

Pilot ECBC-Compliant Building in Jaipur: Background and Highlights of Prabha Bhawan

Under the U.S.-India Energy Dialogue, the Pacific Northwest National Laboratory (PNNL) has been working with the State of Rajasthan, India to facilitate the implementation of the Energy Conservation Building Code (ECBC). The implementation of ECBC saves energy in buildings, reduces operating costs and minimizes environmental impact.



Source: MNIT

Figure 2 Front Entrance of Prabha Bhawan

In collaboration with PNNL, the Malaviya National Institute of Technology (MNIT) Jaipur expanded Prabha Bhawan, converting it to an ECBC-compliant pilot.

The building is used for academic and office purposes with 11,300 m² of partially air-conditioned space. The new building consumes 30% less energy than a standard ECBC-compliant building (using whole-building performance compliance approach).



Source:

Figure 1 U.S. Energy Secretary Ernest Moniz (left) and Indian Power Minister Piyush Goyal (right) at U.S.-India Energy Dialogue

Table 1 Highlights of Energy Efficient Design in Prabha Bhawan

ECBC Standards	Building Design	Technologies Deployed
Envelope U of Roof: 0.409 W/m ² K U of Wall: 0.44 W/m ² K	U of Roof: 0.35 W/m ² K U of Wall: 0.72 W/m ² K	<ul style="list-style-type: none"> Roof: inverted earth pots as one layer of insulation Wall: insulation sandwiched between layers
Glazing U: 3.3 W/m ² K SHGC: 0.25 VLT: 0.27	U: 1.9 W/m ² K SHGC: 0.28 VLT: 0.39	<ul style="list-style-type: none"> Double-glazed windows Vertical fence shading
Lighting LPD: 1.0 W/ft ²	LPD: 0.3-0.6 W/ft ²	<ul style="list-style-type: none"> LED lighting with occupancy controls Internal glass partitions allowing natural light Dimmable ballasts making use of daylighting
HVAC COP: 3.04	COP:3.75	<ul style="list-style-type: none"> Variable refrigerant flow system (115,000 Btu/hr capacity) Enthalpy wheels in meeting rooms¹ Ductwork insulation
Renewables N/A	Rooftop solar PV system ²	<ul style="list-style-type: none"> 157.5 kW Two hours of back-up storage Surplus power exported to low-voltage grid³

U-value: Heat transfer coefficient; lower U-value means better insulation.

SHGC: Solar heat gain coefficient.

VLT: Visible light transmittance; higher VLT means better use of daylight.

LPD: Lighting power density measures the load of lighting equipment in a given area.

HVAC: Heating, ventilation and air-conditioning.

COP: Coefficient of performance measures efficiency of HVAC system; higher COP means better efficiency.

¹ The enthalpy wheels recover the cooling from exhaust air, reducing energy use for cooling.

² Saving extra 20% energy compared with standard ECBC-compliant building.

³ Also to reduce losses while converting high-voltage power to end-use, low-voltage power.

Pilot ECBC-Compliant Building in Jaipur: Benefits and Lessons Learned

Other Benefits

- Lower operating costs, less connected load and reduced demand charges
- Prestigious feeling with energy-efficient features
- Showcase of ECBC compliance and benefits
- Improved thermal comfort

Accomplishments and Lessons Learned

Updated “Schedule of Rates” to streamline energy efficiency procurement

- Not all equipment/materials needed for ECBC compliance are available on the Schedule of Rates (a list of approved products for public procurement). This slowed the procurement in Prabha Bhawan.
- Recognizing these problems with the Schedule of Rates, BEE has since worked with the Central Public Works Department to update the Schedule of Rates.

Documented the need for a robust product testing, rating and labeling system

- Manufacturers may overstate energy performance of products in the absence of a robust building material testing and rating system, which MNIT identified with windows performance simulation. This allowed MNIT to properly rate the materials it used.

Increased capacity within central and state public works departments and beyond

- Public buildings like Prabha Bhawan receive approval from central or state public works departments instead of local building officials for ECBC compliance. All central government public buildings must be ECBC-compliant. Enhancing the capacity within public works departments is important to 1) make all of their buildings compliant with ECBC and 2) mainstream ECBC implementation.
- Prabha Bhawan is an active ECBC training site where the capacity of government officials, building owners and various other stakeholders is increased.

Demonstrated ECBC Benefits with Pilot Buildings

- Prabha Bhawan serves as a real-world example of ECBC compliance to the public. It has made people across India highly aware of ECBC feasibility and benefits.



Figure 3 Naturally Day Lit Computer Lab with Ceiling Insulation

“The project is an example of a well-structured approach towards achieving energy efficiency. . . . In current times, the decrease in energy usage is a very important aspect of building industry. An institute like MNIT has set an example by doing this project.”

**Sunit Mathur, General Manager,
Rajasthan Renewable Energy Corporation Limited**

“Light is an important factor for comfortable working in a computer lab. The long hours of concentrating on a computer screen are less stressing due to the quality of light inside the labs.”

Sanjay Rajpal, MNIT Central Computer Center