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GREEN INITIATIVES: VIABILITY OF A PUBLIC INVESTMENT PROJECT ON PUBLIC LIGHTING

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Abstract This paper highlights the viability of a Solar street lamp project versus an electricity street lamp project. For a section of two kilometers requiring 100 luminous units for a ten year - exploitation period, the total cost of the electric investment rises to ¥ 2,690,100whereas the solar system consumes only ¥1,470,000. The solar system allows economies of about 335W per luminous unit and can generate a budgetary economy of about ¥ 1, 173,840 in energy saving for the whole project. Beyond its economic advantages, the solar public lighting system offers easy installation (no cables), easy use thanks to a quasi permanent autonomy and free maintenance due to the longevity of solar modules and LED lamp usage. Over all, it contributes to environment protection by the use of clean energy and a rational use of natural resources. It thus constitutes an investment economically profitable, and an economical and ecological solution for the long run, exploitable by developing countries.
Key words Solar street lamp; LED (Light Emitting Diode) lamp; Clean energy

1 Introduction

Due to constant rising of temperatures on the surface of the planet, subsequent awareness increases as for the interest in environmental questions. Governments from various countries launch campaigns as well as incentives to promote and support green initiatives. However several constraints still seem to make obstructions to such initiatives. Among the multiple constraints, we quote the basic economic question of profitability for green investments. “Responding to environmental problems has always been a no-win proposition for managers as reported by Noah Walley and Bradley Whitehead in, “It’s Not Easy Being Green” (May–June 1994). Green initiatives, for certain managers’ viewpoints help the environment and hurt business; some executives even claim to harm their business while protecting the earth. Thus to many economic actors, the cost of environmental compliance appears to be significantly higher compared to the positive financial return that it might generate.

We think however, that the progress made up to now in the field of green technologies offers much better financial opportunities and is within investors’ reach. Green investment can prove to be income generating for private sector investments as well as for public investments. There is no doubt that an investment must be economically profitable to be approved and initiated. To determine the profitability of an investment, return on investment calculations[1] is required. Also, many other investment tools, such as net present value or payback period (internal rate of return) which consider all economies likely to be generated by the project according to the cost, the product lifespan, and wealth creation.

Our analysis therefore aims to demonstrate through this paper the viability of a green investment economically, socially, and environmentally. We limit our analysis to a comparative study of two projects of public lighting from two different energy sources, electric and solar.

2 Data and Methodology

To reach our objective, the paper uses information from the market to assess the investment costs of both investment projects. Concrete figures computed from basic information gathered from factories in China are applied to assess the investment costs as well as the operating costs over a ten year exploitation period for the street lamp projects. Finally, innovative suggestions that comply with today’s environmental requirements are enlightenment to support decisions maker in measuring value and objectively determine the project viability. The currency used is the Chinese Yuan.

2.1 Public lighting[2]

Conceived initially to ensure citizen safety, facilitates, and traffic, public lighting has significantly evolved thanks to technological advance. From the simple lanterns located at the ends of streets, to the standardized lanterns whose candles burn inside the lanterns, suspended on the first floor of buildings, public lighting continued to evolve to the reverberates equipped with mirror and functioning with an oil of tripe, then with gas till moved to it full rise in the Fifties with the invention of low pressure mercury discharge lamps, more effective thanks to electricity, source of innovation particularly at that time. Since then, public lighting has become a true science which does not cease evolving with technological improvements. Nowadays, the switching on and the extinction are carried out from afar via a remote-controlled relay. The operating hours are fixed according to the astronomical calendar which gives the hours of sunset and sundown. A photoelectric cell is used to adjust hours depending on atmospheric conditions.

2.1.1 System organization

The public lighting system is organized into three sectors with respect to the electric system.

- The Production: done from a high voltage power station
- The Transportation: ensured by high voltage networks and relayed by transformers for possible connections.
- Distribution: Ensured by middle and low voltage cables which power cities and feed posts.

2.1.2 Solar system

The solar public lighting system on the other hand consists of autonomous installations. They are generating stations of energy which guarantee an autonomous power supply for the apparatuses, i.e., independent from an electric power supply system. Solar energy is thus produced on the spot. The principal components are:

- Solar panel
- Light source: LED lamp
- Batteries
- Controller: with current limitation functions for saving more energy**.**
- Pole: 6 to 8 meters high and 4 millimeter in diameter, composed of a galvanized steel frame with powder anti-corrosion coating
- Accessories: all necessary cables, (cable joined) and screw bolts, packing etc

2.2 Empirical street lighting feasibility study

We start from a comparison of the electric and solar systems to draw economic, social, and environmental conclusions as well. Our analysis focuses on basic components of the two systems for a ten year use. The main components of expenditure for the road lighting are:

- The cost of products acquisition,
- The cost of installation of transformers and cables,
- The cost of energy consumption,
- Maintenance and operating costs.

We assume a main road of more than two kilometers. The distance between two poles is 40 meters and the poles are on both sides of the road. This project will require 100 units of light.

2.2.1 Electricity street lamp investment cost

Table 1 Electricity Street Lamp Expenses

Component	Quantity	Price ¥	Total Amount ¥
Lamp HP E40 - Na gas- 220/240 V-50 Hz	100	3,500	350,000
BASIC Charge	100	800	80,000
Pipelines	2500 M	75	187,500
Transformer	1	110,000	110,000
Cable	2,500M	115	287,500
Accessories	350,000 X 5%		17,500
To control box	2	5,500	11,000
Initial investment cost			1,043,500

Source: Hangzhou Youguo Opto-Electronics Technology Co., Ltd

(1) Electricity consumption

The lights function twelve hours from 6:00 p.m. to 6:00 a.m.; the price of electricity is ¥ 0.8 / kW. 400w high pressure sodium lamps are used for the project. Each luminary will cost 3.84 ¥ per day. All the lights will cost 384 ¥. The total in one year (365 days) will be of 140,160¥; and for 10 years of exploitation¥1,401,600.

(2) Maintenance fee

The main cost of high pressure sodium lighting is lamp replacement. It includes equipment purchasing fees and workers wages. The average lifespan of High-pressure sodium lamps is one year. If no voltage fluctuation affects the lamps. We have to change bulbs once every ten years. The purchase of equipment and workers amounted to ¥ 245,000 for the operating period.

Then the overall expenses which include equipment purchasing, workers fees and maintenance rise at ¥2,690,100 for10 years. Beyond the monetary cost, the system generates ecological damages and inefficiencies which can be extremely high when quantified.

2.2.2 Solar street lamp investment cost

Table 2 Solar Road Light Cost

Component	**Description**
Solar panel	Mono-silicon, rated power 130w
light source	65W LED lamp, made of Dia5mm LED, super bright, brightness adjustable.
Battery	12V/200AH Lead-acid battery, maintenance-free
controller	12V/10A, automatically time and light control, overcharge and over discharge protection Current limiting control With current limitation function, for saving more energy.
Pole	Φ4mm thickness, 10-11 Meters height, Material: Galvanized steel frame with powder anti-corrosion coating
Price ¥	13,600
Quantity	100
Initial investment cost ¥	1,360,000

Source: SOLARANDU STD LTD

(1) Electricity consumption

Charges related to electricity consumption for the solar system is condensed to battery replacement within five years use considering their five years lifespan i.e. (550 X 2) X 100 = ¥ 110,000

(2) Maintenance

The solar panel lifespan is thirty years[4]; the LED lamps have a lifespan of at least 50,000 hours, which means they can be used for more than 10 years without requesting any replacement; the controller 10 years and 30 years life span for the pole.

3 Results

Considering the initial investment cost, the electric system appears to be economically profitable ¥ 1,043,500 verse ¥ 1,360,000 from a solar system; the analysis in the long term however reveals the solar power system to be more viable ¥ 2,690,100 against ¥1,470,000. The solar investment makes it possible to bring savings of over ¥ 1,220,100. Moreover the solar modules into analysis are Mono-crystalline[3], with a conversion rate of up to 18% that is to say they are smaller and easy to install, resistant to strong wind weathers.

Sixty five watt LED Lamps used for the solar system corresponds to the 400W high pressure sodium lamp "LVD" lamp in electric systems, which represents an energy saving of 335 W by luminous point generating an annual saving of ¥ 117,384 and ¥ 1, 173,840 for 10 years. Moreover the cost of acquisition proves to be acceptable in regard to the advantages offered by its lower cost of implementation and installation meaning the absence of cable usage, therefore the cost of implementation is negligible and the maintenance fees almost non-existent.

On the social aspect, lamps, "LED", used in the system have illumination power up to 22 meters with low fuel consumption of energy. Not only that they make the traffic safer, but also embellish and enlightened the surface. The solar system is thus lights free independent from an electrical power station.

On the ecological level, the solar system produces nonpolluting energy and contributes to the reduction of CO2 while the electric system is hostile to the environment through the carbon dioxide which contributes to global warming. Unlike fluorescent and most HID technologies, LED's contain no hazardous mercury or halogen gases.

4 **Conclusion**

Facing the need for electrification in developing countries where the average electrification rate is 41% in South East Asia and 23% for sub-Saharan Africa, the solar system is an optimal solution through its multiples advantages summed up in its simplicity of installation and operation. For a section of two kilometers, the solar public lighting system offers an energy saving of 335W which represents approximately an annual cash economy of ¥ 117,384. The system offers a range of energy production with almost zero maintenance costs. It is therefore an economical and practical solution for developing countries because it allows the lighting of the new public infrastructures, lighting of municipalities and zones difficult to electrify as in mountains. It thus constitutes a viable public investment from its multiple advantages and its considerable potentialities for the no cabled areas. In addition its adoption complies with sustainable development policy because it supports the rational use of natural resources thus supporting environmental protection. It is therefore beneficial for public and private executives to take advantage of this new technology which enables independence from fossil fuel energy, and promote protection of natural resources preserve the generations to come.

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