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DESIGN ISSUES for sustainable social housing

Introduction:

This booklet has been produced by the partners of the Renease Project

'Renewable Energy Against Social Exclusion'

This project was kindly co-financed by Altener II programme the European Commission The project partners are as follows.

- **Carbery Housing Association: (Lead Partner)**
Registered Charitable company approved by the Department of Environment for Social Housing Development. Funded by the DoE&LG and Altener II Programme, currently negotiating various Social Housing projects in County Cork
- **Northern Ireland Housing Executive:**
The public Housing Authority for the North, NIHE is a manager of over 120,000 public homes and has extensive development experience. NIHE has adopted a sustainable energy strategy and participates in a number of European Networks around innovative approaches to housing.
- **Cork County Energy Agency:**
Established in 1995 through Co-Funding from SAVE programme of the European Commission and Cork County Council. The Agency runs a Public Information Energy Office in the Spa House in Mallow and has also been involved in 30 EU Co-Funded Energy projects to-date
- **Blackwater Resource Development:**
A local partnership of community organisations based in the Blackwater Valley (North County Cork). They have promoted Environmental projects and organise training and dissemination events for local communities.
- **REVES:**
The REVES network of Cities and Regions of the social economy is a network of 30 local authorities throughout Europe who work strategically with the social economy in the promotion of regional development and the combating of social exclusion.

During the course of the project the partners have worked closely together in ensuring the success of the project this booklet is one of the main deliverables of the project and is meant as a simple Good Practice Guide for developers of Sustainable Social Housing.



Fuel Poverty

Definition of Fuel Poverty

“Inability to afford adequate warmth because of the energy inefficiency of the home”

Existing Situation:

Ireland has the poorest insulated houses in Europe at present, which imposes very substantial costs including:

- Energy losses, amounting to 24% of household energy consumption or 7% of total final energy consumption.
- Health losses, comprising 650 premature deaths, 2000 cases of cardiovascular and respiratory disease, concentrated on the poorest and most vulnerable, notably the elderly.
- Additional Greenhouse gas emissions of 3 million tonnes of CO₂, (5% of National total), and a situation where we will have great difficulty meeting our Kyoto protocol obligations.
- Additional SO₂ emissions (a prime cause of acidification) of 16,000 tonnes, in a situation where we will have great difficulty in meeting our obligations under the Long-Range Transboundary Air pollution Convention.

Effects of Fuel Poverty

- On Individuals
 - cold homes & condensation cause discomfort
 - damage to furniture & clothes
 - allergic reactions to fungal spores from damp conditions
- On Health Authorities:
 - Excess winter deaths
 - Additional illnesses
- On Utilities:
 - Fuel debt and disconnections
- On Landlords/Owners
 - Rent arrears
 - High turnover and vacancy levels
 - Increased maintenance costs (e.g burst pipes)

Sustainable Development

What is Sustainable Development?

Sustainable development concerns the distribution of the world's precious resources over time. Many definitions are available. For example, sustainable development:

*“is development that meets the needs of the present without comprising the ability of future generations to meet their own needs (*¹ *Bruntland Report 1987)*

*“means living on the earth's income rather than eroding its capital. It means keeping consumption of renewable natural resources within the limits of their replenishment. It means handing down to successive generations not only man-made wealth, but also natural wealth, such as clean and adequate water supplies, good arable land, a wealth of wildlife and ample forests (*² *White Paper on the UK Environment, 1990)*

The Need for Indicators of Sustainability

*“Indicators of sustainable development need to be developed to provide solid bases for decision making at all levels and to contribute to the self regulating sustainability of integrated environment and development systems” (*³*The Earth Summit Agenda 21, 1992 – Chapter 40)*

To ensure housing is being provided in a sustainable manner, it can be useful to keep a long term record of 'environmental indicators', easily understood statistics which tell us how well we are looking after the householders and the environment. Examples of indicators could be:

- Home energy ratings on a scale of 0 (very hard to heat) to 10 (excellent)
- How far from home a person must travel to meet basic needs
- The weight of waste recycled per year
- Energy consumption per household expressed as an amount of CO₂ per annum.

Examples of integrating indicators into decision-making by a client could be:

1. Stating the ratio of external wall area to floor area at initial design stage

A low score for this can increase open space between properties or reduce land costs. A low score also lowers building costs, materials consumption and final energy use when built. A complicated plan perimeter or lots of separate buildings are symptomatic of a high score and high heat loss and expense.

¹ (1987) Our Common Future: “The Bruntland Report” – Report of the 1987 World Commission on Environment & Development: Oxford University Press

² (1990) This Common Inheritance, Britain's Environmental Strategy. Cm 1200: HMSO

³ (1992) The Earth Summit: Agenda 21 – United Nations

2. Percentage of untreated timber or softwood used

Timber can often be left untreated in dry areas, or preservatives used which are not toxic to mammals when touched or when treated timber is burnt. Use of faster growing softwood is generally less damaging than use of hardwood, most of which is logged unsustainably.

3. Money spent on replacement and repair for houses less than 15 years old

Often it will be better to specify a longer design life and spend a little more at first to get robust finishes, or to avoid unproven materials and difficult to repair fixtures to reduce ongoing costs e.g. studies have shown that replacing hardware can be a major ongoing cost.

It has been suggested that a target should be set of providing a 24 hour mean internal temperature of 18C, at a cost of no more than 10% of income.

Low Energy Design

Benefits of Low Energy Design

- Considerable energy and CO₂ emissions savings
- Reduced impact on the environment
- Reduced dependence on conventional energy supply
- Improved levels of thermal & visual comfort
- Cost-effectiveness
- Added market value of the building

In addition to wishing to provide tenants with affordable heating, there is a new urgency to the quest for energy efficiency, due to the vulnerability of people globally to the effects of climate change caused by burning fossil fuels. Although average global temperatures are rising, the effects will be uneven, and may leave Ireland cooler. In low-lying areas of Bangladesh and Egypt, flooding and storms may displace many millions of people. In other areas, desertification and climate change may cause agricultural failure and the loss of animal species.

To reduce the risks from climate change, the Irish government has made a commitment to limit the CO₂ emissions increase to 13% above 1990 levels by 2010.

Heating fuel is not the only source of heat in homes. Electricity for lights, hot water heating, sunshine and heat from people and cooking, all end up as heat. These other sources of heat in the home are called internal gains, and can provide most of the heating required by a well insulated dwelling, so that the home is always well above outside temperatures even with the heat off. Putting in extra insulation to make the most of normal heat gains is an

appropriate strategy for social housing where people may not be able to afford full heating all the time.

Superinsulation

With extra insulation, especially in the best heated living areas, the number of days when heating is required and the size and cost of the heating system can be reduced. With high insulation levels and more “fabric” heat loss, more energy may be used to heat hot water for washing than for room heating and half the total energy lost by the house may be due to ventilation air lost to the outside.

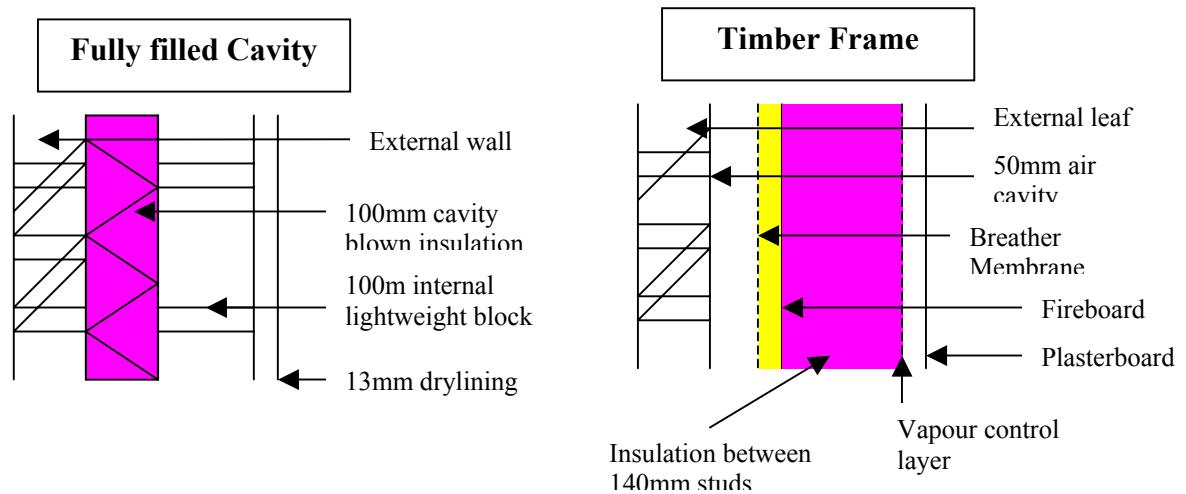
Building Regulations have minimum standards for thermal insulation and energy conservation. Higher standards are advisable for social housing:

- Higher insulation standards reduce condensation risks provided that adequate ventilation is present. Insulation and draughtproofing are often confused. Some ventilation is always necessary for health. Weak spots in insulation layers attract condensation and mould.
- Flats on the ground floor of blocks, and houses at the end of terraced blocks, have more heat loss than homes in the middle of blocks so high standards are important for all homes.
- Some homes may not be heated for long periods, due to the circumstances of householders and their dependants, so that adjoining properties also become colder. A well-insulated building will often remain warm enough to protect human health without additional heating.

Practical Insulation

Walls

With masonry construction a structural engineer can often increase the wall cavity to 150mm after a check calculation. Allowing 100mm of insulation to be installed, alternatively 100mm of blown insulation can be installed in a 100mm cavity as shown.. The wall cavity of timber-framed houses can be increased to 100mm to allow an extra 50mm of insulation to be installed while remaining a 50 mm air cavity for weather-proofing. Timber frame also has insulation between the 90mm or 140mm uprights.



Roofs

Modern warm roof construction uses special breather membranes to avoid the need for cold ventilated spaces above loft insulation. Mineral wool is very economic and thicknesses of 300mm can be appropriate, especially in bungalow lofts.

Ground floors

These should be insulated both below and at their edges. Solid concrete floors are more draught-proof than suspended floors.

Cold Bridges

Cold bridges, or weak spots in insulation layers, lower average insulation levels and attract condensation e.g. heavy block walls which carry on up into unheated spaces. Cold bridges should be designed out (ref: "avoiding risks" BRE)

Insulation Types

It is preferable to use bigger thicknesses of cheaper insulation materials rather than thinner layers of expensive types. If there is a small gap in a thick layer, the heat has further to go to escape than with a thin layer. Some expensive insulation types may not perform as well in the long term e.g. heat reflective facings may get dirty and ineffective and special insulating gases within plastic foams will leak out. Like clothes, putting insulation on in layers will be warmer and covering or filling gaps is very important. Considerations of fire and vermin resistance can favour mineral fibres.

Windows as Insulation

Even double glazed windows let out about ten times as much heat as ordinary walls so any improvement is worthwhile and may cost very little. To improve performance, ask for 18mm air gaps between panes, or larger gaps where noise is a problem. Ask for each of the options of low emissivity glass, insulating glass spacers, or argon gas filling to be priced at tender stage, because sometimes unit manufacturers may charge very little extra for these. Check the insulation performance of frame materials. Softwood is generally better than hardwood or aluminium.

The Main Living Area

The main living area is important in the design of low energy housing, as studies have shown that it is usually heated to higher temperatures, and on more days, than the rest of the home.

This is reflected in common energy rating programmes, where the areas including the lounge are termed 'Zone 1' and assumed to be heated much more than the rest of the house, termed 'Zone 2'. It will save energy if Zone 1 can be heated separately from Zone 2, e.g. by having its radiators on a separate heating circuit with its own wall-mounted thermostat and control valve.

Because higher temperatures are demanded in Zone 1, and on more days, insulating this zone well is very effective, turning the energy from people, TV, lighting, food, into useful heat gains. Providing a little insulation between Zone 1 and the rest of the home can help keep zone 1 temperatures up so that people do not need to turn a central heating system on. Otherwise in superinsulated homes the temperature of the whole house rises to that of Zone 1. Some insulation between Zones 1 and 2 can work especially well if Zone 1 has extra heat gains from a cooking area, from a nearby hot water cylinder, or from windows facing south or south west.

Minimising Ventilation Heat Loss

Small gaps left during the construction of homes leads to unnecessary and uncontrollable extra ventilation and draughts.

To reduce unnecessary heat loss:

1. Ensure airtight construction by filling gaps e.g. With expanding foam around window and door frames.
2. Provide fresh air for occupants in a planned way e.g. secure trickle vents, openable windows, passive stack ventilation.
3. Provide occupants with controllable ventilation to remove excess moisture E.g. Switchable extract fans in kitchens and bathrooms.

Example Ventilation Heat Loss From House

Fabric loss through walls etc. 150 W/c

Ventilation air loss 50 W/c

Heat loss total 200 W/c

W/c = Watts for every degree of difference between inside and outside

Building Materials

Heavyweight or Lightweight

Lightweight materials such as timber frame or lightweight block warm up quickly when heated, and then feel comfortable, as people are very sensitive to the temperatures of the surfaces that surround them. Furniture and furnishings in rooms have the effect of bringing the thermal mass of a room to somewhere between heavyweight and lightweight, whatever the wall construction.

In kitchens and bathrooms with heavy walls, a lot of moisture may be introduced very quickly before these walls have a chance to warm up, so that condensation occurs even though the walls have a reasonable insulation value. Heavy stone or concrete blocks, or steel reinforced concrete would be most vulnerable to this problem. Lightweight plasters or extra plasterboard linings can help surfaces warm up more quickly, and can help avoid condensation if the overall insulation level is high.

In living rooms and bedrooms some thermal mass will slow the fall in temperature after heating is switched off and help prevent dampness accumulating in soft furnishings. This can be a benefit to people with an allergic reaction to dust mites and spores. Whatever the construction, ventilation is needed if condensation is to be avoided.

Heavy wall construction and exposed solid floors can maximise the benefit of solar heat gains, by storing heat for later in the day or evening.

Solar Energy

Passive Solar Design

Using passive design the building traps and stores solar energy for heating without the use of fans or pumps. Improved internal daylighting and the avoidance of overheating are also considered passive design.

With well-insulated homes, windows do not have to be overlarge to benefit from solar gain, and daylighting with high windows or rooflights should be a major consideration for amenity and to save on electric lighting. Smaller windows, with smaller heat losses, can still provide big psychological benefits.

- South facing windows are best, but for solar gain without overheating it is often sufficient to increase south facing window areas slightly and to make north-facing windows smallest.
- Face bigger, higher, rooms and open circulation areas to the south to maximise the penetration of solar gain into the dwelling.
- Although facing within 30 degrees of South is optimal for heat gains, Southeast and Southwest facing windows also benefit from solar gains and will suit morning or evening use.
- Heat reflective or 'low emissivity' glass will help ensure that windows can gain more heat than they lose over the year.
- Plant deciduous not evergreen trees to allow winter sun to reach windows. Outside water features or reflective metal roofs can be used to multiply the strength of sunlight or make it more effective for lighting.
- Upper stories will get the best solar input. Remember that projections and trees may overshadow lower windows and reduce the amount of light and solar heat drastically.
- Daylight and solar performance can be less important for upstairs bedrooms, which may receive enough heat from rooms below.
- An open porch or shelter with a transparent roof can allow solar drying of laundry and reduce condensation risks from clothes drying inside the home.

If larger southerly windows are used, larger rooms, a piped heating system with thermostatic valves in every room, and heavyweight finishes such as tiled floors and block walls can make the most of solar inputs while avoiding overheating. Higher levels of solar overheating and winter cooling from larger windows will be more tolerable in spaces that are not continually inhabited, such as hallways. Conservatories with glass roofs and walls

should not be heated and should be thermally separate from the main building.

Designing for Daylighting

For daylighting, the heads above window openings should be as high up as possible. Light coloured floor finishes, window shelves, or even mirrors, can direct daylight deeper into a plan, cutting the need for electric lighting.

Even a comparatively small skylight will admit a lot of light, but will also contribute more to heat-loss in winter and to summer overheating than a vertical window.

Active Solar Systems

The energy from solar systems can be of considerable benefit for low-income tenants as there is more often someone home to use the energy e.g. Older people prefer higher temperatures, and energy is needed for clothes washing and drying.

Active systems are more used than they were. More solar heat is used if the solar panels are shared between a number of houses. If someone is out another resident can still use the extra hot water from a shared system. To protect against legionella bacteria in the supply, it should be possible to heat the water to about 60 degrees before use. This might be done by having a heating coil from a boiler nearer the top of a large tall storage cylinder, with a solar water heating coil nearer the bottom.

Shared Solar Systems

Systems to provide solar pre-heating for hot water or for ventilation air will be more cost effective if provided for a number of dwellings together, as this provides a more constant demand and lowers average capital costs. A solar panel can provide about half the energy needed for hot water heating.

Active Solar air heating and Air Quality

Dust mite allergens and other chemicals are common in homes, but will be reduced if the home is better ventilated. This can have benefits for health. Using the sun to pre-heat ventilation air in a glazed roofspace or panel, even on overcast days, can enable the air in a home to be changed more often without using fossil fuels to heat it. A glazed roofspace is less sensitive to orientation than a solar water heating panel, and can provide useful output on more days and on overcast days.

Moderated Solar

The use of insulating shutters, blinds, or curtains can maximise the benefits of daytime solar energy while reducing heat loss at night. If warm air from the interior gets between the insulating shutters and the window temporary condensation may occur. Silica gel may absorb enough water to avoid too much condensation in a small, enclosed space.

Placing a sliding or folding insulated shutter in a sealed space between two panes of glass, or outside the glazing, could also avoid this problem.

Sunspaces and Conservatories:

If heated, sunspaces and conservatories with mostly glazed outsides can use as much energy as the rest of the house together, so it is important to include them in designs in a systematic way to avoid heating them through autumn, winter and spring. Windows typically let out ten times as much heat in winter than walls, before taking solar gains into account, although south facing low emissivity windows can get as much heat from solar gains as is lost to the outside.

If it is wished to heat a sunny space, a compromise is to have a room within the house, which has bigger high performance windows and rooflights facing south, rather than wholly glazed roofs and walls. This would be a sunny room rather than a sunspace, and might be inset into a plan, with some insulation between it and the rest of the dwelling if the glazed areas are very large. Insulated window shutters, e.g. Between inner and outer glass panes, and overhanging roofs, can control excess heat gains in summer and excess losses in winter. Rooflights let in much more light than windows, but are also prone to overheating in summer and to chilling in winter. High performance glazing and doors, or new window types that reduce heat loss by pre-heating incoming air, can allow bigger glazing ratios without adding greatly to heat losses.

CO₂ Emissions

Burning fossil fuels produces carbon dioxide gas. This is a major cause of global climate change and CO₂ emissions are likely to be reduced by future governments.

- Electricity generation using fossil fuels results in high CO₂ emissions because all of the heat produced cannot be turned into electricity.
- Heavier denser fuels such as coal and oil contain more carbon and result in more emissions than lighter fuels and gases, which contain more hydrogen.
- Renewable energy comes from converting solar energy and usually results in zero nett CO₂ emissions. Renewable energies include:
 - (i) Firewood from forests which are continually replanted.
 - (ii) Water turbines and wind turbines producing electricity
 - (iii) Electricity from solar photovoltaic panels
 - (iv) Biofuels: Natural products which are converted to heat or gas.
 - (v) Hot water from solar water heating panels

Heating Systems

Wood burning stoves

Wood burning stoves without pipes and radiators provide radiant heat which feels very comfortable, and may be suitable as a backup system in areas subject to power cuts, or as an occasional winter boost to a small main heating system in a small or well insulated home. Stoves have a minimum burning rate so limiting output can be difficult. Wood is a renewable fuel which can be replanted.

Boiler Efficiency

Condensing boilers are more efficient and for gas they do not cost very much more than a conventional boiler. Oil condensing boilers are more expensive, making them suitable to take most of the heating load in larger or communal heating systems, with cheaper oil boilers for occasional backup.

Efficiency figures for common gas and oil boilers are available on the database 'sedbuk.com' on the Internet. High efficiencies can be used to get a good Energy Rating score for a house but insulation levels should not be reduced very much as fuel prices may keep rising and boilers must be replaced sometime.

To show the potential effect on running costs of a new efficient boiler, divide the running cost with the old boiler by the efficiency of the new boiler, then multiply by the efficiency of the old boiler. This gives the reduced running cost.

Heating controls

All heating systems should now be provided with room thermostats, a water thermostat and programmer. Electric storage heaters without enhanced insulation or fans controlled by a room thermostat should be avoided. The new Building Regulations soon to be adopted by the Irish Government will require at least 2 zones in every dwelling.

Advanced controls

Additional automated 'zone' controls can be provided to allow tenants to easily heat one room only, or to heat the bedrooms at different times. These are quite costly. Electronic energy managers are also available to adjust the warm-up period of the heating to allow for the weather, but these are expensive for individual houses. Such controls are better value for a heating system for a bigger complex.

Hot Water

Hot water heating can be half of a home energy bill. 'Fast recovery' hot water storage cylinders are best as they reduce the time a boiler takes to heat the cylinder, saving fuel. Gas 'Combination' boilers make it possible to omit the cylinder and to heat water as it is needed, saving even more. Spray taps, used with a good water head, save water and energy, and can increase the number of outlets served by one boiler.

Community heating networks.

Creating networks of pipe-work serving whole areas makes the future use of biomass powered heating, or generation systems more practical, and can reduce the need for boiler maintenance visits to each home. With social housing the heating loads for each tend to be so small as to make a very advanced heating appliance, such as a ground source heat pump or automated woodchip heat and power plant, too expensive for each house to have one.

Heat from these networks is generally sold to the user using a smart card re-filled by paying at a local shop. Metering like this also stimulates energy saving. Users of 'Pay-as-you go' electricity meters typically save 10%. Volume-based heat meters (euro 100) are typically less expensive than heat differential meters (euro 300.)

If the water temperature is kept down below 95 degrees this enables corrosion-resistant plastic pipes to be used and cuts heat losses. Past systems often failed due to the use of badly installed steel pipes with high water temperatures and high pressures. Nowadays, lower water temperatures enable joint-less lengths of flexible pre-insulated plastic pipes to be used. These are also compatible with solar water heating systems and underfloor heating, which involve lower water temperatures.

Instead of doing an area-wide pipeline network, a smaller shared heating system and pipe network within each block of several homes, may be more economic if using simple boilers.

Heat metering and paying for electricity

If tenants are sold heat instead of fuel, heat can be sourced economically, using a central boiler system servicing numbers of dwellings. Bigger building complexes and district heating can use the waste heat from electricity generation, saving on running costs, and making it easier to change fuels if prices change. e.g. Companies may wish to pipe in waste heat from electricity generation to reduce their liability to climate change levy and fuel taxes, or a well insulated apartment complex could generate its own cheap electricity with a big gas CHP* engine *Combined Heat and Power

WATER CONSERVATION

In time, it is possible that water metering and charging will be introduced. This could have adverse effect on social housing tenants with low incomes, unless steps are taken to reduce the amount of water used for daily needs.

Domestic Water Consumption

- The average person in Ireland consumes approximately 150 to 200 litres of water per day.

Average Household Water Use	
Flushing the toilet	9.5 litres/flush
Taking a bath	80 litres
Taking a shower	5 litres/min
Using a washing machine	80 litres
Using a dishwasher	35 litres
Watering the garden	540 litres/hour
Drinking use	10 litres/day

- High quality, potable water is used in many domestic applications where such quality is inappropriate, such as watering gardens and flushing the toilet.
- The proportion of households owning water-consuming appliances has increased considerably in recent decades.
- The majority of households in Ireland pay water charges based on the rateable value of their home and not on the volume of water consumed.
- In Ireland there is a dependence on lakes and rivers for water needs. An increase in hot weather use could therefore lead to drought vulnerability in areas.

Benefits of Household Water Conservation

- Reduction in average household water consumption
- Conservation of water resources, which are finite.
- Lowering domestic running costs for metered homes.
- Reduction of the demand on both the public water supplies and wastewater treatment facilities.
- Saving in energy and the need for further investment.
- As water travels from source to household to sewage plant, energy is used to pump it, treat it, heat it, pump it back and treat it again.
- If less hot water is used this saves heating energy.

Water-Conserving Fixtures & Appliances

- **Showers** used on average 40 litres of water, (half that needed for a bath)
 - less than 25% of houses have a shower fitted.
- Spray head taps & showers reduce the volume of water supplied by:
 - aeration (adding air to the water)
 - use of smaller water droplets
 - flow restrictors reduce maximum flows in pipes
- Low-flush toilets (3.5 to 6 litres/flush) discharge a reduced water volume at a higher velocity than conventional toilets.
- Short lengths of piping to hot water taps reduces the amount of cold water that is normally run to waste before hot water comes from the hot-water cylinder.
- Permeable landscaping materials (in place of “hard” surfaces) absorb and retain rainwater. This reduces the need to water gardens and minimises run-off sewers.
- Water butts can collect rainwater for garden watering or car washing.
- Composting toilets use no flush water and the end product can be used as a fertiliser. Properly maintained, these can operate well.
- Natural reed beds can be an option for secondary sewage treatment. Sizeable land area however is required.

Rainwater recovery

Rainwater can be stored and used in the home. Communal systems will be more cost effective, especially for toilet flushing where no treatment is required. Until water charging is introduced there will be little incentive for such systems.

Land Development

Sustainable Land Development

Land is a non-renewable resource and should be conserved for agriculture where possible. Building on 'Brown', urban or recycled sites conserves land and generally results in less pollution for air, water, and land compared to building on 'Greenfield' sites.

Building and making roadways pollutes rivers and increases the speed of water run-off, and reduces groundwater levels and quality unless special care is taken. Full water treatment should be available for new housing.

Traffic, children and pets from new 'Greenfield' housing all threaten wildlife.

Grouping developments

Social housing near existing centres gives better access to employment opportunities.

There are smaller numbers of people in each household, and retailing is changing, so that a bigger number of dwellings are needed in any area to keep local facilities viable.

A range of local amenities:

- Allow multi-purpose trips and reduce car use
- Promote local employment and social integration

Mixed-use development makes best use of existing infrastructure and parking.

A balance of house types, incomes, and tenures encourages age mix, long-term residency, and affordable housing choices. To design development to achieve this will need collaboration between social housing developers, planning authorities, and private developers.

Social mixing is best promoted by homes with a similar external appearance being well mixed together in the same street.

Building higher density housing next to public transport routes creates extra passenger revenue for public transport operators so services can be maintained and improved. It is also more economic to provide social services and gas or district heating networks to such developments. Research suggests a density of 100 people per Hectare, or 45/50 dwellings, to sustain public transport and local services. Ref Hillman and Whalley 1983, Newman & Kenworthy 1990. Spread out houses means that energy is

wasted travelling to them, and it becomes difficult to do daily journeys by walking or cycling.

Built Form

Aim to maximise density for a development consistent with its likely future position in a town and the needs of occupants. Good urban design, attention to defensible space issues, and mixed uses makes high densities possible without compromising quality. Use of good architects and planning consultants increases the yield of quality dwellings on any site.

Continuous building frontages of terraces or apartments save land, are more energy efficient and often more economic to build, and can front major pedestrian routes while remaining secure. Continuous building frontages and dense tree planting will shelter developments from wind and traffic noise.

Very tall isolated buildings will bring strong winds down to ground level. Lay dwellings out on more open sites with the roof slopes facing within 30 degrees of south where practicable. This will allow solar water heating panels to be fitted later in the building's life. Ideally the larger windows of larger rooms should face this way, or can be oriented to take advantage of morning or evening sun.

Often it will be better to have a small garden and private rooms facing towards the South. However terraced homes facing east and west still benefit from solar gain and daylighting. Tall windows increase the quality of daylighting, reducing the demand for electricity for lighting.

Local heating networks can reduce the need for individual boilers, fuel tanks, and flues when planning higher density schemes. This can reduce pollution and vandalism risks and creates the opportunity to reduce low cost waste heat from electricity generation, or to use biofuels to provide reliable long term heating prices.

Movement

Transportation is the fastest growing energy use so reducing the need for motorised transport will cut energy use and pollution. Cars do not provide mobility for children, most of the elderly and infirm. Clustering development near public transport provides the opportunity to do essential journeys for the majority of social housing tenants who do not own a car. E.g. by building more houses within 500M of bus stops.

Personal access can be enhanced by the provision of paths used by both pedestrians and cycles. The health of occupants of social housing is poor partly due to poor diet and lack of exercise. A lack of social status is also a contributor to ill health. Walking is socially inclusive and increases health and public safety. To encourage personal movement:

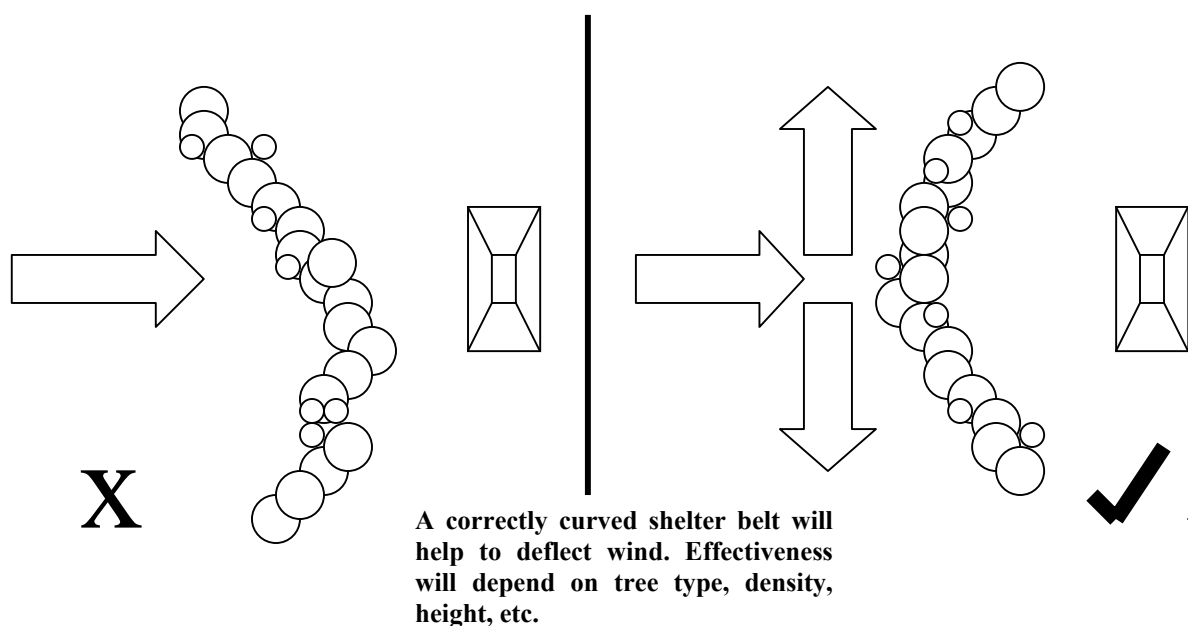
- Privilege cyclists and walkers, with special routes away from roads and short cuts.
- Avoid steep slopes, to suit prams, the elderly etc.
- Provide traffic calming measures, to discourage joy riding and general high speed driving and help residents feel safe walking.
- Provide directional signage and lighting, and overlooking where possible. This ensures the walkways are secure and safe and so will encourage their use.
- Provide continuous routes (fragmented routes cause danger).
- Shield from traffic exhaust noise and tyre spray with steps in level or screening.

Site Planning for Enhanced Microclimate

Every 100M of height makes a site cooler by 0.6 degrees centigrade. Often existing plants on a site will indicate how exposed it is. Local planting and land forming can be used to shelter homes, enhancing their microclimate. Trees can be planted early if the site owner gives permission, without the need for a planning application. Small trees are inexpensive and become well established and robust quite quickly. Woodlands reduce windspeed, noise, reduce temperature extremes, and improve air quality by removing small particles and other pollutants.

Planting a mixture of deciduous and evergreen trees provides shelter, and the evergreens can be cut down later before they grow to overshadow homes in winter. Plant a lot of trees, as some will die and extra ones can easily be removed later and used for firewood, a renewable fuel. For urban and semi-urban areas, trees, bushes, fencing, walling, level changes and continuous frontages can provide privacy and shelter. Leaving open space or areas including car parking as fewer, larger areas makes planting large native trees an option, and can allow more flexibility for building options later.

Natural habitats should be retained and enhanced to support the maximum variety of living things. Wildlife corridors can allow wild creatures to move near houses. Large trees can support many insects and birds. Wood can also be harvested for building, or for burning as bio-fuel, from time to time. Organisations like the National or Woodland Trusts may agree to manage woodland donated to them. Closer to homes, deciduous trees are preferable, as they shed their leaves and allow light from the low winter sun to reach windows. Evergreens are more suitable to screen roads beside developments and to cut noise and wind.



Remember.....

A low energy sustainable house must be designed so that the orientation, layout, insulation, heating and ventilation system work together. With adequate temperatures and ventilation levels, an integrated design maximises cost-effectiveness in construction and minimises fuel costs.

Within each of these areas the integrated approach should also be applied.

Layout: To maximise passive solar gain the dwellings should be planned internally so that main living rooms are on the south side of the dwelling and service rooms to the north.

Insulation: Should be distributed around all exposed elements of the house to minimise overall heat loss, and ensure there are no parts significantly colder than others. For example a single glazed window in an otherwise well insulated house is likely to result in local condensation.

Heating Systems: must be correctly sized for the actual heat loss from the house (with warm up allowances). Oversizing is likely to waste energy. Undersizing will lead to sub-standard temperatures. Heating controls must be able to respond to incidental and solar gains and to provide adequate heating in all parts of the house.

Ventilation: should be through intentional openings, which can be controlled by the occupant (such as trickle ventilation and extract fans) and not through unintentional ventilation paths (such as leaks around openings for service pipes and cables). In a well-sealed house, ventilation openings and systems must be designed to provide adequate air change rates.

Orientation: At the initial stages, where possible, dwellings should be positioned to take maximum advantage of solar gains and any existing protection from the wind.

This booklet was produced as a result of an EU Co-Funded Energy Project from the Altener II programme of the European Commission the Project partners would like to thank the European Commission for their support of this project, they would also like to thank all of the contributors to the project.