



## A path to high performance Fenestration system



Sustainable Façade Conference  
Yash Shukla, New Delhi, February 16, 2016

### Context : Glass Façade

- Element connecting indoors with outdoors
- Aesthetic expression and identity to building

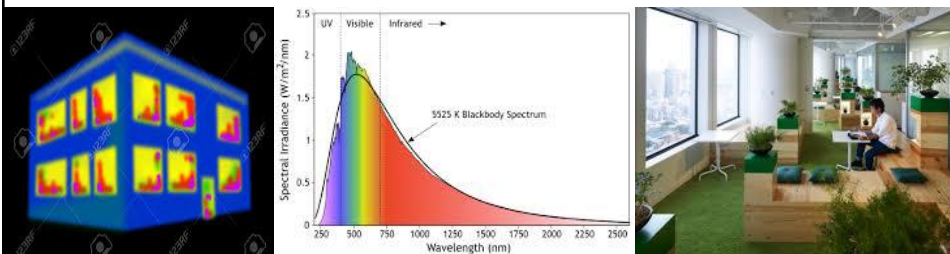
**“Aesthetic matters are fundamental for harmonious development  
of both society and the individual” – Friedrich Schiller**



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 2/25

## Context : Fenestration

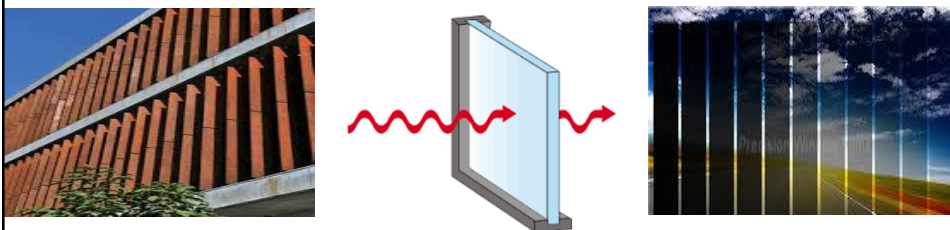
- Heat gain through Façade add to cooling load in hot climates
- Visible Light Transmission help conduct activities inside building



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 3/25

## Parameters to understand Façade performance

- Reduction in heat through conduction – U Value
- Reduction in direct solar gains – Shading & SHGC
- Increase availability of visual light – daylight, VLT



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 4/25

## Optical Characterization

- Measurement of Glass properties in solar spectrum
- Optically characterized more than hundred glass from Indian market
- Glazing database is available on website



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 5/25

## Early Design Tool – COMFEN India

- Indian Climates with Indian Glass Database
- In-built Life-cycle Cost Analysis (LCCA)
- Integration with Radiance for Visualization



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 6/25

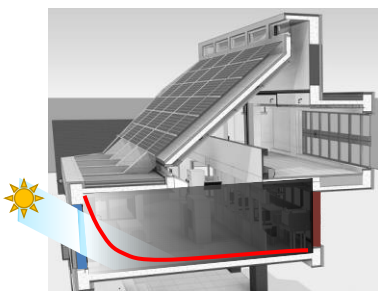
## Façade in Indian Context : Challenges

- Deep floor plan office does not allow daylight to penetrate deep inside.
- Evaluation of impact of shading on façade.

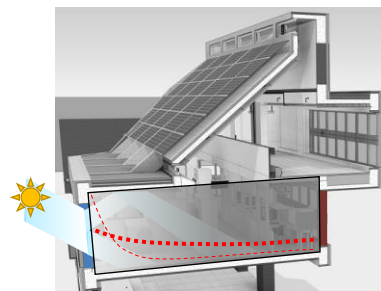


Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 7/25

## Effectiveness of Laser Cut Panels



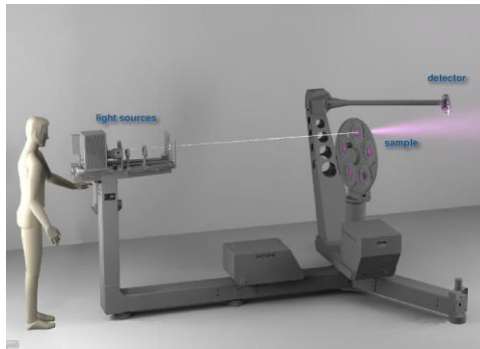
Building with normal glass



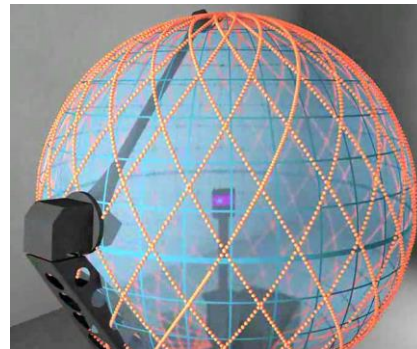
Building with LCP

Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 8/25

# Measurements of Laser Cut Panels



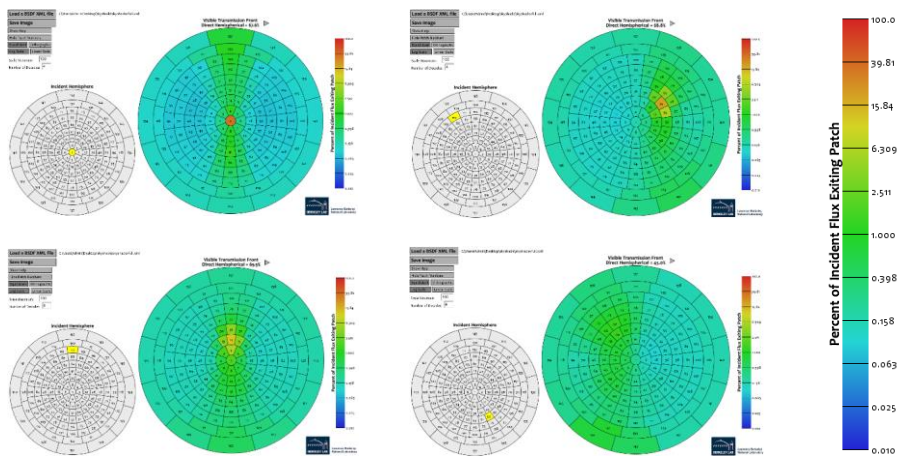
Gonio-Photometer II machine illustration



Initial patterning of measurement

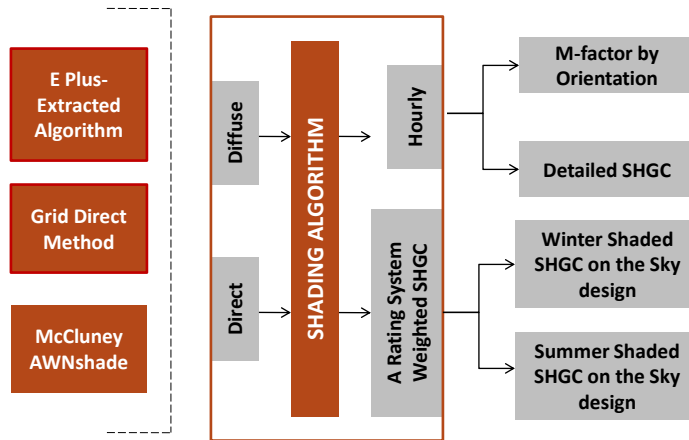
Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 9/25

# Measurements of Laser Cut Panels Use in RADINACE & ENERGYPLUS



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 10/25

# Impact of Shading on Façade Adjusted Solar Heat Gain Coefficient



Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 11/25

# Impact of Shading on Façade Adjusted Solar Heat Gain Coefficient

Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 12/25

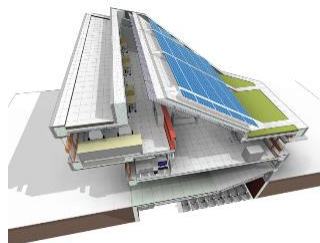
# Centre for Advanced Research in Building Science and Energy at CEPT University



**Design Assistance  
Facilities  
DESIGN**



**State of the Art  
Testing facilities  
CONSTRUCTION**



**NZEB  
M&V  
OPERATION**

Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 13/25

# THANK YOU

[yash.shukla@cept.ac.in](mailto:yash.shukla@cept.ac.in)

Yash Shukla, Sustainable Façade Conference, New Delhi, February 16, 2016 14/25