BEEP Integrated Design Process for Energy Efficient Buildings
Why environmental sustainability depends on Energy Efficient Buildings?

- Globally, buildings use about 40% of energy and they emit approximately 1/3rd of GHG emissions.

- In India, buildings account for 1/3rd of the electricity consumption.

- By 2047, buildings will become the highest consumer of electricity.

But....

- Energy sources are limited.

- Burning more fossil fuels to generate energy means increased GHG emissions & higher global temperatures.

Electricity Consumption in India (2016-17)

- Agriculture 18%
- Domestic 24%
- Commercial 9%
- Industry 40%
- Others 7%
- Traction and Railways 2%

Source: Ministry of Statistics & Programme Implementation, 2018
Energy Efficient Building and Thermal Comfort??

- Thermally comfortable buildings are necessary to maintain the health and well-being of the occupants.
- 75% of a person's time is spent inside buildings.

• But, only 5% of Indians have access to cooling—though this number is increasing.

What is needed?

Provide thermal comfort with reduced energy use.
BEEP Integrated Design Process & Charrettes
## Conventional Design Process

<table>
<thead>
<tr>
<th>Concept design</th>
<th>Schematic design</th>
<th>Design development</th>
<th>Construction drawings</th>
<th>Construction</th>
<th>Commissioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Client</td>
<td>• Architect...</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Structural Engineer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• HVAC Engineer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Green/Energy Consultant.....</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Project manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Contractor....</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Integrated design- What do you integrate?

Integration of:

- Multiple design professionals
- Multiple aspects of building design and construction

Source: Adapted from Lechner, Norbert: Heating, Cooling, Lighting: Sustainable Design Methods for Architects
Integrated Design Process

Experience shows:

- Cost-effective and energy efficient design (25-40% energy savings at no/marginal cost increase) is possible if the architect, engineer and client work together in a Design Charrette/Workshop during the early design phase.

- More savings are achieved when the architects and engineers continued to work together in the design phase.
Why Integrated Design?

- Better thermal comfort
- Achieve sustainability with no additional investment
- Attract better tenants/occupants
- Reduced energy use
- Reduced equipment size
- Reduced operation & maintenance cost
Stages of an Integrated Design Process

Concept design

Schematic design

Design development

Construction drawings

Construction

Commissioning

Conducting a charrette

Charette preparation

Follow-up, checks & commissioning
What is a Charrette?

The word “Charrette” is a French word, originally meaning a cart. It has evolved to mean a collection of ideas or a session of intense brainstorming.

This happened in the 19th century, when students of L’ecole des Beaux Arts in Paris would ride in the cart sent to retrieve their final art and architecture projects, frantically working together to complete or improve these projects.

Today it implies an intensely focused activity intended to build consensus among participants and develop specific design goals.
Who participates in a charrette?

**Client**
- Owner
- Promoter
- Building operator, Facilities / O&M etc.

**Design Team**
- Architect
- HVAC consultant
- Electrical consultant
- Green Building Consultant etc.

**Building execution team**
- Project manager

**Users**
- Building operator, Facilities / O&M etc.

**Landscape designer**

**Interior designer**

**Construction manager**

**Contractor**
Charette preparation

- Prepare the project brief
- Identify an individual or team to own / lead the integrated design process
- Assemble the design team, and (if possible) the execution team
- Create a few conceptual architectural designs
- Carry out climate and other preliminary analysis to understand what strategies may work
- Get background information on possible strategies (Technical specs, cost....)
Stages of an Integrated Design Process

Conducting a charrette

DAY 1:
• Fix the energy / comfort goal for the building

DAY 2:
• Finalise the set of strategies that may be applied

DAY 3:
• Test out the effectiveness of the strategies
  o Energy savings and comfort (through simulation tools)
  o Capital and operational cost (cost database tool)
• Develop alternative designs

DAY 4:
• Decide on final strategies / design
• Decide on next steps & assign responsibilities to track progress
Stages of an Integrated Design Process

Charrette Follow-up

- Prepare a charrette report and circulate to all participants
- Make sure the lines of communication are open between all charrette participants
- Hold periodic meetings to review the implementation of the charrette recommendations
- Prepare a final assessment after the completion of the project and after occupation.
Charrette tools (Analytical)

- Climate analysis tool (e.g. ClimateConsultant etc.)
- Weather data (.epw files etc.)
- Basic sun-path tool (e.g. Sketch-up, Ecotect etc.)
- Tool to calculate heat gains through building envelope (e.g. RETV compliance tool)
- Thermal comfort and energy simulation tool (e.g. EnergyPlus, DesignBuilder etc.)
- Daylight simulation tool (e.g. Radiance, DesignBuilder)
- Cost Database tool
BEEP Integrated Design Charrettes

- Technical support to 22 building projects (IT buildings, hospital, offices, residential complexes, academic institutions,..)
- >1.5 million m² built-up area
- 25-40% estimated energy savings
Building Design: Integrated Design Process

- Hospital
- Educational campus
- Residential township
- World Trade Centre
- Office & Retail complex
- Training institute & govt. office
Thank you

For details contact:
Saswati Chetia; saswati@gkspl.in