• USE OF INSULATION

Insulating a house includes:

- Ensuring the gaps between frames, windows and doors are tightly sealed, thus minimising the loss of warm air to colder outside air temperatures during the winter periods.
- The appropriate use of insulation materials under the floors, and in the walls and the roof, so as to enhance the potential of the house's envelope, thereby optimising comfort conditions and reducing the need for heating energy during the winter periods, in particular.
- In the case of Clay Brick walls, the extent of the R-value (resistance) of the insulation material required will depend on the climatic zone. In climates, such as Durban, for example, insulation in the walls has been found by thermal modelling to be an unnecessary cost.

Conversely, in climates like Johannesburg where the diurnal temperature swings are more pronounced, insulation in the cavity adds value by helping to achieve optimal comfort conditions.

Incorporating thermal mass in the walls is the key to optimising the value of Passive Solar Design, by providing the "energy efficiency edge" over lightweight walling systems that demonstrate no capacity to self regulate.

Lastly, using plants and vegetation for screening helps protect the house from the cold winter winds – particularly important in high exposure typography.

> "The application of sound passive solar design principles with thermal mass in the floor slab and walls provides the potential to virtually eliminate the need for artificial heating and cooling other than for short periods of extreme weather that occur during a year".
>
> David Baggs, Technical Director, Ecospecifier Australia

With clay bricks widely available throughout South Africa, there is no good reason to compromise on achieving optimised Thermal Comfort ~ for good.

REFERENCES

Research Studies that validate the critical role clay bricks have to play in facilitating optimal thermal comfort and lowest energy usage for heating and cooling of houses in South Africa include:

- WSP Energy Africa - CR Product Study
- WSP Green by Design – Modelling studies of 'The Thermal Performance of Walling Envelopes' for 40m² and 130m² house types using Design Builder and Energy Plus Software.
- Structatherm Projects - Thermal modelling of a 132m² CSR house using Visual DOE.
- Empirical research - "A study of the influence of the wall R-value on the thermal characteristics of Australian housing - University of Newcastle Priority Research Centre for Energy (in conjunction with the Australian Research Council and Think Brick Australia)
- The Parametric Study – "The potential for increasing thermal comfort through selection of construction types in Brisbane" - Queenstown University of Technology in Brisbane
- The Full Life Cycle Assessment (of 2 house types in 3 climatic zones and 4 different orientations using 5 walling types) by Energetics, for www.thinkbrick.com.au

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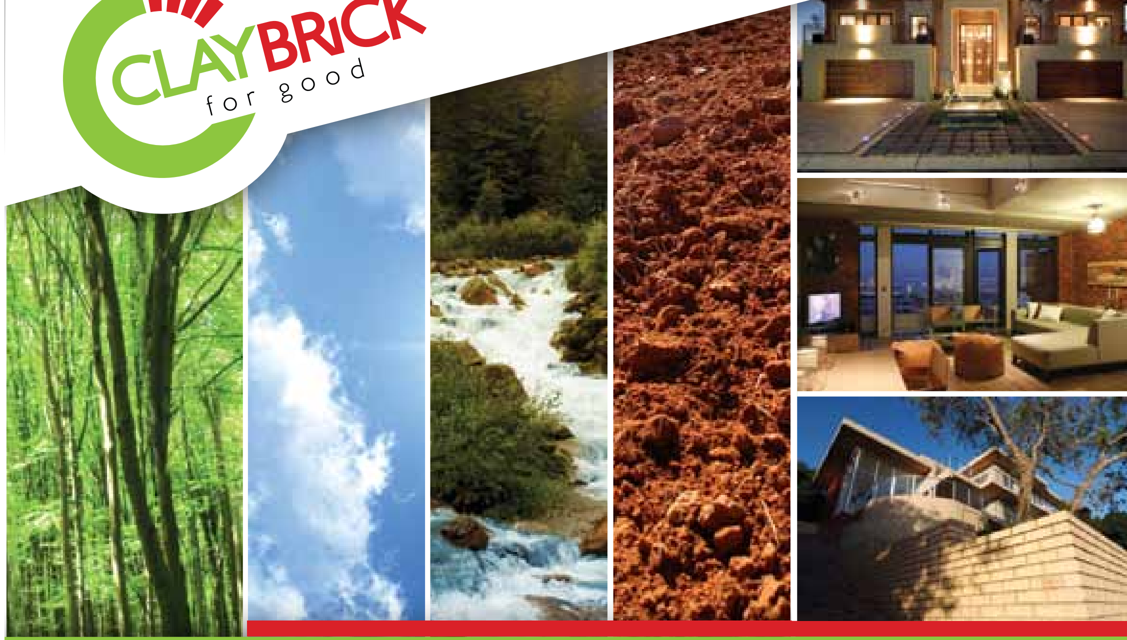

ACHIEVING OPTIMAL THERMAL COMFORT

To achieve optimal thermal comfort without mechanical heating and cooling, thereby creating an energy efficient home begins with understanding the local climatic conditions in which the house is to reside and the fundamentals of how your choice of building materials will perform.

THERMAL MASS IMPROVES ENERGY EFFICIENCY - FOR GOOD

Substantive comparative research into the contribution of different walling materials to the thermal performance of a house has defined the "necessity" of having thermal mass, as provided by Clay Bricks in the building envelope, to achieve "optimal" thermal efficiency.

Thermal Mass provides walls with an ability to slowly absorb and store heat, and then release the heat back into the cooler night air. This function is particularly important for climates like South Africa, which are characterised by well defined diurnal temperature swings across its climatic zones, and long hot summer days.

Thermal mass functions together with resistance (resistance as provided by the brick itself, the air cavity between the two brick skins and a combination of the above incorporated with insulation within the air cavity), to achieve optimal thermal comfort with less need for artificial heating and cooling, and by extension a more energy efficient home.

Thermal Modelling and empirical research proves that for South African climates, insulated lightweight walling envelopes associated with frame type building, such as Light Steel Frame Building [LSFB] and timber frame construction lack the requisite thermal capacity to perform as competently, or as comparably as Clay Brick wall alternates in moderating internal temperatures and achieving optimal thermal comfort conditions.

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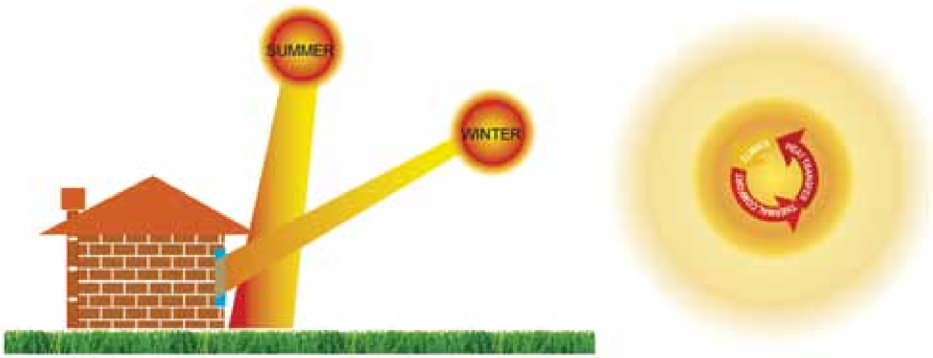
PASSIVE SOLAR DESIGN MAXIMISES ENERGY EFFICIENCY - FOR GOOD

In South Africa, good energy conscious design begins with the employment of Passive Solar Design techniques - often described as "designing with nature in mind" – an investment in the world we live in, if you will.



Primer for Energy Conscious Design - Dieter Holm & Reinold Viljoen 1996

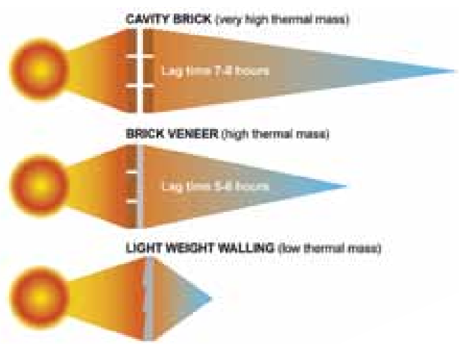
Four Pillars of Passive Solar Design:

- **ORIENTATION TO THE SUN**

Notably in the Southern Hemisphere, a north facing orientation is best for using the sun's energy effectively to reduce the cost of energy for heating.

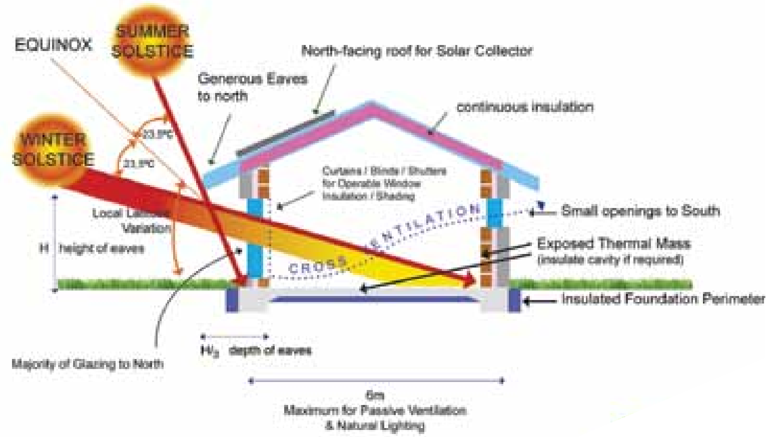
In winter, the sun should be able to enter the house and be stored in the internal thermal mass, and then released back into the internal spaces during the night to counter the inroads of the cold night air.

In summer, the external thermal mass provides "thermal lag" to slow the transfer of heat through the walling envelope, preventing the hotbox effect associated with lightweight walling envelopes.



Research highlights that lightweight walls demonstrate an inability to create the important time lag between the peak solar radiation falling on the exterior of the wall and a resultant peak indoor temperature occurring at roughly the same time (hot) time of the day. The net effect is that the heat is then trapped inside the building by the insulation, resulting in "hotbox" conditions.

North facing living areas will allow winter sun energy to be absorbed by the thermal mass inside the house, as provided by double Clay Brick walls and/or concrete floors, and be stored and then released during cold nights, thereby providing **free heating** for the house while reducing energy consumption.



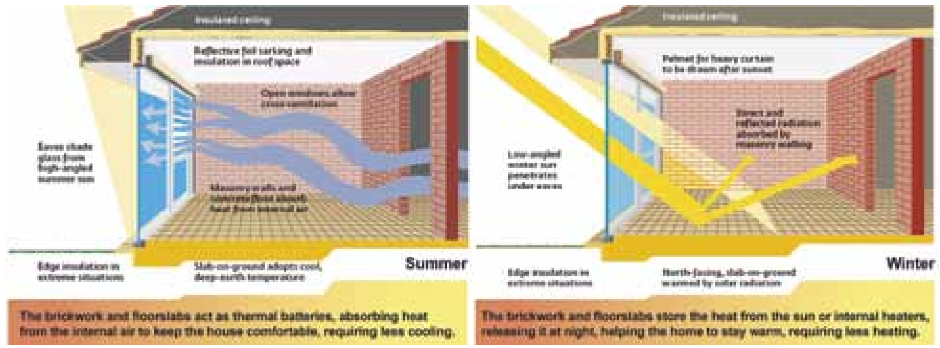
- **SHADING AND SCREENING**

Shading is important to limit the time the sun's rays are able to enter the house, particularly on hot summer days. The sun's path changes between summer and winter.

Shading via the eaves of the house should be provided to restrict heat radiating onto the walls, while the shading of window openings should limit radiant heat from entering the house during the summer months.

The house should be designed to allow the lower angled winter sun's rays to radiate into the house and be absorbed by the thermal mass inside the home.

Typically, good shading is needed to the north-east and west windows for longer periods of the year, with north-facing shading essentially being required only for the summer months.



- **CORRECT VENTILATION**

Considerations of wind direction and using the wind to enhance comfort makes sense. By placing windows to capture the prevailing breezes that provide for cross ventilation, and therefore circulation of air throughout the house in summer, will produce target thermal comfort conditions for longer.