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

ENERGY INNOVATION FOR LIFE

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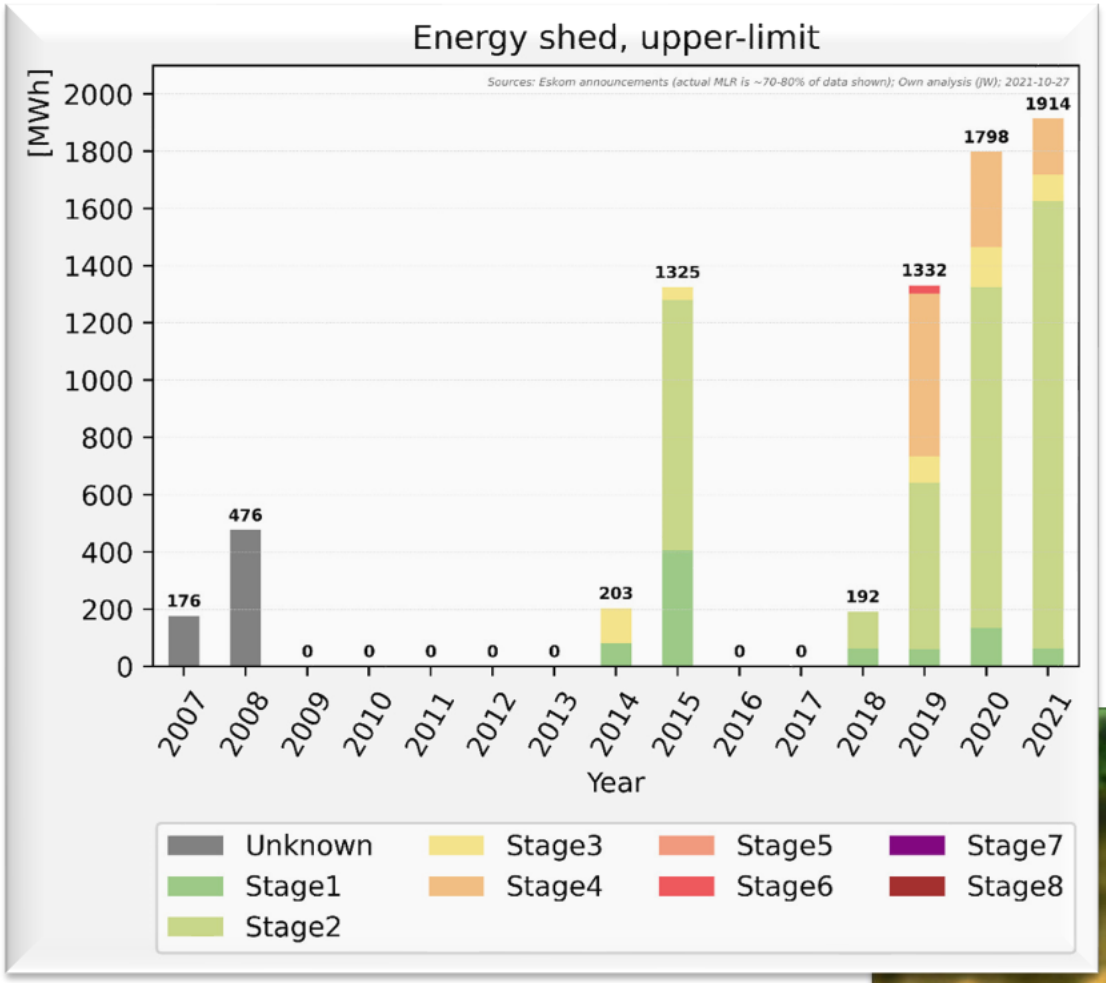
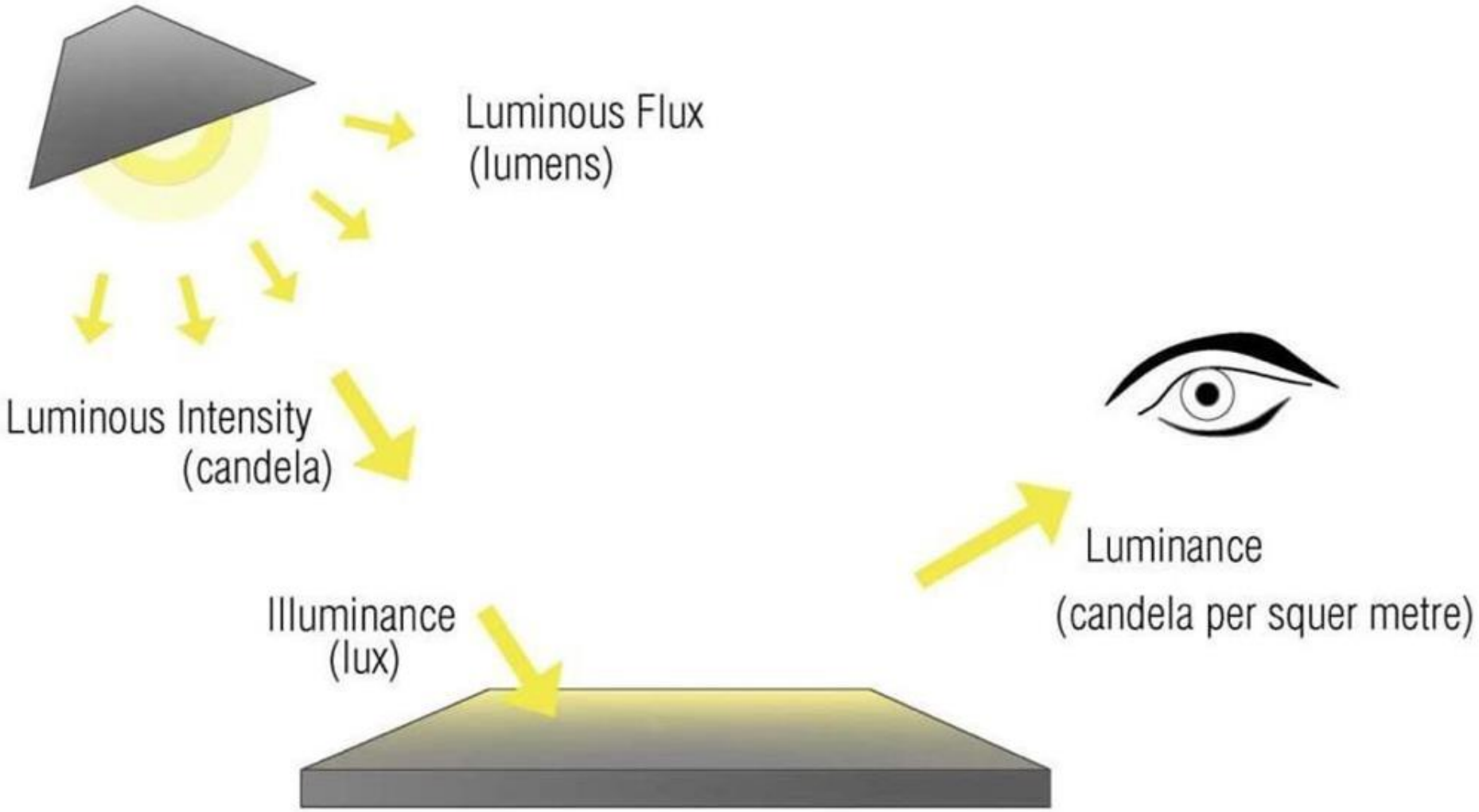
Why Go Energy Efficient?



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

A Ballast regulates the current and provides the voltage to the Lamp

Lighting basics: Technologies, Fittings & Bases

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SANEDI Energy Efficiency Lighting (SEEL) Tool

SEEL

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Lighting Basics

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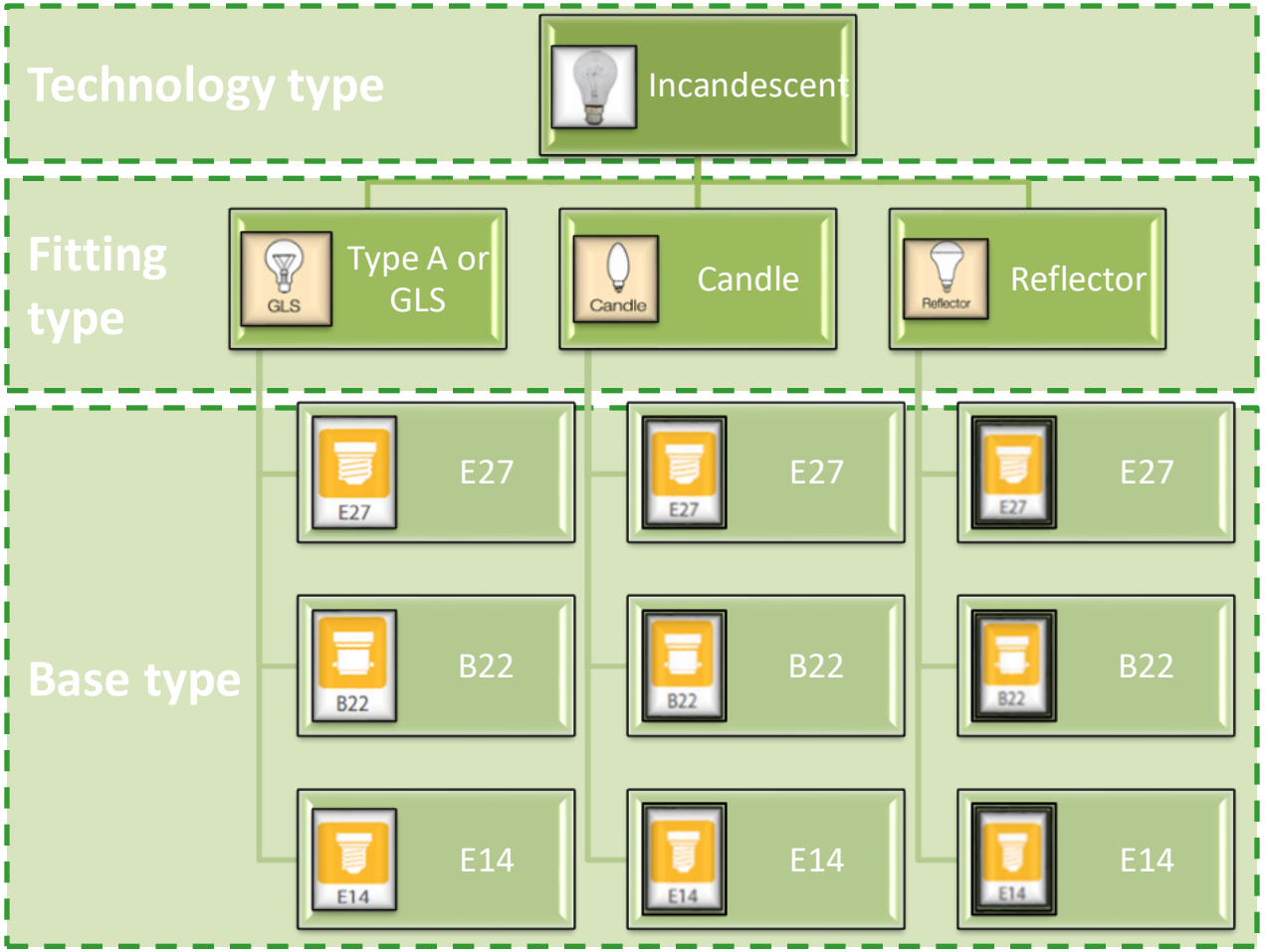
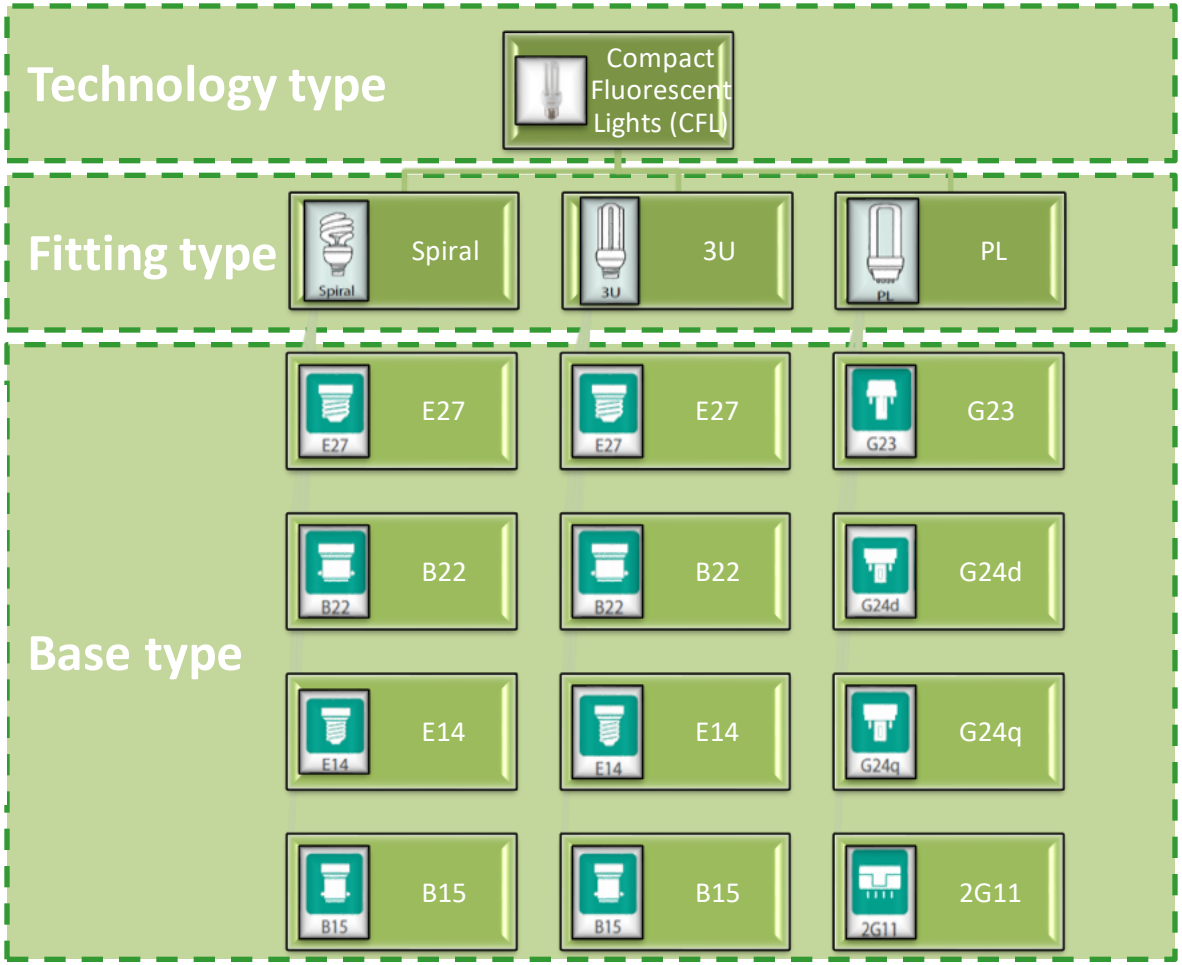
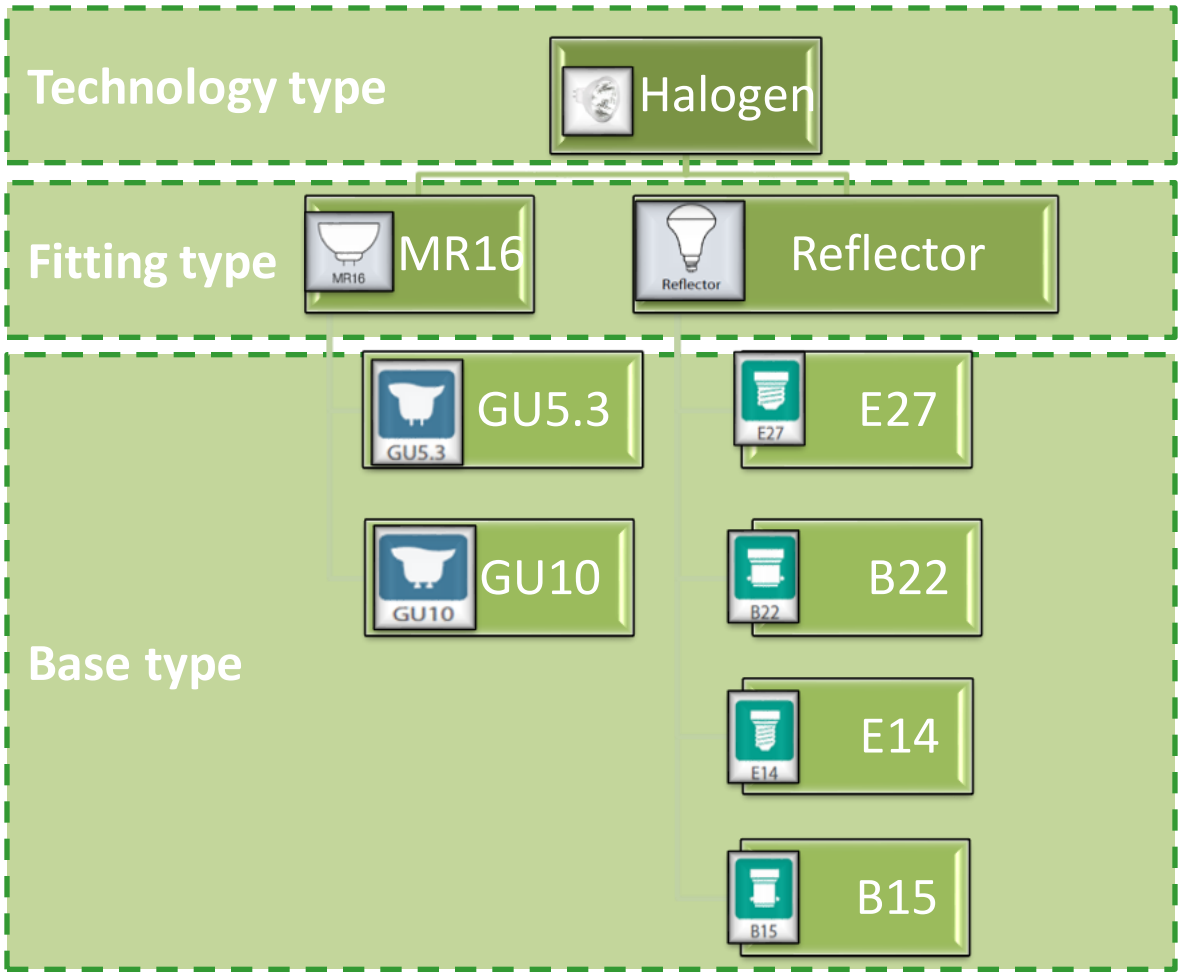
Lighting Basics: Technologies, Fittings & Bases



Lighting Basics: Technologies, Fittings & Bases



Lighting Basics: Technologies, Fittings & Bases



Lighting Basics: Technologies, Fittings & Bases

Technology type

- Fluorescent

Fitting type

- Linear
- Circline
- 2D

Base type

- G13 (T8 1,2,3,4 and 5 ft)
- G10q
- GR10q
- G5 (T5 1,2,3,4 and 5 ft)
- G10q

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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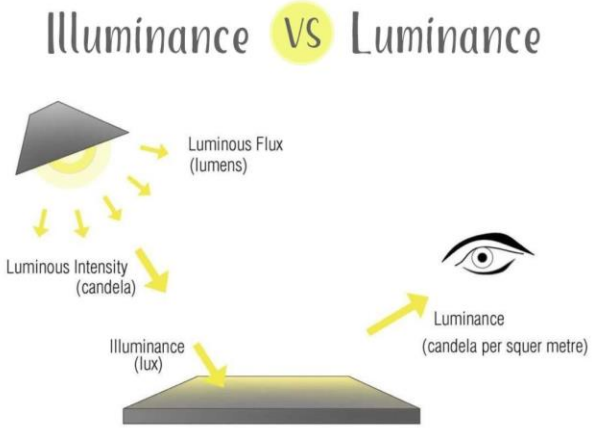
Planning for the Retrofit

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

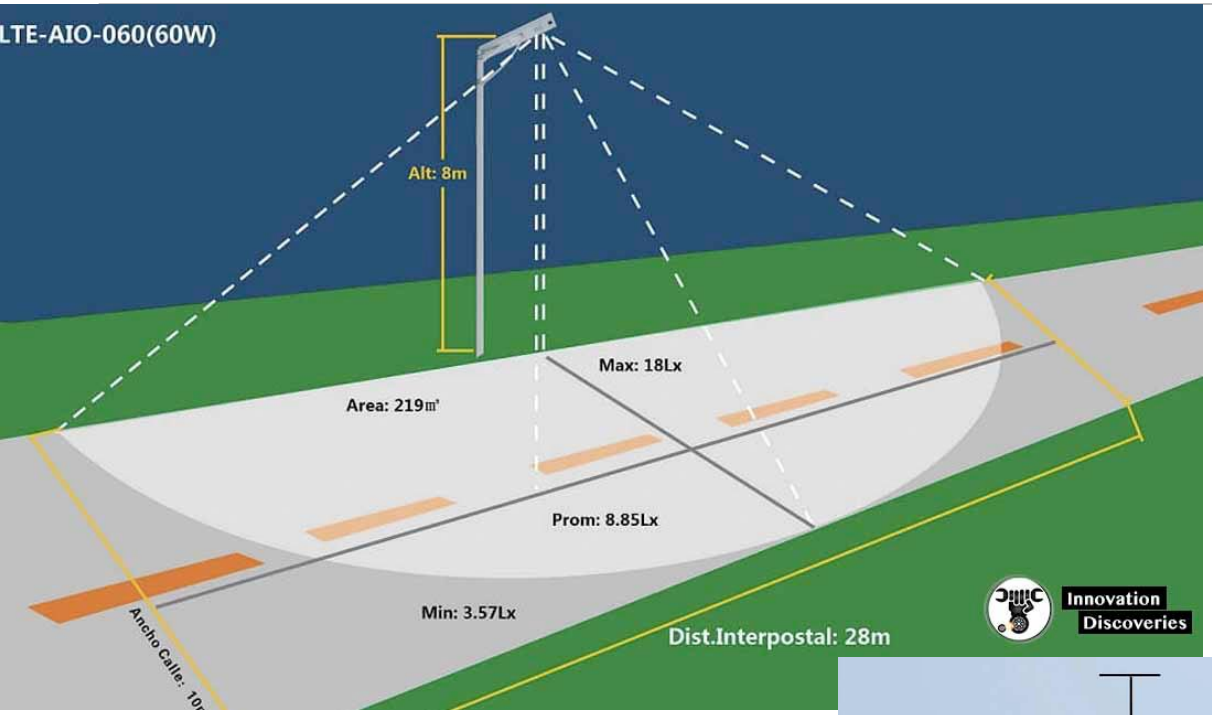


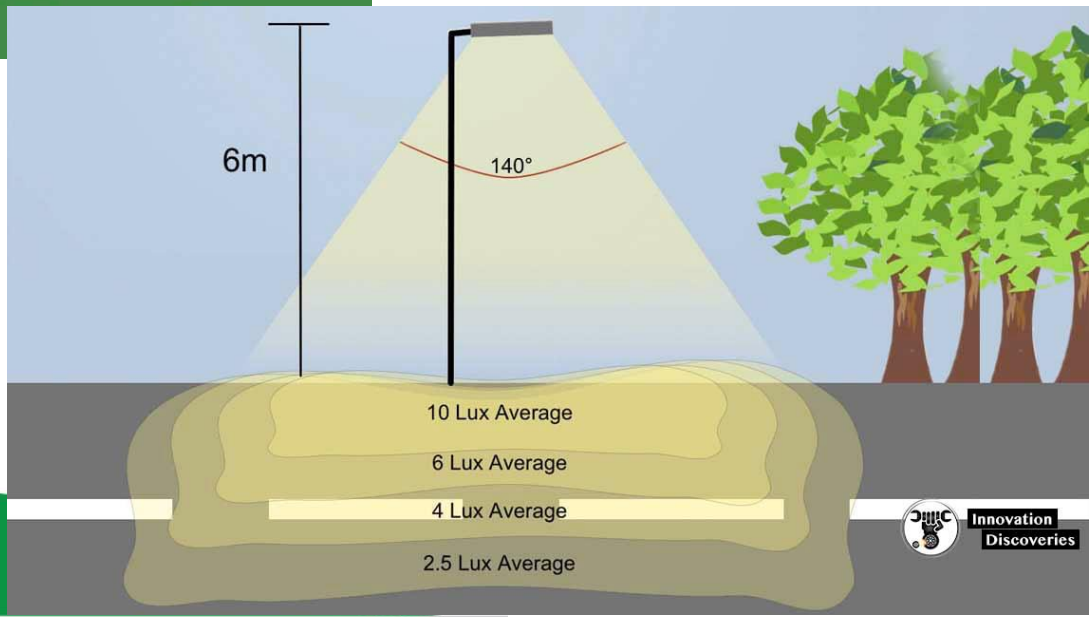
- This will ensure that minimum modifications to the existing infrastructure are needed during the retrofit, thus reducing costs

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 exiting fitting type – this will also determine the lamp application

Step 2.

- Match the existing base type – ensure new LED light can replace the exiting 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:

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

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:

$$Cost\ of\ Retrofit\ or\ Project = Light\ purchase\ cost + Total\ recycling\ cost + installation\ cost$$

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

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 inother 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

SEEL

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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

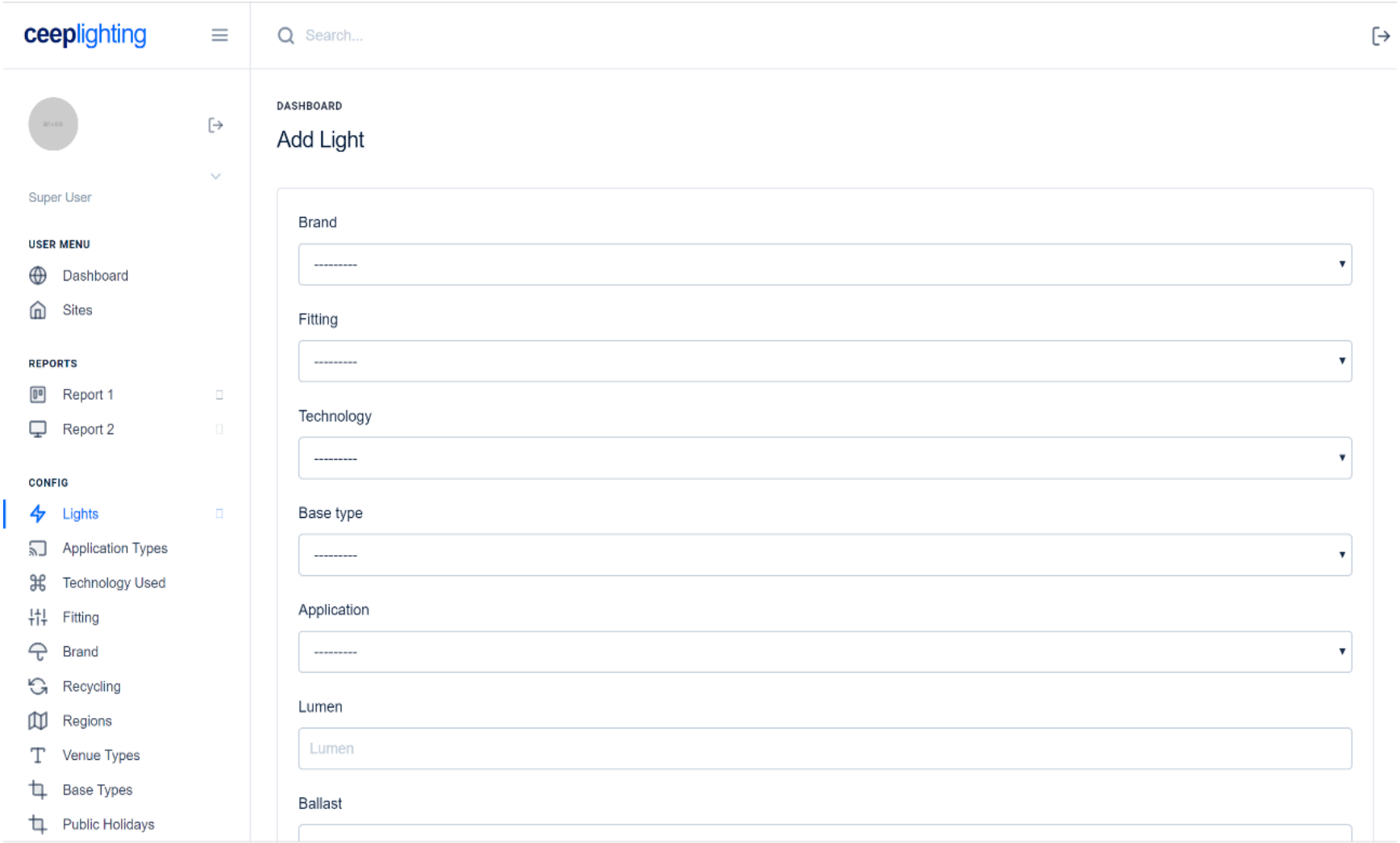
Calculate A pay-back period

- Based on the replacement cost and the potential savings

Cost-comparison between BAU & switch to EE lighting

- Based on projected savings

SEEL Web


ceeplighting
Search...
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

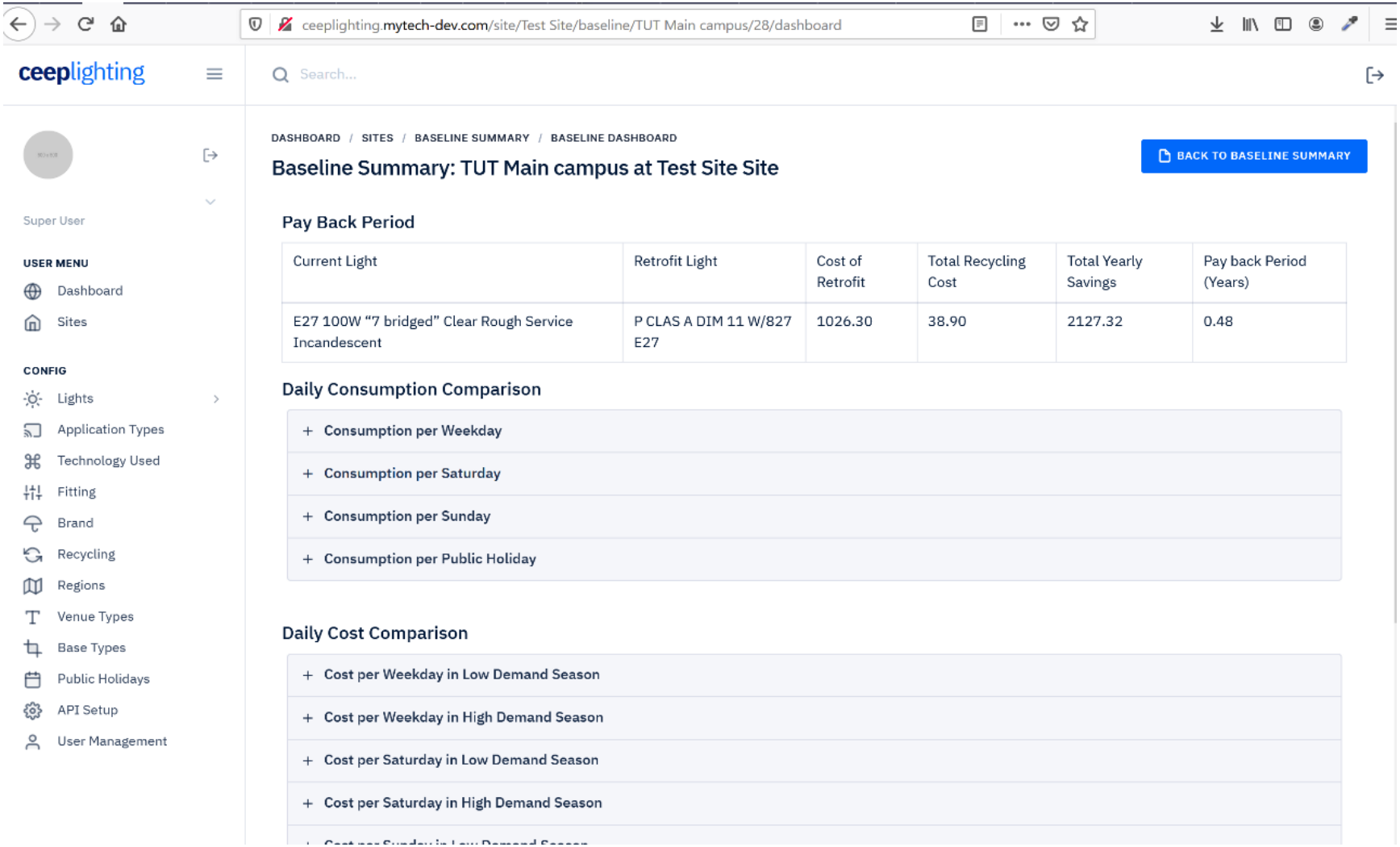
Technology

Base type

Application

Lumen
Lumen
Ballast

SEEL Web


ceeplighting.mytech-dev.com/site/Test Site/baseline/TUT Main campus/28/dashboard
ceeplighting
Search...
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
DASHBOARD / SITES / BASELINE SUMMARY / BASELINE DASHBOARD
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

SEEL Web

ceeplighting

Search...

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
- API Setup

+ 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

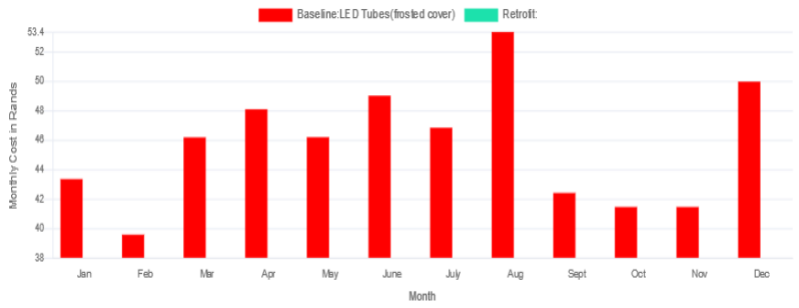
Monthly Cost

– Monthly Cost

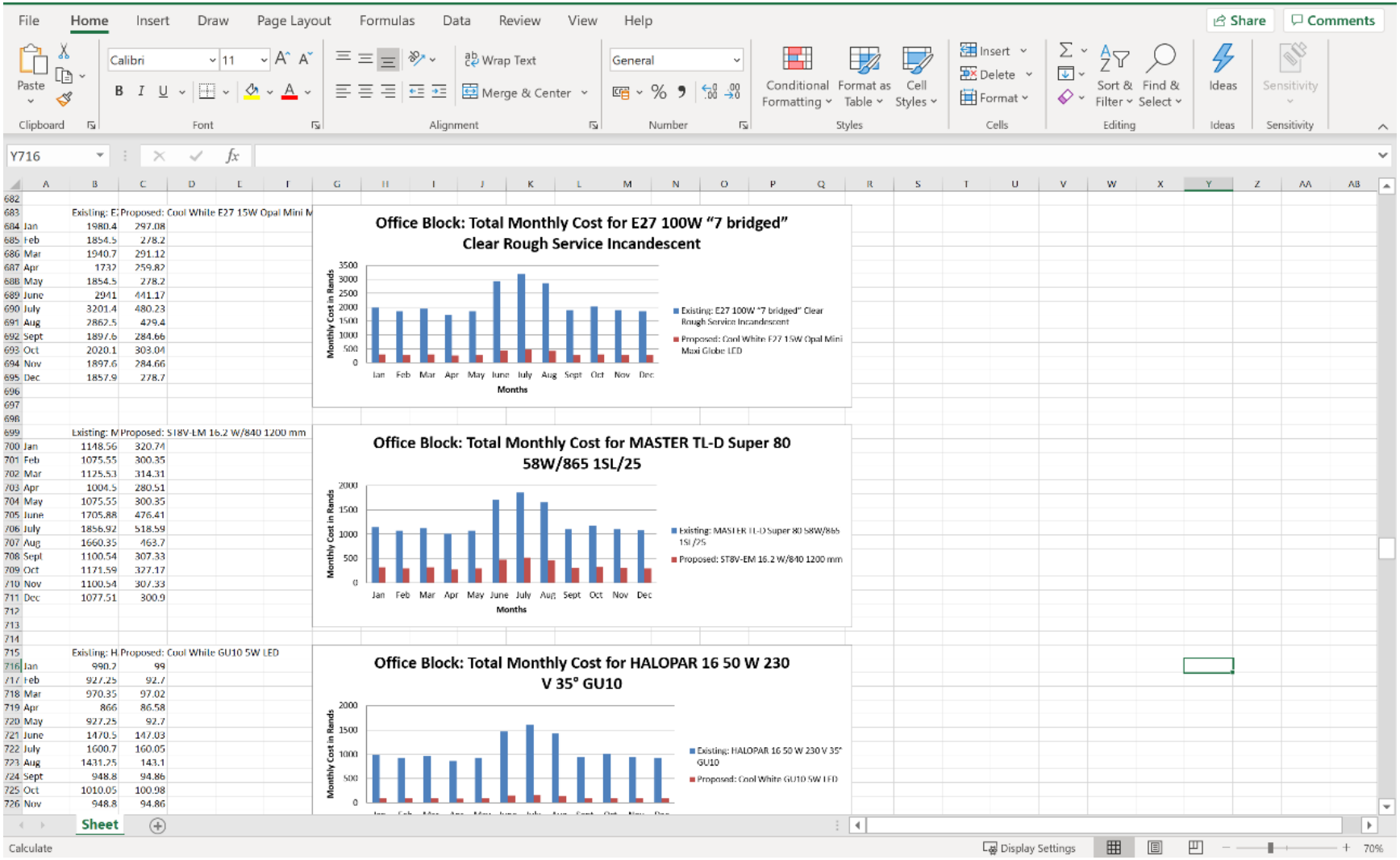
Baseline: LED Tubes(frosted cover)
Retro:

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)

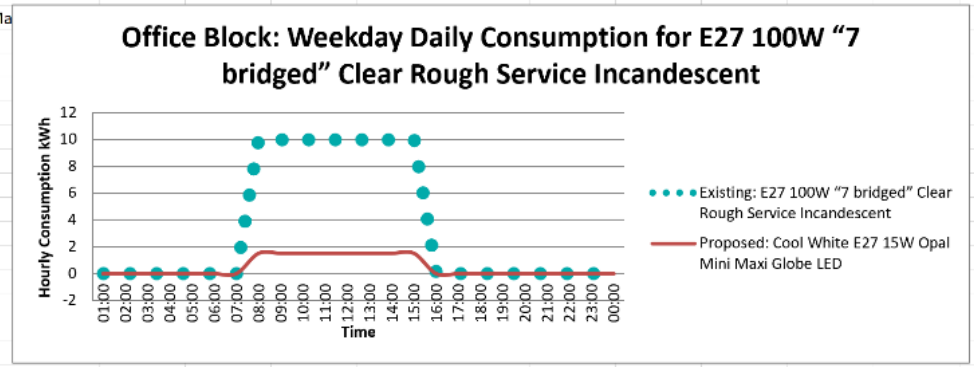


SEEL Web (Excel output)

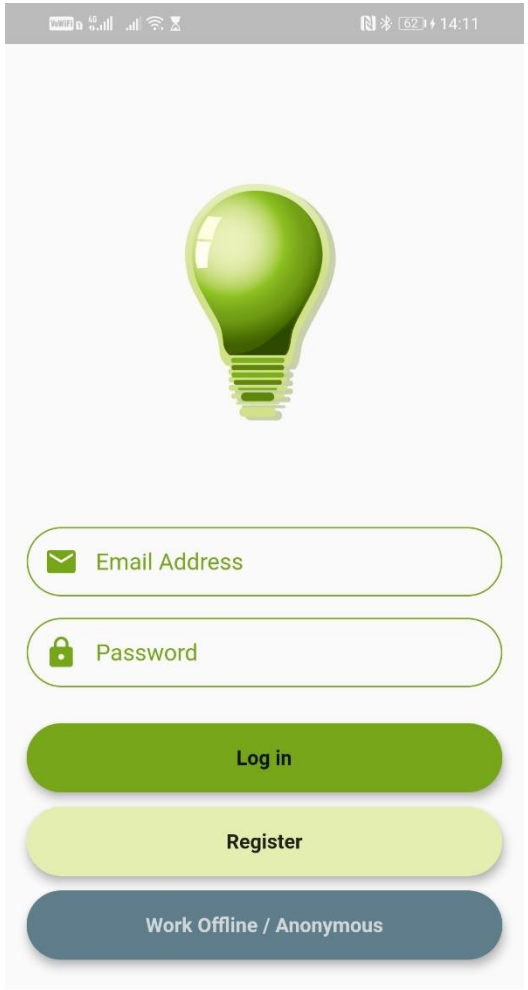
Number	Venue	Existing lig	Proposed L	Lights Num	Existing wa	Proposed w	Existing Lu	Proposed L	Existing To	Proposed T	Expected Y	Existing To	Proposed T	Expected Y	Retrofit Cc	Recycling c	Payback period (Years)
1	Office Bloc	E27 100W	Cool White	100	100	15	1152	1100	226.6	34	192.6	26,040.20	3,906.28	22133.92	11945	389	0.54
		MASTER TL	ST8V-EM 1	100	58	16.2	5000	2520	131.42	36.64	94.78	15,103.02	4,217.69	10885.33	4063	389	0.37
2		HALOPAR 1	Cool White	100	50	5	350	375	113.3	11.32	101.98	13,020.10	1,301.76	11718.34	5386	429	0.46
		Cool White	Cool White	100	13	7	550	560	29.44	15.88	13.56	3,384.68	1,823.36	1561.32	8011	429	5.13
3	Outside Off	E40 250W	BRP393 LEI	100	250	200	27000	28626	1098	878.4	219.6	87,118.63	69,694.43	17424.2	428842	389	24.61
4	TUT Main c	E27 100W	P CLAS A D	10	100	11	1152	1055	201.6	22.19	179.41	2,389.92	262.60	2127.32	1026.3	38.9	0.48

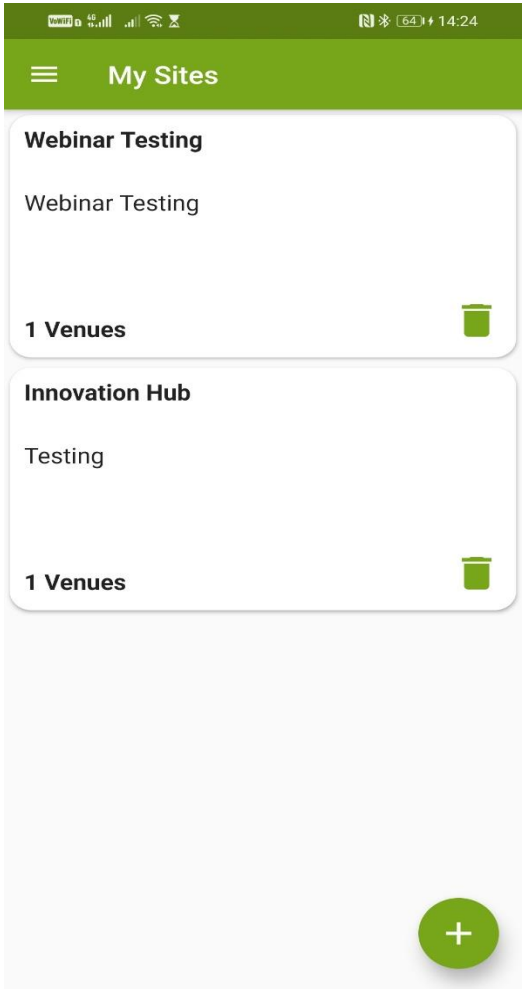
Office Block

	Existing: E2	Proposed: Cool White E27 15W Opal Mini Ma
01:00	0	0
02:00	0	0
03:00	0	0
04:00	0	0
05:00	0	0
06:00	0	0
07:00	0	0
08:00	10	1.5
09:00	10	1.5
10:00	10	1.5
11:00	10	1.5
12:00	10	1.5
13:00	10	1.5
14:00	10	1.5
15:00	10	1.5
16:00	0	0
17:00	0	0
18:00	0	0
19:00	0	0
20:00	0	0
21:00	0	0



SEEL App


14:11
Email Address
Password
Log in
Register
Work Offline / Anonymous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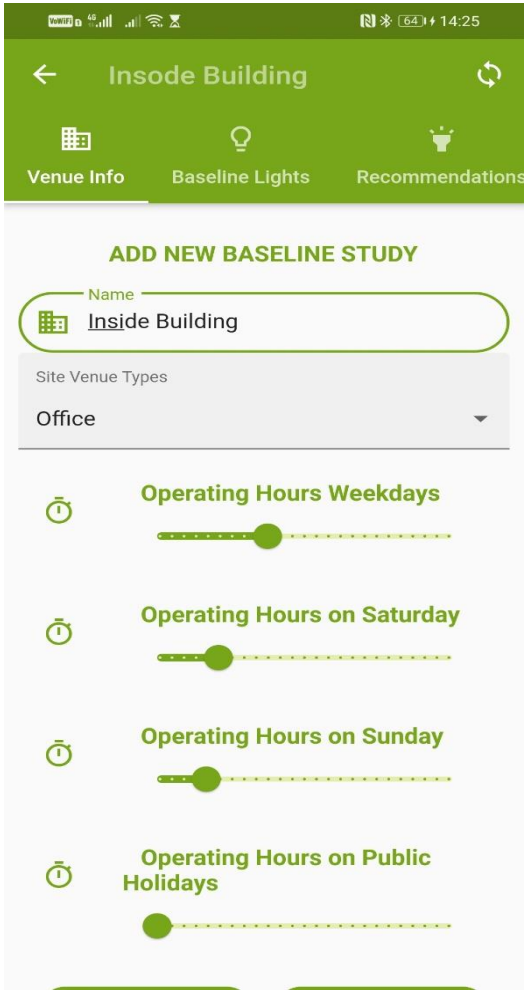
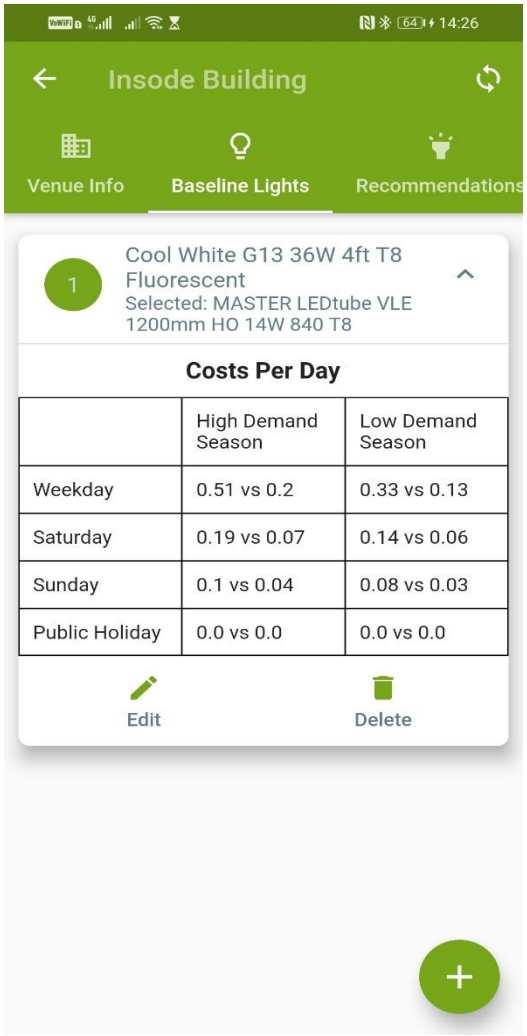
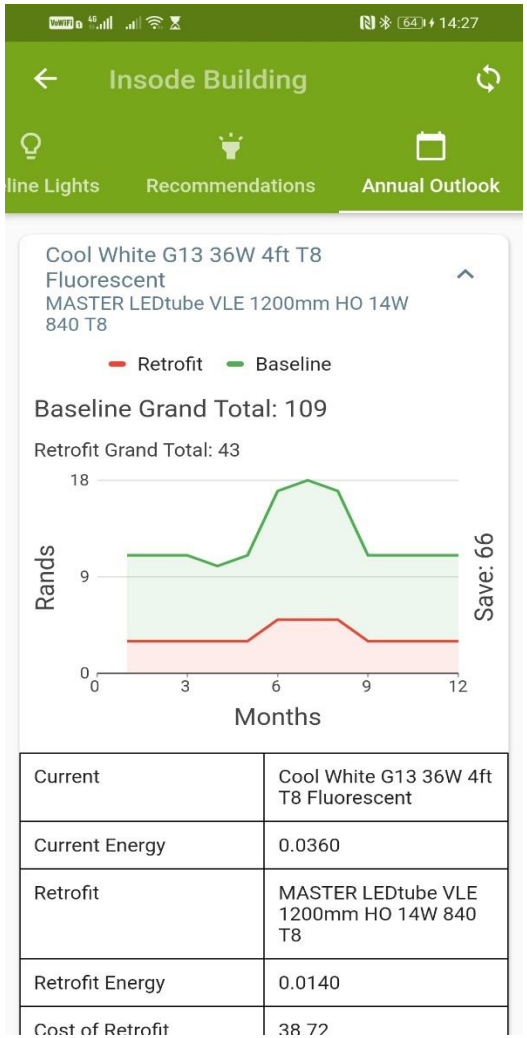
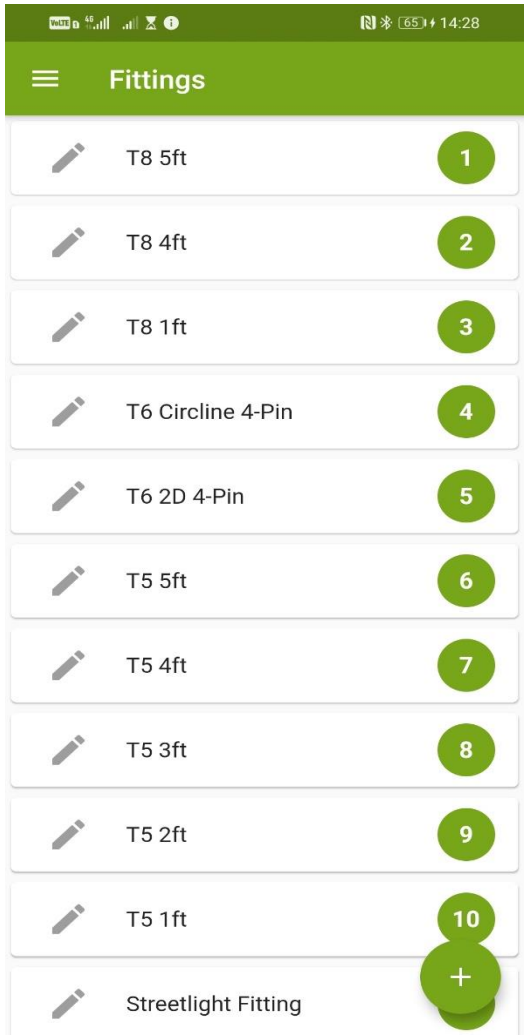
My Sites
Webinar Testing
Webinar Testing
1 Venues
Innovation Hub
Testing
1 Venues


14:25
Insode Building
Venue Info
Baseline Lights
Recommendations
ADD NEW BASELINE STUDY
Name
Inside Building
Site Venue Types
Office
Operating Hours Weekdays
Operating Hours on Saturday
Operating Hours on Sunday
Operating Hours on Public Holidays

SEEL App


14:26
Insode 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


14:27
Insode Building
line 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
Save: 66
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


14:28
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

- Site 1 (Security)
  - Capex R2.4m
  - Payback 1 year
  - Total Savings R7.1m
- Site 2 (Security)
  - Capex R280k
  - Payback 1.5 years
  - Total Savings R1.8m
- Site 3 (Office)
  - Capex R3.4m
  - Payback 2 years
  - Total Savings R9.8m

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THANK YOU

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