

**WELCOME** to the

**CECA**  
UoFT



**Lighting Workshop**



# LAND ACKNOWLEDGEMENT

"We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land." #TKARO FOR ALL

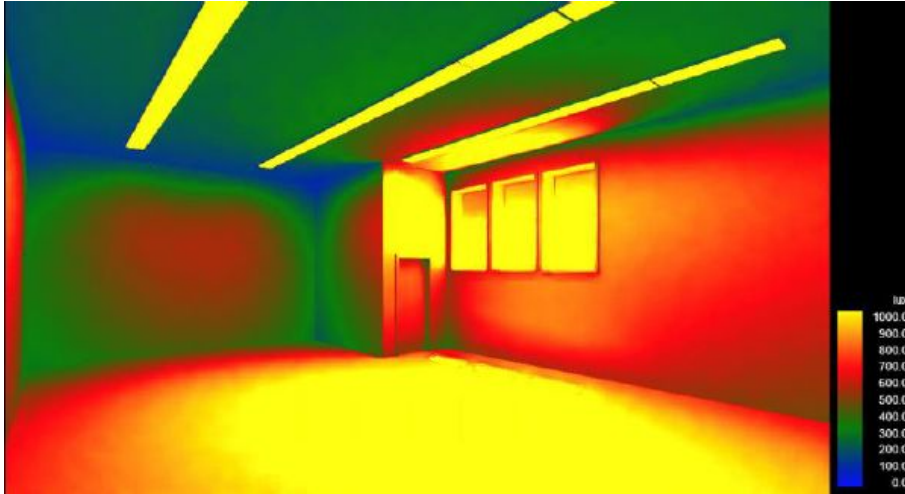
# What is CECA?

## Multi-disciplinary design team

- Provide **workshops** on sustainable building energy
- Participate in **Green Energy Challenge** (design competition)
  - Proposal for building in community to reduce energy usage and move towards net-zero
- Provide **networking opportunities** with industry professionals
- Provide opportunity to use **softwares** to help audit and evaluate building performance



# OUTLINE



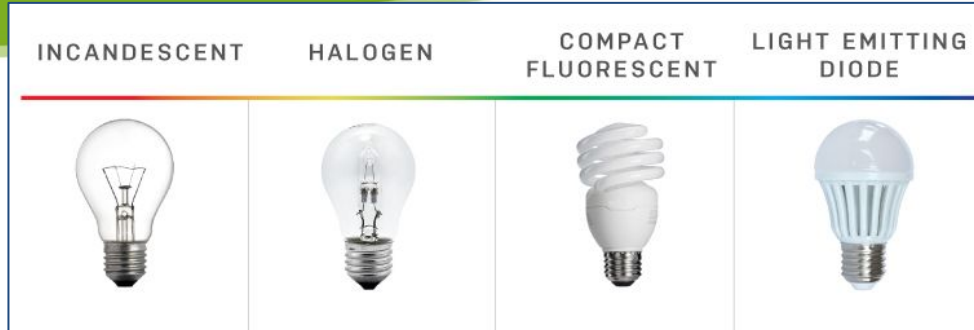
1. Terminology
2. Lighting Audit
3. Analysis
4. Recommendations
5. Activity

# Why lighting retrofits are important

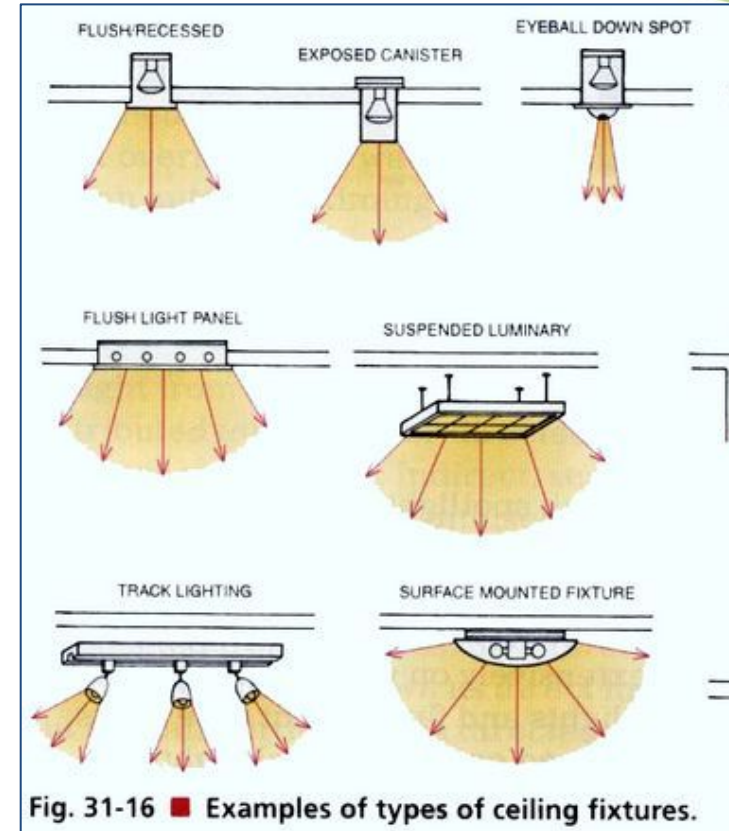
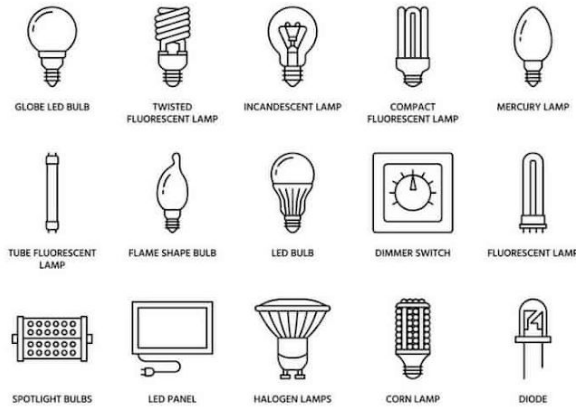
- **Lower energy consumption**
  - In commercial and institutional settings, lighting accounts for 13.5% of energy used
- **Improved visual environment**
  - “Good lighting quality improves occupants’ satisfaction, morale, well-being, and work productivity”
- **Cost savings**



# Bulb vs Fixture



## Light Bulb Shapes



# Important parameters in Lighting

## Lighting Facts Per Bulb

**Brightness**

820 lumens

**Estimated Yearly Energy Cost \$7.23**

Based on 3 hrs/day, 11¢/kWh

Cost depends on rates and use

**Life**

Based on 3 hrs/day

1.4 years

**Light Appearance**

Warm

Cool



2700 K

**Energy Used**

60 watts

**Lumens** measure how much light you are getting from a bulb  
**Lux** = Lumen/m<sup>2</sup>

**(\$)** Average cost of electricity varies by region

**Number of hours** the lights are on

**Wattage** = rate of electricity usage  
**kWh** = measure of amount of energy or electricity usage

# Data Collection



<b>Parameter</b>	<b>Method of data collection</b>
Brightness	using lux meter
Hours of operation	ask the building manager
Number and type of fixtures and bulbs	manual count
Number and type of switches	manual count
Wattage	Ask the building manager or make a reasonable assumption based on the type of bulb.



# Analysis

Location	Light type	Total Wattage (W)	Daily Operating Hours	Total Weekly Operating Hours	Weekly Energy Use (kWh)
Stairwells and Hallways	CFL	195.0	10.0	70.0	13.7
	T12	5240.0	10.0	70.0	366.8
Classrooms	T12	21195.0	8.0	52.0	1102.1
Offices	T12	3720.0	8.0	52.0	193.4
Washrooms	CFL	26.0	12.0	84.0	2.2
	T12	1600.0	12.0	84.0	134.4
Child Care Rooms	T12	3920.0	8.0	56.0	219.5
Kitchen and Lunchrooms	T12	800.0	4.0	26.0	20.8
Library	T12	4800	10.0	84.0	403.2
Damaged Light	T12	6600.0	N/A (Varies)	61.0	402.6
	CFL	104.0	N/A (Varies)	80.0	8.3
<b>Weekly Energy Usage (kWh)</b>					<b>2045.2</b>
<b>ANNUAL ENERGY USAGE (kWh)</b>					<b>79761.8</b>

# How do you know if the room has enough light?

IESNA Lighting Handbook provides recommended light levels

ROOM TYPE	LIGHT LEVEL (FOOT CANDLES)	LIGHT LEVEL (LUX)	IECC 2015 LIGHTING POWER DENSITY (WATTS PER SF)
Bedroom - Dormitory	20-30 FC	200-300 lux	0.38
Cafeteria - Eating	20-30 FC	200-300 lux	0.65
Classroom - General	30-50 FC	300-500 lux	1.24
Conference Room	30-50 FC	300-500 lux	1.23
Corridor	5-10 FC	50-100 lux	0.66
Exhibit Space	30-50 FC	300-500 lux	1.45
Gymnasium - Exercise / Workout	20-30 FC	200-300 lux	0.72
Gymnasium - Sports / Games	30-50 FC	300-500 lux	1.20
Kitchen / Food Prep	30-75 FC	300-750 lux	1.21
Laboratory (Classroom)	50-75 FC	500-750 lux	1.43
Laboratory (Professional)	75-120 FC	750-1200 lux	1.81
Library - Stacks	20-50 FC	200-500 lux	1.71
Library - Reading / Studying	30-50 FC	300-500 lux	1.06
Loading Dock	10-30 FC	100-300 lux	0.47
Lobby - Office/General	20-30 FC	200-300 lux	0.90
Lobby - Reception	20-30 FC	200-300 lux	0.75

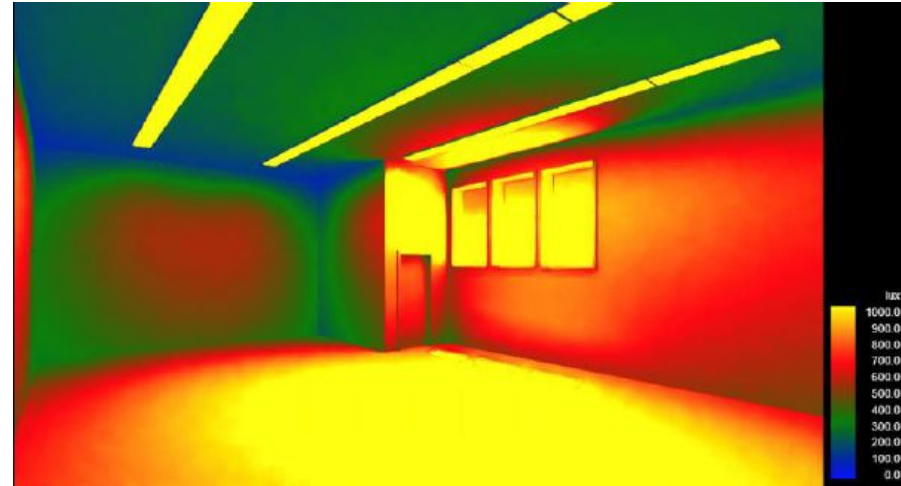
# Recommendations

- Install energy-efficient lighting fixtures.
- Install lighting controls and occupancy sensors
- Replace incandescent lighting with LED or CFL bulbs.
- Rely on daylight for interior illumination.
  - eg: light shelves
- Use metal halide or sodium discharge lamps for outside areas.

# Photometric Analysis

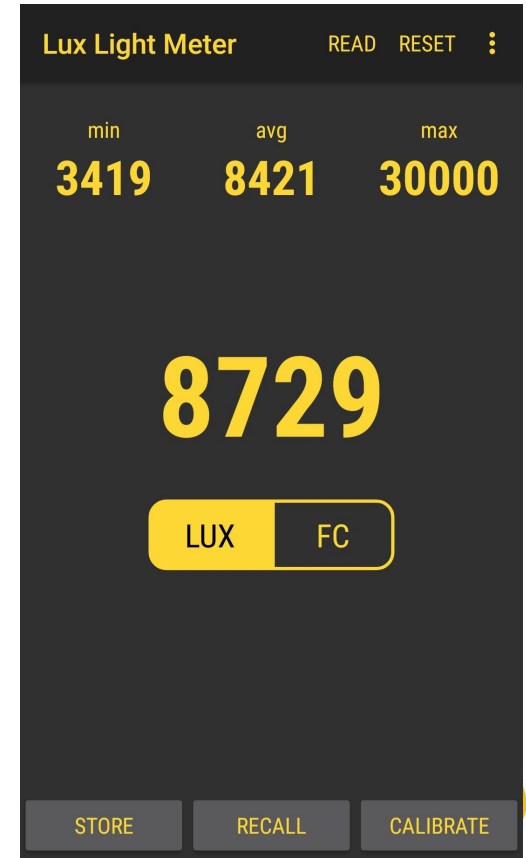
Revit allows you to model the rooms using daylight conditions, existing conditions, and with new retrofits.

- check where to place lighting retrofits to ensure uniformity of light and elimination of glare and other localized effects



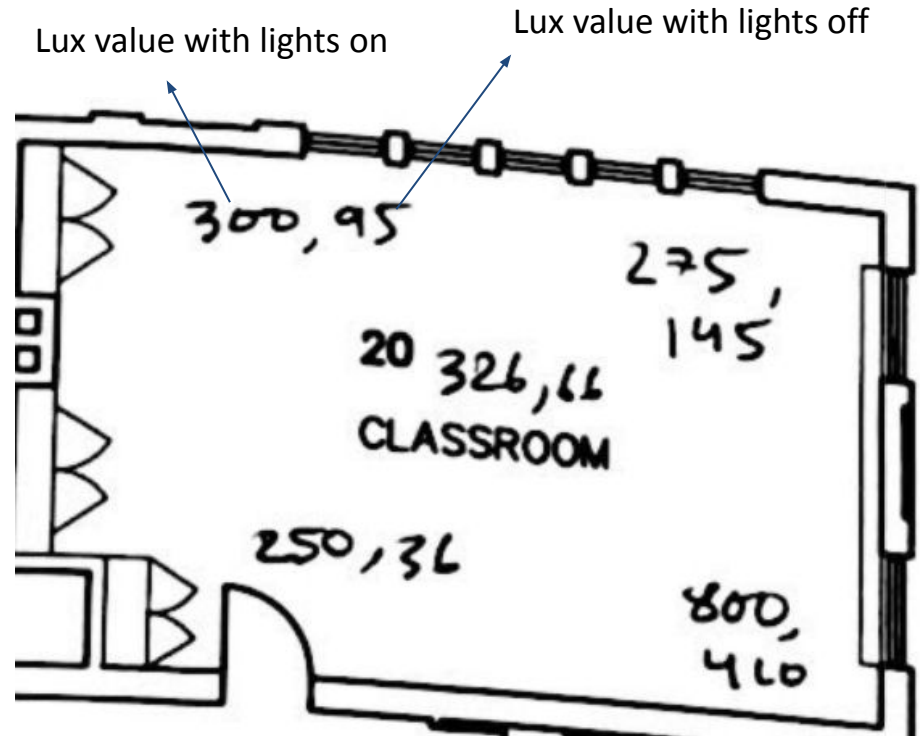
# Activity: Is your room bright enough?

Download the Lux Light Meter App!



# Activity!

- Hold your phone facing the screen towards the ceiling
- Take two lux measurements with
  - lights turned on
  - lights turned off
- Repeat at all 4 corners and in the centre



# Activity!

- Calculate the average lux of lights on condition and lights off condition
- Compare to the table on the side

Does your room meet lighting standards?

Kitchen	General	300 lux
	Countertop	750 lux
Bedroom (adult)	General	100–300 lux
	Task	500 lux
Bedroom (child)	General	500 lux
	Task	800 lux
Bathroom	General	300 lux
	Shave/makeup	300–700 lux
Living room/den	General	300 lux
	Task	500 lux

# Questions?





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# THANK YOU

## for Coming to our Workshop!

**Remember to...**

Sign Up for our [Newsletter!](#)

Check Out our Website: [www.cecAUoft.com](http://www.cecAUoft.com)

**Follow us on our Social Media Accounts!**

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**Contact us!**

Email: [cecAUoft@skule.ca](mailto:cecAUoft@skule.ca)