Energy Efficient Lighting

Overview

According to the International Energy Agency in 2013 electricity for lighting consumed 20% of the output of the world's power stations.[1] For the USA the share of lighting was 15% in 2016[2]. The use of energy efficient lighting is one of the simplest and most cost effective ways of reducing energy consumption. Efficient lighting programmes can be implemented in several areas within cities by:

- Replacing traditional incandescent bulbs with compact fluorescent light bulbs (CFLs).
- Replacing old fluorescent tubes with efficient fluorescent tubes.
- Replacing old magnetic ballasts with electronic ballasts in fluorescent tube systems.
- Installing lighting control systems (motion and lux level sensors)
- Using light-emitting diode (LED) technology wherever possible. This technology is developing fast and is getting steadily cheaper. LED's are now able to replace most conventional lighting applications, such as traffic lights, down lighters, streetlights, security lights and even strip lighting to replace fluorescent tubes.
- Making streetlights more efficient e.g. by replacing mercury vapour lights with high pressure sodium lights or LEDs that operate on around a third of the power. LED lights have more than double the life span. Decreasing costs makes them financially more viable for street lighting.

Figure 1: CFLs save up to 80% of energy compared to incandescent light bulbs

Photo: Armin Kübelbeck, CC-BY-SA, Wikimedia Commons

It is anticipated that LEDs will be used in most applications in the future.

1 https://www.iea.org/topics/energyefficiency/subtopics/lighting/
2 https://www.eia.gov/tools/faqs/faq.cfm?id=99&t=3

LED: lights of the future

The development of LED lights is moving fast. LED alternatives are now available for nearly all lighting applications. Their advantages include:

- 80 to 90% more energy efficient compared to incandescent lights; on average 20% more efficient than fluorescent lights.
- LEDs have a very long life span of claimed 30000 to 50000 hours.
- LED lights are available in many light colours including the popular warm light of incandescent bulbs.
- LED prices are decreasing fast as this technology becomes more mainstream.

It is anticipated that LEDs will be used in most applications in the future.

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Figure 2: Types of LED light bulbs.

Photo: Geoffrey Landis at English Wikipedia

Implementation

Lighting is a significant component of electricity consumption in the residential and commercial sectors that in South Africa together consume around 50% of the country's electricity[3]. The replacement of lights with highly energy efficient ones is one of the simplest and most cost effective measures to reduce electricity consumption and related greenhouse gas emissions.

The replacement of incandescent light bulbs with CFL or LED lights reduces the electricity consumption by around 80% to 90%.

In a domestic and work environment a task light like the pictured desk lamp is far more energy efficient than general lights at the ceiling because it lights only the area that needs to be lit from a very short distance. If task lights are applied the brightness of the general lighting can be strongly reduced resulting in energy savings. A typical desk lamp with CFL bulb needs only 8 to 11W, or with LED bulb only 5W.

Figure 3: Desk lamp brightly illuminating a small area

Source: CC0 Public Domain 12 https://www.usea.org/sites/default/files/event-file/497/South_Africa_Country_Presentation.pdf

Lighting technologies differ strongly in energy efficiency, life span and price. In order to compare cost all three factors must be considered. Below are comparisons of energy efficiency, life span and finally lifecycle cost of four most common technologies. These are:

- Incandescent,
- Halogen (incandescent technology but bulbs filled with halogen),
- CFL, and
- LED.

3 https://www.usea.org/sites/default/files/event-file/497/South_Africa_Country_Presentation.pdf

The brightness of light is measured in lumen. The electricity demand of light bulbs is measured in Watt. The lumen rating allows comparing the electricity consumption of different technology light bulbs providing the same brightness. In the table below lumens and wattage of incandescent, CFL and LED lights are compared. Please note that the figures are estimates. Especially the LED technology is developing fast becoming more energy efficient (see textbox below).

Figure 4: Comparison of brightness (lumens) and power consumption (watt) for different technologies

DIMMER → BRIGHTER

LUMENS	450	800	1100	1600
Standard Incandescents	40W	60W	75W	100W
New Halogen Incandescents Save up to 28%*	29W	43W	53W	72W
CFLs Save up to 75%*	9W	14W	19W	23W
LEDs Save up to 77%*	8W	13W	17W	N/A

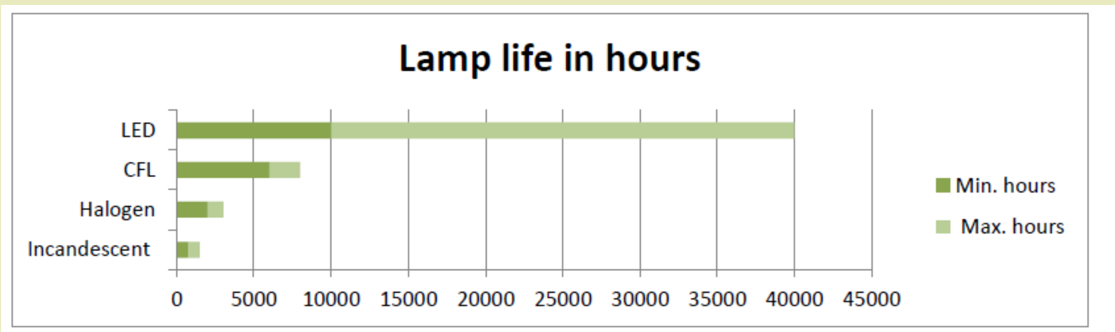
LEAST EFFICIENT ← MOST EFFICIENT

*Percentage of energy saved by replacing a standard incandescent light bulb; based on usage of approximately 796 hours annually and average residential electricity rate of $0.15/kWh

Source: IDAVIDMCALLEN, 2015
https://idavidmcallen.wordpress.com/2014/05/05/led-watt-conversion-light-replacement-guide/

The expected minimum and maximum lifespans of the different technologies are indicated in the figure below. It is noted that cheap LED lights tend to have a far lower lifespan than more expensive ones.

Figure 5: Comparison of lamp life of different technologies

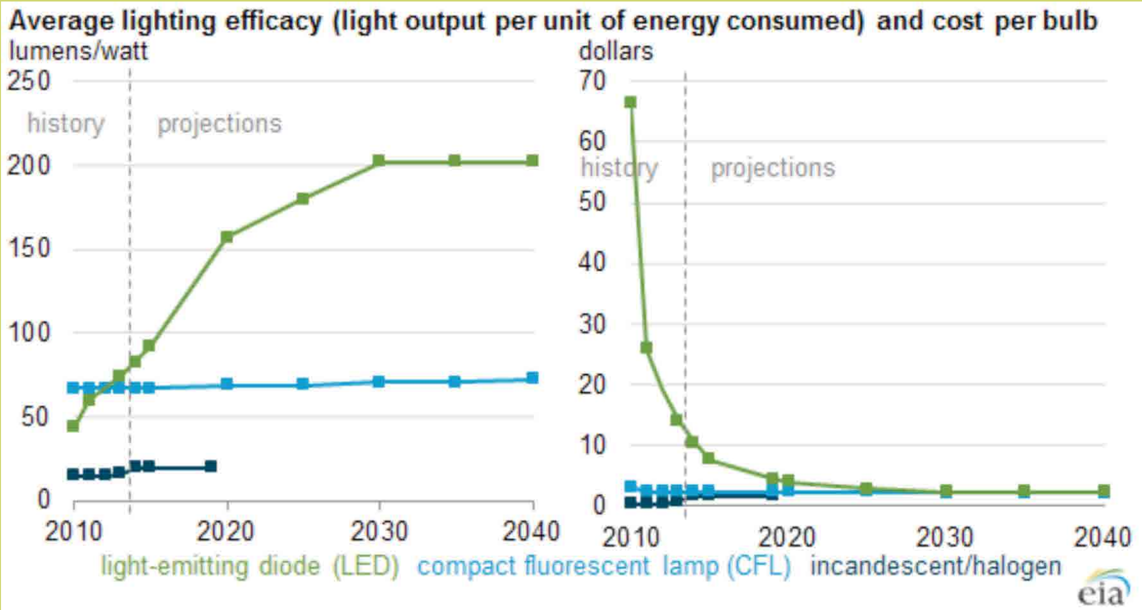


Source: mygreenhome, 2014
http://mygreenhome.org.za/wp-content/uploads/2014/05/Guide-to-Globes-20-May-v3-.pdf

LED bulb efficiency and cost

The US Energy Information Agency expects the energy efficiency of LED bulbs to increase while prices drop.

Figure 6: Average lighting efficacy



Source: U.S. Energy Information Administration, 2014
https://www.eia.gov/todayinenergy/detail.php?id=15471#

From an electricity system's perspective energy efficient lighting has the benefit of reducing electricity demand, including during the evening peak period. It therefore contributes to the security of electricity supply in the municipality and nationwide. Eskom and the DoE have recognized that efficient lighting plays a major role in demand side management (DSM) and have funded programmes for the mass roll-out of CFL lights in the past.

From an electricity consumer's perspective efficient lighting technologies have the following benefits:

- CFL and LED are expected to last several times longer than incandescent bulb and require only one fourth to one fifth of the amount of power. Over their life cycle, these efficiencies more than compensates for the higher purchasing costs of approximately R25 for CFL and R50 for LED.
- From an environmental perspective, approximately 800kg of CO_2 will be saved over the lifetime of one CFL or LED bulb compared to the equivalent incandescent, assuming that the electricity source is a largely coal based power station.
- The cheapest way of reducing electricity demand for lighting is behaviour change. It is estimated that through behavioural changes. Changes to energy efficient technology should be accompanied with campaign for behaviour change.
- The replacement of fluorescent tubes (T12 or T8) with more energy efficient ones (T5) and the installation of electronic ballast will improve energy efficiency by around 25%.
- Installing sensors in buildings which only switch on lights in the presence of a person (movement sensors) or at insufficient lux levels (light sensors) will further reduce power demand for lighting.

WARNING

CFL and fluorescent tubes contain mercury vapour, which makes their safe disposal important. They must not be thrown into the general waste but should be taken to specific recycling facilities or electrical appliance shops for recycling or safe disposal. Some supermarkets also have drop-off containers for CFLs or tubes. The distribution and promotion of CFLs should be accompanied by education about their safe disposal.

This problem does not apply to LED lights.

Municipal buildings and facilities

The business case for energy efficient lighting is so strong that municipalities should implement energy efficient lighting technologies in their own buildings and facilities. This requires them to develop a strategy for the systematic implementation of energy efficient lighting.

In addition, municipalities should promote energy efficient lighting with communities and businesses.

An energy efficient lighting strategy requires:

- Locating responsibility for retrofits of lighting with a specific department. This is typically the department responsible for maintenance of municipal buildings.
- Identification and prioritisation of municipal buildings and facilities; drafting a retrofit programme.
- Identification of funding for lighting retrofit. This may come from the maintenance budget or through making the case for municipal capital budget, arguing that future savings justify higher upfront costs. Additional funding can be sourced through the Energy Efficiency Demand Side Management (EEDSM) programme of the DoE. This programme offers grant funding for energy efficiency measures.
- To ensure long-term implementation the municipality should adjust its standard specifications for lighting so that efficient lighting is routinely procured and installed. This may require a capacity building process amongst staff involved in lighting procurement.
- To implementation of any energy efficiency measures including lighting follows four steps:
- Energy audit of the lighting system and its electricity consumption.
- Design of energy efficiency measures. These can be simple exchanges of light tubes and bulbs with more efficient ones. However the re-design of the whole lighting system may achieve higher savings and rationalisation reducing maintenance costs. This step includes an indication of the expected savings and estimated pay-back period of the capital cost.

Lighting Behaviour Changes

- *If a room is well windowed, use natural light and not electric lighting*
- *Turn of lights in unused rooms*
- *Use task lights instead of ambient lighting wherever possible*

- Implementation of the measures. In most cases this will require a tender process and appointment of a service provider (see Green Public Procurement). However, simple replacements of light bulbs and tubes with more energy efficient ones can be done in-house e.g. as part of maintenance.
- Monitoring and validation of the energy savings and whether or not they correspond to the design estimates.

In South Africa the standard tubes are T8, but T12 tubes can still be found in old buildings. T5 tubes and LED tubes are more energy efficient and will likely become the new standard. T12 tubes can simply be replaced by T8. For the installation of T5 tubes into old fittings a retrofit kit or adapter is required. For the fitting of LED tubes the ballast must be by-passed.

Figure 7: T5 retrofit adapter

Source: http://www.t5fixtures.com/how-to-use-t5-light-bulbs-with-t8-or-t12-light-fixtures/

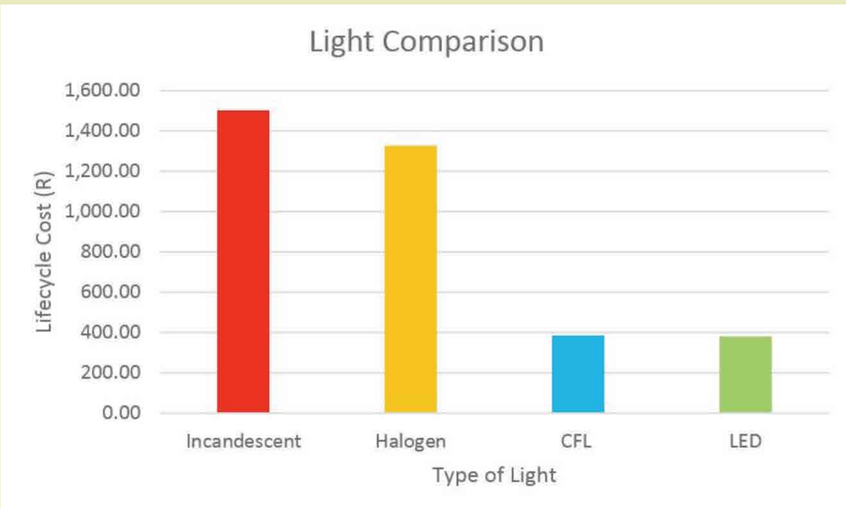
FINANCIAL ASPECT

To date energy efficient lighting interventions have been implemented by many municipalities in their buildings. The experience shows that the electricity savings typically pay for the new technologies in less than 3 years.

Prices of CFLs and particularly of LEDs vary strongly according to the type of light and the quality. In 2017 the prices of CFL were between R25 and R80 if a single bulb is purchased. Prices for LEDs were in the range of R50 to R120.

The University of North West has published a lifecycle costing study for the different technologies for domestic use taking into account cost of electricity consumption, life span and purchasing costs of lights. The figure below that already in 2014 LEDs had the lowest lifecycle costs followed by CFLs.

Figure 8: Life Cycle cost comparison of different lighting technologies



Source: NWU, 2014
http://www.nwu.ac.za/faculty-engineering-energy-saving-home-lighting

The authors of the study state:
"In conclusion, the LED has the lowest lifecycle cost making it the most economical, it uses the least electrical energy and it does not have any mercury in it making it the most environmentally friendly. Thus, when replacing old light bulbs, spend a little more money on a LED and save more than R1100 over the lifecycle of a single LED." [4]

In commercial and industrial environments, around 25% electricity savings can be achieved through the replacement of older fluorescent tubes (T12 or T8) with energy efficient ones (T5)[5] and the installation of electronic ballast and lighting control systems such as sensors. The costs of T5 tubes are only marginally higher than of T8 tubes and retrofit kits are available. Also LED tubes are available that are around 40% more energy efficient than fluorescent T5 tubes. The prices of LED tubes are decreasing fast but they are currently still around 8 times more expensive than fluorescent tubes.

Street Lights

Street lights consume around 20% of electricity used for municipal operations[6]. It is therefore worth focussing on street lights to reduce the electricity consumption and costs of the municipality. There are several technology options for street lights that are explained in detail in the brochure "Efficient Public Lighting Guide". The guide can be downloaded at http://www.cityenergy.org.za/uploads/resource_17.pdf).

The most common ones are listed in the table below and shown in the images on the next page.

Table 1: Comparison of different street lighting technologies

Type	Overview	Colour of light	Life time (hours)	Lumens/ Watt
Mercury Vapour	Pros: inexpensive, medium life span Cons: inefficient, contain mercury, get dimmer with age	white	12000-24000	13-48
High Sodium Pressure	Have replaced Mercury Vapour in many cities Pros: energy efficient, medium life span Cons: yellow colour, contain mercury and lead	Golden yellow	12000-24000	45-130
Compact fluorescent	Only for small street lights Pros: very energy efficient, good colour rendering Cons: limited size; become dimmer with age, contain mercury	Soft white	12000-20000	50-80
LED	Rapidly evolving technology, that is expected to become mainstream Pros: very energy efficient, long life, low maintenance, Cons: high initial costs	white	50000-70000	70-150

Source: SEA, 2012: Energy Efficient Lighting Guide (modified)

Figure 9: Examples of street lighting technologies

Source: SEA. (2012) Sustainable Energy Africa. Energy Efficient Lighting Guide

Figure 10: Solar street light

Photographer: Milton Dawson

Source: https://commons.wikimedia.org/wiki/File:Mammoth_Lakes_CA_Solar_Street_Lights.jpg

SOLAR STREET LIGHTS

Solar street lights do not need a connection to electrical grid and are therefore a solution for areas without grid connections. They are stand-alone units consisting of solar panel, battery, LED light and light sensor that switches it on and off at dusk and down. Suppliers claim a life span of five years. The life span of the battery may be shorter. Theft is being experienced as a problem of solar street lights.

FINANCIAL ASPECT

The replacement of mercury vapour streetlights with high pressure sodium (HPS) streetlights is becoming the norm in cities, due to the energy and financial savings achievable. LED lights are the technology of choice due to their long life and related low maintenance costs. They are still relatively expensive but are being introduced increasingly due to their versatility and quality of lighting. They are already cost competitive with pay-back periods of around seven years when replacing inefficient mercury vapour lights. It is anticipated that the costs of LED street lights will further come down making them fully cost competitive.

The costs of a solar street light depend on its brightness and can be anything between R5000 and R30000. At this cost and considering the risk of theft it is expected that solar street lights will only be used in special circumstances in the near future.

Traffic Lights

Traffic lights are another financially viable field for energy efficiency interventions. The replacement of incandescent or halogen light bulbs with LED ones saves up to 80% of electricity. In addition, LED lights have a much longer life span than incandescent and halogen lights. This reduces the maintenance cost of traffic lights.

Table 2: Comparison of cost and power consumption of traffic light technologies

Cost and energy comparison			
	75W Incandescent	55W Halogen	LED 8-10W
Purchase price for a single traffic signal bulb (R)	14	8	400
Electricity usage (W)	75	55	10
Lumens (lm)	1100	1500	1300
Lumens/watt	15	27	130-160
Lifespan (hours) for single bulb @ 8hours/day	960	960	14400
Bulb cost over 10 years @ 8 hours/day	420	240	800
Energy consumption over 10 years for single bulb (KWh)	2160	1584	288
Energy cost over 10 years @ ave electricity rate of R0.81/KWh (at est 10% increase p.a) (Rands)	1749.6	1283.04	233.28
TOTAL Cost over 10 years for single bulb	2169.6	1523.04	1033.28
TOTAL Cost over 10 years for single aspect (3 lights)	6508.8	4569.12	3099.84
Cost saving with LED retrofit of Incandescent traffic signal (single aspect, 3 lamps) over 10 years			R 3 408.96
Energy consumption over 10 years for single bulb	2160	1584	288
Energy consumption over 10 years for single aspect (3 lights)	6480	4752	864
Energy saving with LED retrofit of Incandescent traffic signal (single aspect, 3 lamps) over 10 years (KWh)			5616 KWh
Carbon emissions reduction (t CO_2e)			5.8 t CO_2e

Method notes:

Life span of incandescent and halogen bulbs based on 4 months; LED based on 5 years.

Average electricity costs estimated as R1.00/kWh.

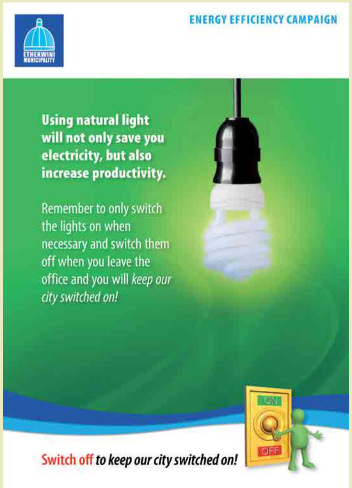
Reduced maintenance costs excluded from calculation.

Source: SEA. (2012). Energy Efficient Lighting Guide, updated 2017

FINANCIAL ASPECT

There is a very strong case for energy efficient technologies in street lights as LED lights reduce the electricity and maintenance costs strongly. Due to the increased cost of electricity, the payback period of installations made today will be significantly less than 3 years.

Figure 11: eThekwini Municipality, Energy Efficiency Staff Campaign Poster



Source: eThekwini Municipality, Energy Office

Awareness Campaigns

Awareness campaigns should promote energy saving in the workplace and at home includes in lighting. It is important for the success of awareness campaigns that messages are sustained, varied and engage the target group. This can be achieved through information on achieved energy savings, requests for feedback, or competitions.

Awareness of energy efficiency also needs to be built amongst municipal staff involved in the procurement and maintenance of lighting equipment. Energy efficiency must determine the procurement policy of lighting equipment.

The business case for energy efficient lighting is strong and municipalities should raise awareness with other government institutions, businesses and the general public of the benefits of energy efficient lighting. This can be done through environmental education campaigns, and in partnership with organised business and education institutions. The municipalities should participate in national programmes should they be implemented again such as the mass distribution of CFL to households in their areas of jurisdiction. These programmes should particularly target poor households for whom the higher price of CFL is a barrier to realising the savings of electricity costs. Distribution programmes should be repeated to prevent households from reverting to incandescent bulbs once CFL lights are broken.

Municipalities are responsible for waste management and campaigns for energy efficient lighting must raise awareness of the disposal of CFLs and fluorescent tubes that contain mercury vapour. The safe disposal of CFLs is an important environmental issue which needs serious attention. Municipalities should cooperate with the electrical appliances and recycling industries to develop a safe disposal system that is easily accessible for consumers in all parts of the municipality.

Barriers and opportunities

The main barrier to implementing energy efficient lighting is the high initial costs of installing new lights. Due to the decreasing costs of the new technologies this barrier is diminishing. In the short term it can be addressed by

- using grant funding programmes like the EEDSM provided by the Department of Energy;
- establishing a policy to implement energy efficient lighting especially in buildings where the pay-back periods are typically less than 3 years;

Other barriers are limited capacity and knowledge of municipal officials and companies in this field. With the energy efficient technologies fast becoming main stream solutions the competence is growing. Training courses should be provided to municipal staff responsible for maintenance and specialised lighting such as street and traffic lights.

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Case study 1: LED Traffic lights in eThekwini Municipality

LED traffic lights consist of arrays of tiny light emitting diodes that are extremely energy efficient and have a very long life. Each LED is about the size of a pencil eraser, and hundreds of them are used together in an array. The LEDs are replacing the old-style incandescent halogen bulbs rated at between 50 and 75 watts. LED units have three main advantages:

- *LEDs are more visible because the LED array fills the entire surface of the traffic light making them brighter overall.*
- *LED bulbs last for years, while conventional bulbs in traffic lights only last for months. The longer replacement intervals reduce the maintenance costs considerably.*
- *LED bulbs save up to 80% of electricity.*

Between 2009 and 2011 the eThekwini Municipality has installed LED lights in all traffic lights.

- *41 000 lights replaced at 759 intersections;*
- *Project cost: R41m;*
- *80% saving of electricity achieved amounting to around 6MWh/year;*
- *Substantial saving on maintenance costs;*
- *Electricity savings along would have resulted in 10 years pay-back period but the additional savings of costs have resulted in 3 to 4 year payback period; and*
- *Savings of approximately 6000t CO_2e of greenhouse gas emissions per year.*

Figure 44: LED traffic lights in Durban

Source: http://www.durban.gov.za http://www.durban.gov.za/City_Services/energyoffice/Enery%20Office%20Project%20Pictures/LED_traffic_lights_LR_02.jpg

Between 2009 and 2011 eThekwini Municipality installed LED lights in all its traffic lights.

Case study 2: Efficient Lighting in Municipal Buildings in Ekurhuleni Metro

The Ekurhuleni Metropolitan Municipality (EMM) institutionalised a sustainable energy approach through energy efficient practices in its municipal buildings already in 2005. The Germiston Civic Centre and EGSC buildings, serving as EMM's political head office and administration head office respectively, were identified for energy efficiency retrofits in 2005.

Among the energy efficiency measures implemented in both buildings, was the replacement of incandescent lights with CFLs, the replacement of cool-beam down lighters with LEDs, and the replacement of ninety-six, 8-foot double fluorescent light fittings with 5-foot double fluorescent lights with electronic ballasts. In addition lighting timers have been installed. In total 2003 CFLs, 90 LED lights and 2 lighting timers were used for the lighting component of the project. The CFLs were found to be highly efficient. The efficient lighting installations achieved substantial savings:

- *Pre retrofit energy use: 387 718 kWh/year*
- *Post retrofit energy use: 109 894 kWh/year*
- *Energy savings: 277 823 kWh/year*
- *Percentage of energy savings from the use of CFLs and LEDs: 75%*
- *Percentage of energy savings from the use of fluorescent lights with electronic ballasts: 13 %*

The emissions reduction for greenhouse gases represented in CO_2 equivalent and other pollutants such as NOx and SOx were:

CO_2e reduction: 260 tonnes/year

SOx reduction: 2205 Kg/year

NOx reduction: 1 035 Kg/year

This retrofit project of the lighting component alone has resulted in 387 718 kWh of energy saved in one year. In this year it achieved saving in the order of R369 000 and a payback period of less than year. Additional benefits are the GHG emission reduction of around 260 tons of CO_2e, 2.2 tons of SOx and 1.1 tons of NOx per year. It is noted that this project was installed at a time of little experience with the new technologies. Apparently, the users were satisfied with the equipment and lighting quality.

Figure 12: various images of the Ekurhuleni case study

EGSC Building

Germiston Civic Centre

8 foot double fluorescent lights

Lights timer set to switch on at 5h30 and switch off at 19h00

Source: ICLEI. (2005). Improving Energy Efficiency in Ekurhuleni Metropolitan Municipal Buildings

Lessons learned

At the time of this project in Ekurhuleni energy efficiency technology and equipment were new in the South African market and it was difficult to find sufficiently experienced tradespeople. This has changed and the CFL and LED are now mainstream products that are produced in the country. Therefore these technologies must be mainstreamed.

The formulation of the policy on Energy Efficiency in Council Buildings and on Council Premises, the State of Energy Report, the draft Energy Efficiency and Climate Change Strategy of Ekurhuleni and the subsequent retrofit project have been part of the Ekurhuleni municipal strategy that can be replicated in other South African cities.

Case study 3: Efficient Lighting in City Health Building in eThekwini Municipality*

Figure 13: eThekwini Municipality City Health Building

Photo: S. Godehart

The City Health Building has been selected to pilot an energy efficiency programme for municipal office buildings in eThekwini Municipality. The pilot is being carried out in collaboration between the Energy Office, the Architecture Unit and the Health Unit. The purpose is to assess the energy consumption of a building and select, implement and monitor the most effective measures. The project was funded by the EEDSM programme. The assessment was carried out by consultants in 2013. The measures were implemented by a contractor in the same year.

The City Health Building is a 4-storey office building that accommodates 2 labs, an auditorium and large storerooms. The floor area of the building is 11,200m^2. It was built around 1970. Since then the internal uses of the building has changed and the additional light fittings have been added to the system show in the photograph below.

Baseline Assessment

The baseline assessment showed that lighting constituted 32% of the power balance in summer and 39% in winter. It was therefore a large component of the overall electricity demand.

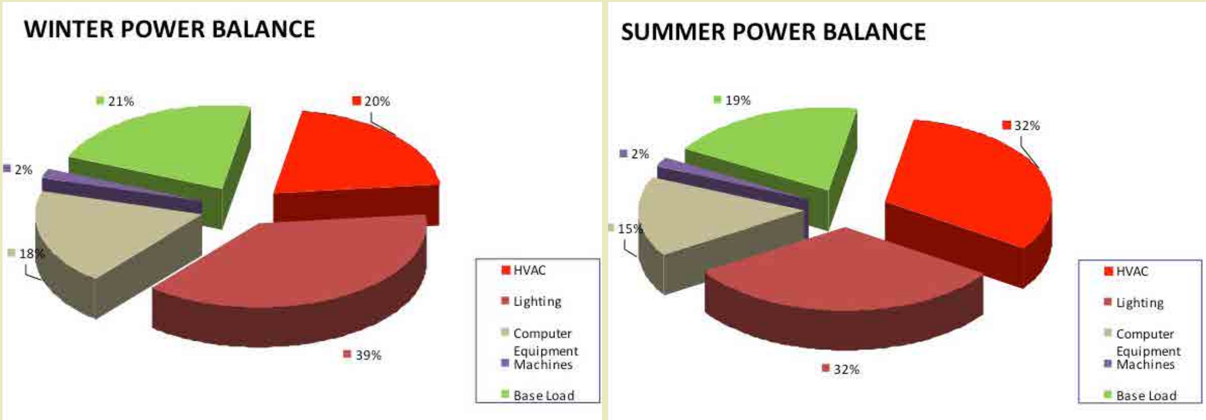
A specific lighting assessment was conducted. The methodology included the compiling of electrical energy balances and noting areas for increased optimisation. The assessment included the following elements:

- *Monitoring of power consumption,*
- *Inspection and measurement of the lighting installation,*
- *Calculation of lighting energy usage, &*
- *Calculation of energy savings.*

The lighting installation comprised almost entirely of fluorescent lamps fitted in a varied range of light fittings. Linear fluorescent lamps made up 96.5% of the light sources in the building and the bulk of these fittings were dated and fitted with magnetic ballasts.

* This case study draws extensiviely from: eThekwini Municipality EEDSM 2013-14, Baseline Report: City Health Building. Unless referenced otherwise, information is sourced from this document.

Figure 14: Winter and summer breakdown of demand for electricity in City Health Building

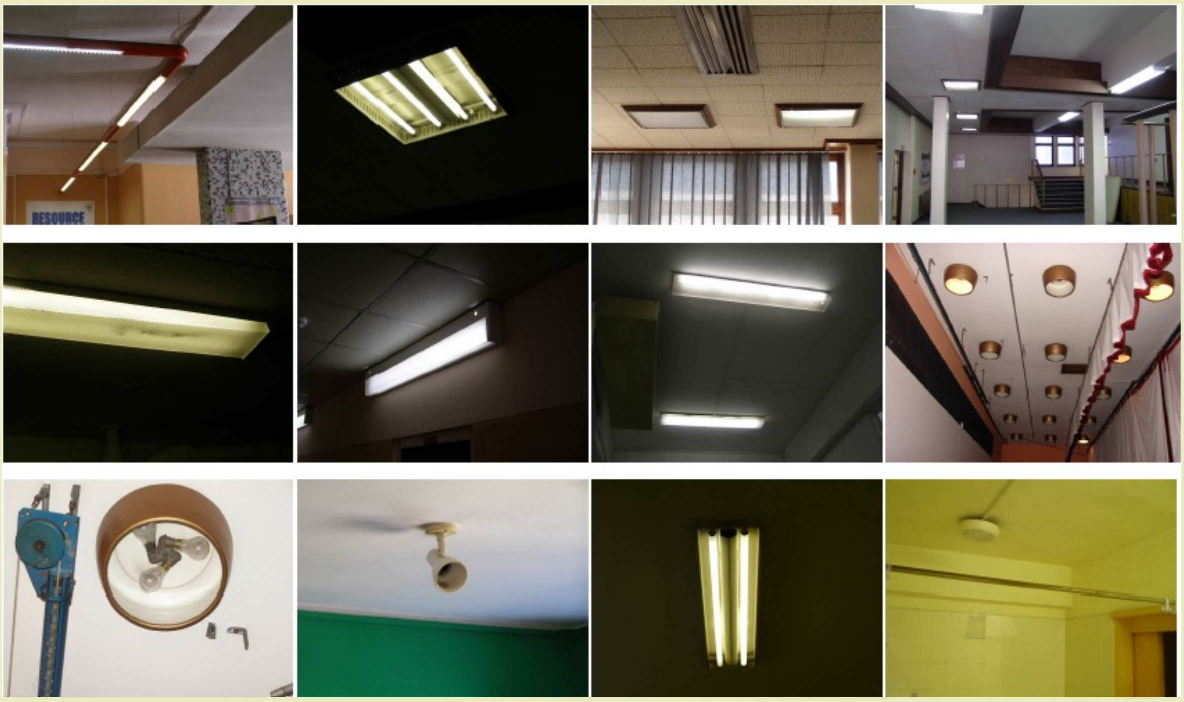


Source: eThekwini Municipality EEDSM, 2013-14

Minimum lighting levels were generally exceeded but the task lighting was, for the most part, not acceptable. Staff discomfort was experienced. A complete redesign of the lighting is suggested to:

- *comply with the latest applicable standards;*
- *make use of new energy efficient light sources;*
- *standardise light sources for simplified maintenance; and*
- *introduce automatic switching and dimming devices.*

Figure 15: Examples of light fittings in City Health Building before redesign



Source: Presentation by SNA Consulting Electrical Engineers, 2013

Lighting Redesign

The entire building was measured and the lighting was modelled using energy efficient, task sensitive light sources. The new design is aimed at reducing energy consumption and annual maintenance costs as follows:

- *Reduction of high loss equipment;*
- *Removal of high energy light sources;*
- *Replacement with modern light sources and reflectors;*
- *Reduction and rationalisation of light sources; and*
- *Compliance with task and safety lighting requirements.*

The lighting redesign would make use of new energy efficient lighting technologies such as:

- *T5 fluorescent to replace the T8 fluorescent lamps (over 80% of lights);*
- *Fluorescent lamps to replace the incandescent lamps;*
- *LED lamps to replace the existing halogen lamps;*
- *Reduction of lamps from 2119 to 1571; and*
- *Rationalisation of types of light fittings from 25 to 6.*

Table 3: Proposed light fittings after redesign

SCHEDULE OF PROPOSED LIGHT FITTINGS				
LIGHT FITTING	**QTY**	**TOTAL LAMPS**	**RATING (W)**	**TOTAL (KW)**
2x49w T5 Low Brightness	353	706	49	34.594
2x49w T5 Prismatic	109	218	49	10.682
Recessed 3x14w T5 Prismatic	165	495	14	6.93
Recessed 18w CFL Downlighter	134	134	18	2.412
Compact Fluorescent Bulkhead	17	17	16	0.272
Compact Fluorescent Bulkhead	1	1	50	0.05
	779	1571		54.94

Source: Presentation by SNA Consulting Electrical Engineers. (2013).

The lighting redesign is expected to have the following costs and benefits:

- *Improved lighting for staff despite a reduction from 2119 to 1571 lights*
- *55KW reduction in connected lighting load;*
- *49KW reduction in operational lighting load;*
- *174MWh reduction in annual energy consumption;*
- *R 8500.00 annual maintenance cost savings;*
- *R 204 000.00 annual savings for electricity;*
- *R 960 000.00 estimated installation cost; and*
- *Estimated pay-back period of 4 years (considering increasing cost of electricity).*

Lessons learned

In this project the lighting system was completely re-designed. Many old fittings were removed or replaced with new ones. The investment was therefore higher than in other energy efficient lighting projects. However the project achieved additional benefits:

- *Energy savings of 174MWh/year;*
- *Reduced number of fittings from 2116 to 1571;*
- *Simplified and cheaper maintenance through rationalsation and reduction of light fittings; and*
- *Improved working conditions for staff through better task lighting.*

Many government buildings have been built in the 1960s to 1970s. Over time most of them had changes to how they were used and related additions to the lighting system. In buildings of this age re-design and rationalisation of the whole lighting systems is often justified.

Support organisations

Financial assistance

The Energy Efficiency Demand Side Management (EEDSM) programme provides grant funding to municipalities for energy efficiency projects in their buildings and facilities. Municipalities must apply to the DoE to benefit from the programme.

Department of Energy

https://www.energy.co.za

GIZ

South African German Energy Programme (SAGEN)

https://www.giz.de/en/worldwide/17790.html

Training

The Energy Training Foundation

www.energytrainingfoundation.co.za