SUSTAINABLE ENERGY FOR ENVIRONMENT & DEVELOPMENT PROGRAMME

URBAN SEED UPDATE

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Exploring LED Street Lighting

Introduction

Street lighting accounts for around 24% of the energy consumed by South African municipalities and contributes 28% to the carbon emitted by municipalities in the delivery of local services. Many South African cities have effectively introduced programmes to make street lighting more efficient through replacing traditional Mercury Vapour (MV) lights with High Pressure Sodium (HPS) lights. HPS lights use as little as 50% of the power of MV lights and last up to 6000 hours longer.

Internationally cities are now beginning to investigate and implement programs to try and make public lighting more efficient by replacing traditional High Intensity Discharge (HID) lights with more energy efficient and longer lasting LED Lights. South African cities have begun to investigate the applicability and affordability of this technology in South Africa. Although lifetime costs are yet to be established, this update aims to provide cities with an overview of the technology including advantages and possible challenges. It also outlines steps which cities can take to evaluate the viability of LED street lighting.

LED Technology

LED stands for light emitting diodes and these are very small, solid state lights that are extremely efficient and robust as they do not produce much heat and do not have a fragile filament. Each LED is usually smaller than 0.5cm^2 so hundreds of them are used in an array to produce enough light for large applications.

Some of the benefits of LED street lights over regular street light fixtures are:

HPS versus LED lights

- Use 30-90% less electricity for a similar light output than HPS lights
- Have up to five times the life expectancy
- Light is controllable (dimmable and can be instantly turned on and off)
- Light is highly directional, lighting the areas you want and not those you don't
- Contain no mercury or other hazardous materials

If the City of Cape Town had changed all of its street lighting fixtures to LED's and saved 30% on the electricity, then in 2007 they would have saved 27 million KWh of electricity, which equates to R8 640 000.00 (32c/KWh).

The greatest challenge currently is assessing the financial viability of LED street lighting. To assess this, the entire lifetime costs of both LED and HPS technologies need to be calculated and compared so that the payback times and financial viabilities can be measured. Cities could provide some valuable data on current fixtures, but some testing of LED technologies will also need to take place.

International LED Cities

Various international cities have implemented LED street lighting pilot projects to test the real world performance of LED street lights in terms of actual energy consumption, light output and life expectancy. Many of these cities are located in the U.S.A and Canada and include; Oakland, California; Raleigh, New Carolina; Ann Arbor, Michigan; as well as Anchorage and Toronto in Canada, among others. The following summary of the project in Oakland, California is of a similar approach to many of the other cities and offers a useful model for South African cities.

Oakland, California

The city has a program where different LED fixtures are tested. Manufacturers are requested to provide technical information on their products and these fixtures are then tested in modelling software against the city's standard fixtures. Modelling of the fixtures is not essential but does provide some valuable preliminary performance data without having to purchase and test the fixtures physically. It is therefore a way to save time and money in the early stages of a project. Potentially viable fixtures are then physically tested and compared to regular HPS fixtures as well

International city LED pilot site

The City of eThekwini has embarked on an LED pilot project. Findings indicate that the conventional 40m spacing of public streetlights is too far for optimal LED illumination. This would ideally be more closely spaced and no higher than 6m high. It may be that the technology will be most economically introduced within new urban developments, using completely new approaches and fittings better suited to the technology.

as the provided technical specifications. Once suitable fixtures are identified, the second phase of the project begins.

In a residential area of Oakland a test project was setup where fifteen 78W LED street lights replaced 121W high pressure sodium (HPS) street lights. One street was illuminated with all new HPS lights. A second street was illuminated on one side with HPS lights and on the other side with LED lights and a third road was illuminated with LED Street lights only. Both the LED lights and the HPS lights were tested for actual consumption and actual light output at various distances from the fixture. Public perception and acceptance is also gauged through surveys.

The LED City Program

The LED City initiative is an expanding collaborative group of government and industry working towards the implementation of various LED lighting projects in various cities around the world. Becoming an LED City provides technical and practical support through their partners and also helps create awareness of the initiative internationally.

How to become an LED City

- Identify a pilot LED light-ing installation.
- Contact LED fixture manufacturers with solutions for the pilot application selected.
- Select, purchase and complete installation of LED lighting products for the initial pilot project.
- Contact Deb Lovig, Cree LED Programs Manager, at HYPERLINK "mailto:deb_lovig@cree.com" deb_lovig@cree.com to discuss joining the LED City/University program.
- Get agreement from the mayor's office as well as the municipal manager.
- Confirm energy savings, energy cost savings and maintenance cost savings as compared to the traditional lighting solution.
- Plan an announcement of your participation in the program.

Piloting LED in your city

Calculate life-cycle costs of current technologies
Life-cycle costs include initial capital costs as well as maintenance costs over the lifetime of the fixtures

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Acquire samples of the BETA-LED and Lumecon fixtures
These two brands appear to be the most commonly used brands internationally and could therefore provide a benchmark against which to evaluate all other potentially viable LED fixtures. They may need to be imported.

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Request technical specifications from local distributers of equivalent LED street lighting technologies, including the IES files. Model the performance of the various fixtures.

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Estimate life-cycle costs of LED technologies

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Calculate cost-benefit of LED vs. HPS technologies
Compare all costs over a 10-20 year period to take into account the different maintenance schemes required

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Using the best fixtures identified in the modelling, set up physical testing programme in a parking lot or street and register as an LED City

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Assess the real world viability of LED street lighting technologies. The evaluation would include actual energy and light measurements over time as well as public response to the new fixtures.

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