

ELECTRICAL ENGINEERING
6TH SEM

EECM (Electrical Energy Conservation and Management)

Unit 7: ECBC(Energy Conservation Building Code)

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ECBC (Energy Conservation Building Code)

- With the background of high energy saving potential and its benefits bridging the gap between demand and supply, reducing environmental emissions through energy saving and to effectively overcome the barrier the Govt. of India has enacted the Energy Conservation Act, 2001.
- The Act provides the much needed legal framework and institutional arrangement for embarking on an energy efficiency drive.
- This includes Energy Conservation Building Code.

- The Act empowers Govt. of India and State Governments to modify ECBC as per climatic conditions of states.
- To notify the code in Govt. gazette to make it mandatory for commercial buildings
 - a) Having a connected load of 100 kW or contract demand of 100 kVA or above.
 - b) 1000 sq.m of air conditioned area.

Commercial Building Includes

- Office Buildings
- Hotels
- Restaurants
- Retail malls and shops
- Hospitals
- Educational Institutes.

PURPOSE of ECBC

- The purpose of this code is to provide minimum requirements for energy efficient design and construction of buildings.
- Efficient use of energy and its conservation in the building or building complex
- Energy saving
- Cost saving
- Reduce CO₂ emission

ECBC includes following Building Systems

1. Building Envelope (walls, roofs, windows)
2. Heating, Ventilation and Air Conditioning (HVAC)
3. Lighting Service (Indoor & Outdoor)
4. Service Hot Water and Pumping
5. Electrical Power (Transformer, Power Factor)
6. Star Labelling and Minimum Star Rating

ECBC Guidelines on Building Envelope

WALLS	ROOF	WINDOW
Use insulation with low U-value	Use insulation with low U-value	Use material with low U-factor
Reduce air leakage & use vapor barrier	Reduce air leakage & use vapor barrier	Use prefabricated windows and seal the joints between windows and walls.
Use light colored coating with high reflectance	Use light colored coating with high reflectance	Use glazing with low Solar Heat Gain Coefficient (SHGC)

ECBC Guidelines on Building Envelope

- Use of more day light and correct HVAC system sizing
- Opaque part (walls, roof, slab)
- Fenestration Systems(window, skylight, ventilators and doors that are half Glazed)
- Envelope affects the thermal comfort of occupants as well as energy consumption of the building
- Heat Transfer Takes place through walls , window and roof by all the three methods i.e. **Conduction, convection of air and Radiation.**
- Thickness of wall is proportional to thermal resistance. More thickness means less heat transfer.

Building Envelope Cont..

- Air Leakage- From doors shall be avoided with the gaskets.
- Building envelope Sealing .
- Insulation of roofs
- Insulation to be protected from sunlight, moisture, wind and other physical damage
- **Cool Roofs**: It is a roof with reflective coating that has high emissivity and reflect the suns energy away from the roof surface.
- Remains 10 to 16 degree cooler than a normal roof under hot summer

For Windows

- ❖ Films
- ❖ Coatings on glass
- ❖ Gas filling between the glass
- ❖ Reduction of air leakage
- ❖ Special glasses allow the visible light to pass while bypass the infra red radiation.

ECBC Guidelines on HVAC (Heating Ventilation and Air Conditioning)

Natural Ventilation

- Suitable Wind direction & orientation of building
- Opening in the buildings should be well distributed
- Air to enter at low level and out ward at higher level
- No building should obstruct. the incoming air
- Window of living room should open in open area
- Two window (instead of one)on one wall if that wall is exposed to out side

By Stack Effect

- Natural ventilation by stack effect occurs when inside building is hot and outside is cool.
- Cool air from outside will try to come from outside and hot air shall go outside from the top where ventilators have been provided .
- Hence , Ventilators should be kept as close to the ceiling as possible.

Energy conservation in Ventilation system

- Use of adequate number of ceiling fan(sizes are provided in the Code)
- Use of electronic regulators

Air conditioning(AC)

Requirements in AC

- USE of timers so that it can start and stop the system for different schedule
- Cooling systems < 28kw(8tons)
- Heating systems<7kw
- For heating and cooling simultaneously: A band of 3 deg C is desired to be provided
- Piping /Ducting of heating and cooling must be insulated

Condensers

- Locations : free from interference from buildings etc.from heat point of view
- No other system installed near by
- Soft water for water cooled systems

ECBC Guidelines on Service Water Heating and Pumping

- For hotels, hospitals: water heating is needed
- As per code mandatory requirements are: Solar heating ($1/5$ th of the capacity)
- Heat recovery: e.g. DG sets exhaust, AC condenser outlet (exception that uses heat recovery for at least $1/5$ th of the design capacity)
- Minimize electric heating
- Reducing stand by losses
- Reducing heat and evaporation losses in heated swimming pools

- Temperature control of water set at 49 deg C
- For each 5.5 degree C reduction in water temperature can save 3-5% in energy costs
- Insulate the storage tank
- Insulate pipes
- Heat Traps: allow cold water to go inside and does not allow hot water to come out side e.g. in Geyser
- Swimming Pools: Temperature to be maintained at 32 deg C and shall have a min insulation value of R-2.1

ECBC Guidelines on Lighting

In Practice : Right quality , Right Quantity of light to be provided efficiently (with less energy) By using right technology and its effective integration.

Efficient equipment

- Electronic Ballast, CFL ,LED lamps
- Maintaining those efficient equipment

LIGHTING CONTROL

- Automatic On/Off when needed
- Dimming Control(modulate light out put for reducing the intensity of light)
- Timers
- Occupants and motion sensors

- Applicable for buildings > 500 sq.m
- Occupancy sensor to switch off light after 30 min of sensing no occupancy
- Compound light : photo sensor astronomical sensor
- Display lighting to have separate control
- Master lighting control for hotel rooms
- Internally illuminated exit signs shall not exceed 5W per face-LED exit sign boards

ECBC Guidelines on Electrical Power

- Transformers
- Energy efficient motors
- Power factor correction
- Electrical metering and monitoring
- Power distribution system

Transformer

DRY type transformer

- Where fire hazard are present
- At load centers

Oil type transformer: where no fire hazard

- Since it is at load end it will have low and high power requirement so its no load losses should be minimum.
- Or Losses at 50 percent load should be minimum

Energy Efficient Motors

- Induction motors are mainly used
- All motors $>375\text{W}$ in the building and expected to operate >1500 hours /year(Efficiency $>70.2\%$)
- All motors $>50\text{KW}$ and expected to run >500 hours per year shall have efficiency as per IS 2615 for energy efficient motors(94%)
- Optimum loading of motors is at about 75%
- Rewinding reduces efficiency and hence not suitable for energy efficiency

Power Factor Correction

- All electricity supplies $>100\text{A}$ 3 phase shall maintain their power factor between 0.95 lag to unity at the point of connection
- It reduces system current
- Hence losses (I^2R losses) are reduced.
- Reduced power consumption of the device
- Reduced electricity bills
- Improved electrical energy efficiency
- Extra KVA availability from the existing supply
- Minimized voltage drop in long cables



Thank
you!