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Хөгжлийн Хөтөлбөр

United Nations Development Programme
Mongolia

# Mid-Term Evaluation Report:

# Provision of Energy Efficient Social Services (UNDP Project MON/97/301)

*Prepared for the Government of Mongolia,*
*UNDP, and the Government of Norway by:*


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**Final Report**

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## Preface

In October 2000, UNDP commissioned an independent Midterm Evaluation of its *Provision of Energy Efficient Social Services* project (PEESS: MON/97/301), often referred to as the 'Straw Bale Buildings' project, which has core funding from UNDP and considerable additional support from the Government of Norway. The team was also asked to review the draft project document for the closely-related upcoming *Commercialisation of Super-Insulated Buildings in Mongolia* project (MON/99/G35) supported by the GEF and Norway.

This report on findings and recommendations was prepared by Peter Johnston with input from two national consultants, Mr. Sodnomdorj Jargalsaikhan, an energy services and environmental impact consultant, and Mr. Sugarragchaagiin Tserendash, a construction engineering consultant, both with extensive experience. Ms. Budjav Bat-Otgon served as the team's translator.

Reviews of this sort are highly dependent on the cooperation of those interviewed, whether within the project, the government and UNDP or outside contractors, architects, beneficiaries and other interested parties. The team appreciates the willingness of those we contacted to spend considerable time answering our questions with candour and at times even enthusiasm. Reviews tend to disrupt the day-to-day operations of a project and this was no exception. However, the PEESS National Project Coordinator, Mr. S Ganbold, the International Adviser, Mr. Gordon Johnson, and the other PEESS staff put up with our questions and incessant disruptions with grace and friendliness. This final version of the report addresses several comments and questions from the GoM, project staff and UNDP on an earlier draft. None of the earlier conclusions or recommendations have been changed but some new material has been added.

At times, external reviews seem to be carried out primarily to meet some bureaucratic requirement. In this case, both the PEESS project staff and UNDP stressed their desire for an honest, critical review. We would like to thank all those we met for their cooperation and constructive attitudes.

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Ulaanbaatar, Mongolia
and Suva, Fiji
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## Abbreviations and Acronyms

In late 2000, some government ministries and departments were in the process of reorganisation, including new names. Names shown below were being used in October 2000 along with newer unofficial names.

| | |
|---|---|
| ACA | Agency for Construction and Architecture (Mongolia) |
| ADB | Asian Development Bank |
| ADRA | Adventist Development and Relief Agency |
| Aimag | Provincial level of Mongolian government |
| ALGAS | Asia-Pacific Least-Cost Greenhouse Gas Abatement Strategy (ADB) |
| APR | Annual Project Report (UNDP reporting format; replaced PPER) |
| Bag | local (village) level government. |
| BTR/TPR | Bipartite or Tripartite Review (i.e. involves either 2 or 3 parties) |
| CCF | Country Cooperation Framework of UNDP (1st Mongolia CCF 1997–2001; 2nd will be 2002–06) |
| $CO_2$ | carbon dioxide (common GHG; produced by burning fossil fuels) |
| CR | Country Review (1999 Midterm Review of UNDP's CCF) |
| ECC | Energy Conservation and Environmental Consulting, Ltd. |
| EEH | *Energy Efficient Housing*, formally *Commercialisation of Super-Insulated Buildings in Mongolia* (UNDP/GEF MON/99/G35) |
| ESCO | Energy Service Company |
| ESMAP | Energy Sector Management Assistance Programme (WB) |
| GEF | Global Environment Facility (UNDP, UNEP & World Bank) |
| ger | traditional nomadic home |
| GHG | Greenhouse Gas(es) |
| GoM | Government of Mongolia |
| GTZ | Deutsche Gesellschaft für Technische Zusamenarbeit, GmbH (German Cooperation Agency) |
| HAAP Unit | Housing Area Action Plan Unit (GoM with ADB support) |
| HDR | Human Development Report |
| IA | International Adviser (PEESS) |
| IPF | Indicative Planning Figure (UNDP; previously Indicative Programming Funds) |
| JICA | Japan International Cooperation Agency |
| MAP-21 | Mongolian Action Plan for the 21st Century (UN Agenda 21) |
| MID | Ministry of Infrastructure Development (Mongolia) |
| MNE | Ministry of Nature and Environment (Mongolia) |
| NCSD | National Council for Sustainable Development (of Mongolia) |
| NEX | National Execution (UNDP programming 'modality') |
| NGO | Non Governmental Organisation |
| NPAP | National Poverty Alleviation Programme (Mongolia) |
| NPC | National Project Coordinator (*recruited* by PEESS) |
| NPD | National Project Director (*appointed* by MID) |
| NSC | National Steering Committee |
| PEESS | Provision of Energy Efficient Social Services (UNDP project MON/97/301) |
| PPER | Project Performance Evaluation Report (old UNDP report format) |
| PTA | Posts and Telecommunications Authority of Mongolia |
| PV | photovoltaic (direct production of electricity from the sun) |
| SB | Straw Bale |
| SBB | 'super-insulated' Straw-Bale Building |
| soum | District level of Mongolian government; division of a province or Aimag |
| TACIS | Technical Assistance for Commonwealth of Independent States (European Commission) |
| Tg. | Abbreviation for Tugruk; (also called MTg.) |
| TOR | Terms of Reference |
| TRAC | Target for Resource Assignment from the Core (UNDP funding) |
| Tugruk | Mongolian currency (In Oct. 2000, US$ 1.00 = 1080 Tg ) |
| UNV | United Nations Volunteer |
| USAID | United States Agency for International Development |
| WB | World Bank |

# 1. EXECUTIVE SUMMARY

## 1.1 Purpose of evaluation

This evaluation of the *Provision of Energy Efficient Social Services* (PEESS) project was arranged by UNDP to provide independent advice to the GoM, the project and UNDP on appropriate actions, if necessary, to address issues in the project's design, implementation and management while re-enforcing successful elements. The evaluation also allows lessons learned during the four years of the project's existence to be incorporated into a new, and closely related, GEF project on the *Commercialisation of Super-Insulated Buildings in Mongolia*.

## 1.2 Conclusions

About two-thirds through its duration, overall progress within PEESS has been satisfactory:

- PEESS has already completed or contracted straw-bale (SB) and renovated building projects sufficiently to effectively demonstrate both SB technologies and techniques for improving energy efficiency in existing buildings.
- Over 100,000 users of social service buildings have benefited from the investments and they are generally pleased with improved winter comfort levels. There is considerable anecdotal evidence that these SB buildings and renovated buildings are far more energy efficient than similar buildings without 'super-insulation.'
- However, energy efficiency and costs savings have not been confirmed through adequate monitoring and measurements of the buildings or their components important for energy efficiency (insulation, heating stoves and boilers, windows, etc.).
- Project targets for numbers of SB buildings have been exceeded while targets for retrofits and SB greenhouses are on schedule. Although there have been concerns regarding standards, designs, quality, cost and safety, the project has made reasonable progress in addressing them.
- PEESS is well behind its targets for photovoltaic (PV) installations, has dropped targets entirely for proposed combined demonstration and social service centres, and has been unable to demonstrate cost-effective SB greenhouses for food production. Activities for PVs and greenhouses require reconsideration; the decision to drop the combined centres was correct.
- Training targets for the full project lifetime have already been exceeded in terms of trainees although only 28% have been women (30% considering trainee-days) and the project has never evaluated its overall programme or its individual courses.
- Management, execution and implementation are broadly satisfactory but inspections during SBB construction have been inadequate, affecting the quality of some buildings. Supervision of national UNVs needs to be improved. Both management and planning have improved in the past year but some managerial and advisory issues for the far-larger, and more complex, combined PEESS / GEF project need to be reconsidered.
- The working relationships between project staff and staff of the implementing agency (ACA) are generally OK but the GoM has not provided funding for ACA to fully carry out its implementing role.
- There are few, if any, incentives in Mongolia for energy efficiency and the GoM has not made funds available for replication of SB and related techniques. Currently, prospects for wide-scale replication of public sector, social service SB buildings after the project concludes appear to be small. However, the new GEF project, concentrating on commercialisation of private housing, is more likely to succeed in long-term replication.
- UNDP should be commended for raising US$3 million in external funding since 1997 from Norway and GEF for PEESS and the new energy efficient housing project.

## 1.3 Recommendations

The project should now concentrate on consolidating results, documenting and measuring energy and cost-effectiveness, and effectively publicising what has been learned. The following actions are recommended:

***Demonstrations***

- No additional *straw-bale social service buildings* should be built, unless already contracted, but PEESS should provide modest funding for the maintenance of existing SBBs if owners provide 50% of costs and assist with determining actual energy use.
- *Combined demonstration / social service straw-bale buildings* should, as the Steering Committee decided, be dropped from the project as they would undermine social services.
- No new *building retrofits* should be carried out in 2001 unless energy use monitoring is carried out by owners or users during the coming winter.
- No new *straw-bale greenhouses* should be built but existing ones should be renovated if owners pay a third of costs and participate in monitoring actual food production.
- No new *photovoltaic systems* should be installed but existing systems should be monitored and assessed. UNDP should consider a stand-alone rural PV project for GEF (or other) funding.

***Training***

- PEESS should arrange an independent review of the effectiveness and impact of its past training efforts.
- All future PEESS (and new GEF project) training activities should routinely include assessments by trainees and trainers.

***Research***

- PEESS should arrange accurate measurements of *energy use and costs* in representative SBBs, retrofitted buildings and comparable buildings which are not 'super-insulated.'
- As noted above, for all new *retrofitted buildings* retrofits, measurements of energy use for a full winter should be a prior condition of renovation.
- Energy efficiency and suitability of *stoves and boilers* should be determined, preferably in cooperation with the WB/GEF energy efficient stoves project.
- Energy savings should be determined for improved *window and door designs*.
- Interviews should be carried out with users and owners to determine *users' attitudes* to SBBs and building retrofits.
- *Other research* should include energy and cost savings of insulation, windows, doors and door seals, and the effects of different patterns of building maintenance and use.
- *Cost-benefit analyses* and life-cycle costs should be determined for the various energy-efficiency options and combinations indicated above.

***Standards***

- Various design and construction-related recommendations are made to improve the quality and reduce the costs of SBBs.

***Partnerships***

- PEESS should consider an informal group of its partners to advise on mechanisms to improve sustainability and replication after the project ends.

***Public (and internal) information***

- PEESS should begin to regularly produce high-quality materials for the public, semi-technical reports for professionals.
- Once the new national UNVs are engaged for the GEF EEH project, PEESS should produce a monthly internal newsletter in Mongolian for its staff.

***Management and staffing***

- Either new *national staff or national consultant* positions should be arranged for construction engineering and monitoring, energy efficiency monitoring and Mongolian language writing and editing.
- For the combined PEESS/GEF project, staff should be organised into *functional teams* with clear lines of authority and responsibility. There should be regular staff meetings.
- Professional staff, including all national UNVs, should have *quarterly workplans* with clear goals, priorities, and timetables and regular internal reporting.
- UNDP should assure sufficient resources for an *international adviser* on planning and management for at least a 60% basis throughout the combined PEESS/GEF project.
- *Steering Committee* membership and functions should be reconsidered, adding new members with business skills and assuring more advice on mechanisms for post-project sustainability.

***Future PEESS reviews***

- As the main financial contributor to PEESS, the Government of Norway should be invited to participate in the final project review.

***Mongolian government***

- If PEESS makes a solid case for energy and life-cycle cost savings for SBBs (and energy-efficient building renovations), the Government of Mongolia should develop and adopt appropriate policy and financial measures to encourage their replication.
- The GoM should provide sufficient financial support to the PEESS implementing agency to allow it to play a more effective implementing role.

***The GEF Energy Efficient Housing (EEH) project***

- This is a worthwhile project and a logical extension to PEESS with far better prospects for sustainability. It should be supported and begin as soon as possible.
- Specific recommendations are made to modify or further address: i) execution and implementation; ii) policies on subsidies; iii) marketing; iv) appropriate house designs; v) the needs of the informal housing sector; vi) avoidance of a 'technology driven' approach; vii) support for non-housing SBBs for the non-formal business sector; viii) serious attention to public awareness; ix) demonstrating energy efficiency gains for housing; x) home heating; xi) careful choice of recipients acceptable for housing support; xii) project review criteria; xiii) the proposed Energy Demonstration Centres; and xiv) adequate international advisory input.

## 2. INTRODUCTION

***Background***. The *Provision of Energy Efficient Social Services* (PEESS) project began in May 1997 with core UNDP finance of US$0.3 million and the expectation of mobilising an additional US$1.76 million. The initial expected completion date was April 2000. A significant project revision was approved in early 1999, extending PEESS for two years[1] following an agreement by the Government of Norway to contribute the equivalent of US$1.74 million. Based on the additional funding and the lessons learned during two years of experience, the revision both significantly modified and expanded PEESS's objectives, outputs and activities. This independent, external evaluation considers the initial project design but is based primarily on the expectations of the time of the major revision (Revision H) of 1999. It was formally requested by UNDP, which prepared the attached Terms of Reference.[2] The review team reports to the Government of Mongolia (GoM), UNDP and the Government of Norway.

***Timing of the review.*** As its name suggests, a Midterm Review is normally carried out about halfway through a project, which in this case was late 1999. However, this was only a few months after the project's expansion and modification, too soon to be of much practical use. In addition, a closely related project is expected to begin within two months, the *Commercialisation of Super-Insulated Buildings in Mongolia* project (also referred to as *Energy Efficient Housing* or EEH), to be financed mainly by the Global Environment Facility (GEF) and the Government of Norway, and proposed to be managed under the same arrangements as PEESS. A review at this time may provide useful suggestions for changes during the remainder of PESS and also allows lessons learned from PEESS to be considered in the final design and implementation of the new EEH project. In brief, although the project is nearly two-thirds complete at the time of the review, and will have spent about 70% of available funding by the end of December 2000, this is an appropriate time for an independent review.

***Purpose of the review and key issues***. UNDP has advised that the review serves two immediate purposes: decision-making and taking stock of lessons learned from experience. Specifically, it provides a basis for identifying appropriate actions to: a) address issues or problems in design, implementation and management; and b) reinforce initiatives that demonstrate potential for success. The focus is on the following main issues:

- *Lessons learned.* What lessons have been learned, both positive and negative, in relation to the project's main components: research, demonstration, public information, partnerships, standards and training.
- *Needed adjustments or improvements.* Based on the above lessons, what adjustments are needed in the project's design, implementation strategy or workplans, or what improvements are needed in the project's implementation?
- *Directions for the duration of the project.* Regardless of the project document's contents, what should be the project's main areas of focus during the remaining period of implementation?
- *Ways and means to promote sustainability.* Given the planned activities and the recommended areas of future focus, what ways and means should the project employ to ensure continuity and sustainability following completion of the project?

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[1] The April 2000 Tripartite Review extended PEESS by a further six months until 31 October 2002, the current expected completion date.

[2] The evaluation TOR are attached as Annex 1 and an itinerary as Annex 2.

- *Specific lessons relevant to the new GEF project.* What lessons have been learned by the project that are of particular relevance to the new project to be undertaken by UNDP and the GoM (*Commercialisation of Super-Insulated Buildings in Mongolia;* MON/99/G35)?

***Methodology used***. The review was carried out by an international team leader and two national consultants who specialise in building construction and energy issues respectively. During the first three weeks of October 2000, the team interviewed about fifty people in Mongolia,[3] contacted six others who are familiar with the project or its objectives by e-mail, visited eleven field sites[4] where PEESS has implemented construction or renovation activities between 1997 and 2000 and visited two additional sites where NGOs or local government agencies have supported similar activities. The field visits included six straw-bale buildings (three health clinics, two kindergartens and one women's centre), three buildings which were renovated or retrofitted to improve heating energy efficiency (two offices and one multiple purpose hall/school/office), two straw-bale houses and three straw-bale greenhouses. The methodology was essentially reading a wide range of materials in Mongolian and English[5] (including background reports, contracts, designs, standards, project reviews, training reports, etc.), visiting a representative sampling of sites (including some known to be of poor quality or not functioning well), asking a reasonably consistent set of questions[6] of knowledgeable people, and attempting to estimate ourselves energy use at one site.

***Structure of the report***. This report is structured according to the Midterm Review format provided by UNDP and shown in Annex 1. Following Section 1, the Executive Summary is Section 2, this introduction. Section 3 covers the project and its development context; Section 4, findings and conclusions (covering project concept and design, project implementation, and project results); Section 5, recommendations; and Section 6, the lessons learned.

In order keep the main report to a reasonable length, many detailed comments are relegated to the ten annexes (which exceed 40 pages in length). The first six are standard annexes as specified by UNDP and cover the TOR, those interviewed, field trips, etc. Four additional annexes comment on matters specific to this review: the new GEF energy efficient housing project which is closely related to PEESS; possible opportunities for separate rural photovoltaics (or other renewable energy interventions) by UNDP; construction-related issues; and a summary of energy-related issues.

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[3] Annex 3 lists those interviewed in Ulaanbaatar and by e-mail. The main interviewees during site visits to various Ulaanbaatar districts and Tuv Aimag are shown in Annex 4.

[4] Annex 4 describes all field visits, which extended over five days, and summarises the team's findings.

[5] Annex 5 is a list of the main documents reviewed.

[6] A set of questions, prepared early in the evaluation to guide the interviews, is attached as Annex 6.

## 3. THE PROJECT AND ITS DEVELOPMENT CONTEXT

The *Provision of Energy Efficient Social Services* project began on 20 May 1997 and is expected to conclude by 31 October 2002. The information in this section, which describes the context of PEESS, is taken directly from the original 1997 Project Document, a 1999 project revision, and the April 2000 Annual Project Report.

***Problem to be addressed.*** The March 1999 Project Revision (page 5) states the problem to be addressed as follows:

> "The present project revision primarily addresses the need to develop in-country human resources and technical capacity through **training**[7] aimed at developing skills and knowledge in building energy-efficient super-insulated (including straw-bale) buildings and greenhouses; refurbishing existing buildings to increase their energy efficiency; erecting and installing and maintaining photo-voltaic (PV) systems and other, preferably renewable, energy-efficient technical applications. Specifically the project will address the following problems:
>
> a) Insufficient skills and human resources available for the installation, construction, operation and maintenance of an energy-rational infrastructure for – but not limited to – social services;
> b) Lack of a suitable setting for the large-scale introduction of renewable energy applications, energy-efficient construction and energy conservation initiatives;
> c) Malfunctioning of the social services infrastructure because of high consumption of non-renewable energy resources eating up to a third (occasionally 45%) of the budgets for social service provision;
>
> In addition the project will address:
>
> d) Pollution due to high volume of coal or other fuels burned, and poor energy efficiency of traditional stoves (Mongolia has one of the highest per capita $CO_2$ emissions in the world);
> e) Receding forests due to fuel demand for heating purposes;
> f) Insufficient employment opportunities in rural areas; and
> g) Low quality of life due to unbalanced food habits."

***Development Objective.*** The Development Objective, or main overall objective, of PEESS "is to support the Government of Mongolia (GoM) to implement its program of Poverty Alleviation and Sustainable Development through a community-based approach to development. Specifically, the project will help develop social services that are less dependent on non-renewable resources for its energy needs, freeing financial resources for their core activities and giving a significant contribution to the conservation of the natural environment and better rural livelihoods. To achieve this objective, the project will support the introduction of energy-efficient buildings and renewable energy technologies. The demonstration of these technologies will hopefully have a large-scale replication effect, reducing the energy needs for heating and improving the living conditions of the poorest segments of the Mongolian population."[8]

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[7] The bold emphasis is in the original document.

[8] This is from page 2 of the PEESS *Annual Project Report* (APR) dated April 2000. The wording is slightly different from the Project Document but identical in meaning.

***Immediate Objectives***. The most recent PEESS *Annual Project Report* (APR) dated April 2000 lists the four 'Immediate Objectives' (i.e., the project objectives in support of the wider overall Development Objective) as follows:

Objective 1: To reduce energy consumption and $CO_2$ emissions in the social service and housing sector.

Objective 2: To demonstrate the use of energy-efficient technologies in the social service, housing and agricultural sector (for extended food production).

Objective 3: To develop in-country capacities to build super-insulated buildings, refurbish existing ones, erect greenhouses, install and maintain PV systems.

Objective 4: To create an enabling environment through streamlined government approval procedures and public awareness programs.

The above wording is slightly different from that of the most recent (March 1999) major project revision, (Revision H) but the meaning is the same and the above formulation is a bit more clear. The original 1997 objectives were essentially the same and are not discussed in this report.[9]

***Main stakeholders***. The 1997 project document refers to 'target beneficiaries' rather than stake-holders. It describes them as follows (page 10):[10]

> "The target beneficiaries of the project are first and foremost the local communities and especially women and children of several isolated *soums*, who will benefit from a better pre and post maternity care and general care, a better education, and possibly improved nutritional intake. Besides these, other beneficiaries are: (i) the manufacturing and construction enterprises of the private sector who will benefit from an enhanced market, (ii) young people who often in a rural situation do not find employment, (iii) the local elected bodies who will benefit from a reduced demand on their limited financial resources, and (iv) the GoM which will benefit from an enhanced development of social infrastructure as the vehicle to promote better livelihoods and local economic development."

Other stakeholders are (or have been):

- the present executing and implementing agencies, the Policy Implementation and Coordination Department of the Ministry of Infrastructure Development (MID) and the Agency for Construction and Architecture (ACA), respectively;[11]
- the original executing and implementing agencies from May 1997 to April 1999, the National Council for Sustainable Development (NCSD) and the GoM's MAP-21 Unit, respectively;
- close partners such as the Adventist Development and Relief Organisation (ADRA) which initiated straw-bale building techniques in Mongolia and was for a time a PEESS co-

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[9] The original project document (approved April 1997) lists the Immediate Objectives as follows:

Obj 1: Reduce the energy consumption of social services infrastructure.

Obj 2: Demonstrate the use of renewable energy for meeting the energy needs of social services infrastructure.

Obj 3: Demonstrate the usefulness of low-cost 'greenhouses' for extended food production and/or livestock sheltering.

Obj 4: Human Resource Development. Developing skills (hands-on-training) in building super-insulated houses, refurbishing existing ones, installing and maintaining PV systems, efficient heating systems, heating with renewable energy resources, erecting greenhouses. Creation of local employment and establishment of income-generating enterprises. Create awareness of demonstrated technologies: advocacy and public information.

[10] This section of the *prodoc* (B.4) was not modified in the project revision of 1999.

[11] During the evaluation mission (October 2000), some government ministries, departments and agencies were being reorganised and renamed. These are the old names as they appear in the project document.

implementing agent; and Raleigh International of the UK which is financing a number of Straw-Bale Buildings (SBBs) jointly with PEESS; and

- other donor organisations which are involved in related or overlapping activities such as the Asian Development Bank (ADB's housing sector finance project), GTZ (the German-Mongolian renewable energy project), JICA (Japan-Mongolia rural energy project), the World Bank (WB/GEF efficient urban stoves project) and possibly the Netherlands Government (a new 'Energy Service Company' or ESCO project).

***Expected Results.*** The 1997 project revision (page 5) describes the expected results as follows:

"At the end of the project, the following outcomes are expected:

a) A strong and growing cadre of engineers, professionals, businesses and household representatives, at least 400 people (of which at least 50% women), qualified in designing and constructing super-insulated buildings and houses;
b) Streamlined and simplified Government approval procedures (including blueprints, gender-specific guides and training packages, technical manuals, standards and norms) that ensure safe and high quality (renewable) energy-efficient technology techniques;
c) A 50% drop in coal consumption for institutional and household heating compared to similar brick buildings outside the project (the project will establish baseline monitoring data);
d) At least 10 (preferably renewable) energy-efficient technology applications demonstrated by the project, including a variety of simple, low-cost heat-loss reduction techniques;
e) Understanding of and confidence for this type of buildings (sic) and for new energy-efficient technologies amongst a gender-balanced population, as well as central and local governing bodies (proven through an opinion poll at the end of the project);
f) National, *aimag* and *soum* governments policies allocating significant resources to the new technology and its use in the public sector. At least Tg 100 million invested by the national Government before 2003. At least 30 , *aimag* and *soum* governments contributed significant amounts (minimum of 15% of total investment) to newly-introduced technologies."

The relevance of the problem statement; the clarity, relevance and practicality of the project objectives; the availability and allocation and expenditure pattern of resources; and the success of PEESS in meeting its stated objectives are among the topics discussed in the next section of this report.

# 4. FINDINGS AND CONCLUSIONS

## 4.1 Project Concept and Design

### *4.1.1 Project Document*

***Problem definition.*** The project document defined the problems to be addressed by the project reasonably clearly. However, it was misleading to state that social service infrastructure had broken down "*because* of high consumption of non-renewable energy resources." Highly inefficient energy consumption is more of a symptom of complex social and economic changes over the past decade than a cause. High levels of non-renewable energy use can be considered rational in a cold country with huge resources of coal. The immediate issue is very poor efficiency in fossil fuel use, not the need for its replacement through the large-scale introduction of renewable alternatives. This may seem like a minor point (since renewable energy is a small component of PEESS) but it may in part have led to PEESS resources being spread too widely over both energy efficiency (SBB construction and renovation) and renewable energy (solar energy initiatives), activities which require somewhat different skills.

***PEESS strategy***. The project strategy is covered in some detail in the 1997 project document (pp. 10-14). It includes an overall 'strategic framework' and four 'operational strategies'. The framework is an integrated approach to energy as a catalyst for social services development involving improved local capacity, improved central and local policies for decentralised efficient energy technologies, and the promotion of these technologies. The overall strategy is based on accelerated introduction of new technologies on a large enough scale for a noticeable impact and market development, with careful selection of sites.[12] The operational strategies are:

i) mobilising community initiatives (i.e. a fundamentally participatory approach involving the communities in up to ten Aimags and using local workforces);
ii) human resources development (a wide range of hands-on technical and possibly business training);
iii) advocacy, information and resource mobilisation (workshops on energy – especially heating – issues, widespread information dissemination, resource mobilisation for continuation of activities under the GoM and establishment of funding to finance soum-level activities and micro-finance credit for the poor); and finally
iv) technology development (improvements to straw bale compaction, straw-bale buildings and windows, heating stoves, and possibly PV components such as controllers).

The strategies are articulated better than those of many project documents but the approach is extremely ambitious and covers a very broad range of required skills and experience. It is not clear that a single relatively small project can deal effectively with all of the issues or that the available financial resources were sufficient.

***Clarity of project objectives***. Recall that the project objectives are to: 1) reduce energy consumption and $CO_2$ emissions in the social service and *housing* sector; 2) demonstrate the use of energy-efficient technologies in the social service, *housing* and *agricultural* sector (for extended food production); 3) develop in-country capacities to build super-insulated buildings, refurbish existing ones, erect greenhouses, install and maintain PV systems; and 4) create an enabling

[12] For example straw-bale buildings are to be demonstrated where straw is abundant and solar photovoltaic electricity only where there is no electric grid or no extensions expected "in the foreseeable future."

environment through streamlined government approval procedures and public awareness programs. (The emphases – *in italics* – have been added).

PEESS has been criticised as being too 'technology driven': its real core emphasis is on a very particular technology, i.e. 'super-insulated' straw-bale buildings, rather than on the ultimate objective of providing energy efficient social services by whatever interventions, policy or technical, are most appropriate. The *de facto* objective seems to be the design and construction of SBBs. This seems to be apparent from the skills of staff (i.e. civil engineering[13] not energy-efficiency or the provision of social services) and budget allocations[14] (i.e. a heavy emphasis on straw-bale training, design, standards, and construction). The concern is legitimate; PEESS was clearly conceived as *an SBB project to improve energy efficiency and social services*, not as a project designed to improve these services but neutral regarding the choice of technology.

Nonetheless, the focus on SBBs is appropriate; it focuses PEESS efforts mainly in a specific and relatively neglected area / technology which could have a very significant impact on the target populations. A broader energy-efficiency-for-social-services project probably would not have such an impact.[15]

However, the efforts to improve social services and to promote straw-bale building technologies simultaneously have probably resulted in some of the inadequate linkages among objectives, inputs, activities, and expected results which are discussed below. In addition, dealing with the social services, housing and agricultural sectors (as clearly specified in the objectives above) would have spread project resources far too thinly. Appropriately, PEESS has not dealt with housing and has attempted little (a few greenhouses) within agriculture.[16]

***Project linkages***. The problem definition and strategies of the original 1997 project document were retained in the 1999 revision. However objectives, inputs, activities, outputs, and expected outcomes were all changed following the addition of substantial financial resources and based on the experiences of two years of implementation. The linkages among these elements are generally clearly described. PEESS has fifteen outputs to reach its four objectives. Many of these are satisfactorily developed. For about half of them (seven), however, the linkages are somewhat unclear or inadequate:

- Output 1.3 (regional demonstration training centres and inspection units) assumed that a single complex could be used for demonstration, training, inspections, etc. and simultaneously for social services such as health clinics or primary schools. This was not at all practical and would have undermined the social service objective. It was subsequently dropped.
- Outputs 2.1 (approximately 40 remote PV installations) and 2.2 (proven reliability of PVs) considerably underestimated the financial and technical resources which are necessary for reliable and sustainable provision of energy services to rural communities through renewable energy technologies. There is extensive experience globally which shows that successful

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[13] There are nine professional or technical staff positions including the national UNVs. Of these, seven are held by civil or construction engineers. The others are a mining engineer and a land-use planner.

[14] Expenditure thus far to specifically measure the relative energy efficiency of straw-bale versus standard buildings is only 0.3% of the PEESS budget. Expenditure on SBBs (including training, study tours, design, standards and construction) is well over 60%.

[15] In addition, this is an appropriate niche for UNDP. Numerous technical assistance agencies are willing to provide assistance in the broader area of energy efficiency, although not specifically aimed at small buildings.

[16] The TOR ask "what opportunities, if any, are being lost by limiting the target to social service buildings?" Limiting the scope mainly to social services has improved the project by focussing efforts which could otherwise be dissipated. It has been appropriate to attempt to establish solid foundations for public clinics, etc. before delving into private housing and financial mechanisms for housing finance.

photovoltaic (and other small renewable energy) programmes are very time and skill intensive and cannot be treated, as the project document does, as simple 'add-ons'.

- Output 2.4 (25 low-cost greenhouses for extended food production). As for PVs, the project design may have underestimated the resources and skills needed to develop low-cost straw-bale greenhouses and demonstrate increased food production. Unlike SBB clinics or kindergartens, there was apparently no prior information or experience suggesting economic viability. There was no input from an agricultural expert or agronomist (who might have provided estimates of the quantity and value of food production from an SBB compared to a conventional greenhouse) or any clear end-of-project expectations.
- Output 2.5 (other renewable energy-efficient technology applications) apparently assumed that renewable energy technologies provide the solutions for inexpensively addressing energy efficiency in Mongolian public service buildings. Some of the specific activities are appropriate but the output is not clearly developed. It is similar to numerous donor-initiated energy demonstrations of the 1980s where inputs and activities were not clearly linked to practical needs and outcomes were speculative.
- Output 3.5 (energy-efficient construction technologies in university curriculum) is a useful, though time-consuming and resource intensive, output. However there is no link to *any* resource allocation in the project document.
- Output 4.2 (increased public awareness) is a catch-all of workshops and campaigns with poorly developed expectations. A good public awareness campaign requires significant resources (time, staff and funds) which the project design does not seem to adequately provide.

It is questionable that this project could really effectively address two areas in which it was expected to make an impact: 'receding forests due to fuel demand for heating purposes', and 'low quality of life due to unbalanced food habits.' It is not clear that cooking with wood is the major cause of deforestation in Mongolia and the PEESS greenhouse approach is unlikely to improve nutrition.

***Implementation and management***. Both the 1997 project document and the 1999 revision clearly describe the implementation and management arrangements. The original executing and implementation agencies were inappropriate and these were changed in early 1999.

***Indicators***. Practical indicators for use in project monitoring and evaluation are seldom well developed within project documents. Often the indicators are not measurable in either a quantitative or qualitative manner. As shown in Table 2, for PEESS most indicators are adequate but some could be reformulated and improved.

**Table 1: Appropriateness of PEESS Indicators for Achieving Immediate Objectives**

| Immediate Objectives | Indicators | Comment on Indicator |
|---|---|---|
| Objective 1: To reduce energy consumption and $CO_2$ emissions in the social service and housing sector. | 1. Reduction in fuel consumption in social service buildings by 50%<br>2. Improved access of rural poor to social services | 1. Good indicator; in principle this is easily quantifiable<br>2. OK; measurable by improved access to kindergartens, clinics, etc. |
| Objective 2: To demonstrate the use of energy-efficient technologies in the social service, housing and agricultural sector (for extended food production). | 1. Introduction of at least 10 energy efficient technologies<br>2. Testing and proof of reliability of new technologies<br>3. Increase in food production | 1. OK; easy to quantify<br>2. Vague. What constitutes 'proof of reliability'? Prodoc specifies "95% of SBBs in good condition at project end."<br>3. Output is easy to quantify. A specific output per greenhouse indicator might be appropriate. * |

*Note:* Table is continued on next page

**Table 1: Appropriateness of PEESS Indicators (continued)**

| Immediate Objectives | Indicators | Comment on Indicator |
|---|---|---|
| Objective 3: To develop in-country capacities to build super-insulated buildings, refurbish existing ones, erect greenhouses, install and maintain PV systems. | 1. Training of at least 400 people to design and build SBBs.<br>2. Improved quality and safety of straw-bale buildings<br>*3. No indicator provided for greenhouses or PV systems* | 1. OK but better if design & training were separated, and approximate number of training-days for each included.<br>2. Perhaps "improved … as indicated by adoption & approval of standards" ?<br>3. For GH & PVs, an appropriate indicator could be 80% of PEESS demonstrations are functioning by the end of the project." ** |
| Objective 4: To create an enabling environment through streamlined government approval procedures and public awareness programs. | 1. Streamlined government approval procedures for EE technologies<br>2. Increased awareness and demand for SBB & EE technologies | 1. OK; no comment<br>2. "Increased awareness and demand" are hard to quantify or estimate qualitatively and it is not clear how awareness creates an enabling environment. *** |

*Notes:* * *If* more greenhouses are built under PEESS, perhaps a Mongolian agronomist could advise on an appropriate output per $m^2$ of greenhouse area and be hired to evaluate production from all greenhouses near Ulaanbaatar.

** Barring vandalism, greenhouses and PV systems with even modest levels of maintenance should last well beyond the end of PEESS.

*** It is probably not worthwhile addressing this as awareness surveys can be expensive and are not very reliable.

### *4.1.2 Project Relevance*

PEESS addresses key development needs and priorities of Mongolia as expressed in various government policy statements both four years ago, when the project was designed, and today following recent national elections. It has a strong emphasis on capacity development, is highly relevant to two key areas of UNDP's thematic focus (poverty eradication and sustainable livelihoods; environmental and natural resource sustainability) and was designed to strengthen the capacities of relevant government agencies (MID & ACA, soums), private sector entities (designers, builders) and NGOs (ADRA,[17] Raleigh) to initiate and sustain relevant initiatives. Although PEESS does capitalise on UNDP's expertise and experience in capacity development, it has a sizeable construction component which is not normally a UNDP priority or usually considered a UNDP strength.[18]

The project design is highly relevant to the needs of beneficiaries, examples being:

- public service building users (who suffer from severe winter cold in poorly designed buildings and from inadequate budgets for meeting both heating and other critical needs);
- designers (who lack skills in designing energy-efficient buildings, whether from SB techniques or in general);
- officials (who require adequate and safe standards and norms for SB buildings and energy efficiency within buildings; who require new inspection skills for SB building techniques);
- builders (whose construction skills are weak in general, for SB buildings in particular).

The project design is gender sensitive, specifying several measures to directly involve a high percentage of women as participants and as beneficiaries. It is not clear to what extent direct beneficiaries participated in project design as those who drafted the project document are no longer

[17] It is likely that ADRA staff strengthened PEESS capacities rather than vice-versa.

[18] PEESS's April 2000 *Annual Project Report* shows 48 separate contracts issued in 31 months (May 1997–Jan 2000) totalling US$600,000 in value. 28 of these were for SBB construction or building renovations, at an average cost of $15,000 per contract. It is fair to say that in practice UNDP procedures are not ideal for processing lots of construction contracts quickly. Consequently, project staff have spent a considerable amount of time in contracting-related processes.

in Mongolia. However, several interviews suggest that the document was probably written mainly by UNDP staff with limited consultations, except perhaps with the central government. It seems likely that wider consultations would have resulted in different execution and implementation arrangements during the first two years of the project.

## 4.2 Project Implementation

### *4.2.1 Efficiency and effectiveness*

The external funds available from UNDP and the Government of Norway for PEESS total US$2,072,535, of which nearly 84% is Norwegian cost-sharing. The GoM has contributed office space and other non-cash inputs. Table 2 shows the current approved budget (16 June 2000) with actual expenditure through 1999 and planned expenditure for 2000 through 2002. This year, project delivery has been less than planned as informal revised October estimates[19] indicate.

**Table 2: PEESS Actual and Expected Expenditure (US$ thousands); 1997 - 2002**

| **Year** | **1997** (6 m) | **1998** | **1999** | **2000** | **2001** | **2002** (10 m) | **Total or average** |
|---|---|---|---|---|---|---|---|
| Total Budget (Rev. M of June 2000) | 121 | 175 | 540 | 739 | 342 | 103 | 2002 |
| Total Budget (Estimate of Oct. 2000) | 121 | 175 | 540 | 579 | 430 | 175 | 2002 |
| Average spending rate ($ thousands / month) | 20 | 15 | 45 | 48 | 36 | 18 | 31 |

*Notes:* 1) The total of $2.02 million excludes certain overheads
2) PEESS was due for completion at the end of April 2002 but this was recently extended through October.
3) Revised October estimate is approximate. It is based on discussions with PEESS staff. Year 2000 under-expenditure is assumed to be allocated equally by quarter over the remainder of the project.

As Table 2 shows, by the end of 2000 (2/3 through currently expected project duration), PEESS will have spent 70% of available funds. The average rate of expenditure, shown in the bottom row, has been increasing from 1997/98 to 1999/2000 and then declines. Although this is no measure of efficiency or effectiveness, it indicates that the project seems to be spending funds at a reasonable rate. Normally this sort of expenditure pattern would be no cause for concern. However, in 2001 PEESS is in effect expected to be combined with the new *Energy Efficient Housing* (EEH) project. The planned combined PEESS/EEH expenditure rate for 2001 (shown later in Table 5) is nearly double that of 1999/2000, which raises some planning and management issues that are discussed below.

***Accomplishments and targets***. This evaluation has not included a detailed assessment of the effectiveness of resource allocation (financial or technical). However, Table 3 on the next page summarises, to the extent possible in a short (and possibly misleading) table, some PEESS accomplishments thus far compared to targets.

[19] The revised October 2000 estimate is approximate. Discussions with PEESS staff suggest under-expenditure during 2000 of about $160,000. This has been arbitrarily allocated equally by month over the remainder of the project, i.e. 55% carried forward to 2001 (12 months) and 45% to 2002 (10 months).

**Table 3: PEESS Planned and Actual Outputs 1997 through 2000** (page 1 of 2)

| Expected PEESS Outputs: 1997 - 2003 | Actual Outputs 1997-99 | Outputs During 2000 | | Actual Outputs by end of 2000 | Expected Outputs by end of 2000 | Comments |
|---|---|---|---|---|---|---|
| Information in this column is taken from the 1999 revised prodoc | Apr 2000 APR | Planned | Actual | Draft Oct. 2000 Semi-APR | If 72% of total PEESS goal is met | In previous column, 72% used as PEESS is 72% complete at end of December 2000 |
| **Research** | | | | | | |
| Confirm SBB energy savings | none | study | poor draft | Inadequate studies | – | Hoped to demonstrate 50% SBB energy savings |
| Demonstrate PV reliability | | as above | | | | Requires a separate study but unlikely to confirm much |
| Assess greenhouses | none | survey | ? | ? | – | Survey planned in late 2000, too late to measure actual food output during summer growing season. |
| Reliability tested efficient stoves | none | none | none | none | – | Some related work underway by WB/GEF project |
| Studies on insulation alternatives | Complete; ADRA | none | none | complete | complete | Simple but useful reports |
| **Demonstrations** | | | | | | |
| 26 SB social service buildings | 18 | 8-12 | 12 | 30 | 19 | Total planned will be exceeded; 8 more planned |
| 22 energy efficient retrofit buildings | 5 | 10-15 | 11 | 16 | 16 | Numbers are on target; 7-8 planned for 2001 |
| 5 regional SB training centres | 0 | 0 | 0 | 0 | 4 | Now planned under MON/99/G35 |
| 40 PV installations | 8 | 10-12 | probably 0 | 8 | 29 | Only 1/3 of 2000 target reached (which is appropriate!) |
| 25 low-cost SB greenhouses | 5 | 10-15 | 11 | 16 | 18 | 90% of 2000 target reached but ***not*** 'low-cost' |
| 10 misc. renewable EE demos. | 0 | 0 | 0 | 0 | 0 | Insulating curtains tried in 2 SBBs |
| **Public Information** | | | | | | |
| Wide range of workshops | numerous | 2 seminars | 1 national; 2-3 Aimag | numerous | various | Hard to summarise in a short table |
| **Partnerships** | | | | | | |
| 100 million Tg from GoM by 2003 | none | none | | none | ?? | Unlikely considering GoM budget constraints |
| 15% SBB & RF costs from 30 Aimags | none? | 15%? | 15%? | – | – | 2000 contributions *for retrofits only*; 0% for SBBs |

**Table 3: PEESS Planned and Actual Outputs 1997 through 2000** (continued; page 2 of 2)

| Expected PEESS Outputs: 1997 - 2003 | Actual Outputs 1997-99 | Outputs During 2000 | | Actual Outputs by end of 2000 | Expected Outputs by end of 2000 | Comments |
|---|---|---|---|---|---|---|
| Information in this column is taken from the 1999 revised prodoc | Apr 2000 APR | Planned | Actual | Draft Oct. 2000 Semi-APR | If 72% of total PEEES goal is met | In previous column, 72% used as PEESS is 72% complete at end of December 2000 |
| **Standards** | | | | | | |
| Windows & doors designed/tested, etc | designs completed | no new activities | | designs completed | designs completed | No work on doors; no actual testing |
| SB house design competition | none | √ | not done | none | – | |
| Streamlined GoM approval procedures | attempts made? | ? | ? | See note 5 below | See note 5 below | Standards are under development |
| SBB specifications (clinic; kindergarten) | See note 3 | √ | √ | complete | | Erdenet, completed May 2000 |
| **Training** | | | | | | |
| Evaluation of 1997-99 training | not applicable | planned | none | Not done | 97-99 training evaluated | Evaluations should be routine |
| 400 trained (50% women) See note 4 | 594 | ? | 199 trainees | 793 | 288 would be trained | By Sept 2000, 28% were women (women-days =30%) |
| University curricula | none? | needs assessment | not done | none | Assessment and some curricula developed | Shifted to new project MON/99/G35 |
| University course design | none? | none | none | none none | none | As above |

*Notes*: 1) RF = building retrofits; APR = PEESS Annual Project Report; Semi-APR = Semi-Annual Project Report.

2) Expected outputs during 2000 from Jan-Dec 2000 draft PEESS workplan; Actual outputs during 2000 from rough draft Oct 2000 Semi-APR.

3) Drawings / standards done prior to 2000 not appropriate and new contracts issued in 2000.

4) Trainee breakdown (by end Sept. 2000): 473 in SBB, 188 in misc seminars (including SBBs), 46 in straw baling, 44 in greenhouses, 32 in windows & 10 in retrofits.

5) National norms and standards for SBB technologies are under development and are expected to be completed by mid 2001.

***Explanatory Note on Project Targets.*** The targets shown in column 1 of Table 3 (see 'Demonstrations' on the previous page) are those which are clearly shown in the revised Project Document of 1999 and therefore used by the evaluation team. However, project staff understood informally from UNDP staff (no longer in Mongolia) that these targets were meant to exclude all of those already completed during 1997 and 1998. In this case, the apparent targets would be as follows: ***SBBs*** 26 targeted + 8 completed = 34; ***RFs*** 22 + 2 = 24; ***PVs*** 40 + 6 = 46; and ***Greenhouses*** 25 +2 = 27.

However, as noted above, an evaluation should be based on the signed agreement, not subsequent differing interpretations.

Table 3 provides information on the quantity of various outputs by late 2000, two-thirds through the project's duration. Of course these raw numbers provide no guidance on the quality or suitability of what was produced:

- *SBBs*. New SBB constructions have arguably[20] already exceeded the planned quantity for the entire project by 15% and may exceed its overall target by 40%;
- *Retrofits*. 'Retrofit' buildings, i.e. those renovated for improved energy efficiency, are proceeding on target, with about 70% of all planned renovations for the entire project now complete;
- *Greenhouses*. Low-cost SBB greenhouse are 90% on target in terms of numbers. However, they are not low-cost and there are serious doubts regarding their cost effectiveness;
- *PV*. Numbers of photovoltaic lighting installations are well below expectations. Only 20% of the 40 systems planned by the end of PEESS have been installed, i.e. only a third of expected completions at this stage in the project's life. Under-expenditure, however, is no cause for concern as the justification for PEESS involvement in PVs needs serious reconsideration;
- *Other demonstrations*. For other miscellaneous, mostly renewable, energy efficiency demonstrations (ten planned during the project) almost nothing has been done;
- *Energy centres.* Five dual-purpose energy centres / social service SBBs (clinics, kindergartens, etc.) were to be constructed by the end of the project. PEESS correctly concluded that this was impractical (the buildings cannot serve both purposes effectively) and the centres have been dropped from PEESS for consideration under the upcoming GEF *Energy Efficient Housing* project;
- *Training*. The total numbers trained[21] (793) is nearly double the plans for the entire project (400). However, if the target is understood to be those trained in SB techniques (473), the target has been exceeded by 18%. There have been nearly 40 separate seminars and hands-on courses extending over nearly 9,100 'trainee-days'. 28% of trainees (and 30% of trainee-days) have been women, considerably less than the 50% target but probably not unreasonable for design and construction-related activities; and
- *Training evaluations*. The 1999 revised project document clearly specifies an evaluation of 1997/98 training but this was never carried out. Although the evaluation team reviewed several examples of course outlines and training materials, we were unable to find any evaluations of courses by either trainees or trainers. Training materials appear to be of generally acceptable quality. However, it is not possible to judge the quality or relevance of the training carried out. There is no formal follow-up so it is not known how many trainees (of either sex) have since used the training, although the required information is apparently available within PEESS.

There are other areas in which even the limited information of Table 3 raises some questions:

- *Energy savings*. PEESS is fundamentally concerned with energy savings in buildings yet there is no consistent, hard, reliable data on the actual savings of SBBs compared to conventional wood or brick buildings, just considerable anecdotal evidence;[22]

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[20] The numbers are based on those of the project document, not the expanded targets shown in the final note to Table 3. PEESS is jointly financing 8 new SBBs in 2001/2002 which will be built by Raleigh International.

[21] There is some double-counting as an unknown number of trainees have participated in several or more training opportunities.

[22] PEESS is well aware of this and hired an engineering consultant to carry out detailed measurements during the 1999 winter but results have been disappointing. The project is also currently (October 2000) analysing energy-use questionnaires sent to about 18 SBB users.

- *Heating stoves*. The main energy demand for Mongolian buildings (those not connected to a district heating system) is for heating. However, PEESS has not determined which types of boilers and heaters are most suitable for SBBs and other buildings;[23]
- *Other research*. Similarly, there has been no serious assessment of the energy or cost effectiveness of PEESS-supported photovoltaic lighting or greenhouses. Information on the energy savings and cost effectiveness of different components of an SBB (straw insulation, window size and design, door design and seals, insulating curtains, etc.) is also meagre. Although a draft research programme was prepared in 1999, its implementation has been slow and is overdue;
- *Standards*. PEESS has gone through several cycles of trying to develop suitable standards for various types of SBBs with some designs being 'overspecified' and others 'underspecified' (i.e. basically accepting earlier ADRA designs). This was resolved through the choice of competent consultants but remains a controversial area with a wide range of opinions. PEESS is wrestling with the complex set of issues required to produce designs which are practical, safe, meet government norms and are still affordable. Although not completely resolved, PEESS is aware of the tradeoffs and is making acceptable progress;
- *Public information*. The team briefly reviewed examples of information produced by the project (brochures, newspaper articles, videos, etc.) and most seem to be of acceptable quality although we are unable to judge its impact or effectiveness. There have been numerous activities, seminars, media events, newspaper articles, etc. but no attractive, informative and practical brochures are available for distribution to the public or others despite the objective of widespread replication of SBBs and other energy-saving techniques;
- *Partnerships and SBB replication*. PEESS has developed working relationships with other organisations (i.e. ADRA; Raleigh International) which have allowed project resources to support, with others, additional training, some limited research and some expansion of SBB construction. Overall there are only about 80 SBBs in Mongolia of which 30 have been built or supported by PEESS. There is little sign of forthcoming wide-scale replication. There has been no progress toward the project document's goal of 100 million Tg in cash contributions by the GoM for SBB replication. However, due to hard work by PEESS, a number of Aimags have contributed about 15% of the cost of building renovations undertaken by the project during 2000, the first such local government input.

***Summary***. In general, PEESS has been efficient and effective in meeting, and arguably exceeding, the project document targets for SBB construction. This has been due to dedication and hard work by the project staff.[24] Where these physical targets have not been met (PVs, demonstration centres, miscellaneous efficiency demonstrations), the decision to proceed slowly has been justified and allows the release of unspent funds for more effective uses. The project has clearly put considerable effort into training, where targets have already been exceeded. An informal review of course descriptions and materials, mostly in Mongolian, suggests that quality is generally good although uneven. However, insufficient effort has gone into evaluating training effectiveness through evaluations and follow-up surveys of trainees. A key area where PEESS has been less than successful is in demonstrating the actual energy savings of its interventions. Without well-documented studies of the energy savings and life-time cost effectiveness of SBBs (and retrofits), decision makers lack the necessary information to justify investing their own or GoM funds in energy efficient buildings.

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[23] Although 'tested reliability of procured energy efficient stoves' is one of the success criteria of objective 1, there is no corresponding activity in the 1999 revised project document, presumably an oversight.

[24] With the exception of training and other inputs from ADRA, this has been done almost entirely with Mongolian companies and local expertise.

### *4.2.2 Management*

***Execution and implementation***. As noted earlier, the executing and implementing agencies from May 1997 to April 1999 were the National Council for Sustainable Development (NCSD) and the GoM's MAP-21 Unit, respectively. However, the GoM, UNDP and project staff realised the desirability of working directly with the government entities responsible for designing buildings, developing standards and inspection. Execution and implementation were shifted to the Policy Implementation and Coordination Department of the Ministry of Infrastructure Development (MID) and the Agency for Construction and Architecture (ACA), respectively. These arrangements are appropriate and have been reasonably effective. There is close and regular interchange between PEESS and ACA staff. However, the GoM provides no financial support to ACA for its implementing role so implementation has been a drain on its own limited financial and personnel resources. Understandably, ACA is undoubtedly less active than it would be if more GoM support were available.

***Project management***. PEESS has a relatively small project office headed by a National Project Coordinator (NPC) who manages one Construction Engineer, one Technical Adviser, five national United Nations Volunteers (national UNVs) who are located in five Aimags, and several support staff/drivers. He is assisted by one International Adviser (IA). In many nationally-executed (NEX) projects,[25] the NPC plays a subordinate role to an expatriate adviser who acts as a *de facto* project manager. This is not the case for PEESS where the NPC clearly has the decisive leadership role. He is committed and dedicated to the project and its goals. Regarding other management issues:

- ***Overall.*** Overall, PEESS staff seem to be hard-working, committed and for the most part well-motivated. There was a period of some internal discord which seems to have improved considerably in the past year.
- ***The adviser***. The IA has been an effective and supportive adviser, introducing a good planning and reporting system, a range of useful ideas for project activities, a critical – in the positive sense – approach to SBBs, and access to useful global information on SB techniques. He has also displayed good fund-raising skills.
- ***UNVs***. The five UNVs are scattered over a large geographical area where communications and facilities are poor, presenting considerable management difficulties. It is especially important that these dispersed staff understand their functions clearly and are required to submit regular written reports to their supervisor on activities, opportunities and problems faced. During the winter months, when there are no construction activities to supervise or inspect, the UNVs should have a clear work programme of training, monitoring and other activities (with specific goals, priorities and a timetable). It is clear from the team's discussions that the UNVs do not have their own workplans, do not consistently report to the NPC, are apparently not used effectively year-round and at least some do not even work full-time for the project.
- ***Relationship with UNDP***. PEESS staff have the usual complaints regarding UNDP (e.g. UNDP is too slow in approving and dispersing funds; the contract approval process is unnecessarily bureaucratic) but the relationship seems to be reasonably effective.
- ***Monitoring***. Overall, monitoring is uneven. PEESS remains up-to-date on the progress and quality of most key activities, but there are two notable exceptions: i) the training component, which would benefit from a regular evaluation mechanism; and ii) inspection and monitoring of contractors during SBB construction, which seems to have adversely affected building quality in many sites.
- ***Reporting***. Reporting is up-to-date and comprehensive with an easily understandable style, except possibly for reporting of UNV activities. The project's formal reports appear to include honest assessments of shortcomings as well as achievements.

[25] This refers to projects in other countries; the team is not familiar with the arrangements within other NEX projects in Mongolia.

- ***The Steering Committee***. PEESS is guided by a National Steering Committee. The role of the NSC seems to be primarily to approve the draft list of sites for proposed SBB constructions and retrofits[26] rather than advising on key issues or future directions. One NSC member declined to be interviewed by the evaluation team saying that he knew almost nothing about the project. There appears to be no planning input from direct beneficiaries. There also appears to be no input from those with financial or business expertise, i.e. people who could advise on mechanisms or approaches for sustainability after the project ends.

***Future management concerns***. The real management concerns for PEESS are those of the future. As Table 4 shows, there will be a significant increase in management requirements by early 2001 when PEESS (in effect) combines with the new *Energy Efficient Housing* project.

**Table 4: Staffing (work-months) for PEESS and EEH, January 2001 - June 2003**
(Assumes that PEESS finishes end October 2002; EEH finishes end June 2003)

| Staff, Advisers and Consultants | 2000 | 2001 | 2002 | 2003 | Comments |
|---|---|---|---|---|---|
| **Provision of Energy efficient Social Services (PEESS; MON/97/301):** | | | | | |
| Nat Proj Coordinator (NPC) | 12 | 12 | 10 | | Full time until end of PEESS |
| International Adviser (IA) | 6 | 0 | 0 | | 50% time during 2000 only |
| Technical Adviser (TA) | 12 | 12 | 10 | | Full time until end of PEESS |
| Construction Engineer (CE) | 12 | 12 | 10 | | Full time until end of PEESS |
| National UNVs (5) | 60 | 60 | 50 | | All full time until end of PEESS at 5 Aimags |
| National consultants (unspecified work) | 9 | 6 | 3 | | Possibly construction engineer and/or energy use specialist |
| **Energy Efficient Housing (EEH; MON/99/G35):** | | | | | |
| National Project Coordinator (NPC) | | 0 | 8 | 6 | *Assumed* 14 months (for full-time NPC for combined activities of PEESS plus EEH) |
| International Adviser | | 6 | 4 | 2 | Average 40% time 2000 - June 2003 |
| Int'l Civil Engineer | | 3 | 3 | 0 | 6 months during EEH |
| Int'l Financial Advisor | | 2 | 1 | 0 | 3 months during EEH |
| Int'l Curriculum Adviser | | 0 | 1.5 | 1 | 2.5 months during EEH |
| Int'l UNV (one) | | 12 | 12 | 0 | 2 years only |
| National Energy Engineer | | 12 | 12 | 6 | Full time throughout EEH |
| National Business Advisor | | 12 | 12 | 6 | Full time throughout EEH |
| Energy Conservation Center Directors (six nat. UNVs) | | 48 | 72 | 24 | Two years each: probably Ulaanbaatar plus five Aimags |
| National Financial Advisor | | 12 | 12 | 6 | Full time throughout EEH |
| National Curriculum Developer | | 6 | 6 | 0 | 12 months total |
| ***Total work-months*** | ***111*** | ***215*** | ***231.5*** | ***51*** | PEESS and EEH *combined* work-months |
| People supervised by NPC | 8 | 21 | 22 | 11 | Numbers of individuals, not work-months; This e*xcludes* all support staff |

*Notes:* 1) PEESS is from Budget Revision 'M' of June 2000 (except IA reduced by 1 work-month).
2) EEH is from draft project document Rev 7, October 2000 (shifted to January 2000 inception) except it is assumed that the NPC position will continue throughout project so 14 work-months have been added.

[26] This is quite explicit in the minutes of the February 2000 Steering Committee meeting.

From Table 4 it can be seen that the NPC currently supervises 8 staff (excluding support staff) of whom five work in the field and for the most part manage their own work schedules. By 2001, this will nearly *triple* to twenty-one staff and consultants, half of whom are field-based. Table 5 indicates that the combined PEESS/EEH cash-flow in 2001 will be nearly double that of 1999 and 2000 (shown in Table 2, page 13). Although annual expenditures are only indicative, they do indicate that PEESS/EEH will require considerably more management, budgeting and planning efforts and general project coordination efforts by early next year. *This appears to be an excessive burden to impose on the NPC, particularly when the budget (within EEH) for the International Adviser provides for only 1/3 of his or her time to PEESS/EEH over the remaining life of the combined projects.*

**Table 5: Approximate Budget for PEESS and EEH, Jan. 2001 - June 2003 ($ thousands)**
(Assumes PEESS finishes end April 2002; EEH finishes end June 2003)

| Budget Allocation | 2000 | 2001 | 2002 | 2003 | Comments |
|---|---|---|---|---|---|
| PEESS Budget Rev M | 739 | 342 | 103 | 0 | June 2000 budget revision |
| Adjustment | -160 | +88 | +72 | 0 | $150,000 carried forward from year 2000 |
| PEESS Total | 579 | 430 | 175 | 0 | UNDP & Norwegian input only |
| EEH budget from GEF | 0 | 377 | 240 | 108 | |
| EEH Budget from Norway | 0 | 272 | 265 | 63 | |
| EEH total (prodoc Rev 7) | 0 | 649 | 505 | 171 | GEF & Norwegian input only |
| ***Total for PEESS plus EEH*** | ***579*** | ***1079*** | ***680*** | ***171*** | |

*Notes:* 1) PEESS from Budget Revision 'M' of June 2000, assuming $150,000 for 2000 is carried forward.
2) EEH is from draft project document, working draft of Rev 7, Oct. '00 (but assuming Jan. 2000 inception.

### *4.2.3 Some areas of potential success and potential shortcomings*

The results achieved by PEESS thus far suggest the following areas of *potential* success by the end of the project:

- PEESS will probably have completed a range of reasonable standards for various SBBs which have been endorsed by the GoM;
- The GoM will have accepted SBBs and retrofits as appropriate, acceptable and approved techniques for public service buildings;
- Improved standards will have designed, tested and manufactured for windows and doors;
- Close to 1,000 people will have received on-the-job, hands-on training in a range of SBB design and construction techniques, standards, straw baling, energy-efficient retrofitting, etc. thus providing a solid core of trained people for potential future employment;
- Building companies will have improved capacity to construct SBBs;
- Nearly 40 SBBs for social services will have been built and demonstrated plus more than twenty buildings renovated with increased energy efficiency;
- PEESS will probably have demonstrated that SBBs are safe, comfortable and possibly cheaper to build than comparable quality buildings;

- Well over 100,000 Mongolians will have directly benefited from PEESS investments in SBB social service buildings and retrofits;[27]
- Local Aimag funds will have been allocated toward the cost of retrofitted offices or other public buildings; and
- Approximate energy and life-time cost savings attributable to SBBs and retrofit technologies will have been demonstrated and publicised.

The results thus far suggest the following areas of *potential* shortcomings of the project:

- The perception of SBBs among the public and some GoM officials may be that of expensive and unsafe (fire-prone) buildings meant mainly for low-income people;
- Continuing problems of quality of construction and maintenance (and associated problems with vermin) may exacerbate perceptions that SBBs may not be good investments.
- PEESS may have demonstrated that photovoltaics appear to be a costly and unreliable method of providing small amounts of electricity;[28]
- PEESS will probably have demonstrated that SB greenhouses are an extremely expensive means of producing a small amount of additional food;
- The GoM will probably not have allocated an appreciable amount of its own funds for future construction and maintenance of SBBs for social services.
- PEESS may not have actually demonstrated, with good data and technically acceptable methodologies, the actual energy savings of SBBs or retrofitted buildings.
- There is unlikely to be a large-scale programme of replication of social service SBBs in the public sector in Mongolia;
- Many people may have been trained in useful SBB and other techniques but few may find long-term employment using these skills;
- Other useful non-SBB techniques for cost-effective energy savings in buildings may not have been effectively demonstrated; and
- There may be management and planning bottlenecks during the final 24 months of PEESS unless means are found to bolster management.

## 4.3 Project Results

### *4.3.1 Indicators of success in capacity development*

Table 1 (on pages 11-12) shows the indicators of success for PEESS with several suggestions for modifying these indicators. In general, they are reasonable. Earlier sections of this report have indicated various ways in which PEESS has contributed to capacity development through an extensive programme of training. This has included builders; GoM officials responsible for building norms, designs and standards; and many rural people in the Aimags where the SBBs have been built. Project staff have consistently stressed their desire to maximise women trainees. Women have, as noted previously, amounted to 28% of individuals trained and 30% of trainee-days.

[27] This is an estimate based on 40 buildings each serving an average of 2500 people.

[28] In fact, PVs can be cost-effective if they are well planned and implemented.

PEESS has had no impact on improving GoM organisational structures, partly because the original executing and implementing mechanisms were inappropriate and partly because the current executing and implementing organisations are going through a period of reorganisation for reasons external to the project. In addition, there was no explicit broad reorganisational objective, just improved skills development within appropriate departments and ministries of the GoM.

Capacity development through project assistance is generally difficult to assess but even modest efforts can sometimes be effective. For example, a recent (September 2000) study tour to North America, which was very successfully organised at reasonable cost by the IA, has exposed several key GoM officials to ideas, approaches and techniques which may well result in more appropriate SBB standards for Mongolia. Study tours are often notoriously ineffective for knowledge and capacity development but this appears to be an exception.

### *4.3.2 Factors in Project Success*

The following factors affect the chances for project success:

- ***Project management and staff***. Project management has been adequate and staff are largely competent and skilled. However, management demands will increase dramatically during 2001 and this needs to be addressed. Even though PEESS has a preponderance of civil engineers (mostly national UNVs), it lacks sufficient construction engineering capacity for effective regular (i.e. daily) inspection during construction. This has affected the quality, and thus also the image, of SBBs.
- ***General state of the Mongolian construction industry***. The Mongolian construction industry is plagued by poor techniques and shoddy construction in general. It is difficult to improve the quality of a particular type of building (SBBs) in a context where the industry overall is performing poorly. Some of the issues regarding SBB quality are due not to SBB designs but rather the broader problems of construction quality in general. The project can do little to address this.
- ***Government commitment to the project***. Mongolia is undergoing rapid social and economic change. The GoM has numerous serious issues to deal with and is probably not highly committed to this one relatively small assistance project. However, there are indications that the GoM may begin to consider addressing the issues of poor service and high subsidies for energy (both electricity and heating). This would improve the incentives for local government bodies and individuals to take energy costs far more seriously. If it eventuates, this change should increase the chances of sustainability of SBB construction after the project ends.

## 5. RECOMMENDATIONS

Because the *Provision of Energy Efficient Social Services* (PEESS) project will run in part concurrently with, and be co-managed with, the new GEF *Energy Efficient Housing* (EEH) project, it is impractical to consider recommendations for PEESS in isolation. As Table 5 shows, only 30% of the combined PEESS/EEH budget of about $2 million from 2001 onwards is within PEESS; EEH, as a new venture with additional staff and consultants to be recruited, will absorb a great deal of the available management and planning capacity. Nonetheless, the two are formally separate projects. This section concentrates primarily on PEESS but includes aspects of EEH which are relevant to PEESS's success. The main comments on EEH are contained in Annex 7, which is designed be read as a stand-alone report.

The following actions are recommended for the design, implementation, monitoring and final evaluation of the project.

***1) General.*** PEESS has by and large completed, or already contracted, all straw-bale and retrofitted buildings necessary to demonstrate the technology. The remainder of the project should concentrate on consolidating results, accurately documenting and measuring the energy and cost-effectiveness of these interventions, and effectively publicising what has been learned.

***2) Demonstrations***. The various types of PEESS demonstrations are covered in turn below:

- *Straw-bale social service buildings*. The concept has been amply demonstrated, mainly in health clinics and kindergartens as is appropriate. Expected outputs in terms of quantity of buildings will be exceeded. Therefore:
  - i) No additional SBBs, except any already contracted by PEESS or agreed with Raleigh International for joint financing, should be built.
  - ii) However, PEESS should consider a modest financial input for maintenance of existing SBBs but only on condition that owners or local governments: i) provide 50% of the funds required; ii) and work closely with PESSS on measuring energy efficiency.
- *Combined demonstration / social service straw-bale buildings*. The evaluation team endorses the decision of the Steering Committee to drop these from the current project as impractical and ineffective.
- *Retrofit buildings*. PEESS has refurbished 16 buildings for improved energy efficiency out of the goal of 22. Another seven or eight are tentatively planned for 2001.
  - i) It is strongly recommended that no additional retrofits be carried out except in sound buildings: i) with a reasonably long expected lifetime remaining; ii) where preliminary benefit/cost analyses indicate that benefits are likely to exceed costs; iii) where energy use monitoring is carried out by owners or users (with assistance and advice from PEESS) throughout the preceding winter; and iv) where owners agree to meet reasonable future maintenance costs for some agreed period, perhaps 5 years. A sound building better justifies the investment; energy monitoring provides a baseline for comparing future savings.
- *Straw-bale greenhouses*. In terms of quantity, PEESS has already completed 16 of 25 planned buildings. In the single case where the team could verify the actual food production during 2000, the simple payback period for the investment exceeded 40 years even with the heroic assumption of quadrupled output in the future.
  - i) It is recommended that no new SB greenhouses be constructed.
  - ii) However, it is also recommended that PEESS offer to renovate a number of existing greenhouses in areas which can be easily monitored on condition that owners pay a portion, perhaps one-third of the cost and cooperate with PEESS in keeping accurate

records of inputs (seeds, compost or fertiliser, water, labour, etc.) and outputs (type, quality and weight of produce).[29] It is further recommended that PEESS engage a local consultant to advise users on best practices, seeds, time to plant, etc. and to monitor the actual value of inputs and outputs.[30] It may be that the SB greenhouses, though not cost effective, serve a useful social function.

- *Photovoltaic installations*. This review is not a suitable vehicle for a discourse on photovoltaics. PV systems can be very effective at producing moderate amounts of electricity for rural communities.[31] However, it is noted that a long history of PV projects in rural areas in a large number of countries has shown that they seldom function for more than a year or so in public social service buildings.[32] They don't function for long if there is a local electricity supply from a generator or grid. Well-designed and maintained PV systems can be competitive with small stand alone petrol (gasoline) or diesel plants but only if they continue to function well for over a decade,[33] and this requires development of long-term management and financial mechanisms. It is almost inconceivable that PEESS could develop such mechanisms; even if it did so, there is insufficient time within the PEESS/EEH lifetime to assure a reasonable chance of sustainability.

  i) It is strongly recommended that PEESS install no more PV systems.

  ii) It is, however, recommended that PEESS devote modest resources to monitoring and assessing those systems which have been installed.[34] However, not enough will be learned to justify a large expenditure; even without such a study it is apparent that PV systems will not be cost-effective or even reliable in the context of use within PEESS.

  iii) It is also recommended that UNDP consider a stand-alone rural PV (or PV with other renewable energy) project for possible submission to the GEF. This approach would allow the time, skills and resources to provide a reasonable chance of success and replication. Suggestions are provided in Annex 8.

***3) Training***. PEESS has carried out, and continues to carry out, an extensive programme of training which has reached nearly 800 individuals but without evaluations of success.

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29 This would probably involve little more than replacing damaged glass or plastic sheeting.

30 A possibility may be the agronomist / teacher at school 29 in Ulaanbaatar who manages the school SB greenhouse, has arranged some school funding for maintenance, and seems both enthusiastic and knowledgeable about greenhouses.

31 There are numerous recent reports discussing areas where renewable energy can be effective, for example: *The Evolving Renewable Energy Market* (International Energy Agency, 1999), *Fuel for Though* (World Bank, 1999), *Renewable Independent Power Producers: Restructuring the Southeast Asian Electricity Sector Using Sustainable Energy* (Greenpeace International, 1999). The World Bank has also produced several reports on rural photovoltaic companies and cooperatives, emphasising technical, planning, management and financial mechanisms needed for long-term success.

32 The World Health Organisation (WHO), which has long been an advocate and supporter of PV systems for rural health centres for lighting and cooling of medicines has recently shifted to bottled gas (LPG), despite its inconvenience and expense in remote areas, as it is far more reliable and cheaper over a period of several years, especially compared to failed PVs. A colleague of the team leader who has reviewed a number of WHO PV systems has never seen any which still function after a year or two.

33 Typically, well-maintained batteries will need replacement after 5-7 years and lights must be replaced from time-to-time but other components should last for more than ten years. A PV lifetime of 10 or more years requires a reliable mechanism for *regular* maintenance by trained personnel including a system for collecting money for repairs. In general, this almost never happens unless the owner or user is responsible for paying the actual operating and maintenance costs (even where the initial capital cost has been born by a central government or donor.)

34 The monitoring and evaluation should determine which systems still function, the amount and reliability of electricity service, any problems encountered, the time and reasons for failure, the availability and reliability of other electric power, the battery maintenance undertaken (including whether groundwater, rainwater, distilled water, etc. was used to replace battery fluids), and an assessment of whether the PEESS (or other) training was effective in terms of practical knowledge of users.

- *Independent assessment*. It is recommended that PEESS arrange an independent review of the effectiveness and impact of the training it has already completed. This should include a 'tracer' component which attempts to determine the extent to which the training has been used subsequently for paid employment or has otherwise been beneficial for the trainee.
- *Routine training evaluations*. It is further recommended that all future PEESS training activities (and those of the new GEF EEH project) routinely include a written assessment by the trainees and trainers to advise PEESS on training strengths, weaknesses, needed improvements, quality of materials, etc.[35]

***4) Research***. PEESS has considerable anecdotal information, questionnaire results and a draft consultancy study which suggest that a straw-bale building uses roughly half as much heating energy (coal and wood) as a 'typical' wood or brick house. There is some evidence that a SBB uses a far lower percentage of energy, perhaps a fifth as much, compared to a similar-sized ger. However, PEESS has not devoted sufficient resources or time to verifying these estimates. It is recommended that:

- *SBBs and 'standard' buildings*. PEESS should arrange measurements of actual daily energy use[36] and costs in a range of representative buildings, throughout a full winter, including at least five each of SBBs, similar non-insulated wooden buildings, insulated wooden buildings, and gers.
- *Retrofitted buildings*. Similarly, for all new retrofits, PEESS should arrange measurements of actual daily energy use and costs throughout a full winter prior to the retrofit. For at least five existing retrofitted buildings, the same sort of measurements should be made along with, if possible, similar non-retrofitted buildings in the same vicinity.
- *Heating stoves*. Stoves and or boilers are the dominant consumers of energy in buildings which are not connected to a central district heating system. PEESS should arrange, preferably in cooperation with (or through a subcontract with) the WB/GEF efficient stoves project testing of the energy efficiency of a range of common heating/cooking stoves and boilers.[37] The test should also estimate the stove lifetimes under typical operating conditions, determine the flexibility (of boilers) under varying heating demands, suitability of different stoves/boilers burning different fuels (hard coal, coal dust, wood, dung), and the suitability for different types of buildings and loads.
- *Greenhouses and PV installations*. As discussed earlier, PEESS should also monitor and assess the already-completed SB greenhouse and PV installations.
- *Windows and doors*. The team is not certain whether PEESS has completed its work on better window and (especially) door and door-seal designs. Once this has been done, they should be tested to determine their energy savings compared to more 'typical' designs.
- *Other research.* PEESS should attempt to determine the potential and actual energy and cost savings which can be attributed to different components of its interventions: insulation (wall, ceiling, floors, both SB and conventional), type of insulation (both domestic and imported Styrofoam; other materials); windows, door and door seals, heating stoves, and the effects of different patterns of use and maintenance by owners/operators.

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[35] Assessments are relatively easy to do using fairly standard questionnaires which normally do not ask for the respondent's name to assure confidentiality. For long courses, there should be daily assessments (which can help improve the next days' presentations or demonstrations) and end-of course assessments.

[36] The team is aware that PEESS has already attempted to do this but the results were disappointing. Annex 10 (available in Mongolian and an English summary) provides more detailed recommendations.

[37] This could be done under PEESS or EEH but should include heating devices which are suitable for homes as well as other buildings.

- *Cost-benefit analyses*. After the above work is substantially complete, cost benefit and life-cycle analyses should be carried out of the various options and combinations.[38]
- *Attitudes of SBB users*. PEESS should determine the attitudes of various users to SBBs through interviews and perhaps observations by the national UNVs. Issues regarding satisfaction, usage, problems, desired improvements, etc. may also be useful as inputs to the EEH project.

***5) Standards***. The following recommendations are a brief summary of the contents of Annex 9, prepared by the evaluation team's Construction Specialist who concludes that the quality of SBBs has improved during the past two or three years as norms and standards have been developed by the project. It is recommended that PEESS consider the following means to improve the quality, and in some cases reduce the cost, of straw-bale buildings:

- Continue to use strong mesh (rather than wood laths where possible) for plastering both inside and external walls. Inner and outer mesh should be held tightly together with metal wiring to reduce gaps between straw and plastering which can encourage mice.
- Replace straw-bales for ceiling insulation with Styrofoam or other light materials, allowing lighter (and less expensive) ceiling and roof structures.
- Consider thinner plastering and three layer plastering techniques to reduce external wall cracks.
- Continue training with builders and improve inspections to improve the quality of construction of window frames and doors.
- Use windows with triple-pane to reduce heat loss.
- Use simpler, cheaper foundations.
- Fill vertical gaps between straw bales with a straw/clay mixture to reduce wall cracking.
- Retain post and beam construction rather than the older (and less expensive) ADRA designs with load-bearing SB walls.
- Reduce the spacing between roof junctions and specify heavier metal roof covering.
- Develop improved standards for straw bales meant for construction purposes.

***6) Partnerships***. The partnership with Raleigh International, which has much better grass-roots relationships than PEESS, is extremely valuable. Two other donor-supported projects (the ADB's Housing Sector Finance Project and the WB/GEF Energy Efficient Stoves Project) have activities and interests which overlap with those of PEESS (and EEH). It is recommended that PEESS seriously consider some form of practical, informal advisory group[39] which includes representatives of these organisations. The group would meet on occasion with the main purpose of advising on mechanisms to improve sustainability and replication after the project ends.

***7) Public information***. Various recommendations of this report, if accepted, will generate a considerable amount of valuable information: user attitudes; actual energy use (of SBBs, SBB components, other buildings, stoves and boilers); the effectiveness of SB greenhouses; options for efficient stoves and boilers; options for energy-efficient insulation, windows and doors; the day-to-day cost to the user of heating various types of buildings; the life-cycle costs of various energy-efficiency investments, etc. Soon PEESS/EEH will have up to eleven national UNVs in the field and it is important that they be kept informed of the project's ongoing work. It is recommended that PEESS produce:

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[38] This need not require an economist as many energy engineering consultants (at least in most countries) routinely do this sort of analysis.

[39] Formal advisory groups are often too formal and thus ineffective. For PEESS, a formal group could also be interpreted as supplanting the role of the National Steering Committee.

- high quality materials (brochures in colour, articles, handouts) for the public plus occasional technical (or semi-technical) reports for professionals; and
- a regular short, simple monthly internal newsletter in Mongolian for its staff summarising ongoing work, results of monitoring and research, staff travel and movements, etc.

***8) Management and staffing***. As noted earlier, the demand for management, budgeting and planning for PEESS (in combination with the GEF EEH project) will soon increase considerably. The following measures are recommended:

- *National professional staff*. Either through additional local professional staff positions or local consultants, PEESS should increase: i) its construction engineering / monitoring capability;[40] and ii) its energy efficiency expertise, specifically regarding efficient heating. A new full-time staff position should be created for Mongolian language writing and editing;
- *Organisation into teams*. Within a small office, it is feasible to have flexible arrangements with relatively loose responsibilities. Considering the increased staffing of PEESS/EEH, the project should be reorganised into several teams with clear lines of authority and clear responsibilities for each individual. As the NPC will have demanding overall management functions, it is suggested that UNVs report on a day-to-day basis to him through other clearly-specified staff.
- *Regular team meetings*. In a small office, it is relatively easy for everyone to remain informed of progress, problems, each others' work, etc. For the larger PEESS/EEH, there should be regularly scheduled meetings (perhaps weekly, at least twice per month) at which all key staff are expected to be present and report to each other.
- *Individual workplans for all professional staff*. Professional staff, and this includes national UNVs, should have workplans (revised quarterly) with clear goals, clear priorities, and a clear timetable for activities. These should be simple, flexible and useful for both the NPC and the individual staff.
- *Staff reporting*. Individual staff reporting needs vary according to the position. However, for all staff assigned to locations away from Ulaanbaatar (i.e. all national UNVs) there should be unambiguous requirements for the frequency and contents of their regular reports.
- *International adviser***.** UNDP should assure that sufficient resources are made available to allow an international adviser on planning and management to devote at least 60%, preferably more, of his or her time exclusively to PEESS/EEH;
- *The National Steering Committee*. An objective of both PEESS and EEH is wide-spread replication of energy efficient buildings and energy efficient building techniques after the projects end.
  - i) In the future, with few social service SBBs to be built, the NSC should be encouraged to advise on mechanisms for sustainability; and
  - ii) Suitable individuals with appropriate business skills should be invited to join, and actively contribute to, the NSC;
  - iii) In general, the NSC membership may need reconsideration, particularly considering the private sector and possibly non-formal housing orientation of EEH. If possible, a separate NSC should be considered for EEH with a strong focus on commercialising energy-efficient housing;

[40] Although few more SBBs may be built directly by PEESS in 2001/2002, there will be a number of new retrofits, about 8 new SBBs built in partnership with Raleigh, and a need for continued professional monitoring of the quality of existing SBBs.

**9) Future Reviews**. As the main contributor to the combined PEESS and EEH projects, it would be appropriate if the Government of Norway were invited to participate formally in the end-of-project review.

***10) Government of Mongolia***. ACA is likely to take more responsibility for SBBs after the project ends if it has sufficient government support during the remainder of PEESS to allow more effective implementation. Successful long-term replication of SBBs and energy-efficient building retrofits within the public sector also depends on government support and policies, particularly appropriate financial incentives.

- The GoM should provide sufficient financial support to the PEESS implementing agency to allow it to play a more effective implementing role.
- If PEESS makes a solid case for energy and life-cycle cost savings for SBBs (and energy-efficient building renovations), the Government of Mongolia should develop and adopt appropriate policy and financial measures to encourage their replication.

***11) The Energy Efficient Housing (EEH) project.*** If properly implemented, the new project for *Commercialisation of Super-Insulated Buildings in Mongolia* (UNDP/GEF MON/99/G35) should result in far more replication than the current PEESS project:

- It is recommended that it proceed as soon as possible; and
- A number of specific recommendations regarding design and implementation are attached in Annex 7. In brief, these are to modify or further address the following: i) execution and implementation; ii) proposed policies on subsidies; iii) marketing; iv) appropriate house designs; v) the needs of the informal housing sector; vi) avoidance of a 'technology driven' approach; vii) support for non-housing SBBs for the non-formal business sector; viii) serious attention to public awareness; ix) demonstrating energy efficiency gains possible for housing; x) home heating; xi) selection of those eligible for project support; xii) project review criteria; xiii) the proposed Energy Demonstration Centres; and xiv) adequate international advisory input.

## 6. LESSONS LEARNED

It would be fair to say that no unexpected new lessons have been learned from PEESS that are not analogous to observations from numerous earlier donor projects. Nonetheless the following may be of interest:

- *Prior or likely framework for sustainability*. It is difficult for a project to establish an effective mechanism for sustainability and wide-spread replication of energy-efficient public-sector social service buildings in an environment where there are no financial or other incentives for government agencies (local, provincial or national) for such savings. UNDP and PEESS have applied this lesson to the design of the GEF *Energy Efficient Housing* project, which concentrates on commercialising private housing, an area with already existing incentives for savings and replication.
- *Desirability to concentrate resources within achievable and related activities*. The PEESS project document included a range of planned interventions (renewable energy, agriculture, demonstration centres, university curricula) which would have spread the project's technical and financial resources far too thinly. Project staff and the Steering Committee recognised this and have delete some inappropriate areas of activity.
- *Improved energy efficiency is not always cost effective*. The experience thus far with straw-bale greenhouses illustrates that a more energy efficient approach to buildings does not necessarily mean that the investment is warranted. The lesson is that the likely benefits and costs of demonstrations should be estimated before committing to major investments. An investment may be warranted for social rather than economic reasons (e.g. improved nutrition for school children) but the justification should be clear and intervention through a particular project should be an appropriate way to provide the service.
- *Subsidised investments should not be cost-free for the owner or user*. People tend not to value services provided for free. SBB and retrofit investments are more likely to succeed where the owner or user is required to provide some input in terms of finance, labour, maintenance responsibility, etc.
- *Demonstrations should demonstrate a quality product or the project's purpose can be undermined*. Although the quality of recent straw-bale buildings is generally better than that of the early demonstrations, there is still a problem with inconsistent quality of construction resulting in cracks, vermin and understandable concerns regarding the building's lifetime. An investment (such as a solid building inspection programme) which improves quality control is likely to improve chances for long-term project success.
- *Emphasising a particular building technology as appropriate for the poor may undermine replication efforts.* There has been considerable publicity in Mongolia regarding straw-bale buildings as affordable and appropriate for low income families. This may have left the impression that SB buildings are low in quality and not suitable for middle income earners, i.e. those who can most readily access loan s for home construction or renovations. Some participants in the study tour to North America were surprised to learn that SB homes in other countries are often built by, or for, affluent families, a realisation which has altered their perceptions of possible roles for SB construction in Mongolia. This may also affect the marketing approach for SB homes for the GEF project.