consumed per year (incl 6000 missing lights)	**15,625,888**	**0.091404**	**1,428,273**	**per year**
Saving per year		**% saving**	**kg CO2**	
Total Energy consumed per year (excluding 6000 missing lights)		54%	1,395,667	per year
Total Energy consumed per year (incl 6000 missing lights)		**55%**	**1,722,419**	**per year**

Other Environmental Benefits:

In addition to the reduction in carbon emissions through reduced energy consumption, there are other environmental benefits to be harnessed from the project such as:

- LED lights contain less harmful chemicals such as lead, mercury and other harmful substances, and are fully recyclable. The extended life of the LED lighting will also reduce landfill.
- Finally, the LED technology allows for more directed street lighting, so that unwanted spill lighting can be reduced.

Financial benefits

Implementation of the Project will not result in explicit financial benefits due to the fact that current tariffs are too low to justify energy saving investments. However, if realized, the project will allow the city to pay efficiently for street lighting. For example, in 2014 the city planned to spend on street lighting KGS 60 million, including KGS 27 million on electricity expenses. Meanwhile, the Team's calculations demonstrate that street lighting requires a commitment of around KGS 122 million to light the entire city. The project will help reduce that cost simultaneously while meeting those obligations.

Thereafter, sufficient financing from the city will help resolve problems with creditors such as JSC "Severelectro".

Economic benefits

According to results of the analysis, the Economic Rate of Return (EIRR) is 6.35 per cent. It of the project was calculated based on the following economic effects:

- ***Savings in operational expenses of Bishkeksvet.*** The main savings in operational expenses includes savings on the electricity consumption, savings in electric material and transportation expenses.
- ***Savings in emissions.*** Annual emissions savings due to the energy consumption decrease of purchased electricity were calculated based on the following data: 1 kWh of electricity power generate 431 grams of CO_2 gas emissions. The price of emissions was forecasted based on the ICE Futures Europe till 2018 and onwards adjusted to the EU CPI.
- ***Higher tax revenues of all budget levels.*** For the calculation of the EIRR, additional proceedings to all budget levels such corporate income etc. have been considered.

Under the calculation there have been some challenges like digitizing of different economic effects like higher safety on the roads and multiplicative effect of the project implementation, which will stimulate development of small and medium businesses. They are not implemented in the calculation but should be considered as positive economic effects.

The results of EIRR calculation represented the table below:

EIRR calculations, KGS thousand

Item	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Savings in OPEX	48,109	50,753	53,338	55,901	58,439	67,935	70,587	73,147	75,746	78,397
Savings in emissions	3,103	3,378	3,679	3,945	4,202	5,170	5,552	5,796	6,053	7,459
Tax revenues	3,081	3,324	3,519	3,719	4,380	4,403	5,944	7,717	8,425	8,779
CAPEX	(1,131,847)	-	-	-	-	(630,109)	-	-	-	-
Net savings	(1,078,685)	56,294	59,327	62,311	65,927	(554,161)	79,568	83,188	86,820	91,140
EIRR	**6.35%**									

continued,	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Savings in OPEX	81,052	83,645	86,220	88,785	91,350	93,938	96,562	99,233	102,009	104,869
Savings in emissions	7,761	8,055	8,347	8,636	8,924	9,214	9,509	9,806	10,116	10,434
Tax revenues	9,704	10,672	11,605	12,496	13,042	13,592	14,150	14,540	14,946	15,364
CAPEX	-	-	-	-	-	-	-	-	-	-
Net savings	95,181	99,219	103,187	107,086	110,484	113,914	117,392	120,674	124,085	127,599
EIRR										

continued,	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044
Savings in OPEX	107,831	110,877	114,014	117,233	120,542	123,936	127,431	131,019	134,701	138,476
Savings in emissions	10,765	11,105	11,455	11,817	12,187	12,567	12,961	13,365	13,781	14,206
Tax revenues	15,797	16,242	16,701	17,171	17,655	18,151	18,661	19,186	19,724	20,275
CAPEX	-	-	-	-	-	-	-	-	-	-
Net savings	131,240	134,984	138,839	142,799	146,866	151,040	155,338	159,753	164,284	168,927
EIRR										

4.7 Project Costs

An overview of estimated project costs is provided in the Table 18 below:

Table 18. Project Cost Overview

		Qty	Unit Cost (av, USD)	USD
1	**Existing network**			**24,222,121**
1.1	Replacement of 31,000 with high quality LED street lighting units[74]	30,967	578	17,898,926
1.2	Installation costs (local labour)[75]	30,967	6	185,802
1.3	Installation support[76]	16	1,600	25,600
1.4	Installation support overheads[77]	1	8,000	8,000
1.5	Replacement of IP points (including wiring)	120	610	73,200

[74] Unit cost $578USD is the weighted average cost for purchase of 8500 x 224W, 5800 x 168W, 12,200 x 112W and 4467 x 56W high quality LED street lights, capable of withstanding input voltage of 85 - 265V. Unit cost includes a 30% bulk purchase discount.

[75] 3 local personnel at $1USD/hour; 2 hours for 1 light installation. Figures provided by Bishkeksvet.

[76] Support from supplier company to supervise the correct installation of the supplied lights in Bishkek. 2 personnel for 16 days over the period of the project

[77] Includes travel and per diem for accommodation and expenses for 2 personnel; 2 trips to Bishkek over the course of the project.

1.6	Replacement of 2343 street lighting poles[78]	2,343	429	1,005,593
1.7	Remedial work on 16,750 lighting points[79]	16,750	300	5,025,000
2	**Automation system**			**2,731,000**
2.1	Upgrade of 110 IP points	110	2100	231,000
2.2	Control automation system	1	2,500,000	2,500,000
3	**Expansion of the network**			**15,908,924**
3.1	Addition of 15,000 LED street lighting points, with luminaire, mounting arm, lighting pole, electrical works, installation, IP points	15,000	1,035	15,519,000

[78] Unit cost $429USD is the weighted average cost for purchase of 400 of 9-15m, 1299 x 7-9m, 644 x 2.5-5m poles. 20% of Bishkeksvet's poles are assumed to require replacement. A detailed inventory survey is required to determine the actual number of poles requiring replacement. No costs have been included for remedial work on poles belonging to departments other than Bishkeksvet.

[79] Includes 6000 long term non-operation lights and 43% of remaining 25,000 lights. Estimate based on input from Bishkeksvet, records provided and observation. A detailed inventory survey is required to determine the actual extent of electrical remedial work required.

3.2	Addition of 350 LED street lighting points, with luminaire, mounting arm, electrical works, IP points	350	741	259,210
3.3	IP points for new network	214	610	130,714
	SUBTOTAL			**42,862,045**
4	**Engineering, Planning, Safety**			**2,143,102**
	5% of subtotal			2,143,102
	TOTAL			**45,005,148**

The total project cost is $45,005,148 USD. This includes $24,222,121 for remedial work of the existing 31,000 street lighting point network, $2,731,000 for a complete automated control and monitoring system and $15,908,924 to expand the network by 15,350 lighting points.

4.8 Project Staging

In order to reduce the amount of capital investment required for the project upfront, staging the project over three stages has been considered and proposed[80].

Stage 1 involves the replacement and upgrade of the existing lighting network, replacing the lamps that would return an energy cost saving of over 50%. This equates to 19,600 of the street lights in the existing 30,967 street lighting network, and represents 63% of the remedial work required to restore the existing network. Stage 1 also includes the upgrade of the automation control system.

Stage 2 involves the conversion of the remaining 11,367 lighting points on the existing network, and the remainder 37% of required remedial work. Based on financial modeling, it is proposed that Stage 2 be undertaken at Year 6.

Stage 3 involves the expansion of the existing network by 15,350 lighting points in the outer suburban areas of Bishkek that do not yet have street lighting service. 350 of these lighting

[80] Due to the need to maintain the current network by continuing to replace lights approximately annually until Stage 2 is completed, the total of the stage approach is slightly higher.

points are proposed to be installed on 14km of existing roads. 15,000 lighting points are proposed for an area of 600km roads that will need to be installed in Bishkek's outer suburbs[81].

Total cost increases slightly to $45,256,631 USD.

A summary of the capital expenditure for each stage, and the cumulative project cost is show in Table 19.

Table 19. Project Staging Summary

Stage	Description	Total (USD)	Cumulative Total (USD)	
STAGE 1	19,600 street lights replaced with new LEDs Remedial electrical work on 10553 street lighting points (wiring) Remedial work on 1476 street lighting poles Automation system 63% of project engineer/planning/safety costs	**19,685,111**	**STAGE 1**	**19,685,111**
STAGE 2	11,367 street lights replaced with new LEDs Remedial electrical work on 6198 street lighting points (wiring) Remedial work on 867 street lighting poles 37% of project engineer/planning/safety costs	9,662,595	**STAGE 1 + 2**	**29,347,707**
STAGE 3	Addition of 15,350 new street lights in suburban areas	15,908,924	**STAGE 1+2+3**	**45,256,631**
TOTAL				**45,256,631**

[81] The building of roads has not been included in the costing for the project, Stage 3. Installation of street lighting poles has been included in costings.

5. City's potential to attract investments

5.1 Investment Environment

General information: There is a legal framework for the protection of the rights of foreign investors in Kyrgyz Republic. The main document, which regulates investment activities, is the law "On investments in Kyrgyz Republic". This law also regulates relations between the State and the investor. The volume of investments into fixed assets reached USD 375 million in 2013, with 27.4% increase compared with the same period in the previous year.

The majority of investments were in mining, manufacturing and real estate. In 2012, foreign direct investments (hereinafter – "FDI") in Bishkek city totaled around USD 197 million, which is 126.6% compared to the same period in 2011. Around 27.6% of FDI were received from CIS countries. The main target sector of attracting investments is real estate, which accounts for more than 30% from the total volume of FDI.

Current projects: At present, the following main investment projects are realized in Bishkek:

Table 20. Main Investment Projects in Bishkek

Project	Executor	Funding	Type of loan	Project value	Short summary
Development of public transport (2013)	Mayor's office and EBRD	EBRD: USD 10.1 million loan and USD 5.5 million grant. Technical assistance – USD 0.25 million	Sovereign loan to KR, on lend to Bishkek	US$ 15.6 million	Replacement of rolling trolley park (79 low-floor and high-field trolleybuses)
Solid waste management	NA	NA	Sovereign loan to be lend to Bishkek	EUR 22 million	Construction of waste-processing plant and realization of set of measures to improve the situation in the field of solid waste (municipal solid waste) in Bishkek
Improvement of water supply in Bishkek	Mayor's office, EBRD and Investment Fund of the Government of the Swiss Confederation	15 year EBRD loan (including 3 year grace period), 1% discount rate	Municipal loan to be provided to Bishkeksvet	NA	Rehabilitation of water supply, replacement of submersible pumps, drilling of new wells, supply and installation of water meters, special equipment, supply and installation of chlorination equipment
Bashkara-Suu	Mayor's office, World Bank	World bank: USD 5.2 million grant;	Sovereign loan to KR	US$ 6.5 million	Construction of water intake "Bashkara-Suu", from which the continuous flow of supplies of drinking water of entire western part of the city is depended.
Sources: "Investor directory", public sources					

Planned projects: The following investment projects are planned in Bishkek:

Table 21. Planned Projects

Project	Short summary
Modernization of automation system of road control and traffic lights	Establishment of a centralized control of traffic lights, LED traffic lights equipage, environmental sensors, detectors of transport, time countdown boards, cameras and etc.
Introduction of automated control systems of night lighting	The automation of 300 boxes of management of urban lighting and organization of single remote control is planned to be realized within the project
Construction of bakery plant	The corresponding agreement was reached with mayor's office with Turkish International Cooperation Agency (TICA)
Road interchange	The construction of traffic interchange at the intersection of Chui and Foochik streets (one of the busiest in the city)
Reconstruction of "Bishkekteploenergo" boiling-rooms	Reconstruction of a number of boilers, reconstruction of heating systems
Sources: "Investor directory", public sources	

PPP planned projects: The following PPP (public private partnership) investment projects are planned:

Table 22. Projects Under PPP

Project	Short summary	Cost
Comprehensive improvement of outdoor lighting with installation of video surveillance systems	Partial and complete replacement of light points, which fed from centralized electricity, by modern LED lights	About USD 36 million
Comprehensive improvement of parking in the city territory	Construction of multilevel parking at Kulieva and Toktogul intersection	US$ 40 million
Construction of ice palace	The project involves the construction of a large ice palace	US$ 12 million

In 2014, KR faced a major energy crisis: A historically long drought period resulted in an unprecedented low level of water in reservoirs and, consequently, in a significant drop in the electricity production. There is at present a capacity gap of 2,4 GW, of which Kazakhstan supplies an equivalent of 1GW at a price in average 5 times higher than the domestic price.

Uzbekistan supplied gas to the South of the country through a gas pipe connected to Osh, the second biggest city of KR. Kyrgyzgas has been bearing a heavy debt for a number of years, which Gazprom covered in a recent transaction buying Kyrgyzgas for a symbolic USD 1. As a result, Uzbekistan refused to further supply gas and the South of the city suffered severe gas shortages in the winter 2014-2015, to the extent of cooking practices on bonfire in urban residential areas.

As a consequence of electricity and gas shortage, coal prices started increasing dramatically. The government tried to contain them, which led to a coal shortage.

Despite an unpredictable political situation and public legal disputes with the private sector, KR is considered a reliable borrower: Constitutional reform of 2010 strengthened powers of the Parliament in order to avoid authoritarian tendencies from the government, however it has been assessed that the Parliament tends to since paralyze the government's actions rather than to support them.

Following public discontent deriving from the energy crisis, it is realistic to expect new demonstrations towards the parliamentary elections. The government could decide to postpone them.

On the economic side, concerns have been raising in relation to related to the private sector operations, in particular foreign companies. Over the past few years, private companies have been systematically initiate legal disputes against the KR government. The recent legal dispute between the government and the Canadian investor Centerra over Kumtor gold mine sent a discouraging message to potential foreign investors.

However, despite a number of political troubles, KR has never cancelled its national credit commitments and is considered a reliable borrower. There is a clear understanding that the role of donor assistance critical in the country.

5.2 Financial analysis of city budget

This section provides a brief analysis of the financial situation of Bishkek city budget, based on the data provided for 2010 - 2014 by mayor's office.

5.2.1 Main Budget Items

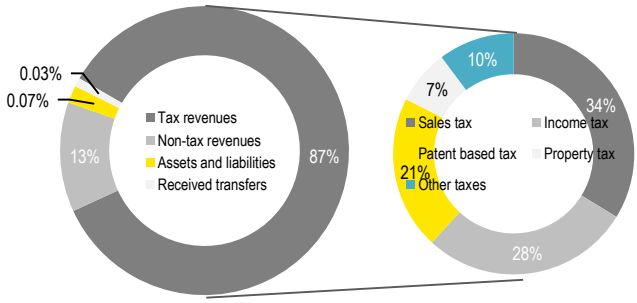
Under the law, city budget should be balanced, this means all expenses should be matched with revenues.

In 2013, balance of revenues and expenses taking into consideration special funds, official transfers, assets and liabilities of city budget reached KGS 6.2 bln.

Revenues

Most of revenues of the city budget are tax revenues (87%) and non-tax revenues (13%). Sales tax, income tax and tax on the basis of voluntary and compulsory patent comprise 81% of tax revenues. The rest comes from property tax and other tax revenues.

Revenue structure of city budget, 2013



Source: City financial administration

Revenues planned as actual

In 2010, budget variance of actual vs planned was 97.3% from planned. In 2013, this factor declined to 91.4%. Furthermore, in 2012 budget variance dropped down significantly to 88.7%. Historically, the variance between actual and planned revenues has been significantly high. The following table represents the budget variance in 2011 and 2012 years:

Table 23. Budget Variance 2011-2012

KGS thousand	2011 ACTUAL	2011 PLANNED	Budget variance	2012 ACTUAL	2012 PLANNED	Budget variance
Revenue	5,983,121	6,415,304	93.3%	5,786,822	6,520,456	**88.7%**
Tax revenues	3,756,826	4,225,758	**88.9%**	4,362,788	5,053,685	**86.3%**

Non-tax revenues	695,204	684,501	101.6%	726,631	728,142	99.8%

The majority of revenue items suffer from non-fulfilment of planned numbers, including national taxes and local taxes. This may happen due to ineffective management and administration of the tax collection.

National taxes

National taxes comprise on average around 37% from total revenues (50% of contributions to the budget of Bishkek from Republican budget in 2013). More up to Budget process analysis. This factor does not stimulate local authorities to develop economic and tax base for city budget. Also, the current system of allocating revenues between different levels of the city budget suffers from instability.

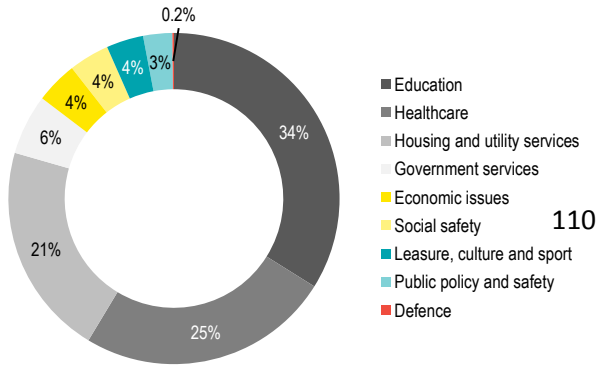
Table 24. National Taxes

KGS thousand	2010	2011	2012	2013
National tax	1,660,186	1,822,548	2,341,466	2,589,641
Income tax	659,875	795,130	1,367,022	1,472,704
Tax on special regimes	1,000,312	1,027,418	974,444	1,116,938
Single tax	109,462	114,714	121,008	114,749
Patent based tax	864,467	890,819	833,032	1,002,189
Tax on specific funds	26,383	21,886	20,405	-

Expenses

The volume of expenses of the city budget increased by 8% compared with previous year due to increased financing on education, health and public services of general assignment in 2013. On average, in 2013 share of

Expenses breakdown of the city budget, 2010 - 2013



operating and capital expenditures of the city budget amounted 93% and 7% respectively.

Budget reform

According to the public sources and decision of Bishkek council on March 18, 2014 "On approval of the budget for 2014 and forecasted 2015, 2016", healthcare and education expenses will be transferred to Republican budget in 2015 and 2016 respectively. All necessary mechanisms were discussed in the recent meeting with expert group and the city budget is currently being prepared to implement this agreement. This will result a significant change in the city budget, since these two sections comprises more than 50% of city expenses.

Source: City financial administration

Table25. City Expenses

KGS thousand	2010	2011	2012	2013
Healthcare	832,800	1,206,082	1,387,518	1,558,433
Education	1,348,200	1,899,662	1,902,460	2,136,244

Most importantly, this will likely affect the city's revenues due to the fact that the Ministry of Finance intends to retain a bigger share of national taxes.

Affordability of project implementation

The following section describes key revenue and expense drivers, the conclusion with an assessment of the current financial health of Bishkek, affordability of project implementation and alternative funding options.

Key revenue and expense drivers

Revenues

As it was mentioned before, tax revenues comprise around 87% from city revenues and the further growth is highly depended on change in sales tax, patent based tax and income tax.

Table 26. City Revenues

KGS, thousand	2010	2011	2012	2013

Sales tax	1,177,441	1,284,052	1,426,975	1,798,495
Income tax	659,875	795,130	1,367,022	1,472,704
Patent based tax	864,467	890,819	833,032	1,002,189

These 3 main elements comprise on average 80% from tax revenues. The volume of revenues from sales tax (2% from each sold product) is mainly driven by profit from wholesale and retail trade in Bishkek. Revenues from income tax (10%) are dependent on employment, development of small and medium size of the business in Bishkek, also improvement of collection of taxes from tax avoidance and etc. Compulsory patent based tax revenues are driven by increase of service providing businesses in Bishkek (exchange, parking lots, bath houses, pawnshops, beauty salons and etc). The growth of these revenues is defined by development of small size businesses. Based on the results, it is necessary to underline that Bishkek budget is highly hinged by sales, income and patent based taxes, which were showing year-by-year growth. Income tax revenues have shown the highest $CAGR_{2010\text{-}2013}$ - 31%.

Expenses

This sub-section shows 3 main elements, which comprise about 57% of the city budget expenses and explains some significant historical changes.

Table 27. City Expenditure Components

KGS , thousand	2010	2011	2012	2013
Wages	1,615,600	2,144,645	1,963,129	2,012,510
Purchase of other services	727,400	812,219	831,175	772,029
Expenses, represented by single entry in the healthcare system	-	275,559	917,596	1,092,759

According to financial administration department of Bishkek, a significant increase in expenses on wages of budget institutions (33% in 2011) was financed by transfers from Republican budget (see Table below).

Table 28. City Expenses and Revenue

KGS thousand		2010	2011	2012	2013
Expenses	Wages	1,615,600	2,144,645	1,963,129	2,012,510
Revenue	Transfers from Republican budget	313,679	1,196,959	628,557	115,923

Purchase of other services (current rehabilitation of property, expenses on maintaining of buildings of educational institutions, etc.) was not showing growth over past years. No detail has been provided for healthcare expenses.

The city's budget expenses on Bishkeksvet are immaterial to the funds earmarked for municipal services, as presented in the following table:

Table 29. City Payments

KGS, thousand	2011	2012	2013
Payments to non-financial state enterprises, including:	518,400	577,030	584,865
Payments to Bishkeksvet	57,943	56,838	56,728
% from total	11.2%	9.9%	9.7%

Payments to non-financial state enterprises consist of "Zelenstroy" (greening and gardening), "Tazalyk" (street cleaning), "Bishkeksvet" (street lighting), "Bishkekgorlift" (maintenance of lifts) and "Bishkekvodokanal"(water/wastewater utility) with around 9% share from total expenses.

Servicing of the loan cost

According to financial administration department of Bishkek, debt service of the city budget is not carried out according to international financial standards (IFRS). For this reason, all transactions regarding debt service are recorded outside of the revenues/expenses.

Table 30. City Loan Servicing

KGS, thousand	2010	2011	2012	2013

Interest received from loans	356,964	150,000	-	-
Interest paid	(216,964)	(225,000)	(51,618)	(100,000)

Alternative funding options

From liquidity point of view, city faces constant deficit and underfinancing of CAPEX (current financing at around 5% from overall expenses). For this reason, current budget cannot afford to finance the entire EE project. From sustainability point of view, city has to comply with certain borrowing ratio:

- Debt service ratio (20%). Bishkek Mayor's office cannot get a loan/credit, in case if debt service ratio exceeds 20% from city annual revenues.

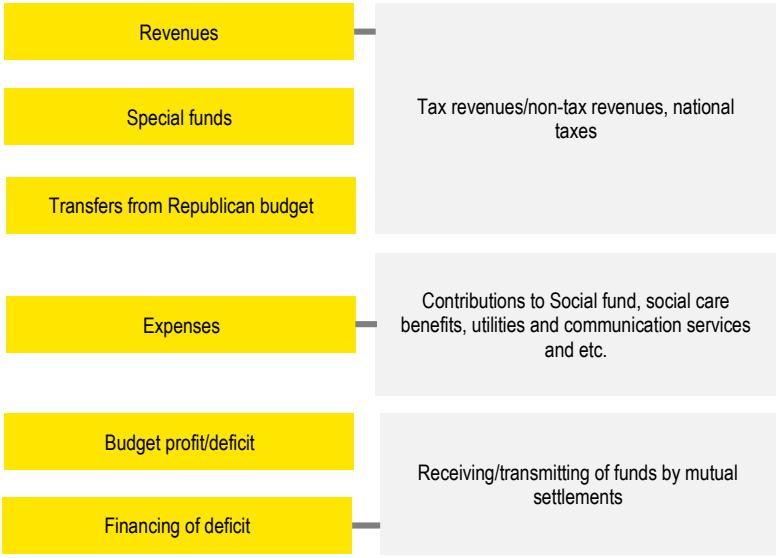
Taking into consideration this ratio, the maximum amount the city can borrow to finance Bishkeksvet investment program is USD 24.9 million. However, the City may have other pressing matters to address outside of this project, therefore the full amount won't be utilized for the street lighting project.

Alternative to debt budget financing can be grants from IFI either to Bishkek city or directly to Bishkeksvet. Transfers from Republican budget can also be considered.

5.2.2 City budget overview

The following section describes the process and components of city budget. After each subsections there are tables representing assumptions of financial model.

Figure 8. Budget structure and regulation



Budget process is set in accordance with the law on the basic principles of budget law in the Kyrgyz Republic dated June 11, 1998 N 78, and the law on financial and economic bases of local self-government on September 25, 2003 N 2015.

Bishkek budget is prepared and executed by the executive authority of local government and reviewed and approved by the city council. Fiscal year in the territory of KR is considered the period from January 1 – December 31 inclusive. It is independent and no funds can be withdrawn to the republican budget.

City council approves annual budget for any subsequent year plus the following two forecasted years. Budget implementation is carried out by the executive body of local self-government through the regional offices of the Treasury and tax authorities. Reports are administered by the relevant executive bodies of local self-government and provided to the Ministry of Finance not later than March 1 of the year after fiscal.

The uniform classification of budget revenues and expenditures for both Republican and local budgets used in KR is approved by the Ministry of Finance. Expenditures cannot exceed limits approved by city council. Any changes can be adopted in case of presence of specific, informed sources of compensation of additional expenditures and occurring revenue.

The decisions on lending from Republican budget are adopted by the Government of KR.

In case if provided budget loans from Republican budget are not repaid by the end of the fiscal year, the outstanding part is collected back to Republican budget at withholdings from national taxes and other revenues, payable to the Bishkek budget.

Budget revenues

Revenues of the city budget (prepared and executed by the executive authority of local government and reviewed and approved by the city council), consist of taxes and levies, non-tax revenues, tax and revenues distributed from Republican budget and transfers from Republican budget.

1. Tax revenues (administrated by Tax administration body) to the city budget are taxes and other obligatory payments. Collection of local taxes and fees is managed by the tax authority and authorized tax inspectors;

2. National taxes and other revenue (50% of contributions to the budget of Bishkek in 2013; This proportion is set each year) include income tax, sales tax and tax based of voluntary/mandatory patent, simplified system of taxation on the basis of a single tax and other state taxes and other revenues;

3. Non-tax revenues include revenues from the management and disposal of municipal property, rent charged for the rights to use the land of the Fund of redistribution of agricultural land and other non-tax revenues;

4. Categorical grants, equalization grants and stimulating grants and funds transferred by mutual settlements are related to transfers from Republican budget;

5. Special funds (funds of budgetary institutions, received from the sale of goods, works and services);

6. Revenues additionally received after budget implementations remain at the disposal of the local government. These revenues cannot be withdrawn and only used for financing of budget expenditures;

Table 31. Budget Revenues

Forecasts	Index	Assumption
Revenue		
Tax revenues, including:		
National tax	Nominal wage growth	National tax, which is consist of income tax and taxes on special regimes (single tax, patent based tax and tax on specific funds of state-financed organization), were forecasted by taking nominal wage growth. These taxes are mostly paid by legal entities, organizations and independent entrepreneurs.
Income tax	Nominal wage growth	
Tax on special regimes	Nominal wage growth	
Local tax	-	-
Property tax	Population growth rate and CPI growth	Property tax (on wealth used/not used for business activities, or land tax) was forecasted by taking population growth rate and CPI growth.
Sales tax	CPI growth	CPI growth was taken to forecast sales tax, due to the fact, that growth of this type of tax could be ensured predominantly by activities of organizations, companies and individual entrepreneurs.
Non-tax revenues	CPI growth mostly, population growth	Most of non-tax revenues (property income and interest, proceeds from the sale of goods and services, fines, penalties and confiscations) were simply forecasted by CPI growth.
Capital earnings	CPI growth	Capital earnings, which consist of revenues from sale of non-financial/financial assets, and issue of state short-term securities except for

		shares, were forecasted by taking CPI growth

Budget expenses

Local budget expenses consist of education, housing and utilities, health, public order and safety, general public services, social protection, economic issues and other expenses. Also, budget expenses are divided into secured and expenses, which could be sequestered in case of non-fulfillment of planned revenue part of city budget. List of items of expenses and index is set by the Coordination council for Macroeconomic and investment policy of the Government by single rate.

The following expenses are included in operating expenditures:

1. Wages;
2. Contributions to the Social Fund;
3. Grants to non-financial private enterprises;
4. Utilities and telecommunication services

The following entries are included in other expenses:

1. Buildings and structures/machinery and equipment;
2. Payments to (non)financial state/private enterprises;
3. Payments of internal borrowings;
4. Etc.

Expenses associated with repayment of the principal from internal and external borrowings are not shown in expenses section, but treated as off balance in the section of “Sources of budget deficiency payment”.

Budget deficit

Based on historical data, the city has been running consistent deficit. It is therefore unlikely to be able to cover any possible debt service. The deficits are usually financed by transfers from Republican budget.

Table 32. City Budget Deficit – 2012-1013

KGS , thousand	2012	2013
Revenues (without transfers)	5,786,822	6,243,220
Expenses	5,833,517	6,300,871
Budget deficit	**(46,695)**	**(57,651)**

Transfers are considered as a part of the budget financing system of Kyrgyz Republic, and allocated from Republican budget by local authorities.

Additional materials regarding of the City budget are presented in Annexes 10 – 14.

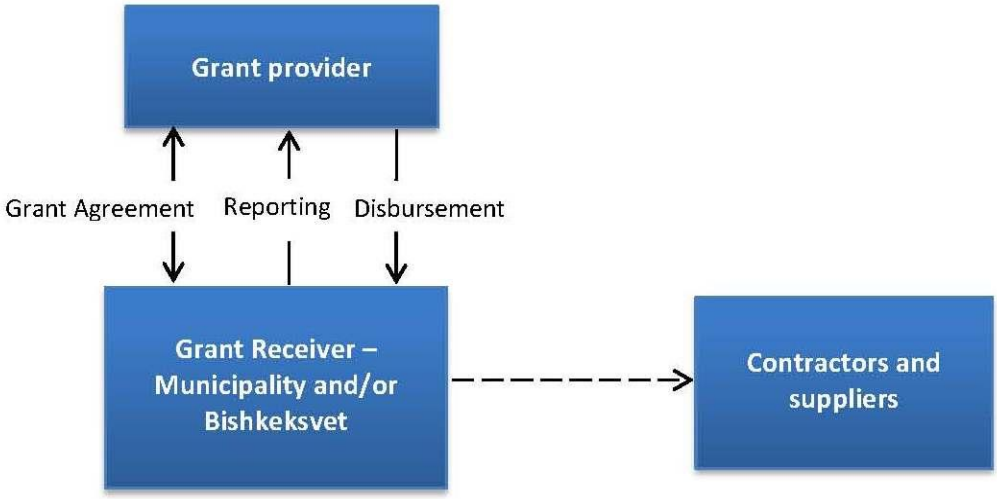
5.3 Potential Legal Mechanisms to Attract Investments

This section provides a review of legal mechanisms facilitating investment in Bishkeksvet. The review is based on the provisions of the laws of the KR, takes into consideration local practices and describes:

- legal mechanisms applicable to financing of Bishkeksvet (increasing Bishkeksvet's budget, grant, loan/credit, finance lease, energy service contract, involving citizens in co-financing); and
- legal mechanisms applicable to management of Bishkeksvet (trust management, enterprise lease, PPP, privatization).

5.3.1 Legal mechanisms applicable to financing of Bishkeksvet

Figure 9. Grant scheme



The Municipality and/or Bishkeksvet are eligible to attract funding for development of Bishkeksvet through grants, which refer to assets (money and/or property) provided free of charge.[82] The laws of the KR differentiate the following types of grants:

- *Grants provided by a foreign State or international/foreign/local organizations* to the Government, local self-government bodies [83], governmental or non-profit organizations,[84] this type of grants is allowed by the laws of the KR, however, the conditions for providing such grants, are primarily established by the grantors;
- *Grants provided by the Government to local self-government bodies within frame of inter-budget relations;* [85] the procedure and conditions for providing this type of grants are governed by the laws of the KR. Grants provided by the Government fall into equalization, categorical and stimulating grants.[86] Of all aforesaid grant types, the Municipality, for the purposes of modernizing street lighting networks, may seek

[82] Article 153 of the Tax Code of the KR of October 17, 2008.

[83] Under the KR Law on Financial and Economic Fundamentals of Local Self-government of September 25, 2003, the local self-government bodies may receive "voluntary contributions" i.e. money provided to local budgets and non-budgetary funds by individuals or legal entities on a free of charge and non-repayment basis to accomplish the tasks and functions falling within the competence of the local self-government bodies.

[84] Article 153 of the Tax Code of the KR of October 17, 2008.

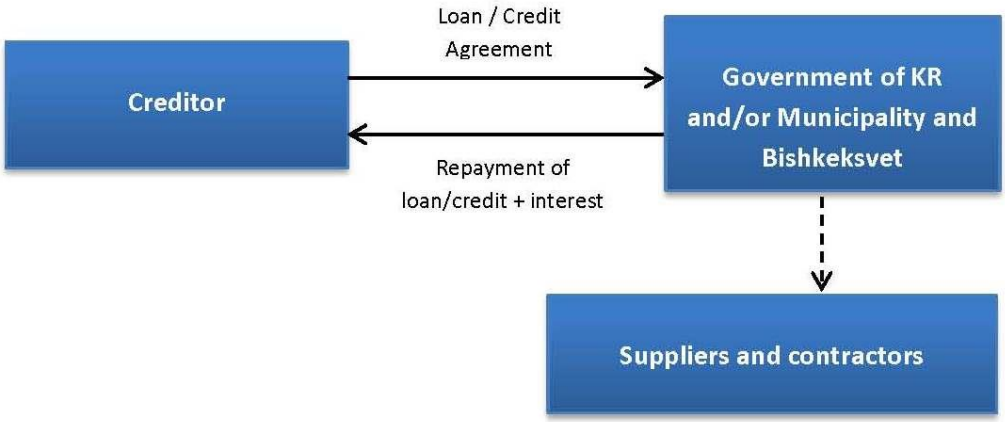
[85] Article 35 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998.

[86] Under Article 35 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998, categorical grants refer to transfers from the republican budget on a free of charge and non-repayment basis to cover certain types of local budget expenditures guaranteed by the State; equalization grants refer to transfers from the republican budget to cover local budget expenditures in accordance with minimum state social standards to maintain stable socio-economic status; shared (stimulating) grants refer to transfers from the republican budget to local self-government bodies to promote efficient spending of budget funds and resources of state priority programs and projects, to increase local budget revenues and to improve local revenue mobilization.

stimulating grants.[87] This type of grant is provided through competition and on the condition that the Municipality provides co-financing to the extent of 10% - 60% of the total project cost. The total amount of stimulating grants must be envisaged in the republican budget, while the amount of a particular stimulating grant cannot exceed 3 (three) million KGS.[88]

Conclusion: A comparison between two types of grants shows that it will be less efficient for the Municipality/ Bishkeksvet to seek a grant from the Government due to the necessity of limiting the amount of such grant (KGS 3 million), reflecting such grant in the total amount of stimulating grants within the frames of the republican budget, holding a competition and co-financing with the Municipality to the extent of 10-60% of the total project cost. It would be preferable for the Municipality and/or Bishkeksvet to seek a grant from foreign States or international/foreign/local organizations.

Figure 10. Loan/credit



The Municipality (and/or Bishkeksvet) or the Government of the KR[89], for the purposes of implementing the street lighting improvement project, may borrow funds by taking loans or credits and provide a security interest (collateral, guarantee) to secure repayment of loans and

[87] The laws of the KR allow Bishkeksvet to receive a grant from the Municipality in accordance with the Regulation on financing of Bishkek development projects through shared (stimulating) grants from Bishkek local self-government bodies approved by the resolution of the City Council of December 2, 2009. However, assuming the Bishkeksvet co-financing requirement, the likelihood of receiving such grant is low.

[88] Regulation on financing through shared (stimulating) grants (approved by Government Resolution of June 29, 2012 No. 462). According to a BCFO representative, there were no precedents of receiving stimulating grants from the Government by the Municipality.

[89] Article 8 of the KR Law of September 25, 2003 No.215 on Financial and Economic Foundations of Local Self-government, Article 4.3 of the Charter of Bishkeksvet, Article 26 of the KR Law of June 11, 1998 No. 78 on Basic Principles of Budgetary Law in the Kyrgyz Republic.

credits.[90] Another option for borrowing money for financing of this project may be to issue municipal bonds. Under the laws of the KR:

- *a loan* is an agreement whereby the lender transfers money or fungible things into ownership of the borrower and the borrower undertakes to return the same amount of money or the same number of things of the same kind and quality to the lender. The amount of the loan must be returned within such time and in such manner as may be prescribed by the loan agreement and unless otherwise provided by law or agreement, the lender has the right to receive interest in an amount defined in the loan agreement. The loan agreement is deemed executed from the moment of transfer of money or things.[91]
- *a credit* is an agreement whereby the bank or other credit organization (creditor) undertakes to provide money (credit) to the borrower in such amount and under such terms and conditions as may be prescribed by the agreement, and the borrower undertakes to return the money received and to pay any interest accrued thereon. The credit can be given as money only and by the banking (credit) organizations only;[92]
- bonds are securities certifying the right of their holders to receive the par value / other property equivalent and a fixed percentage of the par value of the bonds / other property rights from the issuer of the bonds on the specified due date.[93]

The Municipality and/or Bishkeksvet can borrow with the consent of the City Council and the Ministry of Finance of the KR provided that the total debt of the Municipality, including future debt obligations, do not exceed 20% of its annual income including the funds received as a result of taking loans/credits or issuing municipal bonds.

According to the BCFO information, the Municipality has no precedents of receiving credits from commercial banks but has experience of receiving credits from IFIs.[94] The Municipality also has experience of offering municipal bonds to the Social Fund of the KR.[95] The Municipality has no experience of offering municipal bonds to private investors.

Conclusions: From a legal perspective, Bishkeksvet can take loans and credits; however, due to full budgetary dependence and lack of revenues and liquid assets, it may be problematic for Bishkeksvet to receive a loan/credit. The Municipality can receive loans/credits and issue

[90] Under article 15 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998, the Ministry of Finance of the KR is the sole agent of the KR Government in the matters concerning external and internal borrowings, providing credits and guarantees.

[91] Subtitle 1 of Title 34 of the Civil Code of the KR.

[92] Subtitle 2 of Title 34 of the Civil Code of the KR.

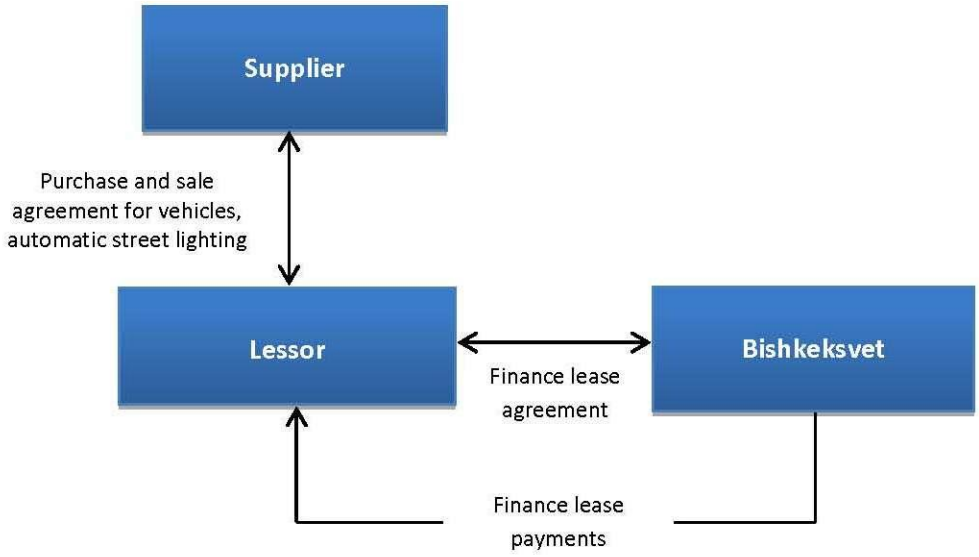
[93] Article 44 of the Civil Code of the KR.

[94] The Municipality executed credit agreements with EBRD (with participation of the Government of the KR) for improvement of city infrastructure carrying lower interest rates than those charged in the market of Kyrgyzstan.

[95] Bishkek Municipality issued municipal bonds worth: 200 ml. KGS in 2008 to finance the purchase of large passenger vehicles, 200 ml. KGS in 2009 to repay the principal, 250 ml. KGS in 2010 to refinance its obligations under the previous offering and to finance road construction, 150 ml. KGS in 2011 to refinance its obligations under the previous offering and to finance road construction, and 110 ml. KGS in 2013 to refinance its obligations under the previous offering.

municipal bonds. However, considering the current Municipality practices, taking credits from local commercial banks does not seem appropriate. The option of offering municipal bonds by the Municipality to private investors, in our opinion, has limited advantages compared to other popular instruments (for example, investment in real estate, bank deposits). The most appropriate option, in our opinion, is to seek unsecured preferential loan and/or credit from IFIs.

Figure 11. Finance lease

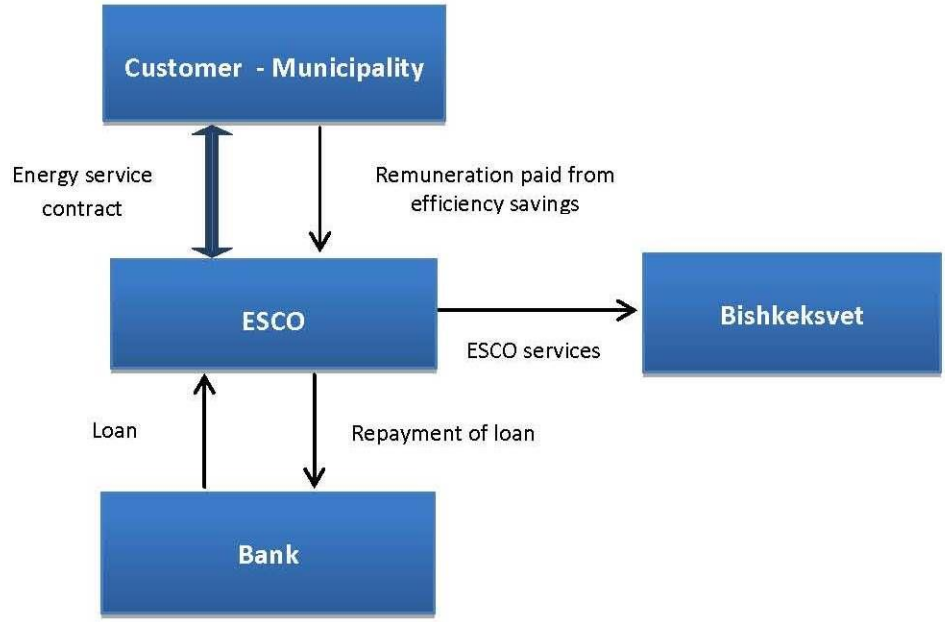


For modernization of street lighting, the Municipality and/or Bishkeksvet can use finance lease. Under the finance lease agreement, the finance lessor (finance lease company, bank or other financial institution) undertakes to acquire into ownership the property indicated by the lessee from the seller identified by this lessee and to provide this property to the lessee at a charge for temporary possession and use for entrepreneurial purposes.[96] The finance lease agreement can stipulate that the ownership right can pass to the lessee upon expiration of the finance lease agreement. The subject of the finance lease typically includes equipment and vehicles. It may not include expendables (i.e. consumable things).[97]

Conclusions: In the opinion of the financial consultant, finance lease cannot be viewed as an efficient method of financing, as it can cover only an insignificant part of capital expenditures necessary for modernization of street lighting. However, finance lease can be used as an additional method of financing to upgrade obsolete vehicles or to purchase ASLMS.

[96] Article 603 of the Civil Code of the KR, Finance Lease Act of July 23, 2002.
[97] Article 604 of the Civil Code of the KR, Finance Lease Act of July 23, 2002.

Figure 12. Energy service contract



For modernization of street lighting, the Municipality and/or Bishkeksvet can use an agreement for introduction of energy-saving technologies or the so-called energy service contract. Energy service contract is not specifically provided for nor is it prohibited by the laws of the KR. The rights and duties of the parties under the energy service contract can be governed by general contract law provisions.

The energy service contract covers the services provided by the contractor, a specialized energy service company or ESCO, in relation to energy performance audit and introduction of energy-saving technologies in the customer's operations. The introduction of energy-saving technologies is financed with the proceeds from credits taken by ESCO. The proceeds resulting from the introduction of energy-saving technologies are used by the customer to pay the fee for ESCO services and to repay credits. The execution of the energy service contract by the Municipality or Bishkeksvet is governed by the KR laws on government procurement.[98]

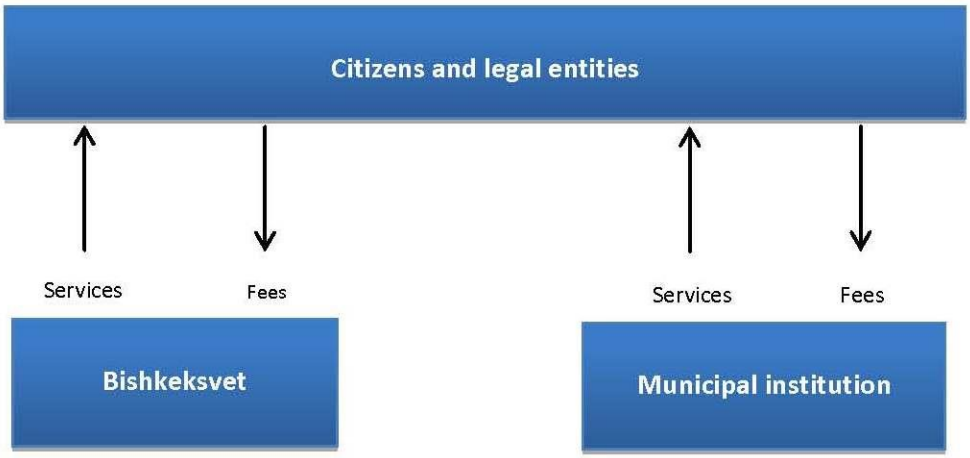
[98] The KR Law on Government Procurement of May 24, 2004.

As currently evident, there is only one precedent of executing the energy service contract in the KR.[99]

Conclusions: The execution of the energy service contract by the Municipality and/or Bishkeksvet may be an appropriate financing option for modernization of street lighting in the city. Thus, this option supposes that modernization will be financed with own or borrowed capital of ESCO and will not require the Municipality and/or Bishkeksvet to invest capital. Obligations of the Municipality and/or Bishkeksvet to creditors and ESCO will arise after the introduction of energy-efficient technologies and will be settled with the proceeds from saving on costs of maintenance of street lighting networks. Also, this option may be attractive to the Municipality considering potential benefits of improved energy efficiency in Bishkek.

However, in the opinion of the financial consultant, the current electricity tariffs are too low to ensure technical feasibility and economic viability of the project and, correspondingly, to attract private partners. It should be noted also that the energy service contract is executed primarily to address the issues of routine operation and maintenance of street lighting networks (e.g. replacement of lamps or wires), rather than to address the issue of building new lighting points.

Figure 13. Involving citizens in co-financing



[99] This refers to the energy service contract executed under the resource conservation investment project implemented by Unison public foundation in Naryn.

The laws of the KR provide that citizens can pay for municipal services provided by municipal institutions.[100] Under the laws of the KR, municipal service is defined as *a certain result of activity of municipal institutions carried out within the scope of their competence and aimed at addressing requests from individuals and legal entities, seeking enforcement of consumer rights and legal interests or obligations arising from civil law relations*.[101] The services provided by municipal enterprises (such as Bishkeksvet) do not refer to municipal services and can be provided on a contractual basis in accordance with civil law provisions.

Municipal services must be included in the basic register or additional list of municipal services and meet established standards. So far, such register, additional list and standards of municipal services are not approved.

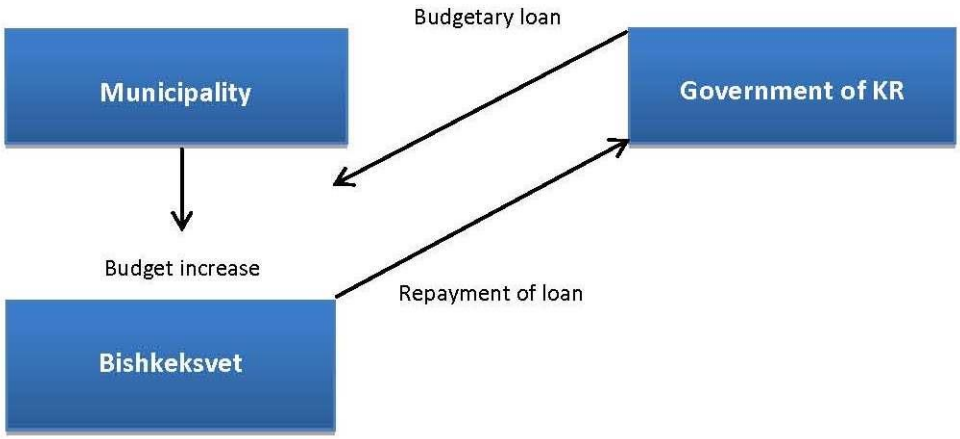
Under the laws of the KR, municipal services are provided free of charge; however, the services involving the right of consumers to possess and use the sources of graver danger or to engage in entrepreneurial activity, can be provided free of charge.[102] The amount of the fee for municipal services must not exceed the cost of providing such services.[103] At the moment, all municipal services are provided free of charge.

The Municipality can consider defining street lighting services as municipal services. The Municipality can also consider introducing the fee (covering the cost) for street lighting services as long as such services involve the use of the sources of graver danger. From a legal perspective, the proposed option is feasible provided that it is supported by the Municipality, the City Council and the general public and appropriate amendments are made to the laws of the KR.[104]

Conclusions: The Municipality can consider defining street lighting services as municipal services and introducing the fee (covering the cost) for street lighting services. The introduction of such fee will require support from the Municipality, the City Council and the general public and amendments to the laws of the KR.

[100] KR Law on State and Municipal Services of July 17, 2014 № 139.
[101] Article 3 of the KR Law on State and Municipal Services of July 17, 2014 № 139.
[102] Article 7 of the KR Law on State and Municipal Services of July 17, 2014 № 139.
[103] Article 7 of the KR Law on State and Municipal Services of July 17, 2014 № 139.
[104] Amendments to legislation should define the services provided by municipal enterprises as municipal services.

Figure 14. Increasing Bishkeksvet's budget



The Municipality may increase Bishkeksvet's budget (within the limits of the city budget) with its own capital subject to consent of the Ministry of Finance of the KR and approval of the City Council.[105]

The Municipality can apply to the Ministry of Finance of the KR for a special purpose budgetary loan from the republican budget, however, under the laws of the KR, budgetary loans to local budgets are provided only to finance top priority funding expenditures such as salary payments, deductions to the Social Fund of the KR, cost of food and medication, social benefits and public utility charges during the budgetary year. [106]

Bishkeksvet can apply to the Government of the KR for a special purpose budgetary loan from the republican budget. The decision to provide the budgetary loan from the republican budget to enterprises and business entities regardless of the ownership form is adopted by the Government of the KR to the extent of the amounts envisaged in the budget for the respective year approved by the Parliament of the KR.[107] The budgetary loan is provided on the condition that the enterprise paid the interest and repaired the principal of the previous credits.[108] Such loan can be potentially used for modernization of infrastructure (including street lighting).

[105] Articles 46-50 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998.

[106] Paragraph 5 of Article 15 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998. Point 4 of the Regulation on provision of budgetary loans from republican budget to local budgets approved by Government Resolution of June 20, 2011.

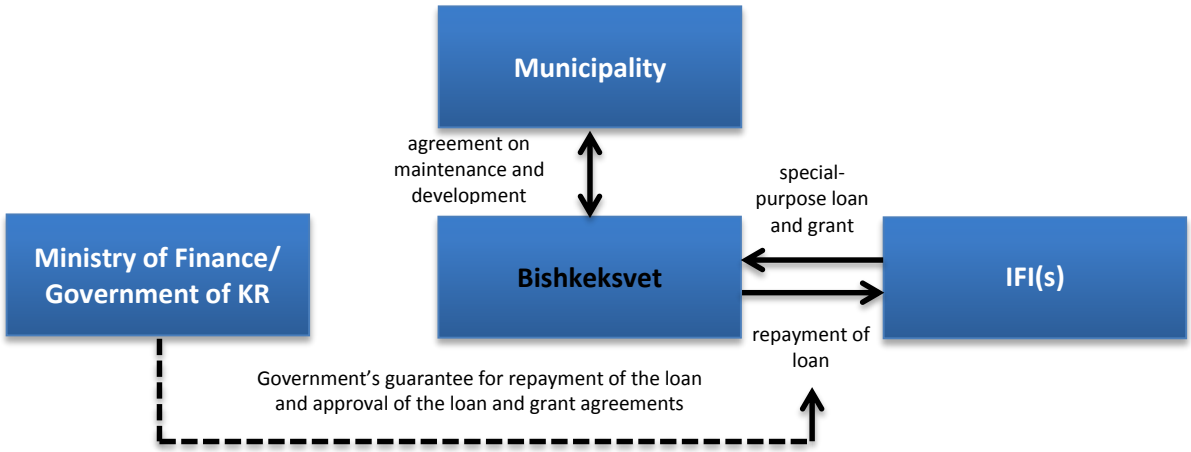
[107] Paragraph 3 of Article 15 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998.

[108] Paragraph 4 of Article 15 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998года.

The due date of the budgetary loan falls before the end of the budgetary year.[109] The decision to write off the debts of business entities under the budgetary loans from the republican budget is adopted by the Government of the KR with the consent of the Parliament of the KR.[110]

Conclusions: The Municipality can increase Bishkeksvet's budget with its own capital subject to consent of the Ministry of Finance of the KR and approval of the City Council. Bishkeksvet may apply to the Government of the KR for a special purpose budgetary loan from the republican budget for improvement of street lighting; however, this option is limited due to the necessity of envisaging these amounts in the republican budget and the obligation to repay the loan within the budgetary year.

Figure 15. Bishkekvodokanal model[111]



Following the model used in the EBRD's project in relation of Bishkekvodokanal Operational Production Division (the "Bishkekvodokanal"), the Municipality may consider entering into an agreement on maintenance and development of street lighting with Bishkeksvet. Such agreement would formalize relationships between the Municipality and Bishkeksvet by stipulating specific indicators for the street lighting services and strengthening their cooperation in maintenance and improvement of the street lighting system. One of the main components of successful implementation of such model is the solution of an underfunding problem such as combination of two financing mechanisms: special-purpose preferential loan and grant. Both

[109] Under Article 11 of the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998, budgetary year in the territory of the K R is a period starting on January 1 and ending on December 31 inclusively.

[110] Paragraph 9 of Article 15 the KR Law on Basic Principles of Budgetary Law in the KR of June 11, 1998.

[111] All date on this model was obtained through familiarization with the Agreement on maintenance and development between the Municipality and Bishkekvodokanal provided by CDA and oral information from the specialist of the project implementation office of Bishkekvodokanal.

shall be provided by IFI(s) under the guarantee of the Government of the KR, in particular, the Ministry of Finance of the KR, and subject to approval of the special-purpose loan and grant agreements and terms stipulated therein. On the other hand in order to ensure rational and unequivocal use of the monetary funds provided under the loan and grant agreements and control implementation of the project the Bishkeksvet shall establish a special project implementation office. Thus the organizational form of Bishkeksvet will remain the same: the Municipality will act as the founder and the owner of a municipal enterprise.

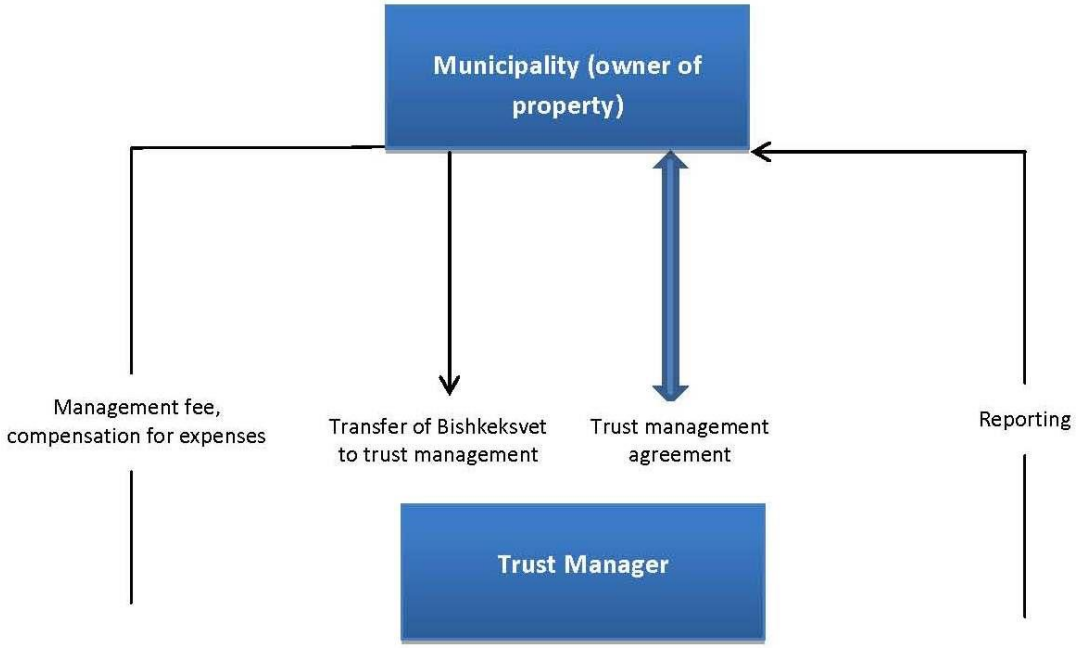
At that it is necessary to take into account significant differences between Bishkekvodokanal and Bishkeksvet. Whereas Bishkekvodokanal has the right and the capability to conduct capital repairs, reconstruction as well as modernization of the water supply network, the drainage system which allows the management of Bishkekvodokanal to implement its functions systematically, Bishkeksvet does not have such a right and capability. Another key difference is that Bishkekvodokanal is able to repay the loan not only from the funds provided annually by the local budget, but also funds paid by its clients (city population) for the cold water supply and drainage services. However, Bishkeksvet is not financially independent and can not charge for the street lighting services. In order to make it possible for Bishkeksvet to obtain funds from the city population the relevant changes in legislation of the KR are required.[112]

Conclusions: The execution of the special agreement on maintenance and development of street lighting between the Municipality and Bishkeksvet, along with the special-purpose loan and grant provided by EBRD and/or other IFI under the guarantee of the Government of the KR may be considered as an alternative appropriate option for modernization of street lighting in the city. However, the implementation of such model shall involve introduction the aforesaid amendments related to Bishkeksvet's authorities, requires relevant amendments in legislation of the KR and additional thorough research with regard to the terms and conditions of the loan and grant at the stage of a feasibility study.

[112] Information regarding the necessary changes to legislation is described in Section 9.5 (Involving citizens and legal entities in co-financing) of the Report.

5.3.2 Legal mechanisms applicable to management of Bishkeksvet

Figure 16. Trust management



Municipality, as the owner of the property of Bishkeksvet, may transfer Bishkeksvet as a property complex[113] intro trust management. Under the laws of the KR, the trust manager can be an individual entrepreneur or a for-profit organization (including a foreign company), except for a state enterprise. [114] The trust management is provided for remuneration paid by the owner to the trust manager. The term of the trust management agreement must not exceed 5 years, but the law allows the parties to extend it.[115] The trust management is not subject to the licensing requirements.[116]

Under the trust management agreement, the trust manager undertakes to manage the owner's property complex in the owner's interests, to report to the owner on its management activities, to bear subsidiary liability to third parties with its personal property for losses inflicted by the

[113] Under Article 33 of the Civil Code of the KR, enterprise as a property complex includes all types of property used in its activity, including land plots, buildings, structures, equipment, tools, raw materials, products, rights of claim, debts, rights in distinctive signs such as trade name or trademarks and other exclusive rights, unless otherwise provided by law or agreement.

[114] Part 1 of Article 858 of the Civil Code of the KR.

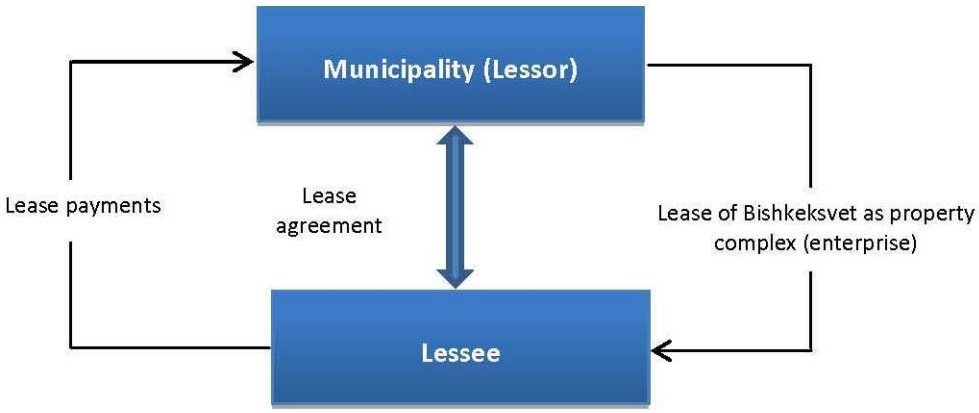
[115] Chapter 43 of the Civil Code of the KR.

[116] Article 15 of the KR Law on Licensing and Permitting System in the Kyrgyz Republic of October 19, 2013.

improper management of the owner's property.[117] The owner may not interfere with the operational activities of the trust manager.[118] The procurement of the trust management services for Bishkeksvet as a property complex is governed by the Government Procurements Law of May 24, 2004, and depending on the amount of procurement of these services per year, [119] will require a tender. [120]

Conclusions: The Municipality can consider the option of transferring the property complex of Bishkeksvet into trust management to the person having professional knowledge and skills required for management of street lighting system for remuneration and compensation for expenses of the trust manager. The transfer into trust management is performed under the government procurement rules. The trust management agreement can contain a number of conditions, including the achievement of certain economic indicators, the use of energy-efficient technologies and others.

Figure 17. Lease of enterprise



The Municipality, as the owner of the property of Bishkeksvet, may transfer the property complex of Bishkeksvet into a long-term investment lease.[121] The lessee may be any individual or

[117] Part 1 of Article 850, Part 3 of Article 862, Part 5 of Article 863 of the Civil Code of the KR.

[118] Part 3 of Article 857 of the Civil Code of the KR.

[119] According to the Government Resolution approving threshold amounts for procurement of goods, works and services of September 16, 2005 № 440, the tender is required if the budgetary organization performs procurement of goods and services for an amount exceeding the minimum threshold amount of KGS 500,000 .

[120] Article 38 of the Government Procurements Law, provides the grounds for conducting procurement without tender (procurement from one source).

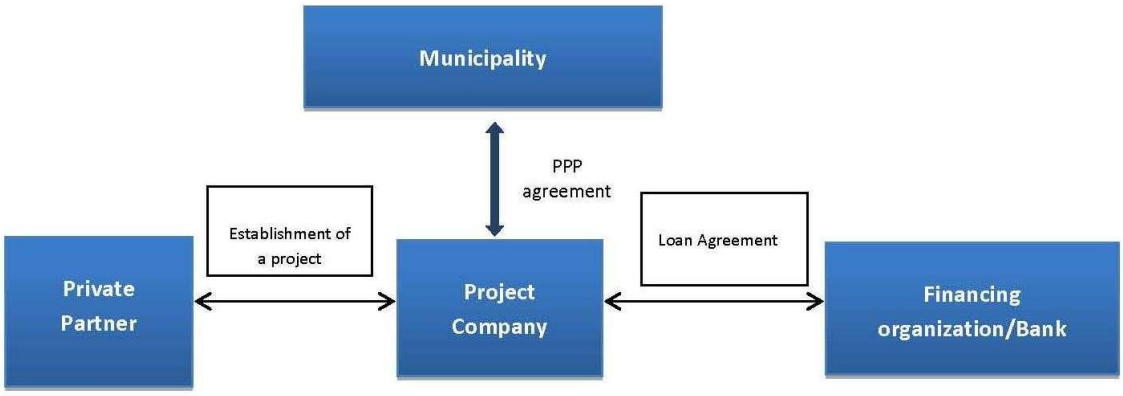
[121] Chapter 3 of the Regulation on awarding limited real rights over real estate objects held in municipal ownership of Bishkek, approved by the resolution of the City Council of May 22, 2002 № 127.

legal entity. The lessee pays the lease payments to the owner of the property. The term of the lease is not limited by law and the parties are free to define it in the agreement.[122]

The lease is provided through competition,[123] unless otherwise decided by the City Council.[124] Before leasing the enterprise, the Municipality, as the lessor, must notify all creditors (under obligations included in the enterprise) who may demand the termination or early performance of these obligations from the Municipality. The lease of the property complex is possible only after settlement of claims of creditors who demand the termination or early performance of obligations.[125]

Conclusions: Notwithstanding the right of the Municipality to provide the property complex of Bishkeksvet for long-term investment lease, this legal mechanism is difficult to implement considering the necessity of notifying creditors, settling their claims and holding a competition. Furthermore, this mechanism might be not economically sound considering that the Municipality will act as the lessor and the customer of street lighting services. Also, it is unlikely that this legal mechanism might be attractive to private investors (considering the necessity of paying the rent, high cost of maintaining the enterprise and lack of profit from the activity of Bishkeksvet).

Figure 18. PPP



The Municipality can use PPP to engage the private partner for the rehabilitation and modernization of street lighting in the city. Furthermore, on October 9, 2013, the Municipality issued the order to initiate the PPP project for street lighting improvement. However, the PPP

[122] Part 1 of Article 547 of the Civil Code of the KR.

[123] Point 93 of the Regulation on awarding limited real rights over real estate objected held in municipal ownership of Bishkek, approved by the resolution of the City Council of May 22, 2002 № 127.

[124] Part 1 of Article 15 of the KR Law on Municipal Ownership over Property of March 15, 2002.

[125] Article 595 of the Civil Code of the KR.

project was not prepared for implementation. The necessity of using PPP for street lighting improvement was also specified in the Bishkek Socio-Economic Development Program for 2014-2018 approved by Bishkek City Council Resolution of June 25, 2014.

Under the laws of the KR, PPP is a long-term (up to 50 years) communication between the public and private partners whereby the public partner engages the private partner for the designing, financing, construction, rehabilitation and reconstruction of facilities, as well as management of existing or newly created facilities including infrastructure facilities[126]. The private partner is selected through a tender; the preparation and holding of the tender and signing of the PPP agreement may take from several months to one year and more.

PPP involves different forms and models of communication between the public and private partners such as: *Build-Operate-and-Transfer (BOT), (Rehabilitate-Operate-and-Transfer (ROT), Build-Rehabilitate-Operate-Transfer (BROT)* and others.[127]

In relation to street lighting system of the city, PPP can be implemented through a rehabilitate-operate-transfer model, whereby the Municipality can transfer to the private partner the obligations (risks) of financing, designing and building new street lighting facilities, rehabilitation and reconstruction (replacement of lamps, wires, pylons, etc.) and management of street lighting systems. This PPP model represents a complex of legal relations stipulated in the PPP agreement. Such agreement can include elements of some types of contractual relations similar to:

- Trust management contract for the property complex whereby the trust manager manages the property of the owner;
- Energy service contract whereby the contractor performs reconstruction, maintenance and operation of street lighting system for remuneration paid from the local budget using the proceeds resulting (fully or partially) from savings achieved through efficient performance and reduced operating costs;
- Lease contract whereby the lessee possesses and uses the property complex during the period stipulated in the agreement;
- Work or service contract whereby the contractor/service provider performs works/provides services and receives remuneration for them; and
- Other contracts provided by the laws of the KR.

To implement PPP, the private partner may establish a special project company in accordance with the laws of the KR.[128] The project company may be given the functions of Bishkeksvet, however, the latter may retain supervisory and monitoring functions with respect to activities of

[126] Article 1 of the Public Private Partnership Law of February 22, 2012 N 7.

[127] Chapter 3 of the Regulation on choosing the form of participation of private partner in PPP projects (models) approved by the Order of the Ministry of Economy of the KR of February 28, 2013.

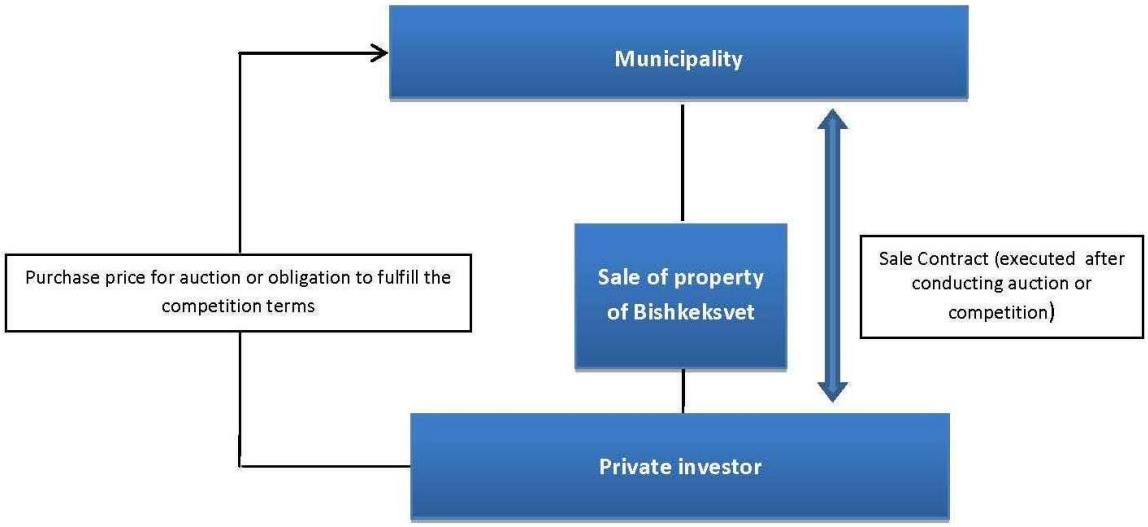
[128] According to part 2 of Article 29 of the PPP Law of February 22, 2012 No. 7, the Municipality may act as a co-founder of the project company provided that it owns not more than a 1/3 participation interest.

the project company. In case of using PPP, the most important issue will be the allocation of risks between the Municipality and the private partner.[129]

Conclusions: The Municipality may engage the private partner for the financing, designing and building of new street lighting facilities as well as rehabilitation, reconstruction and management of street lighting networks. The preparation and holding of the tender and signing of the PPP agreement can take from several months to one year and more. The use of PPP might involve a number of complexities related to the imperfection of legislation and the lack of PPP practice in the KR.

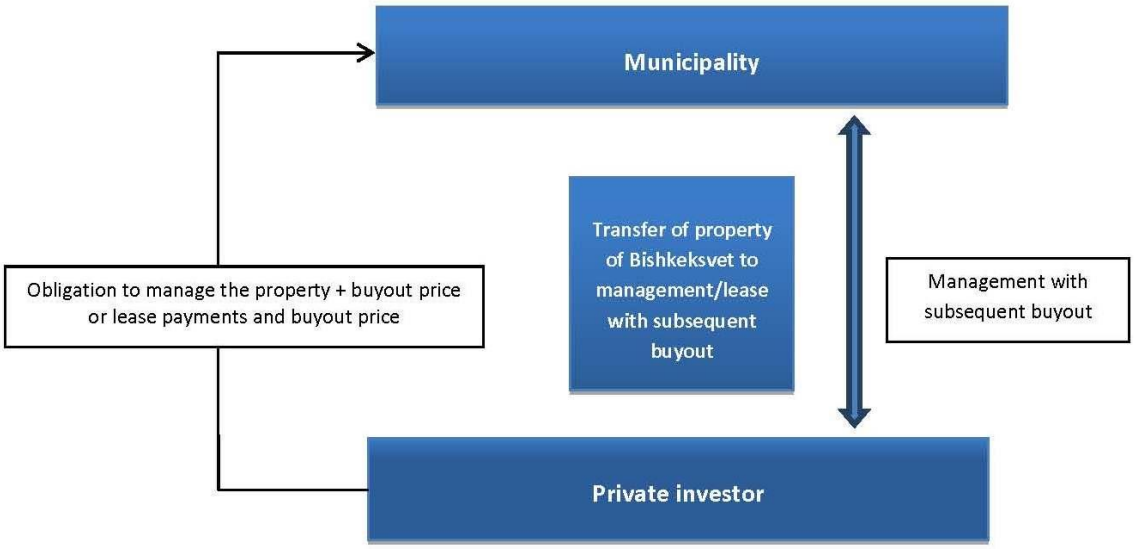
Figure 19. Privatization

Privatization by sale of property complex through auction or competition

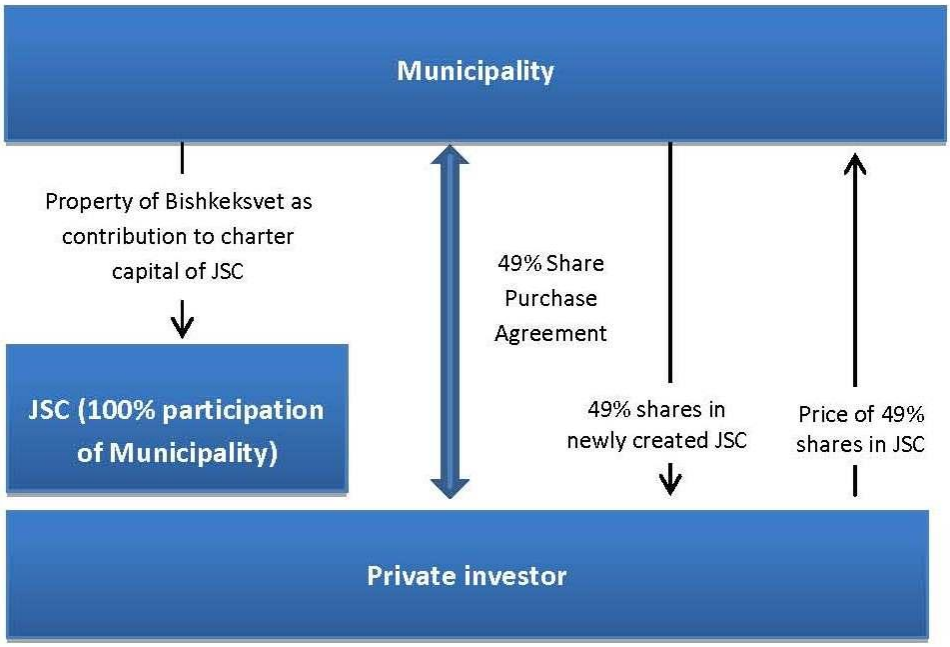


Privatization by transfer of property complex into trust management or lease with subsequent buyout

[129] According to Article 5 of the PPP Law of February 22, 2012 No. 7, instructions and general guiding principles in respect of the identification and allocation of risks between the public and private partners are developed and adopted by the authorized state. At the moment, there are no such instructions and principles in place.



Privatization by creation of a joint-stock company (JSC) with 100% participation of the Municipality with subsequent sale of 49% shares to the private investor



Under the laws of the KR, privatization of municipal property refers to alienation of property held in municipal ownership to ownership of individuals and legal entities.[130]

The Municipality may hold privatization of Bishkeksvet/its property complex by: (i) sale of the property complex through auction or competition, (ii) transfer of the property complex into management or lease with subsequent buyout, (iii) contribution of the property complex to the charter capital of a joint-stock company with subsequent sale through auction of 49% shares to the private investor.[131] All of the above methods of privatization involve the holding of auditions. Privatization is possible if the City Council adopts the program of privatization of municipal assets authorizing privatization of property complex of Bishkeksvet.[132]

Conclusions: Privatization of Bishkeksvet is difficult to implement procedurally considering the requirement for adoption by the City Council of the program of privatization of municipal assets authorizing privatization of street lighting networks. In addition, it is unlikely that privatization leading to loss of control by the city over street lighting networks will get political and public support. The likelihood of sale of 49% shares in the joint-stock company to the private investor is also quite low considering the lack of profit from operation of street lighting networks.

[130] Article 1 of the K R Law on Municipal Ownership over Property of March 15, 2002.

[131] Article 12-1 of the KR Law on Municipal Ownership over Property of March 15, 2002 Article 23-2 of the KR Law "On financial-economic fundamentals of local self-governments" as of September 25, 2003, Regulation on conditions and procedure of privatization of municipal property in Bishkek approved by the Decree of CIty Council as of March 27, 2007.

[132] Article 13 of the KR Law on Municipal Ownership over Property of March 15, 2002.

6. Project Implementation Scenarios

6.1 Connecting Street Lighting Implementation with Projects of High Socio-Economic and Environmental Interest

6.1.1 Pro-poor project staging

As underlined in earlier sections, the main social target of the project is to improve living conditions in the city and, in particular, extend the street lighting to presently most excluded areas, namely secondary streets, residential areas and new settlements.

Two scenarios exist in those areas: either street poles are installed but light points are non functional, or the area is completely not covered by the street lighting network.

In order for the project to make a tangible social impact and generate wide acceptance from its initial phase, it needs to prioritize street lighting improvements in most densely populated areas and in poorest areas, respectively in phases 1 and 2. From the social perspective, it is recommended that phase 2 starts at the earliest to the extent to which funding will allow.

The following **project staging** is recommended from the social perspective:

- **Phase 1** - Fully functional street lighting network;
- **Phase 2** - Network expansion to densely populated residential areas and in most vulnerable/poor areas. Most densely populated residential areas are located in the city center and in the South. Although exact poverty areas mapping hasn't been conducted by the city, it is generally recognized that a large part of poor population is located in the new settlements. More specific mapping of those areas, their coverage rate by the present network and assessment of additional needs are essential at the feasibility stage;
- **Phase 3** – Network expansion in line with the city expansion plan. This part of the street lighting Master Plan will need to be closely coordinated with the city's General Plan (ref. section 3.2.1). Major recommendation of the General plan is for the city to expand to the East and to the West, and to increase density in the South. For example, a strong urban development is planned in the village of Ortosai in the South of the city, which will lead to a higher density.

6.1.2 Enhancement of city's identity and touristic attractiveness

Night urban panorama or nighttime skyline, composed by a combination of street lighting with artistic lighting, plays a determining role in building a city's identity. A lighting Master Plan's function is not only to provide light and enhance safety but also to facilitate travel, develop opportunities for evening outdoor leisure time, build communication spaces, increase the city's attractiveness, express its identity, and raise the city's profile among a broader, international audience.

Although artistic lighting adds on to the cost of street lighting, social and economic benefits deriving from a deeper identification of citizens with their city, more interactive urban spaces at evening hours and an increased touristic attractiveness are largely covering the cost at medium-long term.

Intelligent artistic lighting plan is required to minimize the cost. For example, light up all sides of a historical monument is not necessary as the eye can rather be attracted to an itinerary.

A few examples of artistic street lighting in Dushanbe, Almaty, Cannes and Bath illustrate how its use can transform the image of the city:

Figure 20. Examples of artistic street lighting

The city of Bishkek presents a high opportunity for artistic lighting: it has large avenues with monuments of public interest; water bodies such as the Big Chuy Canal, two smaller Chuy canals and two streams, Ala-Archa and Alamedin; and three big parks, including the open air sculptures Oaks park. Overall, the city is equipped with 40 monuments of national interest and 7 municipal

apartment museums located in a detached house of architectural character. The Lighting Master Plan can elaborate on how the artistic lighting should be shaped and determine priority areas to initiate image and identity building through artistic lighting. At this pre-feasibility stage, the opportunity of creating a lit up itinerary of seven municipal museums has been explored in more details:

Artistic street lighting to strengthen and emphasize upon the municipal museums itinerary:

The Directorate of Memorial Museums of the city of Bishkek developed a cultural itinerary in August 1996 for the 120 years anniversary of Bishkek, called **Patriarchs of Kyrgyz Culture**. Seven memorial museums fall under the responsibility of the Directorate. They are mostly apartment museums located in a detached mansion/house and in a span zone of a few square kilometers. Museums feature paintings, sculptures, manuscripts and a number of artifacts pertaining to the artists and personalities covered by the museums. To enhance on the interest of the itinerary, 3 national museums, falling under the responsibility of the State government, are also located in the same central zone.

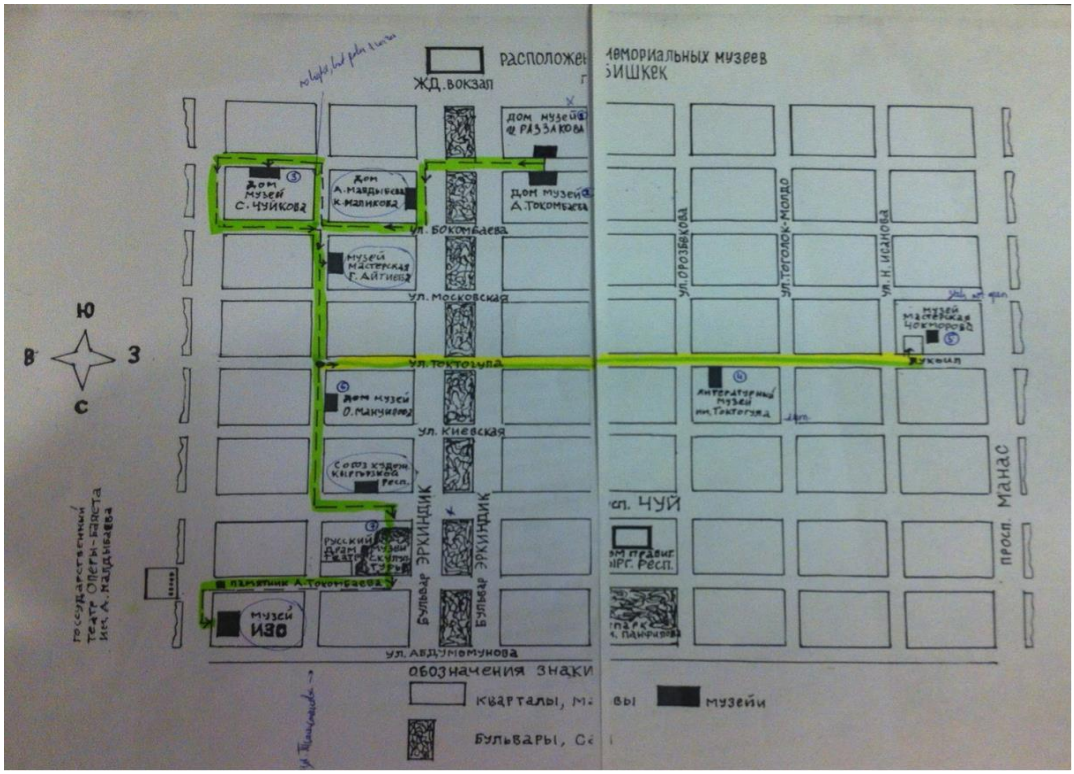
Potential for tourism enhancement of the city:

Location of the municipal museums provides a good opportunity for launching a **cultural pedestrian itinerary path**, which could be enhanced with street and monument lighting. All museums are located in the very center of the city, along the Toktogul street. The main itinerary would be only two to three kilometers long, depending on the museums to be covered by the itinerary, could comprise a maximum of 7 museums and require an average of 2 hours. An enlarged itinerary would also comprise the two museums on Toktogul street (an additional one hour time).

At present, the itinerary strongly lacks visibility due to the following challenges:

- Staff is limited and insufficiently familiar with basic computer design;
- Low salaries, which does not provide incentives for working more. Museums are closed on Saturday and Sunday and often close ahead of the scheduled time due to lack of visitors and motivation;
- Lack of dedicated website for Bishkek tourism;
- Lack of lighting of the mansions;
- Poorly lit pedestrian paths along the itinerary.

Map of the pedestrian itinerary (*to be replaced with a cleaner one when provided*)



Launching of the itinerary would require cooperation between a soft communication component and an artistic street lighting plan development.

The **soft component** requires a very limited cost and is mainly dependent on the decision-making will at the municipal level. The following communication supports and actions could be taken:

Developing electronic and printed communication supports:

- Itinerary map, printed and interactive online;
- Itinerary brief description and brief information on each museum (already largely available in Kyrgyz and in Russian), in Kyrgyz, Russian and English. Both electronic booklet (to download) and printed version;
- Indication of cafes, restaurants and theaters located along the itinerary;
- Tourist reference website: independent or attached to the city tourism website (yet to be made);

Creating nocturnes once a week, combined with special lighting of the itinerary. The museums close at 5pm, they could remain open until 9pm on the nocturne day.

- Special activities could be attached to each nocturne, such as guided tours, a literary talk in one museum, tea and videos available in another museum, etc;
- Dedicated information campaign: on the website, through dedicated national tourist agency, in major city hotels, targeted action during large-scale events (sport event, international conference, etc);
- Establish differentiated museum entry tariffs for CIS and non-CIS visitors. To increase the Directorate's budget, leave tickets revenues within the Directorate;

Ensure safety and civic behavior near the sites. At present, the territory near Razzakov museum is subject to uncivil gatherings involving alcohol, cigarettes and littering. The spaces around museums need to be transformed into open walking and communication spaces with clear civic behavior rules.

Street and artistic lighting could be developed in the following lines:

Lighting would comprise well-lit pedestrian path of the itinerary, creative light, light of the detached mansions, well lit street and museum indicating signs. Creating an atmosphere through lighting on the model of examples of Dushanbe or Almaty could be developed.

Deputy Mayor Aygul Ryskulova has expressed interest in the project. A meeting was to be conveyed in the second half of December 2014 to elaborate on further actions to be taken forward in regard to the soft communication component. The Municipality wants to provide grants to solve specific social problems through NGOs and communication development around municipal museums is condisered to be one of potential activities.

6.1.3 Environmental Cooperation

Chuy-Bishkek Regional Environmental Protection Agency offered to cooperate with Bishkeksvet in the following three areas:

Environmental Protection Fund: The Fund is operational since 1992 and is replenished by small contributions from CO2 emissions related to sewage and solid waste discharge, as well as other kinds of CO2 emissions. An amount of KGS 1.2 is charged per ton of CO2 equivalent emissions. In 2014, the Fund collected and disbursed the amount of KGS 150 million (USD 2.5 million) for environmentally friendly projects. Although the Fund covers the whole Chuy region, 1/3 of projects took place in Bishkek city. For example, the Fund financed modernization and switch from coal to gas of district heating boilers.

The Fund could contribute to the street lighting project with an amount of about KGS 10-15 million (USD 160-250,000) to strengthen its ecological component and/or to contribute to capacity building.

National ecological expertise: Ecological expertise is compulsory and offered free of charge by the Agency upon request. It is accompanied by knowledge sharing and capacity building.

Mercury lamps disposal: There was a mercury lamps disposal section at a worsted cloth factory in 1990ies, which is no longer operational. Its revival could be examined. The Agency is requesting basic information on usage and disposal of mercury lamps in order to develop an environmentally sound disposal system.

6.2 Financial Implementation Options

6.2.1 Main assumptions for a financial model of Bishkeksvet

Assumptions for a financial model of Bishkeksvet

For analysis of Company's financial standing and profitability of its operations, a financial model with a Free Cash Flow calculation for the period from 1 October 2014 to 31 December 2044 (further the "Forecast period") has been prepared. The Forecast period is selected for purpose of providing flexibility in the model.

Our analysis is based on the information provided by Bishkeksvet.

The Financial Model represents the results of analysis of Bishkeksvet's information and these results are subject to changes given additional data or requirements that may impact the Financial Model's structure and specifications.

The Financial Model is designed in Microsoft Excel 2010 in English and Russian. It makes use of the standard add-ins: Analysis Toolpak and Analysis Toolpak – VBA.

The Financial Model must be considered strictly in conjunction with all assumptions and limiting conditions stated in this document.

The following color code is used in the Financial Model:

Input	Hard numbers that has to be entered by user.
Call-up	Figures that were called up. This cell should never be altered.
Calculation	Calculaitons. This cell should never be altered.

The Financial Model structure

The Financial Model is set up in 14 worksheets, which can be grouped into Control, Inputs, Processing and Outputs categories.

1. Control worksheet is designed for scenario selection tools. The User can select scenarios for Macroeconomic electricity consumption, financing and revenue indicators from drop down boxes. Each drop-down box can be changed independently, excluding the Financing terms section, where they are defendant (top-down sequence). Also the User can make assumptions regarding some indicators by entering numbers in cells with input color code. The User can trace results of the Financial model in the Project Key Performance Indicators section.

2. Disclaimer worksheet. The worksheet includes a bilingual disclaimer in Russian and English with a check box. A user of the Financial Model (further the “User”) is not able to access it while the check box is inactive. This worksheet does not contain inputs, call-ups, calculations or outputs.

3. Input worksheet has the data inputs which are necessary for further modeling. It contains a minimum of calculations and does not include any call-ups or outputs.

4. Revenue, Cost of services rendered, General and administrative expenses, Depreciation and Amortization, Capital Expenditures, Working Capital, Debt and Equity worksheets. They are made for calculation of cash flows constituents, generated by Bishkeksvet. These sheets do not include any inputs. Parameters required for calculations are called up from the Input sheet and the results subsection of other worksheets.

5. Discounted cash flows and Financial Statement (abbreviated as “FS” in the Financial model) worksheets reflect the results of the Financial model such as the sum of discounted cash flow, discounted payback period, calculation of the Internal rate of return, forecasted balance sheet, profit and loss statement, cash flow statement. These sheets do not include any inputs. They contain call-ups, calculations and outputs.

6. Tariff worksheet provides an understating of how much the hypothetic electricity tariff should be to enable an investor/owner to pay back the Capital Expenditures programme through their savings.

Assumptions

To comply with the consistency principle in analysis, nominal discount rate has been used, denominated in KGS. The Discounted Cash Flow is calculated based on the assumption of uniform distribution of cash flow over each forecasted period. The income from non-operating activities has not been taken into account in developing the future Free Cash Flow.

Macroeconomic forecast

The Financial Consultant made a consensus forecast based on **estimates**, provided by Business Monitor International, IHS Global Insight and Oxford Economics. Maximum and minimal values of these forecasts have been taken for scenario analysis.

The User is able to choose the following macroeconomic scenarios from drop-drown boxes in General parameters section of the Control worksheet.

1. Base case. It includes average 4.5% growth rate of real GDP of Kyrgyzstan for the period from 4Q 2014 to 2025, with the following gradual decline and a stabilization around 3.1 – 3.2% for the long term perspective. This case implies exceeding of CPI and WPI growth rates over the real GDP growth between 4Q 2014 to 2025 with following normalization of situation. Regarding the average exchange rate, KGS is forecasted to drop 5% against USD in 2015 (the implied data of capital expenditures). It should be noted that a number of CIS counties have devalued their currencies due to the decrease in commodity prices and the devaluation of Russian ruble (Belorussia - 10% devaluation on 9 January 2015, Turkmenia – 22.8% devaluation on 2 January 2015).

2. Pessimistic case assumes average 3.2% growth rate of the real GDP, average 3.7% and 3.5% growth rates of CPI and WPI respectively for the Forecast period. The case implies a 12% decline of KGS versus USD.

3. Optimistic case assumes the highest growth rate of the real GDP and a moderate inflation. The decline in the exchange rate is only about 2%.

Revenue forecast

The Financial Model considers subsidies to a non-financial public enterprise and additional revenue from ancillary services. Assumptions should be entered/chosen by the User in Revenue section on the Control worksheet. The User is able to choose the following options:

1. Types of subsidies to a non-financial public enterprise:

a) Operating subsidies. They have 5 components for covering:

- Cost of services rendered;
- Selling, General and Administrative expenses;
- Depreciation and Amortization;
- Interest expenses;
- Principal debt repayment.

b) Flat sum of subsidy with indexation to CPI. The User is able to input the amount of this subsidy and the frequency of indexation. By default the Financial Model assumes KGS 60,000 thousand flat sum subsidy per year for maintenance of external light points. The assumption was derived from the "ADB Position Paper Street Lighting PPP" document.

2. Consideration of additional revenue from the ancillary services in the cash flow. The User can control it from the drop-down box on the Control worksheet.

As for the additional revenue, total amount of additional revenue from ancillary services on the Revenue worksheet was forecasted with assumption that the growth rate will be equal to the Real GDP growth rate. Constituents of the additional revenue were calculated as average percentage of the total amount of additional revenue.

Operating expenses forecast: For the period from 4Q 2014 to 2044 fixed and variable costs were forecasted together. Fixed operating costs for 9m 2014 up to 2017 were provided by the management of Bishkeksvet. For the period from 2018 to 2043 they were adjusted to respective indices. Variable operating costs such as electricity and material variable costs were forecasted based on consumption rates for the period from 2011 to 3Q 2014 and were adjusted to the effects of the capital expenditures program in the Forecast period.

Electricity expenses: Electricity expenses are main part of Operating Expenses as previously stated in the financial analysis. They are calculated as the product of electricity consumption and electricity tariff. The electricity consumption might consider the savings. The User is able to choose this option on the Control worksheet.

Following types of electricity tariffs are incorporated in the Model:

1. Actual electricity tariff, including the last one in amount of KGS 2.19 without taxes;

2. Forecasted tariff without taxes. For 2015 – 2044 electricity tariffs are adjusted annually by the amount of the CPI rate of the respective macroeconomic scenario for the previous year, which is compliant with the Medium-term tariff policy of the Kyrgyz Republic on electrical and heat energy for 2014-2017 (the Policy);

3. New tariff with taxes. The 12% of Value Added Tax (further the “VAT”) and Sales tax in the amount 1% have been added to the Forecasted tariff without taxes ;

4. Effective tariff without taxes. It is used for calculation of electricity expenses and savings in monetary terms. The tariff is derived from actual and forecasted tariffs adjusted on their effective date.

Regarding the electricity consumption, the User is able to vary its following characteristic:

- Combusting ratio;
- Number of lamps, considered in calculation;
- Power of lamps;
- Average period of combustion of a lamp.

The above mentioned parameters assemble the electricity consumption.

Electrical materials and transportation expenses: Electrical materials and transportation expenses were forecasted with the option to consider the savings.

Taxes and Social obligations: VAT and Sales tax were calculated based on the Tax Code of the Kyrgyz Republic (further the “Tax Code”). Obligatory payments of Bishkeksvet as an employer to the Government Social Fund were modelled based on equivalent of 17.25% of the employee's salary.

Administrative expenses forecast: To forecast general and administrative expenses, historical and Bishkeksvet’s forecasted data until 2017 have been used, adjusted to respective indices.

Depreciation and amortization forecast: Annual depreciation and amortization expenses were forecasted using the straight-line method based on depreciation rate for every group of assets and calculated separately for existing fixed assets and planned capital expenditures.

Working capital forecast: To forecast working capital company’s current assets and liabilities, have been analysed, based on Bishkeksvet’s financial statements and 2011 – 2013 average turnover rates.

Capital expenditures forecast: Capital expenditures for development were forecasted according to Bishkeksvet’s Capital Expenditures programme, provided by the Technical Consultant. Its constituents were classified according to the categories of fixed assets. As these expenditures were not split in phases it was assumed that investments will be made in equal portions over 4 years from 2015.

Maintenance capital expenditures were projected in line with D&A expenses for the previous year.

Financing options: The Model provides an opportunity to finance capital expenditures from following sources:

1. **Equity injection**. It is calculated as the product of Capital expenditures program and the factor of realization. This implies that all parameters of this source of financing are calculated automatically. The Equity injection is esteemed as a capital in the balance sheet;

2. **Debt**. This source of financing considers interest bearing debt as well as grant. The User is able to vary their proportions.

   The variable parameters of the interest bearing debt include start year, tenor, grace period, interest rate, front and commitment fees.

   The Grant is a debt, which does not require principal and interest repayment. The Grant is calculated in similar way as the Equity injection. The Grant is assumed as a debt, which would be amortized within its tenor;

3. **Special government subsidy** is calculated in a similar way as the Equity injection. The subsidy is considered as the capital in the balance sheet.

Based on the abovementioned sources of financing, the User is able to choose the following types of financing on the Control worksheet:

a. Equity;

b. A mix of Equity and Debt. The User is able to vary their proportion under this option;

c. A mix of Equity, Debt and Subsidy;

d. Debt;

e. A mix of Debt and Subsidy;

f. Debt and Subsidy;

Under the b, c and e options the User is able to vary proportion of sources of financing with a 10% pace in the financing section on the Control worksheet.

Weighted average cost of capital calculation: WACC is the most appropriate measure of the return on invested capital. The Financial consultant calculated the Weighted average cost of capital (further the “WACC”) using Damodaran beta and Damodaran debt to equity ratio. The

cost of equity was determined based on the Capital Asset Pricing Model, under which the required return on equity is estimated using the systematic risk (beta). Application of market approach for WACC calculation is not feasible due to the absence publicly traded peers. The calculation of WACC is presented in the Appendix D.

6.2.2 Scenario analysis

This section contains the analysis of the following financial options of implementing the Project. The scenarios represent a mix of different financing sources such as concessional and commercial debts, grant, etc.

The three main scenarios carry the following assumptions:

- The parameters of concessional and commercial debt are depicted below;

Concessional debt		
Item	Unit	Value
Start year	year	2015
Loan Tenor	year	13
Grace period	year	3
Interest rate	%	Libor + 1%
Front fee	%	0%
Commitment fee	%	0%

Commercial debt		
Item	Unit	Value
Start year	year	2015
Loan Tenor	year	13
Grace period	year	3
Interest rate	%	Libor + 4%
Front fee	%	1.2%
Commitment fee	%	0.6%

- The Grant does not require principal and interest repayment;
- Used cash flow is Free Cash Flow to Equity;
- Discount rate (cost of equity) is 20.4%;
- The amount of Capital Expenditures is equal to USD 45 million;
- Bishkeksvet's revenue represents reimbursement of operating expenses and inflows from ancillary services;
- Savings from operating efficiency remains at Bishkeksvet disposal.

	Concessional debt	Commercial debt	Grant	CAPEX	Cost of Equity	IRR	NPV, KGS thousand
Scenario 1	0.0%	55.2%	57.0%	45 mln. USD.	20.4%	20.4%	0
Scenario 2	34.0%	0.0%	66.0%		20.4%	37.0%	525,296
Scenario 3	77.9%	22.1%	25.0%		20.4%	-	820,461

The above results of the financial model demonstrate that Bishkeksvet will be able to finance its operating activity. However, the low tariff on electricity and considerable amounts of Capital Expenditures will not allow Bishkeksvet to repay its debts via energy consumption savings.

Scenarios for the City model are available in the Annex 16.

6.3 Legal and institutional implementation options

Based on the legislation of the Kyrgyz Republic, and the current practice, possible legal implementation options have been reviewed (Section 5.3 above): legal mechanisms applicable to management of Bishkeksvet and legal mechanisms applicable to financing of Bishkeksvet.

Management Mechanisms

Of all legal mechanisms applicable to the management of Bishkeksvet, it is recommended that the Municipality considers such options as: trust management and PPP.

a. Thrust Management

The Municipality can consider transferring the property complex of Bishkeksvet into trust management to the person having professional knowledge and skills required for management of street lighting system for remuneration and compensation for expenses of the trust manager.

The best way to procure the trust management services is to use a two-stage bidding process. The advantage of the two-stage bidding process is that after completion of the first stage, it is possible to negotiate and change tender conditions, which means greater flexibility for the Municipality in terms of bid evaluation and decision-making. The estimated time of completion is 4-6 months.

Risk: The lack of experience of the Municipality in transferring municipal assets into trust management, little incentives for private investors due to short term of agreement (up to 5 years), risk of disputing the tender procedures.

Solution: To ensure the properly drafted tender documents, the open and transparent tender process, the properly executed agreement between the Municipality and the private investor.

b. PPP

The Municipality may engage the private partner in the financing, design and construction of new street lighting facilities as well as rehabilitation, reconstruction and management of street lighting networks. The preparation and holding of the tender and signing of the PPP agreement can take from several months to one year and more.

Risk: The lack of experience of the Municipality in initiating and carrying out PPP projects, complexities of preparing tender documents and the PPP agreement due to lack of experience, risk of disputing the tender procedures, etc.

Solution: To ensure the properly drafted tender documents, the open and transparent tender process, the properly executed agreement between the Municipality and the private investor.

Financing Mechanisms

Within the frameworks of the proposed management mechanisms (trust management and PPP) the Municipality/Bishkeksvet/private investor may consider the recommended financing options, including:

a. Grant Scheme

A comparison between the two types of grants (grants from the Government and grants from foreign States or international/foreign/local organizations) shows that it would be preferable for the Municipality and/or Bishkeksvet to seek a non-government grant.

Risk: Complexities of grant seeking.

Solution: To start grant search through international partners working in the KR.

b. Loan/ credit

From a legal perspective, Bishkeksvet can take loans and credits; however, due to full budgetary dependence and lack of revenues and liquid assets, it may be problematic for Bishkeksvet to receive a loan/credit. The most appropriate option, in our opinion, is to seek unsecured preferential loan and/or credit from IFIs.

Risk: Complexities of grant seeking.

Solution: To start negotiations with IFIs working in the KR.

c. Finance Lease

In the opinion of the financial consultant, finance lease cannot be viewed as an efficient financing option, as it can cover only an insignificant part of capital expenditures necessary for modernization of street lighting. However, finance lease can be used as an additional option for upgrading obsolete vehicles or purchasing ASLMS.

Risk: Tax and customs consequences arising from import of equipment.

Solution: To explore tax and customs consequences arising from import of the equipment acquired under finance lease.

d. Energy Service Contract

The execution of the energy service contract by the Municipality and/or Bishkeksvet may be an appropriate financing option for the modernization of street lighting in the city. Also, this option may be attractive to the Municipality considering potential benefits of improved energy efficiency in Bishkek.

Risk: The lack of legal regulation of relationships arising from energy service contracts.

Solution: To stipulate details in the agreement with the private investor.

e. Involving Citizens in Co-Financing

The Municipality can consider classifying street lighting services as municipal services and introducing the fee (covering the cost) for street lighting services. The introduction of such fee will require support from the Municipality, the City Council and the general public and amendments to the laws of the KR.

Risk: The lack of legal regulation, the public opposition to introduction of street lighting fees.

f. Increasing Bishkeksvet's budget

The Municipality can increase Bishkeksvet's budget using its own funds subject to consent of the Ministry of Finance of the KR and approval of the City Council. Bishkeksvet may apply to the Government of the KR for a special purpose budgetary loan from the republican budget for improvement of street lighting; however, this option is limited due to the necessity of envisaging these amounts in the republican budget and the obligation to repay the loan within the budgetary year.

Risk: The lack of funds in the Municipality, the City Council's refusal to increase the budget.

Solution: To make a well-substantiated and feasible technical and financial proposal stating the need and reasonableness of increasing the budget of Bishkeksvet.6.3.1 Standards

Due to the emerging nature of LED street lighting products on the market, standards have lagged in development, and many countries, KR included have no such standards. Internationally, considering APEC countries, the People's Republic of China, Chinese Taipei, Republic of Korea and the United States have developed standards and specifications to ensure adequate LED product performance and quality. It is recommended that in lieu of KR developing their own standard, an appropriate standard, such as US IES standard be adopted.

Best practice for LED purchase indicates seven key questions to ensure LED product quality, performance and safety.

1. LED product specifications follow economy-wide standards?

2. Testing performed by third-party, accredited laboratories?

3. Requirements of illumination quality included in the procurement specifications

4. Preliminary field trial is a part of the evaluation and selection process?

5. "Application efficacy" considered as one of the selection criteria?

6. Warranty of LED products is at least 5 years?

7. Warranty bond and penalty included as parts of Warranty and Conditions?[133]

Quality of LED lights ranges widely, as does characteristics and cost. It is critical to specify standards/criteria for the design, procurement, installation and operation and maintenance of the streetlights. There are a lot of products on the market, of varying quality. The use of high quality equipment will ensure the benefits gained from improved output, reduced maintenance costs and long product lifespan are realised.

6.4 Capacity building and technical assistance requirements in Bishkeksvet

The monthly salaries of Bishkeksvet workers are extremely low, below what one can reasonably be expected to live off. The Bishkeksvet HR manager reported a high turnover of staff as a result. Due to the hazardous nature of working with electricity, a high turnover increases hazard risk, and reduces productivity.

Bishkeksvet reported no serious injuries or incidents since 2007. However they point out that safety training and safety equipment is sorely lacking. Old equipment, such as maintenance crane trucks, carry increased risk of malfunction, which could lead to serious injury and even fatality.

The project will reduce the demand for maintenance activities. Reducing employees while improving remuneration and conditions for the remaining employees, could be a positive strategy for the future.

Though Bishkeksvet report to be understaffed in all areas except the management level, it is suggested that a reduction in the number of staff could result in greater productivity if the salaries of the remaining staff were increased accordingly. Bishkeksvet would benefit from the introduction of Key Performance Indicators (KPIs) to track financial and operational productivity. Linking KPIs to performance-based bonuses for employees has been widely successful in motivating performance, output and productivity. It is noted Bishkeksvet employees are of a mixed age distribution.

[133] APEC, December 2011, SOLLIA: Street and Outdoor LED Lighting Initiative - Asia, Survey Report and Best Practice Guide for LED Street and Outdoor Lighting.

7. Conclusions and recommendations

7.1 Social and environmental conclusions and recommendations

7.1.1 Urban development recommendations for the Lighting Master Plan (MLP)

- **The latest comprehensive street Lighting Master Plan dates back from 1980.** There is no vision on how street lighting should be expanded in accordance with the city expansion plans. Both the street light planning and estimates of required additional voltage capacity are absent while rapid construction puts an increasing load on the existing capacity.

- Landscape conditions carry relative natural risks and require adequate attention during any city's infrastructure services planning phase;

- Fast population increase is hardly supported by adequate infrastructure development, which means that infrastructure facilities lag behind the construction pace;

- The Lighting Master Plan will need to be developed in line with the General Plan's (Master Plan of Bishkek) expansion projections, after those are updated with the Kyrgyz City Planning Science and Research Institute (General Plan developer) and Bishkek Head Architecture Department (General Plan implementer).

7.1.2 Social conclusions and recommendations

The overall analysis of the present technical street lighting landscape and of the city's financial capacity shows that the city is unlikely to afford high quality electricity saving LED street lighting unless it secures a strong grant component from an International Financial Institution (IFI). At the same time, social analysis clearly shows that there is a strong need for a quality street lighting, in particular on the roads, in secondary streets and in residential areas. The social consultant therefore recommends to review more closely non LED options at the Feasibility Study (FS) stage, which would be more cost affordable yet less polluting than most polluting lamps currently in use. **The primary objective of the street lighting project in Bishkek should clearly be social**, and the energy efficiency objective should come as second and implemented according to what is feasible given the street lighting expansion requirements and the financial capacity.

- The **results of the social survey conducted in March 2015** indicated that the citizens consider street lighting as their first infrastructure priority due to its safety benefits. **Street lighting was clearly given priority over other areas (69% of respondents**), closely followed by improvement of roads' quality (63%). Those were interestingly followed by city greening (45%), then by public transportation system. **Street lighting quality assessment showed a general non-satisfaction.**

- From the analysis of the city's priorities, both at the decision-making and at the citizen's level, it is apparent that citizens' perception of safety and comfort at dark hours is the main target of the project.

- There was however **insufficient data evidence of the major role of poor quality street lighting in the overall safety, road safety** (insufficiently detailed statistics provided, a decrease in the number of road accidents in 2014 while the street lighting quality did not change) **and in women's safety and social integration** (insufficiently detailed crime statistics provided with significantly more crimes recorded against men than against women, no emphasis on more socio-economic opportunities for women with the street light quality improvement). It is recommended that those issues be further explored at the FS stage and more detailed statistics, such as road accidents and street crimes by hour of the day, as well as a more detailed understanding on the crimes committed against women, be obtained. In particular, **attention should be brought to women's safety and the FS should request more specific statistics to further analyse how women's safety and socio-economic opportunities are affected by the present street lighting quality and how improvement in street lighting could positively impact women's lives in Bishkek**. In fact, while generic data shared with the Team did not provide a statistical ground for correlating these matters with street lighting, interviews with citizens' representatives conducted by the social consultant pointed out that citizens strongly connect them with street lighting quality. In particular, women's safety is considered to be of concern.

- Street lighting would to some extent, contribute to improving **road safety**, however it would not be effective without a set of parallel soft and infrastructure measures.

- It is also recommended that the FS connects the street lighting map with the areas of major road accidents to further explore to what extent those accidents may be related to the present quality of street lighting.

- It could be useful to **spread out the social survey more largely**, in particular to understand the priorities and concerns by districts. For example, analysis of criminal statistics showed that the highest rate of criminality takes place in the Leninskiy district, while the population is relatively equally spread between the four districts.

- Particular attention needs to be brought to **new settlements (*novostroiki*)**. These 47 residential areas are located around the city and are estimated to cover about 1/3 of Bishkek's territory, which is poorly equipped with infrastructure services and, in particular, suffers from a nearly absent street lighting. The MLP will need to closely interact with the General Plan's developing and implementing authorities (see above) to determine which of the new settlements are planned to be left in their current state and which ones (if any) should be reconstructed in the near future before setting up a lighting plan in the areas. At the same time, street lighting in those areas remains a high social priority from the safety perspective.
- Although exact poverty areas mapping hasn't been conducted by the city, it is generally recognized that a large part of poor population is located in the new settlements. More specific mapping of those areas, their coverage rate by the present network and assessment of additional needs are essential at the feasibility stage.

The technical and financing options selected should be such that the project brings tangible and visible benefits to the citizens while the cost does not undermine the municipality's ability to conduct other activities of importance for the citizens.

- In fact, the analysis of urban planning and infrastructure development plans shows that the city currently faces a number of high-level priorities that require financial investments. In such context, it is important to understand and keep in mind financial requirements related to those priorities while selecting the best technical and financing options for the street lighting project.

- While benefits related to energy savings and connected GHG emissions reduction cannot be underestimated, **the project would only be supported, at public opinion level and hence at the high political level, if it brings visible and tangible improvements to the population of Bishkek and does not significantly reduce availability of funds for other areas of social importance.** Indeed, during prioritization discussions at the municipal level, street lighting was seen as an important part of the city's development, but not quoted as a top priority activity.

7.1.3 Street lighting staging recommendations from the social perspective

- **Phase 1** - Fully functional existing street lighting network;
- **Phase 2** - Network expansion to densely populated residential areas and in most vulnerable/poor areas. Most densely populated residential areas are located in the city center and in the South. Although exact poverty areas mapping hasn't been conducted by the city, it is generally recognized that a large part of poor population is located in the new settlements. More specific mapping of those areas, their coverage rate by the

present network and assessment of additional needs are essential at the feasibility stage. The Urban Development Consultant recommends to conduct the Phase 2 as close as possible to the Phase 1 for the reasons mentioned above;

- **Phase 3** – Network expansion in line with the city expansion plan. This part of the Lighting Master Plan will need to be closely coordinated with the city's General Plan. Major recommendation of the General Plan is for the city to expand to the East and to the West, and to increase density in the South.

7.1.4 Bishkek's cultural and touristic attractiveness

It is strongly recommended to **develop a detailed proposal and assess the cost of an artistic street lighting**, not included in the present pre-feasibility study. Night urban panorama or nighttime skyline, composed by a combination of street lighting with an artistic lighting, plays a determining role in building a city's identity. A Lighting Master Plan's function is not only to consider providing light and enhance safety but also to facilitate travel, develop opportunities for evening outdoor leisure time, build communication spaces, increase the city's attractiveness, express its identity, and raise the city's profile among a broader, international audience.

Although artistic lighting adds on to the cost of street lighting, social and economic benefits deriving from a deeper identification of citizens with their city, more interactive urban spaces at evening hours and an increased touristic attractiveness are largely covering the cost at a medium-long term. It is recommended to **look at potential targeted international sources of funding for this component** given the present condition of the Municipality's budget.

From the assessment conducted at the PFS stage, it is recommended to particularly look at opportunities that can be presented by the **artistic street lighting to strengthen and emphasize upon the municipal museums itinerary.**

7.1.5 Environmental recommendations

Energy security is a relative concern for Kyrgyzstan due to an unstable electricity supply resulting from an overwhelming dependence on large hydropower stations, which does provide solid ground for energy efficiency measures. At the same time, presently subsidized electricity tariffs do not provide a case for an economically attractive street lighting project, at least with new highly performing technologies such as LED.

- In 2014, water level went down in the Toktogul reservoir, which decreased the country's electricity production. Kyrgyzstan traditionally exported electricity to its neighbours, however at present there is a gap of 2,4 GW between domestic power demand and

available capacity, out of which 1GW capacity equivalent is imported from Kazakhstan at KGS 5/kWh. This price is over 5 times higher than the cost of local production.

Air pollution in Bishkek is three times higher than the country's average. If per capita CO2 emissions amount to 6,5kg in average, they reach 19,5 for a Bishkek citizen. At the same time, **the transportation sector is largely responsible for the air pollution in Bishkek**. The electricity production sector contributes little to the air pollution due to an overwhelming share being produced by large hydro. The street lighting project's energy efficiency target would therefore hardly contribute to reducing air pollution in Bishkek, unless the CHP located in the city produces the electricity consumed by Bishkeksvet. It is recommended that the FS determine whether this is the case and, if so, what is Bishkeksvet's share in the city's electricity consumption.

EBRD assisted the city with developing a feasibility study on the solid waste management, including the establishment of a new sanitized landfill and a partial waste recycling. However, **there are no provisions for mercury lamps disposal and recycling in the project. This will need to be addressed.**

The Chuy-Bishkek Regional Environmental Protection Agency offered to cooperate in three significant areas: national ecological expertise, mercury lamps disposal and potential financial contribution (though relatively limited) from the Environmental Protection Fund. **It is strongly recommended to further explore those opportunities and establish a close contact** with the Agency at the very beginning stage of the project implementation.

7.2 Technical conclusions and recommendations

7.2.1 Technical conclusions

The current street lighting network in Bishkek is not performing adequately for the city. Significant remedial work is required to restore 40% of the existing 31,000 street lamps that are non-operational, nearly half of which are long term non-operational. Remedial work is needed for the street lighting units, wiring, street poles and IP boxes. Furthermore an expansion of the existing network by approximately 16,300 street lights is required to provide adequate coverage for the city including the urban areas.

Severe voltage fluctuations up to (minus) 40% present a major technical challenge to the modernization of Bishkek's street lighting network with an energy efficient solution. Voltage fluctuations are likely to be due to a number of reasons including deteriorated transmission and distribution infrastructure of SeverElectro, deteriorated electrical components in the street lighting network, poor quality equipment, and contact with trees and other obstructions. Off grid solar powered street lighting solutions were considered but found to be cost prohibitive. High pressure sodium lamps were considered, having fair energy efficiency and lifespan, however

they are unsuitable to handle Bishkek's network voltage fluctuations. The LED street lighting solution was selected as the most appropriate technology to meet the criteria for the project. This follows the strong international trend towards LED lighting in the street lighting industry.

LED street light quality varies significantly as does cost per unit. High quality street lights are required to match the unique challenges of the Bishkek system. Key technical criteria required in the solution are an input voltage frequency range of 85 ~ 265 V AC, luminaire efficiency of at least 110lm/W and lifespan of 50,000 hours or more, with high quality casing and structure. Warranty periods that match the claims for product life span should be sought. Led street lighting deliver environmental, social and financial benefits, though capital costs are notably high. Street lighting technology is improving at a rapid rate, and technological improvements are resulting in superior products are lower costs. As a result, financial viability of the solution could shift significantly in the medium term of 3-5 years.

7.2.2 Technical recommendations

Currently, there is no detailed inventory record of the Bishkek's street lighting network. A study is needed to develop a detailed inventory of street lighting infrastructure including identification of each lighting pole, mounting arm, light fitting and lamp type. This should include an audit and report of the condition of each component, to serve as a basis for future work and decision making.

The introduction of suitable Key Performance Indicators (KPIs) are recommended to measure, monitor and improve performance of the street lighting service. Bishkeksvet staff would benefit from training in performance benchmarking, including the importance of accurate recording of power outages, for the calculation of System Average Interruption Duration Index (SAIDI) and the System Average Interruption Frequency Index (SAIFI). This will allow for improved transparency and understanding of the operation of the system and identification of suitable improvement initiatives. Improved monitoring and performance could also assist to attract grant funding and support form development partners.

A detailed study of Bishkeksvet's power system is recommended to monitor and record voltage fluctuations over a period of six months to one year to confirm the specific protections that will be required for the street lighting equipment. The study could also be done further upstream to identify the contributing factors to the voltage fluctuations seen in the network.

In addition, tree branches surround several lighting points, which generates technical and light effectiveness issues during the summer season. Power lines and light points must be kept clear of trees by regular trimming to avoid electrical problems. A thorough coordination with Zelenstroi is recommended to this effect.

The construction of a pilot off-grid solar street lighting installation could be considered to gather solar energy performance data for one year. As solar powered solution costs and battery storage costs decrease, off grid solutions may become viable for undeveloped urban areas where no infrastructure exists and capital costs for an on grid solution would be prohibitively high.

7.3 Financial conclusions and recommendations

7.3.1 Financial conclusions

The proceeds from the City budget do not cover Bishkeksvet's operational expenditures. Its revenues have been consistently lower than what has been invoiced. For instance, the company's revenue under its 2013 budget was around KGS 49 million, while operating expenses stood at around KGS 61 million – a 32% difference. Given the financial situation at Bishkeksvet and its reliance on the City budget transfers to cover its operational and capital expenditures, it is unlikely to be able to borrow to finance the Project. The analysis also revealed low institutional capacity to administer external borrowing.

Despite the fact that the proposed project results in a significant reduction in energy consumption (around 55%), the current level of electricity tariffs does not allow for a sufficient financial effect making it unattractive to private investors. The historical additional revenues at around KGS 3 million per annum are not enough to justify private sector participation.

Given that the City Budget has been consistently running budget deficits, and that more than 71% of its expenditures were aimed at current expenditures, borrowing for the purposes of project implementation might require some sort of state support from the Republican budget.

7.3.2 Financial recommendations

Bishkeksvet could benefit from capacity strengthening in order to improve its accounting and financial management functions before it is able to borrow on its own. The City could borrow from a combination of IFI concessional loans coupled with grants from institutions supporting energy efficiency and carbon emission reduction, given the project's energy saving impact. The City could act as the main borrower for the purposes of financing the project, to be supported by the Central Budget for creditworthiness enhancement purposes.

7.4 Legal conclusions and recommendations

7.4.1. Institutional Structure and Stakeholder Analysis

Conclusions:

Bishkeksvet is fully controlled by the Municipality, its sole founder and highest governing body. In its activities Bishkeksvet communicates with a number of different stakeholders including municipal governing bodies, institutions and enterprises. However, Bishkeksvet has limited competences in managing its operations: its spending (it cannot be other than within the limits of the approved budget and with the detailed breakdown of the funds requested); inability to dispose of the property given to it (as this power is given to MPD); inability to perform major repair and construction of new facilities (as this power is given to MCD and PMCD); inability to create development programs (as this power is given to the CDA), etc.

The existing system of communication and distribution of competences among municipal bodies, institutions and enterprises demonstrates the prevalence of administrative hierarchy-based relationships between Bishkeksvet and other municipal bodies. Moreover, Bishkeksvet does not receive adequate funding. All of the above described does not allow Bishkeksvet to develop street lighting.

Recommendations:

It is necessary to draw attention of the Municipality and the Kyrgyz Government to the existing disadvantages and inadequacy in the system of cooperation between the municipal enterprises with local self-governmental authorities, state bodies, etc. Over the longer term it's recommended to review a possibility of introducing amendments into the local acts governing interactions between the municipal bodies and Kyrgyz legislation with the purpose of changing of legal status, structure of relationships and competence of municipal enterprises and providing more independence in making decisions, conducting economic activities and elimination of barriers in participating at state/municipal procurement.

7.4.2. Legal and Regulatory Framework

Conclusions:

There are a number of issues concerning legal and regulatory framework. Most of them are connected with lack of certain standards necessary for street lighting and imperfection of the legal framework regulating street lighting. Lack of standards refers to the lack of national technical standards for LED lamps as a result of which the KR applies standards of foreign states. Also, there are no energy performance standards and energy efficiency standards in the KR whereas compliance with the energy performance standards and energy efficiency standards is a

requirement for legal entities and individuals that are engaged in generation, transmission and consumption of energy resources. Moreover, the Kyrgyz legislation provides that all individuals and legal entities engaged in generation, transmission and consumption of energy resources are subject to mandatory energy performance surveys. However, currently this requirement cannot be implemented, as there is no act or regulation governing the survey procedure. All of the above described illustrates imperfection of legal framework regulating street lighting.

Recommendations:

The CDA and Bishkek Municipality shall draw attention of the Kyrgyz Government to the indicated disadvantages and gaps in the law with the purpose of developing and adoption of necessary normative legal acts, which would ensure proper legal framework. At that, taking into account the fact of Kyrgyzstan entering into the Eurasian Economic Union (the "EEU") from August 12, 2015 corresponding obligations on gradual entering into force of the technical regulations of EEU shall be considered.

7.4.3. Potential Legal Mechanisms to Attract Investments

Conclusions:

Having reviewed in detail the possible legal mechanisms for attracting investments applicable to (a) management of Bishkeksvet (trust management, enterprise lease, PPP, privatization); and (b) financing of Bishkeksvet (increasing Bishkeksvet's budget, grant, loan/credit, finance lease, energy service contract, involving citizens in co-financing), we have defined those that according to the Kyrgyz legislation and based on our practice can be applicable to Bishkeksvet.

Based on our findings we recommend the Municipality to consider the following two mechanisms applicable to management of Bishkeksvet: trust management and PPP. Both of the options encompass certain risks and solutions, and thus shall be carefully analyzed. It shall be noted that along with the management mechanisms, the mechanisms for financing should also be applied.

Advantages and risks connected with use of each of the mechanisms for attraction financing were described in detail in sections 5.3, 6.3 of this Report.