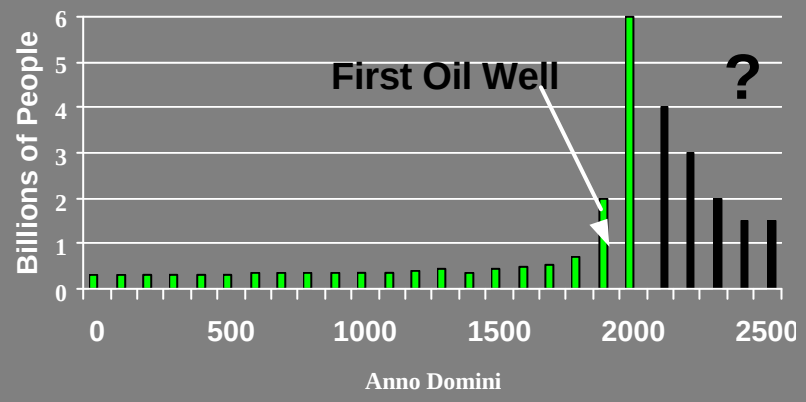
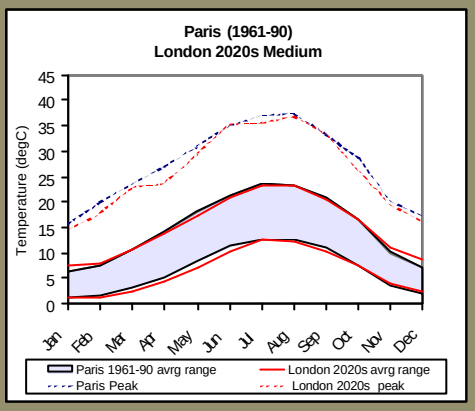
Bill Dunster architects @ the ZEDfactory

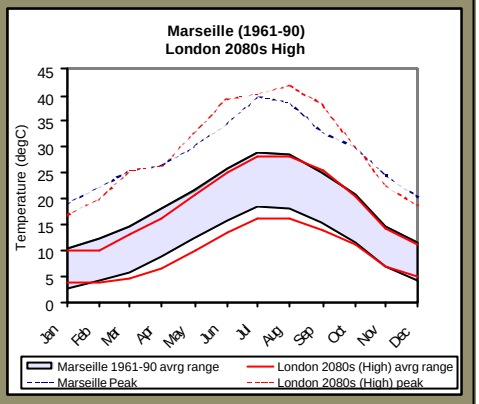
The human population of the planet is directly proportional to the availability of cheap energy ?



Colin Campbell 060704 presentation @ house of commons

Geographical Analogues: Peak temperatures





Paris 1961-90 Temperatures
? London 2020s (Medium)

Marseille 1961-90 Temperatures
? London 2080s (High)

Ecological footprint for UK lifestyle in hectares per person

Based on a 4-person household

		Car mileage	Public transport	Air travel	Electricity & gas	Water	Domestic Waste	Office Footprint	Food	Overall Eco-Footprint	
Typical UK lifestyle	Owns car Holidays by plane every year Recycles 11% Eats out-of-season, highly packaged, imported food	0.90	0.41	0.00	0.30	0.45	0.002	1.70	0.80	1.63	6.19
BedZED Conventional lifestyle	Owns a car & commutes to work by public transport Holidays by plane every year Recycles 60% Moderate meat eater & some imported food	0.45	0.32	0.30	0.30	0.10	0.001	1.02	0.80	1.06	4.36
BedZED Ideal	Lives & works at BedZED Recycles office paper No car- ZE Cars club member Holidays by plane every 2 years Recycles 80% at home Low meat diet with local fresh food	0.09	0.04	0.30	0.15	0.10	0.001	0.34	0.16	0.72	1.90
Global Average											2.40
Global Available	Leaving 16% of bio-productive land for wildlife										1.90

- what right do we have to consume more than our fair share of limited international resource ?

Home truths ?

Chinese oil consumption rose 17% last year

China is expected to double its oil consumption over next 15 years

Peak oil occurs more or less now

Peak gas occurs in about 5 years time

Peak nuclear occurs 10 to 15 years later

- the UK could only ever produce 30 % of current energy demand from renewable sources from within our national boundaries

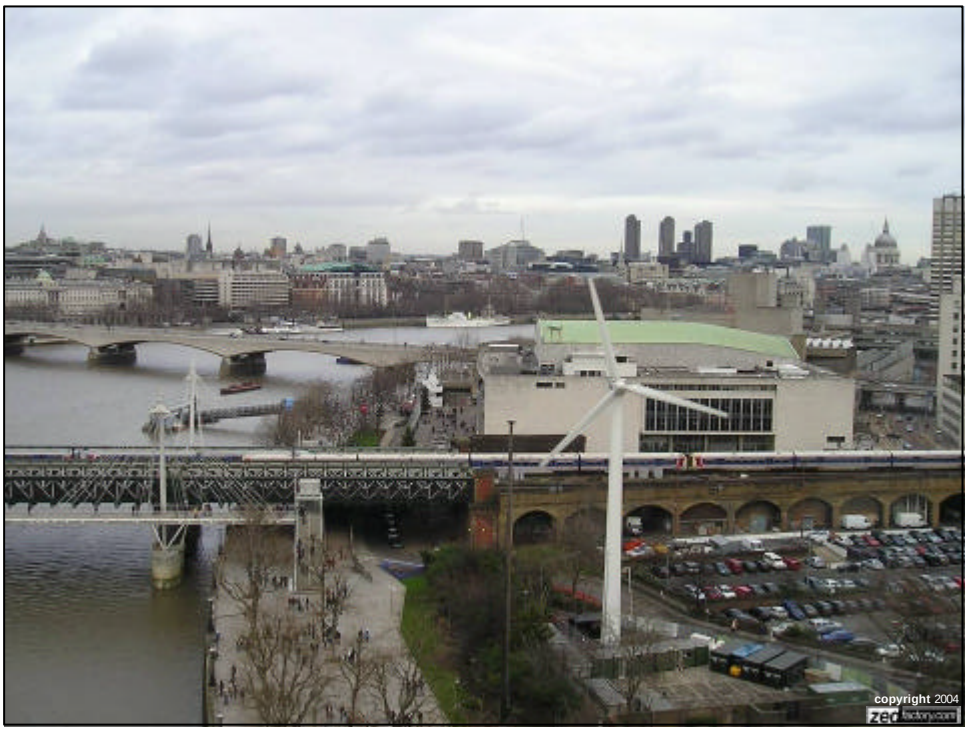
Current UK energy consumption

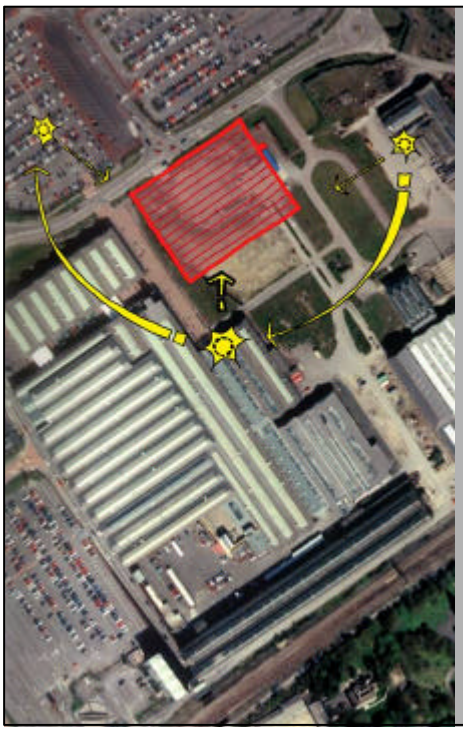
Industry	1416 Twh /yr	20 %
Transport	2397 Twh/yr	33 %
Domestic	2034 Twh/yr	28 %
Agriculture/services	872 Twh/yr	12 %
other uses	508 Twh/yr	7 %
Total	7228 Twh/yr	100 %
subtract losses	2968 Twh/yr	41 %
power consumed	4259 Twh/yr	59 %

UK energy national renewable resource

Wood fuel OD	6 kg/capita/yr @32 kwh	1 %
waste veg oil	2 kg/yr @12kwh	0.5 %
other biomass	330 kg/yr @ 764 kwh	23 %
Offshore wind	1100 kwh/capita/yr	33 %
Onshore wind	88 kwh/capita/yr	3 %
PV	407 kwh/capita/yr	12%
Microwind	244 kwh/capita/yr	7.3%
Wave	550 kwh/capita/yr	16.5%
Tidal	20 kwh/capita/yr	0.6%
Waste technologies	71 kwh/capita/yr	2.1%
Landfill Gas	38 kwh/capita/yr	1%
Total	**3326 kwh/capita/yr**	**100 %**

80% reduction needed from current consumption





Air conditioned

Typical

Good practice

Natural Ventilation

Good practice Open

0.65

Good practice Cellular

0.4

ZEDstandards

0.3

Electricity from wind

Credit – Bill Gething

This house

Is made here, using lightweight modern methods of construction, that is likely to need airconditioning in summer within 30 years


Tram link to
Wimbledon
and Croydon
Ecology
park
Bus
stop
school
shops
Hackbridge Station
20 mins to London
Victoria main line
terminus
copyright 2004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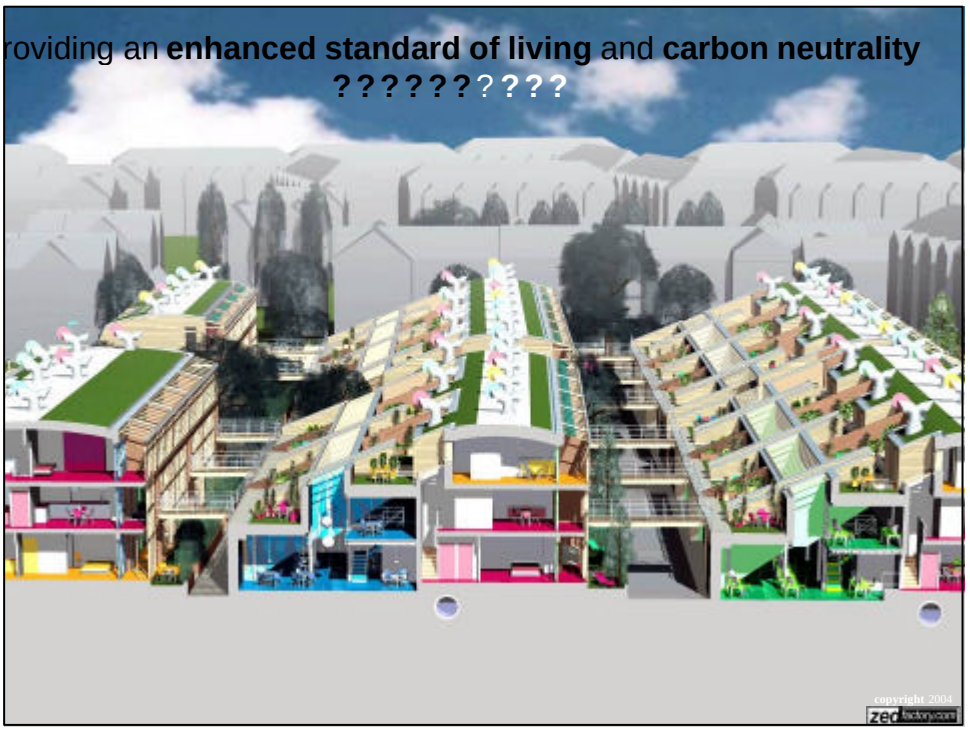
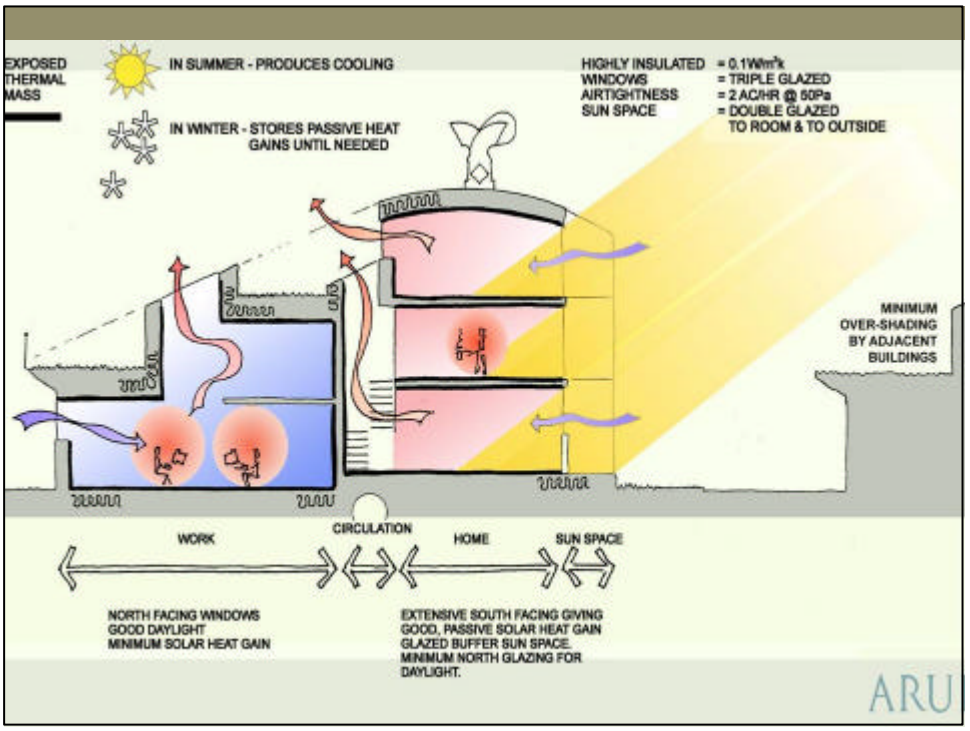
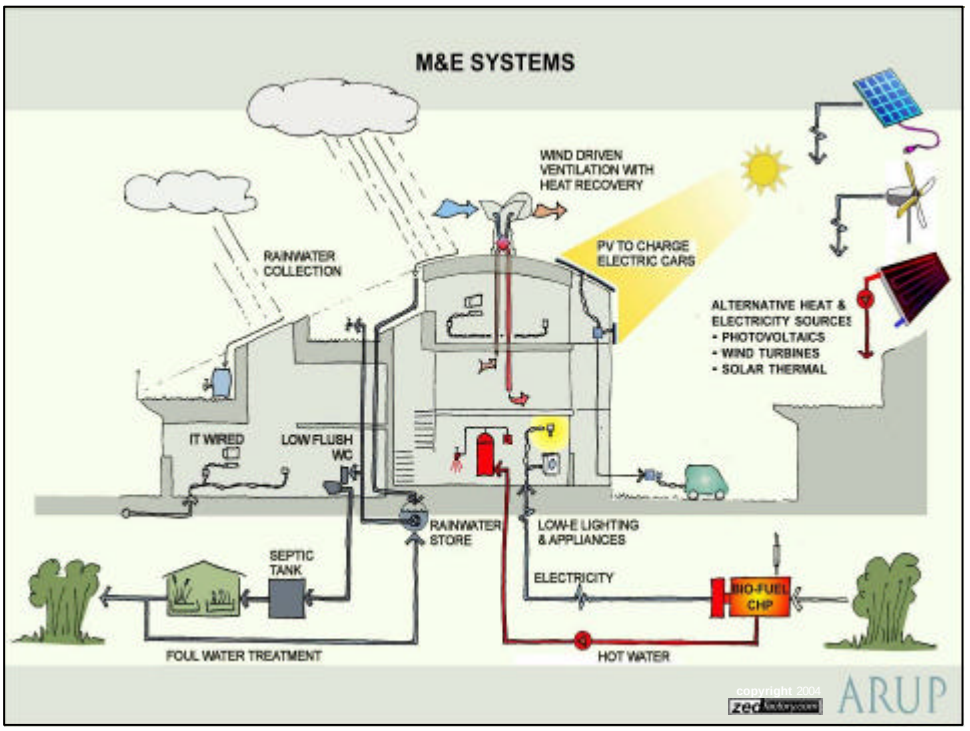
BedZED Beddington Zero Energy Development BedZED? ? ? ? ?

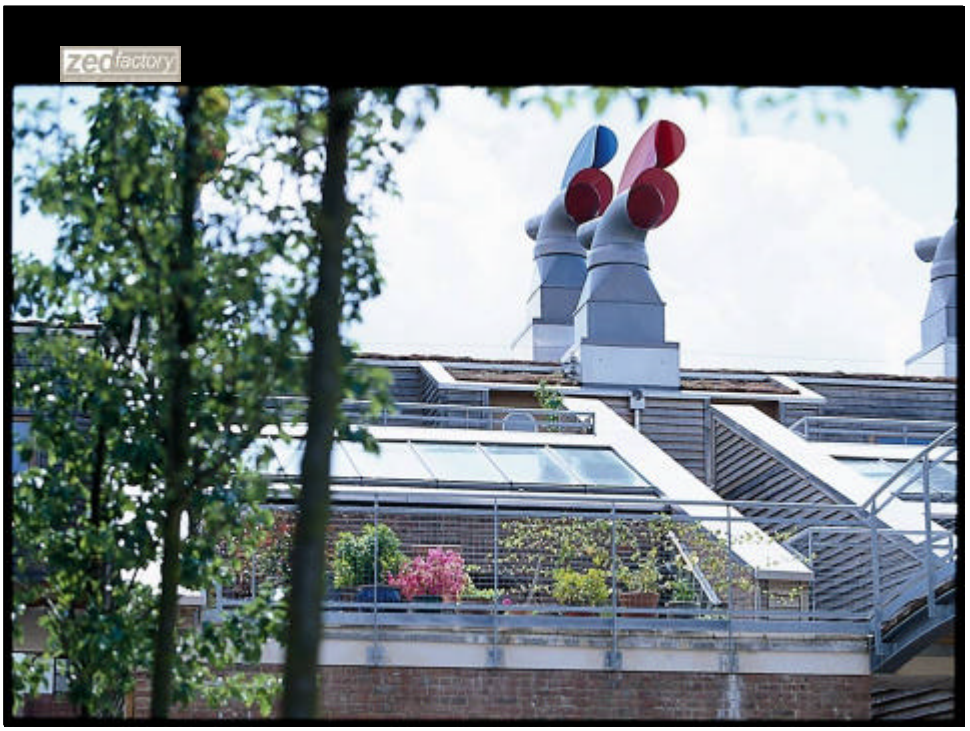
BedHED Beddington High Energy Development BedHED? ? ? ? ?

roviding an **enhanced standard of living** and **carbon neutrality**
? ? ? ? ? ? ? **? ? ?**




EXPOSED THERMAL MASS
IN SUMMER - PRODUCES COOLING
IN WINTER - STORES PASSIVE HEAT GAINS UNTIL NEEDED
HIGHLY INSULATED = 0.1W/m²k
WINDOWS = TRIPLE GLAZED
AIRTIGHTNESS = 2 AC/HR @ 50Pa
SUN SPACE = DOUBLE GLAZED TO ROOM & TO OUTSIDE
MINIMUM OVER-SHADING BY ADJACENT BUILDINGS
WORK
CIRCULATION
HOME
SUN SPACE
NORTH FACING WINDOWS GOOD DAYLIGHT MINIMUM SOLAR HEAT GAIN
EXTENSIVE SOUTH FACING GIVING GOOD, PASSIVE SOLAR HEAT GAIN GLAZED BUFFER SUN SPACE. MINIMUM NORTH GLAZING FOR DAYLIGHT.
ARU


M&E SYSTEMS
WIND DRIVEN VENTILATION WITH HEAT RECOVERY
RAINWATER COLLECTION
PV TO CHARGE ELECTRIC CARS
ALTERNATIVE HEAT & ELECTRICITY SOURCES
- PHOTOVOLTAICS
- WIND TURBINES
- SOLAR THERMAL
IT WIRED
LOW FLUSH WC
RAINWATER STORE
LOW-E LIGHTING & APPLIANCES
ELECTRICITY
BIO-FUEL CHP
SEPTIC TANK
FOUL WATER TREATMENT
HOT WATER
ARUP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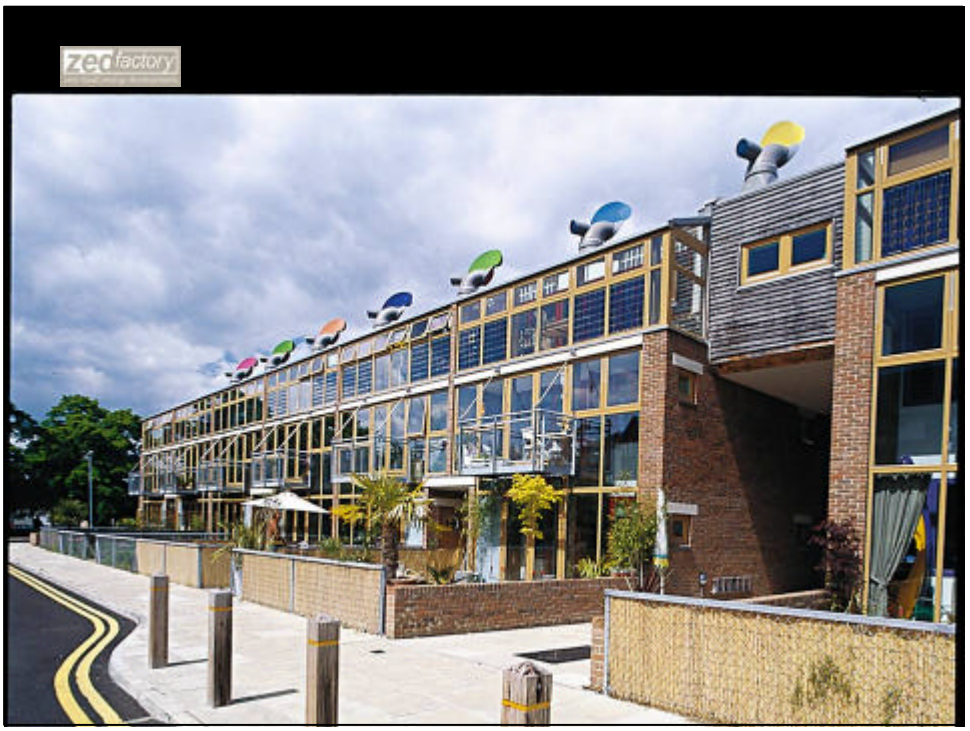
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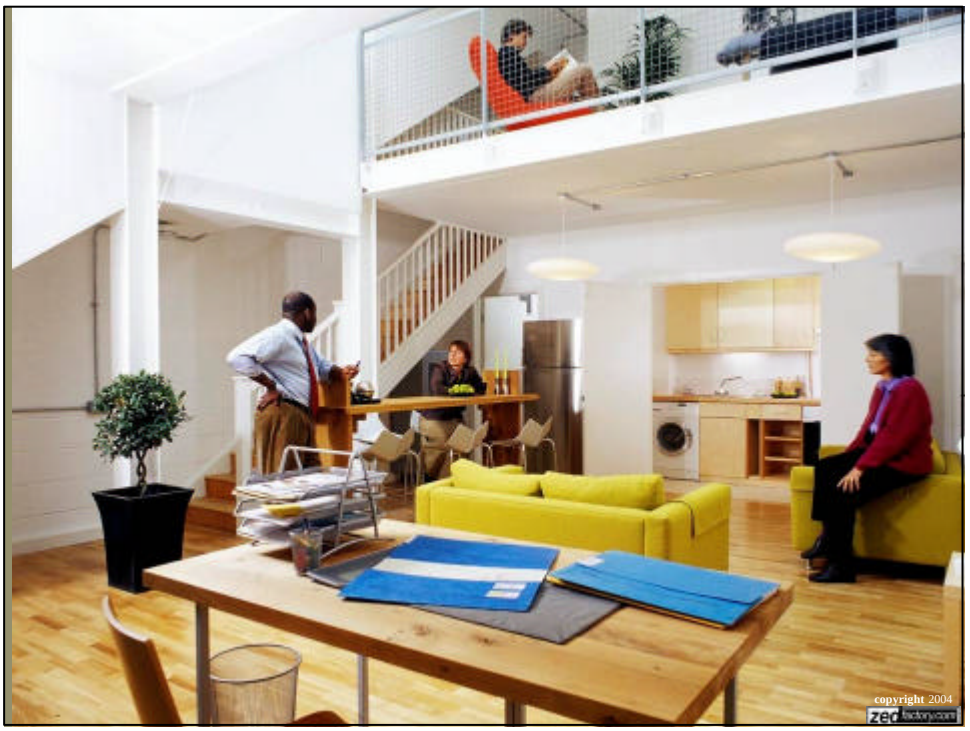
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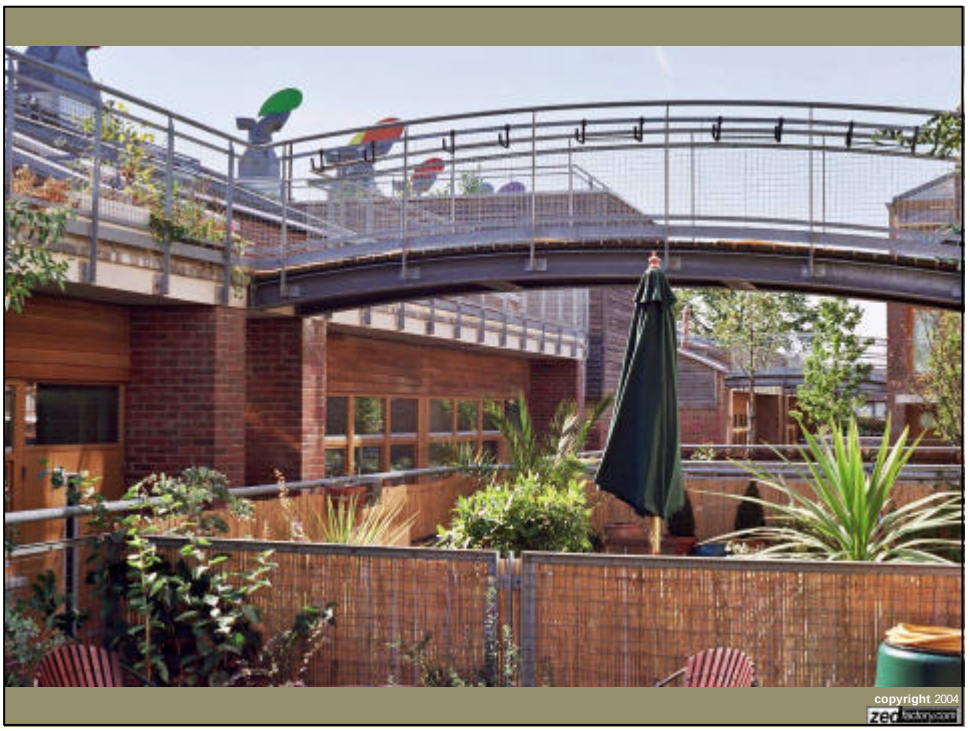
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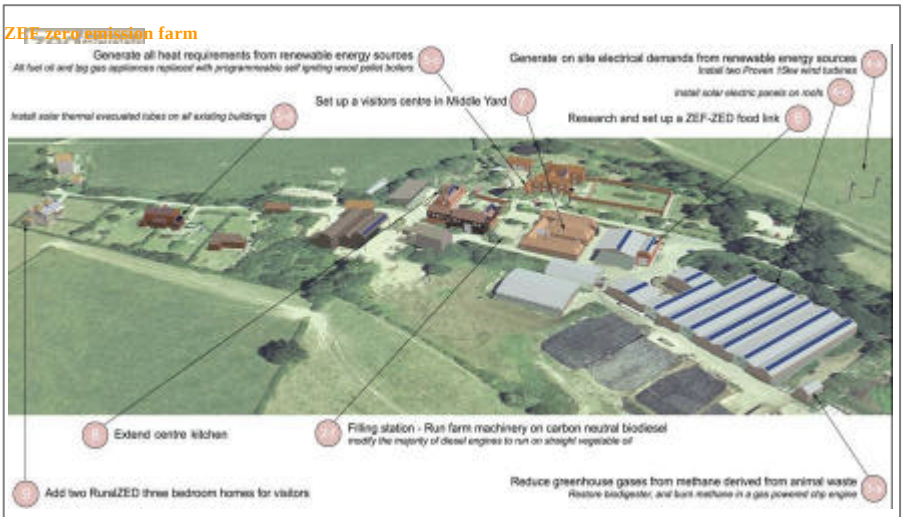
ZFE zero emission farm



- Commonwork is an organic farm and study centre at Bore Place in the low weald of Kent.
- A food link between ZEF (and neighbouring producers) and ZED's in the future is being developed.
- Web based ordering.
- Zero packaging produce delivered in green vehicles - compost waste pick up.
- ~~Bio fuel deliveries (pellets for heating, vegetable oil for transport)~~


Materials Palette
Local - Natural - Durable - Reclaimed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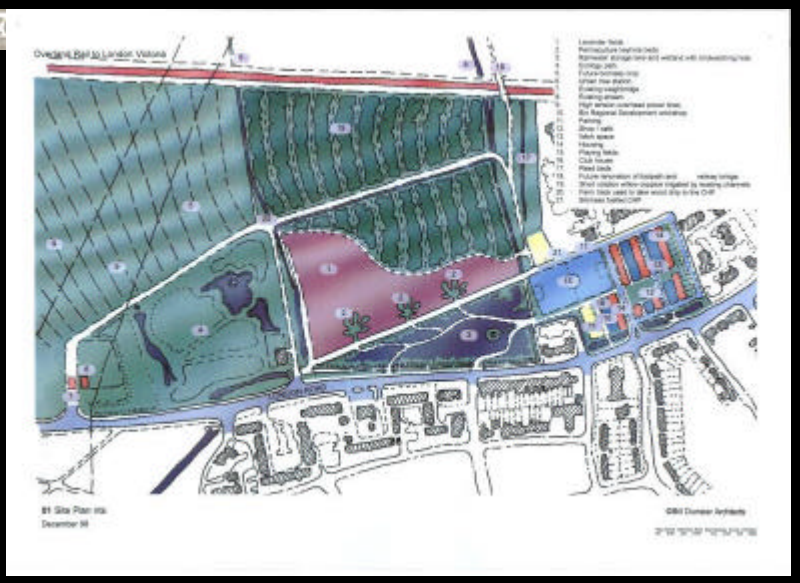
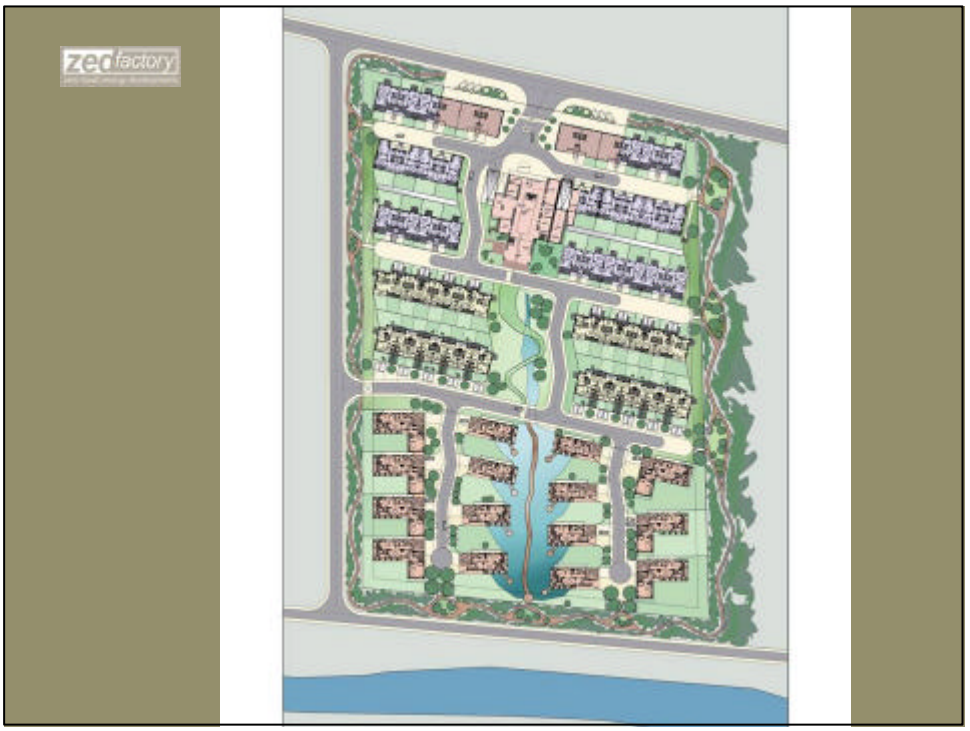
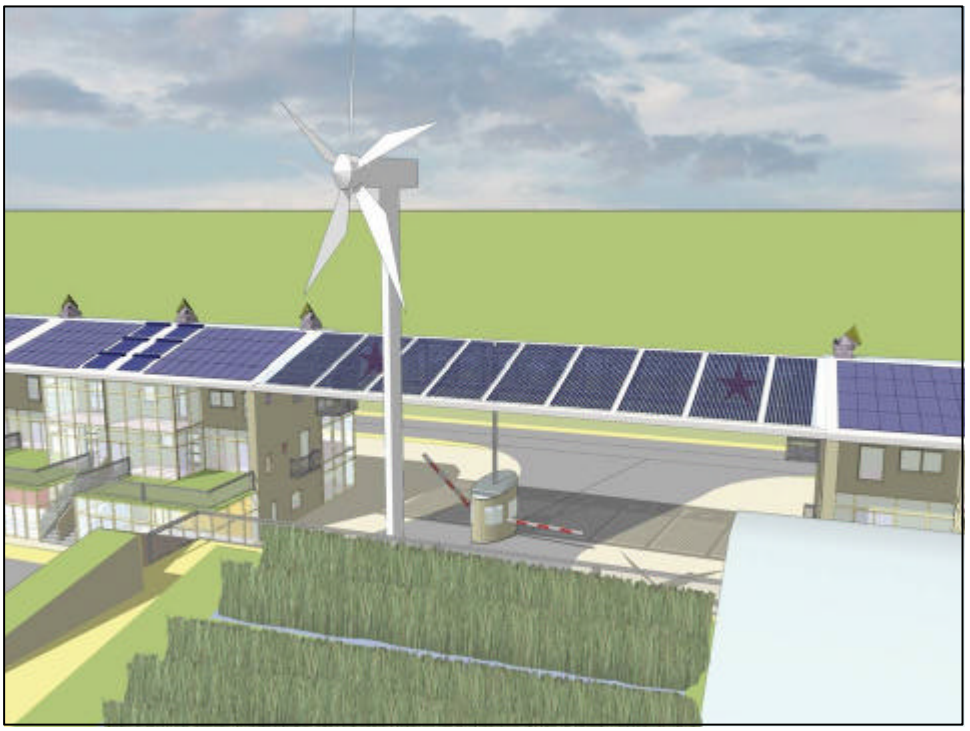


BedZED 1999 as part of a future eco park providing biomass for fuel
?????????????, ????????????

Project Balance Sheet

DEVELOPER	Added build costs	£571,208
	Added revenue[4]	£688,000
OCCUPANTS	Reduced bills	£3,847/year
	Added value	*qualitative*
THE PLANET	CO_2 savings	147.1 tonnes/year
	Water savings	1,025m^3/year



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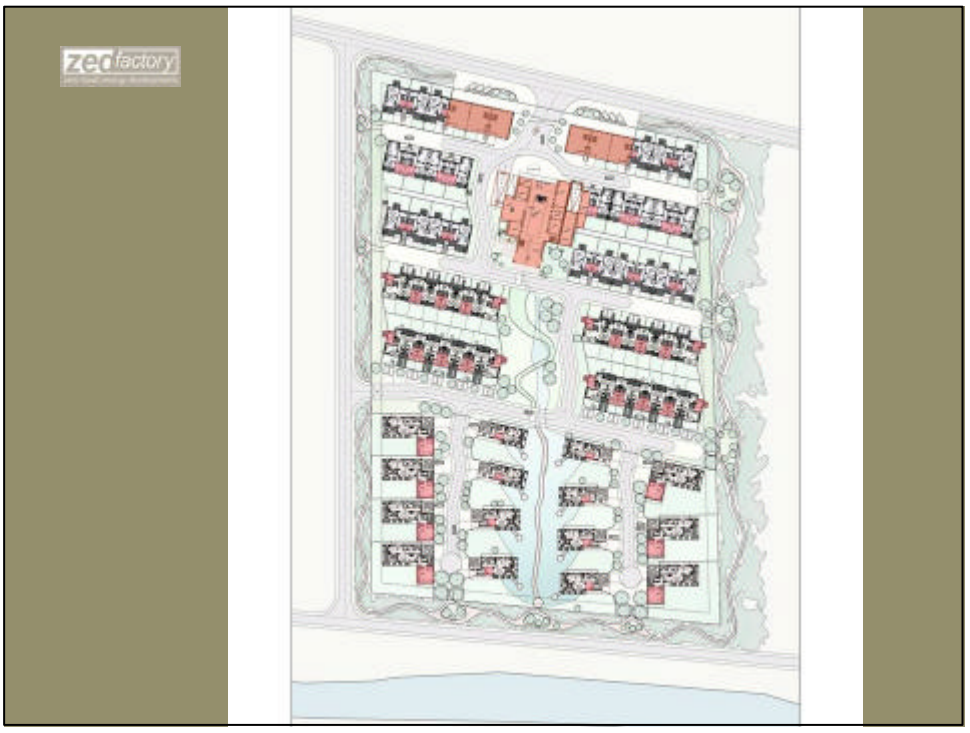
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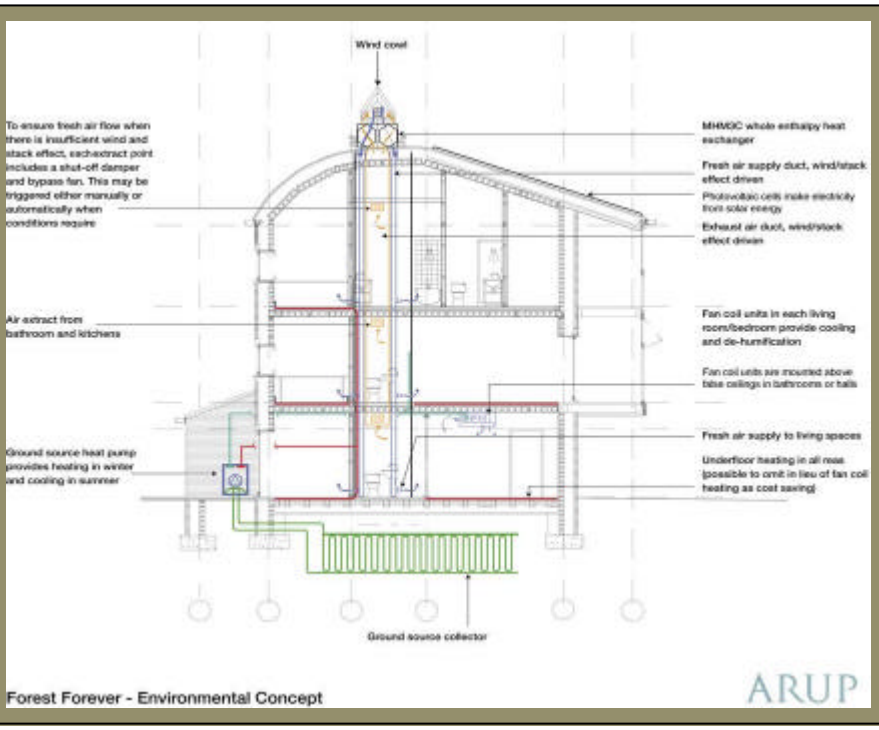
zecfactory



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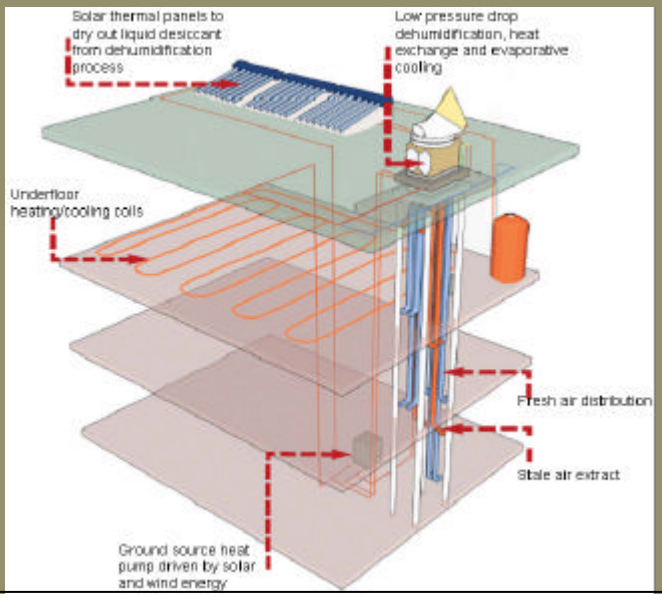
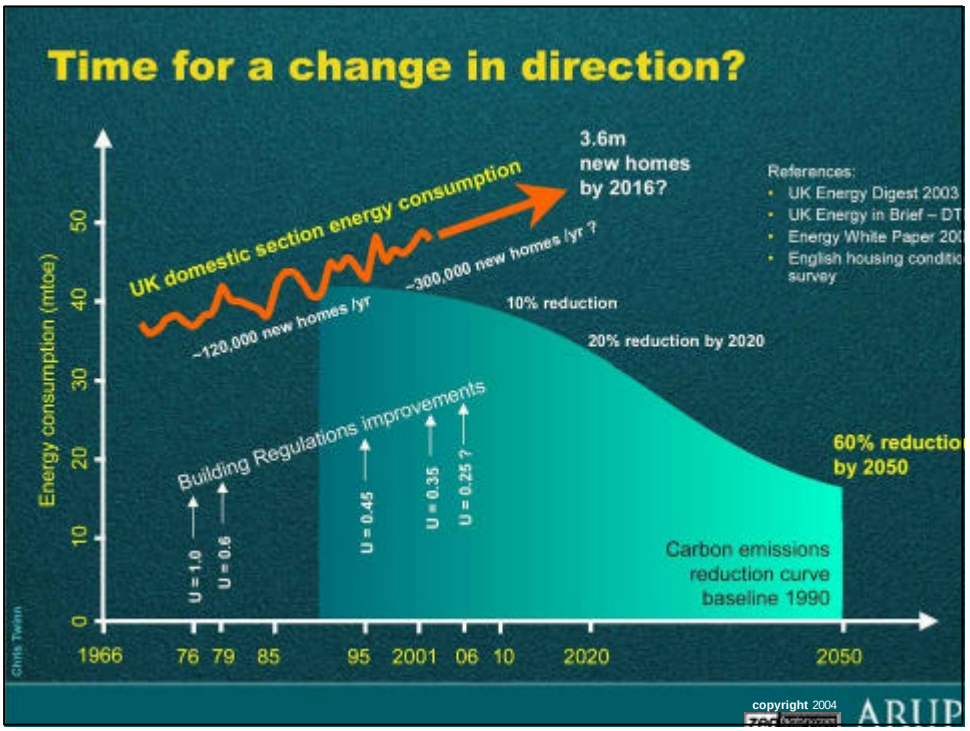
Low Carbon HVAC





The ZEDspec becomes affordable with economies of scale

- it is only more expensive today because of low throughput through the supply chain

Annual new build homes in UK / year - average 162,000 @ average density 26 homes / ha requiring 6,230 ha of land

Gov sustainable communities programme calls for 20,000 extra / homes / year

100 units / year ZEDspec = minimum	15 % above building regs
1000 units / year ZEDspec = minimum	5 % above building regs
5000 units / year ZEDspec =	same price as building regs minimum

We only need 3% of the UK new homes to be built to the ZEDspec to be cost neutral with current building regs minimum specification @ average density of 80 homes / ha

If all 162,000 homes were built to ZED spec at ZEDdensities only 2025 ha required, saving two thirds of the increase in urban sprawl, and still providing every home with a garden

Costs

BedZED - 100 units

cost £ 1475-00 m2 gross internal

ZEDinaBox value engineered version -

cost £ 1250-00 m2 on a 225 unit scheme

Small 12 to 15 unit ZED terrace on site at moment

cost £ 1375-00 m2

Rural ZED contractor build 6 weeks/ unit - 220 units

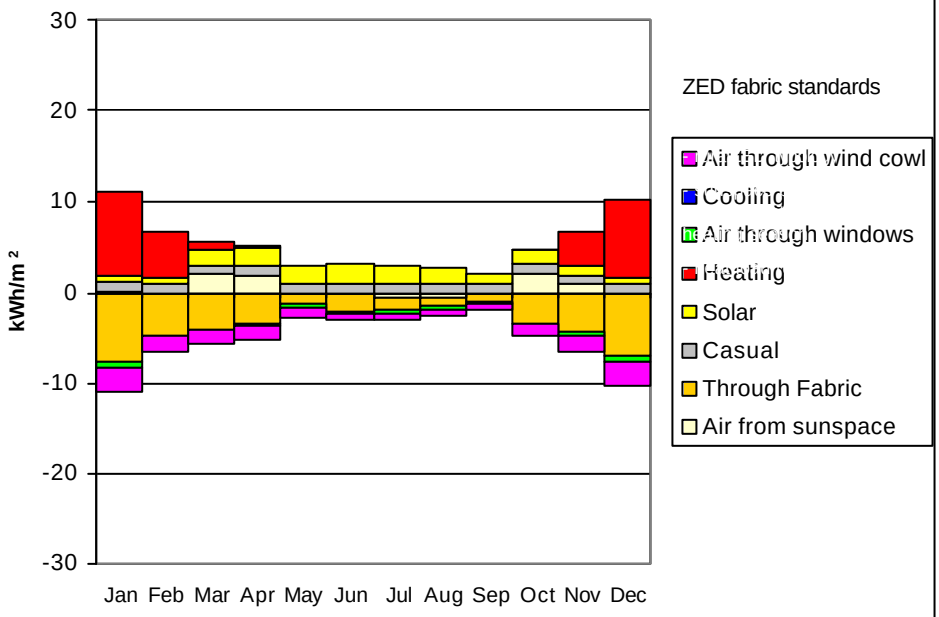
cost £ 1100-00 m2

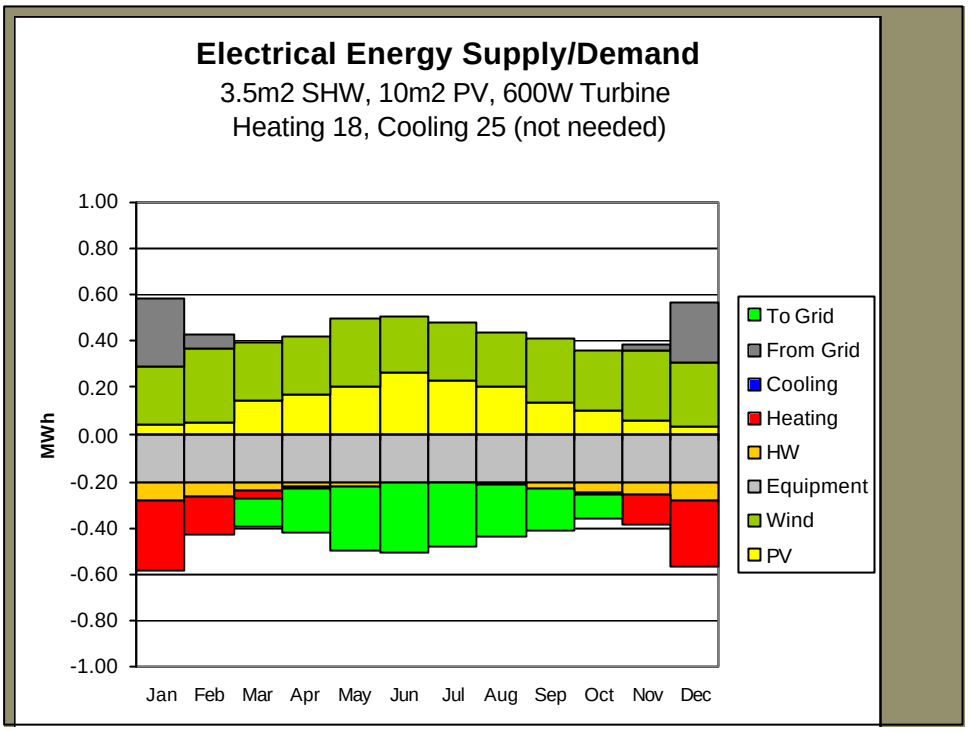
Rural ZED kit self erect - 20 units

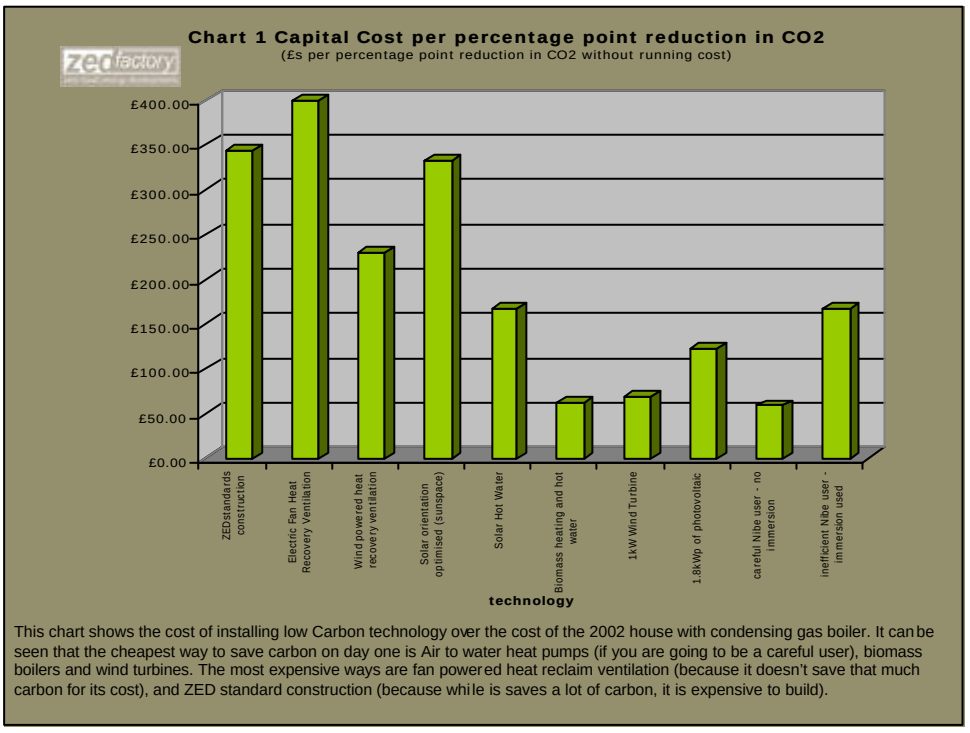
cost £ 875-00 m2

Rural ZED with energy mortgage adopted and contractor build

cost £1050-00/m2

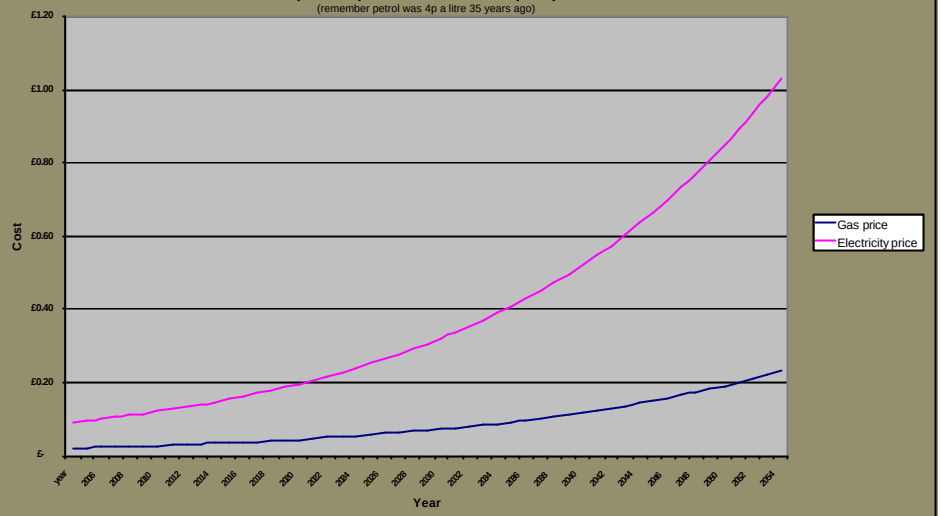






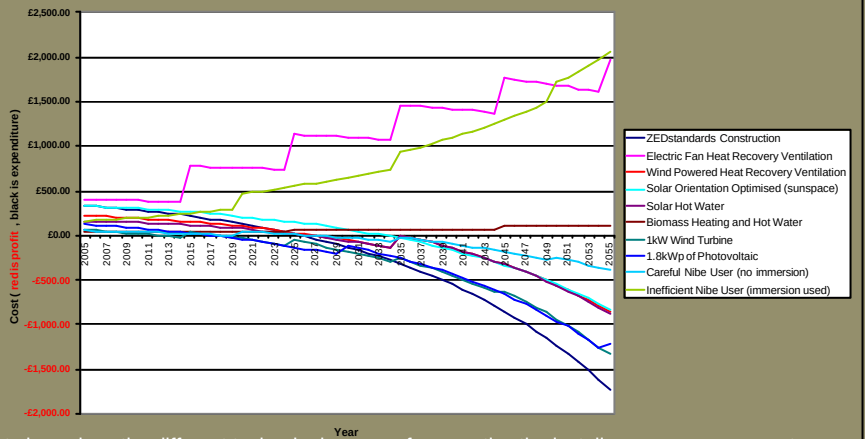
This chart shows the cost of installing low Carbon technology over the cost of the 2002 house with condensing gas boiler. It can be seen that the cheapest way to save carbon on day one is Air to water heat pumps (if you are going to be a careful user), biomass boilers and wind turbines. The most expensive ways are fan powered heat reclaim ventilation (because it doesn't save that much carbon for its cost), and ZED standard construction (because while is saves a lot of carbon, it is expensive to build).

Chart 6 Energy prices at 5% pa price increase over the next 50 years
(The Arup conservative assumption)
(remember petrol was 4p a litre 35 years ago)



The most confident energy price projection we can find is an Arups scenario projecting that average energy price trends for both gas and electricity will compound at 5% per annum excluding inflation. This may be experienced as a series of step changes and plateau as new supplies of gas suddenly become economic following a step change.

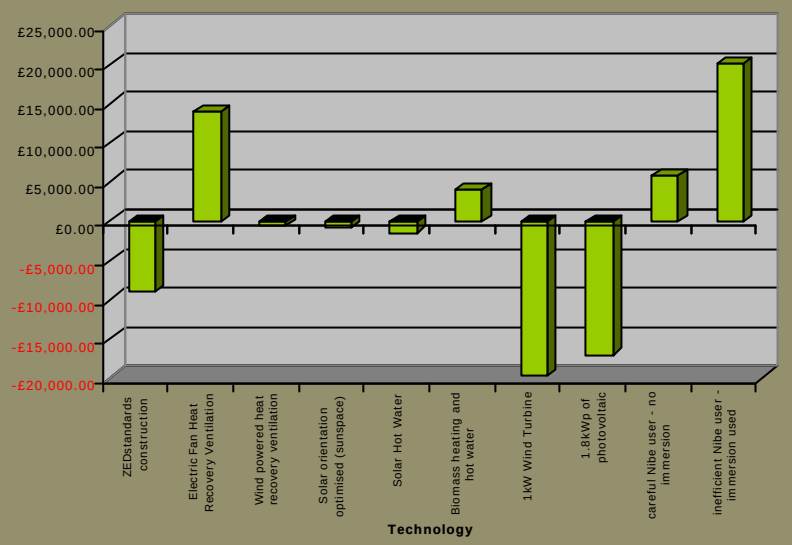
ZEDstandard Chart 1 **Cost per % point reduction in CO2 over a 2002 building regs home 2005 to 2050**
Includes replacement, income from generation/energy saved and estimated projected energy price increases.
Biomass fuel costs tracks gas. No inflation



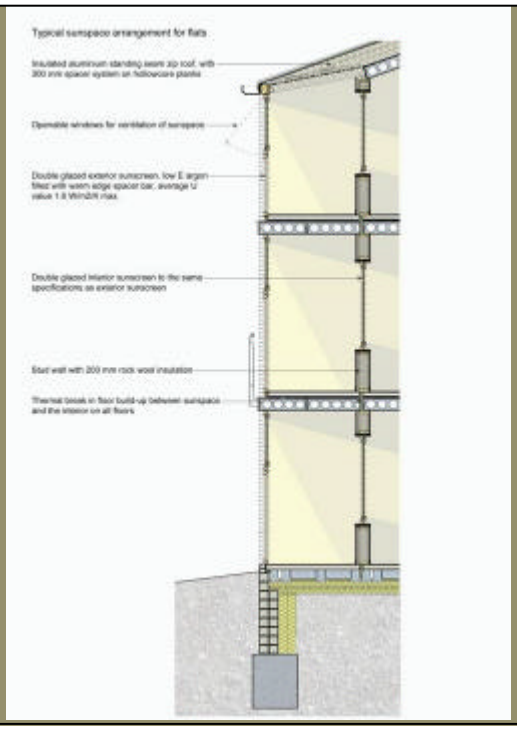
This chart shows how the different technologies move from costing the installer money per percentage point CO2 reduction, to earning the occupier money, either by reducing their bills from what they would have been paying in a 2002 house or actually displacing energy used and selling back to the grid. It can be seen that any technology that uses electricity hardly saves (or generates) cash for the user where as technologies that generate high value, high grade electricity pay back the most.
ZEDstandard, though one of the most expensive capital cost technologies becomes one of the best performers as it saves money year on year and has no depreciation (replacement costs). As fuel prices rise, so does the income from savings made .

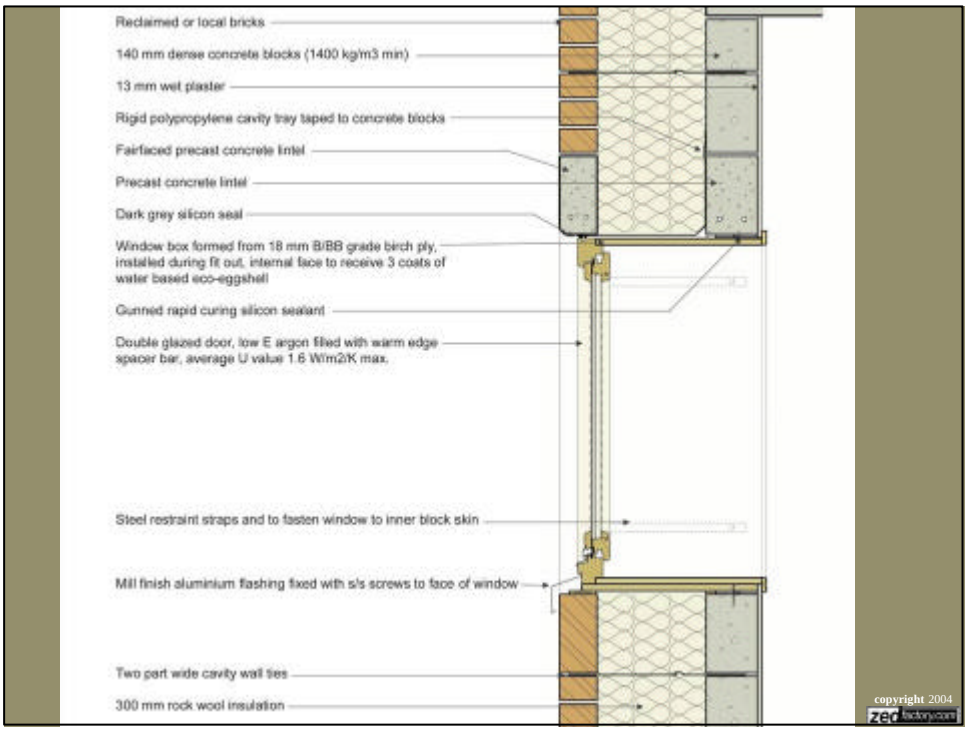
Chart 5 total additional cost/income experienced by 2050

(total capital plus running cost/income on top of that experienced with a 2002 building regs with a gas condensing boiler)



This chart compares against chart 2. Again it can be seen that the gross cheapest technologies at day one are an order of magnitude more expensive because of the cost of the fuel that has been required to run them above and beyond what would have been spent running a gas condensing boiler in a 2002 building regs house.




Reclaimed or local bricks
140 mm dense concrete blocks (1400 kg/m3 min)
13 mm wet plaster
Rigid polypropylene cavity tray taped to concrete blocks
Fairfaced precast concrete lintel
Precast concrete lintel
Dark grey silicon seal
Window box formed from 18 mm B/BB grade birch ply, installed during fit out, internal face to receive 3 coats of water based eco-eggshell
Gunned rapid curing silicon sealant
Double glazed door, low E argon filled with warm edge spacer bar, average U value 1.6 W/m2/K max.
Steel restraint straps and to fasten window to inner block skin
Mill finish aluminium flashing fixed with s/s screws to face of window
Two part wide cavity wall ties
300 mm rock wool insulation
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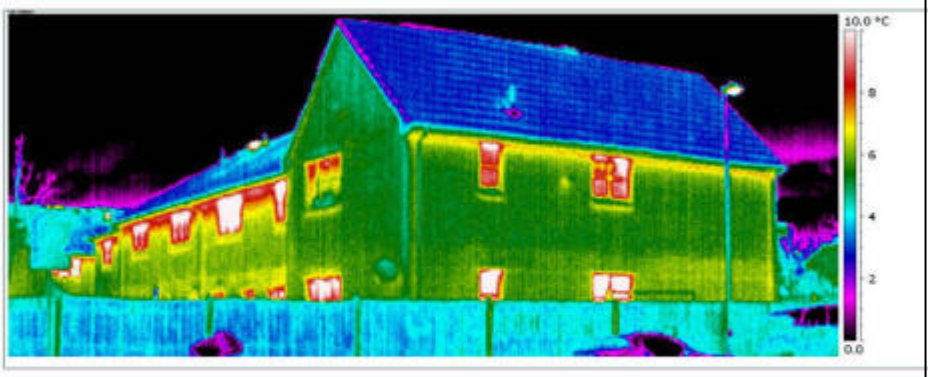

Image 2
Housing development adjacent to block A at rear of site with North facing façade nearest (little solar gain). Heat loss is evident at eaves level. Windows indicate areas with high heat/energy loss. East façade shows higher wall surface temperatures and heat loss at roof junction.

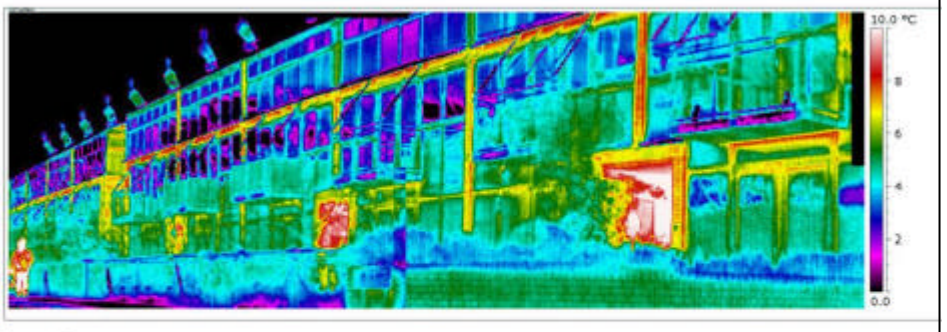

Image 3
Block A and part block B taken from rear of site looking toward main road. Note front door open in nearest property. Elevation is of south facing sun space buffer zone after 6-7 hours low winter sun. Warm areas across structural frame represent solar heat gain rather than heat/energy loss.


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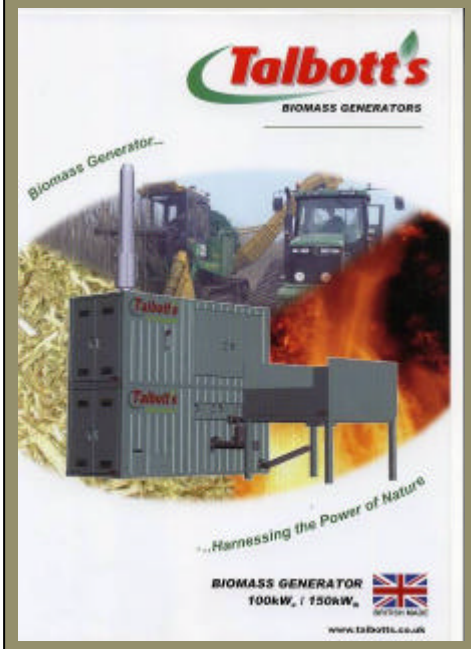
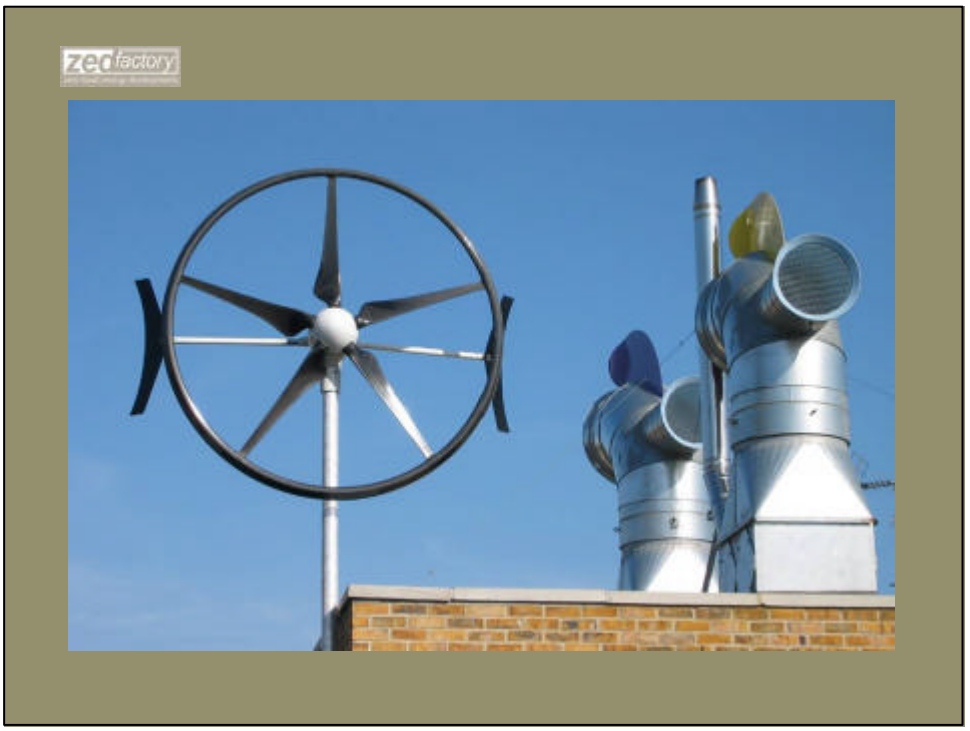


Building integrated micro generation increases the residents awareness of energy consumption

Domestic Wind Turbines - **50% of Your Power**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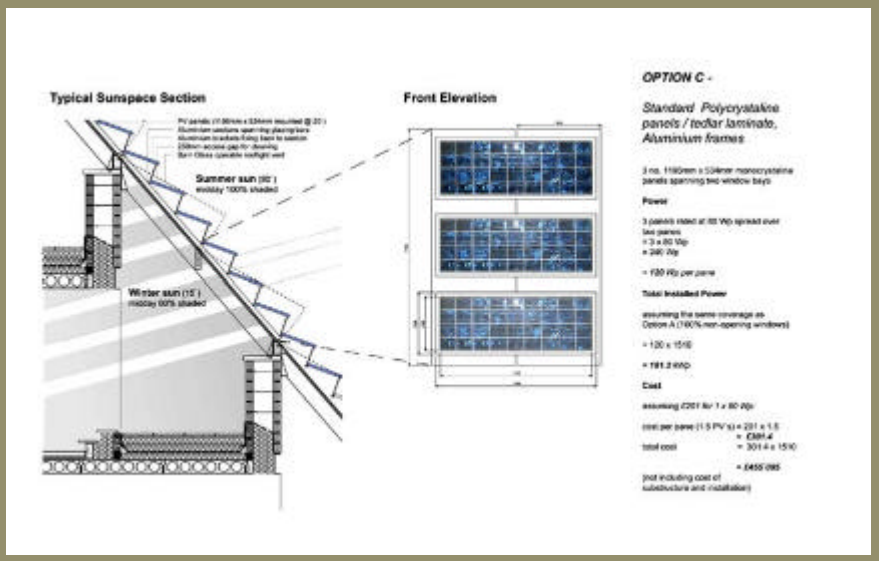
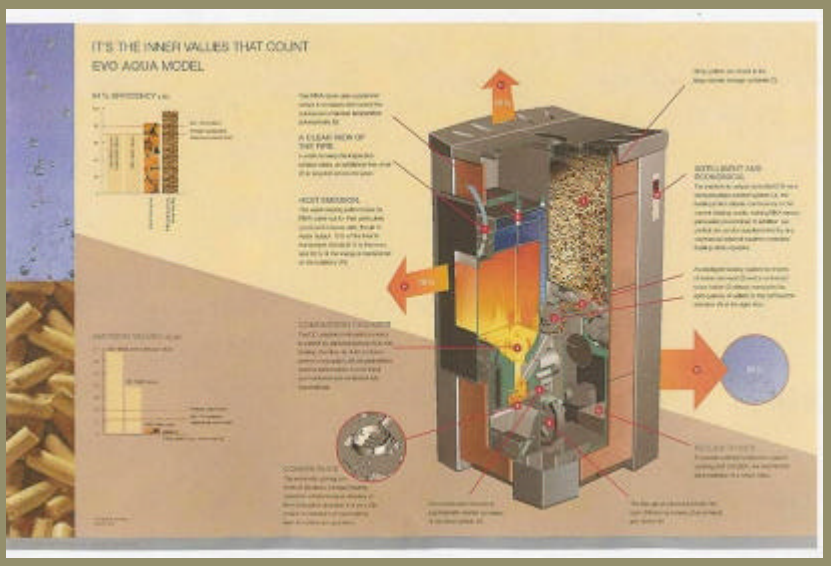


Evacuated tube Solar thermal collectors can provide around 60 % of annual domestic hot water, and means pellet boilers can be turned off almost all summer.

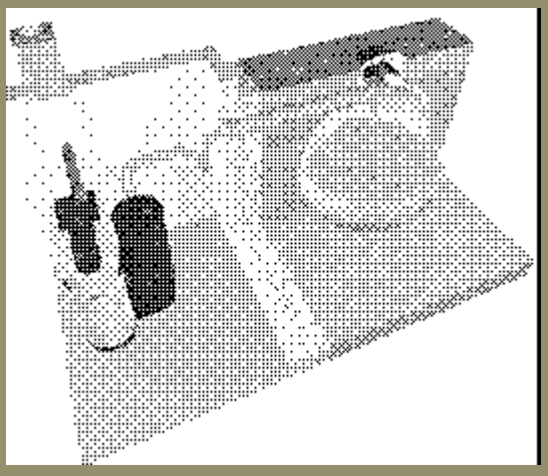

Radiators
Underfloor
Heating

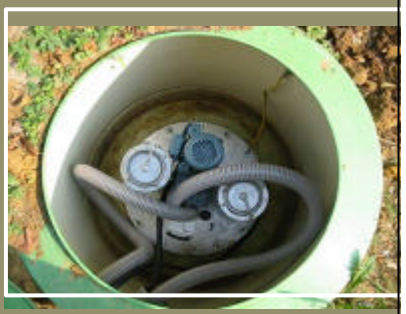

ASHWELL
Green-Tec



Pellet Storage systems

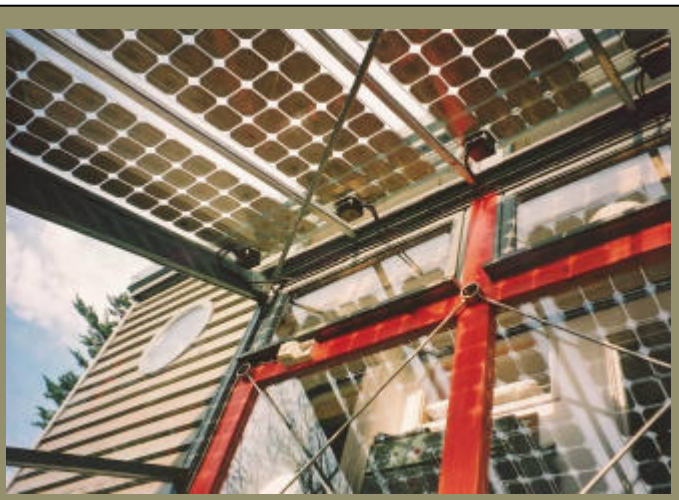
Buried tank

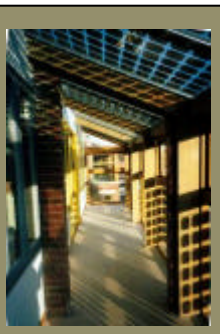




Different solutions for different densities and scales

	Rural ZED	ZED-in-a-box	BedZED inner block	5 storey flats	SkyZED / landzed hybrid
Housetype	Detached houses	Terraced homes and live work units	Terraced homes / offices / live work with garden	High density townhouses and flats	High rise flats with optional commercial base, schools, community
Project image					
Private amenity	• All homes have a front and back garden • Up to 100% homes have sunspace	• All homes have a garden with 300mm soil • 60% homes have sunspace	• Around 75% homes have a garden, around • 70% homes have sunspace	• 60% have gardens • 40% have external terraces • 100% homes have sunspace	• All high-rise homes have glazed sunspace / balcony • Low-rise as ZED-in-a- Box
Renewable energy technology	Micro wind, PV, solar thermal, log / pellet stove with back boiler	Communal pellet boiler / terrace, modest PV, community wind power	Woodchip fuelled CHP	Commercial pellet boiler, large area PV, solar thermal, building integrated wind turbine	Building-integrated woodchip fuelled CHP, wind, PV
Max homes/ha	35	60	120	120	250
National renewable energy resource	Biomass 65 tonnes/ha	Biomass 200 tonnes/ha	Biomass 250 tonnes/ha	Biomass 300 tonnes/ha	Biomass 550 tonnes/ha
Area of SRC coppice needed to supply 1ha urban dev	6 ha coppice/yr	17 ha coppice/yr	64 ha coppice/yr	26 ha coppice/yr	128 ha coppice/yr
CO_2 output/ha	zero	zero	zero	zero	zero
Equivalent CO_2 output if development powered by fossil fuel	Oil 60tonnes CO_2/ year	Gas 118 tonnes CO_2/year	188 tonnes CO_2/year	185 tonnes CO_2/year	345 tonnes CO_2/year
Likely carbon emissions of a conventional development to Building Regs 2002. BRE comment awaited	Oil 115 tonnes CO_2/yr	Gas 218 tonnes CO_2/yr	Gas 315 tonnes CO_2/yr	Gas 315 tonnes CO_2/yr	Gas 680 tonnes CO_2/yr





Solar electric cells powering carbon neutral cars, both private and pool

The solar electric panels at Hope House power the Citroen Berlingo for around 5,500 miles / year. The cost of the panels and the modified van is still less than the cheapest people carrier on the market - with similar functionality in urban areas.

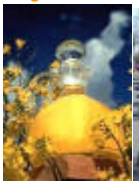
109 KW peak PV installation @ BedZed powers up to 40 electric cars from the pool - each travelling around 10000 miles / year. PV pays back in 14 years when used to charge electric cars

VW Lupo 87 mpg - conversion to run off straight vegetable oil £1350-00

Transport Infrastructure - Vegetable Oil Vehicles

CONVERSION KIT

Single tank conversion kit from Germany - www.Elsbeth.com

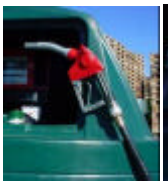


VEGETABLE OIL

Locally grown vegetable oil available from nearby ZEF

EFFICIENT MODERN ENGINE

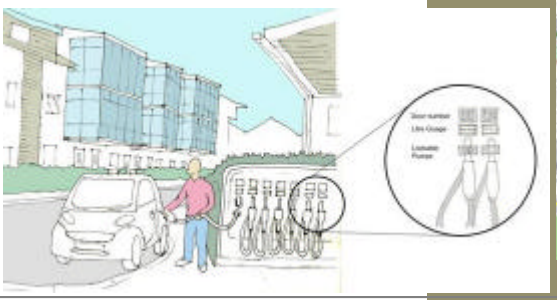
ZEDfactory office car, running on vegetable oil for the past year, at 80 mpg. £1400 conversion



ON-SITE BIOFUEL STORAGE

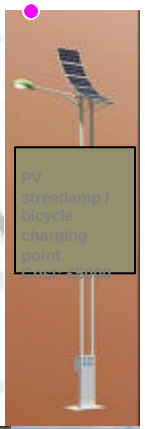
1200 Gallon purpose built steel bunded fuel tank = £2000

1 full tank gives 10 vehicles 9'600 Miles each per annum @ 80 mpg (VW Lupo / Polo 1.9L)



Electric Bicycle Charging

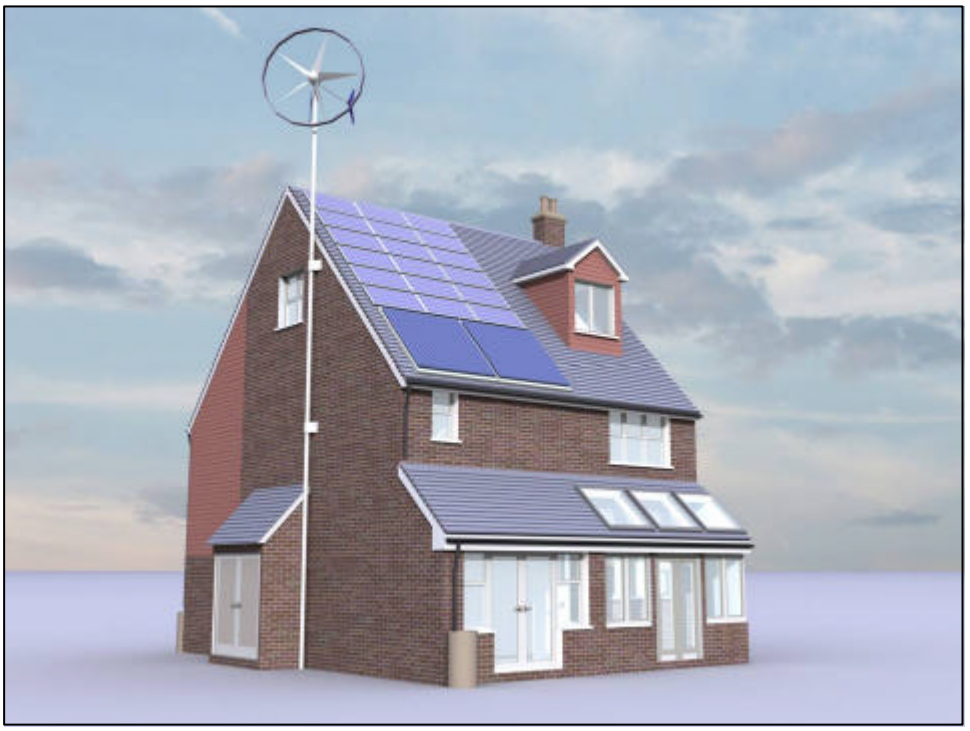
Electric bikes are now on the market from around £500



PV streetlamp / bicycle charging point.

Conversion kits available from around £300

How Does an A1ZEDUP Change Your Home ?

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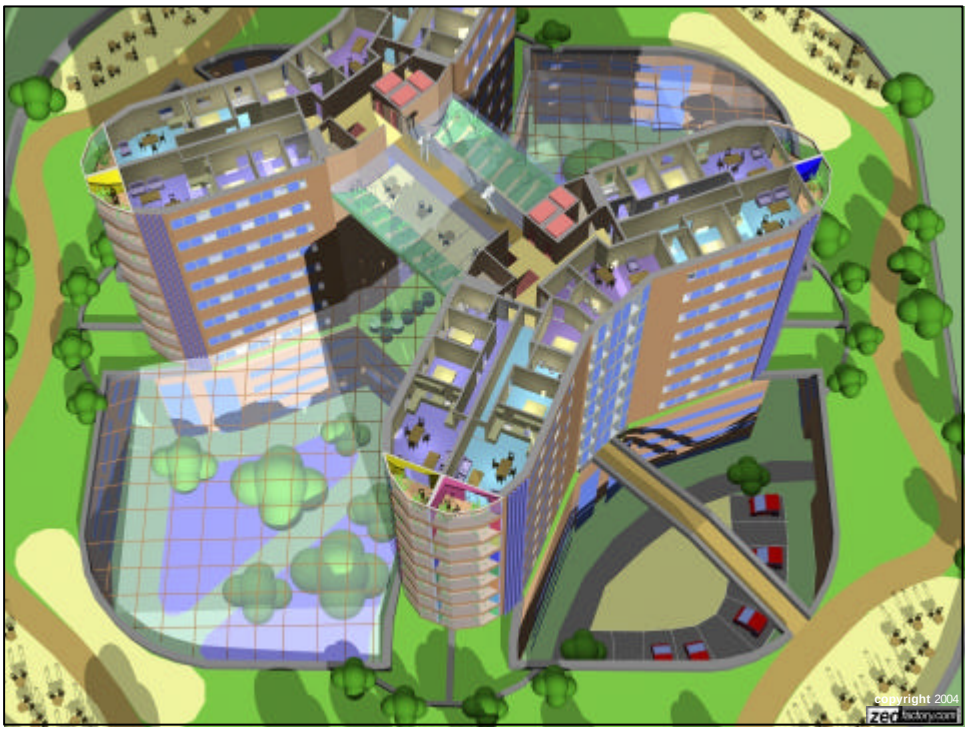
zed factory.com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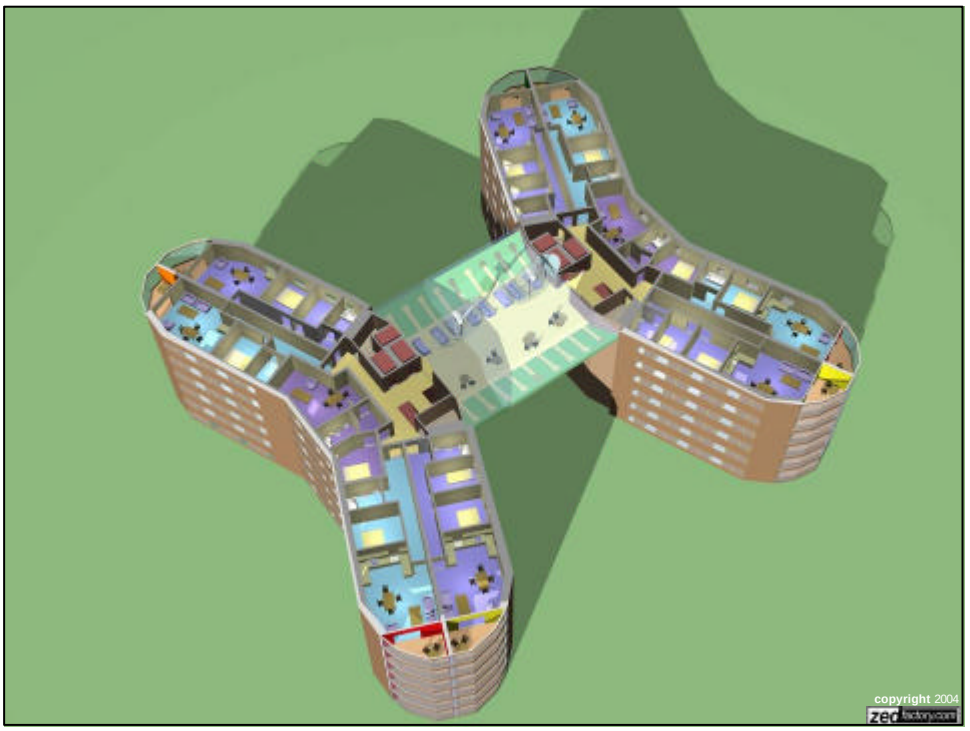
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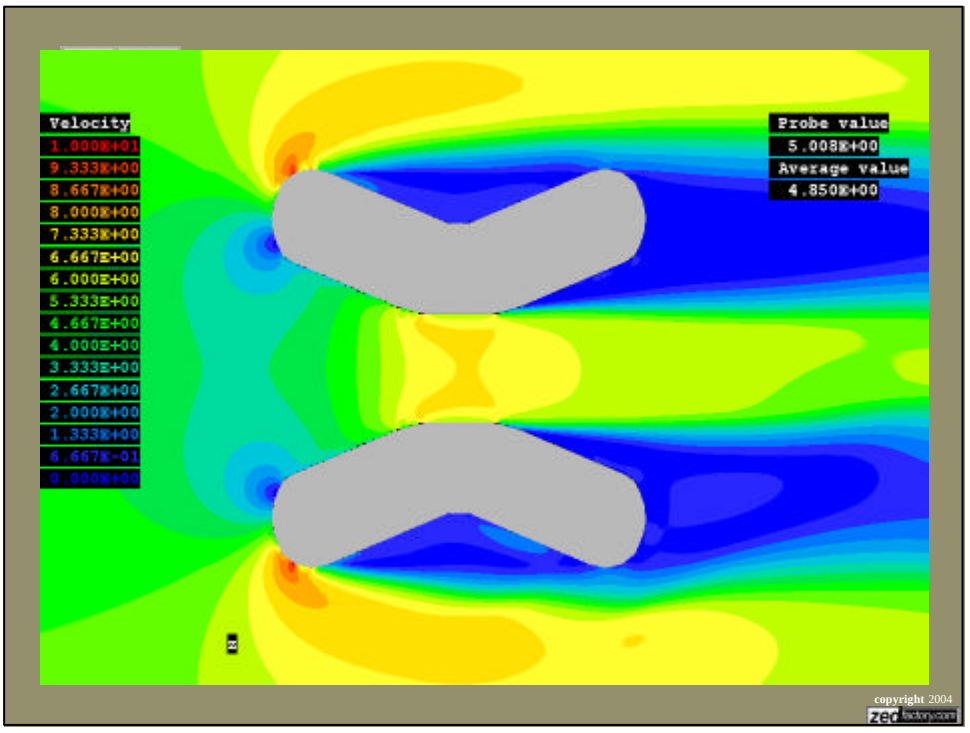
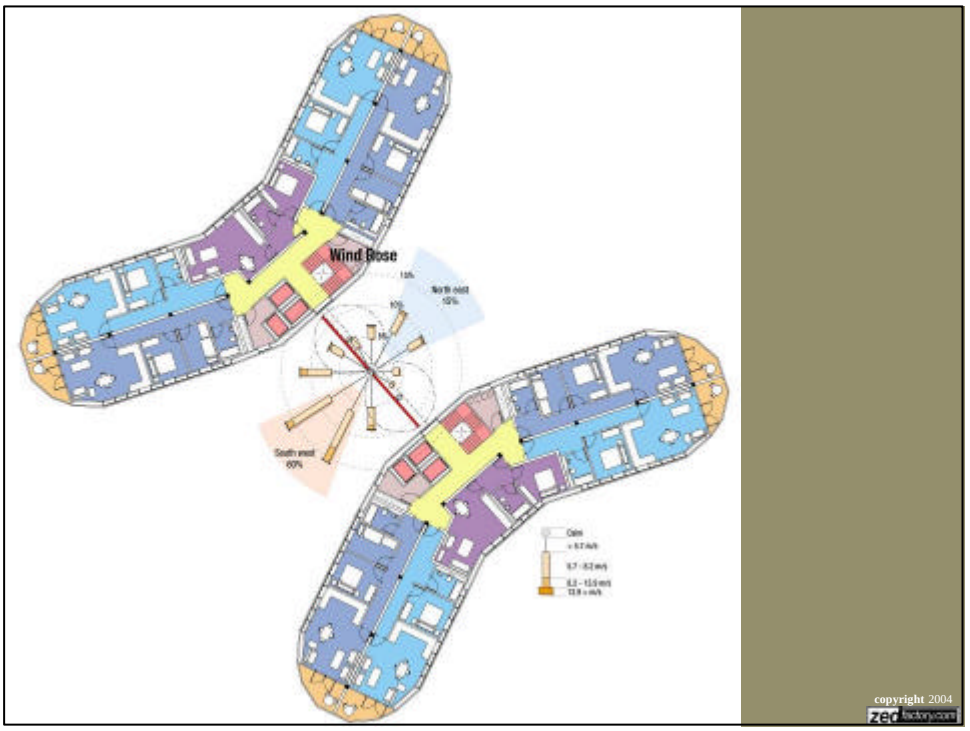

Velocity
1.000E+01
9.333E+00
8.667E+00
8.000E+00
7.333E+00
6.667E+00
6.000E+00
5.333E+00
4.667E+00
4.000E+00
3.333E+00
2.667E+00
2.000E+00
1.333E+00
6.667E-01
0.000E+00
Probe value
5.008E+00
Average value
4.850E+00
copyright 2004
zeg factory.com


Wind Rose
copyright 2004
zed factory.com


zed factory.com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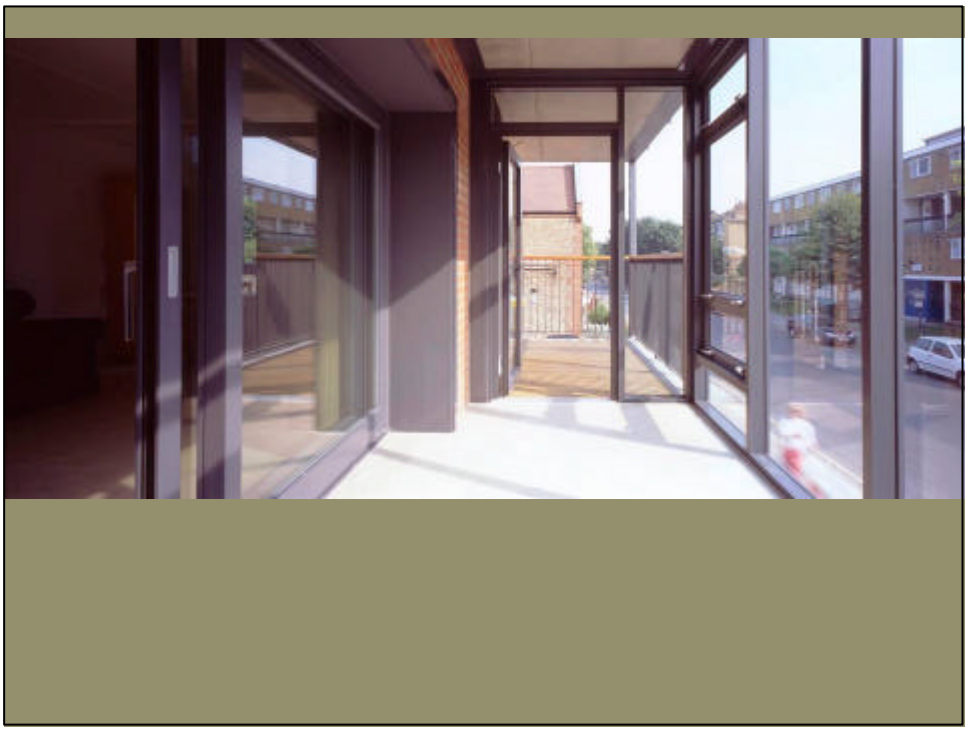
zed factory.com

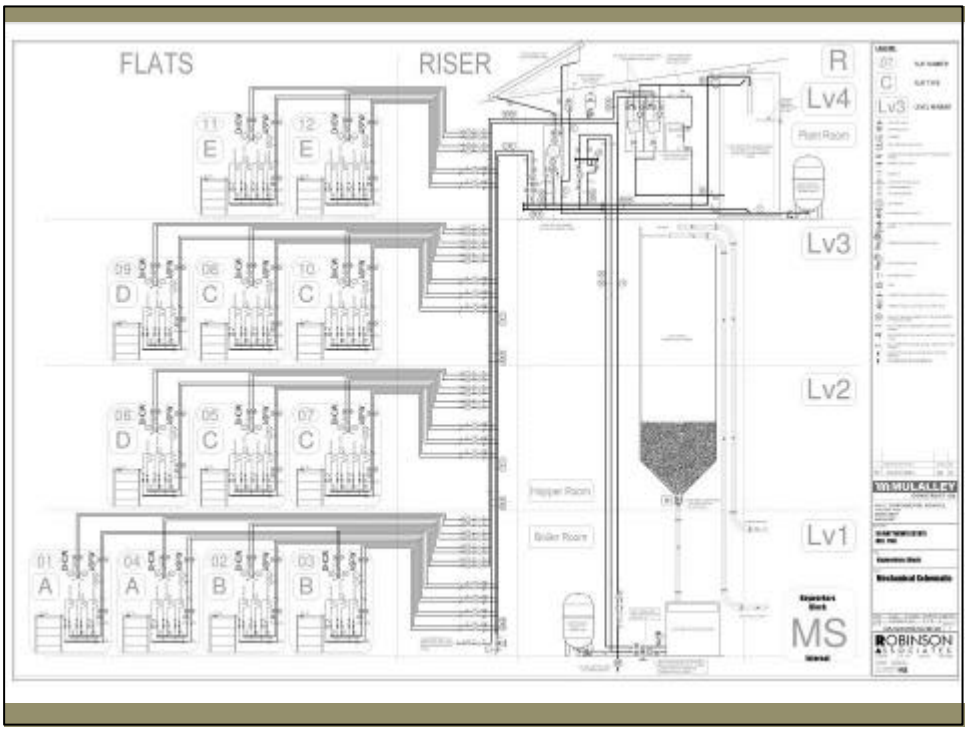
Presentation HA

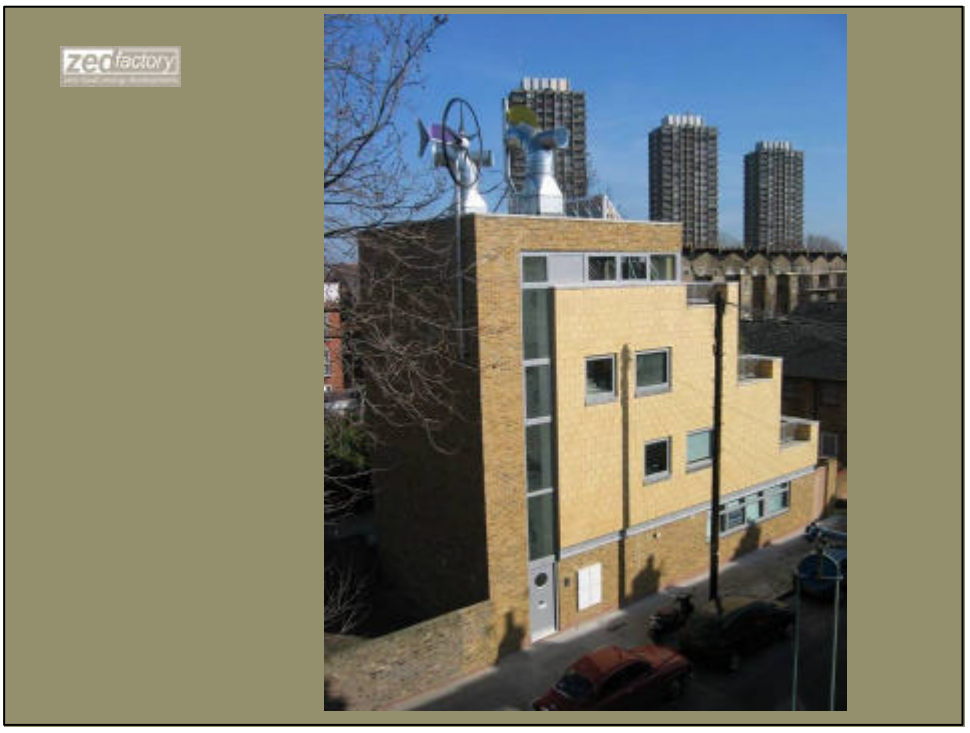
PRP / ZEDfactor

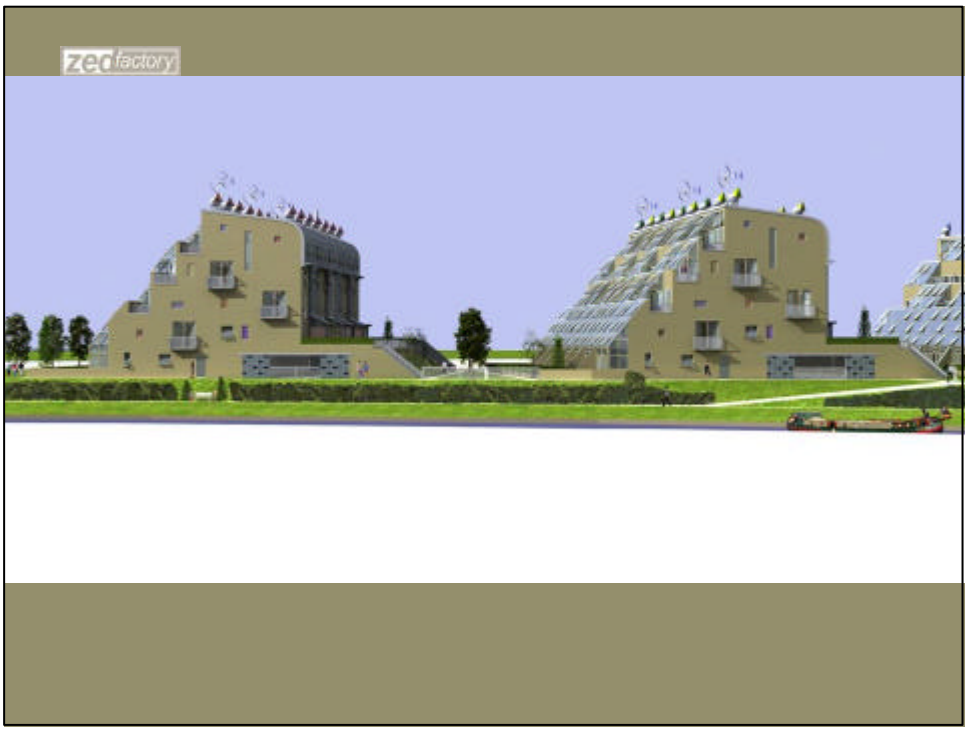
- 12 key worker housing units

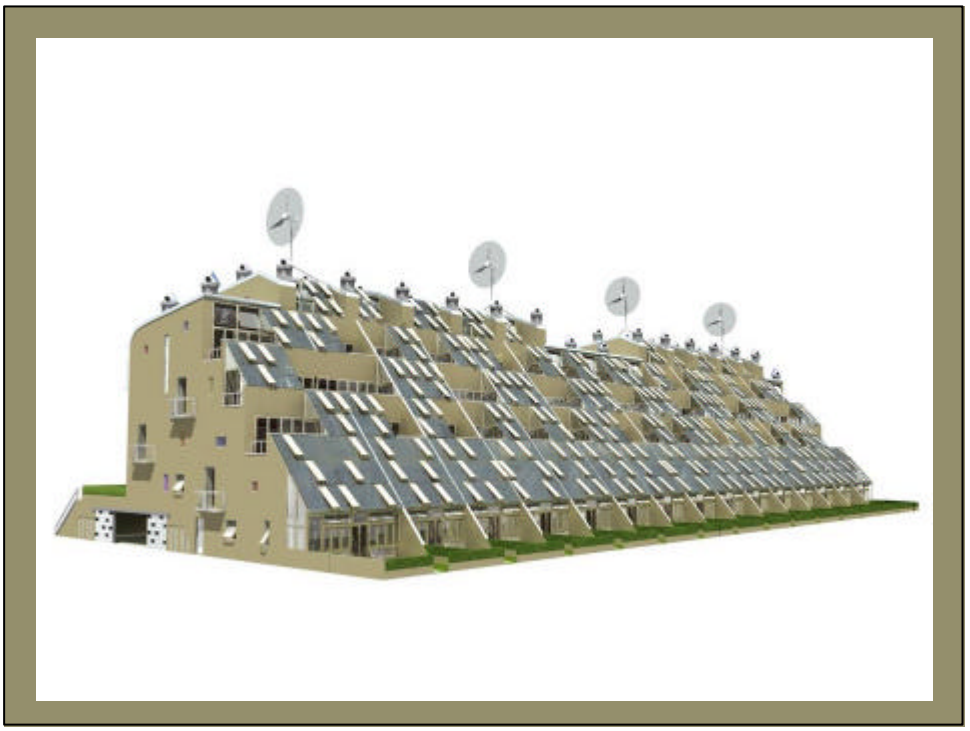
- built to ZEDstandards

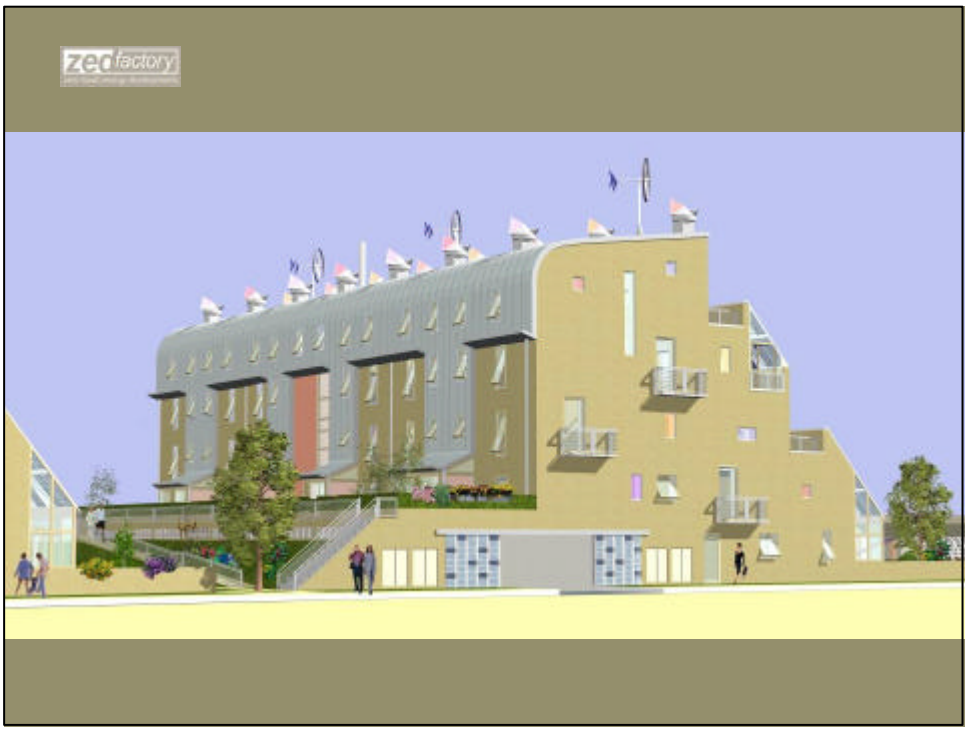



FLATS
RISER
R
Lv4
Plant Room
Lv3
Lv2
Lv1
MS
ROBINSON








zedfactory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zedfactory

Full site of 134 dwellings complete with PV Turbines and Sedum roofs.

This is the full ZED specification including all additional items - full PV, full wind turbines, sedum roofs.

Molesey has a history of regular flooding

Proposed site is raised to within 300mm of the Hurst Road which was raised to prevent flooding. The proposed level of the site is 20% above the environment agencies recommendations

Typical UK Resident			ZED quarter Resident	
- new well insulated home - drives 5000 miles/year - one short haul flight to Spain/year			- PV and solar thermal upgrades fitted -drives veg oil car - holidays in the UK - cycles to station daily - cycles to local market - deliveries from Zero Fossil Energy Farm	
0.36	3%	space heating in home	0%	0
0.48	4%	domestic hot water	0%	0
0.36	3%	appliances in home	7.6%	0.27
2.16	18%	personal transport	15%	0.54
0.36	3%	energy to build home	5%	0.18
1.56	13%	waste and consumer items	22%	0.78
2.88	24%	food	23%	0.72
1.44	12%	shared services	10%	0.36
		shared infrastructure		
12.0 ton CO2			3.54 ton CO2	

Main Core - 5 Generations - 125 years

- Mass Concrete foundations
- Galvanised steel shoes
- Timber post and beam structure
- Concrete thermal mass panels
- Plywood flooring deck
- Rockwool insulation
- Breather membrane
- Roof truss
- Outer brick skin and plinth
- Timber joists and stud partitions

Servicing - 1 Generation - 20 / 30 years

- Kitchens and bathrooms
- Plumbing and electrics
- Sealants and seals
- Timber doors and windows

Fitout - 2 Generations - 50 / 60 years

- Roofing membrane
- Standing seam roof
- Green roof sedum
- Wind cowls
- Timber rainscreen cladding
- Floor paviors and tiling
- Flashings and copings
- Render
- Internal joinery
- Plasterboard
- Timber stairs and internal doors

Applied finishes - 6 years

- Paint finsh and natural wood wax

Legacy Index

Foundations

to Fixtures

Rural ZED cost breakdown of £ 1050-00 /m2 gross internal build rate

- prelims / profit	10 %
- foundations	4%
- Framing	15 %
- secondary timber	16 %
- envelope and insulation	6 %
- roof	4%
- cladding / windows	10 %
- Renewable energy	15 %
- Fit out and kitchen	15 %
- M and E	15 %

Total labour breakdown across all packages is approx 55% of total completed cost - this is the place to achieve cost reductions not minimising component quality or green specifications


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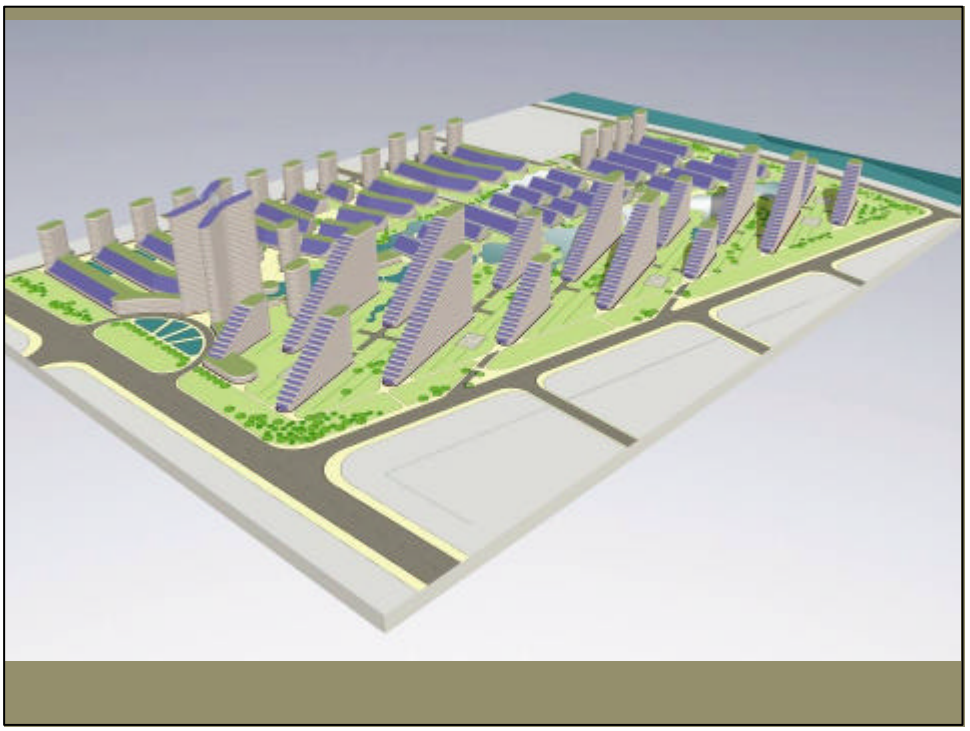
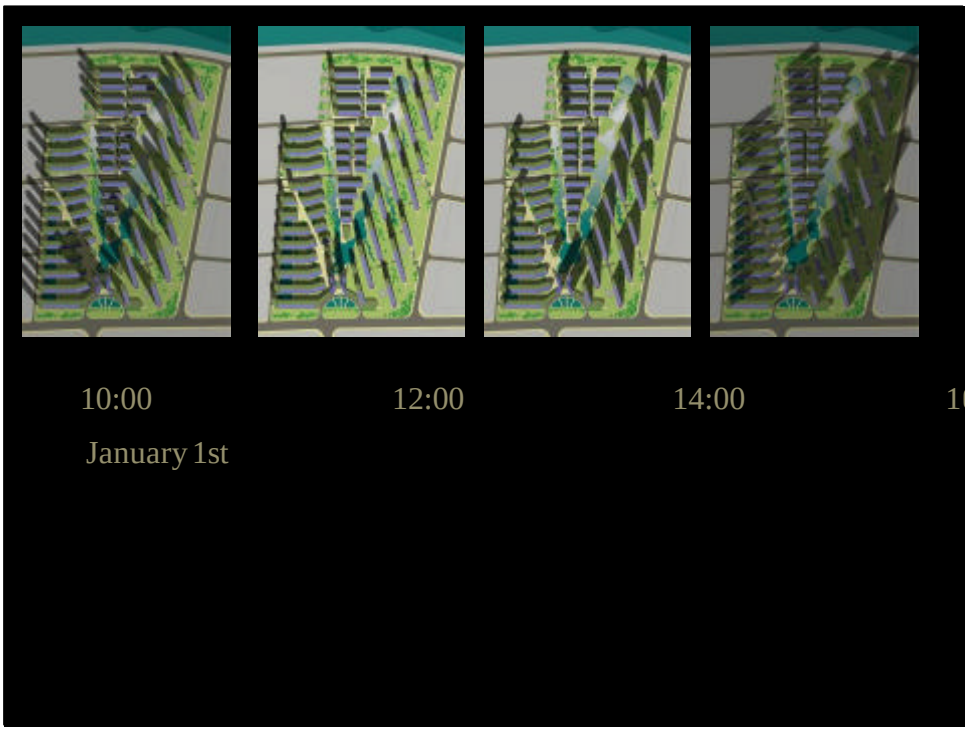
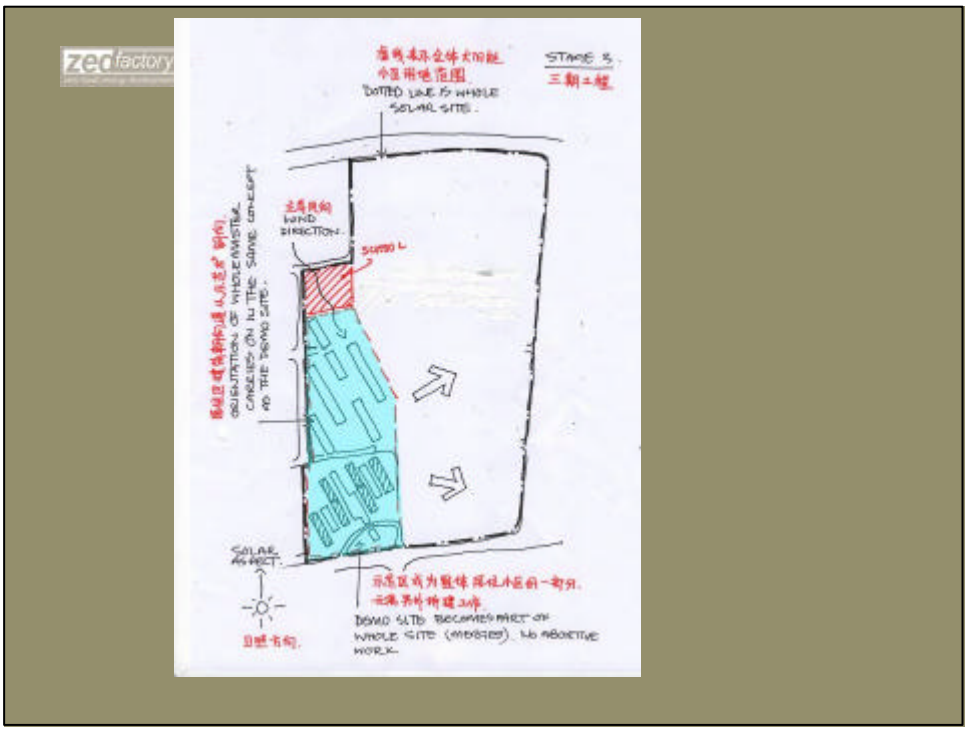
2050
NOW


新世纪大道西段两厢控制性详细规划陈家渡中学、陈渔路、双河路调整方案
土地利用规划图
1:1000



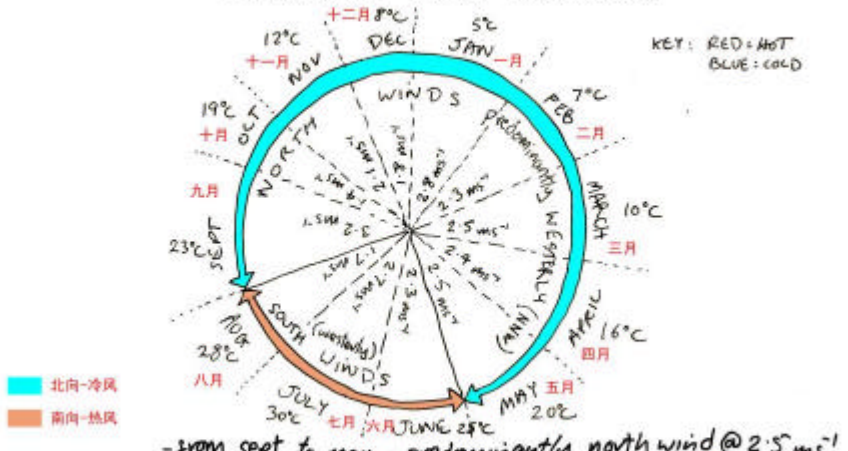

10:00
12:00
14:00
January 1st


zedfactory
STAGE 3
三期工程
DOTTED LINE IS WHOLE SOLAR SITE.
WIND DIRECTION.
SOLAR ASPECT.
DEMO SITE BECOMES PART OF WHOLE SITE (MASTER). NO ABOVE WORK.

2.

长沙风力资源

CHANGSHA WIND RESOURCE



- from sept to may - predominantly north wind @ 2·5 ms⁻¹
- from june to august - southerly wind @ 2·2 ms⁻¹

从九月到五月-主导风向为北向风-平均风速为2.5米/秒

从六月到八月-主导风向为南向风-平均风速为2.2米/秒

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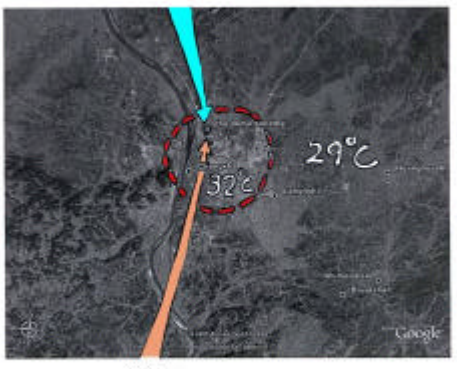
3.

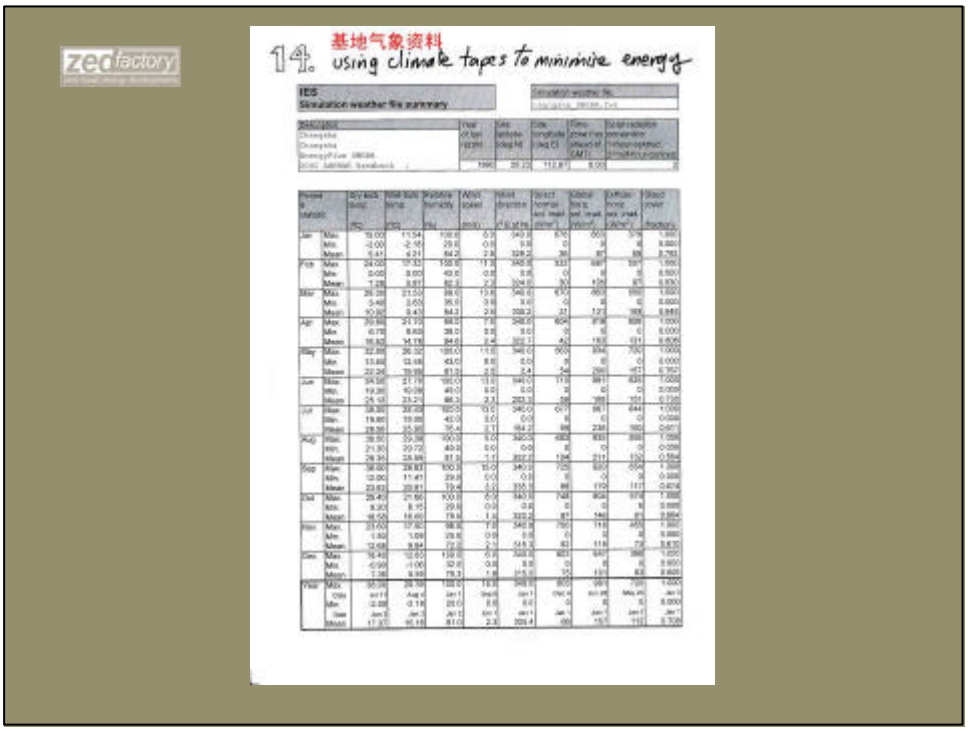
城市热岛效应

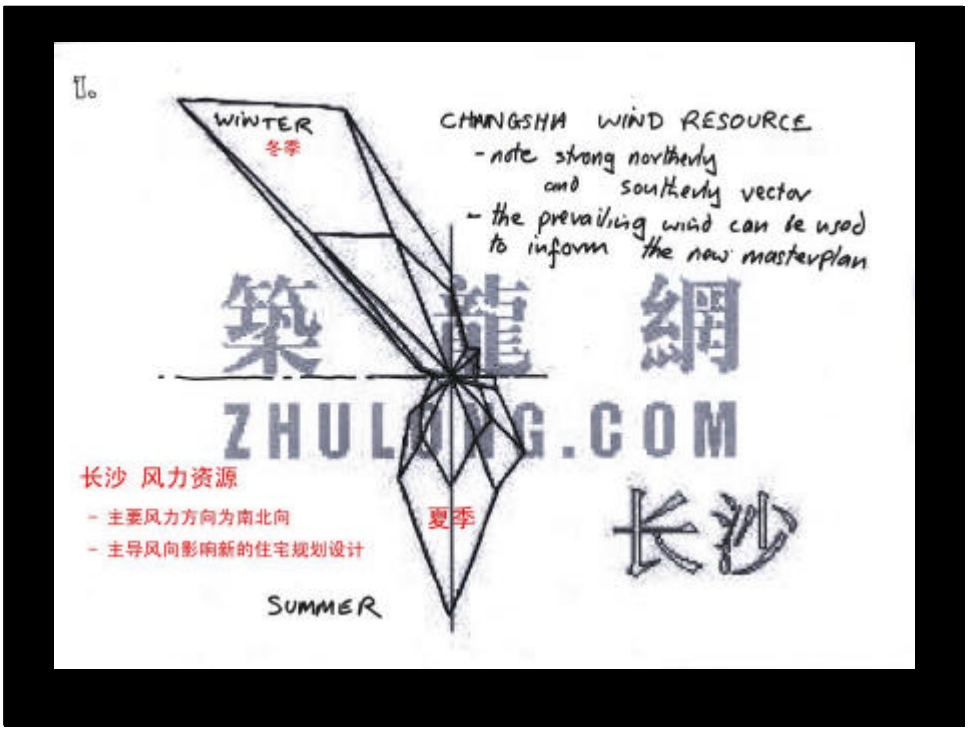
URBAN HEAT ISLAND

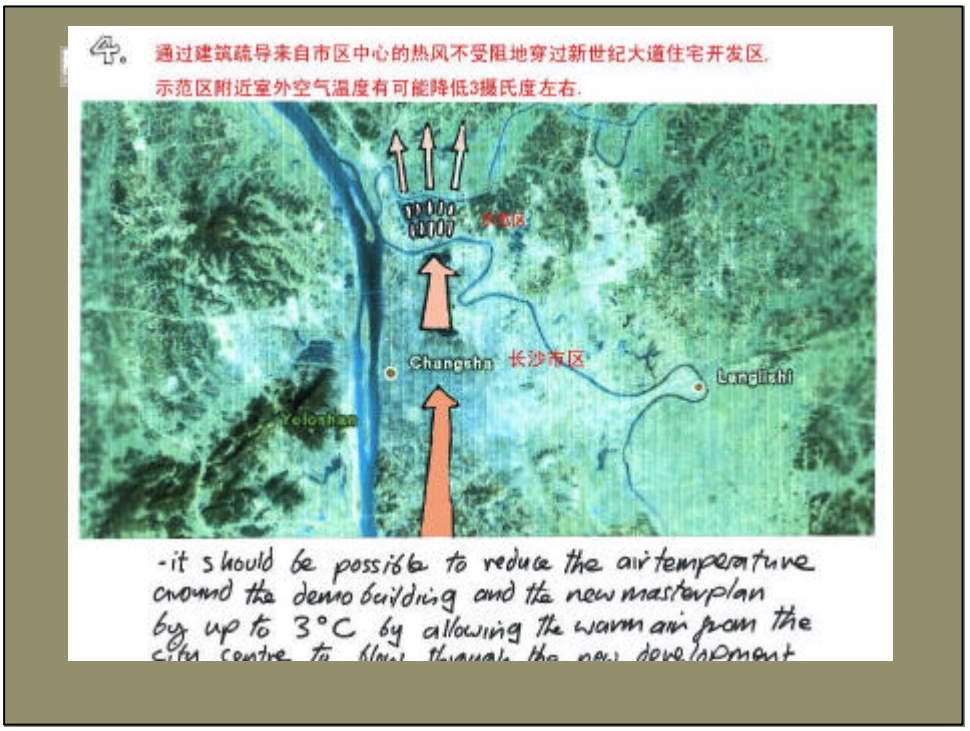


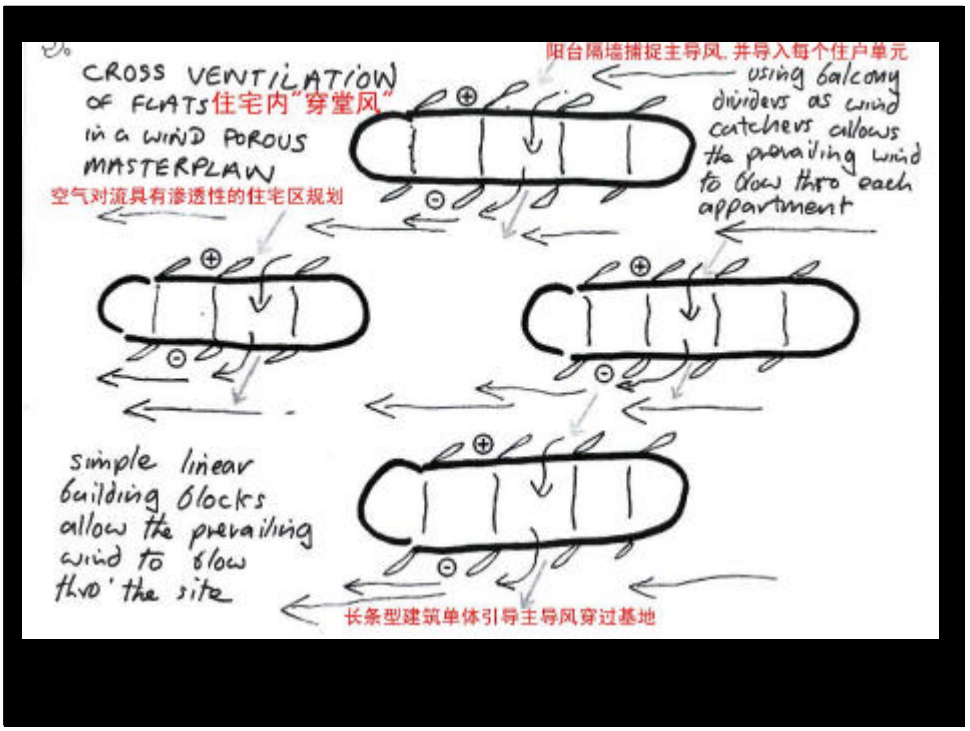
- the centre of CHANGSHA can be up to 3°C hotter in summer than the outskirts

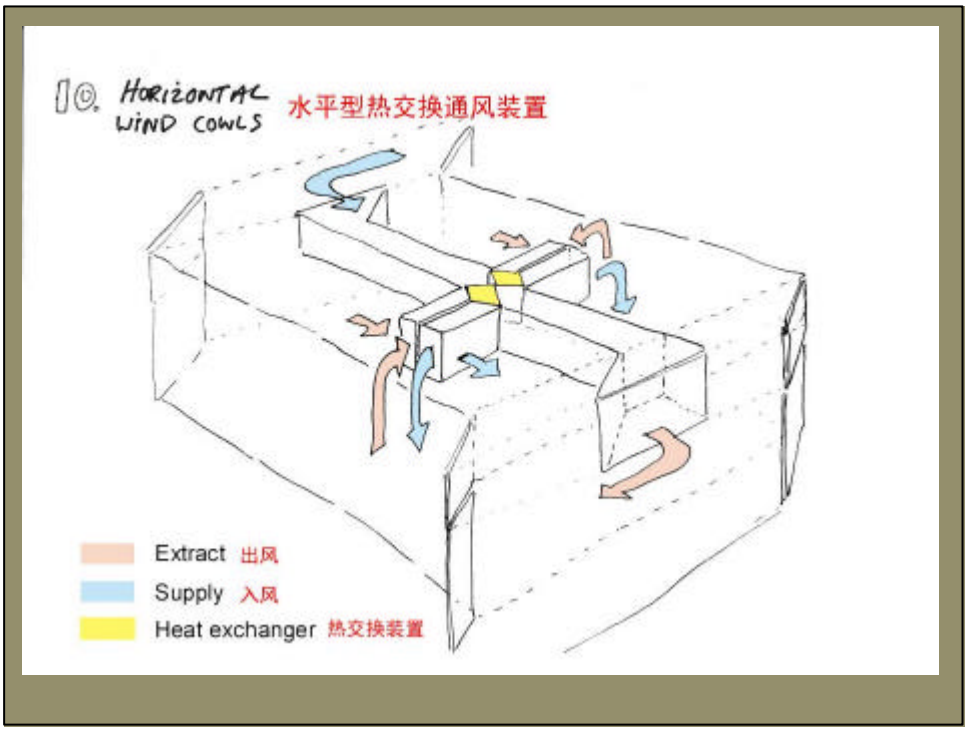
夏季长沙中心地区室外温度比周边地区高3摄氏度左右

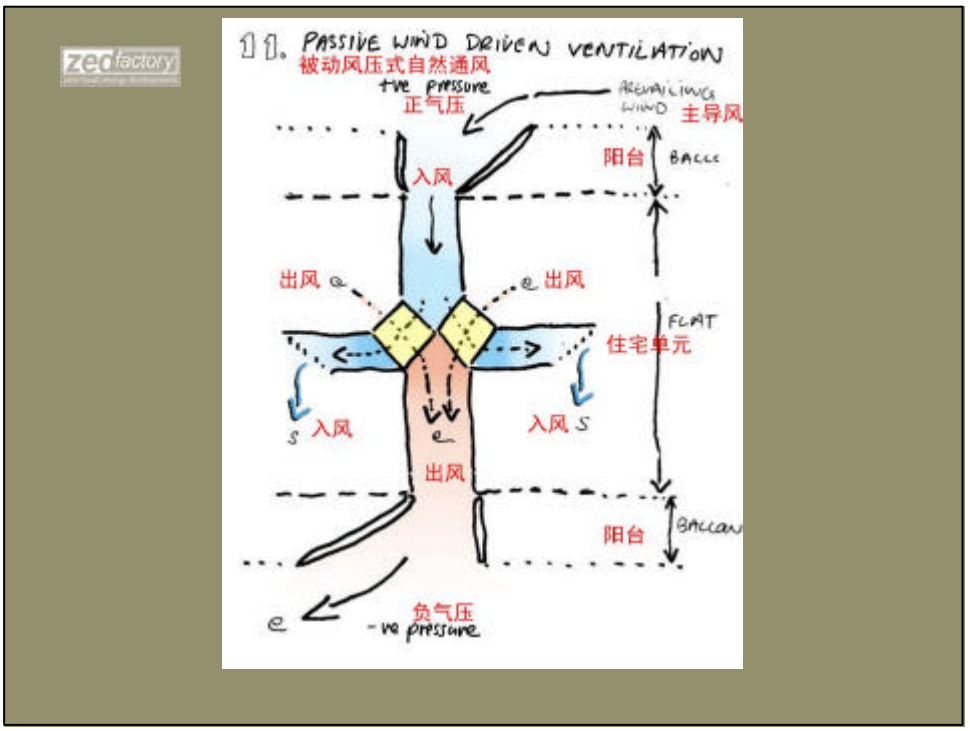

zedfactory
14. 基地气象资料
using climate tapes to minimize energy
IES
Simulation weather file summary

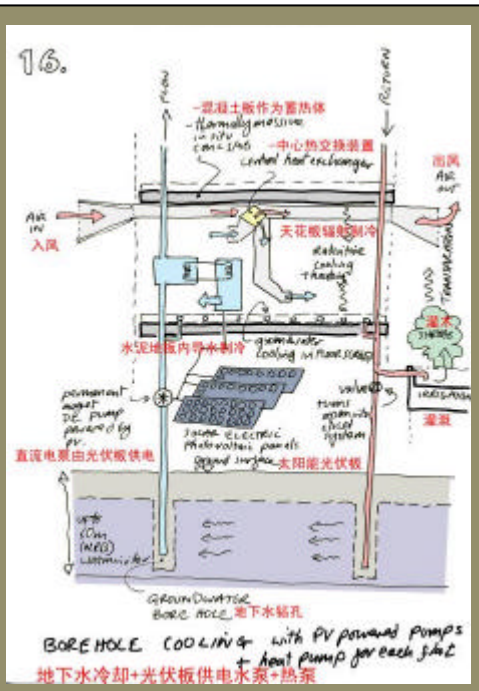

1.
WINTER
冬季
CHANGSHA WIND RESOURCE
- note strong northerly and southerly vector
- the prevailing wind can be used to inform the new masterplan
长沙 风力资源
- 主要风力方向为南北向
- 主导风向影响新的住宅规划设计
夏季
SUMMER
ZHULONG.COM
长沙

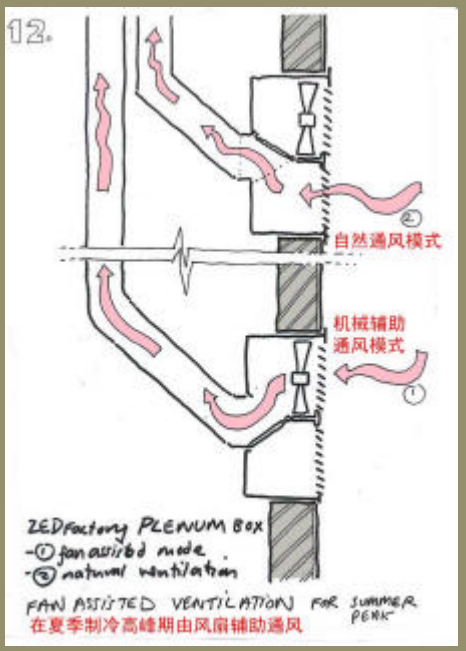

4。 通过建筑疏导来自市区中心的热风不受阻地穿过新世纪大道住宅开发区.
示范区附近室外空气温度有可能降低3摄氏度左右.
Changsha 长沙市区
Langlishi
Yeloshan
-it should be possible to reduce the air temperature around the demo building and the new masterplan by up to 3°C by allowing the warm air from the

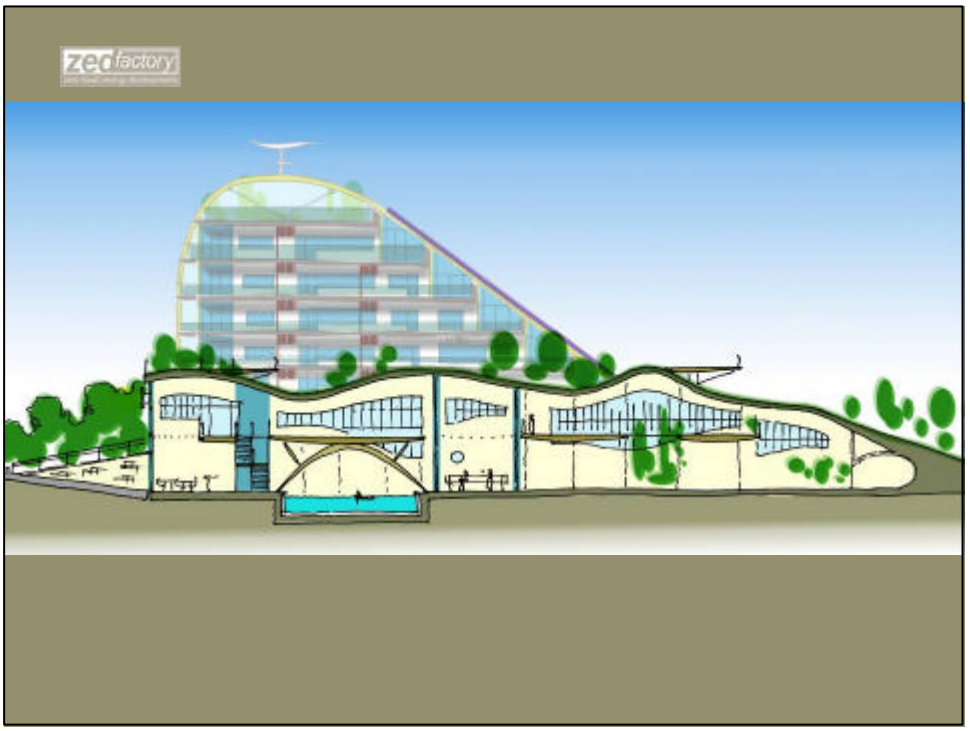

CROSS VENTILATION OF FLATS住宅内"穿堂风" in a WIND POROUS MASTERPLAN
空气对流具有渗透性的住宅区规划
阳台隔墙捕捉主导风, 并导入每个住户单元
using balcony dividers as wind catchers allows the prevailing wind to flow thro each appartment
simple linear building blocks allow the prevailing wind to flow thro' the site
长条型建筑单体引导主导风穿过基地

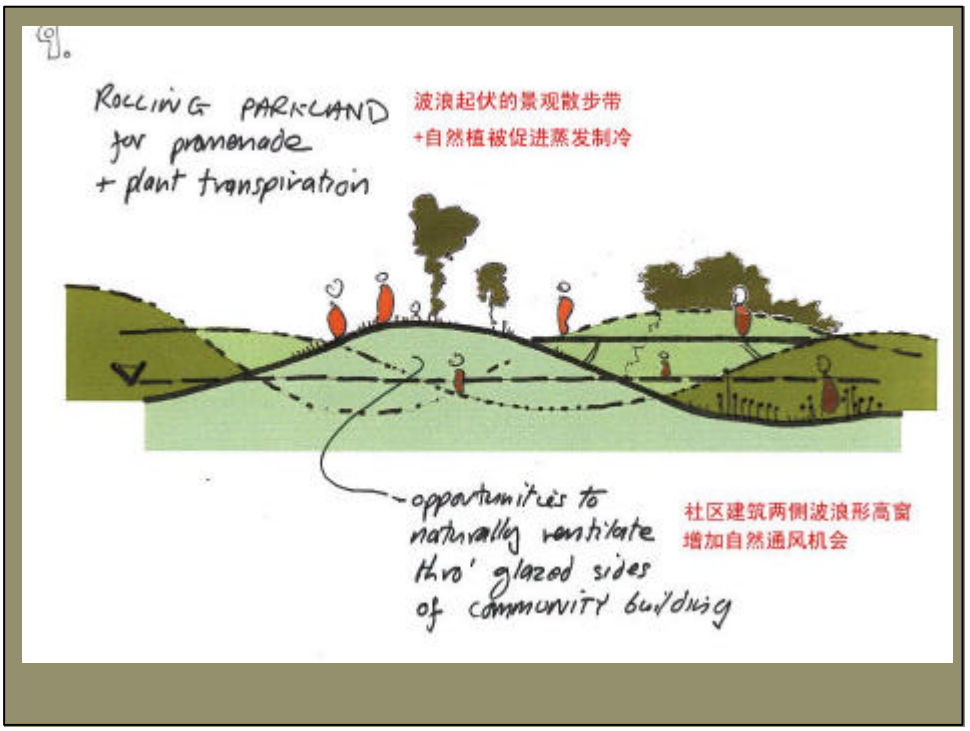

10. HORIZONTAL WIND COWLS
水平型热交换通风装置
Extract 出风
Supply 入风
Heat exchanger 热交换装置

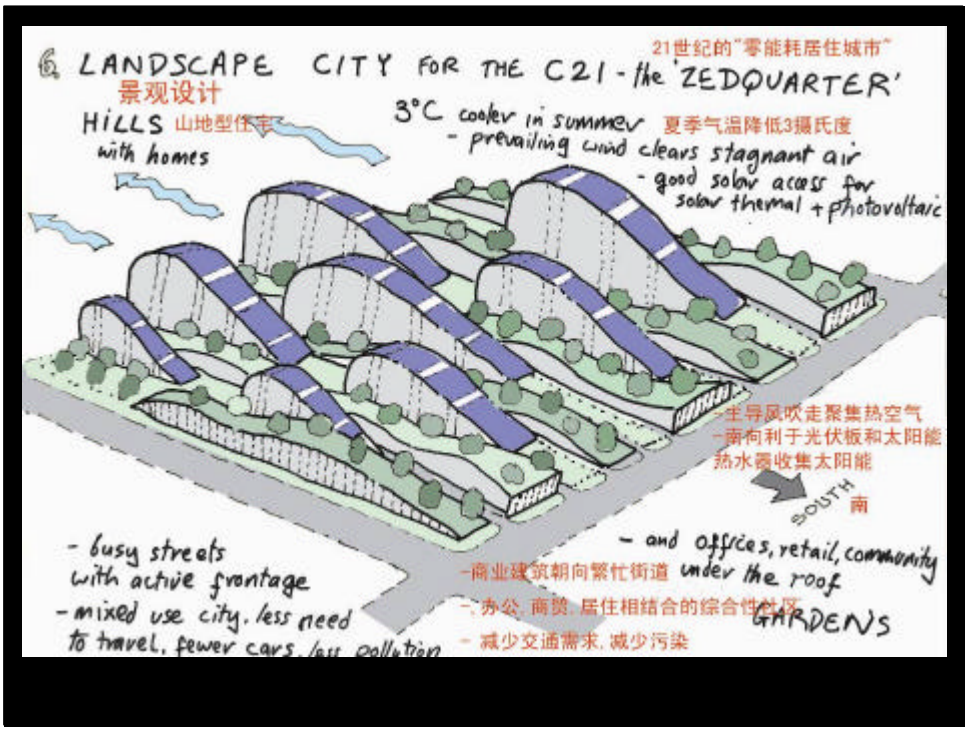

zedfactory
11. PASSIVE WIND DRIVEN VENTILATION
被动风压式自然通风
+ve pressure
正气压
PREVAILING WIND
主导风
阳台
BALC
入风
出风
出风
FLAT
住宅单元
入风
入风
出风
阳台
BALCON
负气压
-ve pressure

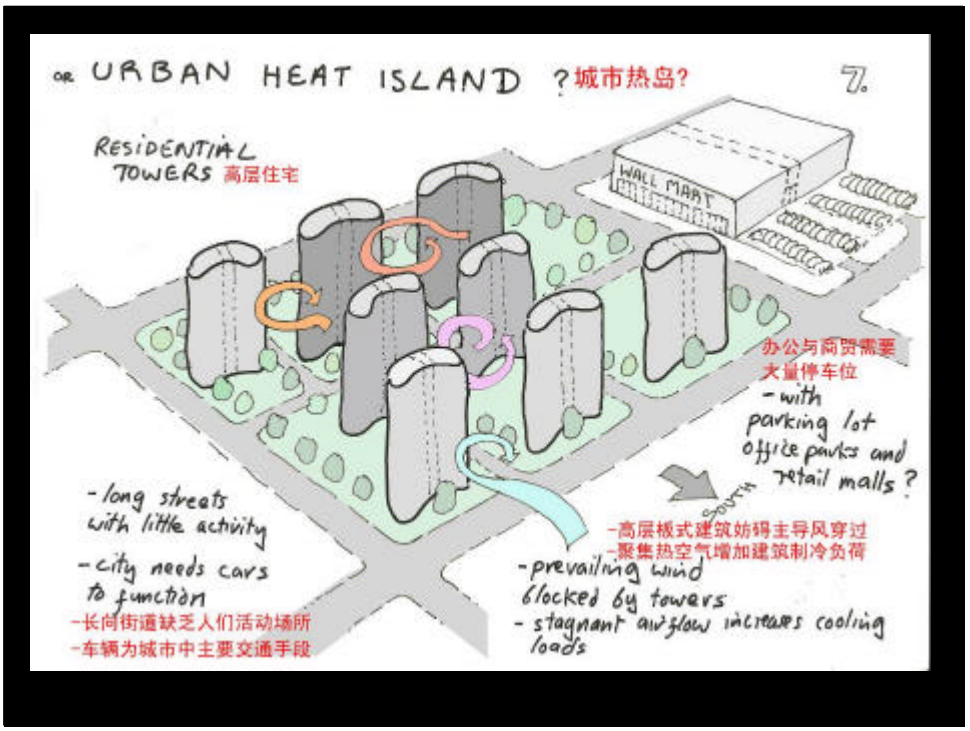

16.
-混凝土板作为蓄热体
-中心热交换装置
central heat exchanger
出风
AIR OUT
AIR IN
入风
天花板辐射制冷
radiative cooling ceiling
水泥地板内导水制冷
groundwater cooling in floor slab
灌溉
直流电泵由光伏板供电
太阳能光伏板
GROUNDWATER BORE HOLE
地下水钻孔
BOREHOLE COOLING with PV powered pumps + heat pump for each slot
地下水冷却+光伏板供电水泵+热泵


12.
自然通风模式
机械辅助
通风模式
ZEDfactory PLENUM BOX
-① fan assisted mode
-② natural ventilation
FAN ASSISTED VENTILATION FOR SUMMER PEAK
在夏季制冷高峰期由风扇辅助通风

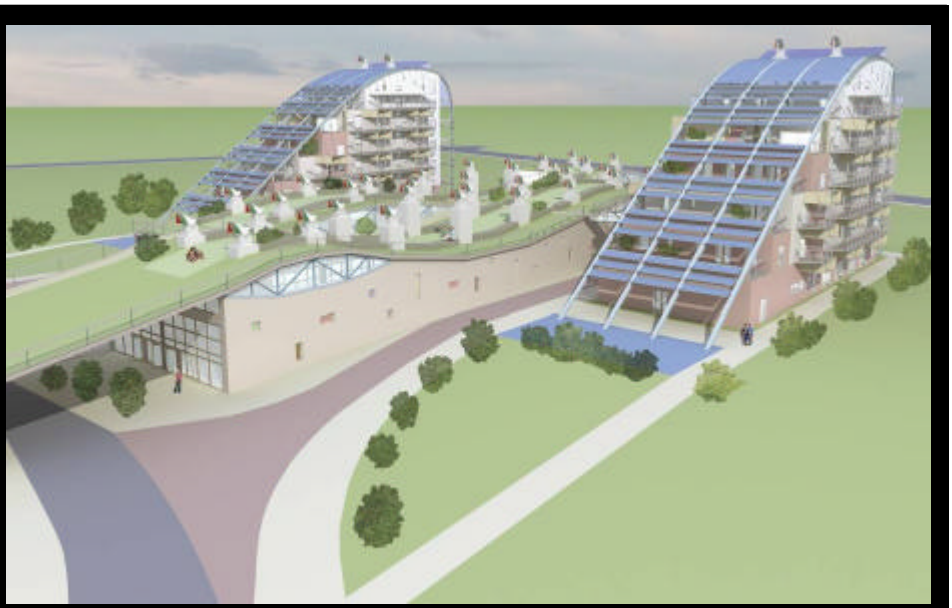

zedfactory

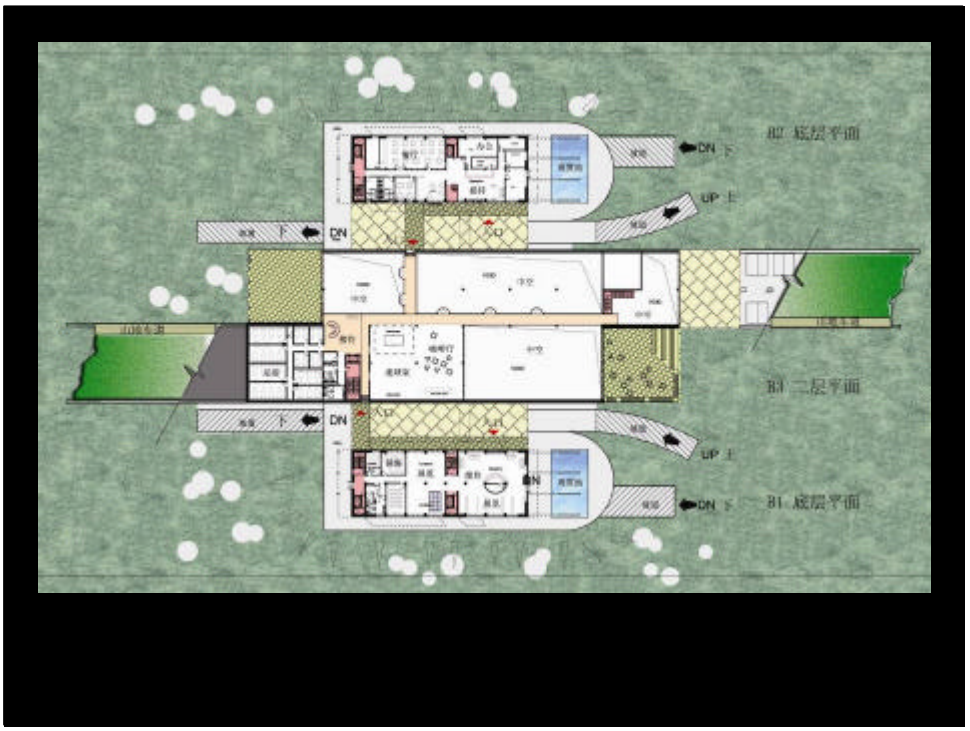

ROLLING PARKLAND
for promenade
+ plant transpiration
波浪起伏的景观散步带
+自然植被促进蒸发制冷
opportunities to
naturally ventilate
two glazed sides
of community building
社区建筑两侧波浪形高窗
增加自然通风机会

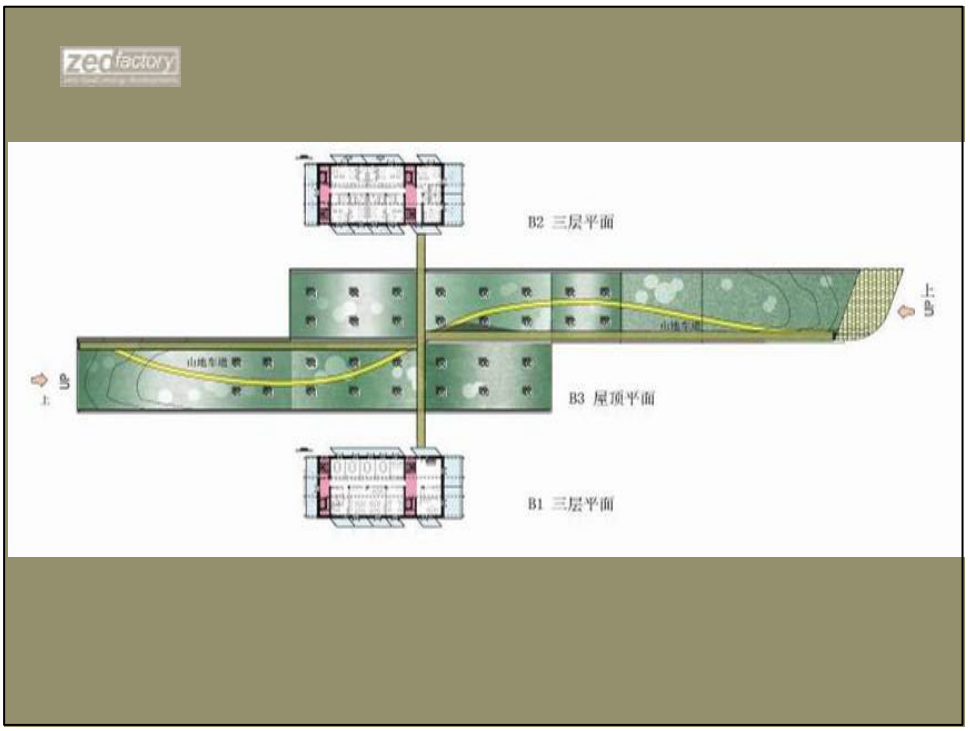

6. LANDSCAPE CITY FOR THE C21 - the 'ZEDQUARTER'
21世纪的"零能耗居住城市"
景观设计
HILLS 山地型住宅
with homes
3°C cooler in summer 夏季气温降低3摄氏度
- prevailing wind clears stagnant air
- good solar access for solar thermal + photovoltaic
-主导风吹走聚集热空气
-南向利于光伏板和太阳能热水器收集太阳能
SOUTH 南
- busy streets with active frontage
- mixed use city, less need to travel, fewer cars, less pollution
- and offices, retail, community under the roof GARDENS
-商业建筑朝向繁忙街道
-办公、商贸、居住相结合的综合性社区
- 减少交通需求, 减少污染


OR URBAN HEAT ISLAND ?城市热岛?
7.
RESIDENTIAL TOWERS 高层住宅
WALL MART
办公与商贸需要大量停车位
- with parking lot office parks and retail malls ?
SOUTH
-高层板式建筑妨碍主导风穿过
-聚集热空气增加建筑制冷负荷
- long streets with little activity
- city needs cars to function
-长向街道缺乏人们活动场所
-车辆为城市中主要交通手段
- prevailing wind blocked by towers
- stagnant air flow increases cooling loads

Modern Group - MOMA




B2 底层平面
DN 下
UP 上
DN
UP
B3 二层平面
DN
UP 上
B1 底层平面
DN 下


zedfactory
B2 三层平面
上
山地车道
山地车道
上
B3 屋顶平面
B1 三层平面

? ? ? ? ? High technology cycling - reconciling low carbon with personal fitness and social status ?

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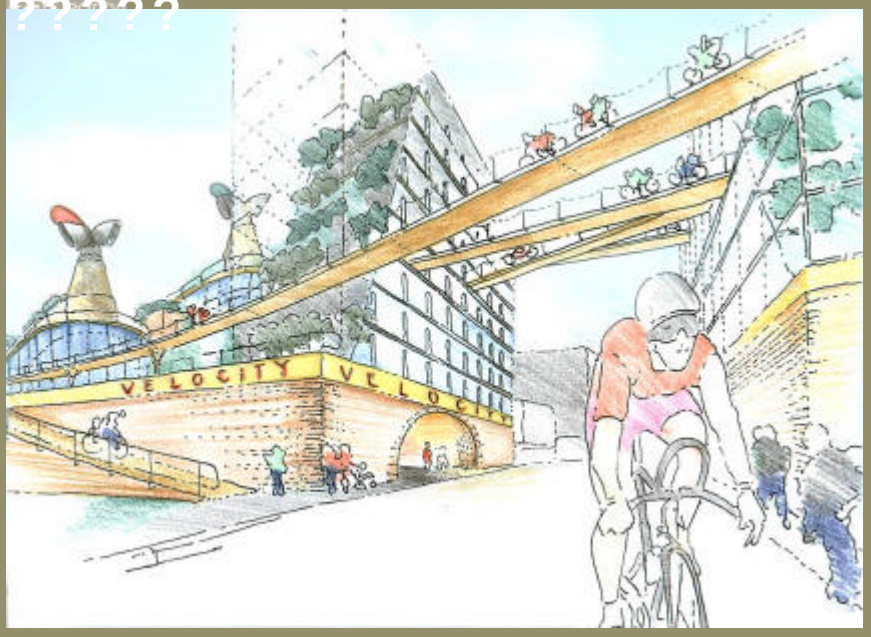

velocity - living in the city ? ? ?

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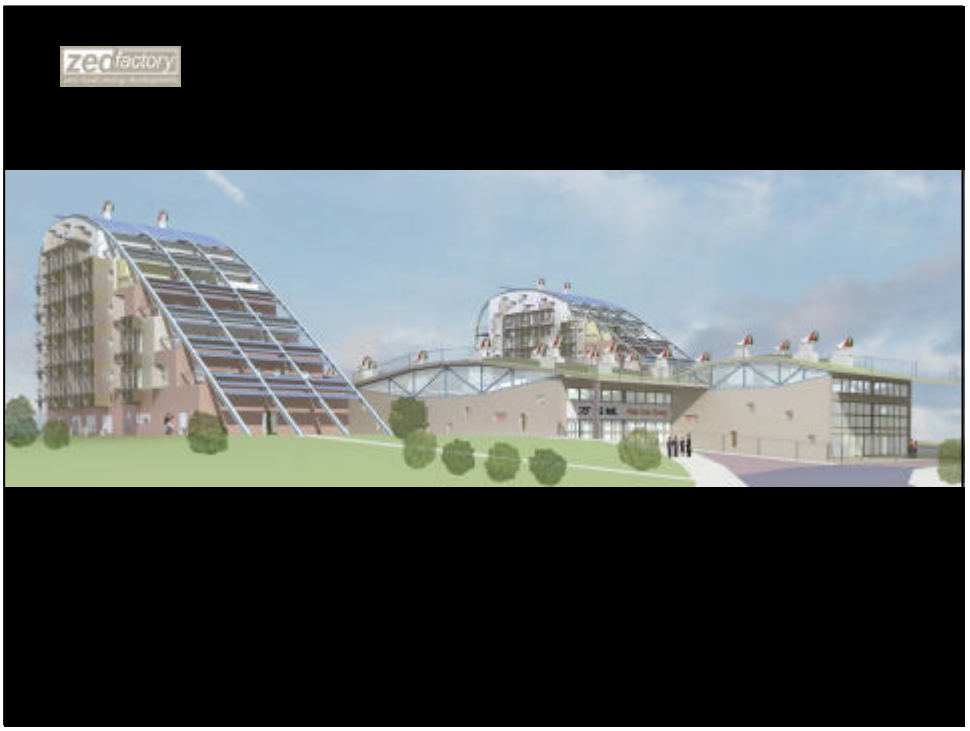
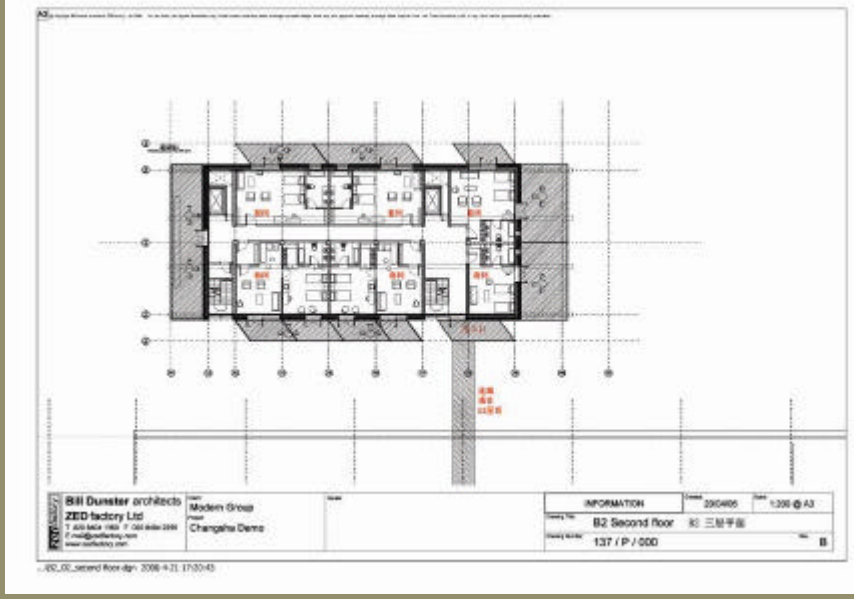



zeofactory
万国城
Wan Guo Cheng


zecfactory


zecfactory


Bill Dunster architects
ZED factory Ltd
Modern Group
Changsha Demo
INFORMATION
B2 Second floor
137 / P / 000
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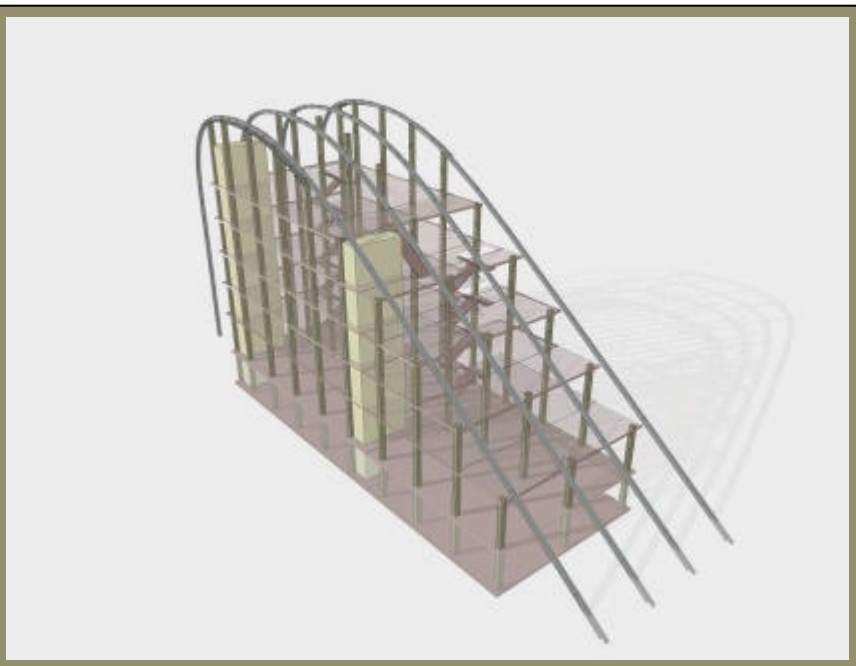

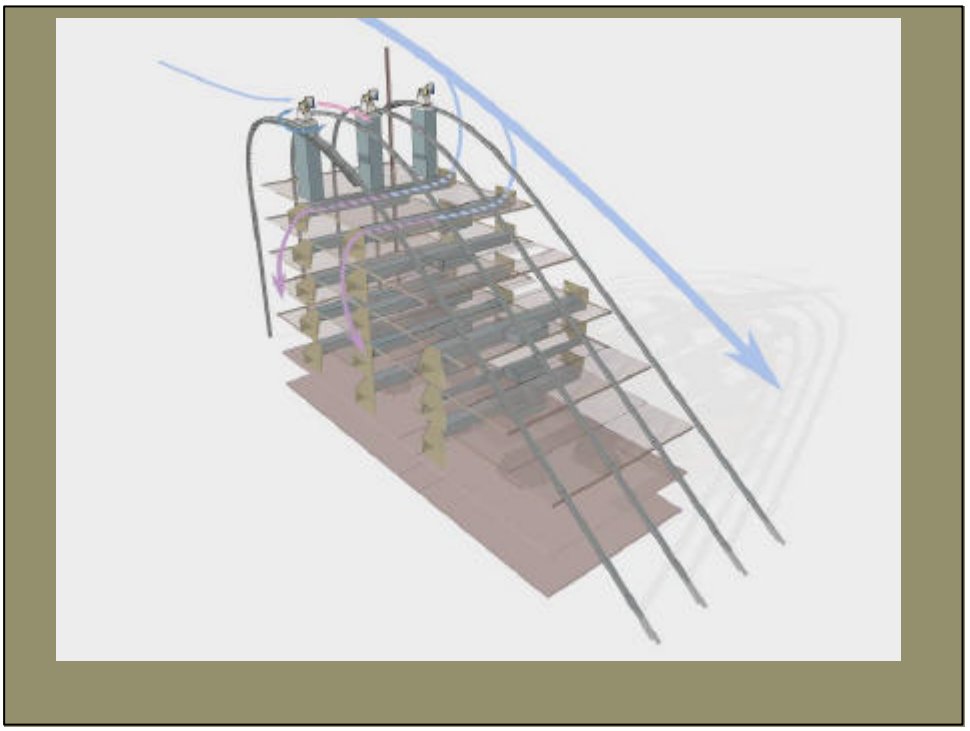

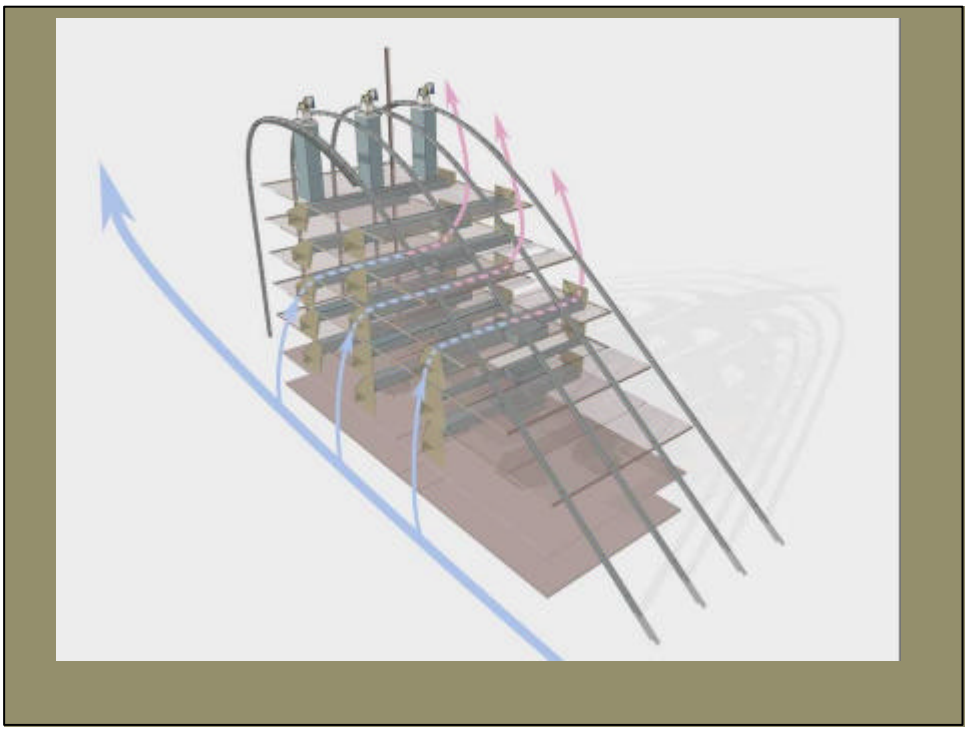

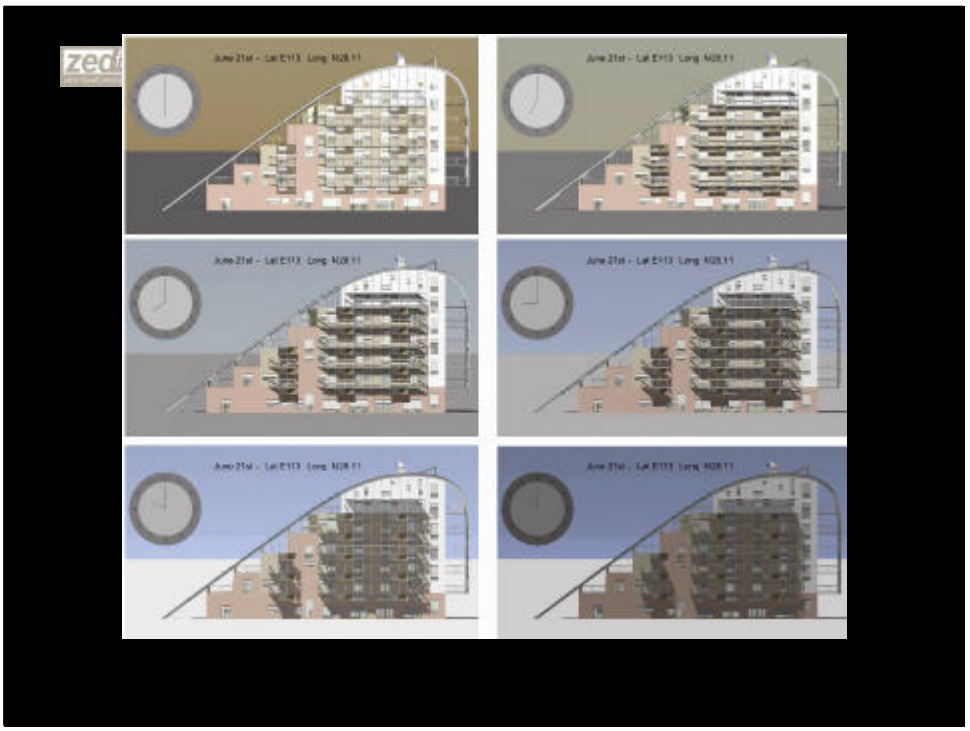

Standard Build

35-50mm insulation, 2 ac/hr ventilation, Venetian blinds

?????? : 35-50?? ???, ???2????,???

Heating load

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Heat gain are positi

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Heat loss are negative

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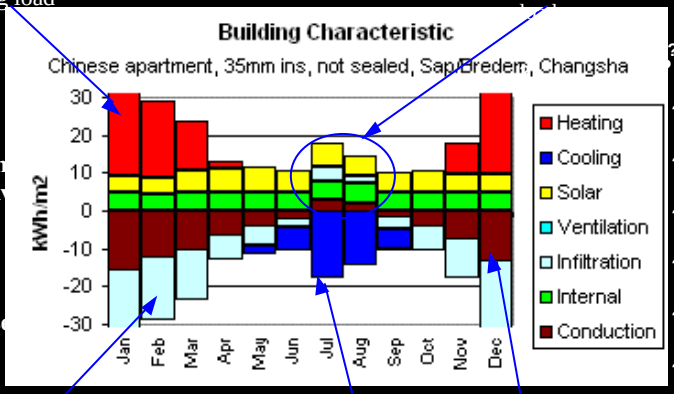

Solar gains, infiltration and poor insulation result in large cooling

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Heat loss through draught infiltration

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Cooling load

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Heat loss through poorly insulated walls

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ZED Apartment

Heat recovery ventilation, external blinds, high mass night cooling

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Negligible heating

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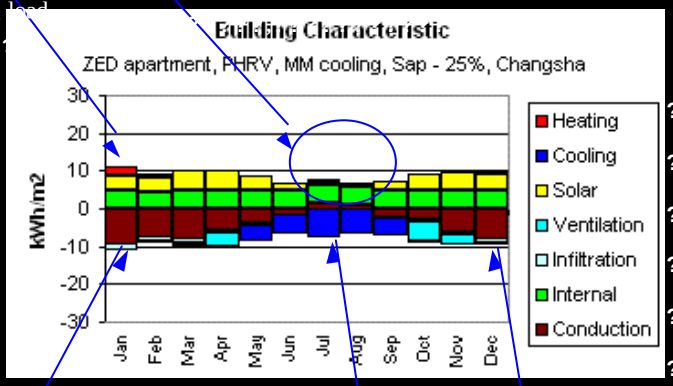
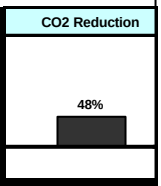
Efficient shutters cut out solar gains, good insulation and air tightness minimise cooling loads





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Background ventilation losses minimised by heat recovery units

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Cooling load reduced

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Heat loss reduced with well insulated walls

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ZED Apartment – Cool Island Design

Controlled ventilation 0.5 ac/hr, external blinds, high mass night cooling

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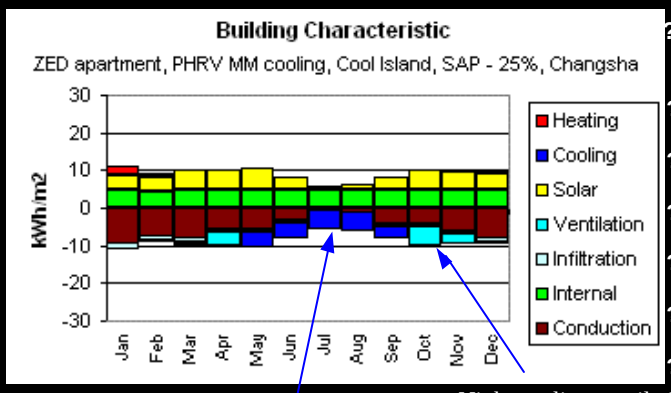

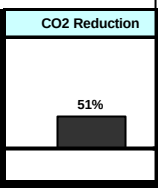

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Cooling load further reduced by cooler outdoor temperatures

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Night cooling ventilation in spring and autumn when air moisture reduced

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CO2 Emissions

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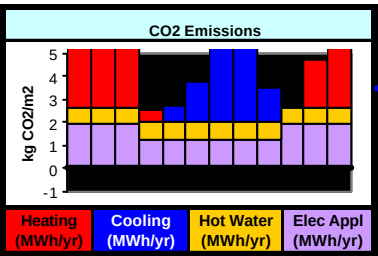

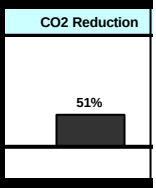

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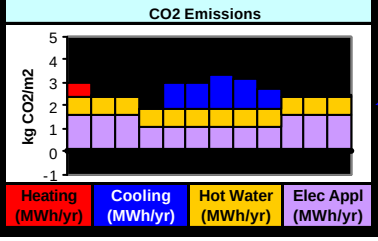
Improvement to building



CO_2 Emissions
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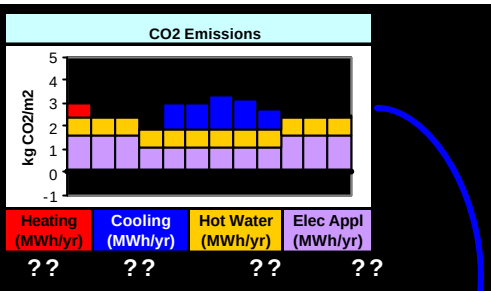
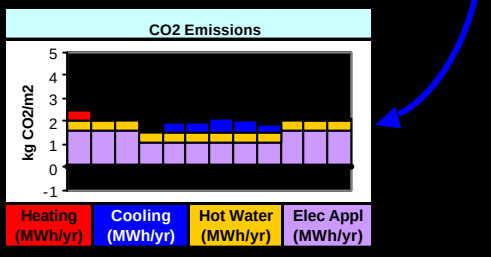
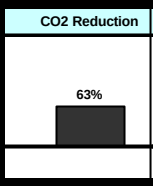
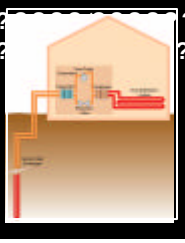






Change from fossil fuel heating and conventional air conditioning to ground source cooling and heat pumps



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CO_2 Emissions
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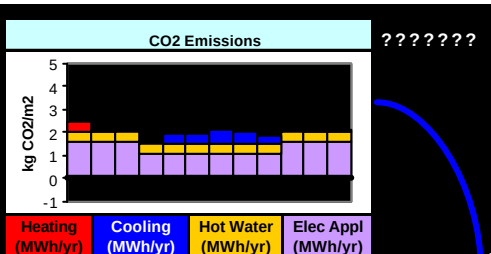

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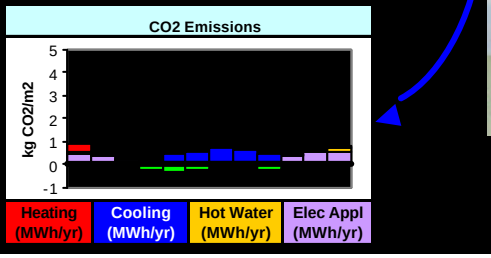
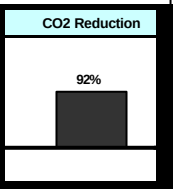
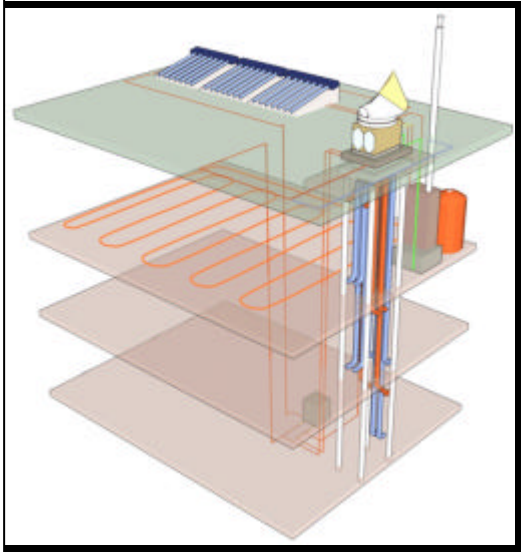




Addition of Solar Hot Water and Photovoltaic panels

Solar powered desiccant cooling



- Supply air dehumidified with liquid desiccant.
- Exhaust air cooled by evaporative cooling.
- Supply air cooled by exhaust air via heat exchanger.
- Liquid desiccant regenerated with heat from solar collectors.
- Optional forced air from individual room fans.
- Optional additional slab cooling from ground water.
- Works in vertical or horizontal system

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