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AUTHOR: *AGULJELN MARKU*
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Improving Energy Efficiency, reducing air pollution Intervening in Public Service Areas to save energy and reduce gas emissions.

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Aguljeln Marku
PhD researcher / POLIS University

Abstract
It is no longer possible to ignore the Climate Changes we are facing and that carbon emissions are the responsible for them. Carbon emissions are mainly caused by the use of energy and its production. Energy efficiency measures offer many opportunities to help rapidly growing cities achieve energy security, energy savings, and reduce costs and emissions. Energy savings, nowadays is a high-priority concern in many countries. Therefore energy-efficient measures are being increasingly implemented in all sectors.

Rapid urbanization has led to massive demand for energy to power economic activity, expand basic infrastructure, and deliver municipal services. Cities now consume about two-thirds of the world's energy, and are responsible for about 70 percent of the world's GHG emissions. Energy efficiency can play a key role in helping meet growing energy demand in cities; it can offer practical, cost-effective solutions to expand and improve urban services, while contributing to cities' efforts to be more competitive and address climate change.

Prishtina faces steady population and economic growth, which requires an expansion of reliable energy and delivery of municipal services. Also the city is one the most polluted capital cities in Europe and that is because of Obiliq Power Plant. Its emissions are about 74 times above the European standard. About 15% of energy in Prishtina is produced by Obiliq Power Plant. Improving the energy efficiency would reduce the energy loss, so the need for energy and by that, for Obiliq, would be lower. Reducing the Obiliq emission will cause the reduction of air pollution.
The methodology used for the energy retrofits comprises three steps, namely assessment of the energy performance, prioritization of sectors having the highest energy savings potential, and giving recommendation for the EE plan. This EE plan must be in line with the strategies and targets set at the national and local level to reduce energy consumption and improve performance in most sectors, including public services.
The priority areas of Intervention will be the public building, street lighting and urban public transport since the public administration has high control of these areas.

Recent studies such as the assessment of the energy performance of Astana and Almaty (Kazakhstan) found that targeted interventions in energy-efficiency in municipal service sectors - including public buildings, district heating, transport, street lighting, waste and water supply – can lead to significant energy savings annually, including 43% savings (3,7 billion kWh) in Astana and 34% savings (3,1 billion kWh) in Almaty.

The aims of this study will be the retrofit for improving the energy efficiency; how much can we save energy from service areas and what effects will it have in reducing gas emissions.

Fig 1 / Obiliq Power Plant
Source / www.insajderi.com

Introduction

Prishtina faces a constant population and economic growth which requires an expansion of the energy and municipal service delivery. Most of the city's infrastructures, such as central heat supply network, water pipes or the residential and public buildings stock are old, with high energy intensity and incur losses. In addition to recent initiatives to improve the capacity and performance in public transport and some retrofit programs for central heating and potable water sector, there is still a huge demand to modernize the infrastructure and meet the future needs with regard to energy and municipal services.

As of now, Prishtina incurs high energy losses for district heat and electricity generation, as well as in the energy distribution for the end-users, mainly in the residential sector. Due to the increase in the mobility of the city residents, private and commercial transport has reached critical levels in terms of density, congestion and GHG emissions. The country is likely to face a difficult road ahead in terms of increasing electricity supply, which no longer meets domestic demand as a result of years of inadequate and weak management. Despite local and international investment, Kosova lives in a continual energy crisis characterized by pollution-producing lignite power generation, an old and inefficient transmission and distribution grid. The country has two lignite fired thermal power plants, Kosova A and Kosova B, located in the municipality of Obiliq and is only a few kilometers from Prishtina. These two power plants have a combined installed capacity of 1,400 MW, though both are out-of-date and run far below installed capacity. Serious pollution is emitted from the two functioning power plants and they release 25 tons of dust and ash per hour, which is 74 times the EU standard for power plant emissions.

Energy related activities are a major source of the emissions of greenhouse gases that contribute to global warming. At a more localized level, energy production and consumption are major causes of environmental pollution that has negative consequences for human health and well-being. Different actors, stakeholders and technologies are directly engaged in each of these consumption-related applications. For example, household members select and use appliances and vehicles, while

companies and municipal authorities install and maintain boilers, water treatment plants, street lighting, collection, transportation and disposal of solid waste, etc. Therefore, different policy instruments would be needed to address each area.

As global demand for energy grows and prices rise, a city's energy consumption becomes increasingly tied to its economic viability (Troy, 2014). A city with a high "urban energy metabolism"—that is, a city that needs large amounts of energy in order to function—will be at a competitive disadvantage in the future. He explores why cities have different energy metabolisms and discusses an array of innovative approaches to the problems of expensive energy consumption (Troy, 2014). It looks at dozens of cities and to understand the diverse factors that affect their energy use: behavior, climate, water supply, building quality, transportation, and others. He then assesses some of the most imaginative solutions that cities have proposed, among them green building, symbiotic infrastructure, congestion pricing, transit-oriented development, and water conservation. To conclude, the author addresses planning and policy approaches that can bring about change and transform the ideas into real solutions (Troy, 2014).

There is a significant connection between the role of the building sector on energy consumption and greenhouse gas emissions, international technical standards, laws and regulations, building energy efficiency and zero energy consumption buildings (Desideri, Asdrubali, 2018).

Khalil addresses the macroscale of urbanism from the perspective of city dwellers' quality of life, and explores the microscale of buildings and the perspective of ensuring indoor air quality within the boundaries of energy efficiency. It presents energy-efficient urban planning as a tool for improving city energy performance (Khalil, 2015)

The principles of eco-design have much to contribute to the planning and management of human communities, industrial parks and networks, architectural practice, and products, and need to make rapid and tangible progress towards a sustainable human economy (Stitt, 1999). This is the primary far reaching manual for the best in class in green plan. This exceptional accumulation of "green" compositions - from fundamental figures, for example, Paolo Soleri and Buckminster Fuller, to overlooked pioneers of elective materials and trial strategies, to specialists around the globe - makes feasible out of the blue an amazing outline of natural structure in design and arranging. It's additionally an unparalleled wellspring of much-required motivation, work streamlining subtleties, and how-to's for this present reality structures and plans that are an everyday part of your work

Methodology

Under the pressures of rapid industrialization and urbanization, Prishtina is facing the challenge of reducing air pollution and CO2 emissions simultaneously while maintaining their economic growth. Under such a circumstance, a growing attention is focused on successful implementation of co-benefit policies that are designed to improve energy efficiency and reduce both air pollutants and CO2 emissions. However, the concept of co-benefit policies must be developed further in order to identify its quantitative and qualitative validity, which can be assessed using a reliable methodology for the estimation of co-benefits and through clarification of the importance of this approach for stakeholders in urban environmental policy-making.

There are several areas in which we can intervene for improving energy efficiency such as: urban transport, municipal public buildings, residential buildings, commercial and industrial

sector, street lighting, power system, urban transport, private transport, district heating, water and wastewater and solid waste. Based on level of control by the Prishtina city administration we are going to focus this study in the areas which are in high control by the Prishtina city administration: municipal public buildings, district heating and street lighting. For these areas we will determine how much energy consumption can we reduce and the corresponding reduction of gas emissions. There are a few software that are useful for these calculations such as: Wattics, Eniscope, ProcessMAP, TRACE, etc. These softwares are specialized for only some kind of calculation mentioned above. TRACE is the one that calculates the data that we want in all these areas of intervention. TRACE has been used and had good result also in implementation for other cities such as Sarajevo, Tbilisi, Astana, etc. Cities that are similar to Prishtina.

So the assessment for Prishtina will be done by TRACE[1].

The statistical information used in this study has been extracted from different edition of databases published by the government organizations. Energy and cost savings potential are assessed through a relatively simple benchmarking process. Basically, the indicators selected for Prishtina are compared with similar indicators from other cities included in the TRACE database. For comparison purposes, cities can be selected based on the level of development, based on climate, or based on population. The cities that do better than Prishtina on a particular indicator become a benchmark that Prishtina itself can aspire to. For example, if several cities have a lower energy consumption for public buildings, it is an indicator that local authorities in Prishtina could achieve energy savings in the 'Public Building' sector. If the specific heat consumption per area of municipal public buildings for a selected number of similar municipalities performing better than Prishtina is X kWh/m², and the buildings in Prishtina consume in average Y kWh/m²,then its relative energy intensity is (Y-X)/Y= Z%. The energy and cost savings potential is calculated for each of the four service areas.

Municipal Public Buildings

The City of Prishtina manages a stock of 112 municipal buildings, of which the majority are educational and health buildings. Most of these buildings were built in the communist years, and as such tend to be relatively energy inefficient.

			Electricity Consumption		Heating Consumption	
	Number	Area (m2)	(kWh/year)	(kWh/year/m2)	(kWh/year)	(kWh/year/m2)
Educational	61	155417	4681021	30.1	16879240	108.6
Administrative	19	17633	1112685	63.1	287284	16.3
Cultural	8	3120	178458	57.2	0	0
Health	24	17483	1687189	96.5	1417730	81.1
TOTAL	112	193653	7659353	39.6	18584254	96

Tab.1 / Energy consumption in municipal buildings in Prishtina
Source / www.esmap.org

[1] / The Tool for Rapid Assessment of City Energy (TRACE) was first developed in 2008 by ESMAP's Energy Efficient Cities Program to help cities expand their municipal services through energy efficiency. It was designed to give city authorities a quick and easy way to assess their energy use and to identify cost-effective and feasible measures they can take to improve energy efficiency in a variety of public sectors including lighting, water and wastewater, buildings, transportation, solid waste, and power and heating. It guides users through the process of data collection and sector prioritization —considering key constraints such as technical capacity and finance— to generate specific and integrated recommendations cities can use to improve and expand their energy efficiency efforts. TRACE's benchmarking function allows a city to compare its energy use against a range of peer cities and show the potential energy efficiency improvement the city may realize if it were to match the average of better-performing cities. For each of these service areas, TRACE requires the collection of a number of indicators.

As shown in the table 1, the total energy consumption for municipal public building is 26'243'607 kWh/ year.
When we calculate the energy performance according to the benchmarking made by TRACE 2.0,Prishtina is an efficient city among peers with similar condition in the database for the heating consumption, but for electricity consumption Prishtina has high consume.
The saving potential calculated by TRACE is 27.84%. That means that we can save 7'306'220 kWh/year by making interventions in municipal public building in Prishtina.
In addition, improved energy efficiency codes can ensure that all new municipal buildings are good energy performers.

District Heating

District heating in Prishtina is provided by Termokos, a local public utility company. Termokos was established in 1970 with a small capacity, and with a network of steel pipes with classic insulation.
Over time, the system has continuously expanded, with more and more buildings added. The total distribution network is 77 km in length. Termokos

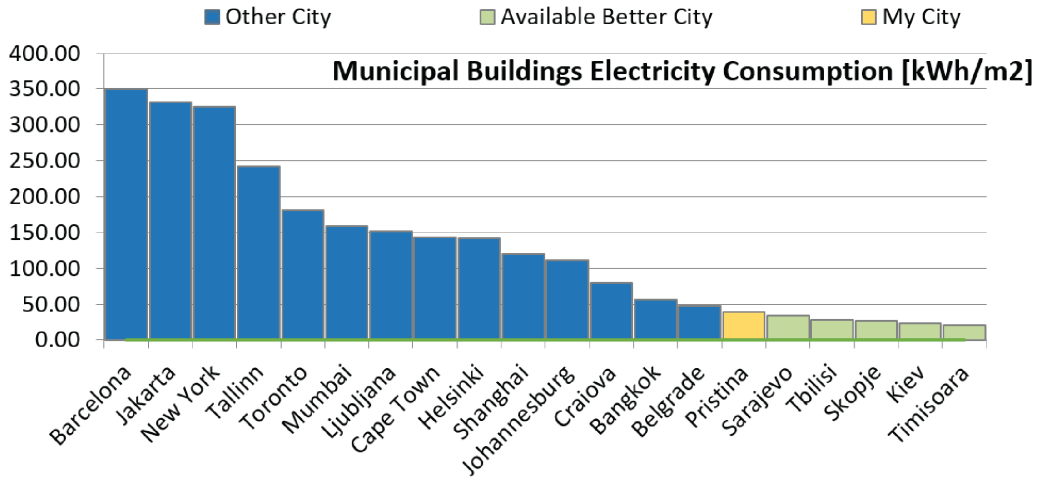

Diagram1 / Peer City Benchmark for Municipal Building Electricity Consumption

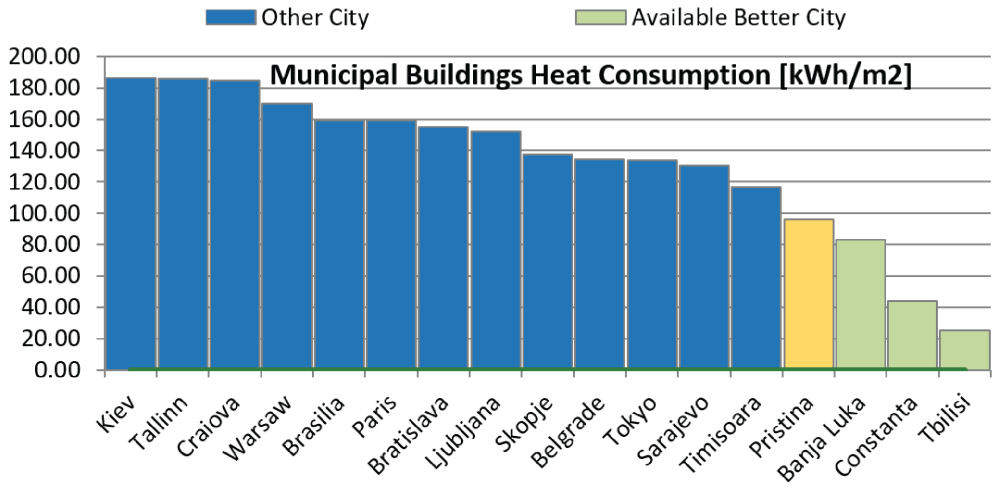

Diagram2 / Peer City Benchmark for Municipal Building Heat Consumption

is responsible for the primary distribution network, from the district heating plant to the substations, while end-consumers are responsible for the secondary network, from the sub-stations to the radiators. Heat is delivered 6 months per year, from October 15ht through April 15th.
In the 2015/2016 heating season, the amount of heat delivered by Termokos was around 165 GWh.
The saving potential calculated by

TRACE is 26.37%. That means that we can save 52'393 MWh/year. To achieve this target district heating network frequently maintenance is needed and also replacing some of the old pipes with new ones.

Fig2 / Termokos main building
Source/ termokos.org

	Produced Heat (MWh)	Delivered Heat (MWh)	Distribution Losses (MWh)	Distribution Losses (%)
Oct-15	9179	7508.42	1670.58	18.2
Nov-15	30405	24932.1	5472.9	18
Dec-15	40627	33314.12	7312.88	18
Jan-16	43169	36032.22	7136.78	16.53
Feb-16	33832	28224.05	5607.95	16.58
Mar-16	34581	29278.21	5302.79	15.33
Apr-16	6893	5798.33	1094.67	15.88
Total 2015/2016	198686	165087.45	33598.55	16.91

Tab.2 / Performance of Prishtina District Heating System
Source / ero-ks.org

Public Lighting

The street lighting sector in Prishtina has underwent significant improvements in recent years. With financial and technical assistance from donors, the municipality has started an ambitious program to improve the performance of the network. In 2011, for example, 20% of all light poles in Prishtina were equipped with state of the art LED technology.

As shown on the table the total consumption of public lighting is 844 kWh/year.

Consequently, local authorities plan to replace the remaining stock of inefficient mercury vapor bulbs (52% of the entire stock) with LED technology. Such solutions have been successfully tested by some of the

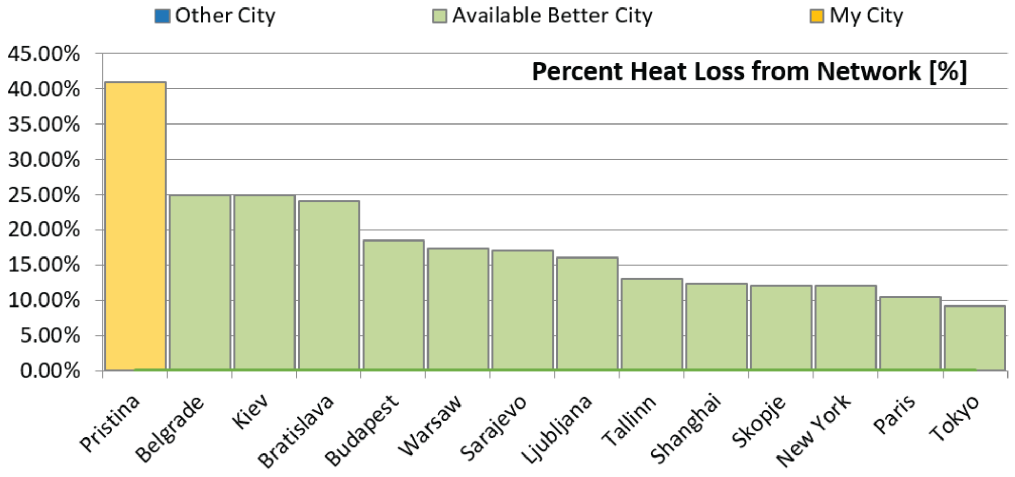

Diagram3 / Peer City Benchmark for Percent Heat Loss from Network

Type of Bulb	Power of Bulb (Watt)	Number of Lighting Bodies
LED-90W	90	700
LED-60W	60	150
LED-30W	30	385
Mercury Vapor-150W	150	299
Mercury Vapor-125W	125	2094
Mercury Vapor-125W in parks and squares	125	881
CFL-Flourescent Bulbs	60	108
High Pressure Sodium	250	892
High Pressure Sodium	150	761

Tab.3 / Distribution of Street Light in Prishtina
Source/ www.esmap.org

municipalities around Prishtina, and they are considered to be a solution for the extension of the public lighting network in the city.

The saving potential calculated by TRACE is 28.78% or 238 kWh/years.

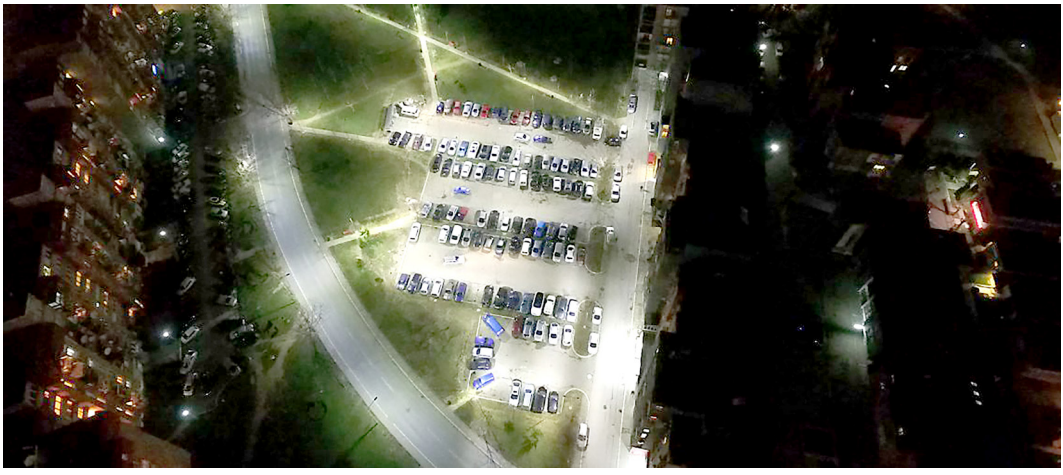

Fig3 / Public lighting in Prishtina
Source / altradeholding.eu

The measures we can take are replacing the non-efficient bulbs with a system that runs on energy efficient LED and high pressure sodium bulbs. And some of street lights can be equipped with-photo sensitive devices that only turn on the lights when it's sufficiently dark outside.

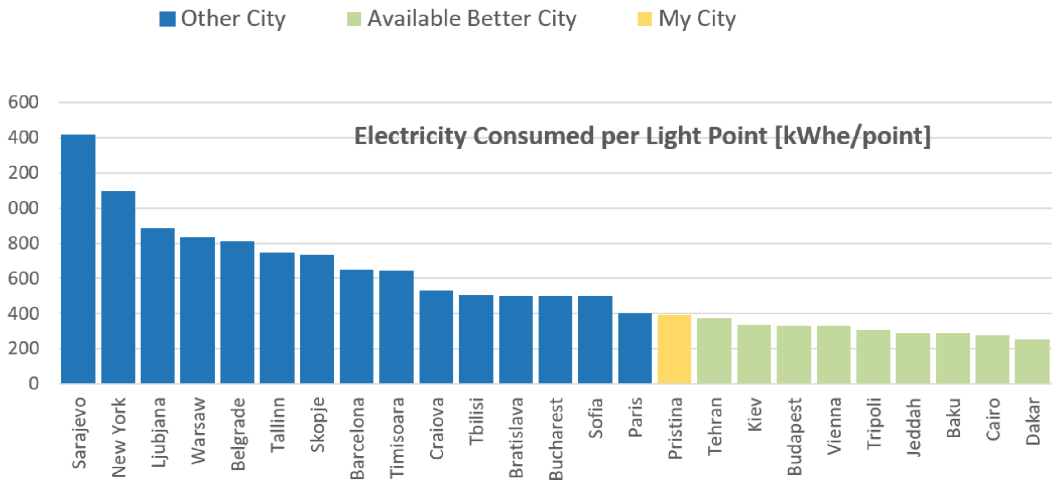

Diagram4 / Peer City Benchmark for Electricity consumed per Light Pole

Conclusion

Considering that electricity is generated from power plants with an obsolete technology, designed at a time when there weren't significant environmental protection requirements, Kosova is in a dire situation in terms of environmental protection.

In Kosova , 97% of Production capacities per energy source is from coal power plants (www.worlddata.info).

That is the reason why the reduction of coal consumption is particularly important to diminish the GHG emissions in order to improve the air quality in the city. 1 kWh of electricity, when produced from a coal burning power plant, will generate 0.94 kg of CO2 emissions to the atmosphere (Carbon Neutral Charitable Fund).

At the table below we can determine how much can reduce CO2 emission from the energy savings that we calculate before.

Benefits

There is now a growing awareness that energy efficient buildings provide a range of benefits beyond simple financial savings, depending on the measures introduced and their occupancy and utilization patterns of the building involved. Hence, the implementation of EE measures in Kosova is driven by a wide range of factors and

can be expected to deliver a wide range of benefits, including the following:

	Energy savings (kWh/year)	CO2 emission reductions (t/year)
Municipal Public Building	7306220	6867.9
District Heating	52393000	49249.5
Public lighting	844	0.8
	TOTAL	56118.2

Tab.4 / CO2 Emission Reductions

Air pollution

As we can see, just by intervening on the areas that consume 12.6% of the total energy in Prishtina (ask.rks-gov.net), we can reduce CO2 emission by 56118.2 tons. What if we make the interventions for the other areas that we didn't study here? How much could the reduction of gas emission be?...

Economic Benefits

Improving EE costs significantly less than investing in new generation and transmission equipment, so EE measures make energy more affordable for households and reduce operating costs for business. Energy efficient buildings also boost the local property market, as they enjoy higher

resale and leasing values and are easier to market.

Environmental Benefits

On the demand-side, EE measures reduce energy consumption and therefore mitigate environmental damage by lowering emissions of greenhouse gases and other pollutants, as well as reducing water use.

Social Benefits

By enhancing the quality of a building's environment, EE measures bring about improved health, well-being and social development. In the work place, an improved working environment results in productivity gains.

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