

## Experience in the Development and Promotion of Passive Solar Energy Efficient Houses

By

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### INTRODUCTION

In recent times, weather related events such as the 1983 Ash Wednesday Bushfires and the 1974 destruction of Darwin by Cyclone Tracey, have highlighted the fact that for many Australians our climates can at times be anything but blissful. While Australia may enjoy a reputation overseas as a sunny holiday haven, experience shows that it is often hot, humid, dusty, windy, cold or wet in turn and, in places like Melbourne, these phenomena may reputedly occur in the space of a single day.

It is therefore a curiosity that contemporary Australian houses still echo design and building traditions that were brought here by predominantly European settlers over the last two hundred years. Most Australian homes do not address the problems of local climate. Building regulations have ensured a high standard of structural soundness and safety. Affluence has enabled our homes to be large in comparison to European countries, but little has occurred to encourage designers or builders to solve the question of climate and thermal comfort. The result is that dwellings now consume more than 14% of all energy used in the community and the demand for energy per head of population is increasing. The demand for ever higher standards of living are revealing the inadequacy of our housing stock and current building practices; in particular it has caused an alarming growth in the use of air conditioning. In many States, peak electricity demand now occurs in the summer. The growth in energy demand, and the exceptionally high peak requirements have obliged Governments to intervene before major supply problems occur. The choice lay between providing greater energy generating capacity, modifying design and construction patterns of houses, or achieving different consumer behaviour.

At the time of writing, Governments in Australia have not taken a mandatory approach to solving these energy demand problems. Education and promotion has been viewed as less obtrusive than legislation, and improving design and construction standards as more cost effective and environmentally satisfactory than increasing energy usage.

In the last decade in particular, the Commonwealth and State Governments have sponsored research into adapting houses to suit local climates. A considerable bank of knowledge has thus been collected by many scientific bodies, universities, pioneering builders and designers. To a large extent, however, these various endeavours have been undertaken with minimal resources and without substantive coordination. It was observed that the advances being made in an understanding of technical solutions to design problems, was nowhere being matched by adoption of the solutions by the housing industry. Today, technology transfer has become the central issue.

There is little to be gained in furthering research into the thermal behaviour of buildings while the existing, substantial bank of technical information lies unused on library shelves. A cursory glance at this information, however, reveals that most of it is not in a form that is useful to those who influence the shape of our homes most.

#### Formation of the GMI Council of Australia

The GMI Council (GMI stands for Glass, Mass and Insulation) was formed as an independent non-profit making body with the objective of promoting the construction of energy-efficient houses through a process of education primarily aimed at builders.

To do this, the GMI Council set out to establish a consultative structure in which organisations and individuals with a wide range of backgrounds relating to housing and energy usage could be involved. This approach would enable the Council to gain a high quality of intellectual input, to draw upon a vast range of experience in areas as diverse as thermo dynamics and marketing and to facilitate a coordinated program to promote change.

The inspiration for this approach came from The Brick Development Research Institute at Melbourne University. This organisation has had many years of experience in promoting the intelligent use of its sponsors product - clay bricks - by a process of education. BDRI has taken an interest in Passive Solar design because of the ability of masonry walls to provide the thermal mass needed in the Passive Solar Process. It realized however, that it would have little chance of promoting the adoption of passive solar design if it worked independently in this area. BDRI was also sufficiently impressed by the overwhelming influence of the builder upon the design and construction of the majority of houses to identify the builder as the prime target for an education program to promote passive solar design principles. BDRI therefore devoted considerable time and resources to conceiving and organizing the GMI Builder-Education Program. It took considerable foresight and courage by the BDRI Council, particularly the President at that time and the Director, to allocate precious resources to a project of long-term significance when there were so many pressing and immediate tasks to hand. The sponsors of the BDRI should no doubt have cause to be pleased with the priority that was given to the formation of GMI when the Program begins to have influence on building practise in a way that is favourable to the use of masonry walls.



The process of planning the GMI Council and raising the sponsorship, from its various sources in Government and Industry, took twelve months. Eventually it was decided to concentrate upon the temperate climatic regions of Australia which include Sydney, Melbourne, Adelaide, Canberra and Hobart. Western Australia and Queensland were not included because of the difficulty of establishing an operation over such distances.

The GMI Council was established with Melbourne as its base in April 1983. Its formation was announced at the Australian Clay Brick Association annual conference in Adelaide when the South Australian Minister for Mines and Energy Mr. Ron Payne presented the first Government contribution to funds and Mr. Digby Hughes was appointed Executive Director. Over time, the project has won the support of the Commonwealth, four State Governments and seven industry associations. It has a full time staff of only five persons and depends for its effectiveness upon its ability to engender a spirit of cooperation and determination to succeed with a venture that will be of benefit to each sponsor as well as the housing industry and the Australian community as a whole.

This feature characterizes the GMI program. It is based upon enlightened self interest and it has been assumed throughout, that none of the parties affected will respond positively unless the benefits of the program to them are explained and clear course of action is revealed.

The task facing the GMI council is enormous and there is much to be done before it can be said to have been successful, but since its formation the Council has;

- . Formed a cohesive, broadly based Consultative Committee, with a commitment to plan technology transfer activities related to the energy-efficiency of houses in South Australia, Victoria, NSW and Tasmania.
- . Prepared a state of the art information-base on energy related factors of house designs for all major forms of house construction, related to actual climatic data in Adelaide, Sydney, Wagga/Canberra, Melbourne and Hobart. These cities represent more than 50 per cent of Australia's population.
- . Devised a method of test for, and proved several safe methods of, insulating external masonry walls.
- . Developed a unique method of determining graphically, the all year energy performance of houses - the Ballinger Heating Load - Heat Discomfort Graph - see attached Technical Background paper.
- . Developed the "Five Star Design Rating" (FSDR) which is both a technology-transfer mechanism and powerful marketing tool for energy-efficient houses.

- Arranged for State Government Bodies in NSW, Victoria and South Australia to act as Agents for the FSDR.
- Arranged for the endorsement of the Five Star Design Rating by the CSIRO and the Prime Minister of Australia, Mr. Hawke, who announced the forthcoming launch of the FSDR in early 1985.
- Prepared the first segments of a Design and Construction Manual and a number of audio visual lecture packages to promote and explain energy efficient house construction.
- Commenced a major educational program aimed primarily at house builders and designers.
- Negotiated the involvement of a number of major and medium size builders in the marketing of FSDR houses in Victoria, NSW and South Australia commencing February, 1985.

#### Structure of the GMI Council.

The formation of the GMI Council was made possible by a grant awarded by the National Energy Research Development and Demonstration Council. The grant was for approximately one third of the funds involved to employ staff, conduct research and education programs, and to develop the associated educational aids. The other funds are from State Governments and private industry sources.

The structure of the GMI Council has three elements.

The first is the Board of Directors or Executive Committee.

The Executive Committee is responsible for the implementation of the program.

It is comprised of representatives of the sponsoring organisations and has overall responsibility for policies, objectives and implementation. It has financial responsibility for the company, establishes salaries and conditions of employment, determines manpower requirements, allocates funds to the various working programs, approves publications and reports to the sponsoring organisations.

The second element is the Consultative Committee.

The Consultative Committee is responsible for developing and coordinating the work program within the policy guidelines established by the Executive Committee. It is comprised of representatives of the building and allied industries and from scientific and government sources.

The Committee's role is to recommend activities and levels of funding, evaluate all technical reports and to monitor the execution of the work programs.



The Consultative Committee has four Advisory Groups that evaluate technical and attitudinal information and propose and participate in the preparation of research work, reports and publications. The Advisory Groups also provide guidance to the Executive Director in the execution of approved activities.

The Advisory Groups, their Chairmen and areas of responsibility are as follows:

#### Advisory Group One

Responsibility: Computer Simulations

Chairman & Convenor: Assoc. Prof. John Ballinger (SOLARCH)

Advisory Group One was responsible for guiding the computer simulation studies of the energy efficiency of houses being undertaken by CSIRO Division of Building Research.

The Group had the task of ensuring that enough data was generated to enable the preparation of a comprehensive guide to the design of low-energy houses. Particular emphasis was given to the relationship of the energy-efficiency and comfort levels of domestic dwellings to changes in the building envelope.

#### Advisory Group Two

Responsibility: Building Technology

Chairman & Convenor: Mr. Digby Forbes (Master Builders'  
Federation of Australia)

Advisory Group Two had the vital role of ensuring that the energy-efficient building concepts that were highlighted by the work of Group One, were both practicable and cost-effective. It has examined practices and procedures with particular regard to wall and floor construction and the use of insulating materials in external walls.

Group Two had the responsibility for designing a physical testing program on wall insulation materials being carried out by CSIRO Division of Building Research.

#### Advisory Group Three:

Responsibility: Market Attitude Research

Chairman & Convenor: Dr. F.A. Blakey (Chief of the CSIRO-DBR)

This group has been responsible for evaluating builder and consumer attitudes to low-energy housing and thereby identifying appropriate areas and types of activity for the GMI program.

#### Advisory Group Four:

Responsibility: Technology Transfer

Chairman: Assoc. Prof. John Ballinger (SOLARCH)

The purpose of Advisory Group Four is to facilitate technology transfer to house builders. Its prime purpose has been to develop a design and construction manual. It also has the responsibility of ensuring that adequate resource material can be transferred to permanent bodies so that the education process can continue after the expiration of the GMI program.

The third element is the staff.

The Council employs a small full-time staff that is based in Melbourne. They are:

Mr. Digby Hughes -	Executive Director
Mrs. Elizabeth Hauer -	Research Officer
Mr. David Zerman -	Communications Officer
Mr. Robert Hodson -	Technical Field Officer
	Secretary

Mr. Hughes has been associated with the GMI program from its original conception in 1982.

#### Activities

The building industry was selected as the focus for activities because it was felt that the proliferation of energy-efficient houses would be dependent upon the attitudes and expertise of builders. The proposal was therefore based upon the need to give commercial viability to this form of construction, to identify what the 'product' in question is and what its advantages are to the parties it concerns. The scope of the work was limited to house design and construction.

The first task was seen to be the creation of a 'product' with its own identity, by the preparation of a design manual. This product is the Five Star Home. The second task was to create awareness of, and interest in, the message involved and the final task was to provide technical and commercial back-up to builders prepared to market energy-efficient houses.

#### The Five Star Design Rating

The Five Star Design Rating is an award for excellence in house design. The design principles of a Five Star home are elegantly simple. The three basics are glass, mass and insulation (GMI). It is how these three basics are utilized that determines the comfort, value and energy-efficiency of the home.

This means that all the common types of construction can achieve the Five Star Design Rating. The importance of each of the GMI elements varies from place to place. What is crucial to energy-efficiency and comfort is that a proper balance of Glass Mass and Insulation is achieved according to the characteristics of the local climate.

GLASS: Windows should be sized and situated to optimize solar energy and light collection and to avoid unwanted heat loss or gain.

MASS: The appropriate use of heavy building elements such as masonry walls and concrete floors plays an important role in helping to maintain pleasant air temperatures in all seasons.

INSULATION: Correct use of insulation reduces unwanted heat flows all year round.

The Five Star Design Rating also takes into account the overall house design including shape, internal layout and, very importantly, local climatic conditions.

The GMI Council gives advice to designers and builders to ensure that they have the technical information necessary to design and build with confidence to make the best use of our climate and energy resources.

For the home buyer, the Five Star Design Rating means that the designers creative expression of the technical principles have been individually assessed. This enables easy identification of houses that can give the required standards of comfort, value and efficiency.

The principal benefits of energy-efficient homes identified by the Five Star Design Rating is being promoted to consumers in the following terms :

- |         |  |
|---------|--|
| COMFORT | <ul style="list-style-type: none"><li>* pleasant temperatures in all seasons</li><li>* bright, naturally well lit rooms</li><li>* privacy from noise intrusion between zones</li></ul>                 |
| QUALITY | <ul style="list-style-type: none"><li>* harmony between your home and the environment</li><li>* zoned floor plans to suit today's lifestyle</li><li>* your future standard of living secured</li></ul> |



VALUE       \* comfort without expensive appliances  
              \* reduced running costs  
              \* increasing resale value as energy costs rise

EFFICIENCY\* more comfort for your energy dollar  
              \* natural climate control  
              \* responsible use of energy resources

LOW-MAINTENANCE  
              \* life long comfort and efficiency of design  
              \* fewer appliances to maintain and repair  
              \* more freedom to enjoy your leisure time

The Five Star Design Rating(FSDR) works in the following way :

House Plan Appraisals. House designs can be appraised at the drawing board stage and be given a Plan Appraisal. This means that Five Star Homes can be built to order as well as on a project home basis.

Five Star Rating. Only houses that have been built can be given a Full Five Star Design Rating. Inspections of individual houses will be carried out by the Appraisal Agent to ensure that they meet the standards set in the Five Star Rating.

The Five Star Design Rating will only be issued by an approved Appraisal Agent. The Appraisal Agents will also give advice about house building and buying and about the selection of general appliances.

#### Activities of the GMI Council.

GMI Activities can be divided broadly into four areas:

- (i) Technical Information Base  
GMI has worked closely with CSIRO and others to prepare a technical information base that can be used as the basis of its recommendations to builders and designers to improve the energy-efficiency of houses. This information is being progressively turned into the GMI Design and Construction Manual for Energy-Efficient Houses on a subject by subject basis. The technical data basis has also been used in the development of the Five Star Design Rating.
- (ii) Design Advisory Services  
GMI has been giving advice to individual builders and designers since July 1984 and has recently completed a series of seminars and workshops in four states aimed at three interest groups;
  - . builders and designers,
  - . government departments, educational and advisory bodies, and,
  - . building material manufacturers.



The seminars and workshops are designed to achieve three main objectives:

(a) The transfer of information to builders and designers and the stimulation of interest in the commercial possibilities of energy-efficient houses.

(b) The development of additional avenues of information dissemination.

(c) The pilot testing of the GMI Manual and the appraisal procedure for the FSDR. The ideas gained through workshops will be incorporated in the final versions of the Manual to be released to the general building community in February 1985.

(iii) Five Star Design Rating

GMI will liaise between builders/designers and the Five Star Appraisal Agents. GMI are the owners of the FSDR, the logo and the rights to the licensing thereof. Funds raised by licensing of the logo will be used in promotional activities.

(iv) Promotions and Advertising.

GMI is assisting builders in the marketing and promotions of energy-efficient houses. Assistance is in the form of advice on marketing, the preparation of literature and press releases and will involve cooperative demonstration programs with builders in 1985.

GMI is also seeking to license the use of the Five Star Design Rating logo by building material manufacturers and major builders. The logo will be employed in this regard in a manner similar to the "Wool Mark" -as a symbol of quality with which it is commercially desirable to be associated. The revenue from such licensing agreements will be used to promote the FSDR by advertising. At the time of the launch, by the Prime Minister, of the FSDR, GMI placed full page advertisements in all the major newspapers and received a most encouraging response from interested builders and potential home buyers. GMI will also seek to increase its involvement with the electronic media and specialized and general press through the insertion of unpaid editorial material.

The GMI program is now set for a heavy workload in 1985 and 1986 to consolidate its achievements and to achieve acceptance of the concept of the FSDR energy-efficient home by the housing industry.

Our immediate objectives are:

- (i) Revise and complete The GMI Design and Construction Manual. This will be comprised of the following sections :

SECTION	CONTENT
One	<u>Design Basics</u>
Two	<u>Recommended Specifications</u> Melbourne/Sydney/Adelaide/Wagga Hobart/Canberra
Three	<u>Construction Details</u> (a) Glass (b) Mass (c) Insulation
Four	<u>Appliances</u>
Five	<u>Five Star Home Owners Guide</u>
Six	<u>Five Star Marketing &amp; Sales</u> <u>Guide</u>
Seven	<u>Detailed Analysis of Energy-</u> <u>efficient Houses</u>
Eight	<u>Five Star Appraisal Guide</u>
Nine	<u>Consumer Literature</u> (a) Appraisal Agents (b) Five Star Homes
Ten	<u>Water Permeance of Insulated</u> <u>Masonry Walls</u> (a) Report on CSIRO Testing Program (b) Building Surveyors Guide

- (ii) Complete pre-launch training program for sponsors and builders  
 (iii) Sell Five Star concept to key builders.  
 (iv) Organise major cooperative demonstration programs with builders in four states.  
 (v) Organise industry sponsored advertising campaign for Five Star Design Rating.  
 (vi) Develop Five Star Design Rating Appraisal System to cover other house types and locations and to give more accurate assessment of second order influences (eg orientation etc.).

### Conclusion.

The establishment of the GMI Council and the development of the Five Star Design Rating could not have been possible, in such a remarkably short space of time, without a high degree of cooperation between government, science, the housing industry and the CSIRO Division of Building. This process built upon years of research paid for by the Government.

Through the forum of the GMI Council, these organizations have achieved, together, a simple device that will enable advanced Australian technology to assume a valuable place in the everyday world.