June 29, 1991

Dr Cherla Sastry
IDRC
Singapore

Dear Dr Sastry

Small-Scale Energy System (Philippines)
Centre File: 83-0114

The above mentioned project has met its objectives to a very large extent and is in a fairly advanced state of development to enable early commercialisation.

The detailed evaluation report on the Biomass Pyrolyser on which a presentation and demonstration which was made on June 26, 1991 in the FPRDI, Los Banos, is attached herewith.

A separate report will be faxed to you in Singapore by Dr Abito by July 1, 1991.

With kind regards,

Yours sincerely

Signed Pradeepmani Dixit & D.V.R Rao
(Original handwritten copy in project files)

44.

Small Scale Energy System (Philippines) - Preliminary report of the Evaluation Team.

Old evaluation report number was 2.1.24

SMALL SCALE ENERGY SYSTEM
(PHILIPPINES)
3-P-83-0114

PREPARED BY : D.V.R. RAO (INDIA) P.ENG
PRADEEPMANI DIXIT (NEPAL)
DR ABITO (PHILIPPINES)

PRELIMINARY REPORT OF THE EVALUATION TEAM

1. The International Development Research Centre (IDRC) sponsored the participation of the above-mentioned members to evaluate the Small Scale Energy System (Philippines) Project supported by them.

2. The members of the team arrived in the Philippines on June 25 and followed the under-mentioned procedures for evaluation :-

(i) presentation of the project background, research methodologies adopted and the results obtained so far by the concerned scientists and their associates;

(ii) discussions on the presentations by a group of interested scientists, the members of the evaluation team and businessmen who are interested in the technology;

(iii) presentation and demonstration of the Pyrolyser unit at FPRDI premises, where it was used to pump water; and

(iv) visit Guimaras Islands in Iloilo to observe the unit being used for drying coconuts.

3. In the presentation and discussion session, a number of eminent scientists from various other institutions also participated and gave their valuable suggestions and advice for further improvement of the system. The members acknowledged with appreciation their inputs during discussions.

4. The members would like to take this opportunity to express their gratitude to Dr Emmanuel Bello, Director, Forest Products Research and Development Institute. They are thankful to the project personnel who presented the details of the project very clearly and who patiently provided clarification on each point raised during the course of the discussion. The members would like to thank Engr Heliodor C Unciano, Ms Leonida P Briones, Ms Yolanda U Robillos and others who accompanied them to Iloilo and Guimaras to enable them to actually see the unit in action. Finally but not the least, the members would like to thank all other staff members at FPRDI who helped them during the evaluation. Dr C B Sastry and IDRC should receive special mention for giving the evaluators this opportunity. Members are of the opinion that the Project has been

able to achieve the general and specific objectives of the Project for which IDRC had provided the support. They are of the opinion that the Project has been able to achieve the following besides meeting the objectives :-

(i) there has been a successful multi-disciplinary team working in the Project which led to the fulfilment of Project objectives and who could continue the good work in future too;

(ii) a dedicated effort by all to continuously overcome various hardships and obstacles during different period to achieve the objectives; and

(iii) to be able to refine, remodel the unit (to make it more efficient) and to test the application of results during the Project period itself.

5. While the members congratulate the research team on their excellent achievements, the members would like to make the following comments. There is no doubt that a successful and useful technology has been developed and tested. This is proven by the interest it has generated upon a wide audience and over a large number of farmers who have had a chance to see the unit. The following suggestions may be considered to make the unit/technology more effective in the Philippines and in other developing countries in Asia. The technology has a high potential in other developing countries of Asia and it may be field tested in some of them to obtain a feedback, if possible.

INTRODUCTION

6. The project was evaluated under three heads, i.e., technical, commercial and social aspects.

TECHNICAL

7. The presentation made on the Project by Engr Heliodor C Unciano and Ms Leonida P Briones and the demonstration of the working of the two pilot plants in FPRDI and in Giumaras has established beyond any doubt that charcoal from coconut shells as well as rice husk can be produced and a combustible gas, similar to producer gas, can be obtained and used to run IC engines or dryers.

8. The technical evaluation will be under three heads, namely, feasibility, usability and maintainability and cost effectiveness.

9. Feasibility. The demonstration has successfully proven the feasibility. It is already in a state of fairly advanced development.

10. Usability. The equipment must be easily usable, safe and need minimal maintenance work. As it is, it is easy to operate. No further development is considered necessary now, unless the villagers actually using it need some changes.

11. As it will be used by fairly inexperienced, non-mechanically minded persons, some safety precautions can be added. One is the addition of a copper wire mesh bulb at the opening, where gas is drawn off to test with a naked flame to ascertain the availability of the combustible gas. When the gas is not being flared, it should be protected/shielded/directed such that operators do not break it, since it also contains carbon dioxide. The existing low pressure water seal should be retained while the scrubber, after the gas cooler, can be eliminated. Water-cooled gas cooler must not be eliminated.

12. It is highly undersirable to use used engine lubricating oil in the bubbling tank as SO_2 (SO_2 and others) will be generated, which are harmful to IC engines and human beings.

13. A cheap way to enhance the life of the pyrolyser is to coat its inside walls with a thin film of clay suspended in water, which will act as a non-rusting fire resistant coating. It can be done after the day's work is over.

14. In the set up for the dryer, the open flame going from the pyrolyser to the suction pump must be enclosed in a wire mesh cylinder to ensure safety.

15. No problems are foreseen in maintenance.

16. Cost. The current cost of fabrication quoted at P60,000 is high. Some ways of reducing it are :

(i) use of 2 or 3 mm thick MS sheet in place of 6 mm plates;

(ii) mounting on a rubble-mud masonry platform instead of steel frames;

(iii) elimination of second scrubber;

(iv) replacing the electric motor-run blower, used to suck air through the charge, with a hand-run blower as it is required for **ONLY** 10 to 15 minutes at the time of starting. In any case, a motor cannot be used as there is not supposed to be any electricity in the village concerned.

(v) the dryer for the copra drying should have mud/slick in mud plaster walls to reduce cost and enhance heat retention. Metal sheet box used as of now results in heat loss due to radiation.

COMMERCIAL

17. The present set up is conceived and devised/designed on the basis of two parameters, viz, production of charcoal briquettes and conbustible gas. It can be satisfactorily used for **EITHER** or **BOTH** purposes.

18. Enquiries made have led to the under-mentioned information:-

(i) there is no immediate market for briquettes made of coconut or rice husk charcoal;

(ii) while charcoal briquettes are said to be exported to Japan/USA, no customer has specified for rice husk briquettes;

(iii) Mr Mauricio C Feliciano of the Landbank had categorically stated that their bank has failed to interest rural people to taking loans to set up briquetting plants.

(iv) rice husk charcoal will need a larger quantity of binder due to its very small size, thereby increasing cost and smoke.

From the above, it is reasonable to conclude that currently, there is very little scope to exploit the domestic market for briquettes made of coconut shell/rice husk/groundnut shell charcoal.

19. This is also true of other developing Asian countries, as one party had tried to promote briquettes in Nepal in 1989 and failed. In India, there is no known effort till now to promote briquettes, probably because those who can spend more money than on charcoal are going in for LPG.

20. It is likely that coconut and rice husk charcoal may not find acceptance either as coal or as briquettes except in source specific or in dedicated applications.

21. In spite of this, usefulness of the equipment for production of combustible gas cannot be ignored.

22. The cost estimates need to be re-worked for each country individually. Further, they need to be revised. For example, Table 14 on page 94 shows the same operating cost of P59,320 over a period of ten years, which is unrealistic in a country with 10% annual inflation.

23. Even so, there is no doubt that the Project is commercially viable as it produces combustible (ready fuel) gas out of material which otherwise will go to waste.

24. In the case of dryer application, local conditions and attitudes of users will dictate whether they will be willing to spend several thousands of Pesos or Rupees or Bh for use as a dryer only when copra or cashewnut, etc, can be dried free in the sun for over nine months a year.

25. Application to Drive an IC Engine. It is most attractive to run an IC engine prime mover with waste/very cheap material as primary fuel. Assuming that the IC engine will be coupled to a generator to run agricultural pumps or domestic lighting or

community lighting in places where no other sources of electric power exist, it will be necessary to be able to run the genset whenever required, even when there is no supply of cheap inputs for the pyrolyser.

26. Therefore, it is essential to use a diesel engine in the dual fuel mode with the capability to run on ASD when gas is not available. Hence, a petrol engine should not be used.

27. The economics of power generation will need to be re-worked for each country because, unlike in the Philippines, where a used Japanese 20HP diesel engine can be obtained for about P4,000; in India, a similar engine will cost not less than Rs22,000, not counting the cost of the alternator. Further, cost of one unit of electricity energy is one fourth the prevalent in the Philippines.

28. As an illustration, if it is supposed that a bank second-hand set up costing Rs1,000,000 is to be considered, the cost of interest will itself come to Rs50 per day (@ 18% interest rate) or the price of 50kwh of electric energy, not counting other costs.

29. With the scenario likely to be as sketched above, it will be useful to set up a few such units in some selected villages to attract the interest of likely users in the neighbourhood and to interest financial institutions.

SOCIAL

30. There do not seem to be any social, religious or ethnic objections to the acceptance and adoption of this technology.

31. It seems essential now to promote activities in carefully selected areas to demonstrate the usefulness of the technology to yield promising results in acceptability. Any such promotion activity must take into consideration the fact that in most Asian countries, domestic and industrial users prefer charcoal in as large lumps as possible. It may, therefore, be necessary to test units of various sizes with raw materials from different sources and sizes in the future to be able to develop the unit to be attractive to many countries.

32. To ensure the market for the charcoal (in addition to the gas) firewood can be used as the raw material in the pyrolyser. This will require adding the cost of firewood in the form of small pieces since it cannot be obtained free. In such a case, substancially larger pyrolysers can be used to produce saleable charcoal. It is suggested that this point be noted when future research is contemplated.

33. This equipment is an excellent one for use as standby source of electricity for use in emergency situations like :-

(i) agitation of pond water for its oxidation and aeration in high investment prawn/fish farms;

(ii) process industry in small scale dye making; and

(iii) ice factories, etc.

34. It is suggested that more field testing be carried out on the existing units; various sized units be tested to make them economically attractive and economically viable. It was reported that 15HP units are not economical at present and larger units tend to be economical.

35. Besides this, it is suggested that one fully operational pilot project to generate electricity be set with part of the cost being borne by the users and its performance, cost economics and reaction of the user groups be monitored. Since electric generation will be most useful and attractive to rural people, emphasis must be given to this activity.

36. Finally, there has been a very good start. Some more effort will make it more acceptable and adoptable. So there is a definite need to continue with the development of the Project.

Signed D V R Rao

Signed Pradeep Dixit

28 June 1991

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