Emerging Building Technologies

Building technologies with focus on Control, Construction and Cooling

The global challenges of tomorrow drive our work today. We shape sustainable development worldwide.

13th December 2018
New Delhi

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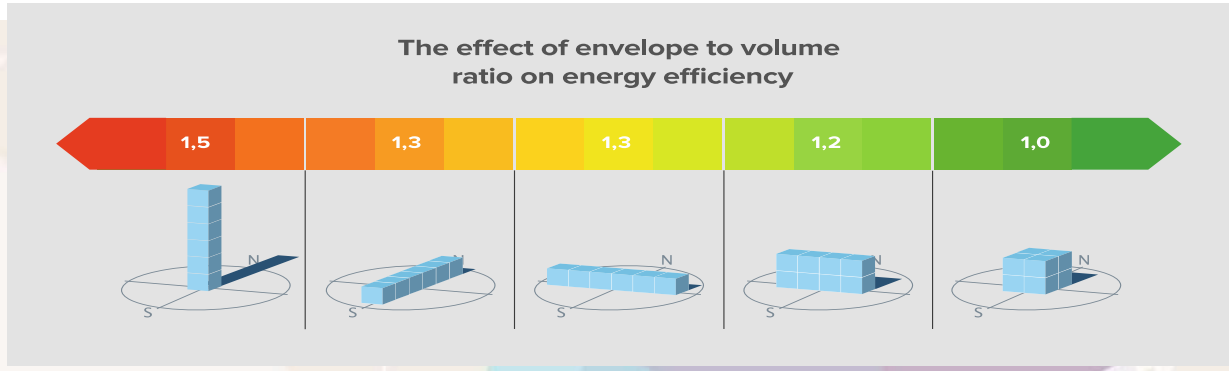
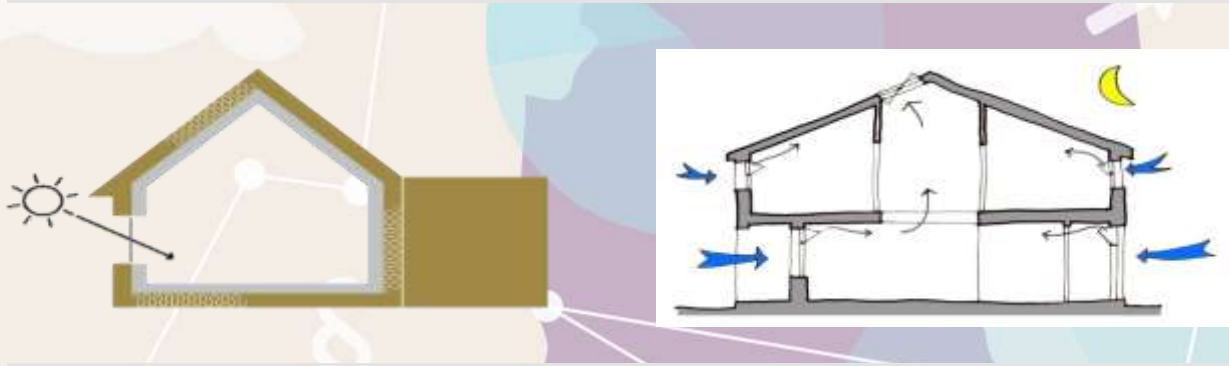
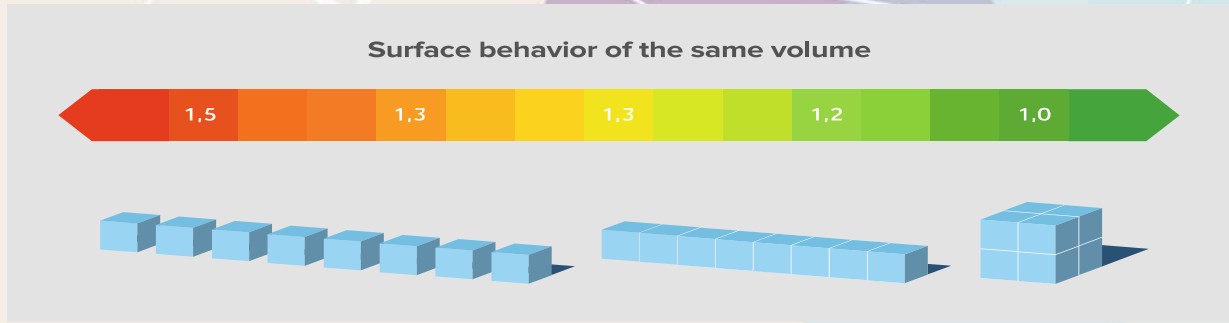
Program Manager (EERB)

Design

- Best Site
- Building Orientation
- Building form
- Building depth
- Window / Wall Ratio
- Zoning of building
- Buffer Zones
- Thermal Mass
- Envelope Colour
- Shading
- Passive Heating
  - (Solar Insulation etc.)
- Passive Cooling
  - (Natural ventilation etc.)

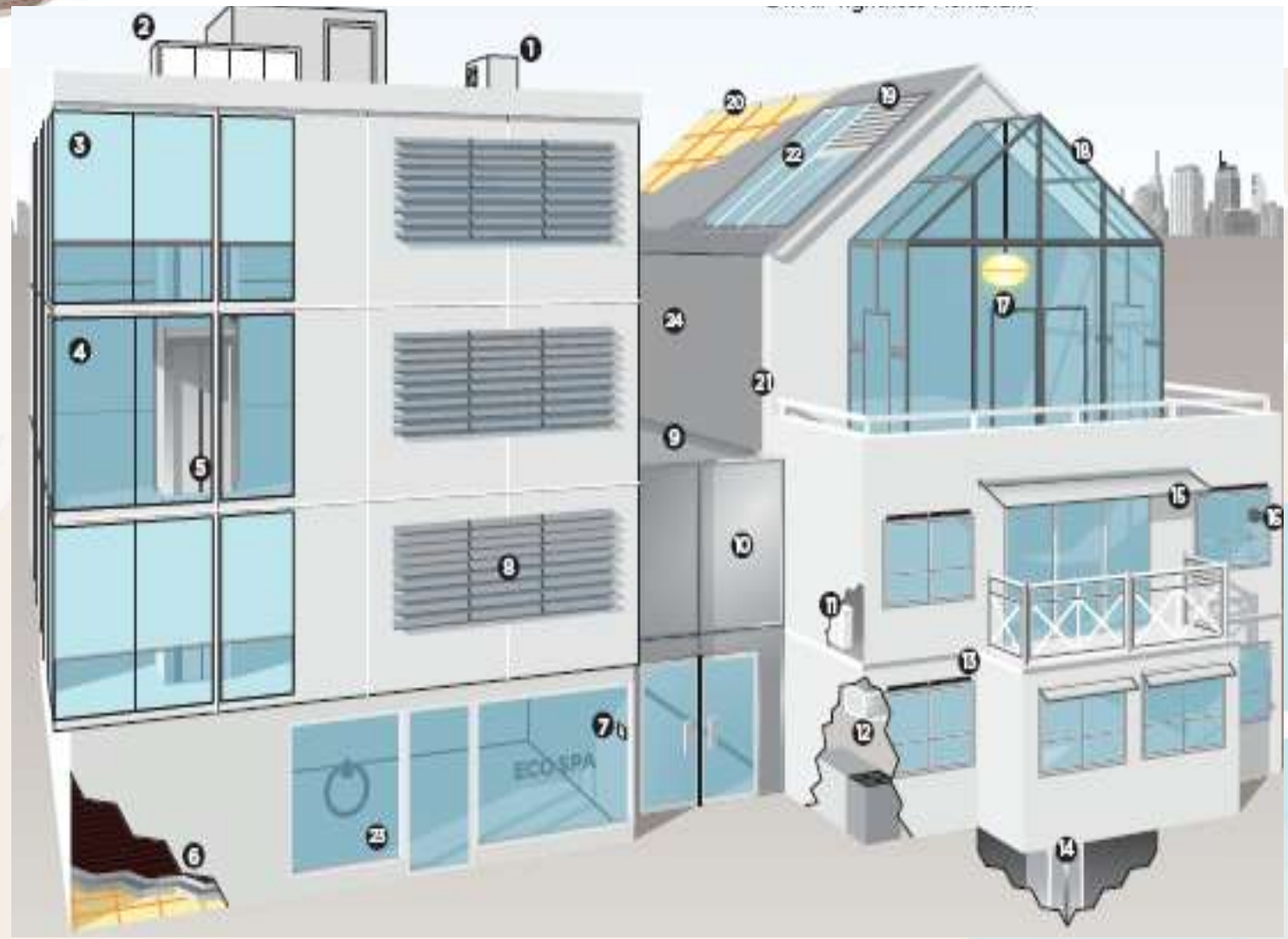






Technologies and Techniques

1. Air cooled chiller
2. Heat pump
3. Automated roller blind
4. Energy effficient glazing
5. Regenerative drive elevator
6. Floor insulation
7. Heating controls
8. Automated shading
9. Insulation
10. Insulation wall system
11. Heating and Cooling controls
12. Heat and Cold recovery ventilation
13. Humidity sensitive air inlets
14. Automated shading
15. Humidity controlled extract unit
16. Lighting
17. Sunspace
18. Automated awning
19. Insulation
20. Sealants
21. Roof window
22. Solar/Low E-window film
23. Air tight membrane



Source: EuroACE

State of the Art Technologies

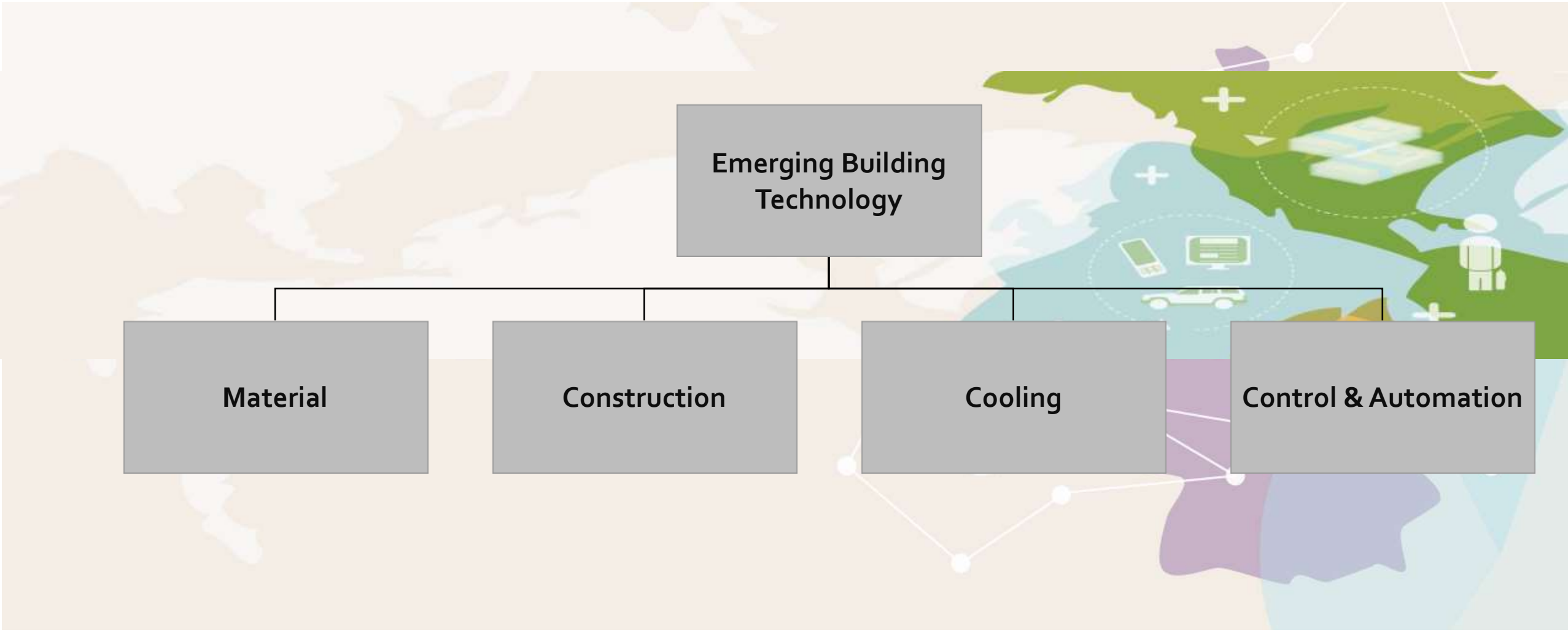
Most used technologies

- Superinsulation
- Triple glazed windows U = 0.8 W/m²K
- Heat & Cold Recovery Systems > 90%
- Hybrid Ventilation
- Demand Ventilation
- Heat pumps (w/w)
- Floor heating/Cooling
- LED Lighting
- PV (+ Battery)
- 5 Star Appliances

Source: Fraunhofer IBP

Methodology

- Identify Emerging Technologies
- Technology Mapping
- Identify Saving Potential
- Long Term Planning
- Setting up Goals w.r.t Cost Benefit Analysis


Emerging Building Technology
Material
Construction
Cooling
Control & Automation

Innovative Building Material

Innovative building Materials

- ✓Lotusan- Self Cleaning Paint
- ✓Titanium dioxide façade-Air Purification
- ✓Fibre composite adaptive system- A fine combination of natural and artificial system
- ✓Translucent concrete-
- ✓Transparent aluminium- ALON is optically transparent (≥80%)
- ✓Bio concrete -It a bacteria based self healing concrete
- ✓Syndecrete- Cement-based composite that uses natural minerals and recycled materials
- ✓Metamaterials
- ✓Bulk fullerene
- ✓Metal foam
- ✓Liquid granite
- ✓ Bendable concrete

- ➢ Low embodied energy
- ➢ Energy efficient
- ➢ Reusable
- ➢ Recyclable

- ➢ Bio degradable
- ➢ Pollution preventing
- ➢ Self healing
- ➢ Self cleaning

- ✓ Advanced Building System – EMMEDUE
- ✓Rapid Panel
- ✓ Precast large concrete panel system
- ✓GFRG building system

Parameter	Excellent	Very Good	Good	Average	Poor
Availability		√			
Energy Efficient	√				
Cost effective			√		
Future potential			√		
Ease of Adoption			√		

Construction

Pollution fighting buildings

Also known as 'vertical forests', they are high-rise forest buildings designed to tackle air pollution.

Ways to break thermal bridging in a tree scrappers

Pollution fighting building in Milan(Italy)

The **Palazzo Italia** actually consumes smog and takes pollution out of the air through its incredibly engineered biodynamic skin

Drone

Autonomous drones are being used to map out – sometimes hazardous – construction sites digitally, and providing a higher level of accuracy.

Use of Drone in Construction

From agriculture to smart cities to construction to surveying, drone technology is increasingly being deployed to enhance efficiency and productivity.

Relevence of technology in India

Parameter	Excellent	Very Good	Good	Average	Poor
Availability			√		
energy ffficient				√	
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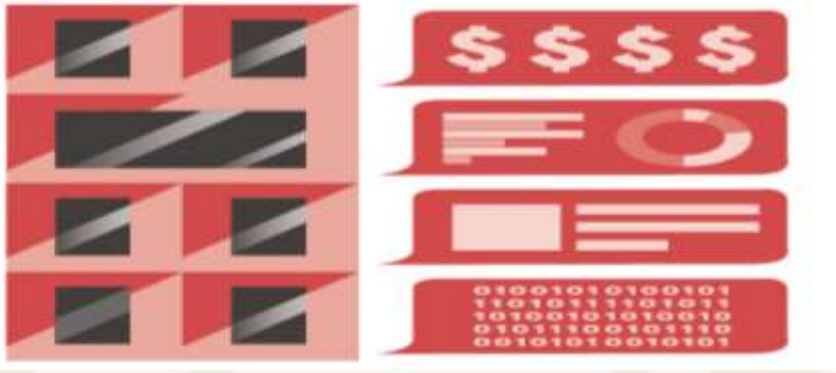
Future potential		√			
Ease of Adoption				√	

Building Information Modelling



1. BIM (Building Information Modeling) is an intelligent 3D model-based process that gives architecture, engineering, and construction (AEC) professionals the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure.

2. The future of BIM construction data will be used to support the predictive and automated maintenance schedules during the building life.

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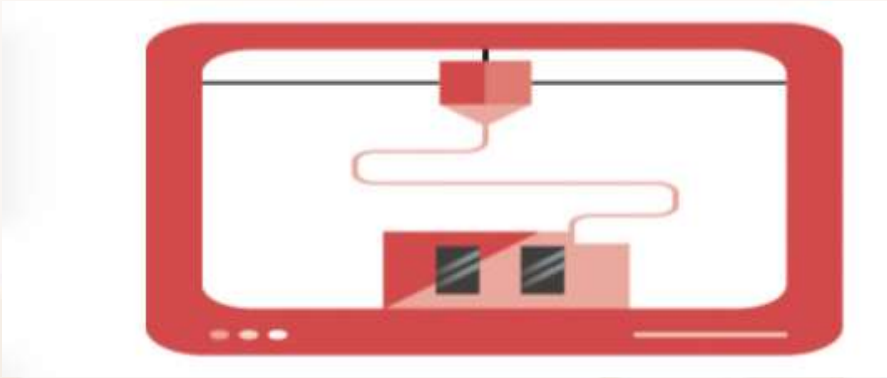
3D Printing



- *Benefit of reducing construction costs, the use of 3D printing makes it possible to embed wireless sensors into the walls of a property, achieving the full integration of technology and the built environment required for genuinely smart buildings."*
- *They can 3D-print walls out of concrete in a relatively short space of time.*

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Cooling

Radiant Cooling

- Use of cooled surfaces to remove sensible heat by radiation and convection.
- Use water to cool the radiant surfaces are called hydronic systems.

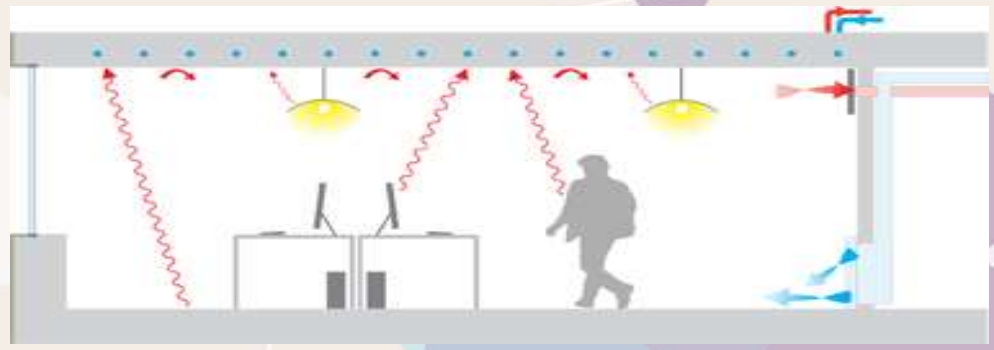

Fig: A room cooled with a high mass radiant ceiling slab. The slab is absorbing heat radiated from the people, surfaces, equipment, and lights in the room.

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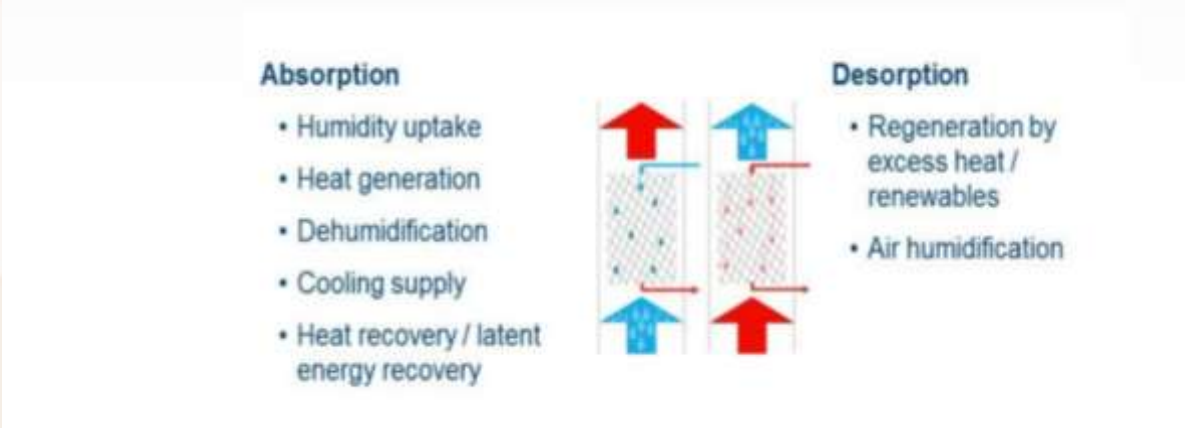
Intelligent hybrid Thermo Chemical District Network

- Works on Absorption technology for district network.
- The ambition of the new technology compared to the existing absorption technology is to develop an innovative open district network system for space heating and cooling that uses a thermo-chemical carrier to transport energy potential through its pipe system.



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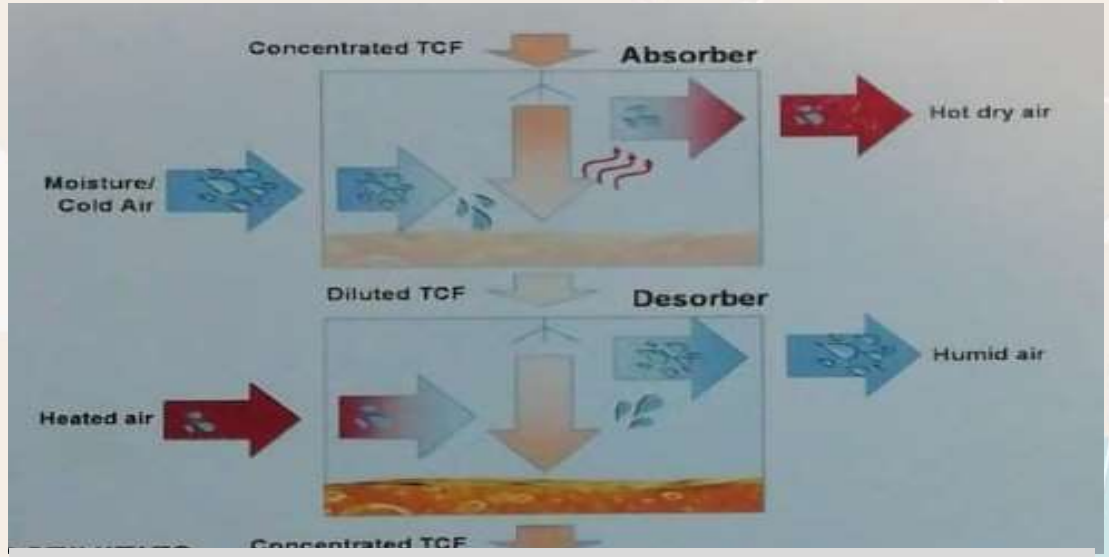
About the technology

- The technology providing heating and cooling energy for buildings by using absorption as a basic principle already exists.
- This technology is based on closed systems, which means absorption and desorption processes operate under pressure within a closed device.
- It is the examination of open absorption technology in that absorption and desorption do not take place at the same time and location.



- Increase energy efficiency of heat transport and storage
- Increase utilization of waste heat and renewable at low temperature
- Contribute to a wider usage of district networks by allowing heating and cooling in one multifunctional network and by adding the additional services drying and humidity control.

Enhance the system

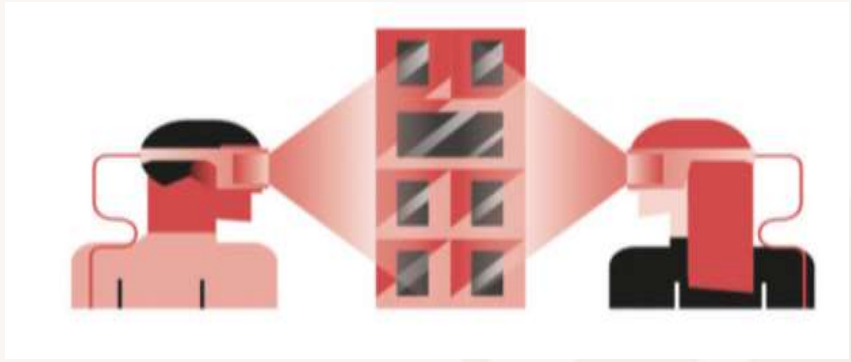
Intelligent Hybrid Thermo-Chemical District Network

- New concept of air distribution in greenhouseIt provides high level of efficiency and comfort.
- it reduces also the operational cost. The conditioned air is necessary only around the crops and not in the entire greenhouse.
- H-DisNet technology can be coupled to existing thermal district network improving their efficiency
- The system can be developed for the buildings.
- It is not too expensive (Prototype cost 10,000 Euro).

*https://www.h-disnet.eu/demonstrators/swiss-demonstrators

Control and Automation

Virtual Reality



- *Virtual reality allows users to "walk" through 3D and 4D model environments without actually moving their feet*
- *Provides true collaboration and decision making ability throughout the construction process.*
- *Use to calculate the energy efficiency Buildings.*
- *Visualize the impact of behavior of on its energy consumption*

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Augmented Reality

Augmented reality provides ability to literally walk through designs via tech like DAQRI Smart Glasses.
https://youtu.be/2SvT5opCCfE for more information

- *Augmented reality allows users to walk through real 3D environments, with their feet, while gathering and/or viewing additional real-time information about that environment.*
- *Increase Savings*

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Prefabrication and Integration with BIM

- Mobile technology that provides complete visibility into the prefabrication process, so that anyone involved in the project can see what is being manufactured, where it is the process, and when it will be delivered.
- **Helps in reducing the thermal bridging.**

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Predictive Analytics

- *Through the use of predictive analytics risk can be managed.*
- *It collects data from subcontractors, materials suppliers, design plans, and the site itself to analyze risk factors based on historical data.*
- ***Predictive analysis helps in optimise the energy efficiency.***

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Smart Devices

1. **Lighting**
   Lights control to provide the right luminosity where and when it is needed
2. **Control Panel**
   Access control panel via interactive touch screen devices or from mobile
3. **Occupancy Detection**
   Occupancy and motion sensors for a comfortable space
4. **Heating, ventilation and air-conditioning**
   Optimum climate, temperature and air control
5. **Power Supply**
   Stable bus voltage and safe access to power network data
6. **Management Station**
   Improved maintenance management and energy performance
7. **Energy Efficiency**
   Increase energy savings and reduce building operating costs

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Building automation

Includes a comprehensive and coordinated control of one or more major system functions required in a facility

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Technology scenario in India

- Drone has been used in India on construction site
- Current 3D printing industry in India faces multitude of challenges and isn't economically viable. But it is a matter of time before these challenges are addressed to bring the industry into the mainstream.
- Lack of awareness among people about3D printing. So, the entire market should be educated first on 3D printing industry and on how it can be used to solve various problems in an efficient manner.
- Also the current range of good quality 3D printers are priced upwards Rs. 1,20,000 ($ 2000). At this price, the printers are very expensive for the majority of the market and the prices should come down by at least 75% for 3D printing technology to become mainstream.
- In India only commercial buildings are using building automation. it is rarely used in residential building.
- Radiant cooling/heating system is used in very cold climate but in India radiant cooling is not that much used. There are few project going on that are working on radiant cooling specially in India.
- Intelligent hybrid Thermo Chemical District Network is a project going on in switzerland it is not yet completed hence in India, people are not aware of this technology.

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Thank you

The global challenges of tomorrow drive our work today. We shape sustainable development worldwide.