ECO-NIWAS SAMHITA

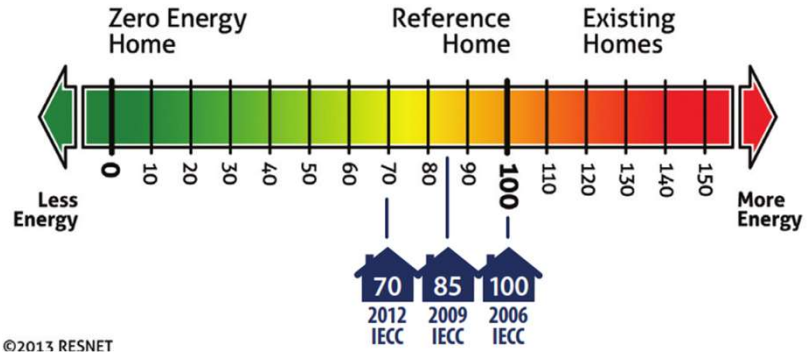
Part 2: Electro-Mechanical and Renewable Energy Systems
(Energy Conservation Building Code for Residential Buildings)

CONSULTATION WORKSHOP

Energy Rating Index (ERI) Approach: Integration of Part 1 and Part 2

Introduction: Energy Rating Index

- The ERI score is defined as a numerical score where **100 is equivalent to the 2006 IECC and 0 is equivalent to a net-zero home**. Each integer value on the scale represents a one percent change in the total energy use of the rated design relative to the total energy use of the ERI reference design.



Introduction: ERI Concept

2018 IECC, ERI path (R406) adds reference to 301-2014, with ventilation modification, on-site power text & changes ERI targets.

1	2	3	4	5	6	7	8
57	57	57	62	61	61	58	58

Required HERS Score by House Size

0 to 3000 ft²	70	6801 to 7400 ft²	30
3001 to 3500 ft²	65	7401 to 8000 ft²	25
3501 to 4000 ft²	60	8001 to 8500 ft²	20
4001 to 4500 ft²	55	8501 to 9000 ft²	15
4501 to 5000 ft²	50	9001 to 9500 ft²	10
5001 to 5600 ft²	45	9501 to 10,000 ft²	5
5601 to 6200 ft²	40	10,001 ft² +	0
6201 to 6800 ft²	35		

GREEN BUILDING CODE FACTS
for the residence located at:

This building achieved Build Green Santa Fe:	SILVER
This building achieved a confirmed Home Energy Rating System (HERS) Index of:	65

Certified Energy Rater Date

Insert HERS Company Logo Here

Points Received in Each Category

Category	Minimum Required Points	Points Achieved
Lot Design, Preparation, and Development	16	40
Resource Efficiency	60	70
Energy Efficiency	70	90
Water Efficiency	45	55
Indoor Environmental Quality	54	75
Operation, Maintenance, and Homeowner Education	14	25
Additional Points- any Section	90	(included above)
TOTAL POINTS	349	355

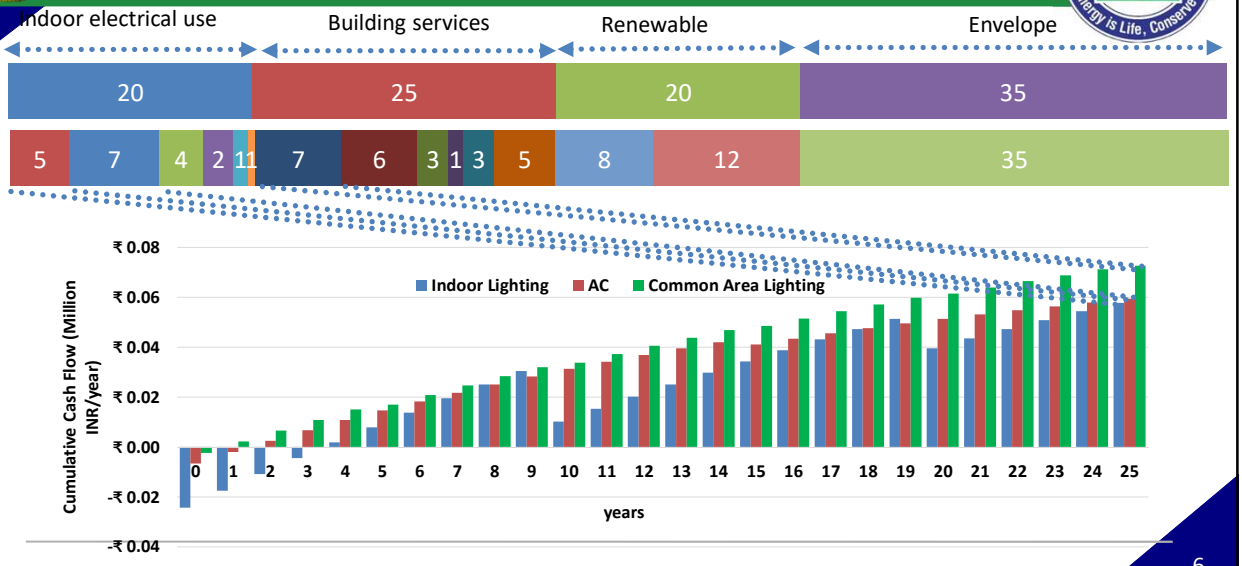
Example: Illustrating ERI

- **0-100 point system**, where 0 represents a net-zero-energy building, and 100 represents reference building baseline usage
- Assumption: Target point score in the ERI system is 55 (this is comparable to the current IECC target)

→ Developers would thus have to achieve 45 points in savings from the various measure categories.

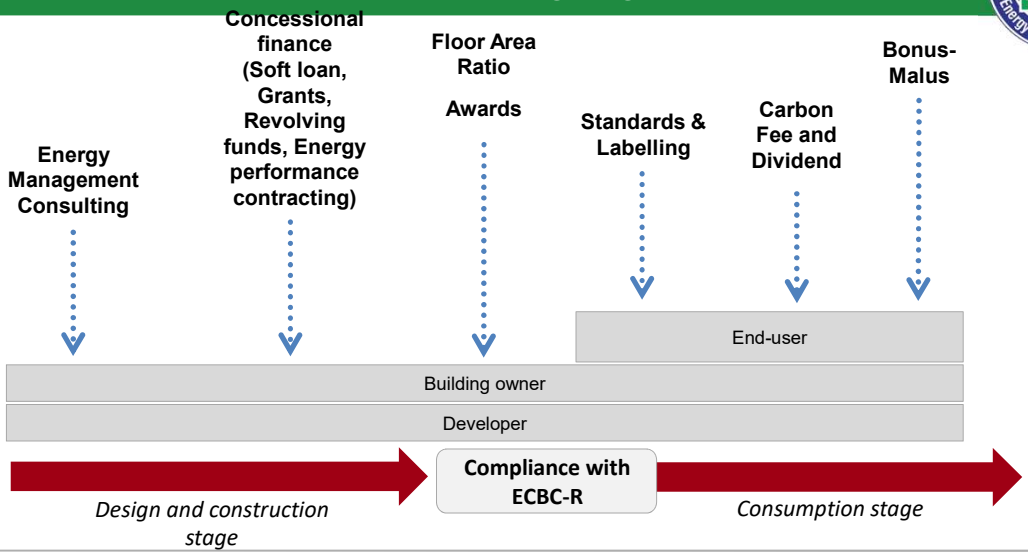
Measure category	Maximum points	Minimum points	Achieved points
Envelope	30	12	15
Comfort systems	15	5	10
Appliances	15	5	10
Common services	15	5	10
Renewables	15	0	0
Low embodied energy	10	0	0
Total points			45

ERI based on Life Cycle Cost



ENS Part 2 Compliance Framework

Overview of incentives and target groups



Incentives

Incentive	Description	Existing practice in India
Standards & Labelling (Regulatory)	Standards for EE appliances and labels for consumer information; labels/certificates for ECBC-R compliant buildings	Standards & Labelling programme for equipment and appliances initiated by BEE, Super-Efficient Equipment Programme
Energy Management Consulting (Reward)	Wide range of subsidised energy consulting services to support compliance with ECBC-R involving on-site visits	Corporate Energy Audit Program as part of the Partnership to Accelerate Clean Energy – Deployment (PACE-D) by USAID
Floor Area Ratio (Reward)	Additional FAR awarded for compliance with ECBC-R	Additional FAR in several Indian states (mostly for GRIHA, in some states also for IGBC, LEED)
Awards (Reward)	Award money for promotors, developers, architects whose buildings comply with ECBC-R or have higher standards than ECBC-R	National Energy Conservation Awards; Haryana: Awards to promoters and architects
Bonus-Malus (Reward)	Fee / reward system with ECBC-R as reference value	No scheme currently in place

Incentives

Incentive	Description	Existing practice in India
Carbon Fee and Dividend (Fiscal)	Gradual increase of fee on fossil fuels, revenues are refunded to consumers	No scheme currently in place
Soft loans (Concessional finance)	Loan with interest below market rate ("soft financing") to facilitate the compliance with ECBC-R	JICA&SIDBI: Financing Scheme in MSME Sector; IREDA EE Financing Scheme (part of EIB credit line)
Grants (Concessional finance)	Grants to facilitate the compliance with ECBC-R	Grants by Indian public-sector banks; GEF grant provided to BEE
Revolving Funds (Concessional finance)	Fund providing loans for EE measures in buildings to facilitate ECBC-R compliance, repayment through energy savings	Energy Efficiency Revolving Fund (EERF) launched by GEF
EPC (Concessional finance)	ESCO implements EE measures for compliance with ECBC-R uses cost savings to repay costs of project	Energy Efficiency Enhancement Project, Standard Offer by distribution companies

Discussion

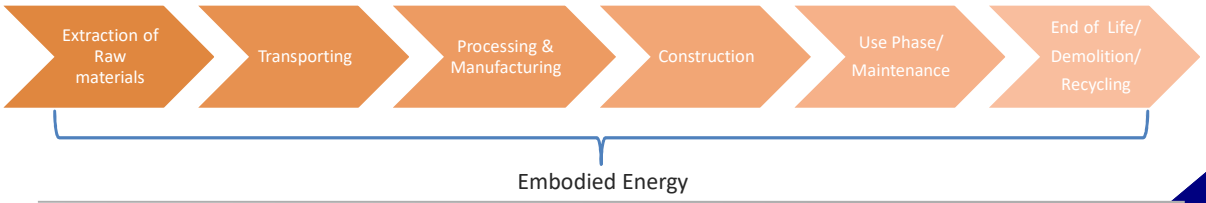
Background slides

ENS Part 2 Compliance Framework

Appendix A: Annualised Embodied Energy

Rationale

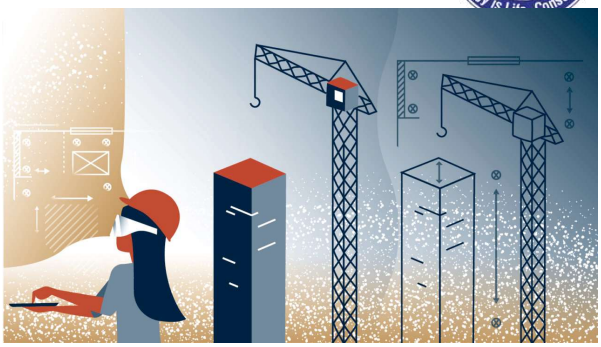
- Embodied energy in construction in India (especially in "formal' residential buildings of the sort that are covered by ENS code) can sometimes be of the order of magnitude of many *decades* of operating energy use and therefore is very significant to consider when such a code is being developed.
- However, this was true for non-air-conditioned housing stock, and it seems likely that, like in the developed economies, increasing consumption of operating energy (e.g., for appliances, common area services, air-conditioning etc.) may cause the embodied energy to become less significant compared to operating energy. Still this is an important area to include in the code.
- Embodied energy is also important because much of it is consumed in the form of primary energy (coal, oil, fuels) causing direct pollution and carbon emissions.



Appendix B: Better Construction Practices

Rationale

Energy can be consumed in bad practices that may be observed on building sites. This needs to be stopped but is currently outside the scope of this code. Typical bad practices include excessive requirement of movement of fluids or solids on site due to bad layout, improper sizing of pipes to save initial costs but causing greater pumping power due to friction, over or under-reliance on assisted manual labour (which may be seen as a form of renewable energy), and industry having got used to fuel-based services or energy-on-tap and so unable to convert to a renewable energy such as solar photovoltaic systems due to their being inform. Often machinery is also designed so as to have very high starting surge loads. These four areas below need to be improved and then can be codified.



Picture Source: https://www.raconteur.net/business-innovation/seven-construction-innovations

Appendix C: Retrofitting of Residential Buildings

Rationale

- Retrofitting consists of additions and alterations to existing (in this context residential) building stock and typically this is set into motion by house owners.
- This code is silent on retrofit provisions and this appendix is created because given the right conditions this situation can change. This code is silent on retrofit provisions because of the principle that laws (and codes) should preferably to be applied retroactively, but in doing so we lose out a large potential of building stock, even if we do assume that a majority of India's residential building stock is yet to be built.

Picture Source: https://clearviewtinting.com/wp-content/uploads/upgrade-cycle-600.png

Appendix D: Improved air cooling

Rationale

- Residential buildings sector accounts for 24% of the electricity consumption and is the second largest consumer after industries. Within the building sector, the residential electricity consumption amounts to 259 TWh (Within this sector, with increasing affluence in the Indian middle class, there is a tendency (in warm humid, hot dry, composite and even moderate climates which always have some hot days) to create comfort by installing an air-conditioner or two.
- Often the rationale for a lower middle class family, who realize that the energy bills are not easy to manage, is that they will use it minimally, only in the night and only in extreme weather, or by setting the thermostat up to higher temperatures. However, air-conditioning, with its superior performance in terms of managing humidity, is addictive, and there is a tendency for its use to increase to the limit of the users' paying capacity.
- It is worse that in this economic class, the tendency is to procure cheap, lower rated inefficient equipment, and install it in poorly insulated houses, which uses even more electricity than it could. This causes residential air-conditioning to become a major barrier in energy efficiency (USAID, 2014).

Appendix D: Improved air cooling

Ventilation: Natural & Mechanical Ventilation

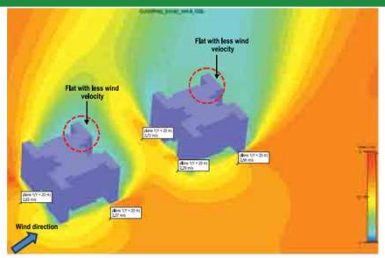
Ventilation in residential buildings can be provided by one of the following methods:

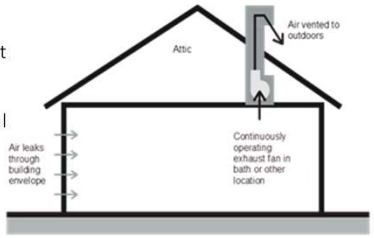
a) Natural supply and natural exhaust of air;

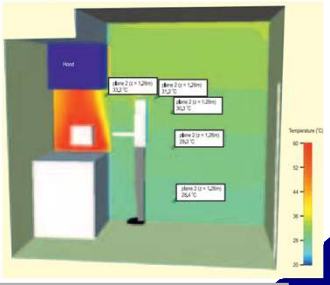
b) Natural supply and mechanical exhaust of air;

c) Mechanical supply and natural exhaust of air; and

d) Mechanical supply and mechanical exhaust of air.





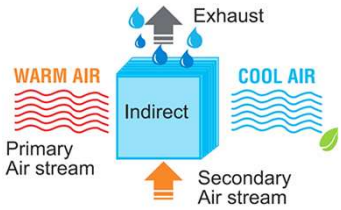


Picture Source: Assisted Ventilation: https://energycodeace.com/
Site ventilation and kitchen exhaust: Indo-Swiss BEEP

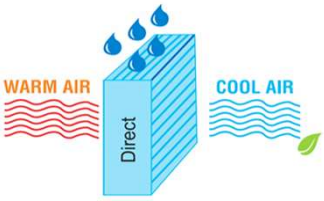
Appendix D: Improved air cooling

Evaporative Cooling: Evaporative cooling is a process that uses the effect of evaporation as a natural heat sink. Sensible heat from the air is absorbed to be used as latent heat necessary to evaporate water. The amount of sensible heat absorbed depends on the amount of water that can be evaporated.

Direct Evaporative cooling (DEC): In this system the outdoor air is brought into direct contact with water, cooling the air by converting sensible heat to latent heat. DEC systems could be divided into: Active DECs which are electrically powered to operate and Passive DECs that are naturally operated systems with zero power consumption. In DEC, the water content of the cooled air increases because air is in contact with the evaporated water. This strategy will be useful in dry and hot climates.



Indirect Evaporative Cooling: Indirect evaporative coolers operates by decreasing air sensible heat without changing its humidity, which is a distinct advantage over DEC systems. In indirect evaporative cooling, evaporation occurs inside a heat exchanger and the water content of the cooled air remains unchanged. This strategy will be mostly useful in warm and humid climates.



Picture Source: http://ategroup.com/hmx/why-evaporative/

Thank You