



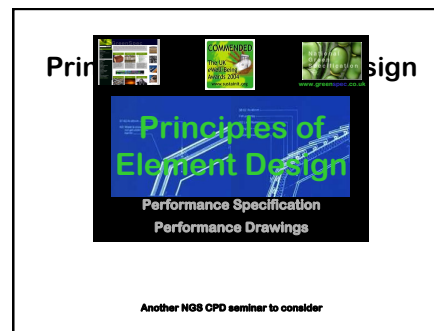
- Principles of Element Design
- Climate Change
- Wind
- Wind Tunnel Testing
- Wind Turbines
- Natural Ventilation
- Moisture Vapour & Condensation
- Thermal Insulation
- Breathing Construction
- Airtightness
- Wind & Airtightness Testing
- Building Elements

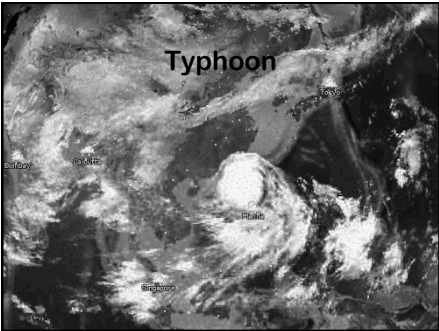
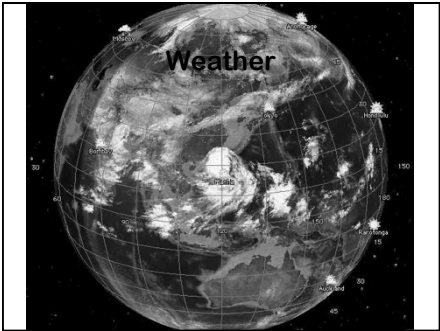
- Passive Ventilation
- Active Ventilation
- Stack Effect
- Atrium
- Solar Orientation & Solar Gain
- Conservatories
- Thermal mass
- Conduction, Convection, Radiation
- Solar Shading
- Thermal mass, Passive and active cooling
- Fluid dynamics
- Mechanical Ventilation
- Air-Conditioning




- ### GBE CPD Seminar Series
- Educational Objective:
    - Comprehensive introduction to subject: from tornadoes to air-conditioning and a lot more in between
    - emphasis on environmentally sustainable solutions
    - design primer: addressing principles and solutions
    - technically rich: materials, construction, services & testing
    - Related GBE CPD Seminars indicated
    - Questions and answers for each subtopic in file 10
  - Audience:
    - Architecture Students Part 1 Year 2/M Arch
    - CPD update for all levels of experience & knowledge
  - Delivery:
    - 3 to 4 hours depending upon audience participation
    - Image only slides 1 hour 265 of 500 turned un
    - Reading 1 hour
    - 26 subject breaks to enable subdivision

- ### Air Movement in Buildings: 1 of 9 Sub-topics in 10 separate files
- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Principles of Element Design</li> <li>• Climate Change</li> <li>• Wind</li> <li>• Wind Tunnel Testing</li> <li>• Wind Turbines</li> <li>• Natural Ventilation</li> <li>• Moisture Vapour &amp; Condensation</li> <li>• Thermal Insulation</li> <li>• Breathing Construction</li> <li>• Airtightness</li> <li>• Wind &amp; Airtightness Testing</li> <li>• Building Elements</li> <li>• Passive Ventilation</li> </ul> | <ul style="list-style-type: none"> <li>• Active Ventilation</li> <li>• Stack Effect</li> <li>• Atrium</li> <li>• Solar Orientation &amp; Solar Gain</li> <li>• Conservatories</li> <li>• Thermal mass</li> <li>• Conduction, Convection, Radiation</li> <li>• Solar Shading</li> <li>• Thermal mass, Passive and active cooling</li> <li>• Fluid dynamics</li> <li>• Mechanical Ventilation</li> <li>• Air-Conditioning</li> <li>• Questions and Answers</li> </ul> |
|--|---|









**From Global Imperative  
To Material Choices**

Another NGS CPD seminar to consider




**Consequences  
of no action**

Another NGS CPD seminar to consider




**Climate Change  
Readiness**  
Future Proofing

Another NGS CPD seminar to consider



**NGS Renewables  
Ready Buildings**  
Image bank buildings

Another NGS CPD seminar to consider



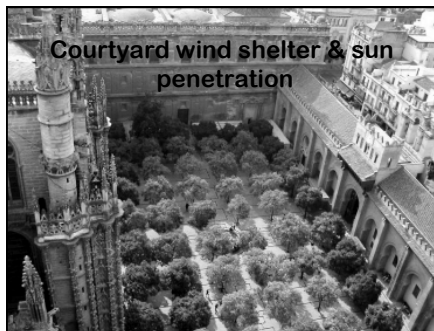
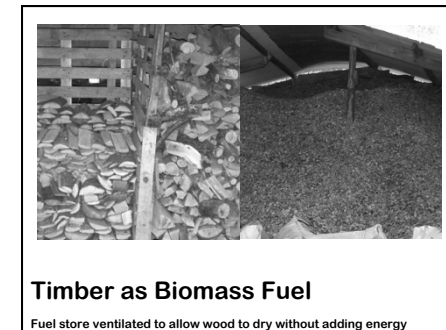
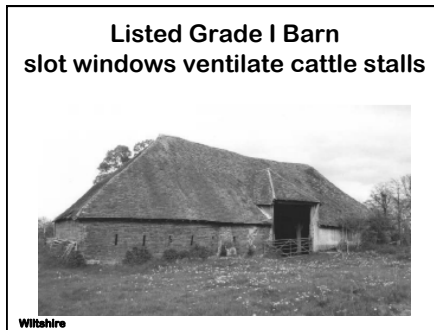
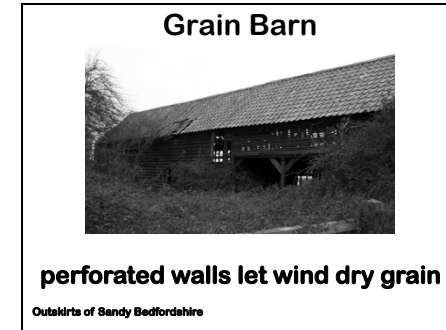
**NGS Energy:  
Renewables**  
Guides and Products

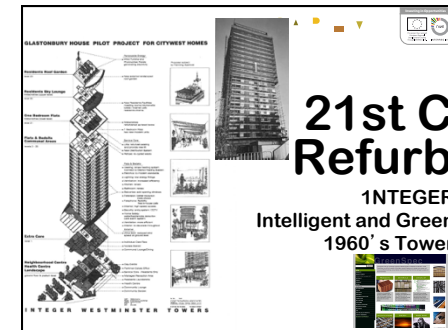
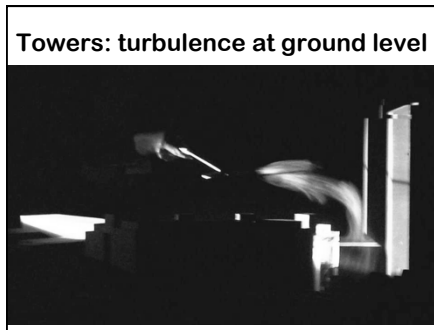
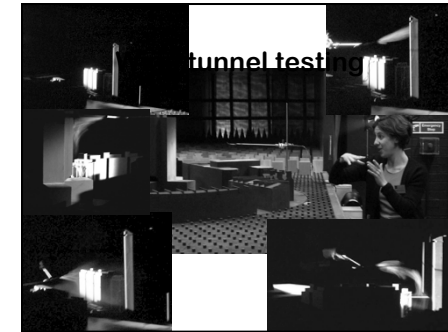
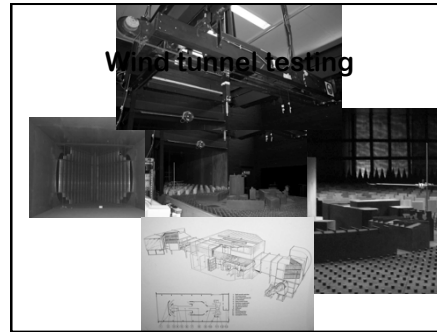
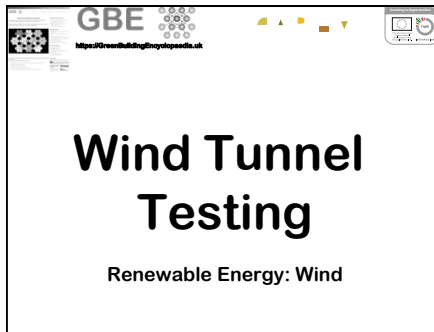
Another NGS CPD seminar to consider

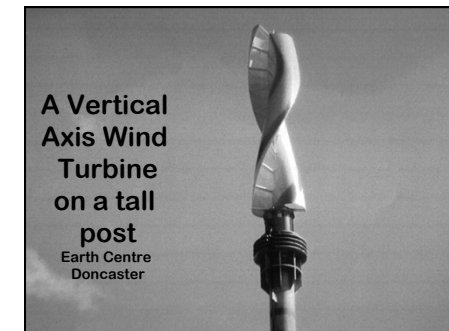
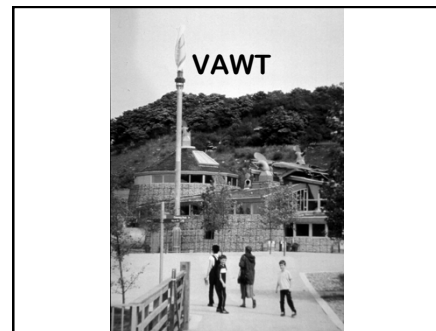
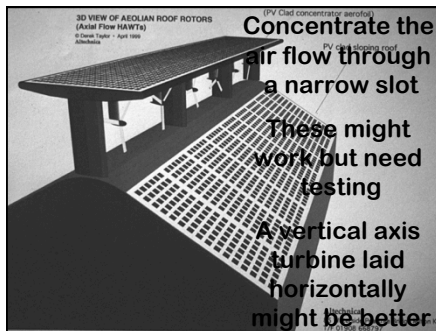
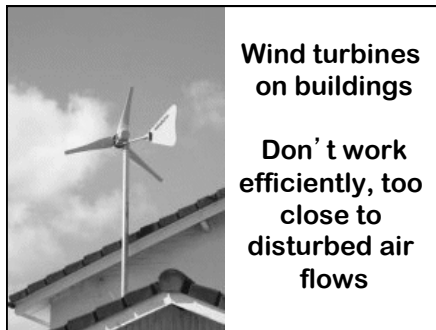
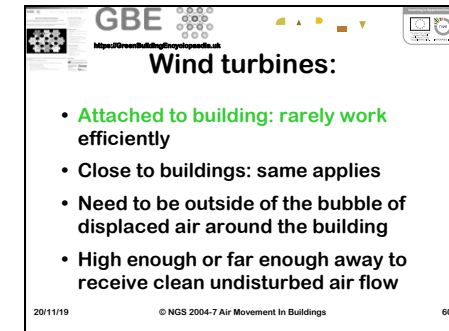
**Air Movement in Buildings: 2 of 9  
Sub-topics in 10 separate files**

• Principles of Element Design	• Active Ventilation
• Climate Change	• Stack Effect
• Wind	• Atrium
• Wind Tunnel Testing	• Solar Orientation & Solar Gain
• Wind Turbines	• Conservatories
• Natural Ventilation	• Thermal mass
• Moisture Vapour & Condensation	• Conduction, Convection, Radiation
• Thermal Insulation	• Solar Shading
• Breathing Construction	• Thermal mass, Passive and active cooling
• Airtightness	• Fluid dynamics
• Wind & Airtightness Testing	• Mechanical Ventilation
• Building Elements	• Air-Conditioning
• Passive Ventilation	• Questions and Answers

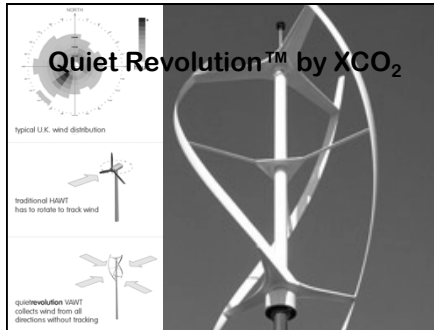






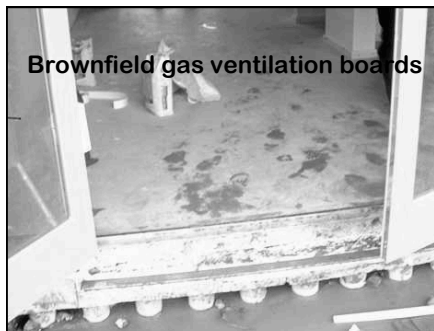
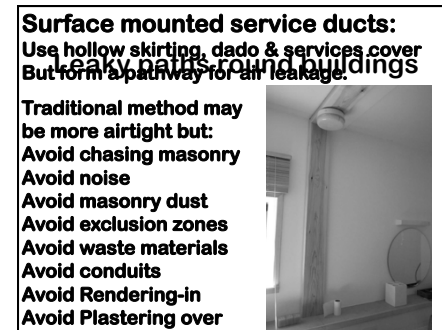
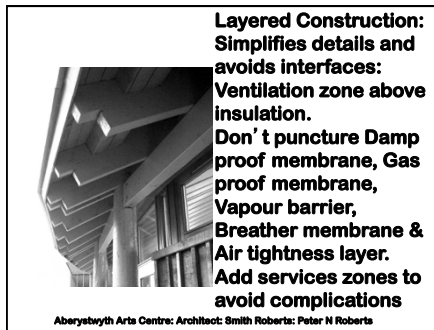




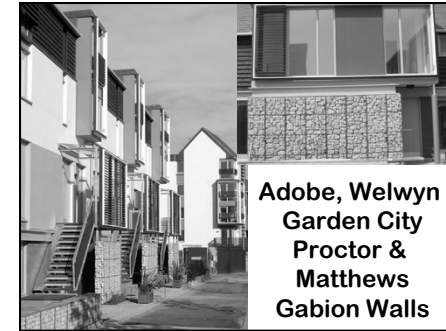
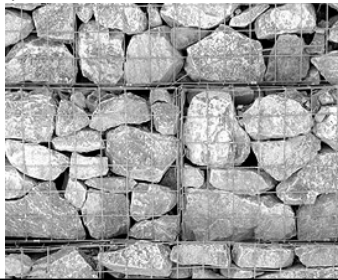


## Air Movement in Buildings: 3 of 9 Sub-topics in 10 separate files

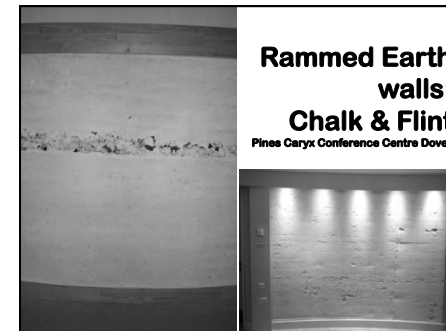
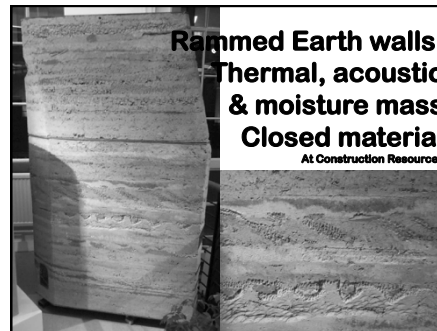
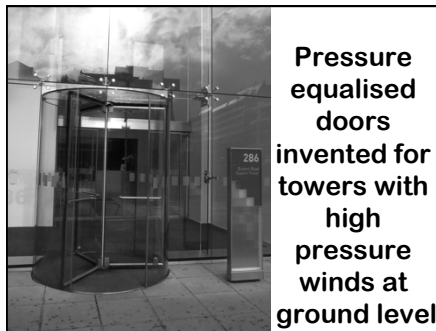
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- Questions and Answers



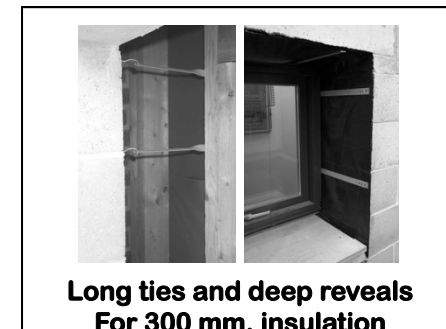
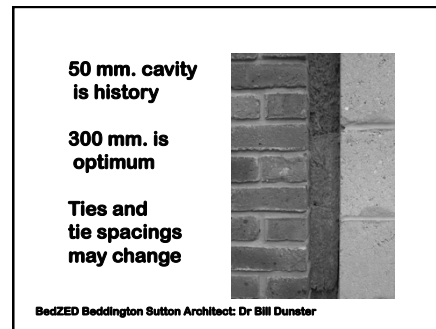
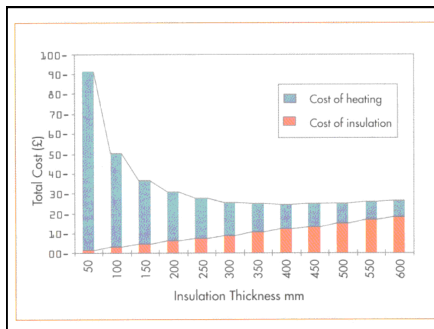
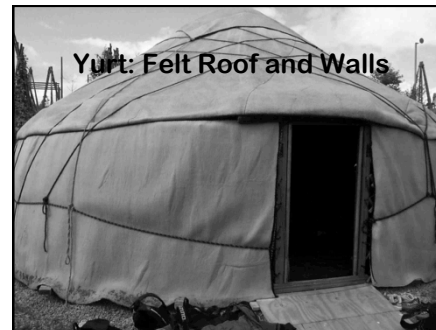
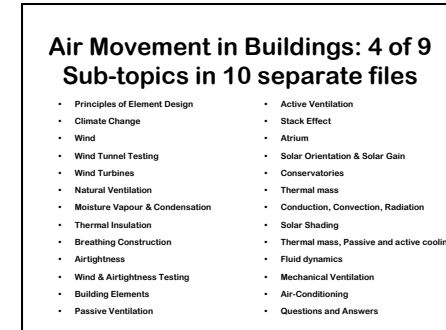
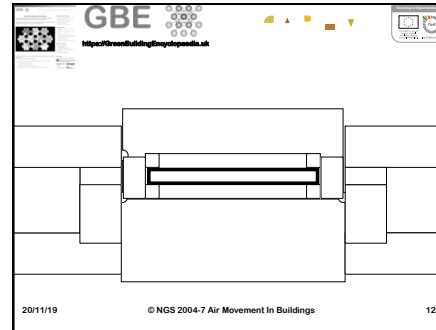
Open materials/construction



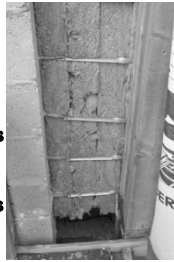
Another NGS CPD seminar to consider







**Zero Fossil Fuel  
Energy Development**  
High thermal mass  
cavity walls and floors  
Low U values  
Rock Mineral Fibre  
Long 2 part cavity ties



BedZED Beddington Sutton Architect: Dr Bill Dunster

**Zero Fossil Fuel  
Energy Development**

High thermal mass  
cavity walls, roofs  
and floors

Low U values  
300 mm.  
Rock Mineral Fibre  
Long 2 part cavity ties



BedZED Beddington Sutton Architect: Bill Dunster

## Breathing Construction



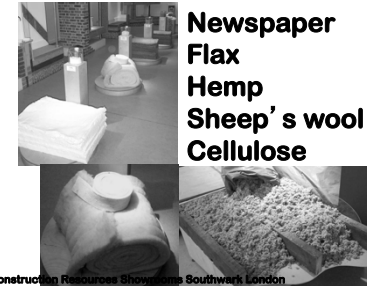
**EVT  
Enhanced  
Vapour  
Transfer™**

**Enhanced Vapour Transfer  
(EVT) and rainscreen**  
Hygroscopic insulation  
maintain their performance  
even when wet  
Vapour and water released  
when conditions permit  
No need for Vapour Barrier  
Use vapour permeable  
construction  
5:1 ratio VR inside:outside  
and an air tightness layer



Construction Resources Showrooms Southwark London

**Hygroscopic Thermal Insulation**



Construction Resources Showrooms Southwark London

**Hygroscopic Insulation:  
Sheep's Wool**



**Airtight &  
Permeable finishes**

**Materials  
Protection:**

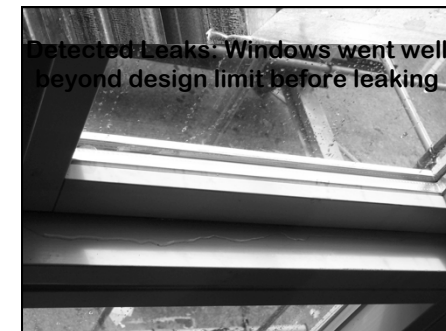
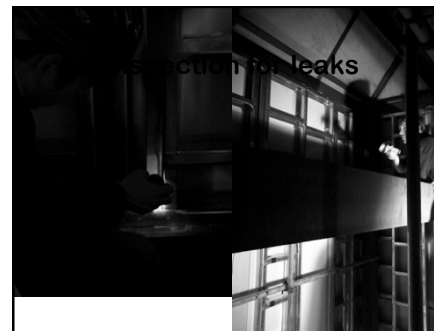
Full hbmpp scheme  
No absorbent surfaces  
Pallet  
Stability bracing  
Corner & edge Protection  
Moisture control  
But:  
Rain Cover needed  
Not Remote storage  
Not off the ground  
Not JIT but JIC

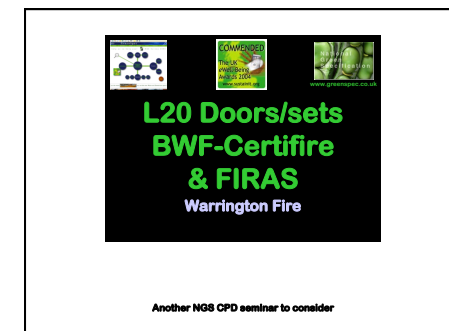
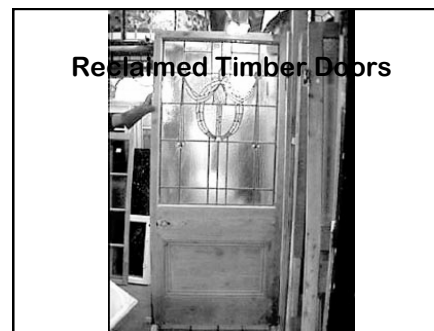
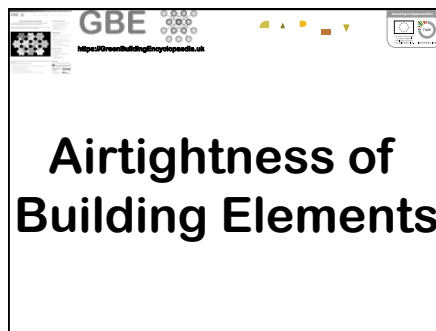
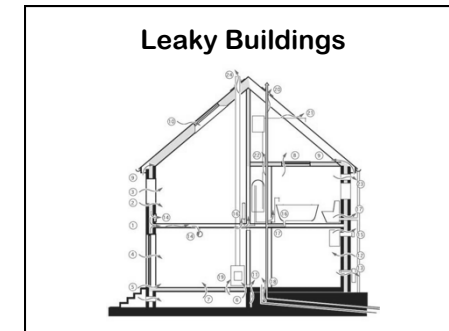
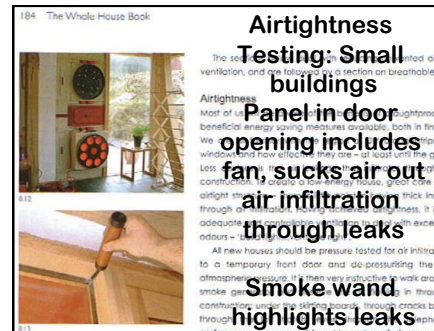
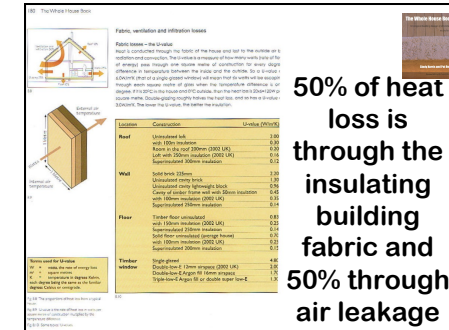
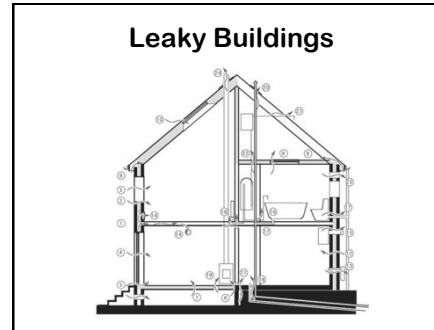
How many doors to push over the windows?  
BedZED Beddington Sutton Architect: Bill Dunster



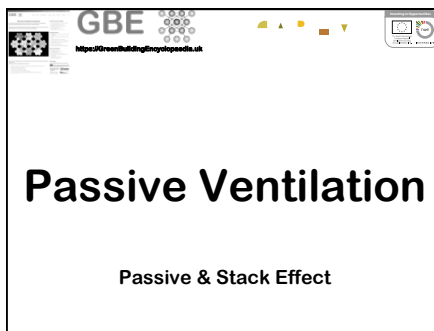
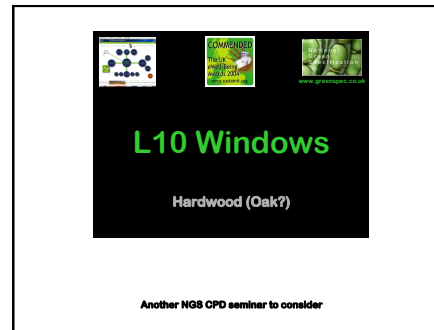
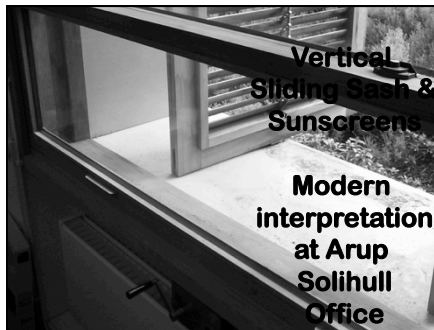
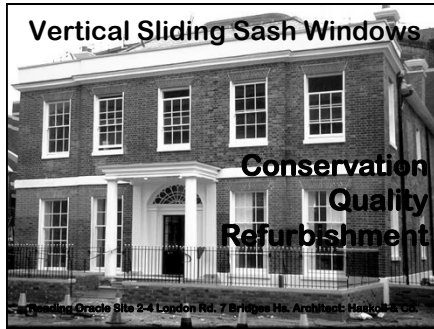
## Air Movement in Buildings: 5 of 9 Sub-topics in 10 separate files

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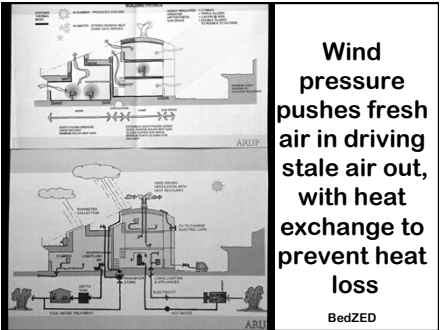
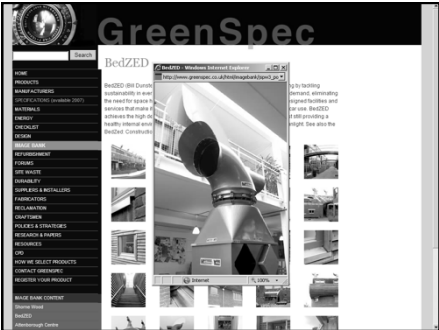
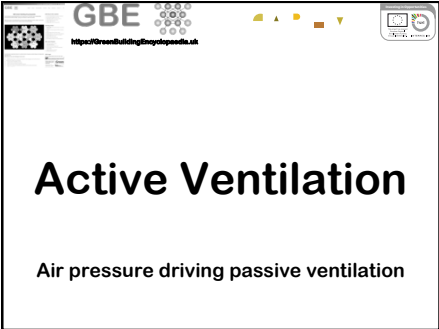
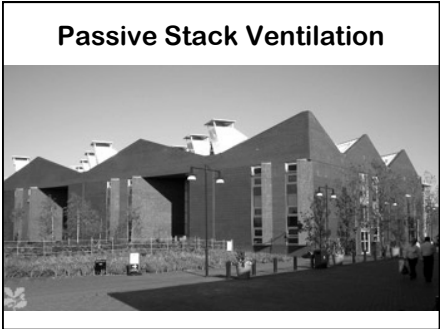
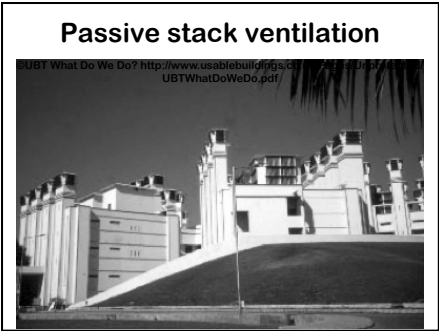


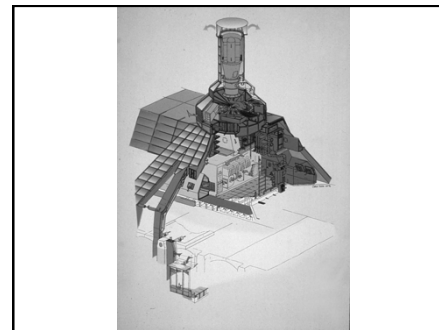
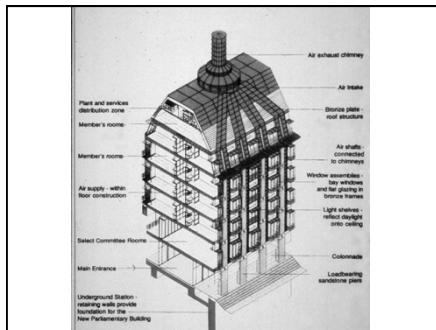
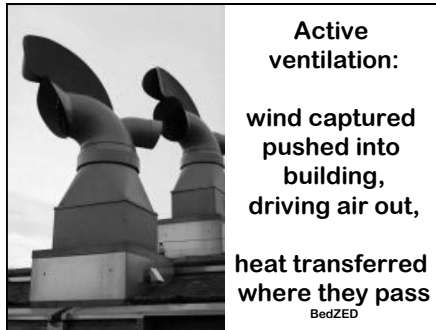


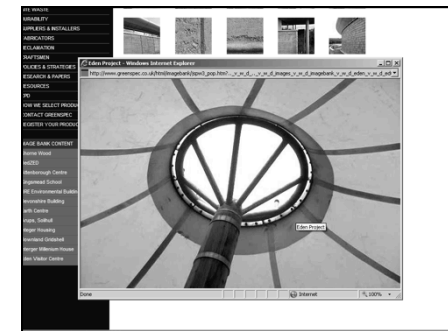
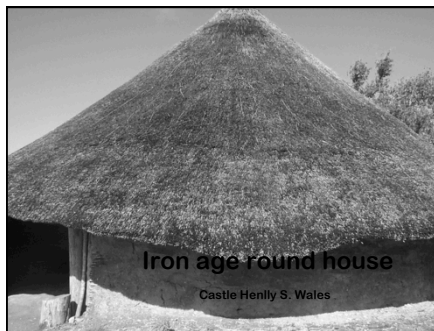
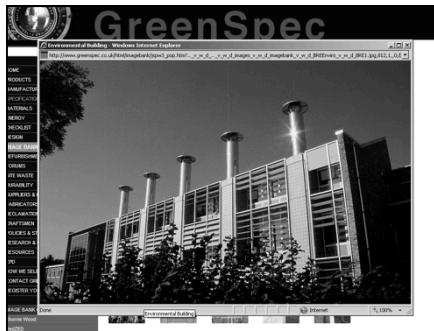
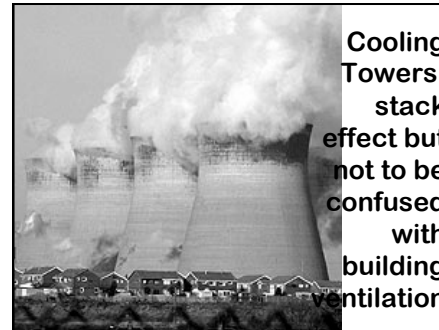


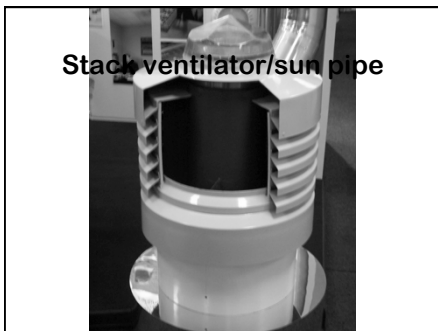
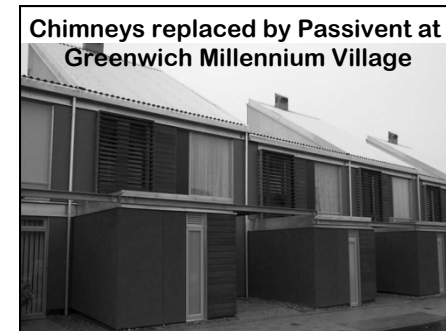




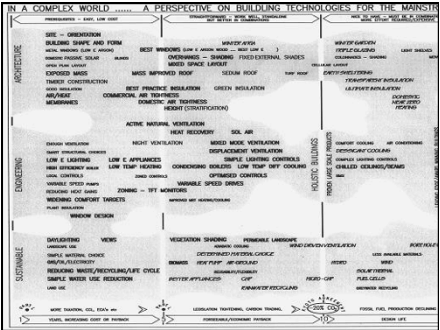
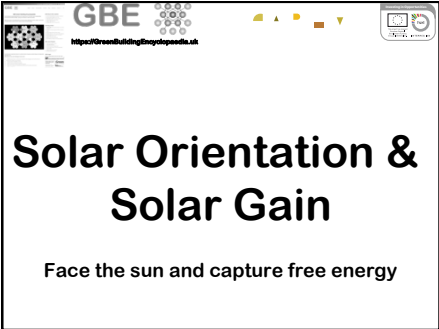
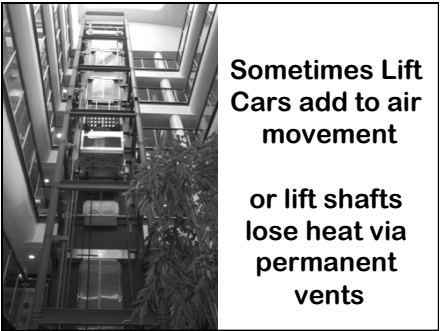
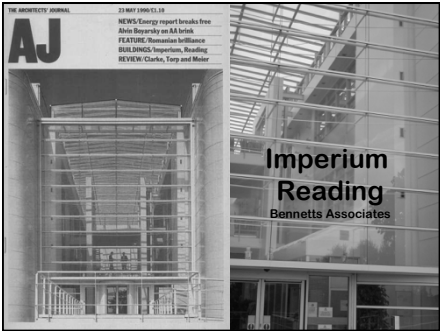
















**Zero Energy Development**

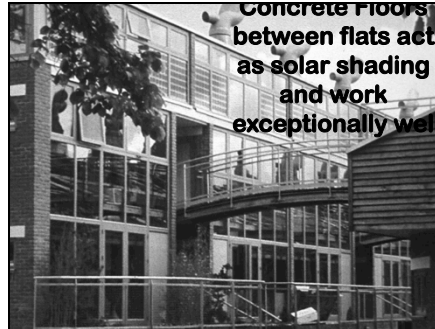


Reduce demand for artificial light and heating:  
Outdoor living  
Conservatory life  
sunny warm cave to retreat to in the cold of night

HHP Hockerton Housing Project, Newark, Nottinghamshire



Hot house in the middle of winter  
Ventilation for summer  
No heating  
Solar gain  
Exposed thermal mass  
Windows and Doors to house



Concrete Floors between flats act as solar shading and work exceptionally well



Sunroom on South face captures the sun

Heavy building elements store the heat and release it later

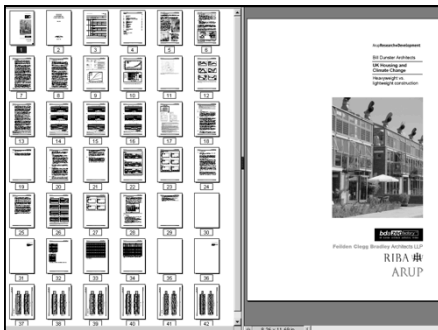


Top floor glass roof lets in too much heat top floor overheats

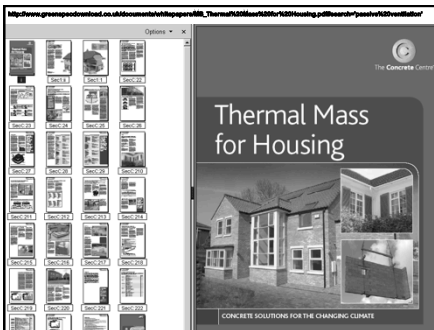
GBE  
<https://greenbuildingencyclopedia.uk>

## Thermal Mass

Ventilation, warmth and coolth



Architectural presentation slide showing a grid of images and a large image of a building.



Thermal Mass for Housing


CONCRETE SOLUTIONS FOR THE CHANGING CLIMATE

GBE  
<https://greenbuildingencyclopedia.uk>

## Hockerton HHP

Conservatories

**Zero Energy Development**



Reduce demand for artificial light and heating:

- Outdoor living
- Conservatory life

Sunny warm cave to retreat into  
From the cold of night

Hookerton Newark Nottinghamshire




Hot house in the middle of winter

GBE <https://greenbuildingencyclopedia.uk>

**BedZED**

Conservatories

**Zero (Fossil Fuel) Energy Development**



BedZED Beddington Sutton Architect: Dr Bill Dunster



Profile: to ensure sun penetration over roofs reaches sill of office space windows  
Sun rooms on south side thermally massive floors walls and roofs store heat until required



Sunroom on South face captures the sun

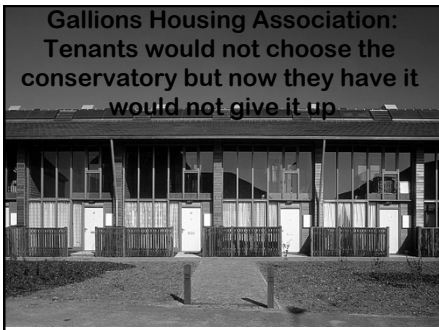
Heavy building elements store the heat and release it later

GBE <https://greenbuildingencyclopedia.uk>

**Gallions HA**

Conservatories

Gallions Housing Association:  
Tenants would not choose the conservatory but now they have it would not give it up



GBE <https://greenbuildingencyclopedia.uk>

**National Botanic Gardens of Wales**

Glass roof



Glass Roof: gain & loose heat

GBE COMMENDED  
The UK  
Green Building  
Awards 2004  
www.sustainable.co.uk

## In the real world

Conservatories gone wrong

GBE COMMENDED  
The UK  
Green Building  
Awards 2004  
www.sustainable.co.uk

## Conservatories Gone Wrong

In the real world

GBE COMMENDED  
The UK  
Green Building  
Awards 2004  
www.sustainable.co.uk

## GLA Head Quarters

North Facing Conservatory

### North facing conservatory

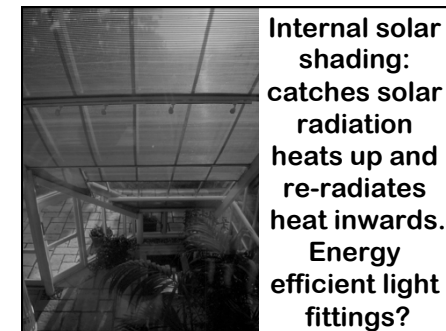
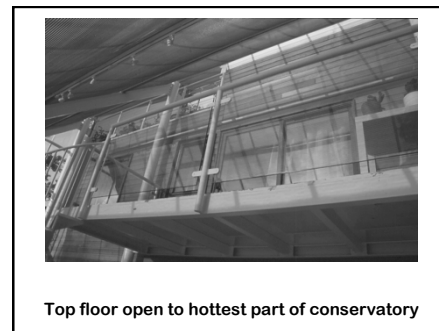
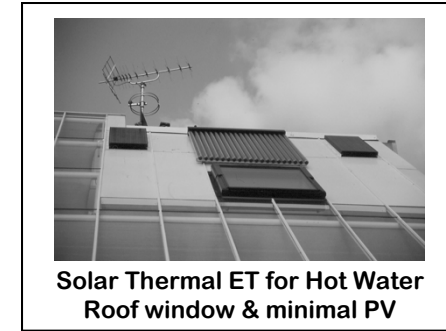
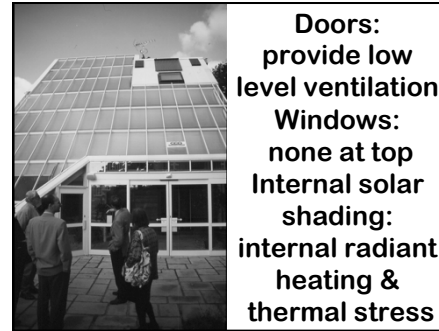
Conservatory design gone wrong:  
solar gain shading but no ventilation  
Tenant fitted Air-conditioning

## 1INTEGER @ BRE Intelligent & green

Not very intelligent Conservatory:  
Secure all-weather garden  
single glazed and double to house but open at top floor  
Some solar shading, some planting

1INTEGER house conservatory at BRE is not all that it could be  
Single glazed  
No thermal mass back wall,  
open to living accommodation on top floor.  
Just sheltered outdoor space

Opening vents in side walls of conservatory but only half way up the height of the conservatory



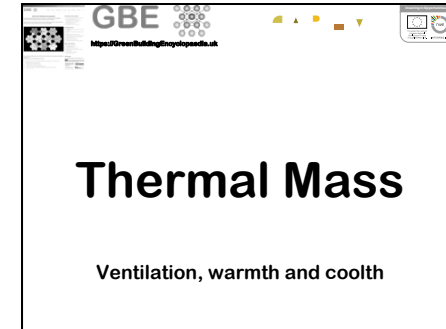




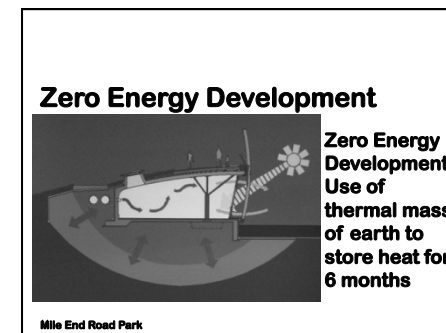
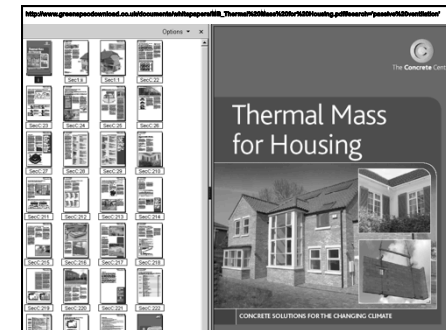
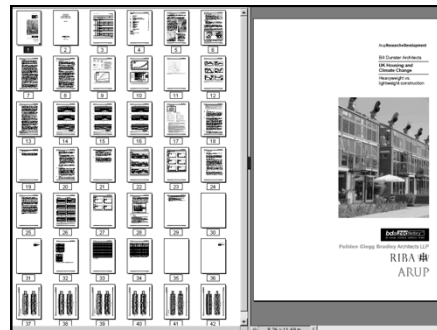
Top floor open to conservatory and no ventilation at high level



Bedrooms face South & open onto the warm conservatory

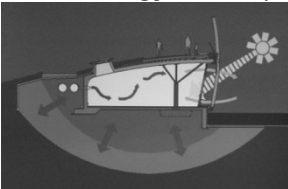


High Thermal Mass at surfaces fairfaced brick, block and plank






### Zero Energy Development



Heat transfer in soil 1m/mth  
6m insulation boards at perimeter  
6 months of heat storage

Mile End Road Park

### ZED 4 Elements



Another NGS CPD seminar to consider

### Conduction Convection Radiation Conduction



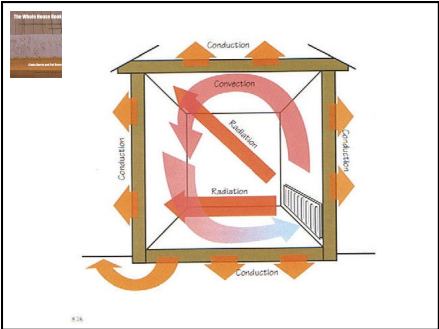
Radiators (Convection)

### The Whole House Book


Ecological Building Design and Materials  
Second Edition

Cindy Harris and Pat Borer  
Foreword by Richard Rogers

Publisher:  
CAT Centre  
for  
Alternative  
Technology  
Publications  
2nd edition  
ISBN:  
1-90217-522-0  
£35 (worth it)



### Rammed Earth @ CAT





Bill Dunster & Solar Penetration  
BedZED Beddington Sutton



## Air Movement in Buildings: 8 of 9 Sub-topics in 10 separate files

- Principles of Element Design
- Climate Change
- Wind
- Wind Tunnel Testing
- Wind Turbines
- Natural Ventilation
- Moisture Vapour & Condensation
- Thermal Insulation
- Breathing Construction
- Airtightness
- Wind & Airtightness Testing
- Building Elements
- Passive Ventilation
- Active Ventilation
- Stack Effect
- Atrium
- Solar Orientation & Solar Gain
- Conservatories
- Thermal mass
- Conduction, Convection, Radiation
- Solar Shading
- Thermal mass, Passive and active cooling
- Fluid dynamics
- Mechanical Ventilation
- Air-Conditioning
- Questions and Answers

## Solar Shading

Used to shade or permit sun passage

Solar shading:  
Common in  
mainland  
Europe  
Will become  
more important  
in the UK if only  
we knew how

100% glazed  
façade requires  
100% air  
conditioned  
office

## Operational Energy

Passive solar control avoids  
mechanical ventilation and  
air-conditioning in summer



City Place, Gatwick



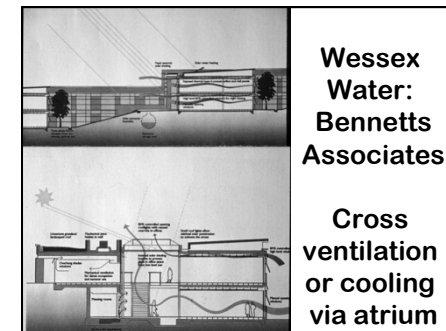
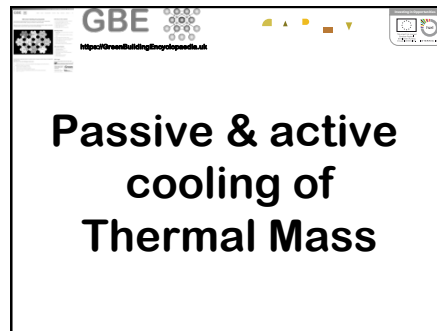
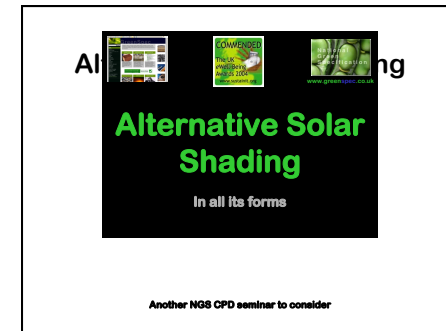
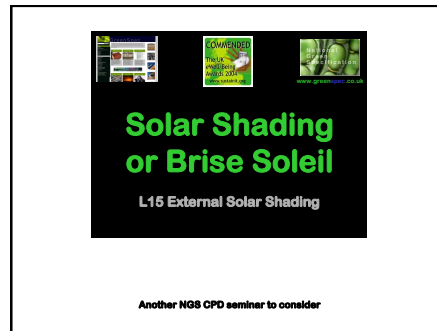
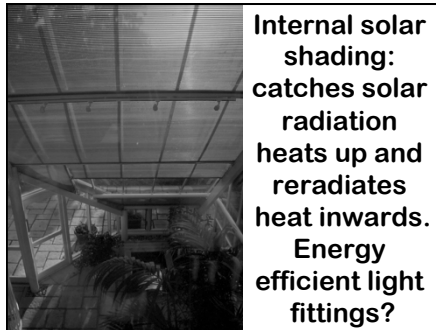
Wessex Water

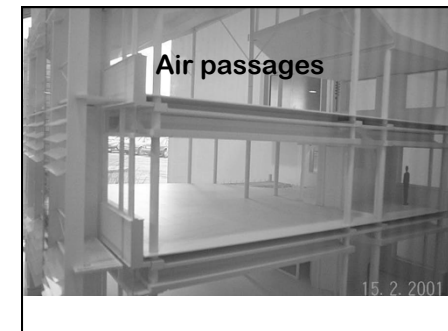
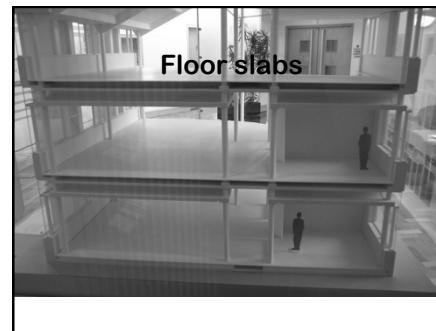
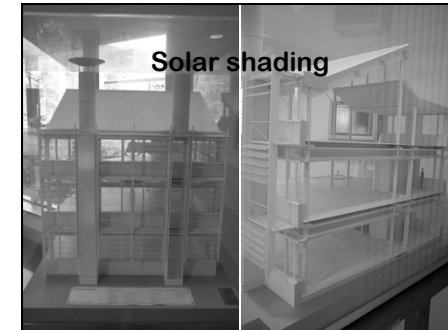
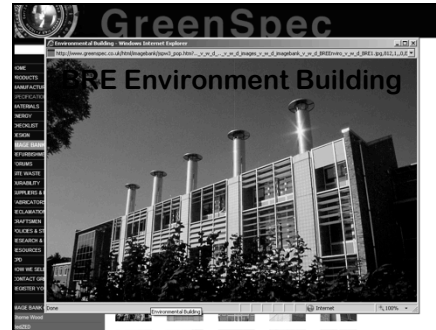
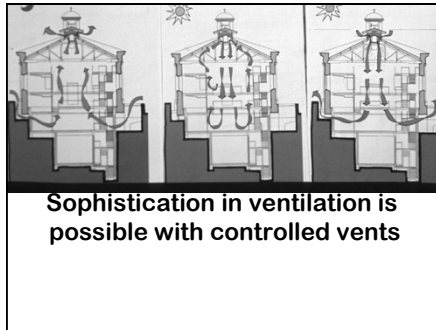
Solar shading on west & north faces  
just the same, but sun paths different

## GreenSpec

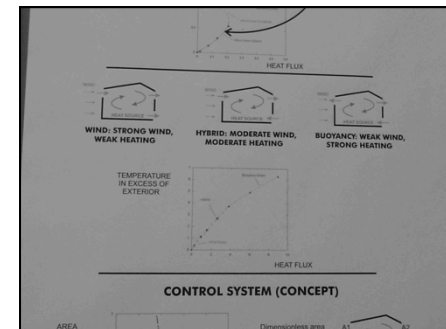
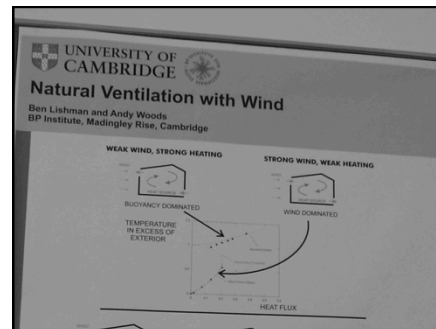
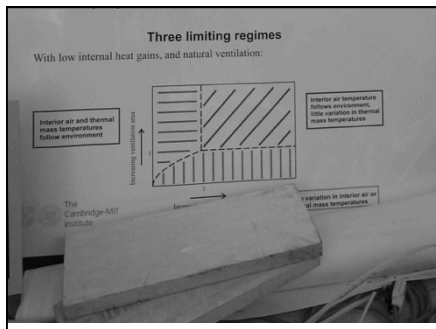
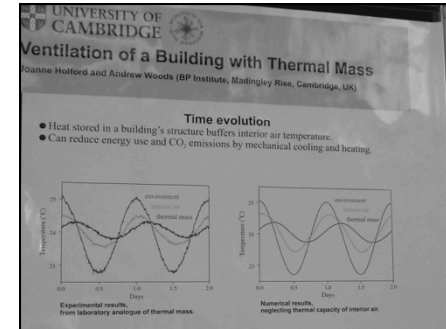
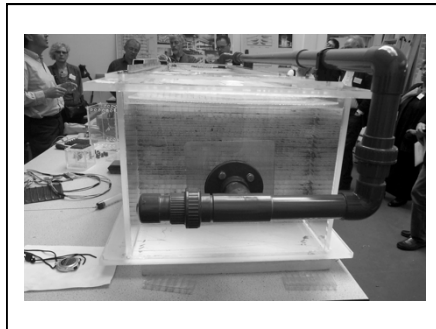
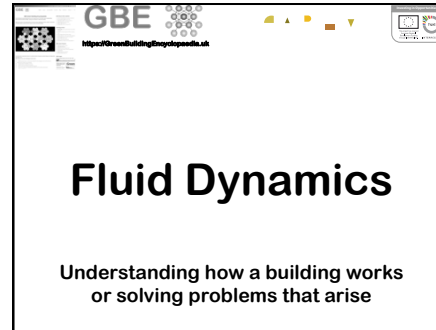
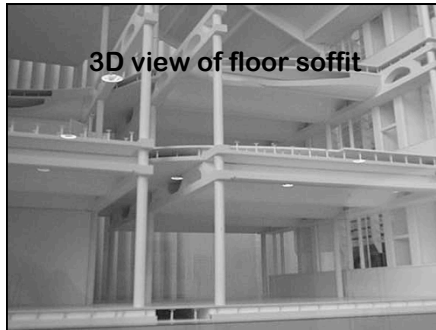


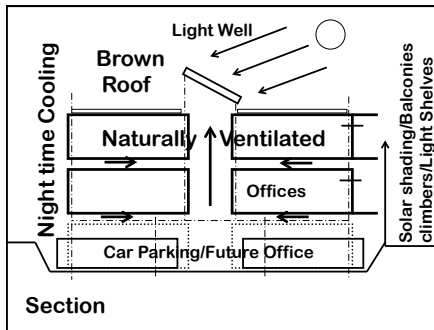
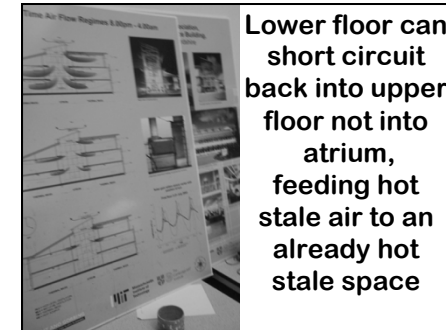
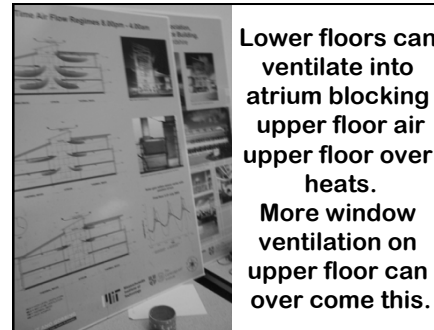
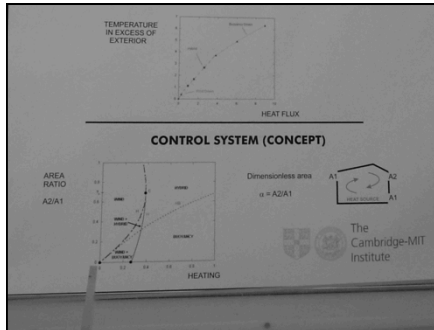
External Solar Shading: Roller Blinds











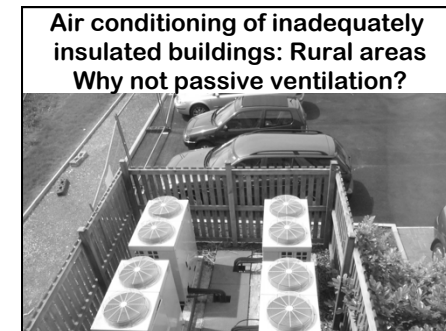
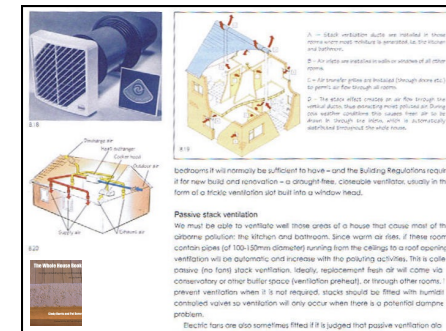
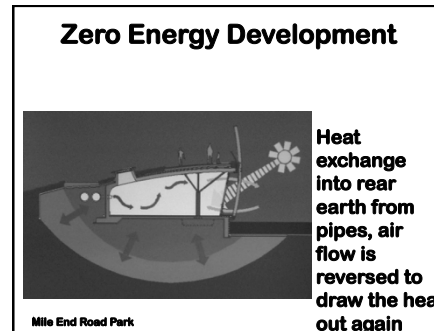
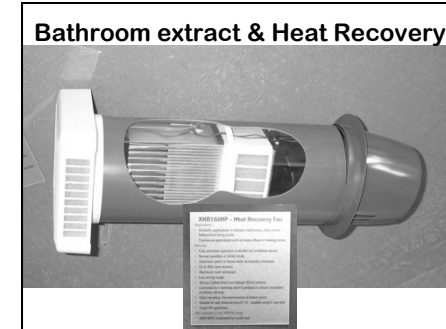
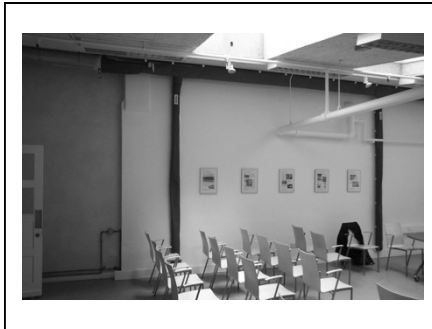
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- Mechanical Ventilation**
- If open windows are not practical
  - E.g. Urban traffic noise
  - E.g. Agricultural smells
  - E.g. Sea Breezes too strong
  - Push cool fresh air in distribute at floor level
  - Displaces hot air that moves up out of its way
  - Draw hot stale air out





Air conditioning of inadequately insulated buildings adding to the heat island effect of cities.  
push heat out below open windows!



Air conditioning v IT heating

