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INTERMEDIATE TECHNOLOGY STOVES PROJECT,

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The Fuelwood Situation

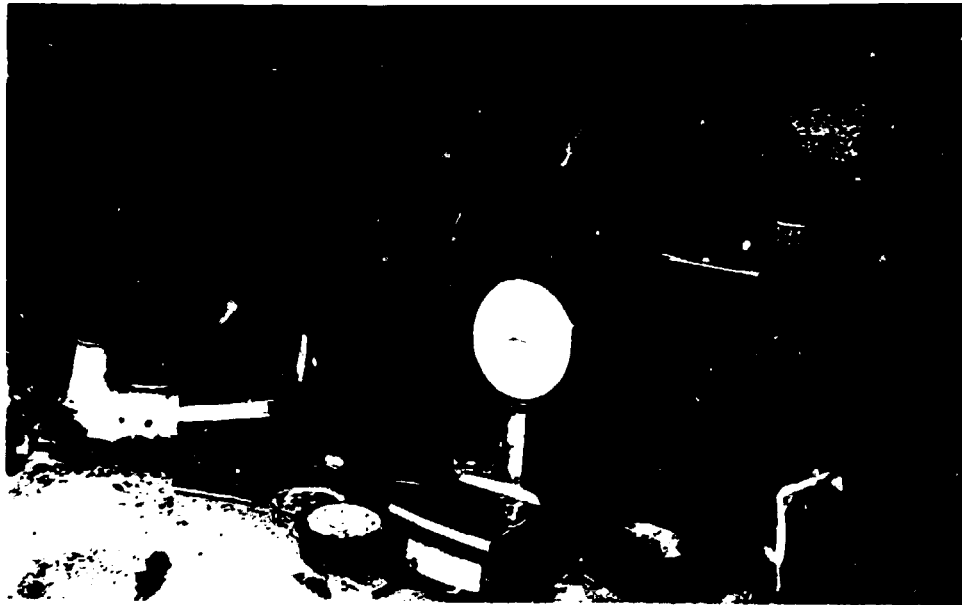
The poorer half of the world's population depend on fuelwood as their sole or principal source of energy for cooking food and for other household needs. Fuelwood accounts for at least half of all the wood used in the world each year and for more than 85% of wood used in Third World countries. This fuel is either collected or bought at an increasing expenditure of direct labour or money. There is as yet no indication that in the foreseeable future any other source of energy will become available on a large enough scale to be of use to the great mass of people who depend upon fuelwood. Demand is now outstripping supply. More than a billion people are already living in situations where their fuelwood needs are being met at the cost of depleting existing resources. The shortages, made worse by the present trends of population growth, are becoming progressively more acute causing increasing hardship for more of the world's population. In this situation an essential part of the solution is to grow more trees but a lot can be done to make better use of the fuelwood resources that remain. The introduction of cooking stoves which use less fuel than traditional stoves such as the open fire can alleviate the hardships in the household and extend the time available for the longer term measures of planting more trees to take effect.



The ubiquitous open fire stove

The ITDG Stoves Project

It is against this background that the Overseas Development Administration began funding the work of the ITDG Stoves Project in 1979. A preliminary investigation revealed that little reliable information was available on design principles for stoves that are low-cost, simple to make and use and have a better performance than traditional stoves. The broad aim of the ITDG project was to provide assistance through collaborative research in the implementation of stove projects in the Third World and to develop an information, advice and training service on improved stove designs and their diffusion to large numbers of people in need. A major premise was that local organisations would need to develop a capacity to carry out design and development work with ITDG providing technical assistance in the country and from the UK research base. Since 1979 the ITDG Stove Project has established collaboration with projects in Sri Lanka, Nepal, Indonesia and Kenya. Assistance has been provided in testing and evaluating existing stove designs, developing new designs made from traditional mud mixes, pottery and metal, and with production technologies. In addition work has been undertaken to standardise testing procedures and develop methods for assessing the design needs of stove users and monitoring and evaluating the progress of stove programmes.



ITDG's U.K. stove testing facility

Work in Asia

The ITDG Stoves Project has been collaborating with three Asian Stove programmes in Sri Lanka, Nepal and Indonesia. After several years of intense collaborative research activities and field trials each of these programmes have developed stove prototypes with improved fuel consumption and reduced cooking times which are also safer and cleaner to use. The earlier efforts were concentrated on the development of massive stoves made from mud by users or extension workers with several cooking-holes and a chimney. Results of field trials with these models were largely unsuccessful because of problems such as poor material durability, erratic fuel consumption and performance reliant on accurate construction and attentive operation of the stove. In response to these limitations research was re-directed towards the development of more durable designs made from pottery by skilled artisans which were easier to supply, use and maintain.



Pottery insert stove installed in mud - Sri Lanka

This second generation of stoves have become known as 'pottery insert' stoves since they can be coated with an outside layer of mud for increased stability, durability and insulation. More than 10,000 of these improved stoves are now being used in the kitchens of Asia and plans are underway to expand production and make the new stoves widely available throughout the countries.

Work in Africa

In Africa the ITDG Stove Project has been collaborating with the Ministry of Energy Programme in Kenya. The focus of this project has been the development of an improved charcoal stove which is made from a combination of pottery and metal by skilled artisans. In the first stage of this project thousands of new improved stoves have been manufactured and sold in Nairobi and the larger provincial towns. The appreciation for reduced charcoal consumption and fuel bills is emphatic and demand continues to outstrip the supply of the new stoves. Efforts to meet this demand will be made through the provision of training courses and support for artisan producers and small businesses. In the more rural areas of Kenya, where wood rather than charcoal is used, work is underway to develop improved stove designs which will reduce the increasing burden of fuelwood collection.



Future ITDG Stove Project

The successful expansion and development of field programmes from limited to widespread production and use of stoves will in most cases require back-up research and development activities focused on the commercial production of the stoves. On the one hand this will involve ITDG in the rationalisation of successful prototype stove designs for production at minimum cost and on the other the evaluation and modification of production techniques and technologies for different scales of output. In addition during this stage the ITDG Stove Project plans to extend its assistance and support to other stove projects in critical areas of need.

Publications

A detailed listing of technical reports and notes as well as more general papers covering the work of the project is available on request.

Addresses

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3.4 Biomass

Biomass projects and consultancies undertaken by the IT Group are listed in Table 3 and summarised below.

3.4.1 Biomass Production and Availability Surveys

Forestry Development in Southern Sudan

In 1979 the Lutheran World Federation commissioned ITDG in collaboration with the Commonwealth Forestry Institute to undertake a feasibility study of the establishment of forestry plantations for timber and fuel wood in four areas of Southern Sudan. The recommendations included proposals to strengthen the South Sudanese Forestry Department.

Biomass resource survey for steam

Under a project financed by the Overseas Development Administration, ITDG undertook a survey of biomass production, use and availability in the rural areas of Fiji, Thailand and India. The survey was part of an investigation on the potential use of small steam plant, and its object was to determine the extent to which fuel is or might be available for small steam plant to take the place of diesel or electric power in rural areas. The survey focused on agricultural residues, although it included consideration of woody materials. There were three main conclusions. First, in many of the areas under consideration wood or agricultural residues are available at low opportunity cost. Second, in many other areas wood and residues are in short supply, and have important existing end uses which would mean unacceptably high opportunity costs for their

TABLE 3 SUMMARY OF BIOMASS PROJECTS UNDERTAKEN

COUNTRY	DESCRIPTION	FUNDING AGENCY	DATE
Bangladesh	Design of steam plant for gas manufacture	ODA	1984
Fiji	Survey of non-wood biomass fuel availability	ODA	1979
Gambia	Review of groundnut shell briquetting	UNSO/UNDP	1982-3
	Stove programme advice, technical assistance and training	UNSO/UNDP	1982-
India	Survey of non-wood biomass fuel availability	ODA	1979
	Design of and technical assistance for wet bagasse burning sugar furnace	ODA	1980-
	Application of steam power to sugar processing (on-going)	ODA	1984-
Kenya	Survey of agriculture and industrial wastes and residues	UNCHS	1982
Liberia	Introduction of improved charcoal kilns	ODA	1980-
Nepal	Programme and technical advice and training to the Nepal Stove Project	FAO	1981-
Papua New Guinea	Specification of waste oil burning pottery kilns	Min. of Ind	1984
Sri Lanka	Study of charcoal market in Colombo	ODA	1980
	Introduction of mobile charcoal kilns	ODA	1981-3
	Biogas feasibility study	SCF	1979
Sudan	Feasibility study for establishment forestry plantations	Lutheran World Relief	1979
	Feasibility study for groundnut shell briquette manufacture and end-use	UNSO/UNDP	1983
Tanzania	Evaluation of stoves programme	IDRC	1982
Thailand	Survey of non-wood biomass fuel availability	ODA	1979
UK	Evaluation of Thai briquette plant	ODA	1983
	Design of briquette burning cooking stoves for the Gambia	UNSO/UNDP	1983
	Global review of the impact of stove programmes	FAO	1983
	Manual on monitoring and assessment for stove programmes (on-going)	FAO	1984-
Upper Volta	Technical assistance on stove design	VITA	1981

use in steam or similar biomass fuelled power plant. Third, in many of the latter areas the use of steam power plant to provide irrigation of conventional crops and new forms of small scale tree production would provide fuel necessary for the plant with a surplus for other uses.

Biomass resource survey for brick works.

In conjunction with IT Building Materials Workshop, ITDG undertook a feasibility study for small scale brickworks in the Lake Basin Area of Kenya, for UNCHS. A component of the project was evaluation of local biomass supplies as a means of providing fuel for the projected brickworks. A survey of wood, agricultural residues and industrial wastes for the area was undertaken. It had been assumed that residues would be available free to provide the bulk of the fuel: however, the survey showed that the amounts of residues produced locally fluctuate significantly; that presently zero cost residues would immediately gain value and price, rendering their use uneconomic; that many have important existing uses from which they cannot be diverted except at high opportunity cost; that transport costs for maize cob, the most freely available residue, would render its use uneconomic. It concluded that the most appropriate fuel would be wood grown on energy plantations attached to the brickworks: such plantations are for other purposes a feature of the area.

Groundnut shell survey - Sudan 1983

As part of a feasibility study for groundnut shell briquetting in Sudan, financed by UNSO, ITDG examined the production, use and availability patterns of groundnut shell for use in the Khartoum area. It concluded that of the shells produced in the area, almost all are used as fuel for the processing plant, as animal fodder, or as brick additives. Evaluation of these uses, and of the potential contribution that briquetted shells could make to Khartoum's domestic fuel supply, suggested that the present uses of shells should be maintained. It noted that in the West of Sudan, shells in surplus might be used for briquetting.

3.4.2 Biomass Processing

Groundnut Shell Briquettes in Gambia

Investigation of groundnut shell briquettes and their use in the Gambia for UNSO as part of a programme of assistance to the Gambia National Stoves Programme 1982-3.

Feasibility study for groundnut shell briquetting. Sudan 1983-4

ITDG was commissioned by UNSO to undertake a feasibility study with the Sudan National Energy Authority on groundnut shell briquetting for the Khartoum area. The study examined shell availability (see above), briquette production costs, and

potential end uses in domestic cooking, baking and brickmaking. Trials were carried out using sample briquettes in all uses: a number of recommendations were made concerning cookstoves design and use changes, together with suggestions for modification to bakeries and brick kilns.

Introduction of charcoal kilns in Liberia

ITDG is working in co-operation with Partnership for Productivity (PFP) Liberia, to promote improved charcoal production in the small/medium range of operations. A major achievement of the project has been the development of an improved pit kiln with a high conversion efficiency, 1/2 times that of the traditional "mountain" kiln and greater under some circumstances than those achieved in portable metal kilns. Two of the new pit kilns have been established at a training site near Yekepa, where courses will be held.

Testing of Thai briquette plant in UK

Technical testing and evaluation in the UK (at the Tropical Development and Research Institute) of a Thai manufactured small briquette plant, and as a result design modifications were recommended.

Charcoal kilns in Sri Lanka

Transfer to and introduction of mobile charcoal kilns to Sri Lanka 1981-3 in connection with large scale land clearances of the Mahaweli project. Also study of the domestic market, and recommendations for changes in marketing and stove types for charcoal produced from the above project.

3.4.3. Biomass Utilization

Bioogas feasibility study Sri Lanka

In conjunction with a technical assistance programme for the local production and use of building materials for a Save the Children Kirillapone shanty improvement project, ITDG investigated the potential for bioogas production for domestic and community cooking, 1979.

Technical advice to the Community Forestry Stoves Programme in Nepal

Since 1980, ITDG has provided advice on programme development and institutional arrangements to the FAO Community Forestry on the development of improved domestic cooking stoves. This has included five technical assistance missions to:

- development training materials and curricular for field workers
- assist in design of needs assessment and monitoring surveys
- develop artisan production units for ceramic stoves;

- monitor and review the programme;

ITDG has also provided training in Nepal and UK. In 1981 the ITDG Stoves Programme started a collaborative project with RECAST, which has included technical advice and training, provision of stove test equipment and computer software packages, materials testing and stove design.

Stove Design in Upper Volta

Volunteers in Technical Assistance (VITA) commissioned ITDG to mount a prototype ceramic stove design and development training workshop in Upper Volta in 1981.

Collaborative Stoves Programme in Indonesia

Since 1980, the ITDG Stoves Programme has been collaborating with Dian Desa on the design and dissemination of improved cooking stoves. The collaboration has involved technical advice and assistance on all aspects of the programme which has focussed on mud and ceramic stoves.

Collaborative Stoves Programme in Sri Lanka

Since 1980, the ITDG Stoves Programme has been collaborating with the Sarvodaya Shramadana Movement on the design and dissemination of improved cooking stoves. The programme which has focussed on mud and ceramic stoves.

Collaborative Stoves Programme in Kenya

Since 1982, the ITDG Stoves Programme has been collaborating with the Ministry of Energy and KENGO on the design and dissemination of metal charcoal and ceramic stoves. The collaboration has included testing, production engineering and local manufacturing advice.

Stoves Project Evaluation in Tanzania

IDRC requested ITDG to evaluate and make recommendations on their stove activities in Tanzania in 1982.

Assistance to the Gambia National Improved Cookstove Project

Since 1982, the United National Sudano-Sahelian Office (UNSO) has engaged ITDG on a regular basis to provide advice and assistance to the Gambian Stoves Project. This has included:

- technical assistance on programme design and implementations
- development and testing of new and improved stove designs including a portable metal stove for burning groundnut shell briquettes and wood
- on-site training on stove design and testing
- provision of a resident stove technologist (9 months)

ITDG has also procured laboratory and testing equipment for the project.

Global Stoves Programme Review

In support of its stoves activities, FAO commissioned ITDG in 1982 to prepare and present a paper evaluating the progress made by stove projects worldwide, and making recommendations on priority needs to improve project performance.

Manual on Stove Programme Assessment

ITDG is currently preparing guidelines on monitoring and assessment requirements and methods for stoves programmes. The manual is intended as a practical tool for stove project managers and will include an analysis of the stages of stove projects, from needs assessment to large scale distribution of improved stoves, together with methods for surveying, analysis and storage of data.

Kiln Design for Papua New Guinea

ITDG has recently undertaken an initial investigation for the design of waste oil and agricultural residue burning kilns for the artisanal ceramic industry. Proposals for detailed design, local construction and training are being prepared for presentation to the Commonwealth Fund for Technical co-operation.

Shell Furnace design development and introduction in India

ITDG, in collaboration with ATDA, has successfully developed a wet bagasse burning furnace for use in small scale sugar factories. This technology has been readily accepted in India where several hundred units have been installed in the last three seasons. ITDG has transferred this technology to Kenya where furnaces have been installed at two separate factories. On both of these contracts ITDG arranged for local manufacture of the furnaces components and organised the installation and commissioning of the furnaces.

The new furnaces permitted factories to run entirely on the bagasse generated in the sugar process without using supplementary firewood, and without the need to dry the bagasse. Enquiries have been received from a number of developing countries.

Steam for Gur Manufacture in Bangladesh and Kenya

Small scale processing with sugar cane to brown sugar products is an important activity in rural areas of many developing countries. The requirement for either a diesel engine or an electric motor to drive the crusher limits the scope of this technology to those areas where these energy sources are

freely available and their cost is reasonable. By employing a new ITDG design of furnaces/boiler/steam engine it is expected that all of the power necessary to drive the cane crusher can be extracted from the bagasse. Not only can the initial cost of the equipment be reduced, but there will be zero fuel costs. This will permit the extension of brown sugar technology into areas where previously it has not been possible to carry out the process, particularly rural areas where diesel and electricity are not available. This new technology will create job opportunities in these areas and also create work for local workshops, as the equipment is suitable for local manufacture. An ODA funded programme, 1984 continuing.

ITDG Sugar Programme

The ITDG Sugar programme (in association with Appropriate Technology Development Association (ATDA) India) has the following capacities.

- advise on choice and assessment of new or upgraded technology for small scale white and brown sugar production.
- preparation of feasibility studies and tender
- selection and inspection of equipment
- erection and commissioning of plant, including supervision of local manufacture
- staff and labour training
- evaluation

The programme is concentrating on the technical development of new processes for white and brown sugar manufacture and on managing co-financed commercial demonstration projects for new and unfamiliar sugar technologies.

Gasifier Powered Humphrey Pumps for Irrigation

The Humphrey pump was invented at the turn of the century and has been revived and developed by Intermediate Technology for small-scale irrigation purposes. A Humphrey pump is a liquid piston will run on any gaseous fuel including biogas. It is relatively simple and has the potential for a long maintenance-free life.

I.T. Power have been commissioned by GTZ (the German Aid Agency) to assess the feasibility of operating the Humphrey pump on producer gas and to compare the gasifier powered system, with alternatives, i.e. solar, wind, biogas and gasoline powered engines.

3.4.4 Biomass Training

As well as on-the-job training and training provided as part of collaborative stove programmes, the ITDG Stoves Programme provides specialist training course in the UK for stove project staff. Since 1983 courses have included:

- metal stove design and testing for two foresters from Turkey for FAC
 - programme design and implementation for four Kenyan Stove project personnel for Carl Duisberg/GTZ
 - stove design and testing for United Nations Association volunteer from Mali
 - stove design and testing for Group de Recherche et D'Exchanges Technologies (GRET) personnel
 - programme design and production engineering for a Nepal Stove Programme Officer
 - stove design and production engineering for two Gambian Stove Programme personnel.
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ITC: STOVES PROGRAMME ACTIVITIES

Based on six years research and development in collaboration with stoves programmes in the Asian and African continents, ITC offers assistance to National and local organisations in building up their capacity to design and implement stoves programmes. Assistance is provided through:

- advice and practical assistance in the field for the development of all aspects of stove programmes;
- complementary applied research and training in the UK in response to and in support of local requirements.

TYPES OF CONSULTANCY

- Policy research, programme reviews, state-of-the-art studies
- Programme and project planning for National organisations and development agencies
- Needs assessment, baseline surveys and project appraisal
- Technical assistance in design and testing of stoves for wood, charcoal and agricultural waste
- Design, implementation and evaluation of pilot field projects
- Establishment of production facilities for metal, ceramic and mud stoves
- Design and implementation of large scale diffusion programmes through the commercial sector and extension programme
- General and specialist training of project managers and designers

CAPABILITY

ITDG started a stove programme in 1976 which has been substantially supported by the UK Overseas Development Administration since 1979. The cornerstone of the programme has been collaboration with overseas programmes in the development of all aspects of stove programmes, supported by UK R & D backup. Overseas collaborators include the Governments of Nepal, Sri Lanka, Gambia and Kenya, in cooperation with non-Government organisations and International Agencies.

The major activities undertaken have been:

- 1) To assist in planning the implementation of National and Regional stove programmes.
- 2) To develop standard procedures and establish test facilities.
- 3) To test and evaluate existing stove designs and develop guidelines for new designs (for wood, charcoal and agricultural wastes, particulate and briquetted).

UK Training and R & D

Since 1982 training in project design and management and technical aspects of design and testing to personnel from stove projects in India and Kenya (GTZ), Gambia (UNSO), Mali (UNAIS/AETA), Nepal (FAO). Design of briquette burning portable metal stoves for the Gambia (UNSO 1983).

Technical Papers

Priorities and Problems in Stove Programme Development, FAO 1979

Compendium of Stove Design: contribution to workshop and publication
FAO 1980

Review of Bread Ovens, 1981

Study of Peat Burning Stoves for Burundi, VITA 1982

Priorities and Problems in Stove Programme Development, FAO 1982

Preliminary Evaluation of the Impact of Wood Burning Stoves Programmes,
FAO 1983

ITC RESOURCES

- Stoves Team of 3 full-time programme and technical specialists and 2 part-time technical specialists.
- Back-up team of over 10 specialist consultants in technical components, socio-economics, evaluation and training employed on a regular basis.
- ITDG Headquarters economists and specialist in women's role in development.
- ITDG Industrial Advisors for small industries and workshop development, combustion and materials development.
- ITDG Stoves Laboratory and Test Facilities.

ITC PERSONNEL

YVONNE SHANAHAN, ITDG Stoves Programme Manager

5 years experience with all aspects of stove programmes. Particular expertise in project planning, methods of needs assessment, monitoring and evaluation. Organisation and implementation of training workshops for senior stove project personnel.

STEPHEN JOSEPH, Principal Consultant to the Stoves Project.

Stephen Joseph has 6 years experience with stove programmes. He was the initiator and first Programme Manager of the ITDG Stoves Programme from 1979-1983.