



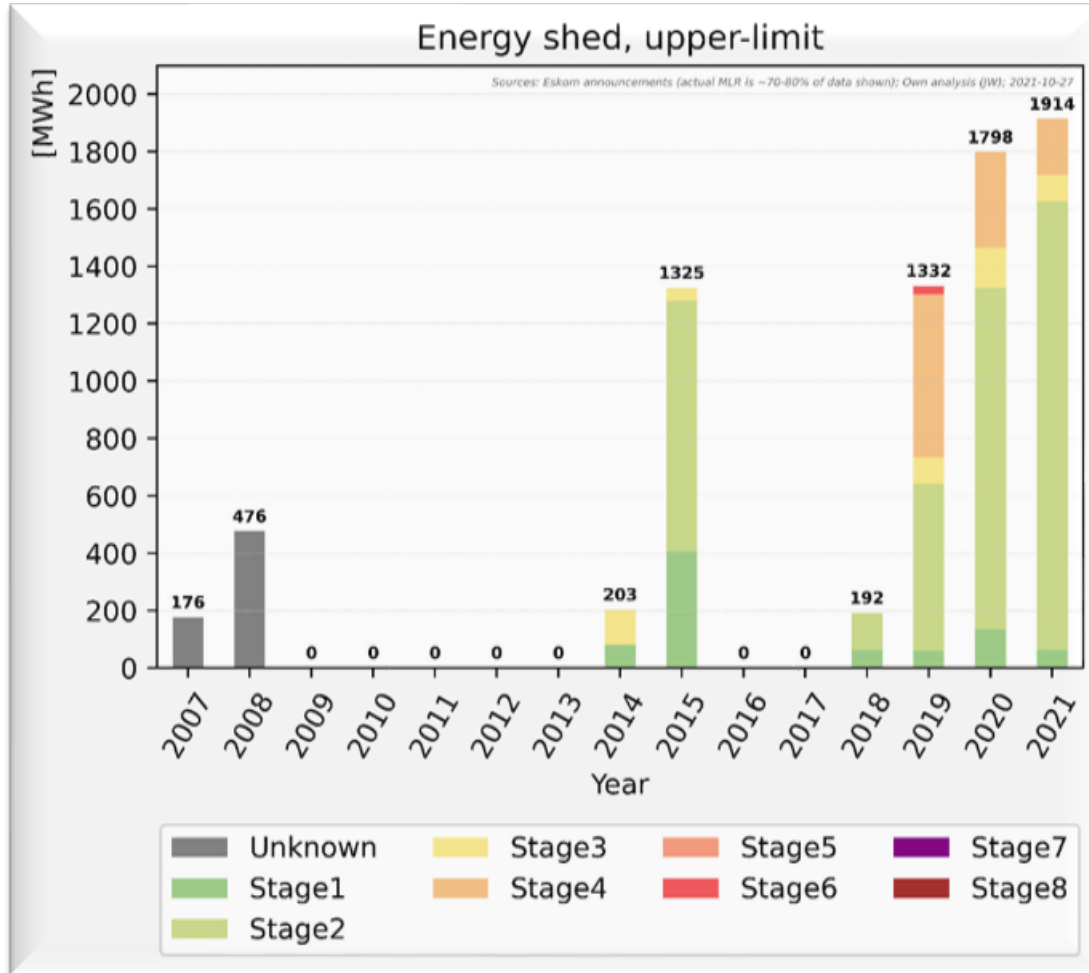
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# Application of the SEEL (SANEDI Energy Efficient Lighting Tool): Results and Experiences from the Field

# Why Go Energy Efficient?

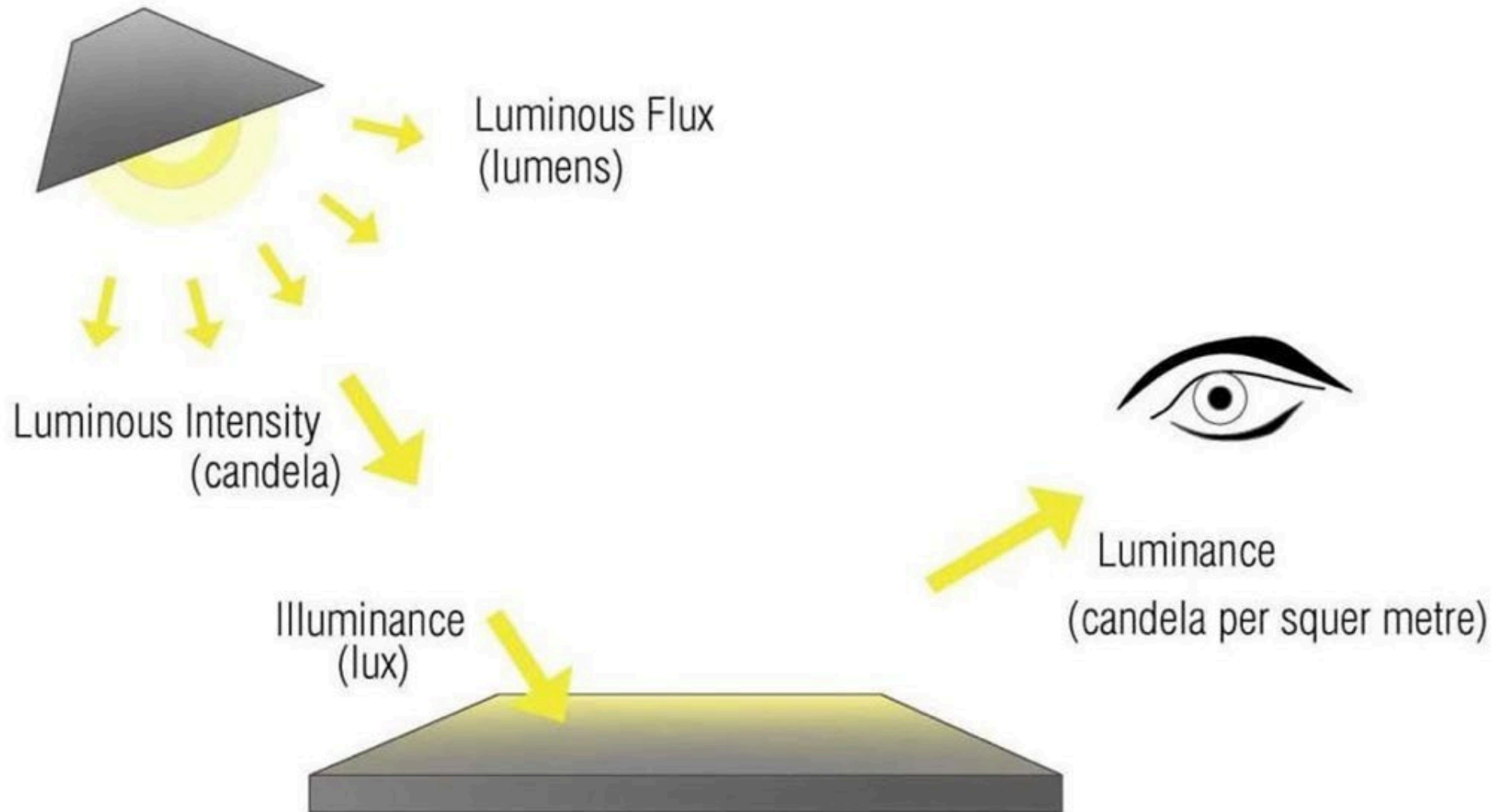


# Lighting Basics: Lighting Technologies



- 💡 Lighting is a major energy load in public and commercial buildings
- 💡 Lighting energy improvements are focussed on replacing lower efficiency lighting with higher-efficiency lighting technologies
- 💡 Key factor is to maintain the same level of service (same amount of illumination/light in a given space)
- 💡 Lighting technologies come with various Efficiencies

# Illuminance VS Luminance



# Lighting Basics: Lighting Technologies



🌱 Thomas Edison invented the first incandescent light bulb in 1879, since then many lighting technologies (lamps) have been developed to meet lighting needs

Light Source	Efficiency Range (Lm/W) (higher is better)
Incandescent	10-18
Halogen	15-20
Compact Fluorescent—CFL, incl. ballast	35-60
Linear Fluorescent, incl. ballast	50-100
Metal Halide, incl. ballast	50-90
High Pressure Sodium	85-150

# Lighting basics: Technologies, Fittings & Bases





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# **SANEDI Energy Efficiency Lighting (SEEL) Tool**



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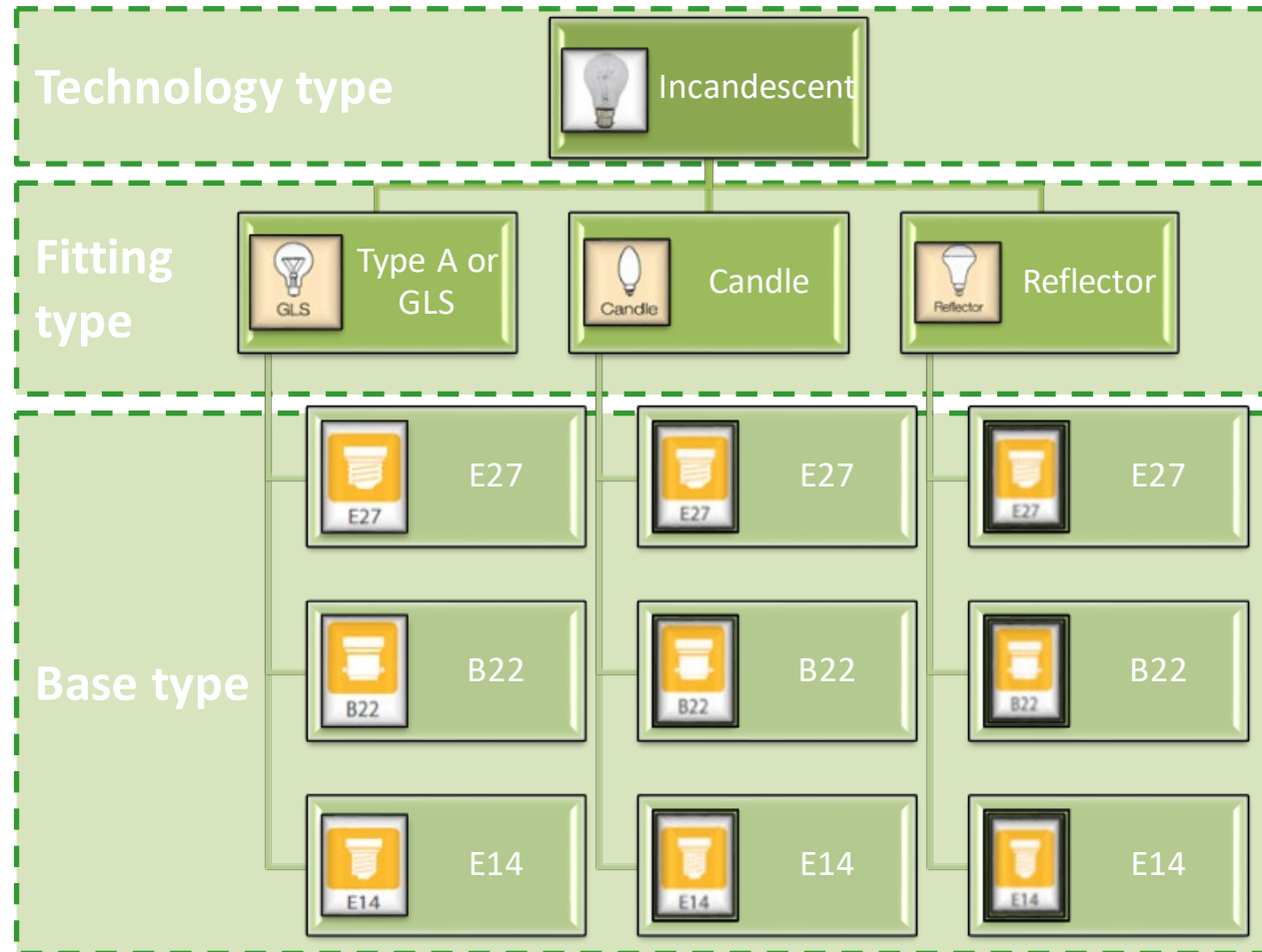
# Lighting Basics

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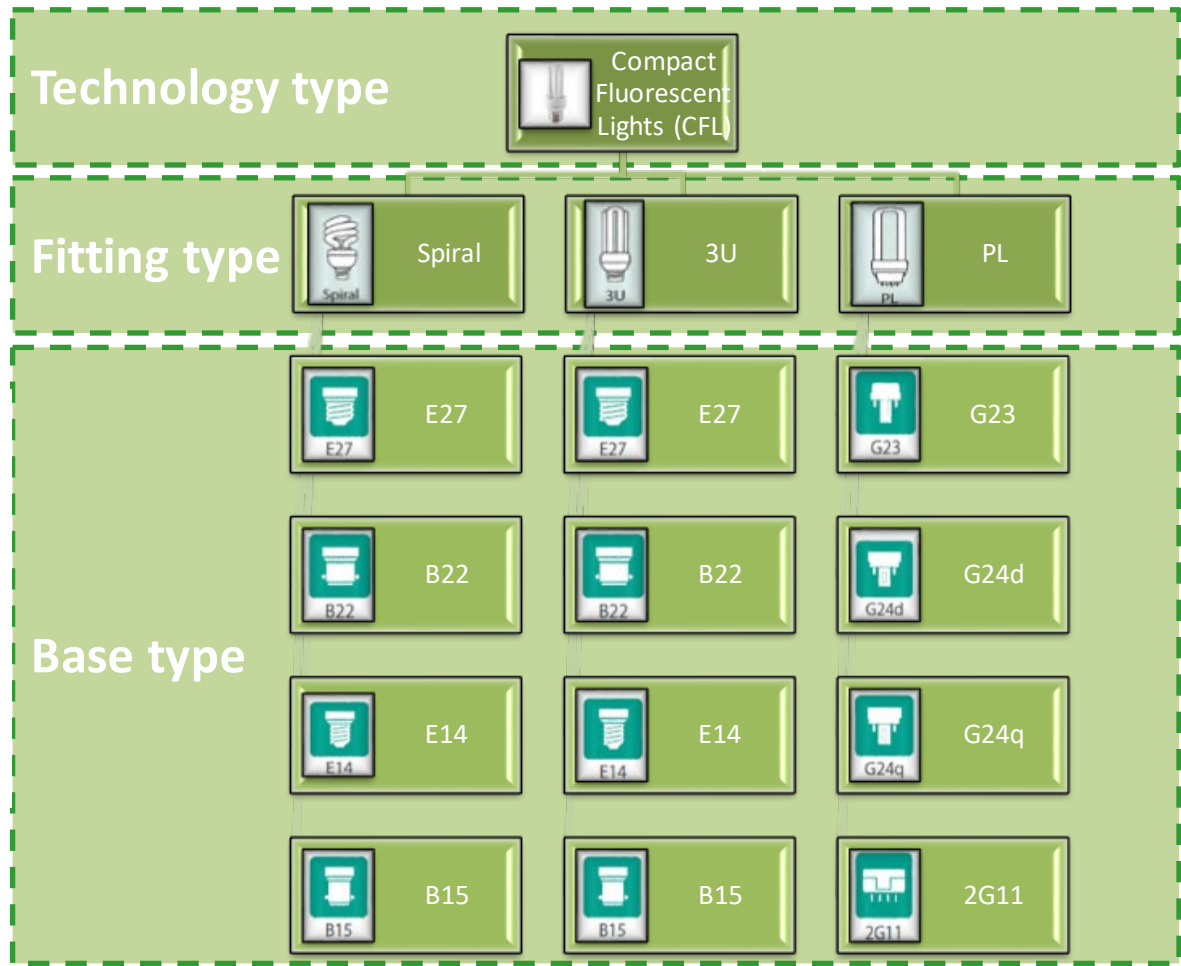




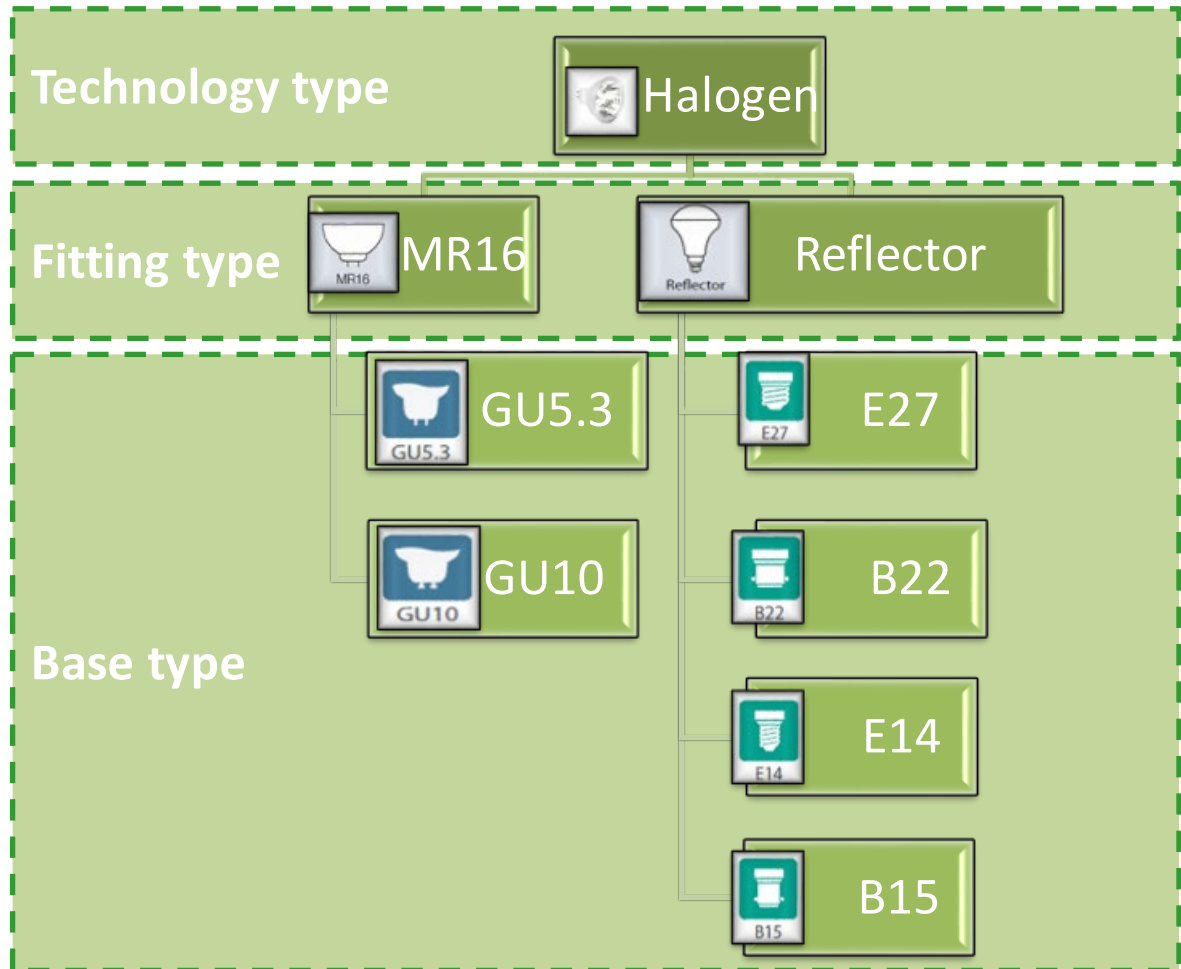
# Lighting Basics: Technologies, Fittings & Bases



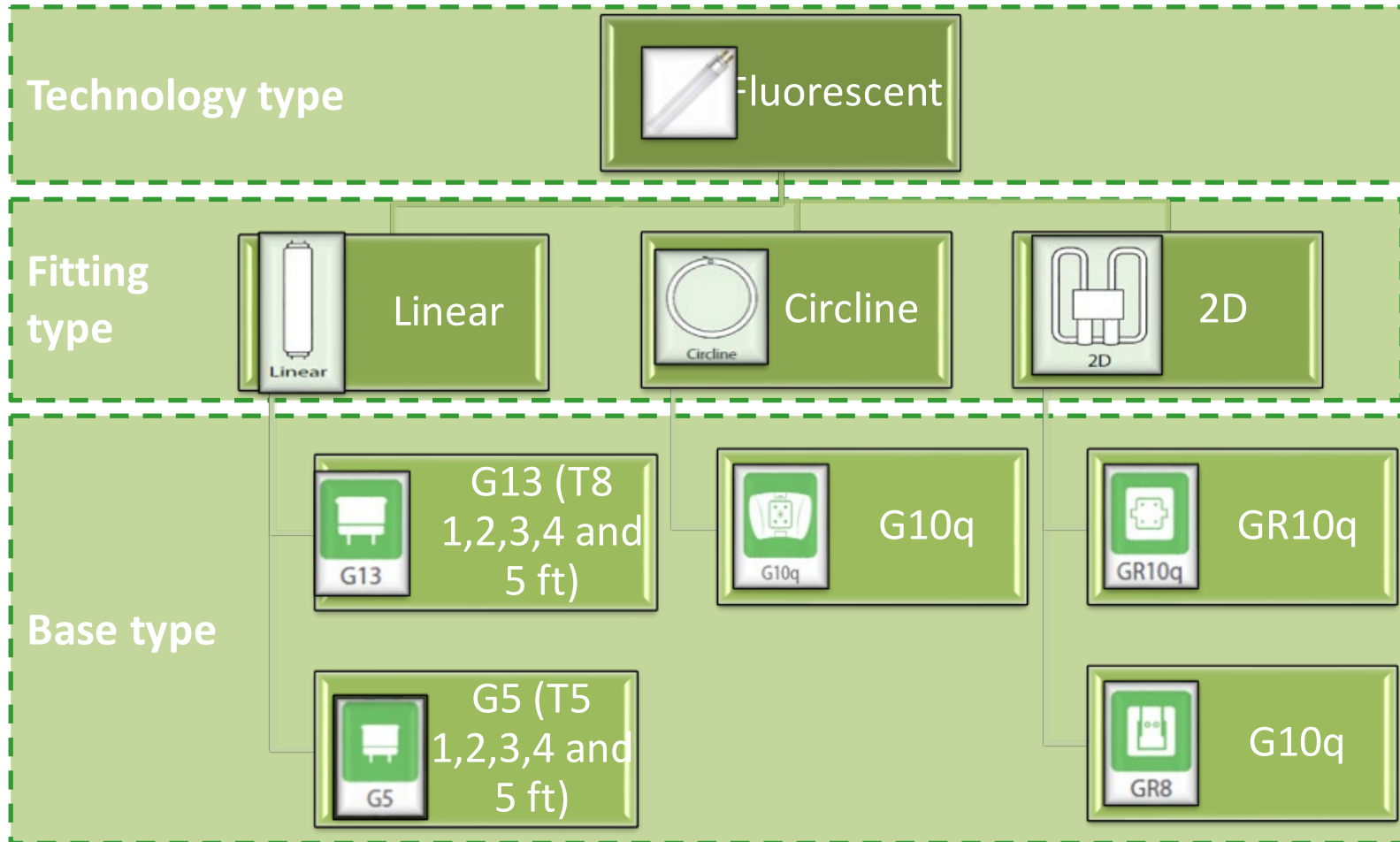
# Lighting Basics: Technologies, Fittings & Bases



# Lighting Basics: Technologies, Fittings & Bases



# Lighting Basics: Technologies, Fittings & Bases



# Lighting Basics: Technologies, Fittings & Bases



Technology type



High Intensity  
Discharge (HID)

Sub-technology  
type



High  
Pressure  
Sodium



Mercury  
Vapour



Metal  
Halide

Fitting and  
Base type

- A large number of fittings and bases are available for these types of technologies
- Replacement of HID lights by more efficient units is done by replacing the entire unit from the pole
- They will all be referred to as streetlight fittings and streetlight bases due to the common use of HID lighting for street lighting.



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# Planning for the Retrofit

# Planning for Retrofit



🇮🇹 Data collected about the existing lighting is used to identify compatible LED replacements.

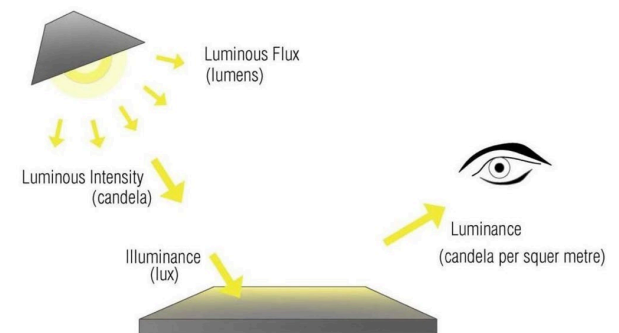
- **LED** is short for **Light-Emitting Diode**

🇮🇹 Compatibility is ranked according to:

- Fitting type
- Base type
- Luminous flux

🇮🇹 This will ensure that minimum modifications to the existing infrastructure are needed during the retrofit, thus reducing costs

Illuminance VS Luminance



# Planning for Retrofit

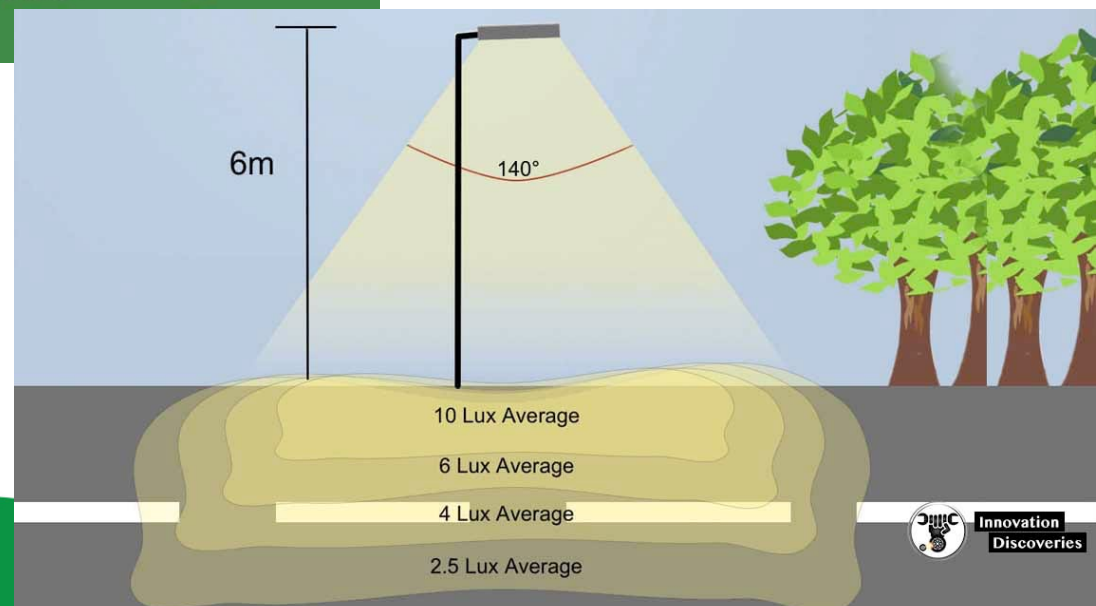
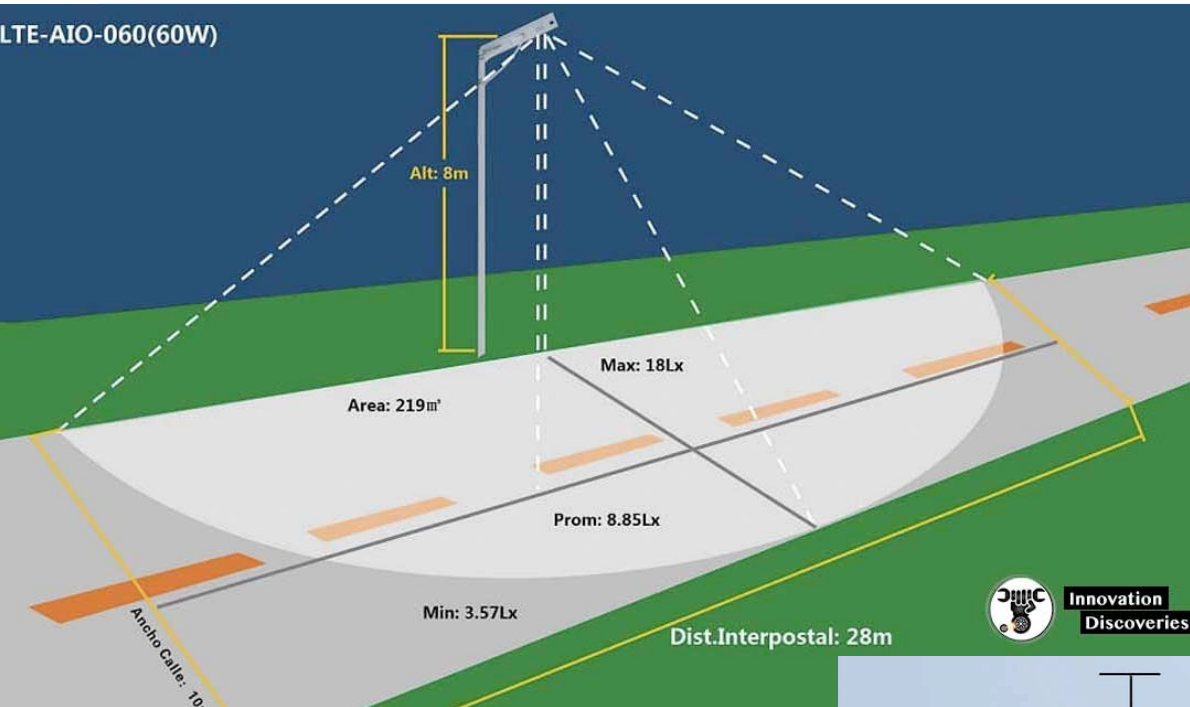


- LED lighting technology has seen rapid development in these past decades
- Most lighting systems (with exception of some specialised applications) can readily be replaced by LEDs
- Fittings and base types of all technologies discussed so far have LED alternatives.
- Advantages of LEDs include
  - High Luminous Efficacy/Efficiency
  - Quick to light even at cold temperatures
  - Flexible control
  - Superior Colour Rendering Index
  - Safer operation





# Planning for retrofit





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# Retrofitting

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# LED selection



## Step 1.

- Match the existing fitting type – this will also determine the lamp application

## Step 2.

- Match the existing base type – ensure new LED light can replace the existing light without major infrastructure changes

## Step 3

- Select LED that will produce the same luminous flux as the existing lamp



# LED Selection – Luminous Flux Selection Guide



- LED technology produces directional lights and can be focused toward the area to be illuminated.
- In some non-LED lighting system, up to 40% of the emitted light is directed outside the area needing to be illuminated (Lack of direction)
- Lower lumen rated LEDs could provide the same useful illumination in the area as indicated in the table below:

GLS ,Candle, Spiral, 3U, PL	Reflector, MR16	Linear and circline Tubes	Streetlight
Select an LED replacement with same luminous flux as the existing fitting (or a little higher if not available)	Select an LED replacement with same luminous flux as the existing fitting (or a little higher if not available)	Select an LED replacement with at least 60% of the luminous flux of the existing fitting	Select an LED replacement with at least 60% of the luminous flux of the existing fitting



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# Costs and Benefits

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# Energy and Cost saving Calculations :

## Payback period



- 🍌 The payback period is an easy and quick tool to assess the economic viability of an investment
- 🍌 A short payback period means that the investment will provide faster benefits/cost savings for the facility
- 🍌 A simple payback period calculation can be calculated as follows:

$$\text{Payback period (in year)} = \frac{\text{Cost of Retrofit}}{\text{Cost Savings per year}}$$

# Energy and Cost saving Calculations :

## Payback period



- 🌱 The yearly cost saving is calculated as the sum of all savings achieved through lamp/light replacement
- 🌱 The retrofit/project cost is in turn calculated as follows:

$$\begin{aligned} & \textit{Cost of Retrofit or Project} \\ & = \textit{Light purchase cost} + \textit{Total recycling cost} \\ & + \textit{installation cost} \end{aligned}$$

### Note:

Recycling costs must be included since old lighting technologies such as fluorescent and high intensity discharge (HID) light contain toxic substances and are required by law to be disposed safely.

Electricity cost increases yearly which could impact the payback period if it spans for more than a year.



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# Responsible Disposal



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# Recycling and Disposal



- 🌱 Fluorescent and HID bulbs contain hazardous substances such as mercury
- 🌱 Lighting waste (as electronic waste) is classified as a hazardous waste according to the National Environmental Management Act (Act No. 59 of 2008).
- 🌱 Since 2016, bulbs may no longer be sent to landfill for disposal, but must be recycled or treated prior to disposal
- 🌱 For any lighting retrofit intervention, it is critical to make sure the service provider would dispose of the waste bulbs/lamps in a legally compliant manner

# Recycling and Disposal



- 🌱 In addition to safely disposing of hazardous substances, recycling will also ensure that glass, non-ferrous metals, ferrous metals, plastic, phosphor powder and electronic components are recovered from the bulbs and fittings and used in other manufacturing processes
- 🌱 Recycling companies usually charge different rates according to the technology to be recycled or treated on a per fitting/lamp basis
- 🌱 To ensure that the waste is managed correctly, it is imperative that a Safe Disposal Certificate from the waste service provider is issued after all the bulbs and fittings have been safely disposed



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# **SANEDI Energy Efficiency Lighting (SEEL) Tool**



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# Available on Two Platforms



Web-  
based

- <http://seel.sanedi.org.za>

App-  
based

- Google Play Store
- Huawei Store

# What can the Tool do?



## Record existing lighting

- Indoor and outdoor

## Calculate current use

- Based on electricity tariffs

## Calculate potential electricity savings

- Based on replacement of current lights with energy efficient technologies

## Calculate potential monetary & GHG emission savings

- Based on potential electricity savings

## Calculate the replacement cost of existing lights

- Based agreed average cost of energy efficient lights

## Calculate A pay-back period

- Based on the replacement cost and the potential savings

## Cost-comparison between BAU & switch to EE lighting

- Based on projected savings



Super User

USER MENU

Dashboard

Sites

REPORTS

Report 1

Report 2

CONFIG

Lights

Application Types

Technology Used

Fitting

Brand

Recycling

Regions

Venue Types

Base Types

Public Holidays

DASHBOARD

## Add Light

Brand

Fitting

Technology

Base type

Application

Lumen

Ballast



## Baseline Summary: TUT Main campus at Test Site Site

[BACK TO BASELINE SUMMARY](#)

### Pay Back Period

Current Light	Retrofit Light	Cost of Retrofit	Total Recycling Cost	Total Yearly Savings	Pay back Period (Years)
E27 100W "7 bridged" Clear Rough Service Incandescent	P CLAS A DIM 11 W/827 E27	1026.30	38.90	2127.32	0.48

### Daily Consumption Comparison

- + Consumption per Weekday
- + Consumption per Saturday
- + Consumption per Sunday
- + Consumption per Public Holiday

### Daily Cost Comparison

- + Cost per Weekday in Low Demand Season
- + Cost per Weekday in High Demand Season
- + Cost per Saturday in Low Demand Season
- + Cost per Saturday in High Demand Season
- + Cost per Sunday in Low Demand Season



Super User

**USER MENU**

- Dashboard
- Sites

**CONFIG**

- Lights
- Application Types
- Technology Used
- Fitting
- Brand
- Recycling
- Regions
- Venue Types
- Base Types
- Public Holidays
- API Setup
- User Management



Super User

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Lights

Application Types

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Venue Types

Base Types

Public Holidays

API Setup

+ Cost per weekday in High Demand Season
+ Cost per Saturday in Low Demand Season
+ Cost per Saturday in High Demand Season
+ Cost per Sunday in Low Demand Season
+ Cost per Sunday in High Demand Season
+ Cost per Public Holiday in Low Demand Season
+ Cost per Public Holiday in High Demand Season

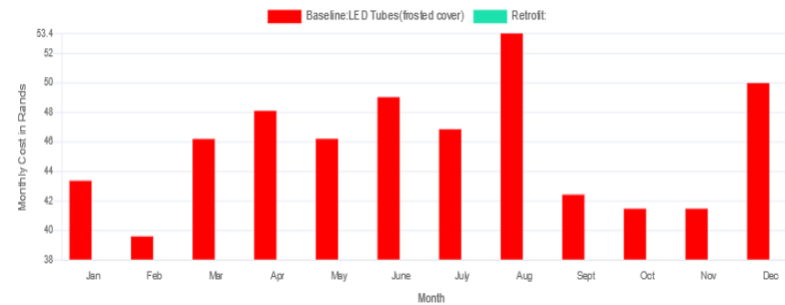
### Monthly Cost

Monthly Cost

Baseline: LED Tubes(frosted cover)  
Retro:

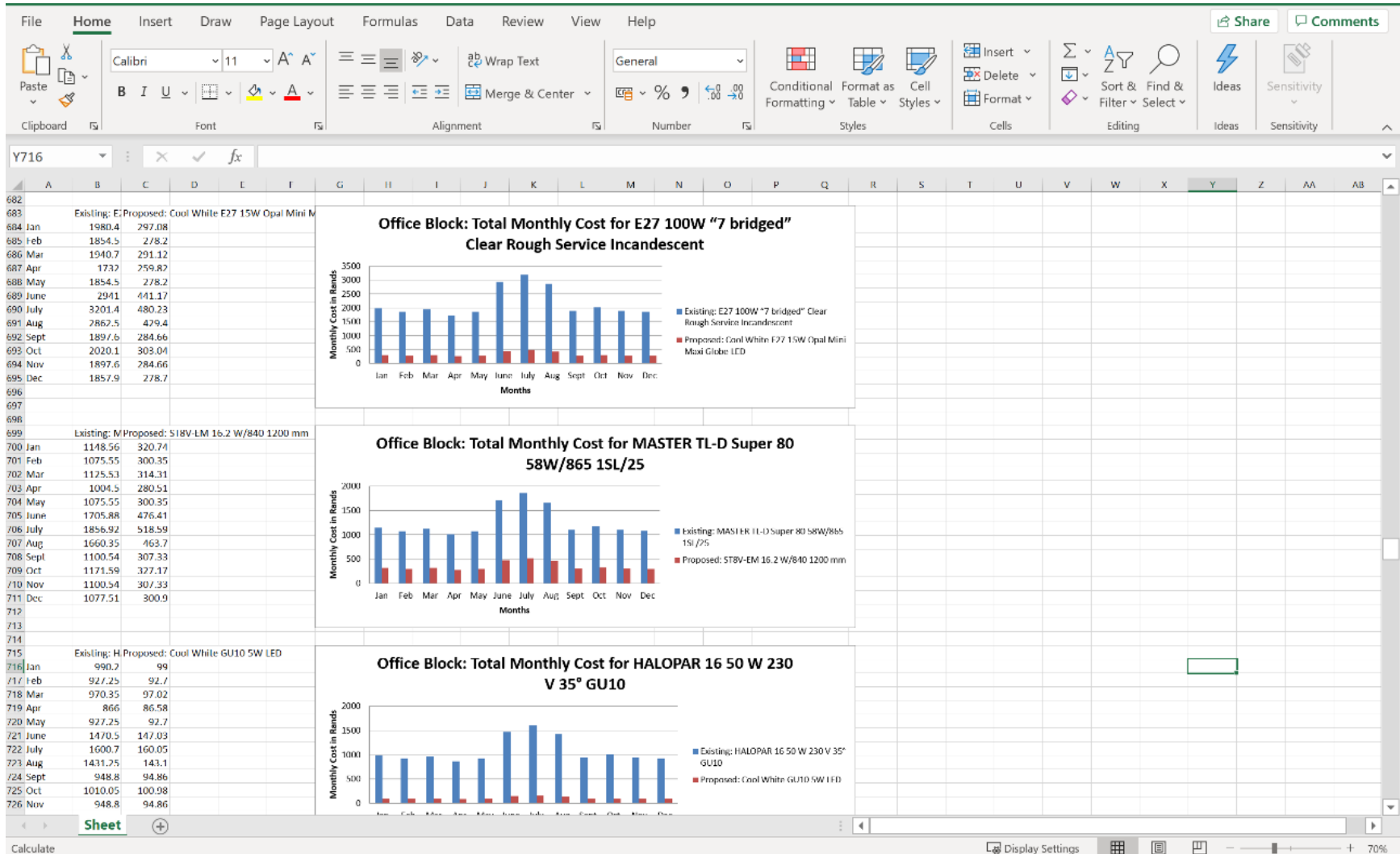
Operating Hours Weekdays: midnight to 1 a.m.  
Operating Hours Saturdays: midnight to 2 a.m.  
Operating Hours Sundays: midnight to 3 a.m.  
Operating Hours Public Holidays: midnight to 4 a.m.

Current Yearly Cost: R 547.78  
Retro Cost: R 0  
Savings: R 547.78

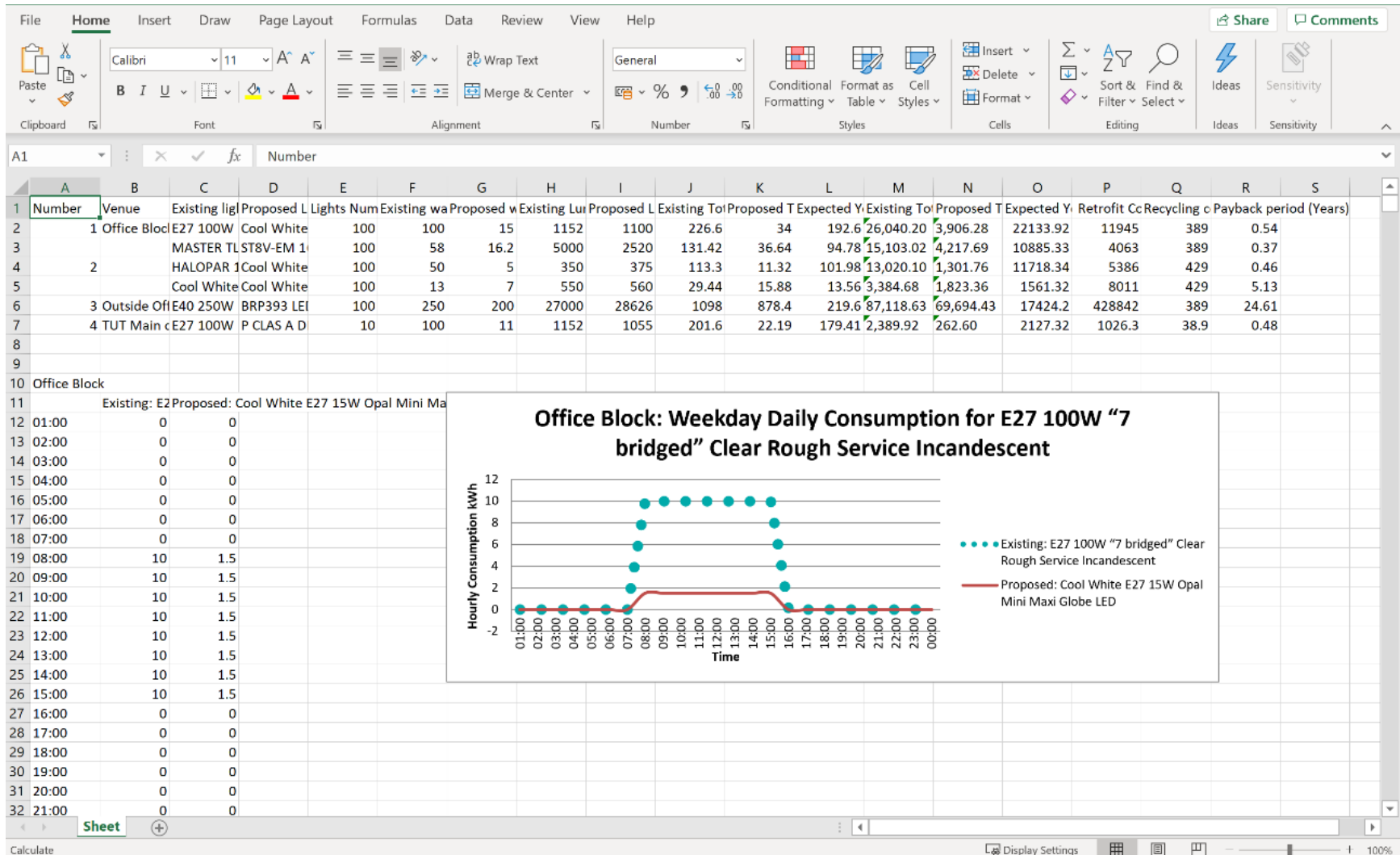




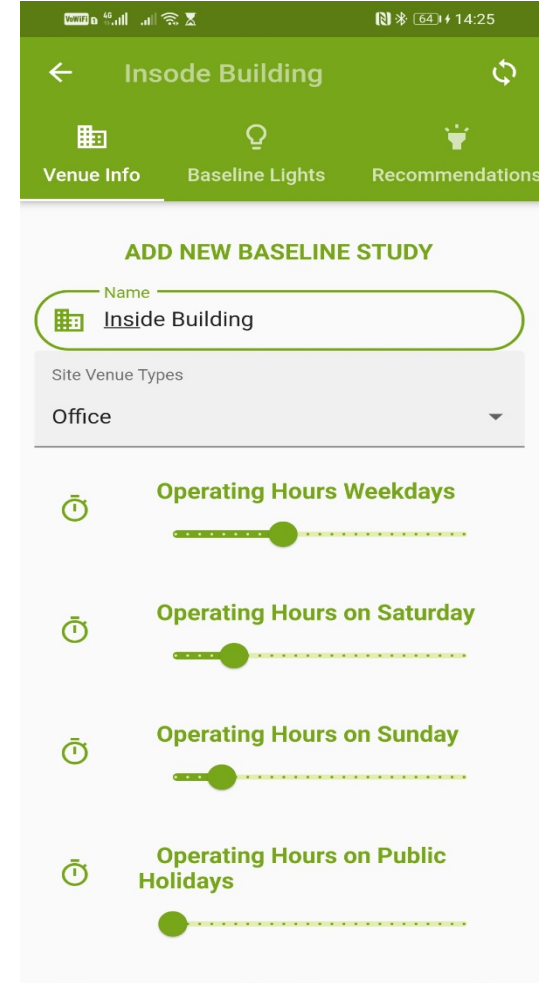
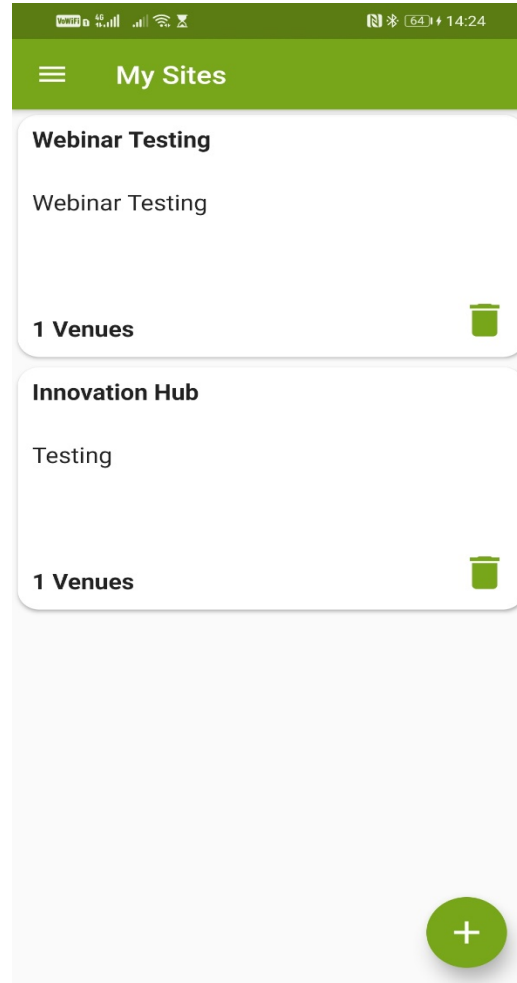
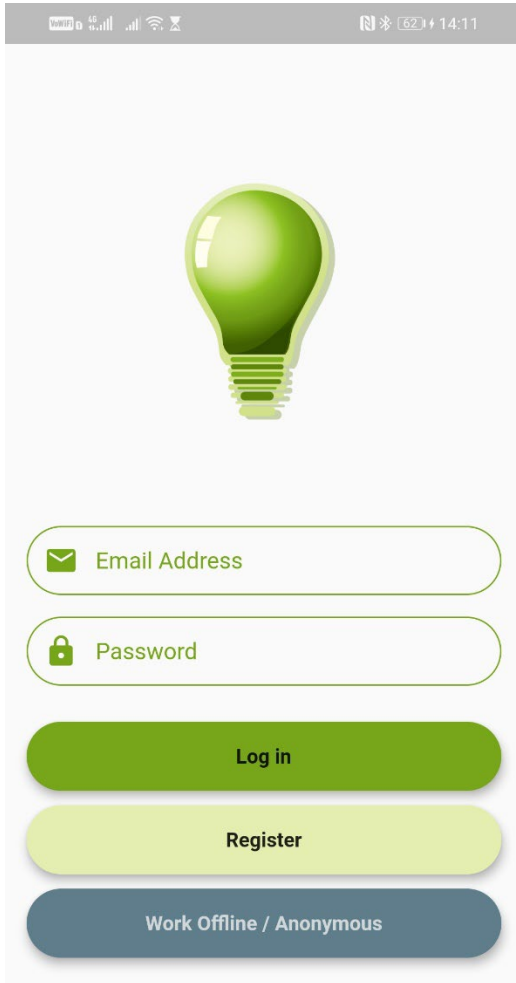
# SEEL Web (Excel output)



# SEEL Web (Excel output)



# SEEL App



# SEEL App



Inside Building

Venue Info | Baseline Lights | Recommendations

1 Cool White G13 36W 4ft T8 Fluorescent  
Selected: MASTER LEDtube VLE 1200mm HO 14W 840 T8

**Costs Per Day**

	High Demand Season	Low Demand Season
Weekday	0.51 vs 0.2	0.33 vs 0.13
Saturday	0.19 vs 0.07	0.14 vs 0.06
Sunday	0.1 vs 0.04	0.08 vs 0.03
Public Holiday	0.0 vs 0.0	0.0 vs 0.0

Edit Delete

+

Inside Building

Baseline Lights | Recommendations | Annual Outlook

Cool White G13 36W 4ft T8 Fluorescent  
MASTER LEDtube VLE 1200mm HO 14W 840 T8

— Retrofit — Baseline

Baseline Grand Total: 109  
Retrofit Grand Total: 43

Rands

Months

Current	Cool White G13 36W 4ft T8 Fluorescent
Current Energy	0.0360
Retrofit	MASTER LEDtube VLE 1200mm HO 14W 840 T8
Retrofit Energy	0.0140
Cost of Retrofit	38.72

Fittings

- T8 5ft 1
- T8 4ft 2
- T8 1ft 3
- T6 Circline 4-Pin 4
- T6 2D 4-Pin 5
- T5 5ft 6
- T5 4ft 7
- T5 3ft 8
- T5 2ft 9
- T5 1ft 10
- Streetlight Fitting +



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# Case Studies

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# Examples





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