City of Buenos Aires, Argentina

Smart management for LED-based public lighting

ICLEI Local Governments for Sustainability

Since 2013, the City of Buenos Aires has retrofitted 91,000 lights in its streets and parks with light emitting diodes (LEDs) and deployed a smart management system of all public lighting. As a result, the City has benefitted from energy savings, decreased infrastructure and maintenance costs, reduced carbon dioxide (CO_2) emissions, and increased safety and well-being for residents, while advancing on the pathway to become a climate smart city.

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Introduction

The provision and maintenance of public lighting is an essential service typically overseen by local government. Modern lighting systems should address a range of different needs, and be clearly embedded in a coherent municipal plan. The choices made will impact on functionality and effectiveness of services. A smart approach calls for easing infrastructure management, selecting appropriate efficient technologies, addressing cost effectiveness over time, reducing energy demand and greenhouse gas emissions (GHGs), while enhancing lighting services.

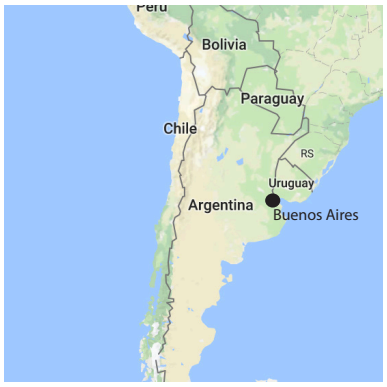
The high levels of energy consumption and CO_2 emissions associated with the use of incandescent lighting have been well documented. Replacing such inefficient streetlights with energy-efficient and longer-lasting lighting technology will result in significant energy and cost savings, as well as reducing emissions and improving road safety. Thus, it is a justified action recommended for all climate action plans.

It is also important to consider and minimize light pollution caused by public lighting. Unnecessary brightness (glare), reduced visibility of stars (sky glow phenomenon), poorly located artificial light (light trespass), and an excessive number of lights grouped too closely together (light clutter) can adversely affect the surrounding climate, wildlife, and the quality of life of inhabitants. According to a study published by International Dark-Sky Association in 2017, satellite images indicate that light pollution is increasing at a rate of two percent per year, both in regard to total area illuminated and total radiance.

To address the above issues, the choice of LED lights and state-of-the-art luminaires is recommended. They can be adjusted to produce the suitable level of illumination and can provide a high degree of control over the direction in which light is emitted, in addition to being highly energy and cost efficient.

Buenos Aires in context

The City of Buenos Aires, the capital and most populous city of Argentina, has established a strategic vision for creating a sustainable city. To achieve this vision some challenges need to be faced: Buenos Aires has a steadily growing population and built environment, which leads to increased energy consumption and higher GHG emissions. In order to abate this trend and promote sustainability, the City identified public lighting transformation as an effective action area.



Facts & Figures

Population (2017)
3,050,000

Land area (2010)
203 km²

Emissions and energy (2014)
Total GHG emissions: 12.9 M tCO_2eq
from energy sector: 7.5 M tCO_2eq
Energy consumption: 12,000 GWh/year
Municipal consumption: 1,000 GWh/year
% consumption from public lighting: 20%

km² - square kilometers
M tCO_2eq - million tons of carbon dioxide (CO_2) equivalent
GWh/year - GigaWatt hours per year

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As of 2013, Buenos Aires had approximately 126,000 municipally-operated lights distributed throughout the city. The majority of these lights were high pressure sodium lamps, which, because of their high energy consumption and short lifetime, incur significant energy and maintenance costs for the municipality. To change this situation, the local government conducted a retrofit and management initiative which has established Buenos Aires as a regional and global model for smart and sustainable street lighting.

Description of activities

Retrofitting public lighting in Buenos Aires

In 2013, the Ministry of Environment and Public Space of the City of Buenos Aires launched the Plan de Reconversión del Alumbrado Público (Plan for Retrofitting of Public Lighting). Following a procurement process in line with the mentioned plan, the local government commissioned Signify (formerly Philips Lighting[1]) to retrofit 91,000 public lights on streets and other municipal holdings, accounting for approximately 72 percent of total municipal lighting stock.

The retrofit commenced in 2013 and was conducted over a course of three years. The first phase saw 11,000 LED-based luminaires installed on the most high-profile streets in the city. In each of the two subsequent years of the project, 40,000 LED lights were installed in secondary streets, public open spaces, and parks. In total, 91,000 new LED luminaries were installed throughout the City of Buenos Aires.

A smart solution for lighting management

Although retrofitting such a significant number of the existing lighting stock as a stand-alone measure would already produce significant energy savings and emissions reductions, the City of Buenos Aires required a more comprehensive solution. Advances in information and communications technology have demonstrated that the impact of retrofitted lighting can be amplified through connected networks for public lighting management.

Following a call for proposals issued by the City of Buenos Aires, a contract for the retrofit and installation of a management system was awarded to Signify (at the time, Philips Lighting). The proposal submitted by Signify detailed a sophisticated management platform for public lighting and a partnership with SAP (Systems, Applications & Products in Data Processing) to allow for state-of-the-art analytics, and consequently more efficient city operations.

Such smart connected lighting management platform enables its operators - in this case the City of Buenos Aires - to visualize, analyze and store the performance data of all lights connected to the system. This means that the City can manage public lights remotely and in a much more efficient way than the conventional method relying on manual oversight. This approach to integrated lighting management allows operators to determine the level of light emitted from any LED luminaire in the network. It also provides direct benefits to maintenance by allowing for

1. Philips Lighting N.V. changed the company name to Signify N.V. in 2018

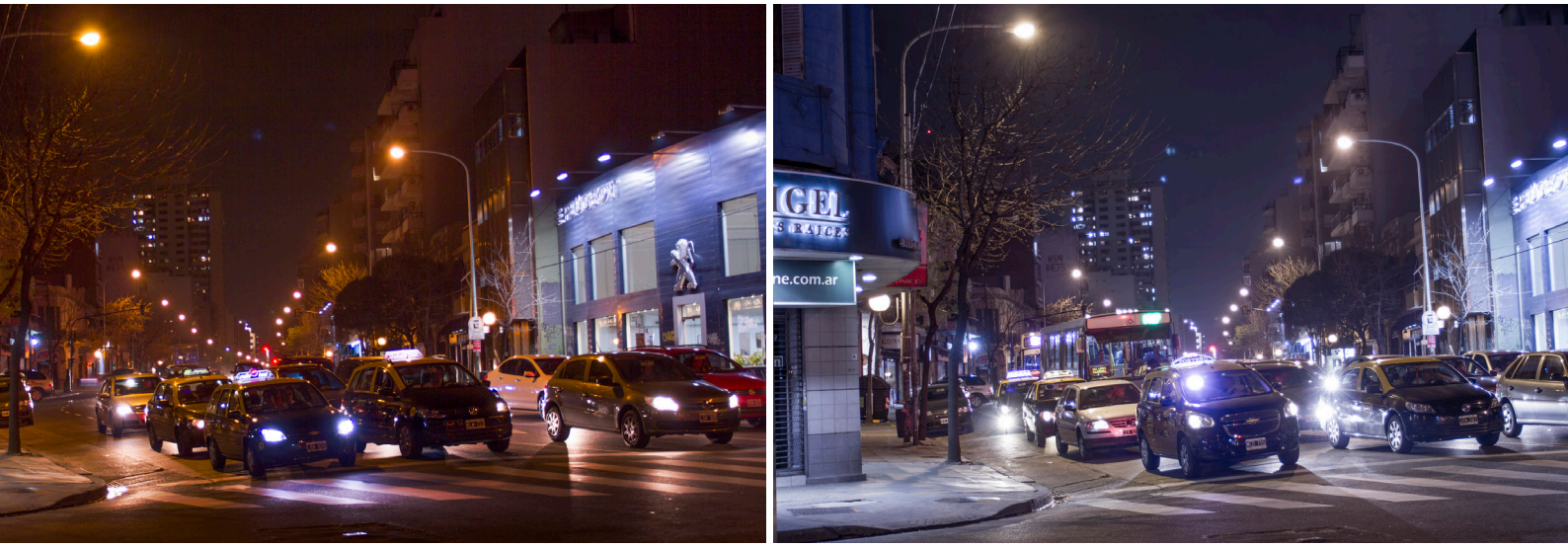

Image 1: Everything is illuminated! Buenos Aires before (left) and after (right) the public lighting retrofit

Source: City of Buenos Aires (Captura Ministerio de Ambiente y Espacio Público - GCBA)

the real-time detection of faulty light and ability to dim or switch-off individual luminaires with precision, resulting in more energy savings.

The partnership between Signify and SAP enabled the City of Buenos Aires to integrate a sophisticated relational multitenant database management system into the lighting management platform. It provides the local government with advanced data processing capabilities, such as predictive text analytics, spatial processing, data virtualization, and real-time data on public lighting and also on some other municipal assets. Deploying this system by Buenos Aires has not only made the public lighting management smarter, but also eased municipal management of more than 700,000 assets, including parks, bus stops, buildings, and bridges. This sophisticated database management system is, for example, also being used for risk mitigation of heavy rain by monitoring storm drains. Thanks to this collaboration, real-time data gathered by Signify management platform from connected streetlights is linked with other data gathered by sensors from different City departments, and turns into more understandable information to be shared on a single "city dashboard". The information can then also easily be incorporated by the City of Buenos Aires in budgeting, planning, and decision-making processes.

Results

The public lighting retrofitting plan and the introduction of the Signify management platform have made immediate impacts in the City of Buenos Aires:

- Retrofit of incandescent lighting with 91,000 new LED-based luminaires;
- Remote adjustment of lighting levels made possible by the integrated management system;
- Energy savings of more than 50%;
- Saving 80,200 MWh (Megawatt hours) of electricity over three years (from 2013 to 2016);
- Energy savings amounting to 54,300 MWh in 2017;
- Estimated increase in energy savings up to 60,100 MWh in 2018, and further grow to an average of 66.100 MWh of electricity per year between 2020 and 2024;
- Carbon dioxide (CO_2) emissions reduction;
- Enhanced lighting services, improved visibility, and reduced light pollution;
- The annual cost savings through this initiative is estimated at more than 6 million USD by 2018, and around 11.8 million USD by 2019;
- Enhanced road safety.

Image 2: Mayor Horacio Rodríguez Larreta visits the city's data management hub (Centro de Control de Telegestión del Alumbrado Público) Source: Matías Repetto (GCBA)

Since the implemented system allows the operator to select completely customizable levels of lighting, the City of Buenos Aires could potentially save as much as 80 percent of the energy costs which had been required to operate its incandescent lighting stock. For maintenance, the precise fault detection and monitoring of public lighting, with the comparatively longer lifetime of LED lights (approximately five times longer than incandescent lights) have reduced municipal operational costs related to public lighting by about 50 percent.

The initiative has also seen considerable success in reducing CO_2 emissions within the city. Projections indicate that an annual minimum of 23,600 tons of CO_2 is avoided in Buenos Aires. Further reductions are possible if the remaining public lighting assets are retrofitted and connected to the management system. Considering that the City is already planning to retrofit the remaining luminaires, they are expecting a minimum of 32,200 tons of CO_2 to be avoided per year from 2020.

The improved visibility provided by the new public lighting is also expected to have a major positive social impact in Buenos Aires by enhancing public safety, increasing the use of public space, and deterring crime during hours of darkness. It is also hoped that improved lighting will decrease the frequency of traffic accidents.

Replication potential

Retrofitting of old, inefficient incandescent lighting and the provision of integrated street lighting management should be considered by municipal governments in all parts of the world. The cost savings and emissions reduction potential of energy efficient lighting and improved system design range between 25 to 80 percent. These measures can easily be included in a climate action plan with short-term investment (even using municipal funds), with costs recovered fast.

The payback period for a municipal LED retrofit is typically between four to six years. The capital requirement to invest in LED lighting has been decreasing annually by 10 to 15 percent, but it still remains higher than conventional lighting options. As such, it is important to build in sustainability criteria in tendering procedures, to ensure environmentally-friendly technologies are used, and a sustainable solution is enabled.

Over a period of time, the energy and cost savings generated from the LED retrofit can be used to pay off the initial investment and reduce the need for additional energy generation facilities. Cost savings from a lighting retrofit can be used for expansion of public lighting to the areas that might be underserved by public lighting and infrastructure.

Where funding is available, a combination of connected public lighting networks and information and communications technologies should be considered. Instant status updates and changes can be provided via web-interface, offering additional services and better supporting the local government in its decision making. Constant and comprehensive

Image 3: Buenos Aires street lighting

Source: Signify

oversight of connected public lighting network helps to provide efficient service to the community.

At a practical level, LED retrofitting requires municipalities to assess and make choices on appropriate elements of the system, ranging from light source technology and luminaire design to procurement models and ways to finance such projects. Schemes that can enable this lighting service should assess options to achieve the highest gains in terms of energy and cost savings, as well as GHG emissions reductions.

Costs, financing, and sustainability of the action

The City of Buenos Aires awarded the contract for the public lighting conversion plan to Signify following a public bidding process. The City financed the retrofit through its own municipal funds.

By the end of 2017, the City's total investment in this initiative amounted to 70 million USD. It is projected that this investment will be recovered in six to seven years, while the installed LED lights are expected to last for 20 years.

In an ideal case, electricity used to power the public lighting network should come from renewable sources, for example by buying green electricity or by own generation (e.g. photovoltaic systems, wind power).

References and further reading

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Buenos Aires Ciudad

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