

# Window Labelling Program for India

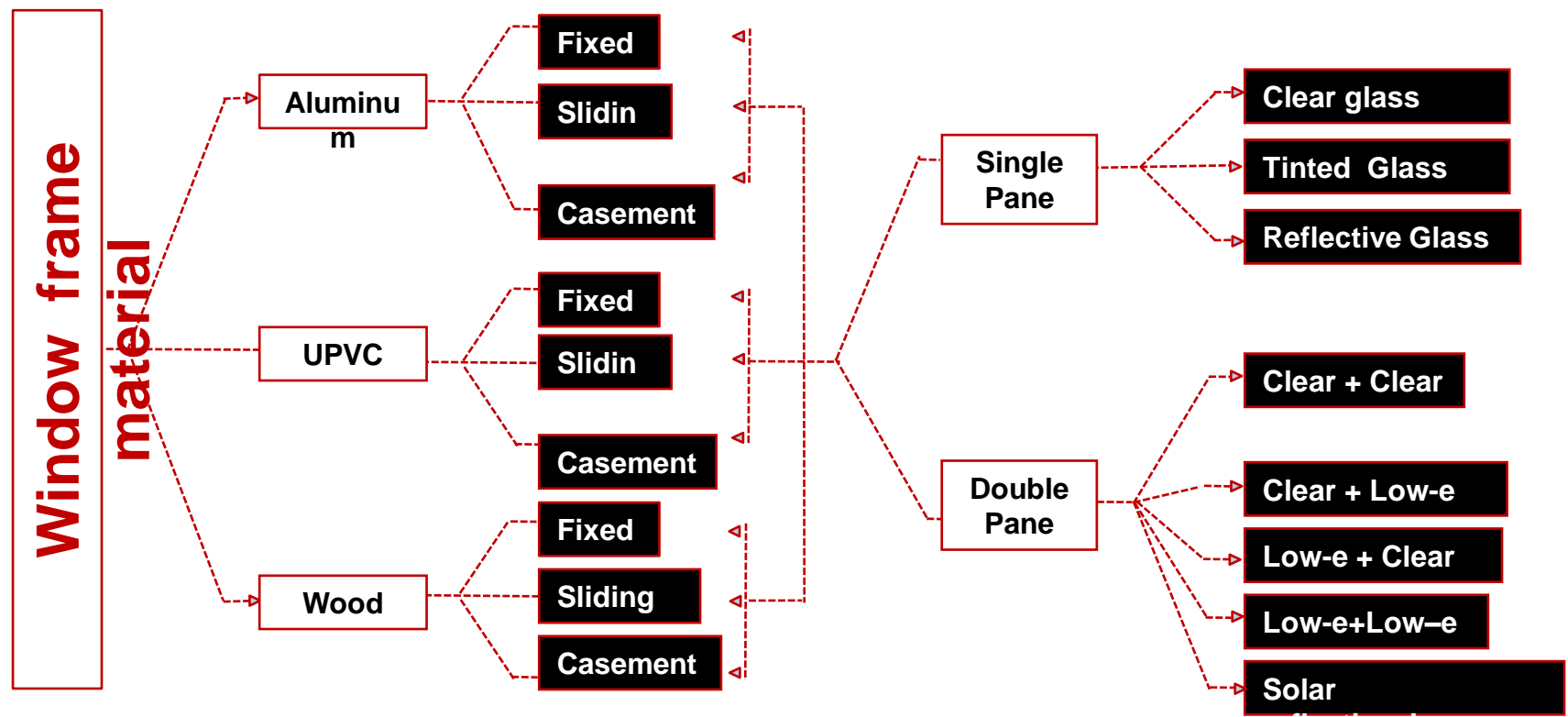
Stakeholder consultation meeting : September 9, 2014, New Delhi



# How Close or Far are we presently from ECBC Windows?



# Run Chart



# Environmental Conditions

## Standard used

### U- Factor Calculation

- Interior Temperature
- Exterior Temperature
- Exterior Wind Velocity
- Radiant mean temperature exterior
- Radiant mean temperature interior

### Solar heat gain Calculation

- Interior Temperature
- Exterior Temperature
- Exterior Wind Velocity
- Radiant mean temperature exterior
- Radiant mean temperature interior
- Incident solar flux
- Solar Spectrum

## ISO 15099

24 °C (75.2 °F)

32 °C (89.6 °F)

3.3 m/s (7.5 mph)

$T_{r,m} = T_{\text{exterior}}$

$T_{r,m} = T_{\text{interior}}$

24 °C (75.2 °F)

32 °C (89.6 °F)

2.8 m/s (6.3 mph)

$T_{r,m} = T_{\text{exterior}}$

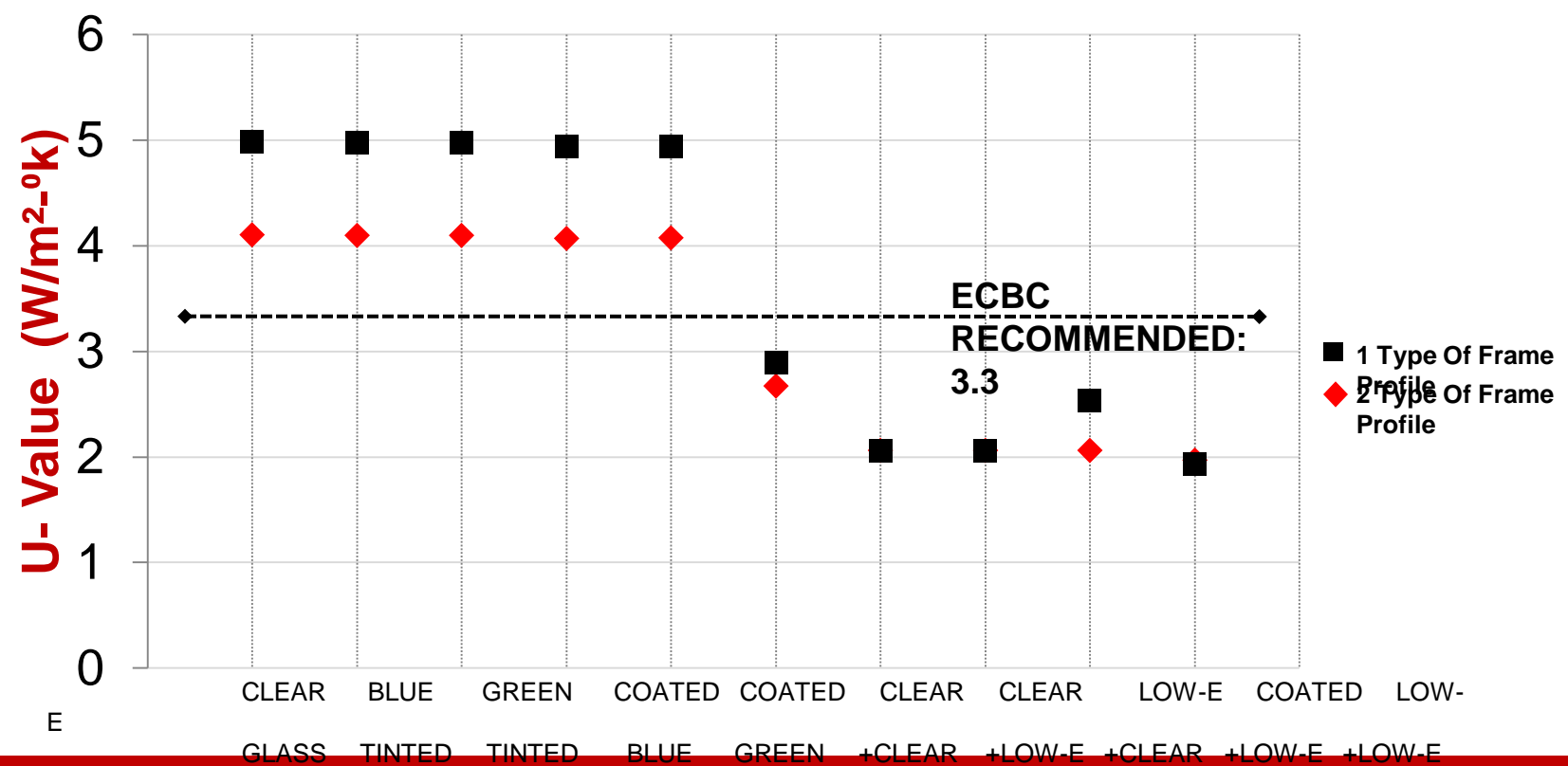
$T_{r,m} = T_{\text{interior}}$

783 W/m<sup>2</sup> (248 btu/hr-ft<sup>2</sup>)

ISO 9050/ 9845

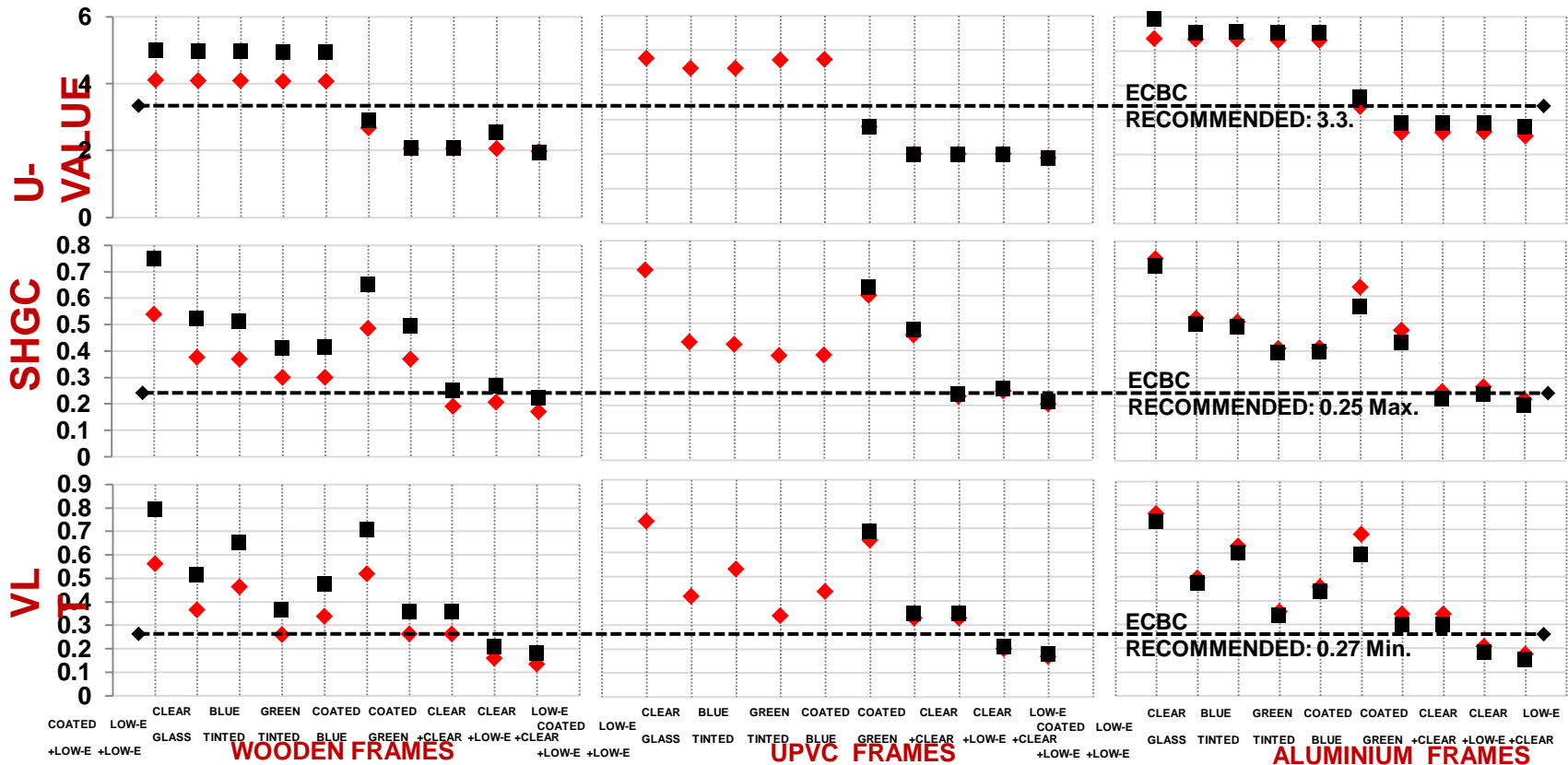


## Two Types of Wooden Fixed Frame Profile - Plotted for Different Glass Types



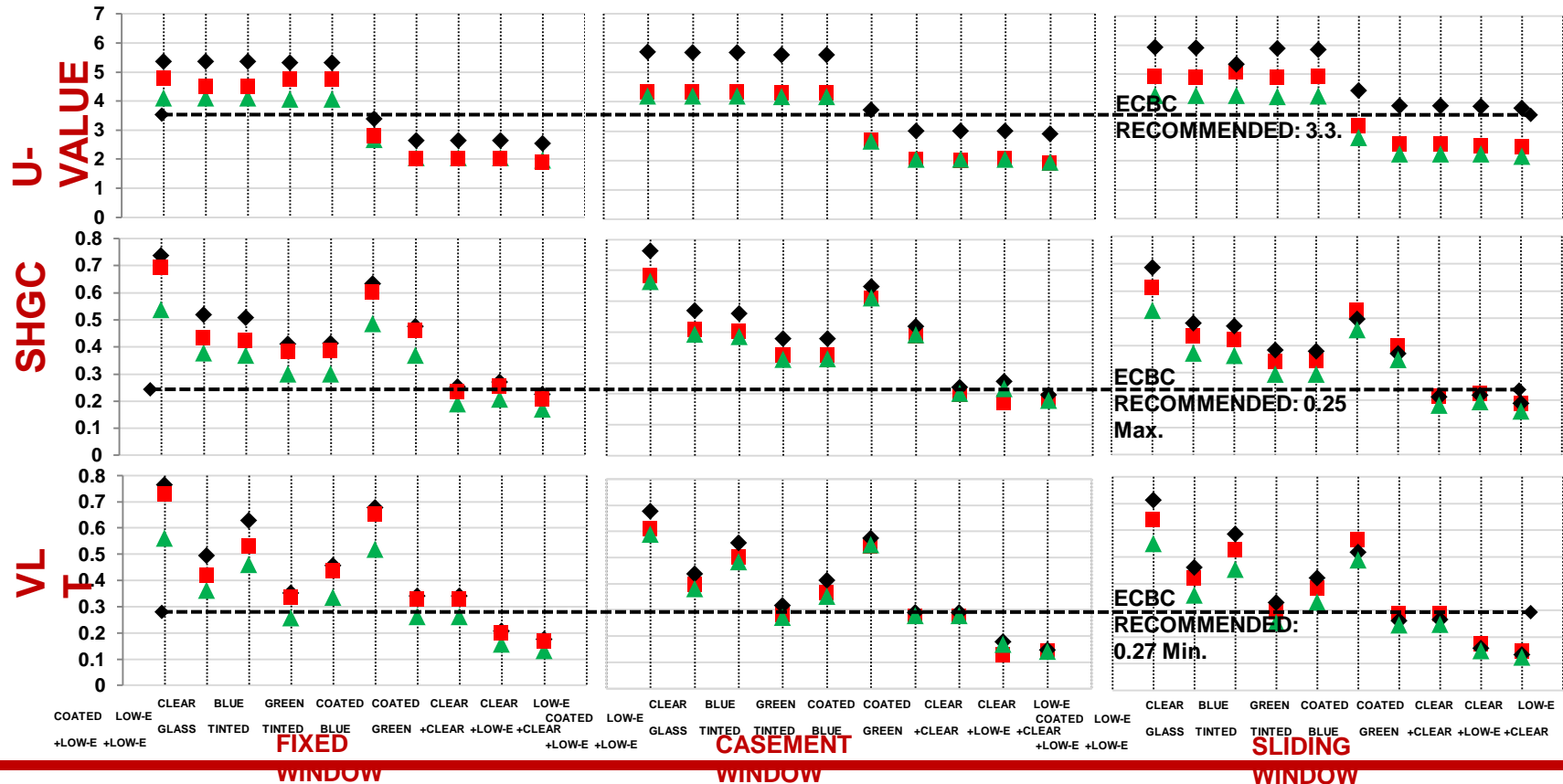
# Material of Window Frame – Fixed Windows

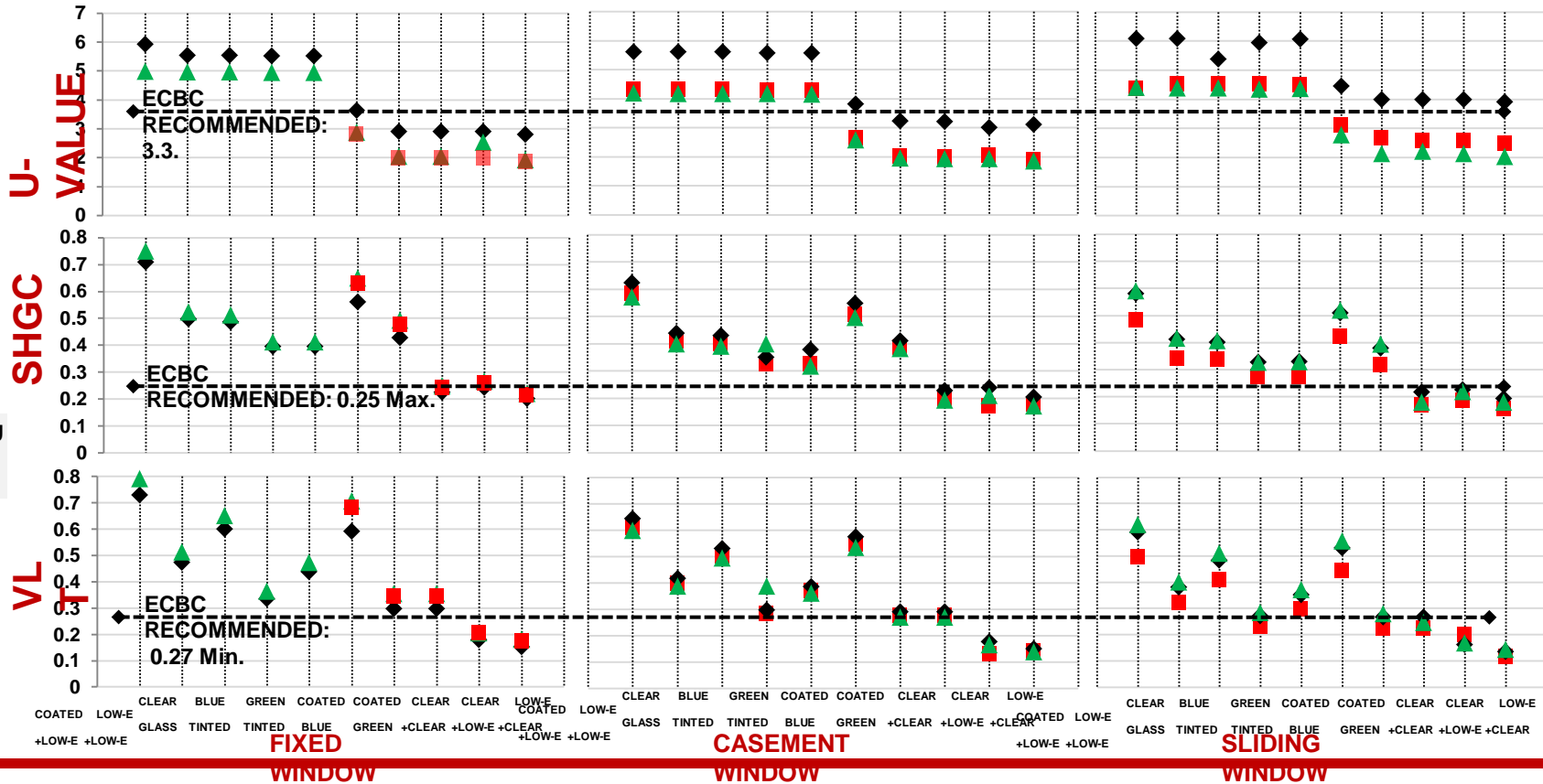
# Observations



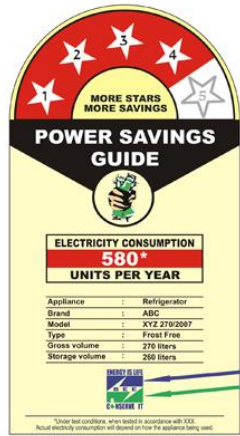
# Type of Window Frame – For Varying Materials – Frame Profile 1

# Observations









## • STAR Label

- Degree of performance
- Three variables – U value – SHGC – VLT
- Reference Commercial / Residential Building

## • Endorsement Label

- Label shows compliance
- Single Label communicates intent
- Tries to capture large market
- First generation building component label



**How do we convince market?**  
**How do we form policy?**  
**How much will we save?**

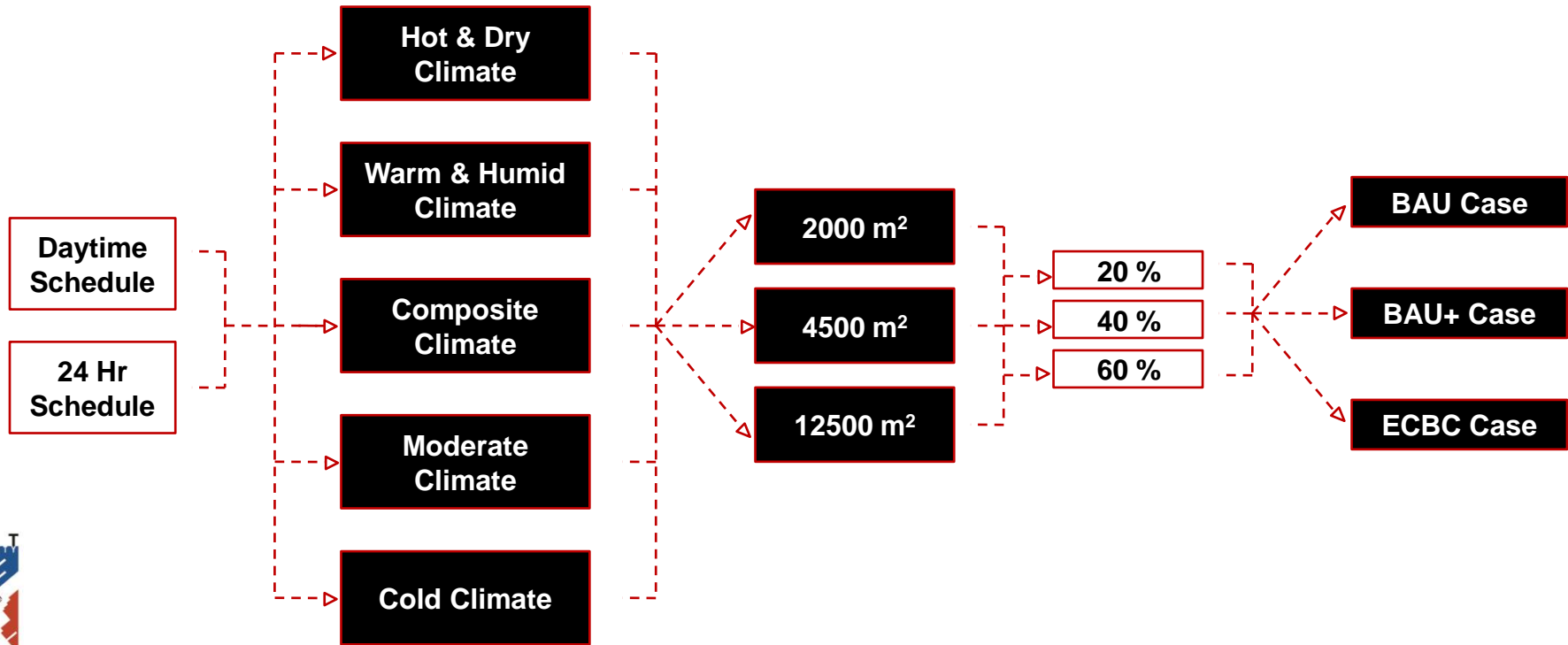


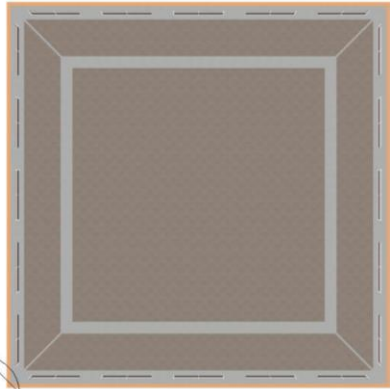
# Scenario: Energy Saving

Cases	BAU	BAU+	ECBC
Window Type	BAU	ECBC Compliant	ECBC Compliant
Other Envelope & System Type	BAU	BAU	ECBC Compliant

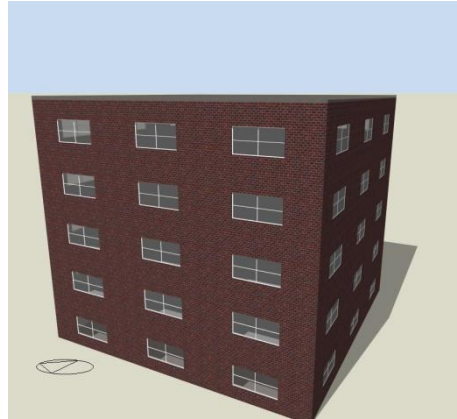
BAU – Business as usual, ECBC – Energy Conservation Building Code

# Run Chart

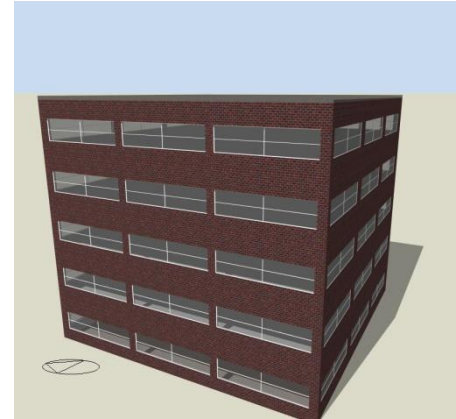




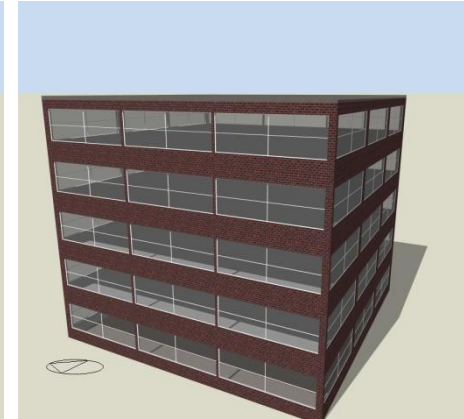
Plan



20% WWR



40% WWR



60% WWR



# Envelope Properties

Window Glazing measures				
Type	WWR	U-Factor	SHGC	VLT
BAU	20%	5.8	0.82	0.8
BAU	40%	5.8	0.82	0.8
BAU	60%	5.8	0.82	0.8
ECBC (CP, HD, WH)	20%	3.3	0.25	0.27
ECBC (CP, HD, WH)	40%	3.3	0.25	0.2
ECBC (CP, HD, WH)	60%	3.3	0.2	0.13
ECBC (Moderate)	20%	6.9	0.4	0.27
ECBC (Moderate)	40%	6.9	0.4	0.2
ECBC (Moderate)	60%	6.9	0.3	0.13
ECBC (Cold)	20%	3.3	0.51	0.27
ECBC (Cold)	40%	3.3	0.51	0.2



# Envelope Properties

<b>Opaque Construction Measures</b>				
	<b>Daytime Schedule</b>		<b>24 Hr Schedule</b>	
<b>Type</b>	<b>Maximum Wall U-Value</b>	<b>Maximum Roof U-Value</b>	<b>Maximum Wall U-Value</b>	<b>Maximum Roof U-Value</b>
<b>BAU</b>	1.99	2.98	1.99	2.98
<b>ECBC (HD,WH,CP)</b>	0.44	0.409	0.44	0.261
<b>ECBC (Moderate)</b>	0.44	0.409	0.44	0.409
<b>ECBC (Cold)</b>	0.352	0.409	0.369	0.261

Geometry type – Five Zone Square Building

# Model Data for Simulation

No. of Floors – 5

Floor Height – 3m

## BEE ECONIRMMAN Simulation Tool for ECBC

### Compliance

Input Parameters	ECBC	BAU
LPD	10.8	13.99
EPD	12.9	12.9
OD	9.3 sqm/person	9.3 sqm/person
Cooling COP	2.6	2.05
Infiltration	0.1 ach	0.25 ach
Cooling Setpoint	24 C	24 C
Heating Setpoint	18 C	18 C
Daylight Control	Yes	No





# Model Data for Simulation

- **Life Cycle Cost**

- Life-cycle cost analysis (LCCA) is a method for assessing the total cost of facility ownership. It takes into account all costs of acquiring, owning, and disposing of a building or building system

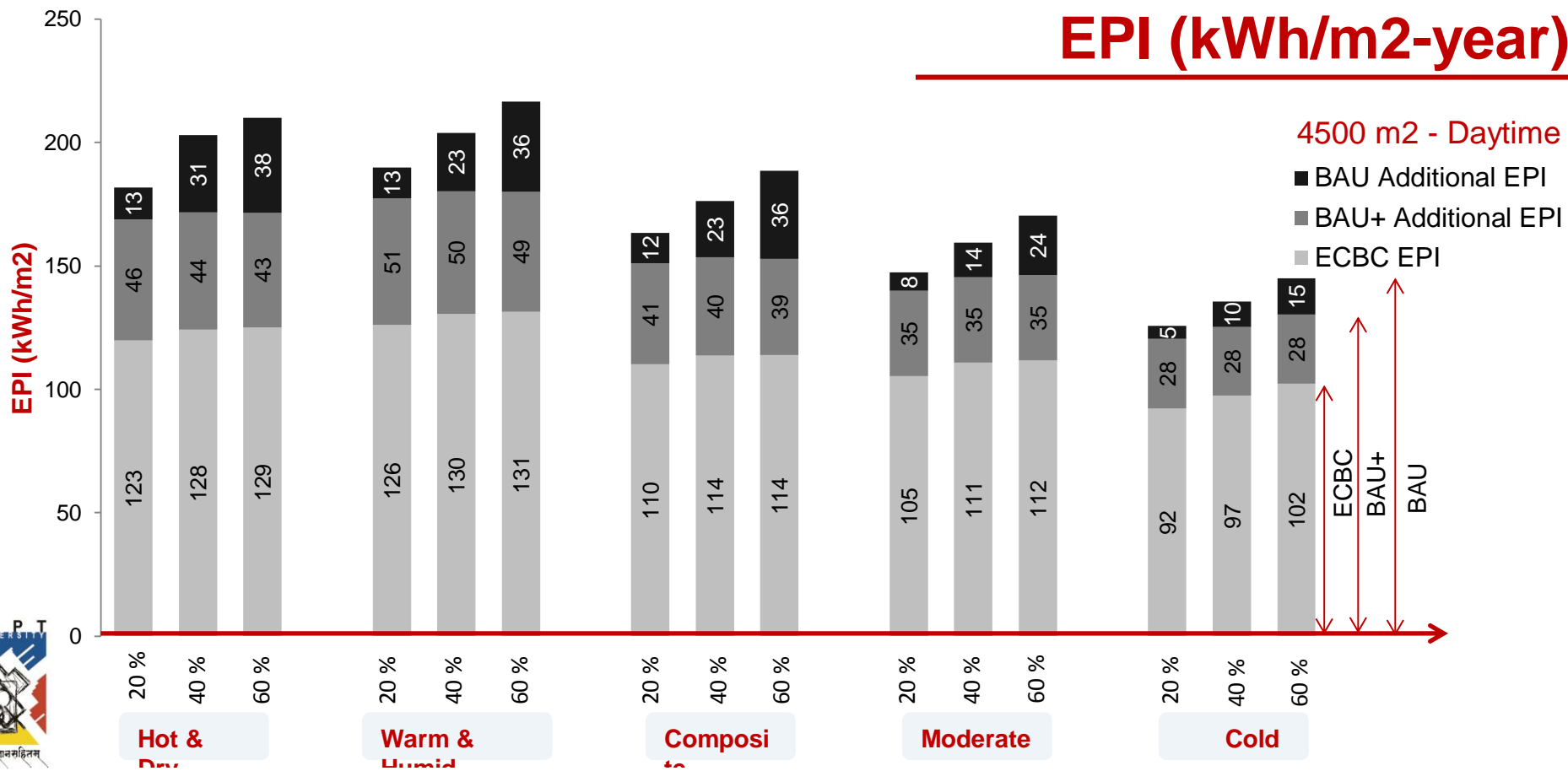
- **Pay Back Period**

- Pay Back period is the period of time required for the return on an investment to "repay" the sum of the original investment

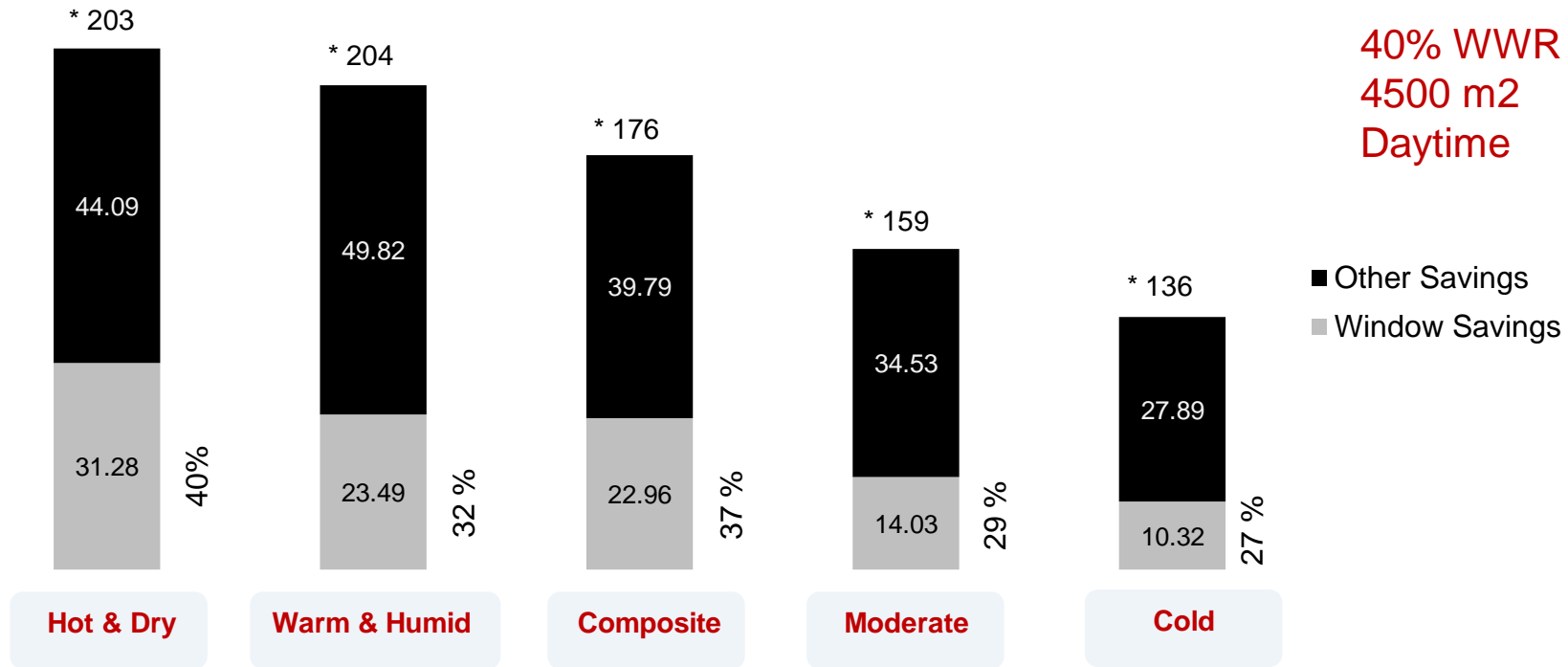
**CPWD Schedule of Rate for May 2012 used for BAU cases  
SSEF funded SoR revision document by TERI  
Market Survey**



# EPI (kWh/m<sup>2</sup>-year)



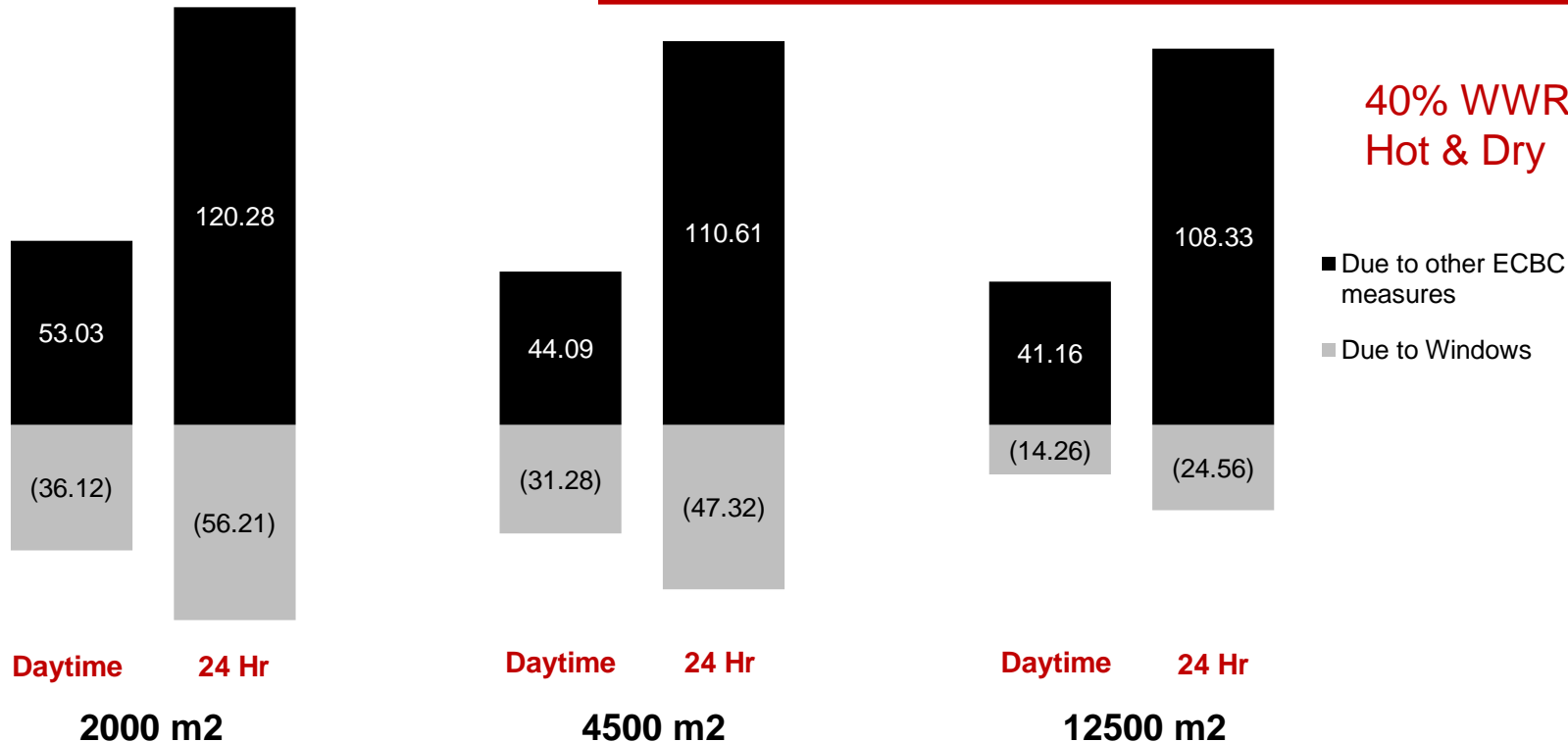
# EPI Savings (kWh/m2-year)



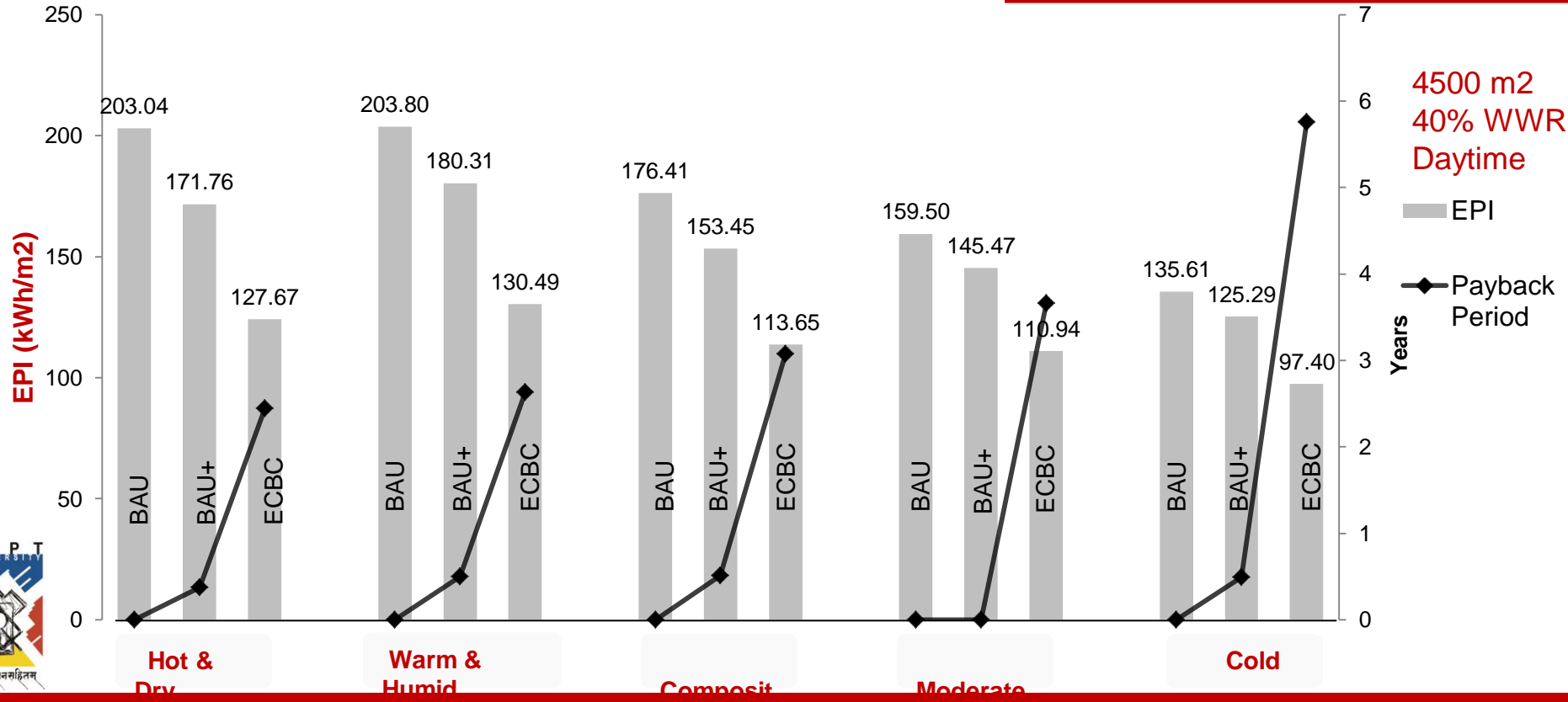
\* BAU EPI



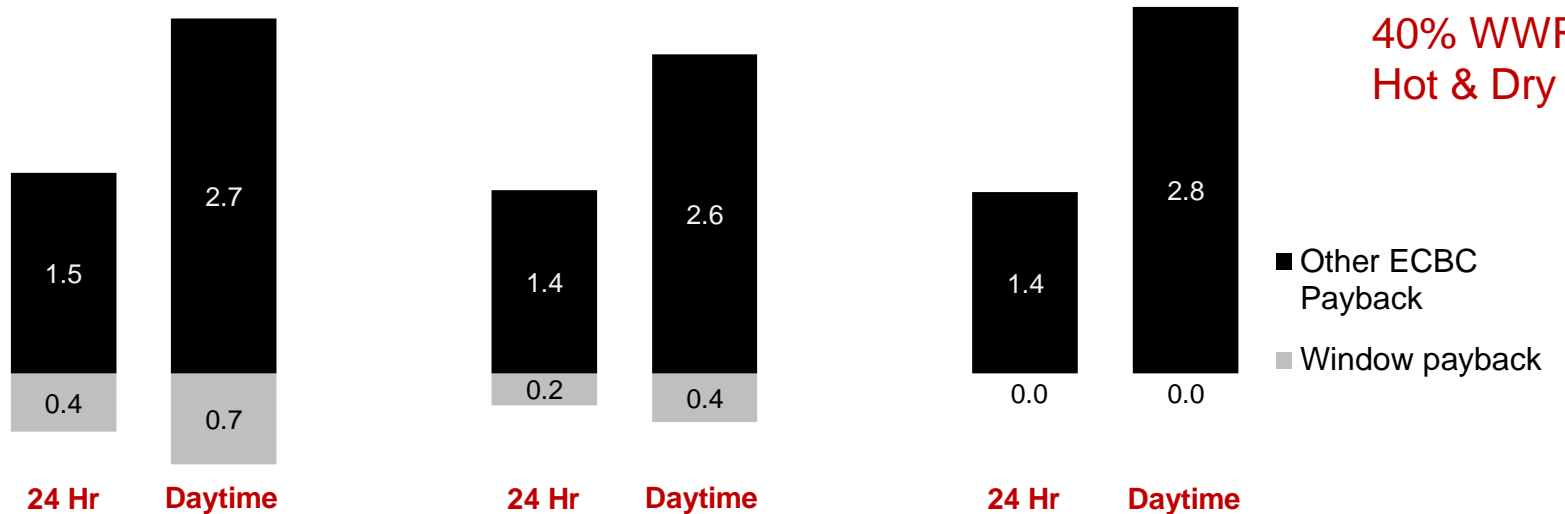
# EPI Savings (kWh/m<sup>2</sup>)



# EPI & Payback



# Payback (Years)



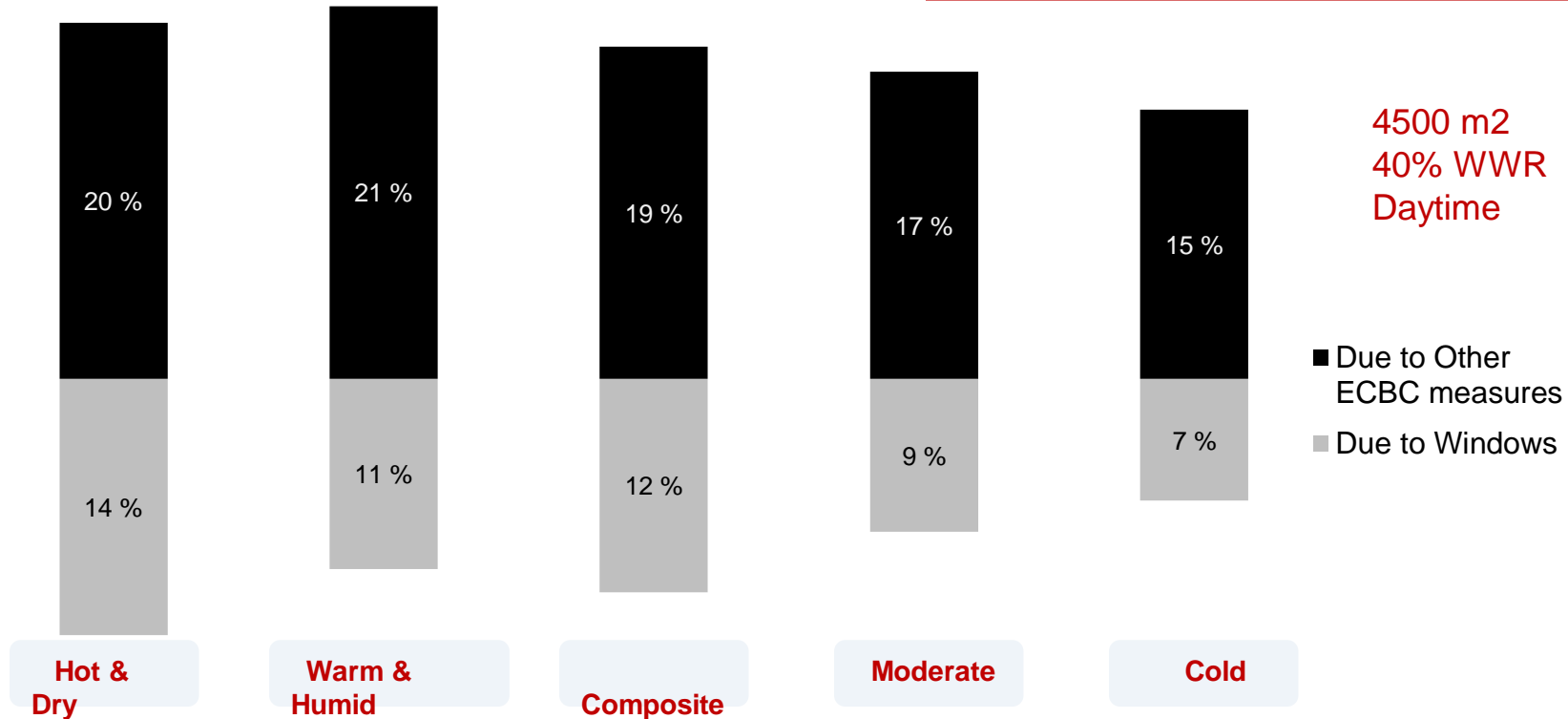
2000 m<sup>2</sup>

4500 m<sup>2</sup>

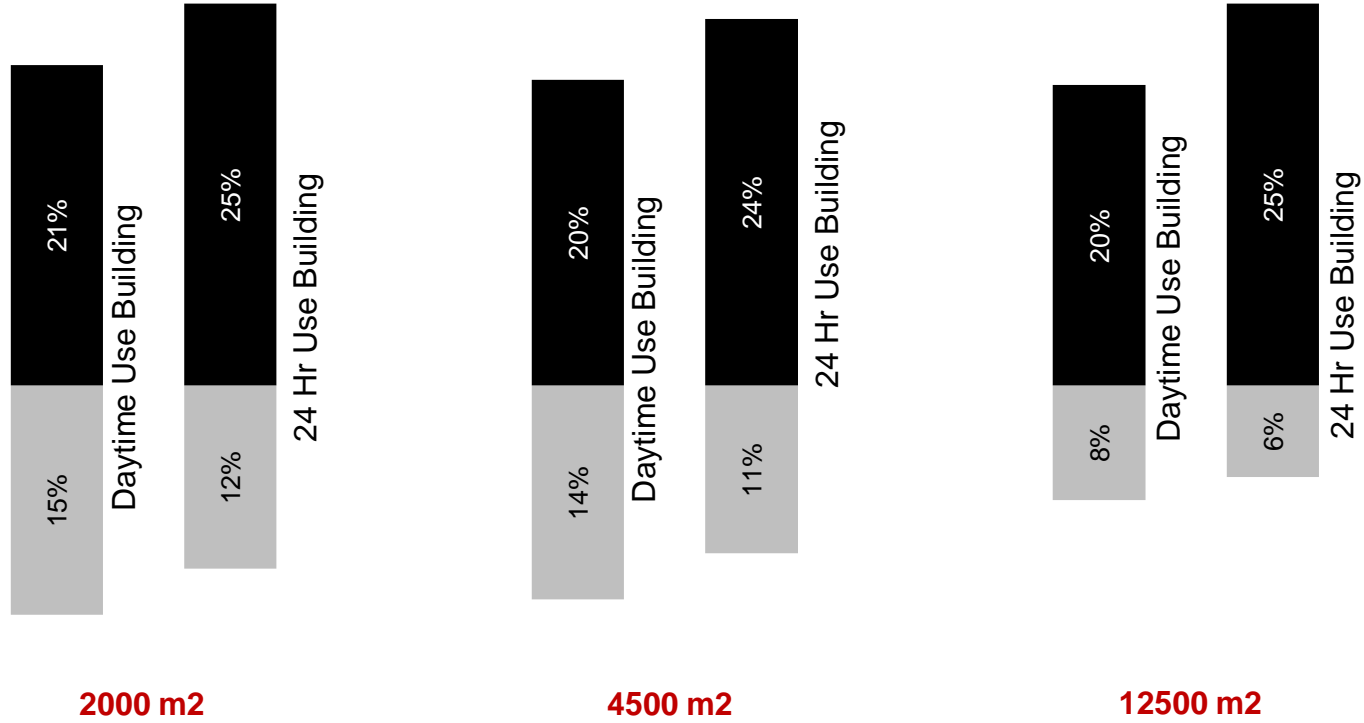
12500 m<sup>2</sup>



# LCC Savings



# LCC Savings



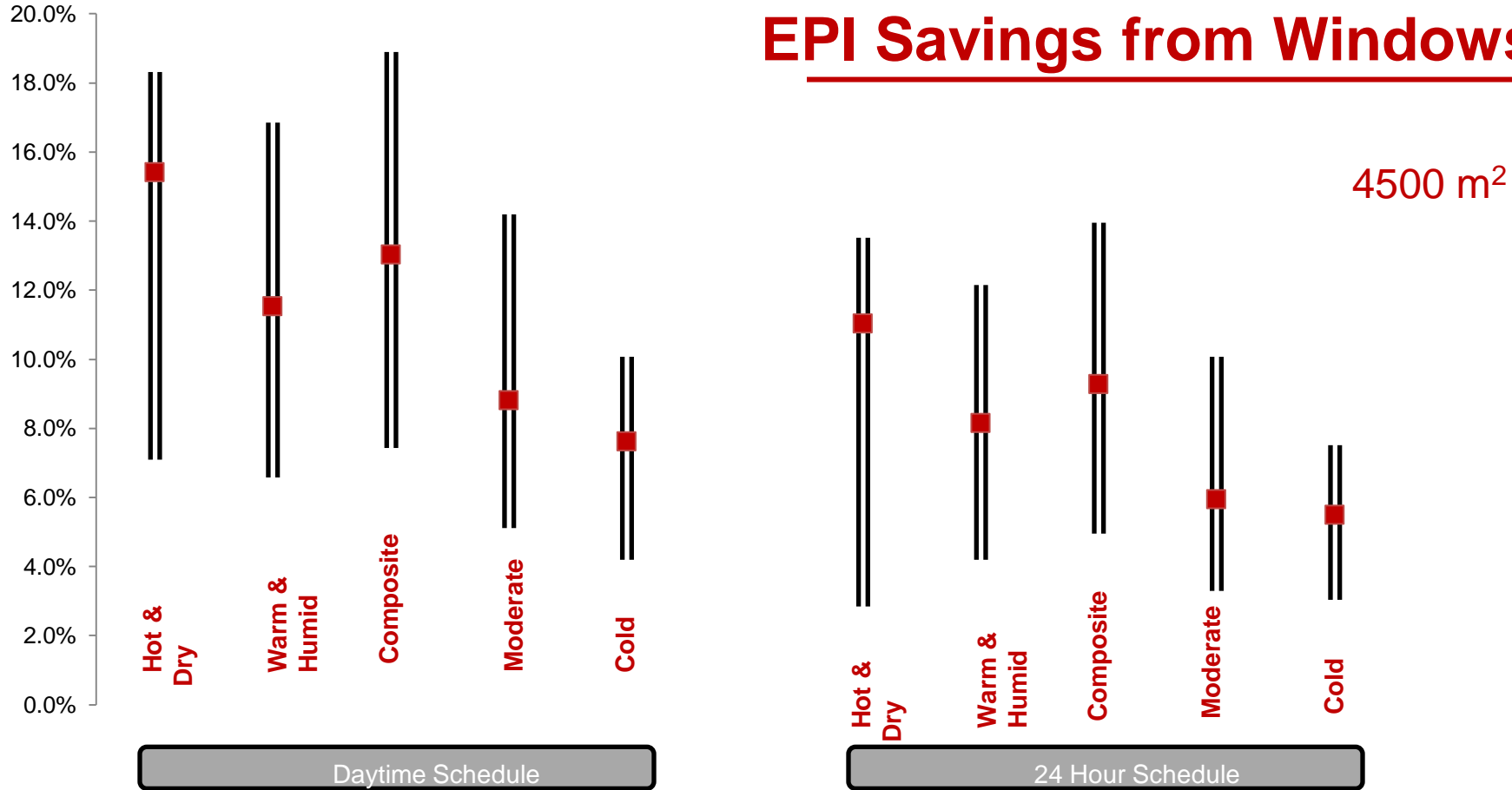
40% WWR  
Hot & Dry

■ Due to other  
ECBC  
measures



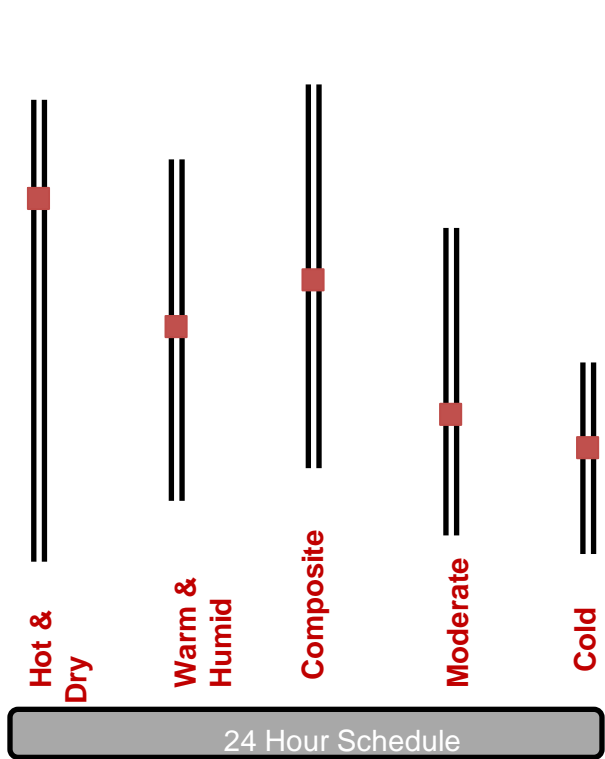
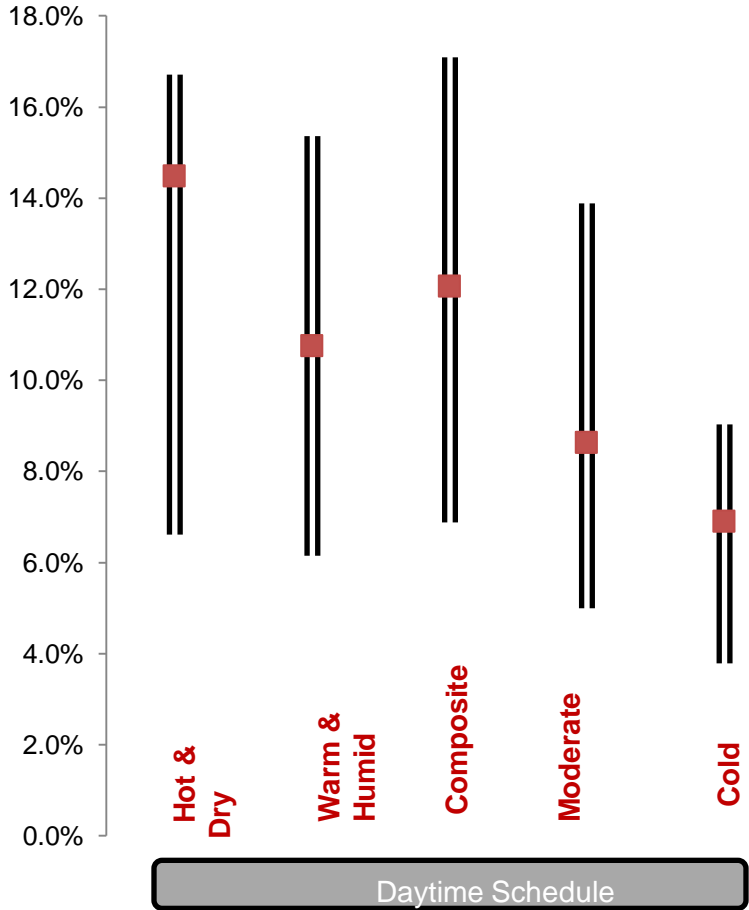


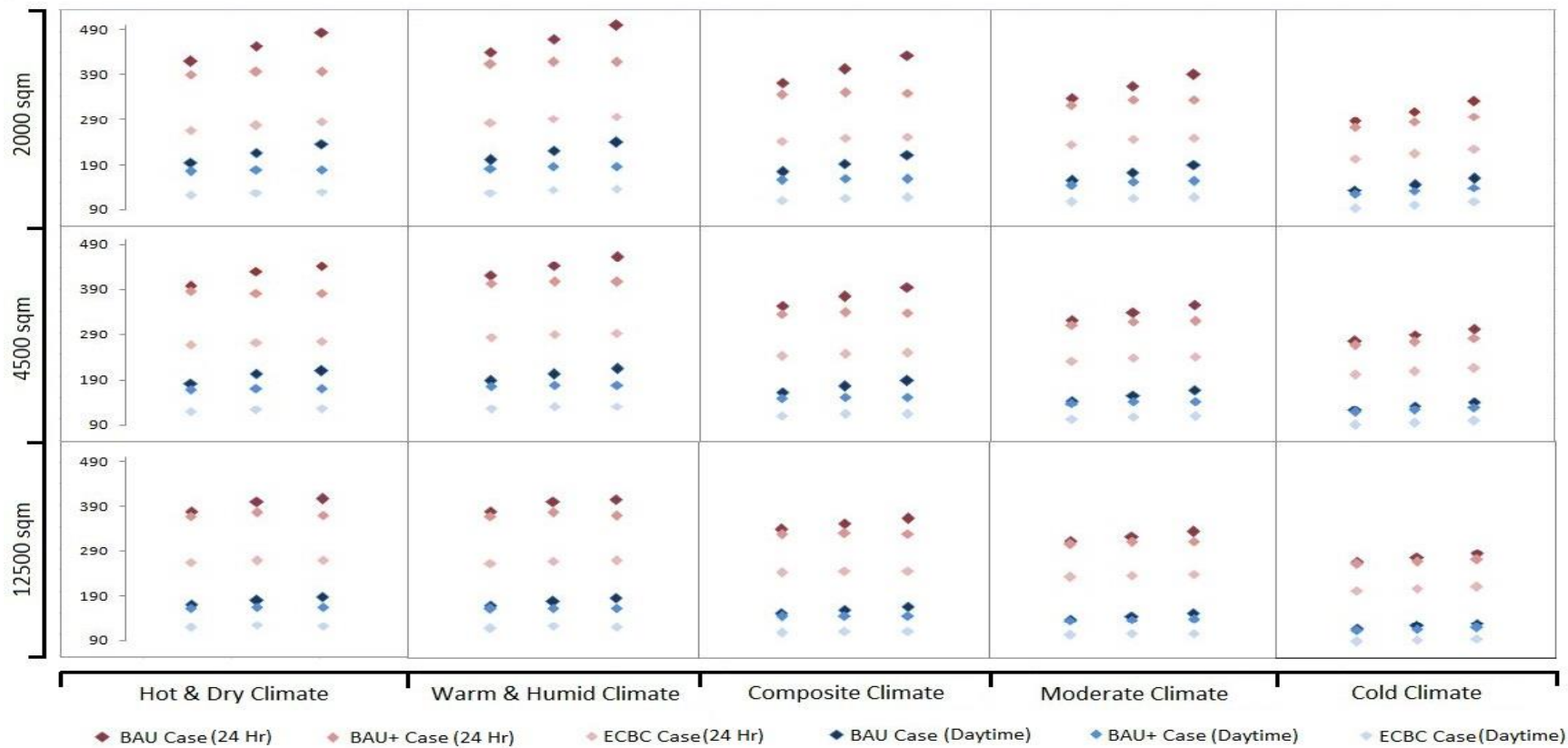
# EPI Savings from Windows



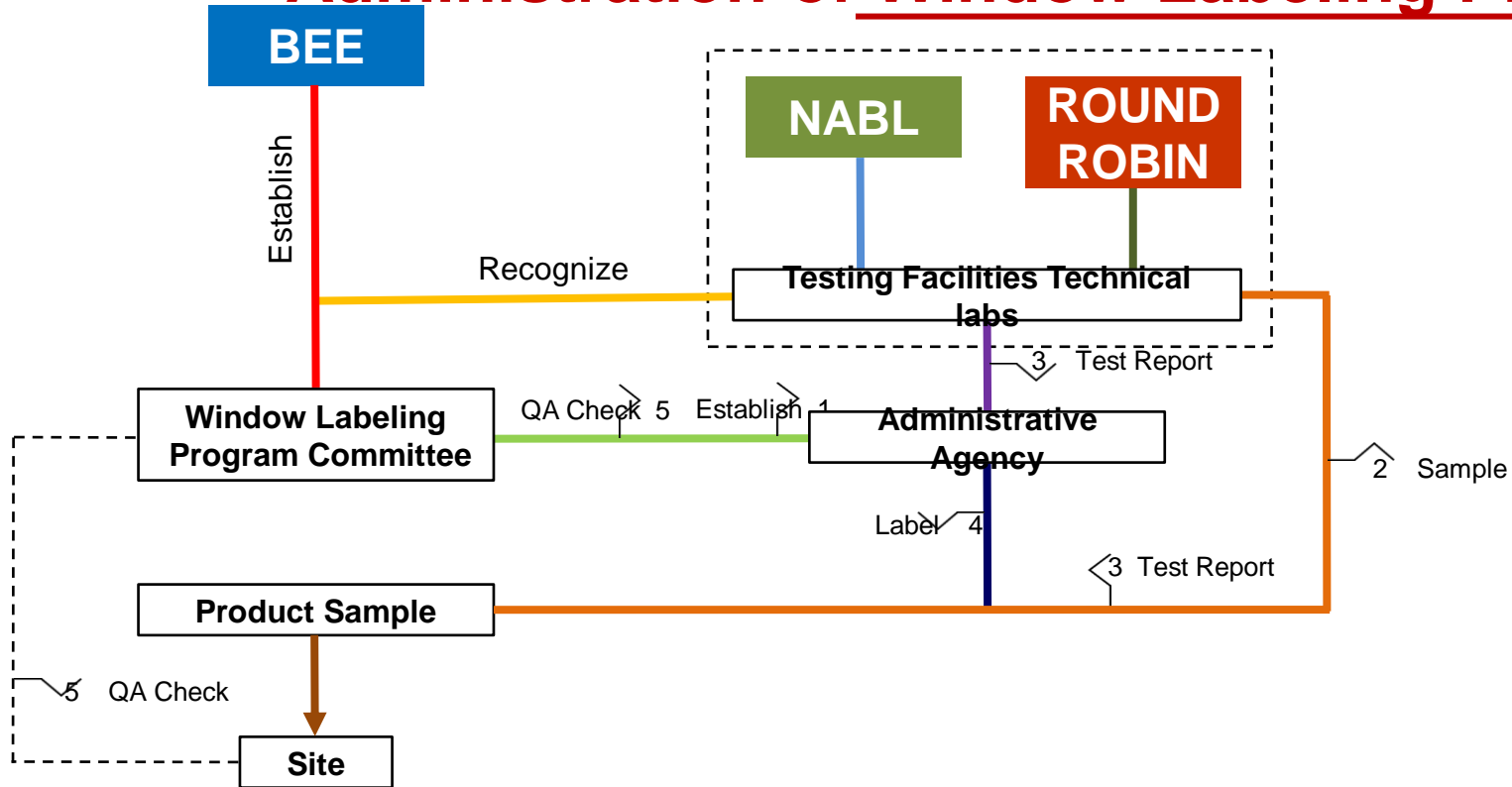
# LCC Savings from Windows

4500 m<sup>2</sup>





# Administration of Window Labeling Program



# Infrastructure for Window Labeling Program

- **Laboratory Facilities**

- Spectrophotometer with FTIR
- Simulation capabilities
- Guarded Hot Box Solar Calorimeter

- **Site test tools**

- Thermography Camera.
- Equipment for measurements such as calipers and tape measure
- Equipment to measure IG-Unit glass thickness and gap width.
- Equipment to verify the presence of Low-E and placement of the coating in an IG unit, e.g., Emissometer (capable of determining the surface of low emissivity coatings)



# Simultaneous research program to facilitate policy formation

- Adoption of Standards – Environmental Conditions
- Data base for product available in India – Portal
- Online tools for selection of fenestration
- Affordable test facilities – Innovation in test equipment
- Sky Models – Radiation data base



**Thank You**