India Insulation Forum
Preaching the Power of Insulation
Agenda

- India Insulation Forum (IIF)
- Insulation & It’s benefits
- Insulation Materials
- Scope of Insulation in Buildings & ECBC Recommendations
- Various Insulation Application Methods
- Challenges
- Recommendations
India Insulation Forum (IIF)

- BEE and IPUA (India Polyurethane Association) have collaborated the establishment of "India Insulation Forum (IIF)" in 2013. The objective of IIF is to enhance awareness of using thermal insulation in building envelope and cold chain industry for energy conservation.
- IIF also coordinate advocacy activities with Government bodies & nodal agencies.
- IIF is proposed to be represented by reputed companies making different insulation materials used for energy efficiency in Buildings.
- The IIF membership is open to all concerned with building insulation, beginning with raw material suppliers, processors & applicators, builders & contractors, architects, regulators and end users.
Content

Your partner to increase your value

1. Stakeholder Awareness
2. Training of Applicators
Comprehensive Delivery
Members of the IIF

Lloyd Insulations (India) Limited
RINAC
GK SPL
RELIABLE INSUPACKS
Kingspan | JINDAL
Parmacell
ALP
SPL
Unifrox PUF
Rockwool India
Omkar Puf Insulation Pvt. Ltd.
BASF
Pioneer Coldstore & Cladding Pvt. Ltd.

Shree Venus Energy System Pvt. Ltd.
Training Manual on application of building insulation

A Step-by-Step Guide to the Practice of Good insulation techniques for the Energy Efficiency of Buildings
Modern society expectation

HOT & SCORCHING
SUMMER 45°C

HUMAN COMFORT

COLD & CHILLING
WINTER 0-4°C

Value for Investment
Is it only Comfort?
Is it only Comfort?

- Cleaner air, better health
- Security of energy supply
- Reduce global warming
- Reduce energy costs
- International competitiveness
### Energy Efficiency – The Largest Fuel

The sixth fuel: Energy efficiency

Oil production would need to double in the coming decades if steps are not made since the oil crises.

The role of different resources

| Resource Type          | Potential Impact
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency</td>
<td>80%</td>
</tr>
<tr>
<td>Petroleum</td>
<td>5%</td>
</tr>
<tr>
<td>Coal</td>
<td>2%</td>
</tr>
<tr>
<td>Natural gas</td>
<td>1%</td>
</tr>
<tr>
<td>Biomass &amp; renewables</td>
<td>1%</td>
</tr>
<tr>
<td>Nuclear power</td>
<td>0%</td>
</tr>
</tbody>
</table>

Source: Censf Bulletin no 35, April-June 2002

The curve presents an estimate of the potential for energy efficiency improvements. Each circle represents a technology or action, with the size indicating the potential impact.

- **Motor systems efficiency**
- **Insulation retrofit (commercial)**
- **Lighting – switch incandescent to LED**

$50 per CO2e if each circle is pursued aggressively.
What is Thermal Insulation

Thermal Insulation is an effort / method / application to

Stop the unwanted heat coming in

Or

Stop the useful heat going out
Heat Load Components

Composite Climate (New Delhi)

Roof: 31%
Wall: 32%
Windows: 31%
Infiltration: 6%

*Direct heat gain from windows not accounted

Summer Heat Flow (May)

Weather Conditions

Temperature
Min.: 18.7°C, Max.: 42.6°C, Avg.: ~32°C

Relative Humidity
Min.: 13%, Max.: 97%, Avg.: ~50%

Net heat flow per unit area

Roof (15 m²)  | 24.6 kWh/m²
Wall (47.6 m²)  | 8.1 kWh/m²
Window (8.4 m²)  | 43.3 kWh/m²
Infiltration (based on floor area 15 m²)  | 5.0 kWh/m2
What Thermal Insulation Can do

• Creates an envelope outside the building
• Stop heat / cold ingress from outside
• Maintains at least 8-9 degrees temp. difference
• Maintains controlled temp. for longer periods
• Human comfort
• High Quality of Life
Impact of Insulation

Composite Climate (New Delhi)  Summer: Heat in-flow (May)

- Business-as-usual construction
  - Roof U-value: 4.2 W/m².K
  - Wall U-value: 2.1 W/m².K
  - Roof: 24.6 kWh/m²
  - Wall: 8.1 kWh/m²

- ECBC compliant roof & wall
  - Roof U-value: 0.261 W/m².K
  - Wall U-value: 0.44 W/m².K
  - Roof: 2.1 kWh/m²
  - Wall: 2.3 kWh/m²

Reduction in heat in-flow through roof ~ 90%
Reduction in heat in-flow through walls ~ 70%
Impact of Roof & Wall Insulation

- Typical summer day in Composite climate (Delhi)
- With a 50mm Envelop insulation.
What Thermal Insulation can do

Typical hot summer roof situation

<table>
<thead>
<tr>
<th>DAYTIME</th>
<th>TEMP. (DEG.C)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AMBIENT</td>
<td>WORKING FLOOR</td>
<td>INSULATED ROOF FLOOR WORKING</td>
</tr>
<tr>
<td>10 AM - 12 PM</td>
<td>39</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>12 PM - 2 PM</td>
<td>41</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>2 PM - 4 PM</td>
<td>41</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>4 PM - 6 PM</td>
<td>40</td>
<td>36</td>
<td>31</td>
</tr>
</tbody>
</table>

Normal building with 150mm RCC, Water Proofed, Brick Wall Insulation : 50-75mm
Insulation Benefits
People, Planet, Profit

**Environmental**
- Stop heat / cold ingress from outside
- Saves on fossil fuel
- Reduces emission of GHG.
- Lower energy losses; avoid the danger of oversized heating or cooling systems that works hard to compensate for the heat or cold losses through the building envelope.

**Economical**
- Effective insulation lowers heating or cooling bills, thus no longer being affected by rising energy costs
- Maintains controlled temp. for longer periods.

**Social**
- Human Comfort – improves the efficiency of occupier/user.
- Provides fungus-free and microbe-free healthier environ, due to absence of cold walls
## Insulation Materials – ECBC Context

<table>
<thead>
<tr>
<th>Fibrous</th>
<th>Rigid</th>
<th>Flexible*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rockwool Insulation</td>
<td>Rigid polyurethane foam</td>
<td>Nitrile Rubber</td>
</tr>
<tr>
<td>Glass wool Insulation</td>
<td>Rigid Poly Isocyanurate foam</td>
<td>Cross linked polyethylene</td>
</tr>
<tr>
<td></td>
<td>Sprayed rigid polyurethane foam</td>
<td>Expanded polyethylene</td>
</tr>
<tr>
<td></td>
<td>Extruded polystyrene foam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expanded polystyrene foam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phenolic foam</td>
<td></td>
</tr>
</tbody>
</table>

*Flexible Insulation: They are non-fibrous rubber or thermoplastic material in nature which are easily shaped to any design or geometry and predominantly used in HVAC.
Scope of Building Insulations

- Roof Insulation
  - Underdeck
  - Overdeck

- Wall Insulation
  - External
  - Internal
  - Sandwich Wall/Cavity Wall

- Floor Insulation*
  *(In Cold Climatic Conditions)*
Climatic Zone Map of India

**Hot and Dry**
- Jaisalmer, Jodhpur and Sholapur

**Warm and Humid**
- Mumbai Chennai and Kolkata

**Composite**
- Delhi, Kanpur, Allahabad

**Moderate**
- Pune and Bangalore

**Cold**
- Leh, Shimla, Shillong

Source: National Building Code 2005, Part 8, Fig. 2
## Roof Assembly - ECBC

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>24-Hour use buildings</th>
<th>Daytime use buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hospitals, Hotels, Call Centers etc.</td>
<td>Other Building Types</td>
</tr>
<tr>
<td></td>
<td>Maximum U-factor of the overall assembly (W/m²·°C)</td>
<td>Minimum R-value of insulation alone (m²·°C/W)</td>
</tr>
<tr>
<td>Composite</td>
<td>U-0.261</td>
<td>R-3.5</td>
</tr>
<tr>
<td>Hot and Dry</td>
<td>U-0.261</td>
<td>R-3.5</td>
</tr>
<tr>
<td>Warm and Humid</td>
<td>U-0.261</td>
<td>R-3.5</td>
</tr>
<tr>
<td>Moderate</td>
<td>U-0.409</td>
<td>R-2.1</td>
</tr>
<tr>
<td>Cold</td>
<td>U-0.261</td>
<td>R-3.5</td>
</tr>
</tbody>
</table>
## Opaque Wall Assembly U-factor and Insulation R-value Requirements

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Hospitals, Hotels, Call Centers (24-Hour)</th>
<th>Other Building Types (Daytime)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum U-factor of the overall assembly (W/m²·°C)</td>
<td>Minimum R-value of insulation alone (m²·°C/W)</td>
</tr>
<tr>
<td>Composite</td>
<td>U-0.440</td>
<td>R-2.10</td>
</tr>
<tr>
<td>Hot and Dry</td>
<td>U-0.440</td>
<td>R-2.10</td>
</tr>
<tr>
<td>Warm and Humid</td>
<td>U-0.440</td>
<td>R-2.10</td>
</tr>
<tr>
<td>Moderate</td>
<td>U-0.431</td>
<td>R-1.80</td>
</tr>
<tr>
<td>Cold</td>
<td>U-0.369</td>
<td>R-2.20</td>
</tr>
</tbody>
</table>
A well drafted document for understanding various application methods of Thermal Insulation in a Building

- Document describes the application procedure in detailed steps
- Application sketches & photographs are included
- Insulation material properties tabled
- www.indiainsulationforum.in
Roof Over deck Thermal Insulation System
Overdeck Insulation

Sprayed Rigid Foam Application
Overdeck Insulation

Mineralwool Slabs
Underdeck Insulation

Mineralwool Application
Cavity Wall Construction

**Rigid Board Application**
- Interior Brick Work
- Adhesive
- Thermal Insulation Board
- Exterior Brick Work
- Plaster

**Spray Application**
Cavity Wall Insulation -

Spray Application - PU

Face brick
Masonry block
Small hole (typically 25mm) in face brick for foam spray to be pumped through
Spray Polyurethane Foam
Cavity Wall Insulation

- **Mineralwool**
- **XPS**
- **EPS**
External Wall Insulation - Facades

Aluminium Cladding
Stone Cladding

External Wall Insulation - Facades
External Wall - ETICS

External Thermal Insulation Composite System

- Base wall
- Cement mortar Plaster
- Adhesive Mortar
- Insulation Board
- Mechanical fastener
- Base coat
- Mesh
- Base coat
- Paint
External Wall – Spray Application
Internal Wall - Mineralwool

Internal Wall Insulation with Mineralwool
Internal Wall - Partition

Fibrous Insulation 64/86 Kg/m³ density

Gypsum cement ply board

Vertical timber studs at 600mm centres to suit typical 1200mm wide plasterboard

Insulation inserted between studwork

Vapour control layer

Electrical cables fixed before insulation is installed
Typical Industrial Practice

• Part of civil contract

• Last item in building construction

• Usually no approved list of manufacturers & applicator or turnkey

• Insulation usually not considered a specialized activity

• Sometimes material purchased and applied by civil masons

• Not properly stored at site leading to damages

• Unqualified contractors do the insulation job → specs. not followed. Job given to water proofing contractors.
Typical Industrial Practice

- Last minute order finalization
- Payment issues
- Financial pressure of civil contractor – budget constraint
- Time pressure to availability and completion → specs compromise
- Work quantity reduced or even short closed contract.
- Financial loss to insulation vendor
- Pull factor missing
Remedial Recommendations

- Most Preferred: Insulation to be made mandatory, highlighting benefits
- Sufficient time to be provided for job execution
- Client / authority to ensure no reduction in scope quantity.
- Sample testing mandatory from authorized labs.
- Municipality clearance only after completion of insulation work.
- Follow global practice.
Thank you