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Air movement in & about buildings 9 of 9 + Q&As

© NGS GreenSpec 2007 CPD in 10 parts

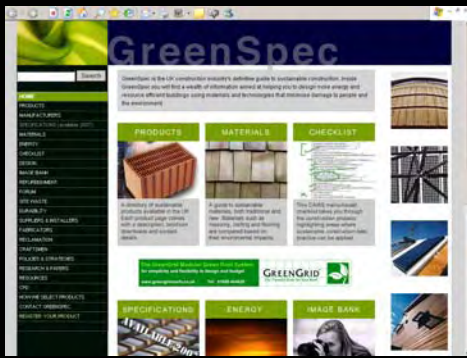
GreenSpec CPD Seminar Series

- **Educational Objective:**
 - Comprehensive introduction to subject: from wind 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 GreenSpec CPD Seminars indicated
 - Questions and answers for each subtopic in file 10
- **Audience:**
 - Architecture Students Part 1 Year 2
 - CPD update for all levels of experience & knowledge
- **Delivery:**
 - 3 to 4 hours depending upon audience participation
 - Reading 1 hour
 - 26 subject breaks to enable subdivision

Air Movement in Buildings: 9 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



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Mechanical Ventilation

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

Atrium & Mechanical ventilation





Fabric Ducting
Air permeable
Distributed
widely
No
concentrated
drafts





**Laboratory
Cabinet
Extraction
of
hazardous
chemical
gases and
products of
combustion**

Mech Vent with Heat Recovery

- Hot stale air is pushed out of the building but that waste heat energy
- Cold fresh air is drawn in and it takes energy to warm it
- Steal the heat out of the outgoing air
- Transfer it to the incoming air
- Heat exchanger in a cross over chamber where the two air do not mix but pass through many thin walled ducts
- Duct walls are low insulating, transparent, conductive, plastic skins 1 – 2 mm. thick.

Bathroom extract & Heat Recovery



XHR150HP - Heat Recovery Fan

Applications

- Domestic applications in kitchens, bathrooms, utility rooms, bedrooms or living rooms.
- Commercial applications such as hotels, offices or meeting rooms.

Features

- Fully automatic operation controlled by humidistat sensor.
- Normal operation in trickle mode.
- Automatic switch to boost mode as humidity increases.
- Up to 80% heat recovery.
- Aluminium heat exchanger.
- Low energy usage.
- This is a Safety Extra Low Voltage (SELV) product.
- Controlled by a remotely sited humidistat to ensure consistent & reliable sensing.
- Quiet operation, low maintenance & tamper proof.
- Suitable for wall thickness from 9"-14". Installed using 6" core drill.
- 3 year UK guarantee.

Also available in the XHR150 range

- XHR150PC is operated by a pull cord.



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- HOME
- PRODUCTS
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- SPECIFICATIONS (available 2007)
- MATERIALS
- ENERGY
- CHECKLIST
- DESIGN
- IMAGE BANK**
- REFURBISHMENT
- FORUMS
- SITE WASTE
- DURABILITY
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- CPD
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IMAGE BANK CONTENT

Shorne Wood

BedZED

BedZED

BedZED (Bill Dunster) is a sustainable housing development in London, designed to demonstrate the need for space heating and hot water services that make it possible to achieve the high standards of a healthy internal environment. See also the BedZed: Construction



BedZED - Windows Internet Explorer

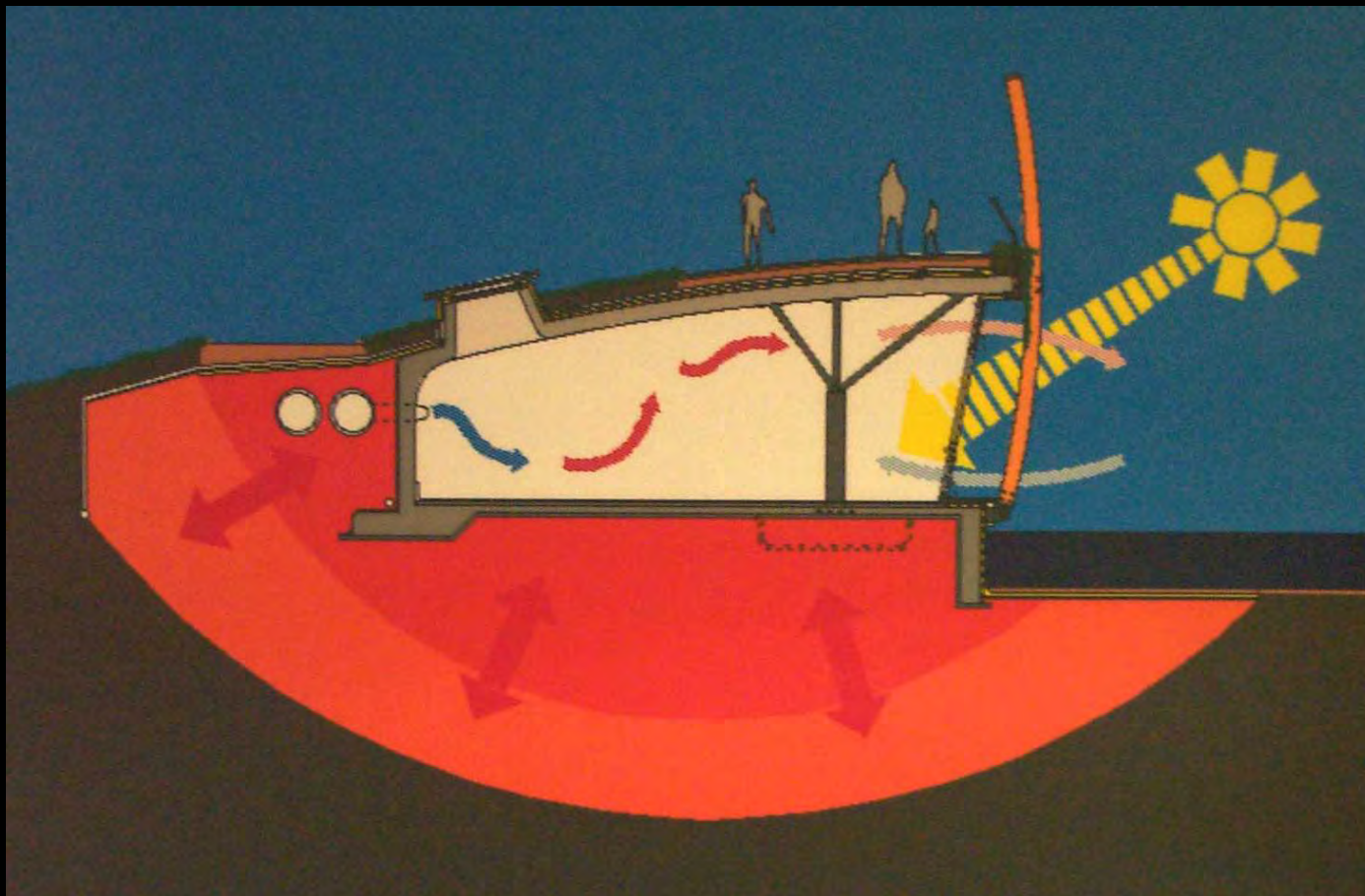
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Internet 100%

ing by tackling
demand, eliminating
designed facilities and
car use. BedZED
st still providing a
nlight. See also the



Zero Energy Development



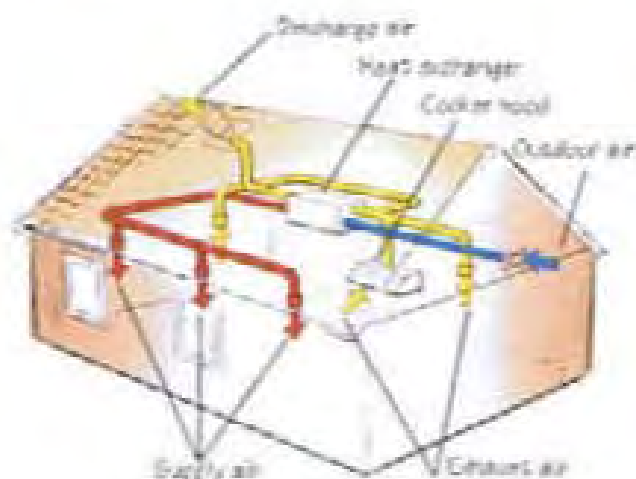
Heat exchange into rear earth from pipes, air flow is reversed to draw the heat out again

Whole House Ventilation

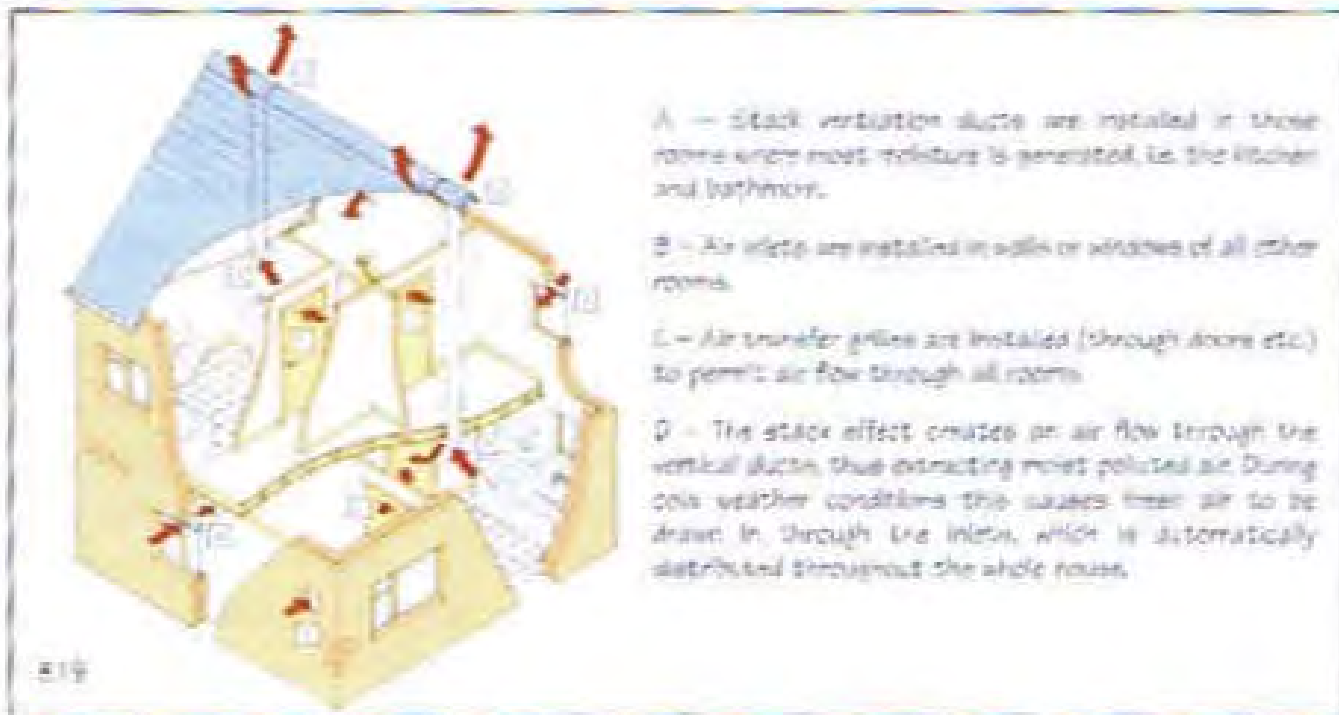
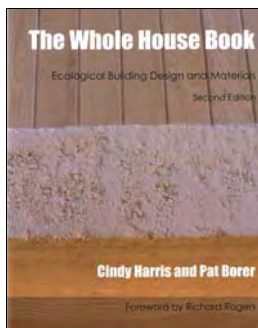
- At Hockerton HHP bungalow
- one pipe in, one pipe out, valves along length to each space
- 225 mm. dia clay pipe, flexible joint, hung from soffit over corridor space
- 100 watt fan with heat recovery.
- Efficient fan essential,
- Airtight building essential
- Heat recovery essential
- More complicated in 2 storey house



8.18



8.20



A - Stack ventilation ducts are installed in these rooms since most moisture is generated, i.e. the kitchen and bathroom.

B - Air slots are installed in walls or windows of all other rooms.

C - Air transfer grilles are installed (through doors etc.) to permit air flow through all rooms.

D - The stack effect creates an air flow through the vertical ducts, thus extracting moist polluted air. During cold weather conditions this causes fresh air to be drawn in through the intake, which is automatically distributed throughout the whole house.

8.19

bedrooms it will normally be sufficient to have – and the Building Regulations require it for new build and renovation – a draught-free, closeable ventilator, usually in the form of a trickle ventilation slot built into a window head.

Passive stack ventilation

We must be able to ventilate well those areas of a house that cause most of the airborne pollution: the kitchen and bathroom. Since warm air rises, if these room contain pipes (of 100-150mm diameter) running from the ceilings to a roof opening ventilation will be automatic and increase with the polluting activities. This is called passive (no fans) stack ventilation. Ideally, replacement fresh air will come via conservatory or other buffer space (ventilation preheat), or through other rooms. I prevent ventilation when it is not required, stacks should be fitted with humidity controlled valves so ventilation will only occur when there is a potential dampness problem.

Electric fans are also sometimes fitted if it is judged that passive ventilation do

+ve pressure whole house heating
relies on leaky building

EVERDRI
condensation control systems

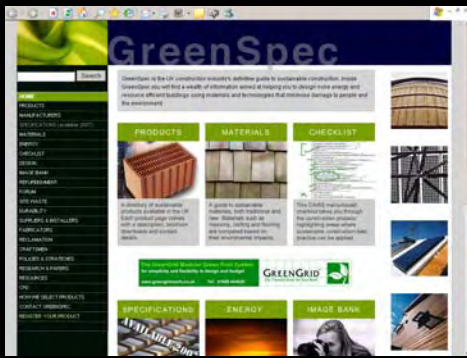


Everdri - Condensation Control Units

Inputs a continuous supply of fresh, dry air into the home creating a slight positive pressure which forces air laden with moisture and contaminant out of the household through natural leakage points. Available in loft and wall mounted versions

The loft unit is installed in the roof space and is ducted to a diffuser which is fitted to the ceiling. The unit draws filtered dry air from the loft space, which benefits from solar gain, and gently introduces it into the home through the diffuser

The wall mounted unit is designed especially for flats and other properties without loft space. It draws air directly from the outside utilising a small 500W heater which tempers the air should it fall below 10°C



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Air-conditioning

Avoid if possible

Air Conditioning

- Avoid at all costs (shoot the letting agent)
- Design walls, glazing, solar shading to not need air conditioning
- But if you have to have it (e.g. Art gallery)
- then use Green Tariff Electricity or PV
- link to Ground Source Coolth Pumps
- Switch from air-conditioning to ventilation when A-C is not needed.

Air conditioning of inadequately insulated buildings: Rural areas Why not passive ventilation?



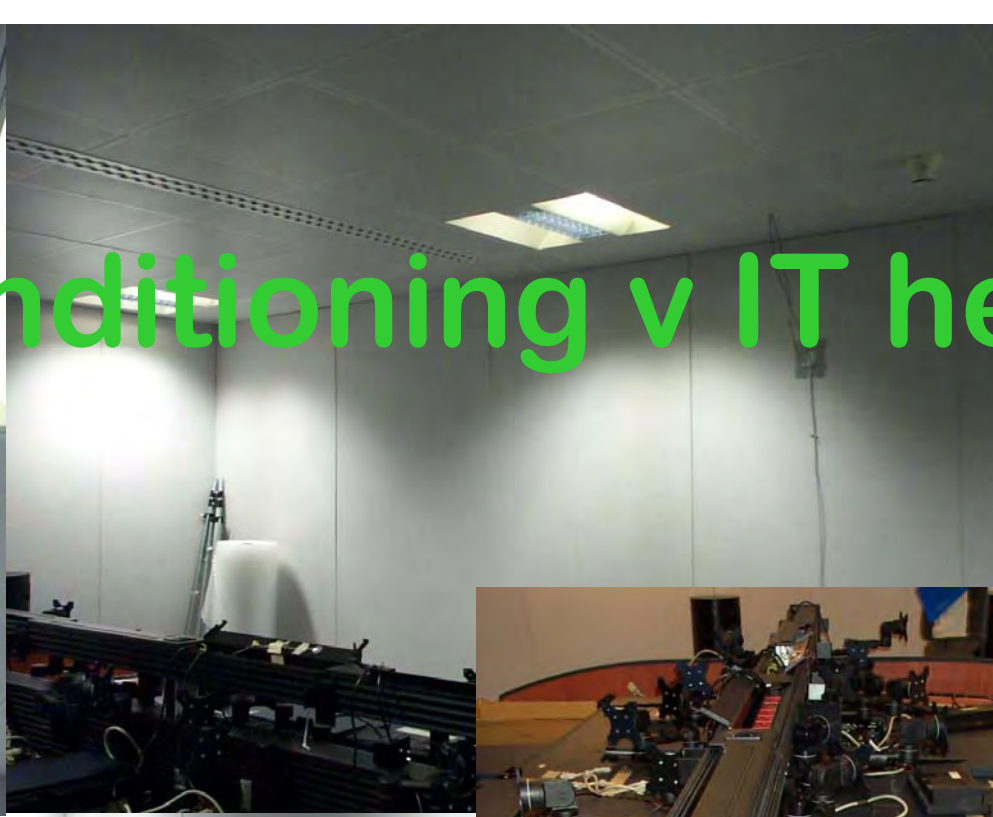
**Air conditioning of inadequately insulated buildings adding to the heat island effect of cities.
push heat out below open windows!**



Comfort conditions

- Bankers in the city on dealer floors
- 8 computers each emitting heat under desk
- Heat rooms then need air conditioning
- Cold head and hot legs
- Flaking by the end of the day
- Need Champaign showers to cool off

Air conditioning v IT heating



Test Yourself Part 9

- Why is mechanical ventilation better than Air-conditioning?
- What opportunities are there for having mixed mode Mechanical ventilation and air-conditioning in the same building?
- How is mechanical ventilation best introduced?
- How does heat recovery work in mechanical ventilation?

How did you do? Part 9

- Far less energy needed to push air than to heat, cool and humidify it
- Ventilation most of the time and air conditioning during performances or when exhibits warrant it.
- Cool air in at low level to displace hot air rising
- Steal the heat from stale air outgoing to heat the fresh air incoming

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