

Indian Army Unveils India's First Geothermal-Based Net-Zero Energy Building: A Landmark Step Towards Sustainable Defense Infrastructure



The Indian Army has demonstrated its commitment to environmental stewardship and sustainable innovation with the construction of India's first geothermal-based net-zero energy and off-grid building by MES Jhansi under the aegis of Headquarters Chief Engineer, Bhopal Zone. This landmark project was officially validated as a Net-Zero building by the team of *Centre for Clean Energy & Circular Economy, National Institute of Technology Calicut*. The team of Prof.A.Shaija, Dr.Vinod Kumar Sharma and Dr.S.N.Deepa visited CWE, Jhansi during 26th - 28th March 2025 and 16th – 18th April 2025 and performed the training and validation of the net zero building.

This building taps into Earth's stable underground temperatures through a closed-loop system comprising ten boreholes, each 120 meters deep. High-density polyethylene piping circulates a natural refrigerant, allowing efficient heat exchange with the ground without emissions, contamination, or contributing to urban heat island effects. The building's heating and cooling systems revolve around a high-efficiency ground-source heat pump. This system uses radiant floor heating during winters and ceiling-mounted fan coil units for summer cooling, providing optimal comfort throughout the year.

During colder months, the building's floor slab acts as a thermal mass, storing and radiating heat evenly, minimizing convective losses. Additionally, the Mechanical Ventilation with Heat Recovery

(MVHR) system ensures continuous fresh air circulation while reclaiming sensible heat from outgoing air supporting superior indoor air quality with minimal thermal loss. The system's intelligence lies in its collector manifold, which balances hydraulic loads and modulates temperature gradients across the geothermal loops using integrated sensors.

Complementing its geothermal backbone, the building generates more renewable energy via rooftop solar panels than it consumes annually registering an impressive EPI below 35. The project offsets a substantial volume of CO₂ emissions compared to conventional buildings, marking another stride by the Indian Army toward self-sufficiency, energy independence, and carbon-neutral infrastructure.