

## LED Artistic-architectural Lighting in the City of Sofia

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### **Abstract**

*The light-emitting diodes (LED) offer new possibilities of realization of:*

- lighting accentuating of architectural projects;*
- lighting architecture;*
- decorative lighting effects.*

*They are represented with pictures of practical implementation of lighting systems in the capital of Bulgaria – Sofia.*

*The paper represents a study of the basic principals and implementation in the classical and the contemporary architectural lighting design. The principals are illustrated with practical examples of architectural lighting realized with traditional and with LED light sources. The problems and the future tendencies are analyzed as well.*

**Keywords:** artistic-architectural lighting; luminaires with traditional and LED light sources; classical and modern architecture, implementation.

### **Introduction**

In the last 10 years the daylight and the night view of the capital of Bulgaria, city of Sofia have renovated on a large scale all the time with the prevailing share of modern architecture with entirely glazed facades. The artistic-architectural lighting in our capital consists of:

- Historical architectural objects in the urban central districts
- Typical objects of the contemporary architecture;
- Typical sculpture architectural and sculpture objects;
- Decorative plastic arts, aquatic effect areas;
- Engineering outfit: tunnels, trestles, traffic junctions on several levels, bridges, outfits part of industrial ensemble;
- Typical underground and over-ground spatial structures, connected with exhibition of archeological objects;
- Historical architectural objects outside the central urban space ( for example The Church of Boyana, The Losen Monastery and so on);
- Decorative lighting of typical objects of the nature and phenomena [1].

In the present paper it is represented the typical approaches to the classical and contemporary lighting designs of artistic-architectural lighting in the city of Sofia. These lighting designs are realized respectively with conventional and LED lighting sources. The object designs are illustrated. The methods of approach and their pertain to the main principles of the architectural and artistic lighting are analyzed.

## LED Design of Architectural Lighting of contemporary Sofia

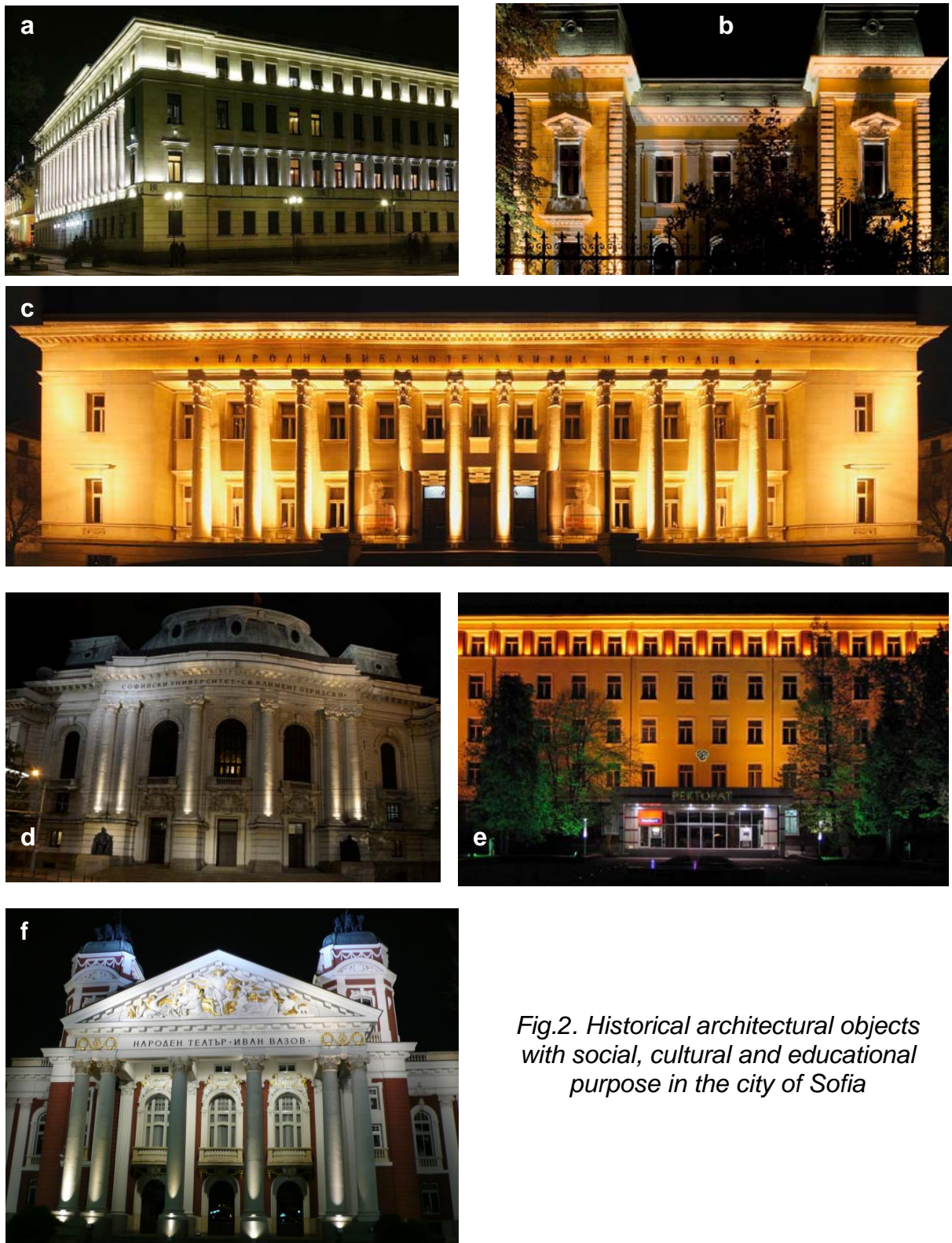
The bigger selection of the historical architectural objects in the central urban spaces [2], [3] are realized basically with conventional lighting sources – low pressure sodium lamps, metal halide lamps, tubular and compact fluorescent lamps – The Administrative Building of the Parliament (2007) – 1a and 1b, The Parliament Building of Bulgaria (2001) and The Church Monument “Aleksandar Nevski” – 1c, Bulgarian Courthouse (2006) – 1d, The Ministry of Defense (2005)- 2a, the Union of the Architects in Bulgaria (2007) – 2b, The National Library - 2c, The Sofia – 2d and the Technical University - 2e, The National Theatre – 2f and others– fig.1 и fig. 2.



*Fig.1. Historical architectural objects in the central urban space*

The project designs for some of these buildings, The Bulgarian Courthouse and The Ministry of Defense are realized as a combination of conventional lighting sources and LEDs.. The LED luminaires are used for localized lighting of the window openings and other elements of the buildings with small dimensions.

The architectural lighting of all these objects is designed with observation of the main principles for modeling of harmonized architectural and lighting composition. It represents the artistic and the architectural merits of the object, keeping its identity and demonstrating the architectural wealth of the urban space during the night.



*Fig.2. Historical architectural objects with social, cultural and educational purpose in the city of Sofia*

For lightening of buildings characterized with classical architecture the following principles are used:

- Symmetry and asymmetry of architectural design;
- Metric (rhythmic) alternation of architectural elements and lighting effects;
- Ratio between the brightness of the illuminated object and its surroundings;



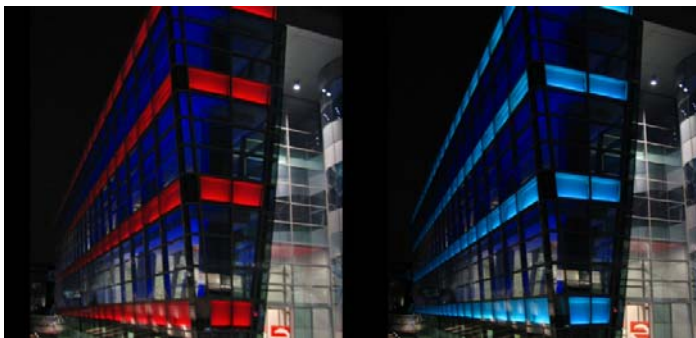
- Light color formation and reflective characteristics of the object and its surroundings.
- Focus of the light composition – compositional center.

By contrast of the cultural and historical architectural objects the trends in the lightening of the buildings with contemporary architecture are for implementation of LEDs.

The LEDs differ from the classical light sources in their construction and electrical, lighting and maintenance properties and characteristics. Regarding this there are expanded possibilities for realization of new and original designs for artistic and advertising lighting.

Their small size allows constructing of compact and mechanically stable lighting fixtures. The small dimensions are significant for the artistic architectural lighting, due to the important requirements for discreet mounting of spots and luminaires on the lightened objects.

The long durability of the LEDs stands for the less needed maintenance. The lighting fixtures with LEDs have practically unlimited working period in the meaning of the lighting systems. This is significant in the cases of hardly reachable mounting positions of the LED luminaires.



*Fig.3 Artistic architectural lighting  
of the East Park Trade Centre,  
Sofia*

The wide variety of LED light colors, the dimming capability and automated program control of the light color give wide possibilities for their implementation in the field of the decorative and advertising lighting.

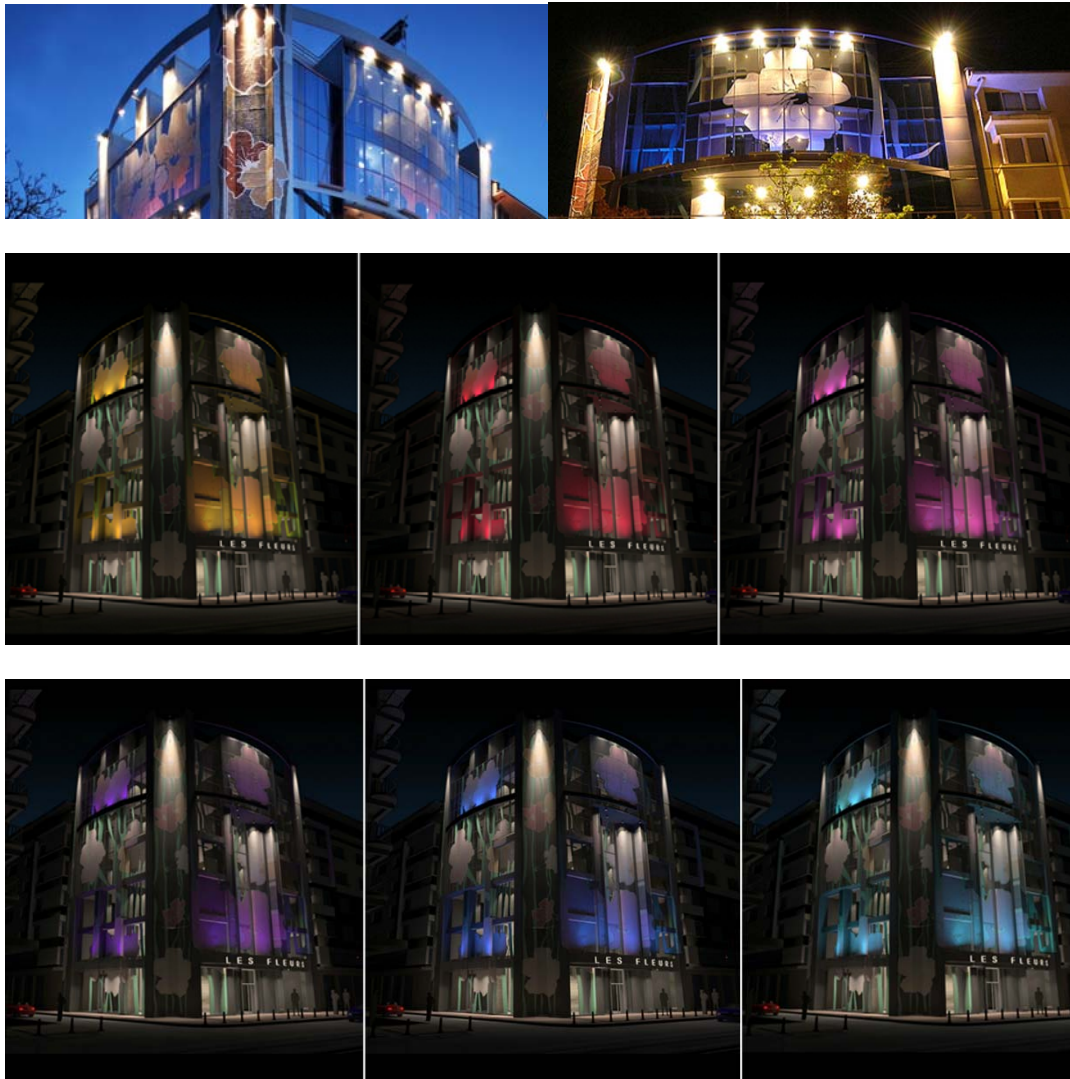
The low working voltage of the LEDs is another significant advantage as a warranty of their safety usage.

Further there are represented some modern lighting designs with LEDs in the city of Sofia. They demonstrate their advantages for representative lighting tasks.

On fig.3 it is represented the architectural lighting of the building of East Park Trade Centre awarded for "Business Building of the Year 2005". The lighting design

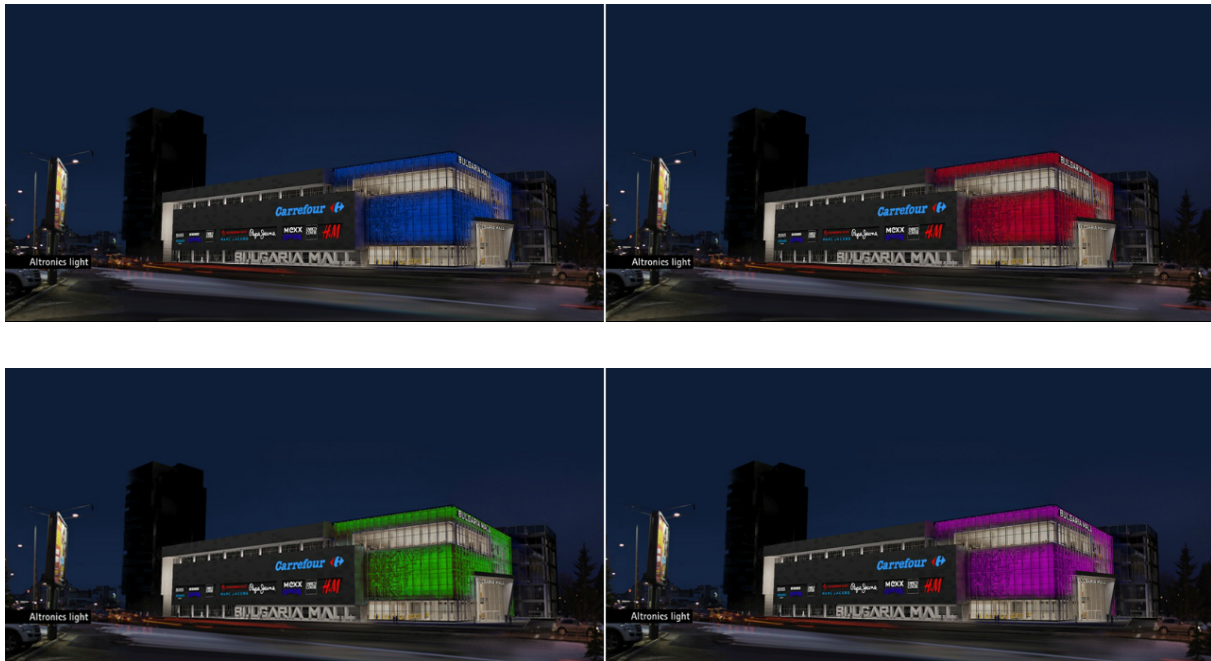
is realized with RGB LED fixtures, which are built in the facade construction of the building.

On fig. 4 it is represented the project visualization and the practical realization of another type lighting design with RGB LED spots. Hotel Les Fleures differs not only with luxury interior but with attractive night vision, representing skillful combination of decorative elements and choice of color interpretation.

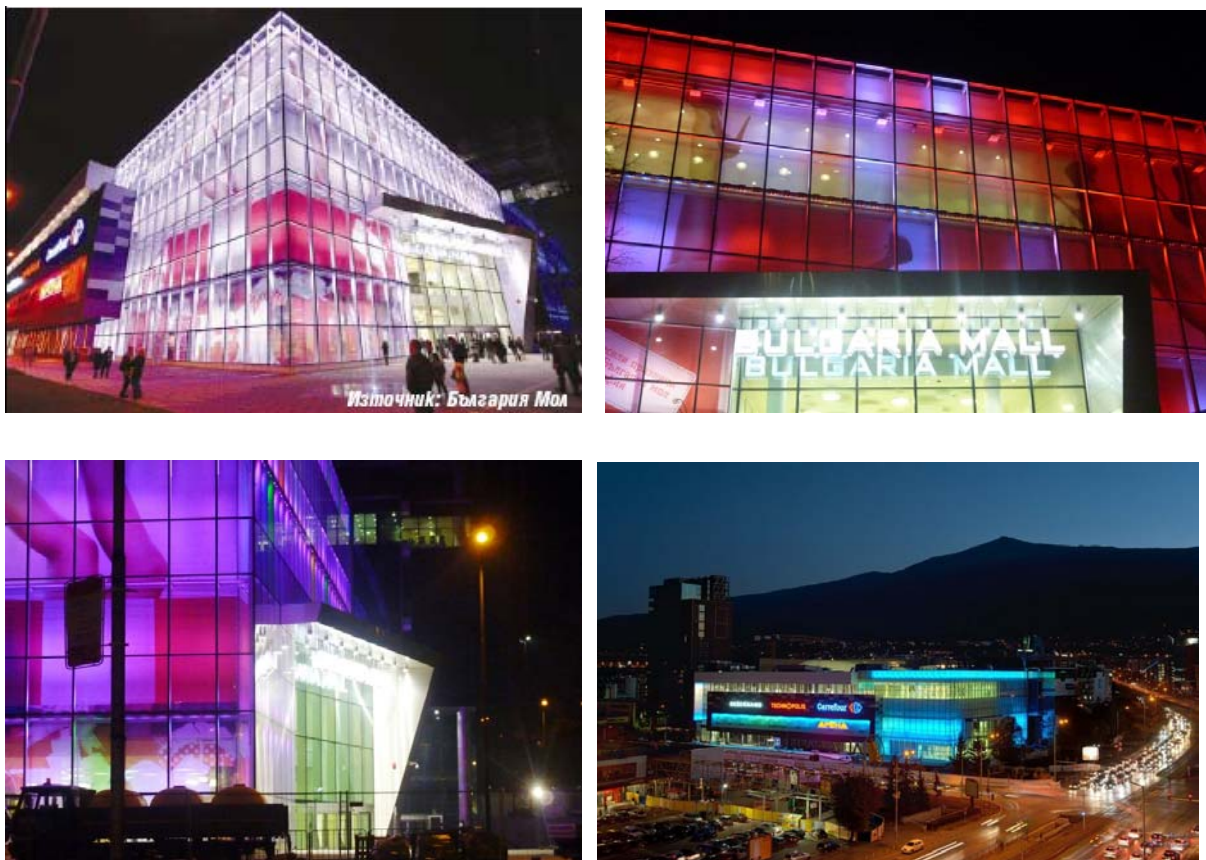


*Fig.4 Dynamic decorative architectural lighting of Hotel Les Fleures, Sofia*

The building of Bulgaria Mall, opened in December 2012 differs not only with its innovative architecture but with the realization of contemporary technical solutions. The visualization of the project design is shown on fig. 5.



*Fig.5 Visualization of the architectural, decorative and advertising lighting of Bulgaria Mall, Sofia*



*Fig.6 The practical realization of the architectural, decorative and advertising lighting of Bulgaria Mall, Sofia*



The facade lighting of the Building of Bulgaria Mall is realized with RGB LED luminaires, with the total number of 505, which are with different lengths (0,33m and 1m). The applied luminaires for outdoor implementations are with high class optics and very good color mixing capabilities. They are reliable and easy for maintenance, with high protection degree IP65, suitable for the temperature range from  $-40^{\circ}$  to  $+35^{\circ}\text{C}$ . Their power supplies work with voltages from 100V to 240V AC and they are individually addressable.

The dynamic lighting scenes are realized with one controller by DMX channel which also controls a part of the interior dynamic lighting. The lighting system allows programming of a big number of dynamic lighting scenarios which could be activated individually as well as in preliminary set schedule. The architectural lighting is set to turn on and off accordingly time schedule and by daylight sensors.

Another exceptionally attractive object is the building of Vertigo Business Tower, which is situated on Bulgaria blvd – fig.7.



*Fig.7 Dynamic architectural lighting of the Vertigo Business Tower, Bulgaria blvd, Sofia*

The building of *Vertigo Business Tower* is a typical representative of the modern architecture and lighting attraction with programmable dynamic multicolored lighting expressing the dynamics of the big cities. It is emphasized the volume of the

building by floor levels as remaining the daylight vision for the asymmetric architectural appearance. The architectural lighting is built in and realized with RGB LED systems. The lighting scenes alternate dynamically as the hue of colors changes for the whole building as well as by its height. The color scenes are the most attractive on celebration days when the sector volume of the building appears as a combination of different colors.



*Fig.8  
Architectural  
lighting of the  
building of Office  
Center, Tsar  
Boris III blvd*

Another approach for emphasizing of the volume and the contours of a building and modifying its night vision by architectural lighting is shown on fig. 8. In this case the night lighting scene forms an impression for the presence of different levels in the central part of the façade as accentuating the asymmetric decorative parts on the top. The lateral stage parts of the façade are traced with horizontally directed spots. An essential disadvantage of this architectural lighting design is the glare from the spots mounted on the lower levels and directed horizontally. The visual discomfort is higher for the drivers which are situated closer to the building.

The represented lighting designs are determined from the tendencies in the modern architecture for building of completely glazed facades or glazed facades with the presence of small area reflecting decorative symmetrical or asymmetrical elements taking part in the architectural ensemble. Because of their small area or the absence of such decorative elements the new tendencies in the artistic architectural lighting are for the use of decorative color and lighting effects, realized with LED systems. In the most cases the lighting designs are orientated to realization of dynamic color and lighting effects and overlap the **lighting architecture**.

The lighting architecture visually demonstrates the strong dependence of the object outlook on its lighting design. In some cases the role of the lighting goes beyond “the emphasizing of architectural worthiness” and becomes more independent in the creation of artistic effects [5]. There are a lot of examples for the shape-light interaction in which the role of the lighting increases and sometimes becomes dominant. In its pure appearance the lighting architecture is demonstrated only with light.

For the most of the represented modern architecture building with glazed facades the daylight and the night appearance are different and trend to the lighting architecture with emphasized night vision with artistic lighting effects.



In unison with the contemporary tendencies arises one natural question. Shall the LEDs find their place in applications of artistic-architectural lighting of buildings with cultural and historical purpose?

In fact almost all buildings with historical and cultural purpose have architectural lighting. The replacement of the existing architectural lighting could be dictated of some significant advantages of the LEDs:

- illuminating – precise direction of the light to the task objects and reducing the lighting pollution;
- operating hours (related with maintenance) – long life without replacement;
- energy saving – reducing the power consumption per year;
- mounting and aesthetical – discrete mounting with saving of the aesthetic look of the facade;
- ecological – after their lifetime [6],[7].

On fig. 9 it is represented an interesting object – the building of The Residence Exclusive Club, more familiar as the Yablanski House.



*Fig.9 Artistic architectural lighting of The Residence Exclusive Club*

The house was built in 1906-1907 with the project of the Austrian architect Fridrich Grunanger. The ornaments were made by the palace decorator Andreas Greis.

This building corresponds to the representatives of the standard classical architecture and it is entirely restored. The entire night vision of the building is magnificent and impressive with precisely emphasized unique architectural elements with the use of discretely mounted LED architectural lighting.

## **Conclusion**

The contemporary tendencies in the architecture with constructing buildings mostly with entirely glazed facades define the new tendencies for choosing of lighting design with prevailing dynamic decorative color scenes or for realizing of lighting architecture.

The LED lighting has several significant advantages regarding the conventional lighting sources and offers a wide variety of lighting design realizations. But the LED luminaires are still expensive. The question is if it worth to investigate in reconstruction of existing architectural lighting with conventional light sources with LEDs for buildings which are representatives of classical architecture. It is important

to be analyzed if the realized potential savings will be enough to cover the initial investments in a reasonable time.

### **Acknowledgement**

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