



ECBC Implementation Experience-A CASE STUDY



Presented By:-

**ECBC CELL
UPNEDA,LUCKNOW**

First Energy Efficient Office Building in Uttar Pradesh

Project :	UPERC Office Building, Lucknow
Location :	Vibhuti Khand, Gomti Nagar, Lucknow
Total Project Area :	5288 sqm
Number of buildings and designation:	Single building
Type of building :	Office Building
Climate :	Composite
Occupancy	5 Days a week, Daytime occupancy

SELECTION OF FIRST DEMO BUILDING



- Selection of the government building.
- Govt Building was selected to show-case implementation of ECBC parameters.
- It was aimed to set an example for the private sector to make ECBC compliant buildings on larger scales.
- UPNEDA after getting designated as SDA in UP, identified govt buildings to be constructed.
- Among the identified govt buildings Chairman UPERC took interest to construct their office building ECBC compliant.
- He was motivated by explaining the benefits of ECBC compliant building in terms of energy saving, financial viability and payback period.
- UPERC just started construction of its office building during July 2015.



CONTD...

- It was a hard task to motivate the construction agency of the UPERC building.
- UPRNN the construction agency was not ready to accept the new applications, to use new type of building material.
- Series of meetings were organized with consultants working in the field of Energy Efficiency and with manufacturers of Energy Efficient materials
- It was a major task to explain the techniques used in ECBC compliant building and how to implement it.
- The materials used in the building were also new to UPRNN, so it was demonstrated.
- Coordinating between the building owner UPERC and the construction agency UPRNN was also a major task while implementing ECBC.
- It was made possible with active support of UNDP-GEF-BEE.

CASE STUDY-UPERC BUILDING



- The alternative that captures the “standard” design or minimum requirements for a project is called the “**Base Case.**”
- Based on the energy consumption, annual Energy Performance Index (EPI) calculated for base case and for each options in kWh/m²/year.
- The Base Case EPI- **123.2 kWh/m²/year** (based on an area of 5288 sqm).
- The EPI for Option1- **86.67 kWh/m²/year**
- The EPI for Option2-**100.75 kWh/m²/year**
- The EPI for Option3-**109.5 kWh/m²/year**
- EPI of Option1, Option 2 and Option 3 after considering the energy generated from SPV are equal to **67.7 kWh/m²/year**, 81.9 kWh/m²/year and 90.7 kWh/m²/year respectively.

EPI COMPARISION

With and without SPV Plant

EPI (kWh/m2/year)	Base Case kWh/m2/year	OPTION 1 kWh/m2/year	OPTION 2 kWh/m2/year	OPTION 3 kWh/m2/year
Without SPV Plant	123.2	86.67	100.75	109.5
With SPV Plant	123.2	67.7	81.9	90.7

U-VALUE OF COMPONENTS



Component	Option 1	Option 2	Option 3
Wall	<p>Wall Assembly detail:</p> <ol style="list-style-type: none"> 1. Outside plaster 15 mm 2. External AAC wall 200 mm 3. Inside Cement Plaster 12mm 4. XPS Insulation 50mm <p>Wall U Value: 0.305 W/m²K</p>	<p>Wall Assembly detail:</p> <ol style="list-style-type: none"> 1. Outside plaster 15 mm 2. External Fly brick wall 230 mm 3. XPS Insulation 100 mm 4. Inside plaster 12 mm <p>Wall U Value: 0.197 W/m²K</p>	<p>Wall Assembly detail:</p> <ol style="list-style-type: none"> 1. Outside plaster 15 mm 2. External Clay brick wall 230 mm + 100mm cavity + 230mm CLAY Brick Wall 3. Inside plaster 12 mm <p>Wall U Value: 0.221 W/m²K</p>
Roof	<p>Roof Assembly detail:</p> <ol style="list-style-type: none"> 1. RCC roof Slab 125 mm 2. PUF Insulation 50mm thick 3. Suitable water proofing membrane 4. Screed Plaster 40mm 5. Internal Ceiling Plaster <p>Roof U Value: 0.36 W/m²K</p>	<p>Landscaped terrace</p> <ol style="list-style-type: none"> 1. RCC Slab 2. PCC 75 mm 3. Water Proofing sheet 4. Gravel 100 mm 5. Geo fabric membrane 6. Sweet Soil <p>Roof U Value: 1.05 W/m²K</p>	<p>Roof Assembly detail:</p> <ol style="list-style-type: none"> 1. RCC roof Slab 2. PCC 40mm 3. Suitable water proofing membrane (negligible effect on thermal conductivity) 4. Tile 20mm <p>Roof U Value: 2.05 W/m²K</p>

Component	Option 1: As-is case	Option 2	Option 3
Wall	<ol style="list-style-type: none"> 1. Outside plaster 15 mm 2. External AAC wall 200 mm 3. Inside Cement Plaster 12mm 4. XPS Insulation 50 mm 	<ol style="list-style-type: none"> 1. Outside plaster 15 mm 2. External Fly Ash wall 230 mm 3. Inside plaster 12 mm 4. XPS Insulation 100 mm 	<ol style="list-style-type: none"> 1. Outside plaster 15 mm 2. External Clay Brick wall 230 mm + 100mm cavity +230 mm clay brick wall 3. Inside plaster 12 mm
Roof	<ol style="list-style-type: none"> 1. RCC roof Slab 125 mm 2. PUF Insulation 50mm thick 3. Suitable water proofing membrane 4. Screed Plaster 40mm 5. Internal Ceiling Plaster 6mm 	<p>Landscaped terrace</p> <ol style="list-style-type: none"> 1. RCC Slab 2. PCC 75 mm 3. Water Proofing sheet 4. Gravel 100 mm 5. Geo fabric membrane 6. Sweet Soil 	<ol style="list-style-type: none"> 1. RCC roof Slab 2. PCC 40mm (1:2:4) 3. 50mm screed 4. Tile 20mm
Glass	SKN 744II	Planitherm - Mint Green (PLT TG) Planilux	Envision 765II, Planilux (Clear Glass)
HVAC	VRV system for the entire building	Radiant cooling with Chilled Beams for the entire building	Chilled Water System
Lighting	All LED lights, Occupancy Sensors for Corridor & office area, Daylight Controls for regularly occupied day lighted area	All LED lights, Occupancy Sensors for Corridor & office area, Daylight Controls for regularly occupied day lighted area	All LED lights, Occupancy Sensors for Corridor & office area, Daylight Controls for regularly occupied day lighted area
Renewables	70 kW Solar Photovoltaic (About 713.6 sqm considered for installation of PV cells)	70 kW Solar Photovoltaic (About 713.6 sqm considered for installation of PV cells)	70 kW Solar Photovoltaic (About 713.6 sqm considered for installation of PV cells)
EPI	67.7 kWh/m2/year	81.9 kWh/m2/year	90.7 kWh/m2/year
Savings	51%	41.5%	35.1%

COST ANALYSIS



Component	Base Case	OPTION 1	OPTION 2	OPTION 3
WALL	<p><u>230mm Brick Wall</u> Volume = 640 cu m Rate = Rs 5667.55/ cu m Cost =Rs 36,27,232 [Ref : DSR 2014 6.4.1]</p>	<p>1.AAC Wall 200 mm 2.XPS Insulation 50 mm <u>AAC</u> Volume = 640 cu m Rate = Rs 6386.95/ cu m Cost =Rs 40,87,648 <u>XPS</u> Area = 2469.4 sqm Rate = 1056 sqm Cost = Rs 26,07,686.40</p>	<p>1.Fly Ash Wall 230 mm 2.XPS Insulation 50 mm <u>FLY ASH</u> Volume = 640 cu m Rate = Rs 6386.95 / cu m Cost =Rs 40,87,648 <u>XPS</u> Area = 2469.4 sqm Rate = 1056 sqm Cost =Rs 26,07,686.40</p>	<p><u>230mm Brick Wall + air gap + 230mm Brick Wall</u> Volume = 1280 cum Rate = Rs 11335.1/ cu m Cost =Rs 72,54,464 [Ref : DSR 2014 6.4.1]</p>
ROOF	<p>150 RCC Roof No insulation</p>	<p><u>PUF</u> Area = 713 sqm Rate = 907.36 Rs/sqm Cost =Rs 6,46,947.68 [Ref : Market Rates]</p>	<p>150 RCC Roof + Terrace garden No Insulation</p>	<p>150 RCC Roof + 20mm Tile Area = 2469.4 sqm Rate = 300 Rs/sqm Cost = Rs 7,40,820</p>
GLASS	<p><u>ET 150</u> Area = 375 sqm, Rate = 1300 Rs/sqm Cost = Rs 4,87,500</p>	<p><u>SKN 744II</u> Area = 375, sqm Rate = 3100 Rs/sqm Cost = Rs 11,62,500</p>	<p><u>PLT TG</u> Area = 375, sqm Rate = 2500 Rs/sqm Cost = Rs 9,37,500</p>	<p><u>ENVISION 765</u> Area = 375 sqm, Rate = 3100 Rs/sqm Cost = Rs 11,62,500</p>

COST ANALYSIS



HVAC	<u>Package type AC</u> Tonnage = 200 TR Rate = 32,000 Rs/TR Cost =Rs 64,00,000 [Ref : CPWD Plinth Area, E & M]	<u>VRV System</u> Tonnage = 200 TR Rate = 55,000 Rs/HP Cost = 1,35,74,000 Rs [Ref :CPWD Plinth Area, E & M]	<u>Radiant Cooling System</u> Tonnage = 200 TR Rate = 1,20,000 Rs/TR Cost = 2,40,00,000 Rs [Ref : CPWD Plinth Area, E & M]	<u>Chilled Water System</u> Tonnage = 200 TR Rate = 1,05,000 Rs/TR Cost = 2,10,00,000 Rs [Ref : CPWD Plinth Area, E & M]
Lighting Cost	18,56,000 Rs	30,44,600 Rs	30,44,600 Rs	30,44,600 Rs
Cost Of Occupancy Sensors	0	Rate = 4447 Rs/ Unit Cost = 25* 4447 = Rs 1,11,175 [Ref : DSR 2014]	Rate = 4447 Rs/ Unit Cost = 25* 4447 = Rs 1,11,175 [Ref : DSR 2014]	Rate = 4447 Rs/ Unit Cost = 25* 4447 =Rs 1,11,175 [Ref : DSR 2014]
Overall Energy consumption	956.25 x 10 ³ KWH/Yr (9,56,250 units)	557.02 x 10 ³ KWH/Yr (5,57,020 units)	594.7 x 10 ³ KWH/Yr (5,94,700 units)	620.3 x 10 ³ KWH/Yr (6,20,300 units)
Overall Cost	1,23,70,732 Rs	2,52,34,557 Rs	3,47,88,609.40 Rs	3,33,13,559 Rs
Extra Cost Incurred	0	1,28,63,825 Rs	2,24,17,877.40 Rs	2,09,42,827 Rs
Saving/annum	0	27,94,610 Rs	25,30,850 Rs	21,34,650 Rs

PAYBACK PERIOD

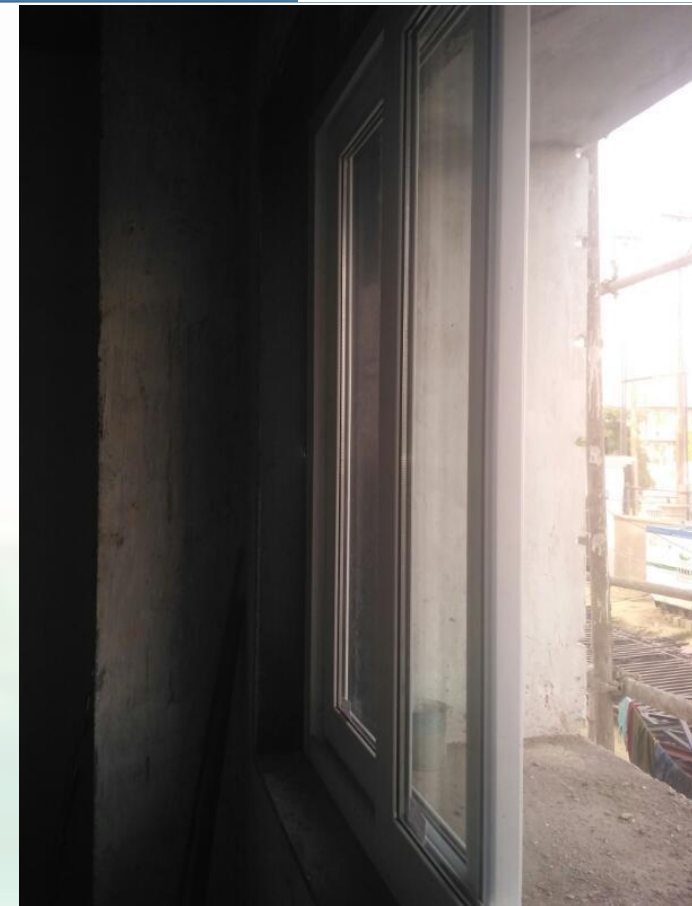


OPTIONS	Energy Savings (KWH/Yr)	Money on Electricity bill saved Each Yr (Rs)	Extra Cost Incurred (Rs)	Payback Time (Years)
Option 1	399.23 x 10 ³ (51%)	27,94,610	1,28,63,825	4.6
Option 2	361.55 x 10 ³ (41.5%)	25,30,850	2,24,17,877	8.8
Option 3	335.95 x 10 ³ (35.1%)	21,34,650	2,09,42,827	9.8

CONSTRUCTION STAGE AT WHICH PROJECT WAS SELECTED



CONSTRUCTION STAGE



PRESENT STAGE



CHALLENGES IN IMPLEMENTATION OF ECBC

- Cost of the ECBC-compliant building is little higher, so financial justification of incremental cost is sometimes difficult to convince the owner of building.
- Due to involvement of various agencies, takes more time in implementation.
- Inadequate professionals and trained manpower in sector also Lack of knowledge about simulation softwares.
- Non-availability of demonstrated case studies to compare the performance between ECBC compliant and Base Line buildings.
- Limited awareness on availability of ECBC-Compliant materials.
- Specifications and Schedule of Rates are yet to be announced by PWD.



THANK YOU