INDO-SWISS Building Energy Efficiency Project (BEEP)

Technical assistance for thermal comfort and energy efficient design

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India’s energy consumption is growing the fastest among all major economies.

- Residential buildings consume ~25% of the total electricity.
- By 2030 residential buildings are expected to consume 38% of electricity in India.
- Projected residential building construction between 2018 and 2030 is >15 billion m².

**Objective:** Reduce energy consumption in new commercial, public and residential buildings in India through energy-efficient and thermally comfortable design.

**Partner Agencies:**
- Bureau of Energy Efficiency India
- Swiss Agency for Development and Cooperation
CASE STUDY: OFFICE BUILDING – ARANYA BHAWAN, JAIPUR
Aranya Bhawan: Measures to Reduce Heat Gains

Roof insulation

U-value: 0.6 W/m².K

Wall insulation

U-value: 0.5 W/m².K

Double-glazed windows

Reduction in glazed area and external shading

U-value: 1.8 W/m².K

SHGC: 0.24

VLT: 36%
Aranya Bhawan: Energy Efficient Cooling System

- Centralised high efficiency water-cooled chiller
- Sewage treatment plant (capacity: 15 m³/d) to provide water for cooling towers
Aranya Bhawan: Renewable Electricity

- Rooftop 45 kWp grid-connected Solar photovoltaic system (SPV) generating around 60,000 kWh per year (~20% of the annual electricity requirement)
- Additional 100 kWp ground mounted SPV system planned
Aranya Bhawan: Energy Monitoring

- Measured Energy Performance Index of **43 kWh/m²/year**.
- ~ **50% lower** compared to the benchmark for energy-efficient office buildings in India.
- Construction costs about >**3%** than conventional design.
CASE STUDY: AFFORDABLE HOUSING – SMART GHAR-III, RAJKOT
Smart GHAR III (Green Homes at Affordable Rate) is a social housing project in Rajkot.

- 1176 2-room apartments (33.6m²)
- Most families cannot afford air-conditioning

**Aim**: Improve thermal comfort through building design
Smart GHAR III: Reducing heat gain through walls, roof and windows

Walls & Roof

- 230mm Autoclaved Aerated Concrete Blocks (U-value of 0.8 W/m².K). AAC cavity walls on southern side (U-value 0.3 W/m².K)
- High-reflective glazed tile roof cladding

Windows

- Low Window to Wall Ratio
- Partly opaque windows/shutters
- Casement windows with large natural ventilation openings
Smart GHAR III: Additional assisted ventilation to increase thermal comfort

- A fan on top of the service shaft provides additional ventilation when the ambient temperatures are low.
During hot summer in Rajkot the daily ambient high temperature is ~ 40°C

Indoor room temperature in flats between 30-32°C → 8-9°C below outside temperature without any cooling
Development of the ECBC-R code

- Indo Swiss BEEP project provided technical support for development of new Energy Conservation Building Code for Residential Buildings

- BEEP is assisting BEE to disseminate ECBC-R to states and municipalities
  - Design of energy-efficient affordable housing projects
  - Amend the building regulations to include ECBC-R
  - Capacity building of officials and building sector professionals
  - Working with selected cities for the implementation
Features of the ECBC-R code

- Building envelope (roof, walls, windows and external openings)
- Sets minimum building envelope performance standards to
  - Limit heat gains / losses
  - Exploit adequate natural ventilation potential
  - Exploit adequate daylighting potential
Estimated impacts of the ECBC-R code

- Estimated impact of ECBC-Residential during 2018-2030
  - Minimum 20% energy savings (in cooling) as compared to a typical building
  - 125 billion kWh of electricity savings
  - 100 million tonnes of CO₂ equivalent abatement
Thank you for your attention

http://www.bEEPindia.org