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PASSIVE SOLAR DESIGN IN BOTSWANA:

A CONSULTANCY REPORT

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PREFACE

The Botswana Renewable Energy Technology (BRET) project (number 633-0209) is jointly funded by the Government of Botswana (GOB) and the U.S. Agency for International Development (USAID). Technical assistance and project management are being provided by Associates in Rural Development, Inc. (ARD) of Burlington, Vermont, under AID contract number 633-0209-C-00-1024-00.

I. INTRODUCTION

This report summarizes the work carried out in Botswana by David Norris, an architect, and Blair Hamilton, a passive solar design specialist, both of whom are part of the ARD architectural team. This solar design instruction and technical assistance, performed between February 13 and March 13, 1984, is part of an ongoing effort by ARD and the BRET project to develop and disseminate ideas, information and designs for improved housing in Botswana. The scope of work undertaken by Mr. Norris and Mr. Hamilton is given below.

1. Contribute to the data analysis of Gaborone solar and control house monitoring.

2. Advise on the construction of the solar office building (not in original scope of work).

3. Help develop dissemination strategies for solar designs in various sectors of Batswana society.

4. In the United States, review, select and prepare background materials for a seminar on passive solar design for Botswana.

5. As seminar leaders, conduct a two-week design seminar with architects, building policymakers and contractors.

6. Prepare a solar design workbook for Botswana.

II. PASSIVE SOLAR DESIGN SEMINAR

A seminar which examined in detail the energy-conserving aspects of building design was held from February 27 through March 9, 1984. The purpose of the seminar was to introduce architectural designers to the concepts and practical application of energy conservation and passive solar heating and cooling as they apply to the climate, architecture and building technology of Botswana.

Mr. David Norris was the architect and team leader for the ARD team which organized and presented the seminar. Other team members were Mr. Blair Hamilton, the solar design specialist, and Ms. Beth Sachs, who prepared much of the visual and written materials presented during the seminar.

Preparation for the seminar began in the United States two months before its presentation. Mssrs. Norris and Hamilton worked with ARD's president and solar engineer, Dr. George Burrill and Mr. Richard McGowan, to define the appropriate content for the seminar and develop a preliminary outline and schedule. Extensive literature searches were conducted to identify and acquire relevant resource materials. Several simplified calculation techniques were developed. Ms. Sachs prepared illustrations for the workbook and slides for the presentations. Mr. Hamilton used the CALPAS3 computer simulation model to perform a large number of thermal analyses of various building energy options. This required the synthesis of an artificial hourly weather file for Botswana, as no such data are presently available. The results, as reported in the seminar workbook, permitted the quantitative evaluation and ranking of 10 different strategies for improving the thermal performance of buildings in Botswana.

The seminar in Gaborone was divided into two parts. The first was directed at technical officers from government and municipal agencies responsible for the design and construction of self-help housing, District Council housing and small institutional buildings. The second seminar was more advanced, being directed at design professionals in both government and the private sector who are responsible for both housing and larger-scale institutional and office buildings. The first seminar required seven days of instruction while the second required three. Almost all of the participants from the first seminar voluntarily stayed on for the second. Participants in the first seminar included representatives from the Self-Help Housing Authority (SHHA) and the Ministry of Local Government and Lands (MLGL). In the second seminar, representatives of the Botswana Housing Corporation (BHC), Botswana Technology Center (BTC), Office of the Chief Architect, and private sector were added to those already mentioned. Members of the BRET project staff attended both sessions. For a list of participants, see Appendix A.

Each seminar dedicated four hours every morning to classroom instruction and two hours every afternoon to practical exercises and site visits. The general outline of the course followed the traditional steps of the design process (see Appendix B) and suggested where and how energy concerns entered into the design of a building.

Classroom instruction combined lectures with slide presentations and/or demonstrations. At the beginning of each session, the appropriate chapter of the seminar workbook (further described below) was distributed to the participants. This relieved them of the need to take notes and provided a future reference source for the material presented. Time was allocated at the conclusion of each two-hour general session for questions. The class then broke up into groups for further discussion of the lecture. The small groups provided a forum in which those less inclined to speak up in public could ask questions.

Both seminars included practical exercises requiring the participants to apply their newly acquired energy knowledge to the realities of everyday architectural practice. In the seven-day seminar, each group was responsible for the design of a house, clinic, or village technology center incorporating energy conservation and passive solar principles. The designs were drawn up and presented to the whole group on the final day of the seminar. In the professional seminar, participants were requested to analyze the energy concerns of both a house and a modular office building, and recommend a series of energy-conservation measures based on cost effectiveness. The practical exercises were very popular with both groups.

Instruction was about equally divided between Mr. Norris' focus on architectural concerns and that of Mr. Hamilton on energy analysis and engineering issues. The use of the computer simulations generated by Mr. Hamilton and the site visits led by Mr. Norris were particularly valuable learning tools. In addition to the designated instructors, the team invited Gus Neilson of Sanitas Inc. to discuss the use of vegetation in the shading of buildings; Dr. Carl Zietlow, ARD project coordinator for the BRET project, to review the techniques of home water conservation; and Neville Wilkinson of the BTC to outline the water conservation techniques of the BTC/BRET office building. An evaluation of both the technical officer and professional seminars was undertaken by Ms. Judith Oki, ARD field supervisor for the BRET project.

III. PASSIVE SOLAR DESIGN WORKBOOK

The major purpose of the Passive Solar Design Workbook was to provide the passive solar design seminar participants with a permanent record of the proceedings. This could serve in the future to assist them in the design of energy-efficient buildings. The workbook, as already mentioned, follows closely the steps in the design process and includes most of the graphs and graphics presented during the lectures (see Appendix C). There are, in fact, two workbooks: one developed for the technical officers, and the other--similar in most respects, but adapted to a more technically sophisticated audience--for the professionals.

While part of the workbook contains general reference material on passive solar and enegy conservation design concepts and calculations, much of the material was developed by Mssrs. Hamilton and Norris specifically in the context of building in Botswana. The finished workbook is quite comprehensive and very useful to anyone concerned with building design and construction. Numerous requests for additional copies have already been received by the BRET project and ARD.

IV. FINDINGS AND RECOMMENDATIONS ON BRET SOLAR BUILDINGS

Upon arrival in Botswana, Mr. Norris attended a meeting of the Solar Reference Group, a group of representatives from the various government and parastatal organizations who the BRET project coordinator thought might wish to review the scope of work for the consultancy and request assistance. The meeting was attended by representatives from the Ministry of Mineral Resources and Water Affairs, the BHC, BTC, USAID and the BRET project. The scope of work was discussed and clarified, and meetings were set up with interested agencies.

A. The BRET Passive Solar House

Since the completion of construction last year, the BRET passive solar house has been monitored continuously using a microprocessor data acquisition system. A preliminary summary of monitoring results from this house was prepared by the BRET project in 1983. It indicated that the house achieved very comfortable indoor conditions without requiring significant purchased energy for environmental control. In order to quantify these benefits and provide a basis for economic analysis, the original performance evaluation plan called for parallel monitoring of a reference non-solar house. At the time that Mssrs. Hamilton and Norris arrived in Botswana, seven months of data had been collected on the solar house. However, data collection from the reference house had not yet begun, due to instrumentation problems. The consultants' efforts thus focused on initiating the data collection process.

While the sensor network and power supply of the reference house had been installed for some time, there were internal hardware problems with the data logger. BRET staff had been unable to diagnose the source of the problems. Mr. Hamilton inspected the monitoring equipment installation in the control house and identified several hardware problems in the data logger, some of which were easily remedied. However, after this was done, it became apparent that prior damage to the data logger had occurred, either during installation or when it had been operating in the solar house. Due to insufficient time remaining during his visit to complete repairs, Mr. Hamilton left instructions with BRET staff for further repair of the data logger. While the BRET staff had, for the most part, done an admirable job of installing this data acquisition system, Mr. Hamilton noted that there were some aspects of system operation and maintenance with which the present staff did not appear to be adequately familiar. This appears to be related to the fact that responsibility for this equipment had been primarily with a Peace Corps volunteer who is no longer with the project. Others, who remain on the BRET staff, were also trained in operation of the equipment, but they would obviously profit from further training and assistance.

In a related activity, Mr. Hamilton reviewed the suggested software programming which had been developed by BRET staff for monitoring the reference house. He then worked with M. Masire of the BRET project to do a major rewrite of this software. Again, the shortage of time and equipment breakdown prevented testing of this software, but ARD personnel will continue to work with BRET staff to finalize its implementation.

In discussions between Mr. Hamilton and BRET staff, a need was identified for a more detailed procedural outline for the comparison of performance between the solar and reference houses. For example, certain experimental conditions may have to be artificially controlled in the reference house to make the comparison meaningful. At present, the conditions maintained in the two homes are different, as are the occupants. A direct comparison of relative energy consumption in the two houses would be most useful if similar environmental conditions existed in each one. As a result of these discussions, ARD is now preparing further, more detailed guidlines for conducting this experiment.

The other focus of activity with respect to evaluation of the BRET solar house was on economic analysis. The ultimate evaluation of the house must address not only its thermal performance, but the cost of achieving this performance. Concern was expressed by the consultants over the magnitude perceived by the people of Botswana of the incremental cost of the solar house compared to its conventional analogue. Also, some of the perceived cost increases had nothing to do with energy-saving features, and were completely separate items. It is important to identify which elements of the redesign were the most cost effective and which could have been eliminated without a significant impact on thermal performance. While in Botswana, Mr. Norris gathered information and made plans for such an evaluation.

Mr. Norris began by meeting with Tom Glass and Jack Sheppard, chief architect and chief quantity surveyor of the BHC, to review costs of the Shakawe EC (which had been quoted as "30 percent more expensive than the typical Shakawe"). At this meeting, he obtained a cost comparison between the Shakawe EC and the A, which Jack Sheppard had prepared to substantiate such a position. Shortly thereafter, he met with Ralph Blair, the supervising architect for BHC, and Duncan Frazer, the contractor, to review ways in which the building's cost could be reduced. Further suggestions were made during the passive solar seminar for design professionals, where the cost issue was presented to the participants with the request that they recommend ways to reduce costs without significantly impairing performance.

Preliminary suggestions for the techniques which could be used to reduce construction costs are contained in Appendix D. A final determination will require both the thermal performance results and a component analysis of costs. Accordingly, Mr. Norris has recommended that the BRET project immediately hire a

qualified quantity surveyor to compare the cost of the EC, stripped of all non-standard, non-energy related amenities, to the standard Shakawe. Preliminary figures supplied by Duncan Fraser suggest that such a stripped Shakawe is about 15 percent more costly than its predecessor, not 30 percent (and these figures were perceived by several others to be too high still).

Mssrs. Norris and Hamilton also recommend that the BRET project begin now to plan for a second-generation design of the Shakawe EC and incorporate the lessons learned regarding performance as well as cost. Mr. Norris believes that such an EC-2 could be built for less than 10 percent more than a conventional Shakawe, with only a marginal reduction in performance and comfort. He also recommends that the name "Shakawe" be dropped altogether for the EC, in favor of a name of its own.

Further, Mssrs. Norris and Hamilton suggest that the Winter Performance Paper be revised prior to release to the general public in order to better integrate the results of the monitoring data and the design philosophy behind the house. It is also suggested that any further documents regarding the solar house and the solar office building should be submitted to the ARD architect for review prior to publication.

B. Solar Office Building

Mr. Norris met with Bart Aarse and Neville Wilkinson of the BTC and Alastair Ritchie of Tswana Design (supervising architects) to review progress on the building, discuss modifications to the design which might yield cost savings without impairing performance, and select and finalize finishes. The progress on the building seems good and the quality of construction adequate thus far. Full notes from this meeting are contained in Appendix E. Specific recommendations made by Mr. Norris are:

- A structural engineer should be consulted because the water catchment tanks may be too close to the building foundations. This may result in cracking of the tanks and leakage to the foundations.

- The roof monitor insulating panels should be removed, as discussed in the meeting with BTC and Tswana Design, as they are costly. This will result in a marginally less comfortable winter condition.

- As recommended, the northeast shading device of the library should be removed for cost reasons, but it should be replaced by a low wall and plantings.

- In anticipation of the same cost issue as the Shakawe, BRET should hire the same quantity surveyor to analyze the energy systems cost for the office building.

V. SUMMARY OF RECOMMENDED DISSEMINATION STRATEGIES

There are a number of dissemination strategies which will help to establish the use of appropriate design practice in the future residential, commercial and government building stock in Botswana. These are:

1. Present information on the potential of solar and conservation design in buildings to decision makers in various government agencies. Information to be presented should include:

   - simplicity, and consistency with Botswana building tradition;
   - readily available technology;
   - examples of successful buildings in Botswana and other relevant locations (e.g., Lesotho);
   - benefits to occupants--comfort, increased productivity, higher standard of living, lower energy costs; and
   - institutional/government benefits--economy, self-reliance, etc.

2. Have solar design experts assist various agencies responsible for standard building designs (SHHA, MLGL, Ministry of Education, BHC, etc.) to develop new standard designs (or "pattern books") which incorporate passive solar/energy-conserving design principles.

3. Conduct further training of technicians who advise self-help homebuilders so that they may incorporate passive solar/conservation considerations into the advice they give.

4. Develop and disseminate model energy criteria for inclusion in the terms of reference for new building programs and individual projects.

5. Have solar design experts collaborate with building design professionals in various agencies responsible for building design on specific projects.

6. Take the kind of information found in the seminar workbook and repackage it for application to various groups and skill levels (e.g., policymakers at the District Council level, school facility planners, SHHA plot holders, etc.).

7. Draft energy budget or prescriptive energy standards for:

   - mechanically conditioned buildings;
   - large commercial/institutional structures; and
   - government buildings.

8. Build more energy-conserving demonstration buildings such as the BRET solar house, addressing other building sectors and income levels.

9. Incorporate energy conservation/passive solar concepts into existing publications on building design and construction.

10. Evaluate and document the performance of residential/commercial/government demonstration buildings.

11. Use high visibility public buildings as one major focus of the energy-conserving building demonstration program.

12. Since District Councils are responsible for building houses for local teachers, health workers and other staff, they should be provided with design information on housing construction, through the MLGL Council Architect's office.

A number of individuals were contacted during the consultancy to further the aims of the strategies listed above (see Appendix F).

Appendix A

LIST OF SEMINAR PARTICIPANTS

L. M. Masule, Lobatse Town Council
Garlicks Marumoloa, Lobatse Town Council
Lore Tlhalerwa, Gaborone Town Council
Philip Nkubu, Gaborone Town Council
Justice Babili, Francistown Town Council
O. Nabalo, Selibe-Phikwe Town Council
Hosiah Chokwe, Kweneng District Council
Robert Letlole, Central District Council
S. Nshakazhogwe, Central District Council
T. Kelebemang, Kgatleng District Council
Budzani K. Mokgopo, Southern District Council
Martin Sebonego, RIIC
Phillip Motshoge, RIIC
James M. Sentle, BRET project
Gabaipone M. Masire, BRET project
Baintlafatsi Leteemane, BRET project
Modise Motshoge, BRET project
Koofete Tebele, BRET project
Carl P. Zietlow, BRET project
Judith Oki, BRET project
Kaell Kove, Building Department
Kereng Mogami, Building Department
M. Mihailove, Building Department
P. Summers, Building Department
M. Tibone, Building Department
D. Oldham, Building Department
B. D. Matiting, Building Department
P. Knudsen, MLGL
T. Meyer, Ntlo Planning Services
A. Ritchie, Tswana Design
D. McDermott, Tswana Design
N. Wilkinson, Botswana Technology Center
John Case, Hi. Tech. Services
R. Blair, BHC
D. Mokotedi, BHC
G. Rabana, BHC
E. Mtui, Germ Construction

APPENDIX B

BRET

Botswana Renewable Energy Technology Project
Private Bag 0092, Gaborone, Botswana
Tel. 52731 Telex 2319 BRET BD

BRET PASSIVE SOLAR DESIGN WORKSHOP

FOR DESIGN PROFESSIONALS

SCHEDULE

DAY 1	7 MARCH 1984
7:30 - 12:30	• Registration • Introduction and Overview • Thermal Comfort • Climatic Factors • Passive Solar Cooling and Heating Strategies
14:00 - 16:00	• Integration of Energy Concerns into the Design Process • Siting for Passive Solar • Site Visit to Passive Solar Residence

DAY 2	8 MARCH 1984
7:30 - 12:30	• Building Form and Orientation • Thermal Design of the Building Envelope • Ventilation Design for Passive Solar Cooling • Selection of Building Energy Strategies • APPLICATION: Evaluation and Proposals for Improvement of the "Shakawe" Model House
14:00 - 16:00	• Building Energy Economics • Applying Passive Solar Design to Small Institutional Buildings • Site Visit to Passive Solar Office Building

BRET PASSIVE SOLAR DESIGN WORKSHOP

FOR DESIGN PROFESSIONALS

SCHEDULE (CONTINUED)

DAY 3	9 MARCH 1984
7:30 - 12:30	• Shading • Use of Vegetation • Water Collection and Conservation in Buildings • Applying Passive Solar Design to Large Institutional Buildings: - Daylighting - Environmental Control
14:00 - 16:00	• APPLICATION: Develop Design Guidelines for a Government Office Building • Resources - Literature, Calculation Aids and Organizations • Closing

Appendix C

BRET PASSIVE SOLAR DESIGN WORKBOOK

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Workshop Schedule

Energy Conservation in Building Design: A Local Perspective 1.0

Thermal Comfort 2.0

Climatic Factors Affecting Building Design 3.0

Passive Solar Cooling and Heating Strategies 4.0

Siting for Passive Solar 5.0

Building Form amd Orientation 6.0

Thermal Design of the Building Envelope 7.0

Ventilation Design for Passive Solar Cooling 8.0

Selection of Building Energy Strategies 9.0

Building Energy Economics 10.0

Use of Shading 11.0

Use of Vegetation 12.0

Daylighting Design 13.0

Integration of Energy Concerns Into the Design Process 14.0

Additions and Retrofits 15.0

Bibliography 16.0

Appendices:

- Efficient Wood Stoves and Building Design A.1
- Conservation During the 1983 Gaborone Water Crisis and Beyond B.1
- Rainwater Catchment Possibilities for Botswana C.1
- Participant Roster D.1

Appendix D

EVALUATION OF BRET PASSIVE SOLAR HOUSE

By David Norris, ARD Architect

The following evaluatior of the Shakawe EC does not directly address the energy performance of the building, as this awaits the detailed analysis of the summer performance data being gathered and the start-up of the control house monitoring. Winter performance was as predicted, while the occupants' admittedly subjective evaluation and spot analysis of monitoring data suggest that summer performance will be as predicted. This evaluation will address, however, the cost issue.

I. Shakawe EC--The Cost Issue

The Shakawe EC, as built, is too costly a prototype to expect the BHC or GOB to undertake a major development of the building as designed.

The building is, according to figures supplied by the BHC, 30 percent more costly than the standard Shakawe A. This cost can be justified on an experimental building, which the EC is, but cannot if the house is to be considered seriously by the BHC as a production model.

Note that the cost of the EC would drop by a projected 20 percent if it were part of a multi-unit (30) tender. Nonetheless, so would the typcial Shakawe A.

It is, therefore, critical at this stage to provide a strategy for reducing the cost of the EC in order to improve its attractiveness as a BHC production model without significantly deteriorating proven energy conservation and thermal comfort capabilities.

II. Cost Reduction Strategies

The extra cost of the Shakawe EC is in the core conservation and solar devices such as the insulation and Trombe walls, the enclosed patio with evaporative cooler, and amenities which are not standard for the Shakawe A such as three-phase electricity and a workshop.

It is clear from the above that further refinement of the core devices and elimination of pleasant (but not economically viable) comfort devices and non-standard amenities will yield a more cost-effective prototype.

Figures supplied by Duncan Frazer, Pty. (the contractor), suggest that the EC stripped of amenities and comfort devices would yield a structure 16 percent more costly than the Shakawe A. A quantity surveyor's evaluation of cost-savings suggestions will determine the reduced building cost which would be achieved if the Shakawe EC were stripped of the above and if the energy-conservation and design modifcations suggested below (section III) were implemented.

It is this improved prototype, the EC-2, which the BRET project would like the BHC to consider for production.

III. Proposed Modifications

Building design modifications:

1. Eliminate the block screenwall and paved patio. They are heat sinks too close to the house and reflect sunlight inside in summer, both of which add to the cooling load. Eliminate the evaporative cooler, as water is scarce.

   Option at tenant/owner expense: Replace the above with overhead and vertical trellis covered with grapevines and gravel. It will provide privacy, shading and cooling of breezes, require less water, and yield an edible fruit crop. Cost: approximately 200 pula.

2. Eliminate the vegetable garden and trellis. They are not standard on the Shakawe A.

   Option at tenant/owner expense: Replace the above, as designed. Cost: approximately 300 pula.

3. Eliminate the concrete perimeter drain. Not standard on Shakawe A. Replace with typical splash blocks.

   Option: Contain, catch and use roof and site runoff. This should be standard on all Shakawes but would require a policy decision recognizing Botswana's 20-year drought cycle. For suggested techniques, see Rain Water Catchment, Possibilities for Botswana, published by BTC.

4. Develop the guest room as a servant quarters and eliminate the workshop. This would involve relocation of the entry to the east elevation and elimination of access from the servant quarters to the breezeway. Like the Shakawe A, this reintegrates the servant quarters to the building and eliminates the separate and costly "workshop."

5. Add a large window and/or French doors between the breezeway and the dining room. This will increase the physical/visual connection between the two and increase use of the breezeway as an outdoor room.

Option at owner/tenant expense: Add a car park, which is an automobile-based amenity of the A, which has been replaced by the breezeway, a people-based amenity, of the EC. If the car park is still desired or required, make it a stand-alone structure located to the west where it can provide shade to the building's exposed west wall. Note that with time and careful planting, trees can do the job better and at lower cost.

6. Eliminate additional kitchen, electrical, gas supply and miscellaneous extras. These are not typical of the Shakawe A.

7. Eliminate guest room north wall insulation, Trombe wall and VAT on floor. On a standard Shakawe, this would be a servant quarter and would not benefit from such amenities. Provide an insulated ceiling.

Energy system modifications:

1. Reduce the south wall overhang to 300mm. Its greater depth is of insignificant value as shading on the south wall.

2. Eliminate insulation in the breezeway ceiling. It is unnecessary.

3. Replace the interior wall wood vents with typical breeze (not vent) blocks. This will reduce cost and improve performance.

4. Remove the exterior weather louvers over the south wall vents, as they obstruct air flow. This will improve performance and reduce cost.

5. Eliminate the dense concrete behind the fireplace. Its thermal storage value is minimal, given the mass-intensive interior.

6. Replace the Jetmaster fireplace with the Rayburn "Unita," a closed-combustion and more efficient unit.

7. Eliminate the Trombe walls. Though monitoring clearly indicates that the Trombes provide welcomed and well-timed heat in the winter, they also provide unwanted heat in the summer, requiring an additional shading device. Their replacement by an insulated wall would not seriously affect overall energy performance, while reducing cost. Trombe walls could be installed at the client's option.

8. Consider going to a gable roof, which will reduce interior heated and cooled volume, provide for easy gable end ventilation, and reduce wall area and, therefore, cost.

9. Increase the use of vegetation for cooling and shading purposes. This would take the form of a handout or pamphlet given to tenants outlining immediate, medium- and long-term planting strategies and specifying plant types by name.

10. Install low-water-consumption toilets, shower heads and tap aerators. Though not presently available in Botswana, their inclusion in a sizeable tender by the BHC would make them both available and only marginally more costly. As a matter of water-conservation policy, their use should be required as a matter of course.

11. Eliminate insulation altogether on exterior walls and replace with solid-block 230mm construction.

Note that all of the above suggestions should be evaluated in terms of their energy and cost impact before they are incorporated into a second-generation design. At a minimum, this would require computer analysis of the energy-conservation options and their ranking by life-cycle cost analysis.

IV. Construction

The contractor had no significant problems in the construction of the EC, which suggests that the objective of not introducing "radial construction technologies" has been met.

The filling of the cavity wall with the light polystyrene beads was problematic, nonetheless. The field architect, quite rightly, required that the cavity be filled once window-sill height was reached in order to guarantee full fill below windows. With a lot of cavity exposed, beads blew away in the wind. The contractor claims, with some justification, that if permitted to fill only at the top course, the beads would be liquid enough to fill all voids adequately while avoiding--by quickly installing the top plate--the wind losses (as well as inspection by the field architect). The ARD architect suggests an experiment to test this hypothesis.

Appendix E

MINUTES OF SOLAR OFFICE BUILDING MEETING

Minutes of meeting held in the offices of Tswana Design on Monday, February 20, 1984, at 0730 hours.

In attendance: Mr. B. Aarsse, Mr. N. Wilkinson, Mr. A. Ritchie, Mr. D. Norris

The meeting was held to review the BRET project with regard to passive solar techniques, as well as additional client requirements.

Office Building

- Monitor light--It was agreed to move high-level windows to internal wall face in order to increase shading performance.

- Translucent panels--It was agreed to remove this element in toto. Contractor confirmed he had purchased translucent glazing: counter proposal to use this material in high-level windows accepted.

- Electrics--Agreed to reduce fluorescent fittings by 50 percent and to omit all fluorescents to inner core r.c. beam grillage; lighting in conference room to remain as initially designed; fluorescent fittings to tie beams in core in lieu of incandescent light.

- Sensors--ARD architect, D. Norris, to discuss with BRET staff the tentative repositioning of data logger sensors, etc., as indicated below:

  --ambient temperature - core low level, core high level, Office 3;

  --lux meters - Office 3, core high level;

  --radiant temperature - Office 5, Office 6;

  --internal wind velocity - core high level;

  --amperage - as before;

  --external ambient temperature - as before;

  --external horizontal radiation - as before;

  --external ambient temperature - entrance door, office;

  --internal ambient temperature - library.

- BTC to acquire apparatus from Meteorological Services to measure:

  --rainfall,
  --radiant temperature,
  --external wind speed, and
  --wind direction.

  Agreed to mount wind speed apparatus on roof; lightning protection to this equipment to be provided.

- Office furniture--Discussed in detail; D. Norris to liaise with client with respect to final details.

- Core--Agreed to encase s.w. tresses as they pass through core at high and low levels; all concrete work to be exposed.

Library

- Omit translucent panels.

- Form deep cruciform bulkheads around timber tie beams as they pass through high-level space.

- Expose r.c. beams as discussed in office building, all to be rendered, ceiling level to be adjusted to allow exposure of beams.

- Omit m.s. rhs columns to perimeter of core.

- Electrics--Minor adjustments made to layout. Add in 4 no. spotlights mounted at high level in monitor light; check switch socket outlets with regard to revised furniture layout.

Workshop

- Client to advise when ceilings required, plus any additional screen walling.

- Internal working arrangement discussed.

Ablution Block

- No matters arose.

External Works

- Car parking--Concern was expressed with regard to heat build-up from these areas and the transfer of heat to the buildings; agreed to control this with the use of perimeter planting.

- Underground water tanks--Another source of radiant heat; agreed to cover all concrete with top soil with the exception of the western tank, which will be used to demonstrate solar voltaic pumps.

- Library--Agreed to omit southern solar louver panels; appropriate plantings to be used to shade exposed wall area.

- Front screen wall--Agreed to reduce light. D. Norris to come back with design for entry way.

- Central courtyard--Agreed to use brick pavings; pool to be incorporated in overall design, as is external library seating area; planter with seat to be included.

- Solar voltaic panels used for water reticulation pumps to be set into fixed louvers to west corner.

- Mat wells to be set into concrete pavings to entry ways at library and office buildings.

- Omit screen wall between ablution block and library facing onto courtyard.

Finishes

- Externally, all buildings:

  --ground to d.p.c. level - CEMWASH MAHOGANY
  --d.p.c. to door head - CEMWASH SANDALWOOD S
  --door head to wallplate - CEMWASH PINE S
  --metal windows and doors - RED OXIDE GLOSS PAINT
  --louvers and structure - TO MATCH COLOMET SHEETING
  --gutters and fascias - TO MATCH COLOMET SHEETING
  --curved logo screen:
    perimeter trim - BTC BLUE
    lettering and logo - BTC BLUE
    background - GREY M67

- Internally, all buildings:

  --walls - M18
  --ceilings - M18
  --columns - M12
  --doors and windows - M60 Gloss
  --door panels - M60 Gloss
  --skirtings - M60 Gloss
  --high-level windows - M18 Gloss
  --office flooring - Colovinyl tiles CV750
  --library flooring - Flortime Universal Super, color-nutmeg
  --ablution block - Colovinyl tiles CV750

There being no other business, the meeting was closed.

Distribution:

BTC	(2)
D. Norris	(1)
Tswana Design	(2)

Appendix F

DISSEMINATION OF INFORMATION ON SOLAR DESIGN

To promote dissemination of solar design ideas in Botswana, BRET staff organized a series of meetings with various agencies of the GOB responsible for the design of buildings to explore potential applications of energy conservation to their designs. Meetings were held with the SHHA, MLGL, the Ministry of Education (MOE), and the Office of the Chief Architect.

Low-Income Housing

ARD's architect, Mr. Norris, met with Ron Campbell of the MLGL and director of the SHHA program to discuss the application of energy design to low-income housing units. Following the meeting, Mr. Campbell organized a presentation of some low-income housing work performed in Lesotho by the ARD architect to representatives of the Gaborone Town Council. They supported transmission of a letter to the BRET project requesting assistance in the integration of passive design into SHHA housing. This represents a very real opportunity to affect the energy efficiency and thermal comfort of one of the most widely built buildings in Botswana.

Mr. Campbell has suggested that the assistance take two forms:

- design input in the development of the SHHA pattern book of standard house designs now being assembled by the agency; and
- long-term training of SHHA technicians at all levels to ensure that the principles and knowledge of energy design are applied to the plot holders, who remain responsible for the construction of their houses under the supervision of a SHHA technician.

Mr. Campbell is to obtain support letters from the various agencies present at the meeting and then submit a formal request to the BRET project for assistance.

Council Housing

The ARD architect met with Paul Knudsen of the MLGL regarding passive design in council schools and housing. Mr. Knudsen attended the professional seminar. Although the focus of the meeting was on school design, the most important opportunity appears to be in housing. MLGL will issue, within the next few months, a request for proposal to redesign all of the numerous council house types. The BRET project has two opportunities:

- to recommend energy criteria for inclusion in the terms of reference, and

- to submit a bid to do the work in association with a local architect and quantity surveyor.

Schools

Dr. Simon and other members of the MOE staff, who were responsible for developing criteria for the design of a new generation of secondary schools, expressed a desire to meet with the ARD design consultant. At the meeting, the design for the Lesotho RET project building was presented. This included a classroom as well as office accommodations. The BRET project might assist the Ministry in the following ways:

- Develop the energy criteria for inclusion in the terms of reference.

- Assist the selected design team in the application of energy design principles and techniques to their designs.

- Develop a prototype school design.

A preference for the third option was expressed by the ARD consultant.

Large-Scale Buildings

Kjell Kove, the assistant chief architect responsible for design, and the ARD architect met to discuss the application of passive principles to the design of larger scale buildings--in particular, the modular office building now in the preliminary design phase. Mr. Kove supports the inclusion of such principles. He attended the workshop and sent five participants as well.

Follow-up should take the form of an offer for sophisticated energy consulting on the modular office building, complete with computer modeling and technical assistance, to the architects and mechanical engineers on the design team. A list of energy criteria for the modular office building was developed and sent to Mr. Kove to assist him in the formulation of the energy design strategy (the list is available from the BRET office).

Other

The Institute of Development Management (IDM) is charged with educating economic development specialists in Botswana, Lesotho and Swaziland. IDM has regional facilities on the

University of Botswana campus which it now wishes to expand to include new dining and sleeping accommodations. IDM's regional director, John Hunter, has submitted a formal request to the BRET project for the preliminary design of the new facility. This will be presented to the World Bank for funding. Vigorous pursuit of the project is recommended. Program and site information have been obtained by the project.

Alastair Ritchie, a partner in Tswana Design, has recently won the commission for the new main library at the University of Botswana. Mr. Ritchie is also the supervising architect for the solar office building and a participant in the professional seminar. He would like to apply passive design to the library and would like to obtain BRET project assistance to do so. The size, location and importance of the project are such that it should be vigorously pursued.