Rural Technology in the Commonwealth

A directory of Organisations

Commonwealth Secretariat 1980

Rural Technology in the Commonwealth

A Directory of Organisations

Second edition 1980

Compiled by Bruce Mackay

Food Production & Rural Development Division
Commonwealth Secretariat
Marlborough House, Pall Mall, London SWIY 5HX

TABLE OF CONTENTS

INTRODUCTION

This directory is a revised edition of the 'Directory of Appropriate Technology Institutitons in the Commonwealth', which we published in 1977. The revisions consist mainly of a more discriminating selection of organisations, and an attempt to distinguish between those technologies which have and those which have not been widely adopted by their potential users. This edition concentrates more on specifically 'rural' technologies than did the earlier directory, and also has more detail about the work of the organisations included.

The distinction regarding the stage reached in the developement and adoption of a technology should make the directory more useful to its readers because it will be easier for them to judge who can best provide the sort of information they are seeking. This does not imply that prototype development is of no value, for experimental work is obviously essential in the development of any useful technology. However, most people in this field would, we think, agree that the acid test of a technology's appropriateness only comes when it has been actively used by ordinary people in the course of their everyday lives.

Some organisations which featured in the 1977 edition have been omitted from this one, either because we have no up-to-date information about their work, or because for one of several reasons we felt that their inclusion was inappropriate.

We have entitled this new edition a directory of 'rural' technology, because the word 'appropriate', which we used in the 1977 edition, has become even looser in its definition than it was three years ago. If there is any organisation engaged on 'inappropriate' technology, it is not going to admit to it! Furthermore, the specific interests of this division of the Commonwealth Secretariat, evidenced by the meetings on rural technology which it has organised in Tanzania, The Gambia, Nigeria and Zambia, are distinctly rural. At the same time, because this is a directory of organisations rather than of technologies, we have included organisations whose primary focus may not be rural, so long as part of their work is concerned with rural technology.

Some facts and figures on the compilation of the directory may be of interest. We started with an original list of 392 possible contacts. After initial research, we excluded 61 of these from the outset. We found out as much as we could about the work of the remaining 331 organisations, before we contacted any of them. 183 organisations were then sent individual letters asking for specific information, and another 133 were sent a printed circular letter asking for general information and a copy of their latest report. We already had good recent information about 15 organisations, so these were not contacted. We received replies from 154 organisations, 99 of which we have included in the directory. Entries for a further 23 organisations were compiled from the first-hand knowledge of our staff or of other people who had recently visited

the organisations, or from up-to-date reports. Another 8 organisations were included although we had neither replies nor recent information about their work, but we were sure that they are in fact active and important in this field. The source of information is indicated in the text (see Explanatory Notes).

The length of an organisation's entry does not reflect the scope of its work or our opinion of its importance. Some organisations in their replies described only those technologies which were well proven by tests and widespread adoption; other organisations described many products and processes, and did not make clear the stage reached in work on them. In many cases, we have included all the information sent, but made clear that it may refer only to experiments or untried prototypes. Wherever possible we have made clear the stage reached in developing a particular technology, but in some cases this proved impossible.

We would like to thank all those who were kind enough to answer our request for information; we appreciate just how much time often went into the replies. We would also like to acknowledge the particular assistance of Steve Bonnist and others at ITDG, London; of Nicholas Jequier, who kindly allowed us access to the files of OECD, Paris; of Paul Sherlock, of OXFAM, who was most helpful on AT work in the South Pacific region; and of Dr. Azam Khan, of the Commonwealth Science Council. Antony Ellman and Tony Moody, of this Division, provided both first-hand information and crucial advice and criticism throughout the project. Doris Ng not only typed hundreds of letters and the directory itself, but also did much of the indexing. The directory was researched, compiled and written by Bruce Mackay.

We also acknowledge the use we have made of the following publications:- "Appropriate Technology Directory", OECD, Paris, 1979; and "Directory of Institutions and Individuals Active in Environmentally-Sound and Socially-Appropriate Technology", UNEP & Pergamon, Oxford, 1979.

Comments and suggestions on any aspect of the Directory will be welcomed, and should be sent to:-

The Director,
Food Production & Rural Development Division,
Commonwealth Secretariat,
Marlborough House, Pall Mall,
London SW1Y 5HX,
ENGLAND.

EXPLANATORY NOTES

1. Organisations are listed alphabetically by country of location, and the entries within each country are themselves arranged alphabetically. Regional and international organisations located in Commonwealth countries are placed in their country of location - for example, the International Institute of Tropical Agriculture will be found under 'Nigeria'. It is made clear in the text that such organisations are not national ones. A small number of international organisations (and the Commonwealth Secretariat itself) are listed alphabetically in a separate 'International' section at the end.

2. The number in brackets at the end of each entry refers to the source of information used to compile the entry.

   (1) Means that the organisation replied to our query with up-to-date information.

   (2) Means that for one reason or another we did not hear from the organisation, but we have recent reliable information about its work, from copies of recent reports or because we have contacted someone who has recently visited the organisation.

   (3) Means that the information may be out-of-date, as the entry is based on the entry in the Commonwealth Secretariat's 1977 directory, or on some similarly dated source.

3. Information is included where available about ordering procedures and prices of publications. However, the prices given are not always the latest ones, and it may be that they and the postage rates are no longer correct. Furthermore, not all organisations are able or willing to provide free publications to everybody who applies, so that the statement in the directory that a certain publication is 'free' does not guaranteee that it will be sent to everyone asking for it.

4. There are three indexes at the end of the directory. The first is of equipment and processes referred to in the directory, and the numbers refer to the entry. The second is an index of organisations, in which the numbers refer to the page. The third is an index of commonly used abbreviations and acronyms found in the directory, and the numbers here also refer to the page.

5. There is one Stop-Press entry, for Zimbabwe, on page 101. Zimbabwe became an independent member of the Commonwealth as the directory went to print, too late to be given a reference number of its own.

1. APPROPRIATE TECHNOLOGY AND COMMUNITY ENVIRONMENT (APACE)

P. O. Box 81,
Wentworth Building,
Sydney University,
NSW 2006,
Australia.

Programme.

APACE is a non-profit organisation, started in 1975, which develops low-impact technologies that can be controlled by the communities using them. It combines technically sophisticated R&D with grass-roots community development programmes. It is the leading AT group in Australia, but suffers from lack of funding for extension of some of its technical developments.

APACE has assisted a community development programme at Irriri, in the Western Solomon Islands, and has now built and tested a second prototype of a small-scale hydro-electric generator (7.5 kilowatts) for the village; an Impulse Turbine (or Pelton Wheel) is driven to about 700 rpm by a 30 metre head of water. The generator will be installed when finance becomes available. Also part of this programme was the building of prototypes of a cassava chipper and of a DC/AC inverter, but these are now in 'suspended animation'.

APACE's main current work is on energy. An off-shoot, APACE Research Ltd., has built and is testing an unique process for the production of ethanol, by means of a solar still, from sugar and fodder beet; cars and tractors have been adapted to run on this fuel. Research is under way on ethanol production from other crops.

A standard methane digester has been built, and a continuous column fermentation system for producing methane from pig excrement is undergoing laboratory tests. A single-blade vertical axis windmill designed specifically for electricity generation is undergoing wind tunnel tests at the University of Sydney.

A small library has been started, and a survey of all 'solar' buildings in Australia is being made, which may be published.

APACE has had to stop answering individual technical enquiries, but instead it has prepared short printed articles on specific topics, which will be sent as standard replies to enquiries. (1)

Publications.

'APACE Newsletter', quarterly, 12pp, reports of APACE work, AT news and events, book reviews - price unknown;

'Liquid Sun', a 15 minute video film about power alcohol - price unknown;

The following 'Bulletins on power-alcohol produced from farm products' are available from APACE Research Ltd., 157A George Street, Bathurst, NSW 2795:-

"PA/100, General information" - free;

"PA/101, Conversion of petrol engines to use alcohol as sole fuel" - $Aus 5.00;
"PA/102, Power alcohol in diesel engines" - $Aus 5.00;
"PA/103, Alcohol/petrol blends in car engines" - $Aus 5.00;
"PA/104, Alcohol crops" - $Aus 5.00;
"PA/105, Production of power alcohol" - $Aus 5.00;
"PA/107, Potential corrosion of fuel systems by alcohol" - $Aus 5.00.

2. CENTRE FOR INTERNATIONAL RESEARCH COOPERATION (CIRC)

P. O. Box 260,
Civic Square,
ACT 2608,
Australia.

Programme.

CIRC is part of the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the main government scientific organisation in Australia. CIRC acts as the 'agent' of organisations in developing countries which want to utilise the skills or information available within CSIRO, from a specific technical inquiry to setting up a complex project with a team of scientists doing sponsored research. Much of CIRC's work is done in collaboration with the Australian Development Assistance Bureau.

CSIRO itself is currently assessing the paper-pulping qualities of tropical hardwoods from Sarawak and Papua New Guinea. It is also developing handling and cold-storage techniques for potatoes, apples and citrus in Bhutan. This involves cold-stores which are easy to maintain and operate, often in isolated areas.

CSIRO is doing research on large-scale solar energy, and on methane digestion. CSIRO is the home of CRRERIS (Commonwealth Regional Renewable Energy Resources Information System), a database for Commonwealth countries in Asia and the Pacific. (1)

3. AGRICULTURAL DEVELOPMENT AGENCIES IN BANGLADESH (ADAB)

P. O. Box 5045,
Dacca 5,
Bangladesh.

Programme.

ADAB links voluntary agencies working in Bangladesh, organising regular meetings on rural development topics and having a library for use of the agencies. It also hosts meetings to discuss and coordinate action on natural disasters such as floods or droughts. It publishes the monthly 'ADAB News', see below. (3)

Publications.

'ADAB News', monthly, 24pp, US$5.00 seamail or $10.00 airmail per year. This carries reports of technologies, articles about rural development, conditions in Bangladesh, reports of meetings etc. For example, the September 1979 issue contained articles on a rainy season sweet potato, drought-relief operations, uses of rice husk and bran, post-harvest losses, women in food-for-work programmes; the October 1979 issue was devoted mainly to small-scale irrigation, with articles also on gur from sorghum, on a small intensive rural development scheme, and the report of a forum on extension services in Bangladesh;

'Workshop practice: a manual for engineering instructors', 68pp, 1978, c.£1.50, mainly in English, parts in Bengali.

4. BANGLADESH SMALL AND COTTAGE INDUSTRIES CORPORATION

137/138 Motijheel Commercial Area,
Dacca 2,
Bangladesh.

Programme.

The Corporation has developed a shellac grinder, ten of which have been provided to growers for tests and demonstration, after tests of the prototype proved satisfactory. A hand-operated sheller for crushing roasted cashew nuts has also been successfully demonstrated. The Corporation also has a demonstration biogas plant, a polythene/bamboo fish dryer in which temperatures attained are high enough to kill larvae and flies, and it is involved in a beekeeping project.

BSCIC has been working with ITDG/ITIS in setting up the manufacture of the Lipikar low-cost duplicating machine, which was originally developed in Bangladesh. (1)

5. DEPARTMENT OF FARM POWER & MACHINERY

Bangladesh Agricultural University,
Mymensingh,
Bangladesh.

Programme.

The department has collected animal-drawn ploughs from all over Bangladesh and has tested them using improved neck harnesses developed in the department. Increases in draught power of up to 25% have been observed in tests with the improved harness.

The department has also built and is now testing prototypes of a rice dryer fueled by paddy husk, and a push-type weeder which can be made entirely by village blacksmiths. A hand sprayer using only local materials has been designed and is now being tested. (1)

6. MENNONITE CENTRAL COMMITTEE

Box 785,
1/1 Block 'A',
Mohammadpur,
Dacca 2,
Bangladesh.

Programme.

As part of a wide-ranging rural development programme, the MCC has developed a pump and crop-dryers. The 'rower' hand pump is a reciprocating piston pump with 2-inch PVC pipe as the cylinder, inclined at 30^{o}, and operated by direct push-pull action on the piston rod; it is fitted with a simple suction surge chamber. Initial test results show this pump to be significantly cheaper and more effective than the widely used UNICEF hand pump, its cheapness coming in part from its simple construction. Maintenance is also simple, as the piston and foot-valve are accessible without dismantling the pump. At a suction lift of 15-20 feet a man can pump about 30 litres/minute. So far about 250 of these pumps have been installed on tube-wells. The MCC is also testing several prototypes of cheap solar vegetable dryers. (1)

Publications.

A 6-page leaflet about the Rower Pump.

7. VILLAGE EDUCATION RESOURCE CENTRE (VERC),
(Technology Unit),
Anandapur,
Savar,
Bangladesh.

Programme.

VERC was started in 1977 as an organisation to support other development agencies with training, communication techniques, information exchange and research. It tries to ensure the appropriateness of its technologies and programmes by involving villagers in all stages of their development, and its current work on technology is largely directed to evaluation and improvement of existing prototypes and models, rather than to further innovation.

One of VERC's main projects has been to upgrade traditional village pottery. Investigation of local glazes has accompanied development of a wood-fired kiln which can reach temperatures high enough for glazing (1,100°C); this kiln is an adaptation of a traditional local model. The Technology Unit has also developed a cheap potter's wheel.

Prototypes of three pumps have been built and tested. The 'Dheki' pump is a standard No. 6 handpump with the addition of a bamboo arm to the handle with a bamboo spring to return the handle after each stroke. This enables the handpump to be used for irrigation, which requires longer periods of pumping. The Chinese chain-and-washer pump has been adapted to be a rope-and-washer pump, while the Bangladesh Rice Research Institute's design of diaphragm pump has been adapted by replacing expensive metal parts with wood or bamboo. The use of bamboo piping in attachments to these pumps is now under investigation.

Silk-screen printing has been established at the Centre, as part of its programme to improve communication between agencies and villagers. Research into local materials suitable for dyes and mordants has been undertaken, and simple dye-mixing techniques developed. A booklet describing the techniques has been printed using the silk-screen.

UNICEF has been supporting a programme to develop educational toys for children, and is now producing some of these toys in large numbers. They include a small bamboo loom, 'young engineering' sets, tools sets and model pumps, and are being used in a non-formal education project in Sylhet.

Other prototypes being evaluated include a water jar, holding about 80 gallons, made from cement over a mould of coarse cloth packed with sawdust; an improved oven made of bamboo reinforced mud; three models of cheap solar dryer, the bases being made of wood, mud and bamboo matting respectively; a silk-spinning chakra and multi-bobbin-cum-pirn winder; a bamboo-frame hacksaw and blacksmith's bellows, and a bamboo drilling machine; three types of cooking box; low-cost latrine slab; honey extractor; and a coconut scraper. There is also a small beekeeping project at the Centre.

Two members of the Technology Unit's staff are touring Bangladesh writing-up and photographing existing rural technologies, and this information will be added to the library which VERC maintains. (1)

Publications.

'Interchange', a newsletter, 6 issues per year.
One-page leaflets on technologies described above;
'Participatory action research in Bangladesh - an experience of VERC', and 'Engaging villagers in participatory research', monographs;
Other publications in Bengali.

8. APPROPRIATE TECHNOLOGY RESOURCE SERVICE

Christian Action for Development in the Caribbean,
P. O. Box 616,
Bridgetown,
Barbados,
West Indies.

Programme.

ATRS is an integral part of CADEC's Project Development Programme, and is basically an information and advice centre on AT for the Caribbean, and for CADEC's own staff and members in their regular development work. ATRS keeps a library of AT material, and in answer to enquiries provides photocopies, or referrals to sources such as ITDG & VITA. General concentration is on agriculture, particularly drip irrigation, but members of the AT Committee, which oversees ATRS, are also working on windmills - an old water-pumping windmill has been adapted to mix clay at a potteries project in Barbados, a Philippino windmill has been constructed, and an ITDG windmill is being tested.

A solar water-heater project started by CADEC is now a self-sustaining commercial enterprise. (1)

9. CARIBBEAN ALTERNATIVE ENERGY PROGRAMME

c/o Mr. I. Lashley,
National Standards Institution,
Culloden Road,
St. Michael,
Barbados,
West Indies.

Programme.

This is a programme of the Commonwealth Science Council, coordinated in the region by Mr. Lashley. National researchers in the region are working on windpower, electricity-generation from steam fueled by burning surplus bagasse, measurement of wind and solar conditions, improvement of charcoal production, and the energy efficiency of cooking. Several projects on biogas are under way, including the use of rice straw, bagasse, sawdust and sewage as feedstock, and alternative designs of the digester. (2)

Publications.

Reports of meetings held in connection with this programme are available from the Commonwealth Science Council, Commonwealth Secretariat, Marlborough House, Pall Mall, London SW1, England.

10. BOTSWANA TECHNOLOGY CENTRE

P. O. Box 438,
Gaborone,
Botswana.

Programme.

The BTC was set up in 1979, under the umbrella of the Botswana Development Corporation, to act as a central focus of the various AT activities in Botswana. The Centre as such does not do its own research, but assists other organisations, locates technical information and funds, and coordinates the work of the different agencies. It has a particular interest in low-cost energy for water-pumping, utilising windmills, biogas-driven internal combustion pumps, and solar rocking-beam engines. It is also pursuing the potential of the icy-ball refrigeration technique. (2)

11. PELEGANO VILLAGE INDUSTRIES

P. O. Box 464,
Gaborone,
Botswana.

Programme.

PVI is devoted to encouraging small industries, giving management and financial assistance as well as introducing new technologies and ideas. It is particularly concerned with the overall uplift of the villages where it is working, concentrating activities there rather than spreading itself thinly, and working on income-generating projects which can be undertaken in the home.

Among the projects of PVI are an experimental dryland orchard, a prototype vertical-axis Filippine windmill, a small batch sorghum decorticator, experiments with small-scale water catchment and storage, a hand drilling rig/auger, a water pump, solar pump, and a forge-fan and compressor adapted from a Volkswagen engine.

PVI has also done a lot of work on building techniques, both in terms of materials (building with 14:1 soil:cement mixture), and designs (igloo, rondaval). (1)

12. RURAL INDUSTRIES INNOVATION CENTRE

P. O. Box 138,
Kanye,
Botswana.

Programme.

RIIC was set up in 1974, and carries out the whole gamut of AT activities. It first identifies 'needed' technologies or changes, by surveys of villagers' problems and their preferred solution; then it develops or adapts technologies in its own workshops, sometimes establishing small production units for large quantities; and it has an extension staff to ensure that there is feedback from the village to the centre in response to any technical innovation.

RIIC has developed two types of wind pump. One is a vertical axis windmill, four of which are being built and tested in cooperation with Pelegano Village Industries, and the other is a conventional windmill, built in cooperation with ITDG and the Serowe Brigade. Methane biogas plants are being tested, and a diesel engine has been adapted to run on a biogas/diesel mix.

Soil cement blocks have been used to construct the buildings at the Centre itself, which are tiled with cement tiles; fibre-glass reinforcement of the tiles was not a success. A block-making machine has been manufactured and sold by the Centre for some years now. A machine to make diamond-mesh fencing has also been developed and proven, and a labour-intensive machine to make barbed wire has been built.

Other projects include solar ovens, beehives, tools, furniture and motor repairs.

A major project at RIIC recently has been the development and testing of a sorghum dehuller, as part of a wider government programme to promote the use of sorghum. Prototypes have been built and tested and development continues.

RIIC is associated with Rural Industries Promotions, P. O. Box 18, Gaborone. (2)

Publications.

Technical papers on the block-making machine and on biogas, and reports of extension surveys.

13. TOOL-CARRIER PRODUCTION UNIT

Kgatleng Development Board,
P. O. Box 208,
Mochudi,
Botswana.

Programme.

This unit has 4 full-time workers and six trainees, and was responsible for developing the Makgonatsotlhe multi-purpose tool-bar. This implement can be drawn by oxen or by donkeys, and can be fitted with a plough, harrow, ridger, planter, cultivator, sprayer, or can be used as a cart. After extensive tests and redesigning, which have overcome the technical problems with the tool-bar, it appears that it will not be possible to produce it cheaply enough to ensure sufficient sales, so large-scale production is not now planned.

Single and double row planters have recently been developed, both of which can be fitted to the Makgonatsotlhe or used as single-purpose implements on their own. 110 planters have been sold, and the Unit anticipates transferring the production to a local commercial enterprise if the volume of sales increases.

The Unit also produces a solar water heater. (1)

14. APPROPRIATE HEALTH RESOURCES & TECHNOLOGIES ACTION GROUP (AHRTAG)

85 Marylebone High Street,
London W1M 3DE,
England.

Programme.

AHRTAG was started in 1977, and has very close links with ITDG. It is also a collaborating centre of the World Health Organisation. Its main work is as a technical information service, answering 600 enquiries on health matters in 1979. It maintains a library, compiles bibliographies, and also advises numerous visitors. It concentrates on low-cost health programmes suitable for rural areas.

With funds from the British government, AHRTAG has assembled specialised information on the 'cold chain', i.e. the safe cold transport and storage of vaccines. This has included the preparation of manuals and educational materials, provision of consultancy services, and the encouragement of research on, for example, liquid-crystal chemical indicators as thermometers. (1)

Publications.

'Auxiliaries in primary health care: an annotated bibliography', 1979, 132pp, £2.95;
'Information sheets', free, on 'Cold chain equipment' (1979), 'Better use of refrigerators for storing vaccines' (1979), 'Baby weighing scales designs', (1978), 'Oral rehydration' (1978), and 'Appropriate technology periodicals' (1978).

15. APPROPRIATE TECHNOLOGY GROUP

Department of Applied Physics,
University of Strathclyde,
107 Rottenrow,
Glasgow G4 ONG,
Scotland.

Programme.

With funds from the British government, the group is doing research on small-scale solar crop-dryers, and experimental work with maize in Kenya will shortly be starting, after modelling and theoretical work in Glasgow. The University also has an Energy Studies Unit, which organised a five-day residential 'Seminar on Renewable Energy Technology for Development', in March 1980. With funds from the Nuffield Foundation, teaching materials and laboratory experiments on the subject of AT & Renewable Energy, suitable for 3rd world colleges, are being developed. (1)

16. BUILDING RESEARCH ESTABLISHMENT

Overseas Division,
Building Research Station,
Garston,
Watford WD2 7JR,
England.

Programme.

The BRE cooperates with national building research organisations in the development and testing of building materials and techniques. It has tested building blocks made with 10% wood sawdust, coir (coconut) dust and rice husks. Two low-cost hand-operated brick-moulding devices have been built and tested in Britain, and further trials are planned. Basic research on the stabilisation of lateritic soils by lime has led to the development of an improved design for a soil-block pressing machine - field testing of the prototype is planned. Metal brackets and ties for strengthening timber houses in earthquake and hurricane zones have been developed, and are being tested in prototype houses in the Caribbean. An improved pit latrine, consisting of two emptiable pits, has been developed and will be tested in Southern Africa. Each year BRE answers several hundred technical enquiries about building. (1)

Publications.

Over 60 'Overseas Building Notes' are in print, with titles such as "Bitumen Roof Coverings", "Foundations in Expansive Clays", "Sanitation without Sewers"; a list is available, and they are free of charge;

'Roofs for climates', 138pp, 1971, £1.25 plus postage;

'Small buildings in earthquake areas', 40pp, 1972, £0.75 plus postage;

'Third world urban housing', 250pp, £5.40 plus postage;

'Worldwide survey of building research carried out for developing countries, with special reference to low-cost housing', 58pp, 1976, price unknown;

'Brickmaking in developing countries', 88pp, 1979, £6.35 plus postage.

17. COMMONWEALTH AGRICULTURAL BUREAUX

Farnham House,
Farnham Royal,
Slough SL2 3BN,
England.

Programme.

CAB comprises four research Insitutes and 10 research bureaux, mostly in the U.K., all dealing with agricultural matters. CAB provides an abstracting service, an information service, and also a pest-identification service. It is financed by Commonwealth governments and by charges and contracts, but its work is international. Its coverage is vast, and its publications extremely comprehensive. (1)

Publications.

Numerous, comprising abstracts, bibliographies, specialist journals, other periodicals, books; a list is available. A small selection is given below:-

'Charcoal: a new annotated bibliography', 29pp, 1979, £7.20 postfree (abstracts 115 works written on the subject between 1973 and 1978);

'Biocontrol News and Information', quarterly, £30.00 per year (£20.00 for 1980; over 2000 abstracts per year selected from world literature);

'Rural Development Abstracts', quarterly, £37.00 per year (includes 'appropriate technology' in contents list);

'Agricultural Engineering Abstracts', monthly, £52.00 per year (includes 'intermediate technology' and 'renewable energy sources' in its contents list).

18. DAVID LIVINGSTONE INSTITUTE

University of Strathclyde,
McCance Building,
16 Richmond Street,
Glasgow G11XQ,
Scotland.

Programme.

The Institute's main work is research on choice of industrial technology in developing countries, but it is also currently investigating the possible removal, by micro-biological process, of lignin from bagasse, so that surplus bagasse can be used as an animal feed. (1)

19. ENERGY GROUP

Department of Engineering,
University of Reading,
Whiteknights,
Reading RG6 2AY,
England.

Programme.

This Group shares a site at Shinfield, near Reading, with the ITDG Power Project Unit. The Group has a programme of research on energy technology for developing countries.

A Humphrey pump is currently being tested in Egypt and Nepal after development by the Group. This is a liquid-piston pump with a capacity of 6000 gallons/hour and a head of about 7 metres. It is powered by natural gas or biogas, and commercial manufacture in India is under study.

A small wind-pump is being developed for use in Sudan, and is being designed for local manufacture there. Also in the Sudan, the Group is doing a systematic study of solar energy potential.

Other projects of the Group include work on a solar driven freon engine for water pumping, solar driven water pumps and liquid piston solar pumps, a project on small steam engines, and work on a solar stove. A study of energy inputs into Thai agriculture is being undertaken. (1)

20. INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP (ITDG)

9 King Street,
London WC2E 8HN,
England.

Programme.

ITDG was founded in 1965, and is now perhaps the world's leading organisation in this field. As well as its own staff it has expert 'panels', on which over 300 volunteers serve, and it also has subsidiary companies which concentrate on small industry, building materials, transport and publications. ITDG provides consultants to projects overseas, answers technical enquiries, and carries out R&D work on intermediate technologies.

ITDG has technical panels of experts on agriculture, building and building materials, cementitious materials, mining, chemistry and chemical engineering, cooperatives, deafness, ferro-cement, forestry and forest industries, nutrition, power, biomass power, engines, hydro-electric power, solar power, wind power, printing, transport, and water.

Among ITDG's recent projects have been the development and testing of a windpump, which is now being manufactured commercially in Kenya and is about to be in India; the development of a vertical axis free stream river turbine to generate electricity, and of small-scale hydro-electric systems, and the testing of an electronic load controller for these; the design and construction of cooking stoves; the testing and evaluation of solar-powered small water pumps, for the World Bank; and the development of small steam engines.

Work has also continued on fibre-reinforced cement roofing components, which are now being manufactured commercially. Work on this and on brick-making for rural areas is done at IT Building Materials Workshop, a subsidiary.

Another subsidiary, IT Transport, has cooperated with institutions in Bangladesh on the improvement of the cycle rickshaw, and of bullock carts and harnesses. It has also supervised a study of labour-intensive road construction, and its 'Guide to Tools & Equipment for labour-based road construction' will shortly be published by ILO.

ITDG itself has been heavily involved with ferro-cement boat-building in the Southern Sudan, where 14 boats of up to 22 tonnes capacity have been constructed; and it has recently licensed to a private firm a paper pulp moulding system which makes egg cartons, fruit and meat trays and other packaging materials from waste paper.

ITDG administers a fund, on behalf of the British government, for the encouragement of AT institutions in developing countries, providing training and advice and material to such organisations. IT Industrial Services, which is also funded by the British government, provides technical and financial assistance to countries wishing to utilise new or unfamiliar technologies, mainly in small industries. It has cooperated with developing countries on fibre-reinforced cement roofing sheets, pedal-powered transport (Oxtrike), a hand-spinning device for woollen yarn, electronic load-controller for micro-hydro-electric generators, machine tools for bolts and nuts, clay pipe press to produce seamless drainage pipes, micro-hydro-electric installations, simple water wheels, an engine-powered thresher, plywood stitch-and-glue technique for the construction of fishing boats, passive solar heating, Humphrey (liquid piston) pumps. It has organised the transfer to other African countries of technologies demonstrated at the Commonwealth Secretariat's 1977 meeting on rural technology, and has organised the transfer of Nepali weaving techniques to Ghana. It has conducted studies on hollow glassware production, electric melting techniques for small-scale glassmaking, paper manufacture, lost-wax brass-casting techniques, the manufacture of simple small electric motors, cotton spinning technologies, the economics of water-pumping windmills, and on ferro-cement fishing boats. It is giving technical and financial help for the production of a low-cost

duplicator, and is field-testing a portable ice-maker for use in transporting vaccines. It is also field-testing 20 solar-powered water pumps, and has provided a small foundry for test in Ghana. ITIS is involved in a joint venture to test a new design of catamaran fishing boat which can land on beaches during monsoon conditions. (1)

Publications.

ITDG's mail order catalogue is 'the largest publications list on intermediate technology'. It is available from IT Publications, address as above. The selected publications listed below are all available from stockists in Bangladesh, Botswana, India, Kenya, Papua New Guinea and Singapore, among other places. All IT publications are paperback. Payment must be sent with order. For surface mail add 20%, airmail add 45% of purchase price.

'Appropriate Technology', 4 issues per year, journal of world-wide AT, £5.00 per year;

'Complete technical drawings' of the following:-
"Manual broadcast sower" (£5.25);
"Three welding jigs" (£1.50);
"Ox-cart" (£0.75);
"Donkey-cart" (£1.50);
"Polyrow peristaltic pump sprayer" (£2.25);
"Hand-pushed sod seeder" (£1.50);
"SATEC multi-crop seeder" (£3.75);
"Murrell's pack saddle" (£0.75);
"IITA rolling injection planter" (£3.50).

'Agriculture green leaflets: dimensional drawings/photoprints wit text', 3-5pp each, £0.40 each, on Kabanyolo toolbar, Chitedze Ridgemaster toolbar, Prototype multi-purpose ox-drawn tool, IT expandable cultivator, Five-tine sweep cultivator, Two clod crushers, Ox-drawn tie-ridger/weeder implement, IDC weeding attachment for Emcot plough, Adjustable width 'V-drag' ditcher/bund former, Sled-type corrugator/ irrigation furrow former, Single-row and three-row rice seeders, Rotary weeder for row-planted rice, Multi-action paddy puddling tool, Cassava grinder, Rotary corn thresher, IDC-BORNU groundnut lifter for Emcot plough, IT groundnut lifter, IT granule applicator, IT high-clearance rotary hoe, Weeder mulcher, Foot-powered thresher, 'Rasulia' bladed roller thresher, Rice transplanter platform, Four harrows - High-clearance peg tooth, Triangular spike tooth, Flexible peg tooth, Japanese; £0.75 each for similar leaflets on oil-soaked wood bearings, eight simple surveying levels, three animal-drawn carts; £1.25 for leaflet on two oil-drum forges.

'Tools for agriculture: a buyers' guide to low-cost agricultural implements', 173pp, 1976, £4.95;

'Manual on building construction', 352pp, 1975, £3.50;

'The power guide: a catalogue of small-scale power equipment', 240pp, 1979, £7.50;

'A Chinese biogas manual', 160pp, 1979, £3.95;

'How to build a Cretan Sail windmill', (with complete construction plans), 80pp, £2.95;
'How to make basic hospital equipment', 86pp, 1979, £2.95;
'Equipment for rural workshops', 94pp, 1978, £2.95;
'Chinese chain and washer pumps', 53pp, 1976, £1.25;
'Ferro-cement water tanks and their construction', 118pp, 1978, £2.95;
'Hand dug wells and their construction', 234pp, 1977, £3.95 (special £1.50 edition available for developing countries only);
'A manual on the automatic hydraulic ram pump', 37pp, 1975, £1.50;
'Small scale irrigation', 176pp, 1979, £3.95;
'Water treatment and sanitation', 90pp, 1979, £2.00.

21. NATIONAL CENTRE FOR ALTERNATIVE TECHNOLOGY

Llwyngwern Quarry,
Machynlleth,
Powys,
Wales.

Programme.

Mainly concerned with practical demonstration of low-energy, non-polluting self-sufficiency in a rich-country environment, the Centre does have points of interest for poorer countries, notably small-scale electrification from wind and water power (the Centre is not connected to the national electric system); practical testing of 30 different solar collectors and 12 windmills; work on a solar steam engine; and its publications. (1)

Publications.

Numerous, including do-it-yourself plans for windmills etc, technical notes on renewable energy technologies, has a mail-order bookshop; mainly oriented towards developed countries. List available for 10p plus postage, overseas orders please send International Money Order.

22. NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING

Overseas Division,
Wrest Park,
Silsoe,
Bedford MK45 4HS
England.

Programme.

With a staff of 12, the Division is funded by the British government. It advises the Overseas Development Administration, foreign governments and UK industry on agricultural engineering problems, and also responds to technical enquiries from overseas.

In recent years a limited number of research projects have been undertaken, some which have led to commercial manufacture of equipment developed at NIAE. Thus a cotton-stalk puller was developed in the Sudan, because of the need for this as a disease control measure; a four-row tractor-operated puller is now being manufactured in the UK, and two types of one-row animal-drawn puller have also been designed. One, in which the drive for the pulling mechanism comes from a small petrol engine, is now being manufactured in Swaziland.

A small drum thresher for wheat and rice, developed some years ago, is now made commercially, and the design has been adapted to thresh sorghum and quinua. Sorghum threshers with a through-put ranging from 400 to 1000 kgs/hour of clean grain are now under test in Yemen and Botswana.

Prototypes of a tool-carrier to match the ICRISAT broad-bed system of cultivation are being tested in India and Tanzania. Implements suitable for the greater power of cross-bred draught animals are being evaluated in cooperation with the International Livestock Centre for Africa.

In Bolivia the Division is completing development of a hand-pushed non-destructive harvester, to harvest grass seeds of crops which ripen progressively making multi-pass harvesting necessary. The Division has also devised a 'tractor support pallet', which can be carried on the front or back of a tractor and contains clean fuel, lubricants and spares, for tractors working far from maintenance facilities. (1)

Publications.

'Newsletter', 'Bulletins' which describe equipment developed, and 'Technical papers' on particular aspects of mechanisation.

23. OXFAM

274 Banbury Road,
Oxford OX2 7DZ,
England.

Programme.

OXFAM is a charity, whose main activity is funding development projects, although it is also well-known for its disaster-relief activities. It had an income of £9.7 million in 1978-79.

OXFAM does not generally do its own R&D, but it has developed a special 'OXFAM Sanitation Unit', for use in emergencies - it is portable, easily erected, and can handle the sewage of up to 1000 people/day. It is now commercially manufactured. Over 60 of the units are still in use in Bangladesh.

OXFAM has field offices in many developing countries, and field staff can provide a limited number of free books and manuals on appropriate technology, rural development and so on, and a free one year's subscription to the journal 'Appropriate Technology'. Recipients must be bona fide development workers who are for some reason (e.g. foreign exchange restrictions) unable to obtain such publications. (1)

Publications.

'Hand-pump maintenance', 32pp, 1977, £1.25 plus 15% postage;
'Gardening for better nutrition', 64pp, 1978, £1.60 plus 15% postage;
'OXFAM Information Packs', on "Nutrition", "Windpumps", "Fruit & Vegetable Drying", and on "Methane", £0.60 each plus 15% postage;
'Sanitation in Developing Countries', 252pp, 1978, £9.75;
Drawings and instructions for the construction of an 'aqua privy' will be available soon.

24. SOLAR ENERGY UNIT

Dept of Mechanical Engineering & Energy Studies,
University College,
Newport Road,
Cardiff CF2 1TA,
Wales.

Programme.

The Unit is engaged mainly in fundamental research on solar energy, but one current project is on solar water pumping, in cooperation with UNDP and ITDG. It will provide papers and

other information to bona fide applicants. (1)

Publications.

'HELIOS', newsletter on solar energy utilisation, aimed particularly at British industry, but with 500 overseas subscribers; three issues per year, free to bona fide applicants;
Report of research completed and in progress.

25. TEACHING AIDS AT LOW COST (TALC)

Insitute of Child Health,
30 Guilford Street,
London WC1N 1EH,
England.

Programme.

TALC makes and sells, at cost, sets of slides with a script or cassette recording, which provide illustrated teaching on specific topics in tropical health (e.g. management of kwashiorkor; common skin diseases of children). Last year TALC distributed 12,000 sets of 24 slides each. It also distributes Child Growth Charts; Flannelgraphs on child care; a two-ended re-hydration spoon; and low-cost books. Most material is aimed at medical students or nurses/health workers in developing countries. (1)

26. TROPICAL PRODUCTS INSTITUTE

127 Clerkenwell Road,
London EC1R 5DB,
England.

Programme.

TPI is the largest of the Scientific Units which operate under the British government's aid programme; it has a staff of nearly 400 and a budget of several million pounds per year. Its work covers all aspects of post-harvest treatment of tropical plant and animal products, including the utilisation of wastes and by-products. It performs basic scientific research as well as production engineering in Britain, sends experts on short and long term assignments to developing countries, and runs a very comprehensive information service.

The TPI provides advice about existing technologies; it has for example in the recent past sent experts to advise on coconut

processing in Sri Lanka and cereal drying in Lesotho. TPI also develops its own technologies if and when it identifies a gap in existing technology; for example, for cashew-processing, TPI first developed a very small-scale treadle-operated processor, but this proved inappropriate in terms of quality control, so a mechanised plant capable of processing 300 kgs/hour was developed, and installed plant capacity in several developing countries now exceeds 100,000 tons/annum. TPI also designed a simple process for checking and sorting Macadamia nuts in Malawi.

Information was not divulged for this directory on the stage reached in the development of TPI's technologies, or on whether they have been widely adopted in the field. However, TPI states that those technologies described in the Rural Technology Guides (see Publications) have all been 'thoroughly tested' in the field.

Technologies developed or adapted by TPI include the following:- mechanised cashew nut processing; a pedal-operated grinding mill for cereals and beans; manually-operated oil-extraction equipment; a domestic tool for macerating fresh coconut meat; equipment to decorticate glandless cotton-seed for use as a food; small-scale fish processing; small-scale processing of rapeseed into edible products; the production of building boards from waste products; various crop-drying cribs; wood-wool cement slab manufacture; essential oil production; cassava chipping and drying; a coconut dehusker; macadamia nut processing; a hand held maize sheller; pad-batch dyeing of plant fibres; a feeder to fit onto a hand-operated groundnut sheller; stirrup-operated coconut grater; hand-operated bast fibre ribboner; sunflower seed decorticator, and a simple winnower; an improved metal charcoal kiln; a process for the production of fish silage for animal feed; and a rice-dryer fueled by rice hulls.

TPI investigations have included the fuel value of gaseous products formed during the carbonisation of coconut palms, and comparative fuel consumption trials with a cross-draught 'producer gas' plant. An experimental methane digester using waste materials such as cassava peelings and cocoa pods has been built, while laboratory work on methanogenic bacteria has been carried out. An improved design of furnace for flue-curing of tobacco was investigated by TPI staff in Malawi.

TPI has also done a lot of work on coir fibre, including finding a suitable black dye, investigating suitable flame retardants and the fire resistance of coir matting, and research on processing. Laboratory work to improve the water-fastness of dyes on sisal has been carried out, and work done on the cultivation, extraction and degumming of ramie fibre. The small-scale spinning of 'sea-island' cotton in the West Indies has been successfully developed, and substantial improvements made to the efficiency of cotton ginning in Afghanistan. (1)

Publications.

Numerous; a selection is given below, but a full list is available from Publications Section, TPI. Single copies are free to public organisations in countries which receive British aid (this does not apply to copies of 'Tropical Science'); the price given includes surface mail.

'Tropical Science', 4 issues per year, journal of TPI, £9.00/year;

'Tropical stored products information', 2 issues per year, £1.60 per issue;

'Tropical storage abstracts', 6 issues per year, £0.55 per issue;

'Oil palm news', one or two issues per year, £1.30 per issue;

'Bibliography of insecticidal materials of vegetable origin', 2 issues per year, £0.90 per issue;

'Conference proceedings' on tropical fish, on animal feeds, on spices, on tropical and sub-tropical fruits, on essential oils, on oil palm; prices vary;

'Produce top quality bananas', a pictorial instruction manual, 12pp, £0.70;

'Marketing top quality bananas', a pictorial instruction manual, 16pp, £1.30;

'Industrial technology: a guide to sources of information in the UK available to developing countries', 1979, 22pp, £0.60;

'Rural Technology Guides', intended for extension workers, providing working details and simple text:

"A wooden hand-held maize sheller", 1977, 8pp, £1.05;

"Pad-batch dyeing of plant fibres", 1977, 54pp, £2.65;

"Mixing insecticide powders with grain for storage", 1977, 14pp, £0.60;

"A feeder to improve the performance of a hand-operated groundnut sheller", 1977, 17pp, £1.00;

"A pedal-operated grain mill", 1979, 32pp, £0.80;

"A stirrup-operated coconut grater", 1979, price unknown;

"A hand-operated bast fibre ribboner", 1979, £0.55;

'Crop Digests', which give particulars of all aspects of their topics on:

"Oils and oilseeds", 1971, 190pp, £1.15;

"Root crops", 1973, 280pp, £1.95;

"Food legumes", 1979, £7.50;

'Reports', usually priced at less than £1.00, on various topics, but including analyses of the market for tropical fruits and vegetables in parts of Europe; techniques for the production of numerous tropical products such as fibres, oils, flours; reports on the pulping characteristics of many species of tropical wood; and on equipment and machinery for various purposes.

27. BIOMASS ENERGY INSTITUTE

P. O. Box 129,
Postal Station C,
Winnipeg,
Manitoba,
Canada R3M 3S7

Programme.

This Institute was founded in 1971, to gather and disseminate information about the potential of 'biomass' energy - i.e. the energy which is stored in plants and animals and in their wastes; for example, distillation of alcohol from sugar-cane for use as a substitute for petrol, the generation of methane gas from livestock waste, and the use of timber as a fuel. The Institute sponsors research, runs a library, answers queries, organises conferences, and generally promotes the use of biomass energy. It is funded by donations from corporations and individuals, and from consultancy fees. (1)

Publications.

'Bio-Joule', quarterly, 8-12pp, price unknown.

28. BRACE RESEARCH INSTITUTE

Faculty of Engineering,
Macdonald College of McGill University,
1 Stewart Park,
Ste. Anne de Bellevue,
Quebec,
Canada H9X 1CO

Programme.

Brace was founded in 1959, and has since become a leading organisation in its field, concentrating on technologies for rural communities in arid areas. Its primary activities are water desalination; use of water in arid conditions; utilisation of solar, wind and biomass energies; general development of arid zones; and appropriate technology and ways of getting it successfully adopted.

It is funded by the Brace bequest, by consultancy fees and by grants. It particularly encourages the establishment of AT institutions in developing countries, and has close links with many such organisations. Brace answers enquiries, and sends out technical information, though it is currently analysing its Enquiry Service after a great increase in enquiries in the past year.

Current research includes testing an organic fluid Rankine cycle engine for water pumping; testing the performance of unglazed steel roof panels as solar energy collectors; developing thermal heat storage in paraffin wax; the reconstruction and re-evaluation of the Brace sail windmill. There is extensive testing of a variety of solar equipment, and continuing development of the Brace greenhouse, with the addition of insulated night covers and a simple heat storage system; the basic Brace greenhouse is now widely used.

In 1978 a solar still (for desalination of water), which Brace had built in 1968 in Haiti, was overhauled. 9 of the 15 bays were still in operation after ten years.

During the year 1978-79 Brace was engaged on work in many developing countries; it supplied technical information on renewable energy to the University of Dar es Salaam, advised the UN on the use of solar energy in Djibouti, advised the government of Mauretania on small-scale desalination systems, and did similar work in Upper Volta, Senegal, and Venezuela. (1)

Publications.

Available from the Publications Department, address as above: all orders subject to a $Can 1.50 handling charge. A full list of publications and an order form is available from Brace. Publications are free to bona fide workers in developing countries, and sold at cost to people in industrialised countries. Most are published in English, French and Spanish, and some in Arabic. All orders must be pre-paid; prices in Canadian dollars.

'Do-it-yourself leaflets', explaining how to make a:-
- *"Solar still", 9pp, 1973, $1.50;*
- *"Solar Steam cooker", 6pp, 1972, $1.50;*
- *"Solar water heater", 10pp, 1979, $1.50;*
- *"Solar Cabinet Dryer", 9pp, 1973, $1.50;*
- *"Savonius wind machine for pumping water", 12pp, 1979, $1.50;*

'Technical Reports' on:-
- *"Performance test of a savonius rotor", 20pp, 1964, $2.25;*
- *"Instructions for constructing a simple solar still", 6pp, 1967, $1.50;*
- *"Plans for a glass and concrete solar still" (with 2 blueprints), 9pp, 1972, $4.50;*
- *"Simple electric transmission system for a free-running windmill", 31pp, 1970, $2.25;*
- *"Production drawing for solar cabinet dryer", 1973, $2.50;*
- *"Storage of solar energy", 22pp, 1974, $2.25;*
- *"Windmill power pumps with intermediate electrical power transmission", 14pp, 1975, $1.75;*
- *"Survey of solar agricultural dryers", 144pp plus photos, 1976, $9.00;*
- *"Plans for construction of solar steam cooker", 1978, $7.00;*
- *"Plans for construction of Brace greenhouse", (6m x 6m or 6m x 18m, specify), $2.50 each;*

"Windpower theory, application and equipment", 27pp, 1978, $2.00;
'Blueprints and drawings':-
"Low-cost wind speed indicator", No. D-5-089, $2.50;
"Piston water pump", No. D-5-084, $5.00;
"Prototype pumps for attachment to windmills""Rotary displacement pump", No. D-M-064, $2.50; "2-Vane pump", No. D-M-065, $2.50; and "4-Vane pump", No. D-M-066, $2.50;
"Simple cooking stove", No. C-6-045, $2.50;
"Solar food warmer and insulated cooker", No. D-6-088, $2.50;
"Solar Hot Box food warmer", No. D-6-093, $2.50;
"Solar pipe cooker", No. D-6-090, $2.50;
"Solar steam cooker", No. C-6-087, $7.00;
"Large-scale solar steam cooker assembly", Nos. C-6-027, -028 and -029, $7.00;
'Fact sheets' on numerous topics, costing around $1.00 with brief description of specific topics, but no great details; also conference papers.

29. CANADIAN HUNGER FOUNDATION

323 Chapel Street,
Ottawa,
Ontario K1N 2Z2,
Canada.

Programme.

The CHF is a voluntary development agency, with a small staff and access to an informal network of consultants. It has funded some informal R&D on adaptation of proven technologies to local conditions. Its principal work in rural technology is its publication 'Handbook on AT' (see below). (1)

Publications

'Handbook on AT', in English, French and Spanish; revised 1979, $14.50 to large organisations and rich individuals $7.50 to small groups and individuals in 3rd world. A new edition of this handbook will be published in 1980, and will include case studies of appropriate technologies which have been successfully diffused and adopted on a significant scale.

30. INTERNATIONAL DEVELOPMENT RESEARCH CENTRE

P. O. Box 8500,
Ottawa,
Canada.

Programme.

IDRC is funded by the Canadian government and supports research on the application of science and technology to development. It particularly concentrates on building up a research capability in developing countries, and on developing technologies which will aid the rural poor while at the same time being based on sound scientific principles.

It has a very wide range of activities, only a few of which can be mentioned here. It supports the Technonet Asia programme; it has assisted in the development of the PVC 'Waterloo' hand-pump, which is now being tested in several countries - this utlises polyethylene piston rings which can be easily replaced as and when they wear out; IDRC has financed work on alternative waste disposal and waste-utilisation methods; and it has funded a lot of work on forestry and timber-utilisation.

IDRC has a special programme in 'Post-Production Systems', supporting several research projects to develop cheap, appropriate technologies for the small farmer. Projects in this programme include the development of ploughs, of groundnut and potato diggers, of seed-drills, cultivators, sprayers and pumps, of threshers, and of groundnut strippers. In drying of produce, IDRC has worked on fish-dryers, on a process for rapidly reducing the moisture content for short-term storage of wet paddy, on large and small-scale solar grain dryers, and on mechanical crop-dryers using a variety of renewable fuels. In the field of crop storage, there has been research into the use of sunlight, oil, ash, sand, salt, leaves and other materials in the treatment of crops for storage, and studies of the changes in the characteristics of legumes under various storage conditions. The development of mechanised techniques for dehulling (dehusking and debranning) of sorghum and millet is one objective of IDRC supported research - a batch dehuller suitable for sorghum, legumes and possibly for millet, is currently being tested in four countries, while a continuous throughput dehulling system has been tested as well. A process for the preparation of minced fish is being developed in India.

IDRC has supported scientific analysis of food crops, to determine their properties and to develop standards which can be used in crop-improvement programmes - crops studied have included sorghum and millet, and various fruit and vegetables; studies have also been made of the quality of cowpeas, mung beans, faba beans, velvet beans and kidney beans.

Projects to improve the utilisation of agricultural produce include the use of waste as fuel to heat fish-dryers, solar

drying of potatoes, and drying coffee berries by using methane gas produced by digesting coffee pulp, as well as an improved process for extracting the oil from shea nuts. Techniques for processing soybean have been adapted to treat lupine (a legume like soybean), while the village production of infant foods has been studied and new methods of fish processing tested in India. (1)

Publications.

Numerous, including a number of seminar and conference proceedings; a selection of titles is listed below. Prices given are in Canadian dollars; special consideration is given to institutions, researchers and administrators in developing countries. A list of all publications is available.

'The IDRC Reports', quarterly, 28pp, free, about IDRC projects;

'Food systems', 1979, 27pp, free, account of IDRC post-harvest projects;

'Cassava harvesting and processing ...', IDRC-114e, 1978, 84pp, $5.00;

'Coffee pulp: composition, technology & utilisation', IDRC-108e, 1979, 95pp, $8.50;

'Fish farming ... IDRC Research', IDRC-120e, 40pp, free;

'Directory of food science and technology in south-east Asia', IDRC-023e, 1975, 267pp, $10.00;

'Sorghum & millet: food production & use', IDRC-123e, 1979, 64pp, $5.00;

'Natural durability and preservation of 100 African hardwoods', IDRC-017e, 1967, 131pp, $10.00;

'DEVSIS: ..... international information system for the development sciences', IDRC-065e, 1976, 247pp, $10.00;

'Rice: post-harvest technology', IDRC-053e, 1976, 394pp, $20.00;

'Biogas technology in the 3rd world: a multidisciplinary review', IDRC-103e, 1978, 132pp, $10.00.

31. COMMUNITY EDUCATION TRAINING CENTRE

South Pacific Commission,
Box 5082,
Raiwaqa Post Office,
Suva,
Fiji.

Programme.

Concerned more with teaching people how to construct and use technologies than with developing new ones, this organisation is involved in teaching community development to women from all over the Pacific Islands. Technologies taught include smokeless stoves (ventilated, made of cement), drum ovens, natural dyes, charcoal making, solar dryer, hot box cooker, soap making, furniture making, and the water seal toilet. (1)

Publications.

'T-shirts and Tapa Cloth', which includes descriptions of many technologies appropriate to the region; $Aus 3.50 in region, $Aus 5.25 outside region; available from the South Pacific Commission, P.O. Box D5, Noumea, New Caledonia.

32. SCHOOL OF NATURAL RESOURCES

The University of the South Pacific,
P. O. Box 1168,
Suva Fiji.

Programme.

The School is principally engaged in teaching and scientific research, but also has special interest in certain small-scale technologies, notably in the renewable energy field. 8 designs of wood-burning stove have been tested under laboratory conditions; all were made from pre-cast concrete modules with cast-iron fittings. Ten prototypes of the best design are now under construction for field testing.

Laboratory and field experiments on biogas production have been done; the field digesters use pig waste, but lab work has tested water hyacinth, sea-weeds and field grasses. No successful design of digester has yet been found - concrete brick cannot be satisfactorily sealed, neoprene rubber tends to rupture, and inlet and outlet pipes tend to get blocked. Research has also been done on the sensitivity of the enzymes to changes in the substrate.

The possible use of coconut oil as fuel in a small diesel engine

has been investigated for the Coconut Board of Fiji. A study of the production of ethanol from cassava and from sugar, for use as a fuel, will be completed in 1980. A prototype solar water heater has been tested for the government.

The properties of reactive silica from rice husk ash have been examined, with a view to its use as a pozzolanic material. With the Housing Authority, the School has tested the use of coir (coconut fibre) as a fibre in cement roofing sheets. The results satisfy the relevant British standards.

Closely associated with the SNR is the Institute of Natural Resources, also part of the university, where the main thrust of activities is analytical services to bodies outside the university. Within this Institute there is now a Centre for Appropriate Technology & Development, which will be starting its programme in 1980. It will be responsible for manpower training as well as research and development of technical equipment. (1)

33. YUNDUM EXPERIMENTAL STATION

(Agricultural Mechanisation Section),
Yundum,
The Gambia.

Programme.

Yundum Experimental Station is the main testing and design centre in the Gambia. A national policy for agricultural mechanisation has been in force for 20 years. The Gambia has decided that agriculture can only be effectively mechanised by a step-by-step progression from hand-cultivation and it has taken great care to identify the tools most appropriate to local conditions.

The Agricultural Mechanisation Section has done rigorous tests of different implements, amongst them: the Uni-bar, the Aplos tool-frame, the OD2 ridger and the Emcot ridger, and now the Sine-Houe tool-bar from Senegal which it has finally identified as suitable for widespread adoption. The manufacturers have adapted the design to suit local conditions, after the Section recommended changes.

In addition to this core programme, the Section at Yundum collects and tests a wide range of manual powered processing machinery and has designed and built limited numbers of groundnut threshers, winnowers, and shellers. (2)

34. BUILDING AND ROAD RESEARCH INSTITUTE

University P.O. Box 40,
Kumasi,
Ghana.

Programme.

This Institute has done work on low-cost roofing materials using bagasse as a reinforcing fibre, and has investigated the pyrolitic conversion of wood and agricultural wastes. The production of lime from wood-fired and residual-oil-fired kilns has been tested, but the residual-oil proved inappropriate. Several brick-making processes have been developed and long-term studies of pozzolana materials carried out. (1)

Publications.

Information sheets on building materials, preservation, construction etc, and specific reports.

35. DEPARTMENT OF NUTRITION & FOOD SCIENCE

University of Ghana,
P. O. Box 134,
Legon,
Ghana.

Programme.

This Department has started what is believed to be the first university course in 'Appropriate Food Technology' anywhere in the world, for students in the BSc Food Science programme. The Department has also built a prototype improved baking oven, which, by the simple expedient of inserting a shelf, doubles the capacity of the traditional oven; it also incorporates a heat store, in the form of broken glass and common salt, in the base. Wholemeal bread baked at the university is now sold commercially. (1)

Publications.

'Improvement of the traditional Ghanaian baking oven', reprint from 'Appropriate Technology' Vol 6 no 2, 3pp, 1979;
'Food News', the bulletin of the Nutrition & Food Science Society, twice yearly, 10-20pp, free.

36. FOREST PRODUCTS RESEARCH INSTITUTE

University P.O. Box 63,
Kumasi,
Ghana.

Programme.

The FPRI carries out research on all aspects of forest products, and much of its work is basic analysis of the characteristics of different timber species, e.g. their suitability as sources of tannin for leather-tanning, and their calorific yield when used for charcoal.

The Institute has investigated the use of wood as a building material other than in the form of sawn timber, and has developed a wood/cement building panel, and a labour-intensive technique for its production. Recent work has been on the addition of bauxite wastes to the mix, to act as a mineralising agent.

Pulps for paper manufacture have been produced from local wood species, and also from banana pseudo-stems, a widely available agricultural waste in Ghana. Results have been satisfactory, though removal of silica and pith from the pseudo-stems will probably improve the product. Wooden roller machinery has been designed to compress the pulp.

Experimental charcoal kilns, including a portable metal one, a mason-type and the latest Philippine pit-type have been built and tested. A solar kiln for drying timber has recently been constructed for tests, first results of which appear very promising. With the Technology Consultancy Centre, the Institute is experimenting with bee-keeping, and a staff member is to visit East Africa to make further studies of this.

Other work at the Institute includes the small-scale collection and processing of gum arabic, with a view to commercial marketing of this product; tests on the inter-cropping of food crops and trees; the treatment of poles for fencing, using vacuum-pressure with a copper-chrome arsenic preservative but also by the double-diffusion method using locally available chemicals; testing of wood glues, and the use of lesser known timber species in glued laminated timber; and the treatment of bamboo for use as structural material. (1)

37. TECHNOLOGY CONSULTANCY CENTRE

University of Science & Technology,
University Post Office,
Kumasi,
Ghana.

Programme.

TCC started in 1972 as a means of channeling the University's expertise into solving problems of development. The approach has been to establish direct links with craftsmen and small industrialists, by having graduate 'project-managers', who act as a link between the expert at the University and the manufacturer needing assistance. TCC has also set up its own production units, and has a central mechanical and welding workshop.

Two technologies developed at TCC have been widely applied, these being soap production and paper-glue. Soap is produced from palm-oil in a wood-fired process, at one of the TCC's own production units. Trainees from Guinea-Bissau and Cameroun have come to this plant. Another unit produces nuts and bolts, cut-plate hoes and ploughshares, gate hinges and other metal products. The third unit is a weaving workshop using 40-inch looms in place of the traditional 4-inch ones, and weavers have been trained to use the new machines, and local carpenters to build them.

An example of the TCC approach has been the technical assistance given to the makers of traditional glass beads, whereby TCC located a commercial source of dye for the beads and, through ITDG, identified a suitable polisher to improve the quality, and thus the value, of the beads. Together with the Forest Products Research Institute, TCC is planning to help farmers to start bee-keeping, as the lost-wax brass-making process, common in Ghana, is facing a shortage of wax. TCC has also investigated the use of this process in the manufacture of items such as door knobs.

TCC has become involved in the revival of a derelict rubber plantation and the repair of its machinery; it has been testing a pyrolitic converter using sawdust and woodchippings, and also testing rice threshers in Northern Ghana; it has experimented with the extraction of castor oil; and it has produced a low-cost plam-oil press. Two models of the pedal-powered Oxtrike are under test at Kumasi.

A steam distillation perfume extractor, the product of which is used to perfume the soap produced by TCC's plants, has been built and tested, and Lever Bros have now acquired the prototype. (1)

Publications.

'Annual Review', a very thorough account of successes and failures. An account of TCC's work has recently been published by ITDG, London:-
'Intermediate Technology in Ghana', by Sally Holtermann, £2.00.

38. INSTITUTE OF APPLIED SCIENCE AND TECHNOLOGY

University of Guyana,
P. O. Box 791,
Georgetown,
Guyana.

Programme.

This Institute is now being established. Its main topics will be alternative energy (charcoal, solar, wind, biogas), wood curing and seasoning, and use of natural products (edible and essential oils, plant extracts). Its major emphasis will be on appropriate technology for rural development. The Department of Mechanical Engineering of the University is testing two biogas plants, one family-size and one for a small community. (1)

39. ACTION FOR FOOD PRODUCTION (AFPRO)

Community Centre,
C-17 Safdarjung Dev. Area,
New Delhi 110 016,
India.

Programme.

AFPRO is a coordinating and servicing organisation for voluntary development agencies in India. It has a Technical Information Service which answers enquiries and distributes information.

AFPRO has teams of experts on water resources, which are located in different areas of the country advising on the siting of wells, drilling problems etc. The AFPRO Construction team is currently constructing demonstration 'Janata' biogas plants in different locations and training masons in their construction; these plants are considered to be a considerable improvement on the older Khadi models because they are much cheaper. (1)

40. AGRICULTURAL TOOLS RESEARCH CENTRE

Suruchi Campus P.O.Box 4,
Bardoli 394 601,
India.

Programme.

The Centre develops and tests technologies and equipment suitable for small-scale farmers, and the designs are then given, for a small royalty, to a sister-organisation, Yantra Vidyalaya (same address). This manufactures them for sale and at the same time trains artisans, on the job, in blacksmithy, carpentry, motor re-winding, engine maintenance, wiring, plumbing etc. Yantra Vidyalaya is self-supporting, and currently produces over 50 different tools developed by ATRC, among which are all the standard agricultural implements.

The ATRC has developed a simple flat-plate solar cooker, 300 of which have been manufactured and sold.

One of the problems of conventional biogas plants, corrosion of the iron gas holder, has been solved by ATRC by means of a reinforced concrete slab, which is both cheaper and lasts longer. Many local farmers have adopted this design. An experimental biogas plant with 2 digestion chambers has been tested as a model, and a prototype is now under construction. A prototype digester which uses garbage, i.e. any organic waste, has been operating at the campus. (1)

Publications.

'Design of a flat-plate solar cooker';
'Garbage Gas plant';
Many others in Hindi and Gujerati.

41. APPROPRIATE TECHNOLOGY DEVELOPMENT ASSOCIATION

P. O. Box 311,
Gandhi Bhawan,
Lucknow 226 001,
Uttar Pradesh,
India.

Programme.

ATDA is one of the main centres for the development of AT in India. It carries out its own studies and development of technologies, but also collaborates with other established AT organisations in these activities.

It has set up pilot projects of cotton-spinning for the handloom industry, small-scale sugar production and small-scale cement production. Solar cookers, biogas plants and whiteware and red clay pottery projects are also being developed.

ATDA provides advice and information on these technologies, and part of its approach is to ensure that the management as well as the purely technical aspects of a new technology are well established.

Other projects include small-scale rice-milling, the manufacture of agricultural tools, improvements to cycle rickshaws, and work on solar water heaters, windmill pumps and oil expellers. (1)

Publications.

'AP-TECH Newsletter', quarterly, $2.00 per year plus postage;
'Directory of machines, tools, plant, equipment, processes and industries', 280pp, 1976, $10.00 plus postage;
Most of the following are c.40 pages, some with drawings; prices do not include postage:
'A search for an appropriate technology for decentralised cottage spinning industry in rural India', $2.00;
'The development of an appropriate technology for decentralised pottery industry in rural India', $2.00;
'Some developments of an appropriate technology for improving physical amenities in rural homes', $2.00;
'Pilot project of decentralised spinning technology for handloom weavers', $2.00;
'Feasibility report on mini-sugar technology', $2.00;
'Cottage whiteware pottery', $2.00;

'Appropriate technology & research projects', $2.00;
'Solar cookers', $2.00;
'Mini-cement technology', $2.00.

42. APPROPRIATE TECHNOLOGY UNIT

Allahabad Polytechnic,
Allahabad 211 002,
India.

Programme.

The Polytechnic runs a Production-cum-Training Centre and an Integrated Rural Development Programme in 15 villages, as well as carrying out regular teaching activities. The AT Unit was set up in March 1978. It develops and tests prototypes, as well as assisting in transfer through the village extension programmes of technologies which can be manufactured by the Production Centre. It runs an AT Information Service, and has links to many international AT organisations.

Among the agricultural implements now manufactured are an improved ploughshare, a pedal-operated winnowing fan, a disc-harrow, and a power-operated wheat-thresher. The AT Unit has also developed a paddy weeder, small-scale flour mill and hand tools.

Hundreds of low-cost water-seal latrines have been built in villages under the Unit's programme, and wells have been fitted with a low-cost chlorinator. A simple bacteria-free water filter has been developed.

In cooperation with TOOL, of the Netherlands, the Unit has built 10 water-pumping windmills for irrigation. These are low-velocity, 12-blade machines on 6 metre steel towers, with a leaking piston of wood in a PVC pipe cylinder. At a pumping head of 15 metres, discharge is 2,500 litres/hour in a wind of 2.5m/sec, rising to 30,000 litres/hour in a wind of 10m/sec, above which wind speed the rotor automatically shifts out of the wind. 5 of the windmills built so far have been sold to private purchasers. In December 1979 the Unit organised a ten-day workshop on windmill technology.

Over 300 biogas plants have been built and installed by the Polytechnic over the years; the AT Unit has developed a cheaper and simpler drumless model, made of simple masonry capped with a reinforced concrete slab.

Solar water heaters, flat-plate cookers and reflector cookers have also been built, but have had only limited success in the trial villages.

The Unit has built and is testing prototype pumps of various kinds such as a bellows pump and an inertia pump.

The Unit reports a great demand for its ferro-cement products, which are now being made in the villages themselves. These include grain storage bins, corrugated roof-sheets, drain pipes, channels for irrigation, door-frames and sanitary fittings. (1)

Publications.

'Polytechnic Resource Letter', 24pp, a monthly newsletter for and about technical education, with articles on AT among other topics; 6 rupees per year;
Mimeographed 'Report on Windmill project', 2pp.

43. APPROPRIATE TECHNOLOGY UNIT

Dept. of Industrial Development,
Ministry of Industry,
Udyog Bhavan,
New Delhi 110 011,
India.

Programme.

This Unit was set up in 1971, and organised 2 national seminars on AT in the early 1970s. Since a re-orientation of its programme in 1977, it has been commissioning R&D work from established laboratories on topics which the Unit identifies as being potentially open to AT solutions.

A mini-chamber system brick kiln has been developed, suitable for use by a rural family. Tests have shown the bricks to be of high quality and fuel consumption to be less than the conventional pyramid kiln.

A study has recently been completed for the ATU on the feasibility of windmills as a source of power in India; this study has covered technical and social implications, location, costs and benefits, and identification of potential agencies for installation and maintenance.

Ongoing research under the auspices of ATU includes work on citronella cultivation and extraction, leather technology, an inventory of skills and tools used by rural artisans, and pilot projects on the production of corrugated roofing sheets and on the seasoning of timber in TS 2 kilns. (1)

Publications.

'Appropriate technology for balanced regional development', two volumes, date and price unknown;
'A programme for the development and utilisation of windmills in India', (in 2 parts).

44. CELL FOR THE APPLICATION OF SCIENCE & TECHNOLOGY TO RURAL AREAS

(ASTRA)

Indian Institute of Sciences,
Bangalore 560 012,
India.

Programme.

ASTRA was set up in 1974, to redirect the work of the IIS towards problems of rural areas, by both simplfying modern technologies and applying modern science to traditional technologies. Among other projects it has carried out work on solar, wind and biogas energy, developed a successful vertical axis wind pump, improved the standard hand pump, and set up an extension centre. (3)

45. CENTRAL ARID ZONE RESEARCH INSTITUTE

Jodhpur,
342 003,
India.

Programme.

With over 300 scientific and technical staff, CAZRI is a major research centre. Its Division of Wind Power and Solar Energy Utilisation conducts research and testing of prototypes of solar equipment - water heaters (double glass compared to single reflector plus insulation cover); cabinet dryer (with iron filling to maintain heat); flat plate collector (with booster at edges), optimisation of air gap between absorber and cover glazing, wirewound tube in plate collector; solar distillation of water; solar steam cooker, with and without selective coatings.

An improved biogas plant based on a Chinese design has been tested and is reported to be satisfactory - pressure on the gas is maintained by the slurry in the outlet tank.

CAZRI tests various innovations in a cluster of villages, and

reports that a major problem with the biogas plant is the lack of regular water supply; while the fact that most cooking is done in the early morning and late evenings makes solar cookers inappropriate. (1)

46. CENTRAL RESEARCH INSTITUTE FOR VILLAGE INDUSTRIES

Khadi & Village Industries Commission,
Maganwadi,
Post Box 4,
Wardha 442 001,
India.

Programme.

Khadi & Village Industries has a very extensive programme of introducing small-scale industries, using appropriate technologies, into the rural areas of India. This Research Institute reports that it has developed the following products and processes.

In the field of oils and soap, it has developed a seed dryer, a neem seed (Morgosa) depulper, a decorticator for neem seed, a power ghani, a groundnut sheller and an improved filter centrifuge. It has also devised a process for the preparation of syrup from Mahua flowers, modified the standard Wardha ghani oil expeller (bullock-driven), and improved the oil-extraction process by fitting the kettle with a stirrer.

In the processing of cereals and pulses, the Institute has developed a process for improved retention of Vitamin B in paddy, and one for the manufacture of Poha from paddy; it has also worked on the utilisation of unpolished rice in food preparation. A hand-operated mill which breaks very little rice has been developed, and a separator, which is fitted to this mill, reduces the labour of winnowing rice which has not been dehusked.

Methods have been developed to recover glue from bones and fleshings. A process for the preparation of Dicalcium Phosphate has been patented, and work has been done on cattle and poultry feed production.

An improved potter's wheel, incorporating simple ball-bearings, has been developed. Hollow bricks and drainage pipes have been made from ordinary clay, as has a village cooler.

The Institute prepares very high quality hand-made paper, suitable for permanent record-keeping, and has improved parts of the paper-making process, such as the lifting device and drying frames. Filter paper, and hardboard made from groundnut shells and rice husk, are among the products developed, while research has been

done on the manufacture of paper from plantation stem fibres, sayali bark, sabai grass and jute sticks. (1)

47. CENTRAL SERICULTURAL RESEARCH & TRAINING INSTITUTE

Shanthivilas,
Nazarbad,
Mysore 570 001,
India.

Programme.

This Institute works on silk-worm rearing and, as part of this, on mulberry cultivation. In the last ten years the Institute has pioneered improved techniques of rearing, which are explained in the publications listed below. Members of the Institute have advised several countries on sericulture. (2)

Publications.

'Mulberry cultivation in south India', 1978, 20pp, Bulletin No.1 of CSRTI, Mysore (available from FPRD, Commonwealth Secretariat);
'New technology of silkworm rearing', 1978, 24pp, Bulletin No.2 of the CSRTI, Mysore (available from FPRD, Commonwealth Secretariat).

48. CENTRE OF SCIENCE FOR VILLAGES

Magan Sangrahalaya,
Wardha,
Maharashtra 442 001,
India.

Programme.

The Centre is associated with Khadi & Village Industries, and acts as a link between rural development agencies and scientists who have developed rural technologies. It does this by demonstrating such technologies and training villagers in their manufacture and use.

CSV has installed about one hundred 'soak-pit hand-flush' lavatories, these using two tanks, with honey-combed walls covered with slabs for anaerobic fermentation. They are reported to be quite successful.

Attempts to popularise bamboo-reinforced cement have not been

successful, but lime pozzolana cement, costing about 60% of the normal cement, has proved useful in constructing a demonstration house.

One of the techniques most widely adopted has been a bitumen solution to stop erosion of mud walls.

Paper is being made from banana fibre. At present CSV is concentrating on the production of board and thick paper suitable for files, while trainees complete their programme.

Tests of an ICRISAT-type solar cooker showed that there was too much loss of heat by convection, the parabola became easily distorted, and the whole unit was too large. Trials with a re-designed model are planned. (1)

49. COLLEGE OF AGRICULTURAL ENGINEERING

Tamil Nadu Agricultural University,
Coimbatore 641 003,
India.

Programme.

This University is one of the two research centres for the 'Coordinated Scheme for Research & Development of Farm Implements and Machinery and Production of Prototypes and their Evaluation under Different Agro-climatic Conditions', financed by the Indian Council for Agricultural Research. This Scheme started in 1974 and has involved extensive development work, both at Coimbatore and elsewhere, and testing at Coimbatore of many prototypes and manufactured models of machinery and implements. The College itself has also done its own work in developing and testing equipment.

Under the ICAR scheme, the following equipment has been developed:- power tiller attachment for a seed-and-fertiliser drill; oscillating groundnut grader; cage wheels for power tillers for wetland puddling; pedal-operated cashew cracker; sunflower seed sheller; trencher for circular trenches round cashew trees; dryland farming sweep, chisel plough and furrow opener; bullock-drawn five-tined cup-feed seed drill-and-planter; power tiller operated paddy harvester; and a low-cost power tiller.

Equipment tested and evaluated has included a tractor-drawn groundnut digger/elevator, bullock-drawn powered sprayer for sugarcane, various foreign hand tools, a cotton-seed delinting machine, a chaff cutter, a husker/sheller, and bullock-drawn and tractor-drawn potato diggers. Studies have been carried out on a variety of seed and seed-and-fertiliser drills.

The College itself has developed the following items of equipment (all are described in the 'Catalogue' referred to in the list of publications below): bullock-drawn chisel plough, sweep, peg-type dryland weeder, star-type dryland weeder, helical bladed puddler, sheep foot roller, cup-feed seed drill, and groundnut and potato diggers; power-tiller operated cage wheel, trencher, bund-former, lawn mower and paddy harvester; hand-operated comb-type groundnut stripper and drum-type groundnut stripper, and (with electric heater) jasmine oil extractor; equipment powered by rotary power sources such as tractor power-take-offs or electric motors, including a paddy thresher (5HP), paddy winnower (1HP), groundnut grader (1HP), groundnut decorticator (1HP), maize sheller (1HP), husker sheller for maize (7.5HP), sunflower seed sheller (3HP), cotton delinting machine (3HP), chaff cutter (2HP), fibre extractor (jute, sunhemp etc) (2HP), pelletiser for fish-meal (2HP), paddy pre-cleaner (1HP), rectangular metal bin batch dryer (2HP), hot air generator with venta floor dryer (10HP plus kerosene), portable continuous flow hot and cold air zone dryer (12HP), continuous flow mixing-type LSU dryer (10HP), vegetable seed dryer (0.5HP plus 18KW heat), seed/grain thickness grader (3HP), Petkus-type seed cleaner-and-grader (7.5HP), Cripper-type seed cleaner-and-grader (1.5HP), and an aerated steam therapy unit for sugarcane setts (10KW).

The College's catalogue also describes a single-walled bamboo storage bin, capable of holding 5 quintals of paddy; a double-walled polythene-lined bamboo bin of similar capacity; a mobile biogas plant; and an hydraulic dynamometer for testing the draught requirements of equipment.

The College has also developed and tested, though not described in the catalogue, a hand-operated groundnut decorticator, maize sheller and dryland weeder; a bullock-drawn imprinter, and a multi-purpose tool-bar which is a lighter and considerably cheaper version of the ICRISAT model (not yet tested). (1)

Publications.

'Catalogue of improved farm implements & processing machinery developed at College of Agricultural Engineering, Coimbatore', 84pp, with one-page drawing and one-page data about each of 41 implements referred to above, price unknown.

50. COUNCIL FOR SCIENTIFIC & INDUSTRIAL RESEARCH

Rafi Marg,
New Delhi 110 001,
India.

Programme.

The CSIR is the central government body for research in all fields of science and technology, with 44 laboratories and about 5000 scientists. Most of its work is not applicable to this directory, but since 1972 it has run the Karimnagar Project, an attempt to apply its resources of science and technology to speed up the development of a 12,000 sq. km. area of Andhra Pradesh. Industries using techniques developed at CSIR labs, housing utilising materials devised by CSIR, a communal biogas plant using 24 ferro-cement domes, the construction of a water-pumping windmill, are among the projects carried out under this programme. Evaluation of the Karimnagar project will provide an unique opportunity to test many of the assumptions about AT and development. (2)

Publications.

'CSIR in the service of rural society', 1978, 75pp, gives an overview of CSIR's work in the field, and a list of current research projects which are relevant to rural areas.

51. DEPARTMENT OF AGRICULTURAL ENGINEERING

G.B. Pant University of Agriculture & Technology,
Pantnagar,
Distt. Nainital 263 145,
Uttar Pradesh,
India.

Programme.

This University department has designed and developed the following agricultural implements:- socketted semi-circular and trapezoidal channels and socketted and non-socketted irrigation pipes; propeller pump; bamboo well screens; animal-drawn lifting patella, buck-scraper, fertiliser/seed drill, sugarbeet drill; tractor-drawn wetland puddler-cum-leveller, field rake, sugarbeet drill; paddy-puddler for hills; hand-drawn seed drill; manual paddy seeder; hand broadcaster; soybean thresher; axial flow thresher for paddy and wheat; deep hole digger; high crop sprayer, and ULV sprayer; potato digger; oldpad thresher for hills; mango-guthali decorticator; rice husk furnace; continuous soybean seed treater; pulse mill; continuous grain dryer; straw alkali mixer.

Since 1966 the department has had an extension service operating in 12 districts, where equipment can be introduced to farmers and where farmers can be trained in the use of implements, and firms advised on their manufacture. (1)

Publications.

20 bulletins on equipment developed, published for use by farmers and manufacturers, price unknown.

52. FOREST PRODUCTS RESEARCH INSTITUTE

P. O. New Forest,
Dehra Dun,
India.

Programme.

This Institute is funded by the government, and carries out research on all aspects of forest products.

It has developed a solar heated timber-drying kiln which has now been installed in six commercial sawmills, after extensive field testing. It has a stacking capacity of 7 cubic metres of sawn timber, and operates effectively at latitudes varying from 17 to 30 degrees North.

Work has been continuing on the use of bamboo to reinforce concrete. The problem of the bamboo first swelling then shrinking when placed in concrete has been overcome by dipping the bamboo in 80/100 grade bitumen; and by sand-coating the bitumenised bamboo, the bond with the concrete is increased. Ten experimental structures are under test at the Institute.

Other research at the Institute includes work on techniques of using short pieces of under-utilised timbers to replace longer pieces of more expensive woods in building structure; testing of different preservatives applied to different timber species; testing of fire-retardants; and the extraction of tannin and oxalic acid from the bark of species of Terminalia, a process which has now been licensed to commercial factories. Wood-wool boards from timber using cement and magnesite have been developed and tested. (1)

Publications.

Numerous; a list is available; they include such topics as the design of a light suspension bridge, studies of bamboo-concrete, test reports on preservatives etc.

53. GARG CONSULTANTS

C-10/1 River Bank Colony,
Lucknow,
India.

Programme.

Garg Consultants provide turnkey services for the setting up of small industries, in particular mini-sugar plants. They have developed certain techniques for training small entrepreneurs and managers, finding the biggest difficulty to be management of technical processes, rather than technical problems per se.

The group is working on improving the crushing efficiency of the mini-sugar technology, on eliminating the difficulty of working with wet bagasse in the evaporation stage, and on reducing the loss of sugar due to inversion. Final molasses of the large-scale sugar technology contain only 35% sugar, while those of the mini-technology contain 57% sugar. A research station for this technology has been built by the Uttar Pradesh Council of Science & Technology.

New products for the traditional potter, whose red clay products have a falling market, are also being developed. Efforts to introduce whiteware pottery at the village level have not been successful so the production of underground irrigation and sewage pipes made of red clay by the potters is being encouraged. Floor tiles with a mosaic finish are also being introduced.

Further work on small-scale cement production is now under way. (1)

Publications.

Complete blue-prints for 100-ton and 200-ton sugar plants and 5-10 ton jaggery plant, and for cottage pottery; prices on application.

54. GOBAR GAS RESEARCH & DEVELOPMENT CENTRE

Khadi & Village Industries Commission,
Kora Gramodyog Kendra,
Borivli,
Bombay 92,
India.

Programme.

The Khadi Commission has been responsible for much of the work on biogas in India, and there are currently an estimated 70,000 digesters of its design working in the country. This Centre does the Commission's research on biogas technology.

Aerated burners, the first of their kind, have been developed. They consume 225, 340, 450, 700 or 1130 litres/hour of gas, giving 55-60% thermal efficiency. Also, industrial burners for use in soap-making have been developed.

A low pressure gas-lamp (7.6 cm. W.G.), utilising a high-pressure silk mantle, eliminates the need for costly pre-formed mantles. The lamp consumes 140 litres/hour, giving a light superior to that of a 40 watt electric bulb.

Thanks to greater efficiency in the appliances, it is now possible for smaller digesters (2 cu. metres) to provide fuel for a family of five.

Work has continued on the design of the digester itself. A horizontal plant, requiring a pit of only 2-3 metres, has been developed and proven. A 'parachute' method for maintaining gas pressure at the correct 7.6 W.G. has been devised, whereby a heavy weight, such as an RCC slab, is attached to the bottom of the gas-holder when the holder is made from plastic or aluminium.

A process has been developed to prevent corrosion of the gas-holder by coating with bitumen and a thick layer of PVC sheet. A light-weight gas-holder, and a collapsible gas-holder, have been developed, and successful tests done on the suitability of galvanised iron gas-holders.

A simple hydrometer, to show the solids content of the slurry, has been designed, as has a ferro-cement mixer for the slurry. Kits for the conversion of 5-6 HP diesel engines have been developed so that they run on 20% diesel and 80% gas, and 17 HP and 2.5 HP petrol/kerosene pumping sets have been converted to run on gas. Studies have been done on the effect of temperature on the rate of digestion and on the gas-production of different feeds (e.g. farm-yard waste, leaves, rice). (1)

Publications.

The Directorate of Publicity, K&VI Commission, Irla Road, Vile Parle West, Bombay 400056, can provide a list of publications and off-prints etc. The Gobar Gas Centre will answer technical enquiries, and give practical demonstrations to visitors.

55. INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS (ICRISAT)

ICRISAT Patancheru P. O.,
Andrha Pradesh 502 324,
India.

Programme.

ICRISAT is one of the international institutes in the programme of the CGIAR, and is now the world's centre for research on sorghum, pearl millet, pigeonpea, chickpea, and groundnut. Over 1000 people work at the 1400 hectare site, and most activity is devoted to breeding and trials.

The Farm Power & Equipment sub-programme concentrates on bullock-drawn implements which can be used in the 'broadbed-and-furrow' farming system encouraged by ICRISAT. Scientific research on soil management and the effects of different draught weights, water etc on soil behaviour, are accompanied by the development and testing of equipment.

The main engineering work is on a multi-purpose tool-carrier, called the Tropicultor. Several modifications have been made to the original design, including changing the Ebra inclined-plate planter and strengthening pivot points in the lifting linkages. Steel press wheels for planting in dry vertisols and split press wheels for wet alfisol, have been developed and tested. An angle blade scraper can be fitted to the tool-carrier, replacing the original fixed scraper attachment; this is now being tested. A land plane has been designed and a prototype built for tests.

ICRISAT is cooperating with manufacturers in the production of improved implements such as ploughs, ridgers and cultivator shovels. (1)

56. KHADI & VILLAGE INDUSTRIES COMMISSION

Gramodaya,
3 Irla Road,
Vile Park West,
Bombay 400 065,
India.

Programme.

K&VIC is a very large organisation, promoting and managing small-scale industries in rural areas and small towns. It has over 20,000 people employed in its projects, which include the manufacture of matches, fireworks, pottery, soap, vegetable oil, paper, cane-sugar and castor sugar, palm-sugar, biogas plants, lime, shellac, bamboo and cane work, fibre products, aluminium utensils, katha (colouring), gum, resin, and cloth. It is also involved in bee-keeping, the processing of hides and skins, and of medicinal herbs and fruits, and in blacksmithy and carpentry. (3)

57. MECHANICAL ENGINEERING RESEARCH & DEVELOPMENT ORGANISATION

CSIR Campus,
Adyar,
Madras 600 020,
India.

Programme.

MERADO developed the India Mark II deep well hand-pump, several hundred thousand of which have now been installed. It is the standard hand-pump for wells in rural water supplies in India. The final product, with a welded pump-head and conventional cylinder valve assembly, met the criteria laid down at the design stage - that it be durable, sanitary, cheap, be able to be operated by women and children, and easy to maintain by a local artisan with a simple tool-kit. Technical enquiries will be answered; designs, drawings etc are available for a payment, the price depending on the particular design. (1)

58. NATIONAL BUILDINGS ORGANISATION

Nirman Bhawan,
Maulana Azad Road,
New Delhi 110 011,
India.

Programme.

This is the Indian government's main housing research organisation, but it is also a UN regional centre, and as such it collects and disseminates technical information throughout the ESCAP region.

The organisation has 9 Rural Housing Wings in different parts of India, which promote low-cost housing using locally available material and skills, e.g. a simple sun-dried-brick house with water-proof mud plaster and thatch roof with fire-retarding treatment, costing (1977) Rs.1500.

The organisation is promoting the adoption of alternative materials, on which it has done research and tests. These include flyash, secondary species of timber, deformed bars, high-strength bricks and tiles, hydrated limes, clay pozzolana, light-weight aggregate cellular concrete and asphaltic corrugated roofing sheets. Pilot plants for the manufacture of several of these products have been built.

A demonstration-cum-training centre for production of bricks by simple and cheap machines has been set up at Chandigarh, and a similar centre for the promotion of dry hydrated lime and clay pozzolana in Delhi.

The organisation has provided technical assistance to many countries including Jordan, Tanzania, Barbados and Cyprus. (1)

Publications.

The following, and others not listed, are available free:
'Technical information series', on Building Foundations, Hard Boards, Secondary Timbers, et alia;
'Technical report on low-cost housing';
'Leaflets on air seasoning of timber';
'Rural housing and village planning';
'Demonstration rural houses with environmental improvements';
'Catalogue of building research in India';
'Shelter house';
The following are among those available for a charge, pre-paid, from the Controller of Publications, Department of Publications, Civil Lines, Delhi 110054;
'Low-cost housing', NBO 4, $0.60;
'Low-cost house designs', NBO 12, $1.65;
'Proc. of a seminar on rural housing and village planning', NBO 14, $4.00;

'A collection of designs of houses for low income groups', NBO 25, $1.90;
'Termite control in buildings', NBO 26, $0.85;
'Advisory Notes', as follows:
No.1, "Precast RC channels for low-cost housing", $0.10;
No.2, "Thin precast RC lintels", $0.35;
No.3, "Flyash as partial replacement of cement in concrete and mortar", $0.35;
No.4, "Precast cellular unit floor/roof", $1.50;
No.5, "Brick cavity walls using common burnt clay bricks", $0.50;
No.6, "RCC frames for doors and windows", $0.45;
No.7, "Precast RC cored units for low-cost housing", $0.35.

59. NATIONAL RESEARCH DEVELOPMENT CORPORATION OF INDIA

61 Ring Road,
Lajpat Nagar III,
New Delhi 110 024,
India.

Programme.

The NRDC is a government organisation which coordinates and encourages innovation in Indian industry. (1)

Publications.

'Invention Intelligence', monthly, about 50pp, £3 per year surface mail; descriptions of inventions, Indian and foreign, of all types, including usually some AT (e.g. the November 1979 issue had an 8-page article about a solar oven, and a 4-page article about a foot-operated pump);
'Appropriate Technology from NRDC of India', Volume I, 1979, 107 Chemical and allied technologies, £15 inc. postage;
'Appropriate Technology from NRDC', Volume II, 1979, 73 Engineering technologies, £10 inc. postage.

60. NATIONAL SUGAR INSTITUTE

Kalimpur,
Kanpur,
Uttar Pradesh,
India.

Programme.

This Institute has developed an improved process for the manufacture of 'khandsari' sugar, i.e. extracting 7.5-8.0% of the sugar from cane by an open-pan process, as opposed to the 4.0% recovery rate of traditional open-pan techniques. Leaflets about this process are available from the Senior Technical Officer. (3)

61. PLANNING, RESEARCH & ACTION DIVISION

State Planning Institute,
Kalakankar House,
Lucknow 226 007,
India.

Programme.

As its name implies, this Division is responsible for 'action' in pilot projects and field experiments, to test the technologies developed at the Institute.

Part of the Division is the Gobar Gas Research & Training Centre, at Ajitmal, where work on biogas has proceeded since 1960. In 1977 this Centre developed the 'Janata' Biogas Plant, based on the Chinese model in which the gas-holder and digester are combined in a single unit, and the whole plant is an underground dome. Intensive work on this model has resulted in a state-wide programme to subsidise the installation of 10,000 plants in Uttar Pradesh in 1979-80. An extensive training programme for masons and community development officials is under way. There are four sizes, of 2, 3, 4 and 6 cubic metres.

The Division is also doing acceptance trials of community biogas plants, with two plants of 35 cu.m. and of 45 cu.m., linked to a central pipeline in a village of 27 families. As well as providing gas for cooking (45%) and lighting (30%) the gas is used to power engines which drive a communal chaff-cutter, flour mill, thresher and well-pump.

Other work on biogas has included digesters with batch and continuous feed; utilisation of crop-waste; 2 and 3 stage plants; mixed feeds and exotic feeds (e.g. water hyacinth); insulated and water-sealed plants; solar heated digesters; rigid PVC,

polythene bag and fixed dome construction. Designs of appliances have been prepared and tested, such as burners, lamps, room heaters, carburettors for engines, generation of electricity, and a lot of work on simplification of construction and reduction of cost has been done.

Jointly with ATDA, the Institute has been investigating improvements to the 'mini-sugar technology' process, particularly an improved crusher and a furnace which will burn wet as well as dry bagasse. A 'shell' furnace has proved successful and is already being installed in a dozen plants.

The Institute has successfully tested a small-scale sprinkler-irrigation project with water provided by an hydraulic ram (hydram). The Gadora project, in a hilly area, successfullly lifted water for irrigation 225 feet above the water source, from a 4" by 2" ram pump. Further experiments are under way in Sikkim.

Work has also been done on the small-scale decentralised white-ware pottery industry. (1)

Publications.

Reports on work-in-progress, including each of the projects described above. A report 'Janata Biogas Plant', 30pp with 12 constructional design drawings, is in draft.

62. REGIONAL CENTRE FOR TECHNOLOGY TRANSFER

Manickvelu Mansions,
49 Palace Road,
Post Box 115,
Bangalore 560 052,
India.

Programme.

This is part of a regional UN programme, linking together institutions in different countries and organising seminars etc, as well as consultancy work and dissemination of information. It assists countries of the ESCAP region to identify relevant technologies and to obtain them by the best means.

The Centre has organised two workshops on the technology of rice-husk ash cement (ASHMOH), and is working with institutions to establish a standard for this product.

An international workshop on small-scale hydro-electric energy was organised in Nepal in 1979, and the Centre is preparing a roster of experts in this technology, and in solar energy.

A workshop on the machine tool industry was organised in 1979, and a roster of training institutions is being prepared. (1)

Publications.

Newsletter, quarterly, free; and seminar and workshop reports.

63. SMALL INDUSTRIES RESEARCH TRAINING & DEVELOPMENT ORGANISATION

B. I. T. Mesra,
Ranchi,
Bihar 835 215,
India.

Programme.

SIRTDO is active in utilising locally-available materials for construction and for other purposes. Two low-height arch foundation dams on a sand foundation have been constructed. One is 4' high, the other 12' high, and they are built of stone masonry without reinforced concrete. 200 acres of land have been irrigated with these dams. Six other dams, built of stone masonry on stone foundations, have also been built, up to 28' high, and these irrigate about 2000 acres.

One field model of a concrete grain silo has been constructed. It utilises the angle of repose of stacked grain, so that the minimum of material is needed for its construction.

An experimental house will be built in 1980 using sun-dried and kiln-fired bricks which have been doped with rice-husk. Laboratory experiments with this material have been completed. Animal and human hair has been used to make corrugated roofing sheet as a substitute for asbestos fibre - the house will use this material also.

A non-thermal process to produce cheap cementous material from industrial waste is planned. A low-head turbine working on a 4' head has been constructed and is being tested, while the first unit of a £3000 solvent extraction plant has recently been commissioned.

Six rural steam distillation units are now in production in surrounding villages - these extract essential oils from plants and medicinal herbs. Another rural industry is processing stick lacquer. (1)

64. SMALL INDUSTRY EXTENSION TRAINING INSTITUTE

Yousufguda,
Hyderabad 500 045,
India.

Programme.

This Institute runs training courses for small industry, and also houses the Small Enterprises National Documentation Centre (SENDOC), which is a major depository of journals and reports about small industrial processes and products. (3)

Publications.

'Appropriate Technology Documentation Bulletin' 6 issues per year, each describing about 25 products or processes;
'SENDOC economics and development bulletin', monthly;
'SENDOC management and behavioural sciences bulletin', monthly;
'Index to product profiles', listing hundreds of product profiles available from SENDOC; and 'product profiles' themselves.

65. VIGYAN SHIKSHA KENDRA

VSK Postbag,
Attara 210 201,
Banda District,
Uttar Pradesh,
India.

Programme.

Founded in 1973, this agency is particularly concerned with getting into the field technologies which have been developed in the laboratory, and with improving existing village technologies. It tries to act as a two-way link between the scientists and technologists in the universities and the workers in the villages, seeing this as one of its major activities.

VSK set up the first pilot production plant to make ASHMOH cement, which had been initially developed at the Indian Institute of Technology, Kanpur. This plant, making 50 tonnes/annum of cement from rice-husk ash, was started in 1976, using rice-husk from a nearby mill and limestone from a neighbouring district. By March 1979 many of the problems had been overcome (e.g. quality control over raw material, lack of field trials of the finished product, high cost due to scale of production), and a reliable cement is being produced and sold.

As rice-husk in any quantity is only to be found at large rice-mills, the technology as presently found cannot become a truly

rural industry, so VSK has a long-term aim to make the whole process of rice-milling, rice-husk burning, and ASHMOH-making, small enough to be located in the villages, so that the value added, and the finished product, will benefit the rural population. But meanwhile VSK is involved in setting up a 500 ton/annum plant to act as a training-cum-demonstration centre for ASHMOH producers, and for masons and other users of the ASHMOH cement. They will be taught how to use this new material in the construction of well-rings, biogas plants, irrigation channels and grain siloes.

VSK has trained several weavers, and is now experimenting with different looms and making improvements to traditional machines to raise productivity. (1)

66. VILLAGE RECONSTRUCTION ORGANISATION

By-pass Road,
Peda Kakani,
Guntur 522 509,
Andhra Pradesh,
India.

Programme.

VRO has extensive experience with genuinely 'low-cost' housing, and has experimented with alternative construction materials. It has constructed three prototype windmills, in cooperation with TOOL, and is also testing and demonstrating two biogas plants, one of which is linked to a latrine. (1)

67. SCIENTIFIC RESEARCH COUNCIL

P. O. Box 350,
Kingston 6,
Jamaica.

Programme.

The Council aims to develop and use 'intermediate or appropriate technology to utilise local raw materials in the generation of employment ...'. The Council's Technical Information Service has been designated the focal point for science and technology information in Jamaica.

Two processes developed by the SRC, namely syruped ginger and caramel from local sugar, have been successfully transferred to local commercial manufacturers. Research on the production of essential oils from local pine, and from juniper hardwood, has shown good results, the latter producing oil identical to Virginia Cedar oil. Citrus oils are being investigated to find a local substitute for limonene.

Floor tiles made from 100% local materials (clay, silica and flux) have been developed and tested, but not taken up by a commercial manufacturer. Tests are continuing on pozzolana cement building blocks.

Tests of prototype methane digesters have been completed, and there are plans for a large-scale unit to handle the waste from 4000 chickens. A five-year plan of the government is to build 2000 family-type and 40 medium-size digesters throughout the country. A flat-plate solar water heater was developed by the SRC, costing about $J1000 suitable for a family. The Council is planning to set up a new Energy Division to investigate and promote renewable energy sources. A small-scale hydro-electric plant has been completed and is in operation, and research has been done on charcoal.

Tests on the inclusion of banana flour and of cassava flour in composite flours, to reduce imports of wheat, have been carried out and an acceptable formula arrived at. (1)

Publications.

'Tropical notes', bi-monthly, price unknown;
'Supersoil for developing countries', price unknown;
'Solar water heater', price unknown;
'Aspects of science and technology for development', price unknown.

68. AGRICULTURAL MACHINERY TESTING UNIT

P. O. Box 470,
Nakuru,
Kenya.

Programme.

This Unit of the Kenyan Ministry of Agriculture has assembled a wide collection of agricultural implements from Africa, Asia and Europe for tests under Kenyan conditions. It carries out standardised tests and recommends whether or not a particular item is suitable for use in Kenya. Its tests are very thorough and its general methodology provides, in effect, a good test of 'appropriateness'. It has identified a satisfactory hand maize sheller, which is now in limited production in Nakuru. Limited production has begun of a pole type ox-drawn multi-purpose hitch. The Unit tested eight small tractors and has recommended one model (Eicher Goodearth), which is now available to farmers.

Recent work has included testing 2 biogas plants, an Oxtrike, 8 types of ox-drawn seeder, jab planter and herbicide 'minimum tillage' techniques, a locally made hydraulic ram pump, a platta pump, crop establishment techniques, and the use of sawdust in ox-cart tyres to replace inner tubes; it is also investigating problems of mechanical pyrethrum harvesting. (2)

69. APPROPRIATE TECHNOLOGY CENTRE FOR EDUCATION & RESEARCH

Department of Physics,
Kenyatta University College,
P. O. Box 43844,
Nairobi,
Kenya.

Programme.

This Centre has carried out R&D, financed by FAO, on the use of sisal as a reinforcing agent for Portland cement. Research on the mechanical properties of such cement was followed by development of production techniques for sisal-cement corrugated roofing sheets and tiles, and the cladding of mud-brick walls using sisal and mortar. These products have been field-tested. A range of 1-ton maize storage bins using sisal-cement has been developed.

The Centre has also held short courses on AT for village school teachers, and has successfully pressed for the inclusion of AT topics in the national school Physics syllabus and in the training of non-graduate Physics teachers. (1)

Publications.

'The construction of corrugated roofing sheets using sisal-cement', 54pp manual, duplicated, KShs 25.00 plus postage;
'The construction of flat roofing tiles using sisal-cement', duplicated, KShs 25.00 plus postage;
'Sisal-cement composites as low-cost construction materials', in 'Appropriate Technology', (London) Vol. 6, No.3, November 1979.

70. DEPARTMENT OF AGRICULTURAL ENGINEERING

University of Nairobi,
P. O. Box 30197,
Nairobi,
Kenya.

Programme.

The Department has been participating in an ILO financed study of appropriate farm tools in East Africa, and of obstacles to their adoption by small farmers. This fits in with the Department's programme of research and development of equipment for semi-arid areas, in which various implements have been examined and tested. The Department has also worked on small-scale irrigation, on grain stores, and on biogas. (2)

71. INTERNATIONAL COUNCIL FOR RESEARCH IN AGROFORESTRY (ICRAF)

P. O. Box 30677,
Nairobi,
Kenya.

Programme.

Established in 1978, ICRAF is an international non-profit institute, with the aim of researching and promoting the better use of tree crops as an integral part of proper land use. Its research plans include work on shifting cultivation, agroforestry in arid zones, in open grass savannahs and in tropical uplands. Its core research will be on multi-purpose trees, fodder trees, fuelwood trees and in soil studies. One of its priorities will be a documentation and information service. (1)

Publications.

Newsletter, occasional, free;
'Soils research in agroforestry', ICRAF conference proceedings, 1979, $15.00 seamail.

72. KHASOKO CENTRE

Christian Rural Service,
P. O. Box 734,
Bungoma,
Kenya.

Programme.

This Centre has specialised in training people in the management of oxen and ox-drawn implements, using the nose-rope method of guidance. It also designs and tests implements, such as chisel ploughs, mouldboard ploughs, ridgers, and tool-bars for line-planting, weeding and harvesting. Ox-carts for two oxen are built at the Centre. 200-1500 gallon water-storage tanks have been built and are in use, as is an improved stove. Experiments with solar crop dryers and threshing equipment are under way.

The Kokise Ox-power Unit, P.O.Box 87, Nyilima, Kenya, also trains farmers to use oxen, and has developed improved harnesses etc. (1)

73. NATIONAL CHRISTIAN COUNCIL OF KENYA

P. O. Box 45009,
Nairobi,
Kenya.

Programme.

The NCCK has in the past sponsored various projects in the field of rural technology, and its representative is a member of the government's Rural Development Technology Committee. Member churches of the NCCK are active in rural development programmes, many of which include innovative technologies or processes.

NCCK funded a small programme to introduce methane digesters, the Meru Harambee Fertiliser Production Self-help Group, which is constructing commercially-available digesters in a rural area near Mt. Kenya.

The Christian Industrial Training Centre was manufacturing and selling windpumps, but has now stopped, and is making hospital equipment, wheelchairs and tricycles.

The Diocese of Maseno South has successfully introduced a simple groundnut sheller in ten locations; the original model was built by a village polytechnic, from designs provided by the UNICEF Village Technology Unit, and subsequent models have been built by a local carpenter. (1)

74. VILLAGE TECHNOLOGY UNIT

UNICEF,
P. O. Box 44145,
Nairobi,
Kenya.

Programme.

This Unit is a demonstration centre, where many small-scale technologies are on display. It is located in Karen, a suburb of Nairobi. Among the technologies on display are solar crop dryers, fuel-fired dryer, maize crib, improved traditional silo, mud-brick silo, cement stave silo, groundnut sheller, maize sheller, hand winnower, handmill, hammer mill, cement water jar, granary basket water tank, flap valve pump, rope-and-washer pump, shallow well pump, deep well pump, hydraulic ram pump, prototype bicycle pump, cretan windmill pump, VITA windmill pump, cinva ram block press, wooden bench vice, oil drum forge, inner tube bellows, raised cooking platform, kerosene tin oven, solar reflector cooker, hot box cooker, solar water heater, charcoal water filter, charcoal cooler, hanging storage shelves, coconut shredder, food safe, child's squatting plate. (1)

Publications.

'Appropriate village technology for basic services', 56pp, being an illustrated description of the technologies above.

75. TARAWA TECHNICAL INSTITUTE

P. O. Box 490,
Betio,
Tarawa,
Kiribati.

Programme.

This Institute has developed various prototypes and done limited testing of them, though they have not yet been significantly adopted in the villages. A new Appropriate Technology Department is concentrating on small-scale home appliances, as these are the implements for which women's and youth groups have expressed a need. Prototypes of a cement water tank, a rotary coconut grater, coconut milk press, a smokeless stove and plastic hand-pump, have been built and tested. (1)

(Kiribati was formerly the Gilbert Islands).

76. APPROPRIATE TECHNOLOGY UNIT

BEDCO,
P. O. Box 1216,
Maseru 100,
Lesotho.

Programme.

The AT Unit was set up in 1978. It has a small documentation centre, and a full-time staff of two, and its role is to act as a central coordinating body for AT in Lesotho, as well as advising BEDCO on appropriate technologies for its small industries. The Unit also encourages R&D work in colleges, ministries etc, and acts as a link between international AT agencies and small projects in Lesotho. ITIS, part of ITDG, is providing a small-scale paper moulding machine and candle-making moulds through the agency of the Unit. The Unit will also be receiving sample models of technologies developed in other African countries. (1)

Publications.

'AT Newsletter'

77. SAVE THE CHILDREN FUND WORKSHOP

P. O. Box 286,
Maseru,
Lesotho.

Programme.

This workshop has until recently been manufacturing a special spinning wheel, designed to work the fine mohair wool which is an export of Lesotho. The future of the project is now under review. (1)

78. TECHNOLOGY TESTING UNIT

Ministry of Rural Development,
P. O. Box MS686,
Maseru,
Lesotho.

Programme.

The Ministry has recently done a lot of work on solar energy, including the design and testing of many types of solar water heater (such heaters are now being manufactured commercially in Lesotho under the name 'Supersol'), a solar water boiler, and solar crop dryers. Extensive testing of solar water heaters has taken place at Thaba Tseka Project, P.O. Box 24, Maseru. (1)

79. THABA KHUPA INTERMEDIATE TECHNOLOGY UNIT

P. O. Box MS 929,
Maseru,
Lesotho.

Programme.

This project is organised by the Christian Council of Lesotho, and is attempting to develop local manufacture of agricultural equipment which is at present imported from South Africa. It has proved difficult to compete with these products, and prototypes of a weeder, cultivator, plough, potato lifter, wheelbarrow, jointer and straight-edge have all proved more expensive than imported items.

More success has been achieved with carts. A scotch-cart, suitable for 2 or 4 oxen or for horses, has been extensively tested and several sold - it is of metal, with wooden sides, wood-bearings, wooden blocks for brakes, and pneumatic wheels. Water-carts, with a welded metal tank of 100 litres or made to measure to fit the customer's requirements, have also been sold.

The Unit has been trying out harness and draught techniques for using horses as draught animals, and the centre's own cart is pulled by a horse which has been trained at Thaba Khupa.

The Unit runs a repair shop as part of its work, as this is a good way to maintain close contact with the farmers. (1)

80. CONTROLLER OF LANDS, VALUATION AND WATER

Office of the President,
Private Bag 311,
Capital City,
Lilongwe 3,
Malawi.

Programme.

This office is now responsible for the further development of the shallow well pump which was initially developed by the Polytechnic and the Ministry of Community Development and which was demonstrated at the Arusha rural technology meeting in 1977; it attracted a lot of interest at that time and has since been further developed and tested. Currently a Mark V model is under development. The Mark IV had a PVC pumphead and piston rod, PVC disc with ring and platevalve for the plunger, and PVC platevalve for the footvalve; the earlier idea of using a PVC reducer with a ball as the footvalve has been abandoned. Recently 30 wells were fitted with polyethelene plungers, after tests in Canada suggested this improvement. Modifications proposed for Mark V include using steel pipe for the pumphead (because of the rising cost of PVC, inter alia); screwing rather than bolting the pumphead to the slab; making the topbush from plastic to iron polypropylene adaptors rather than from PVC; strengthening the pumprod; extending the outlet T; incorporating an airchamber near the plunger; reducing the stroke of the platevalves; finding an alternative to polyethelene for the platevalves; and inserting a perforated pipe section below the footvalve. (1)

81. FARM MACHINERY INVESTIGATION & TESTING UNIT

Agricultural Research Station,
Chitedze,
P.O. Box 158,
Lilongwe,
Malawi.

Programme.

This Unit is responsible for testing of local and imported machinery to assess its suitability for use in Malawi. It has also developed its own equipment, including a maize sheller, groundnut lifter, maize planter, and a multi-purpose tool-bar called the 'Ridgemaster'. A groundnut cracker developed at the Unit has not been commercially successful.

The Unit also has a responsibility for extension and demonstration of equipment, and there are over 100 centres throughout the country where agricultural machinery has been demonstrated to farmers. (3)

82. FORESTRY RESEARCH INSTITUTE OF MALAWI

P. O. Box 270,
Zomba,
Malawi.

Programme.

In 1975 the Institute started a programme of ox-training for logging operations, after studies suggested that the use of animal power could save up to one third of the cost of logging with tractors, as well as saving foreign exchange. Most of the national timber extraction is now done by oxen, which are of course even cheaper now in the light of increased fuel bills and inflation in tractor prices.

Extensive work has been done to improve the performance of oxen through proper feeding, disease control and by allowing young oxen to develop adequate muscles and stamina. The strongest oxen can pull one ton of timber on skids, when yoked in pairs. When wheeled equipment is used, much greater weights can be pulled.

Mechanical innovations include wheeled logging arches to increase working capacity, and animal-powered cable ways to extract timber over steep or rocky terrain.

An integral part of the project is the control of tree-felling so that there is as much shade as possible left for the animals to work in, and careful avoidance of injuries to the animals from timber trash.

Other developments include the design of cheap and moveable logging camps, the development of a wheeled chassis which can be used for general cartage and water-carrying as well as timber-work, and earth scoops for dam and road-making.

Studies are under way into improving the harness designs to optimise the tractive efficiency of the oxen for each of the several tasks they perform.

No publications are yet available, but a manual on the use of work-oxen in forestry will be prepared when the development work has achieved well-proven results and production data. (1)

83. SCHOOL OF BIOLOGICAL SCIENCES

University Sains Malaysia,
Minden,
Penang,
Malaysia.

Programme.

The School has a prototype biogas plant which costs only £50 to make. It has also developed a system for small-scale mushroom growing, using rice straw and cow-dung as the growing medium and spawn available from the Department of Agriculture. From these very cheap inputs a high-value mushroom crop can be obtained within 20 days. (1)

84. TECHNOLOGY DEVELOPMENT & CONSULTANCY CENTRE

University of Mauritius,
Reduit,
Mauritius.

Programme.

This Centre is now in the process of being established, in a collaboration between the university and the government. It will bring together the work of the various bodies working on AT in Mauritius.

At the University itself, some preliminary work has been done on the question of wave power; the production of methane from the digestion of sugar waste has been examined so that the best mix of feed can be established; and a locally available solar still is being tested with a view to improving its performance. Two solar water heater panels have also been tested, and wind data is being collected. A portable but mechanised sugar cane cutter is being developed by the University. (2)

85. KRISTIAN INSTITUTE TECHNOLOGY OF WEASISI

P. O. Box 16,
Tanna via Vila,
New Hebrides.

Programme.

KITOW is a collection of small rural workshops, which provide on-the-job training for young people while at the same time being self-supporting. The island of Tanna is very isolated so technologies appropriate to its enviornment are necessarily small-scale and self-reliant.

Two small cement cooperatives manufacture concrete blocks, ferro-cement water tanks of up to 5000 gallons capacity (above and below ground), grave stones and pig troughs. The ferro-cement work uses flattened bamboo as the frame-work.

KITOW Metal Products manufactures simple metal products such as coconut scratchers and implements made from sheet metal, and repairs trucks, outboard motors, concrete block moulds and pitsaws.

There is a small boat yard, and three boats in a fishing cooperative use longline techniques within and outside the reef. Agricultural products are milled and processed at KITOW, which introduced rice cultivation to the island. Coconut oil is produced, and soap is made from this oil. KITOW has also done work on techniques of charcoal production, and on improved stoves.

The most unusual project at KITOW is a process to make 'producer gas' from wood. This process turns dry wood (moisture content 15-20%) into gas, which is then used to drive a converted truck engine to power a generator. A prototype unit at KITOW, using charcoal, drives a 25 kva generator, giving electricity to a small village and, at the same time, providing cooking gas and direct drive to a saw which cuts the wood used in the process. The various pressure and storage chambers are made from old oil drums. Current work at KITOW seeks to eliminate the need to use charcoal and to burn wood from the outset. (1)

86. DEPARTMENT OF CHEMICAL & MATERIAL ENGINEERING

University of Auckland,
Private Bag,
Auckland,
New Zealand.

Programme.

This Department has research projects under way on the hydrolysis of radiata pine wood to produce alcohol motor fuel, and on small solar crop dryers, following experiments with drying chillies in Sri Lanka and in Tonga. Students' projects have included methane generation from water hyacinth; fluidised bed combustion of sawdust, rice hulls and coir dust; and wood gasification. (1)

87. DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH (DSIR)

Head Office,
Private Bag,
Wellington,
New Zealand.

Programme.

The DSIR is the main government scientific organisation in New Zealand, with 5 research centres and several sub-stations, some of which are in the Pacific islands.

The numerous projects of the DSIR's 24 divisions include research on pasture plants, design and testing of a banana dryer, now in use in Rarotonga, and of a copra dryer for Niue Island.

The Physics & Engineering Laboratory has built and tested a solar collector, a domestic wood-burner, and two types of wood gasifiers for the gasification of agricultural wastes to produce transport fuels. Work is in progress on the conversion of wood-gas derived from sawmill residue. (1)

Publications.

Reports on the work of the Physics & Engineering Laboratory are available, free of charge.

88. INVERMAY AGRICULTURAL RESEARCH CENTRE

Mosgiel,
New Zealand.

Programme.

A 45,000 litre methane digester utilising crop residues has been built at this centre, and many reports and papers on the project are available. (1)

89. AFRICAN RURAL STORAGE CENTRE

IITA,
PMB 5320,
Ibadan,
Nigeria.

Programme.

ARSC is based at the International Institute for Tropical Agriculture, in Nigeria, with sub-stations elsewhere in Africa. It is funded by FAO and DANIDA. The main research is the evaluation of traditional storage structures and the design of improved models. In the humid tropics pre-storage drying of crops such as maize is very important, and as an alternative to solar-drying or exposed field-drying (the one expensive, the other vulnerable to wastage) the Centre has modified a traditional crib design to produce a low-cost maize drying crib, that can be built from locally available materials. For effective drying it has been important to identify the optimum dimensions of the crib, and a structure according to these dimensions is now being recommended. Together with the Commonwealth Secretariat the Centre has published an illustrated handbook showing the construction. (2)

Publications.

'How to build a low-cost maize crib', (available from FPRD, Commonwealth Secretariat, Marlborough House, Pall Mall, London SW1);
Leaflets on storage, in French and English.

90. DEPARTMENT OF PREVENTIVE & SOCIAL MEDICINE

University College Hospital,
Ibadan,
Nigeria.

Programme.

The Department has developed a version of the 'aqua-privy', which is intermediate between the septic tank and the pit latrine. This version does without the complicated moulds often required for the floor-slab and drop-pipe of an aqua-privy; asbestos cement pipe and bamboo have been effectively used for the pipe, and a concrete cast slab over a trench or hole, or raised up on a platform, forms the floor slab.

The Department will be pleased to assist anyone wishing to implement this design, which has been described, with drawings, in the magazine 'Appropriate Technology', Vol 3., No.3, 1976, available from ITDG, London. (1)

91. FEDERAL INSTITUTE OF INDUSTRIAL RESEARCH, OSHODI

Private Mail Bag 1023,
Ikeja,
Lagos State,
Nigeria.

Programme.

With over 60 professional staff, FIIRO has a wide range of facilities and a concentration of technical competence which is at the service of local industrial development. Basic research, the analysis of local raw materials for possible industrial applications, analytic services to local industry, the development of processes and machinery for the production of foods, skin cream, vinegar - these are just a few of the activities of FIIRO.

The most important process to have been developed at FIIRO, and now taken up by manufacturers, is the mechanised processing of gari, a staple food from cassava. This involves the cassava being peeled and washed, grated, sieved, fermented (this part speeded by the addition of old water from previous runs and of soya mash), pressed, granulated, and finally dried. Several plants are now in commercial operation throughout Nigeria.

Other products and processes which have been taken up by commercial manufacturers are the refining of kaolin; the pulping of Gmelina Arborea wood for paper-making; the distillation of potable spirits from palm-wine; the use of coir fibre as upholstery filling; and the manufacture of bricks and tiles from local clays.

As well as developing the standards for such processing, FIIRO also designs and builds prototypes of machinery needed. For example, the distillation of palm wine uses a special still designed by the FIIRO, which yields alcohol at twice the concentration obtainable from other local stills.

Projects which have been completed but which have not been adopted by local manufacturers are mechanised processing of soya-ogi (enriched corn flour compounded of maize meal and soya flour with added minerals); mechanised ogi (flour) processing; skin cream made from cocoa butter; distillation of vinegar from palm-wine; and the manufacture of dyes from vegetable sources.

Currently trials and pilot production are under way of a modified cassava starch for use in the textile industry, for textile sizing and for textile printing and finishing. A composite flour bread (c. 75% wheat, 20% cassava starch and 5% soya) is still being tested.

Work has been done on air-drying of fish; on the blending of long-fibre wood pulp with short-fibre pulp; the investigation of

ceramic glazes: the industrial use of essential oils of lemon grass (ocimum gratissimum); the development of carbon resistors from local raw materials such as palm-kernel; investigation of the use of Nigerian clays as lubricants for oil-drilling; and the development of glass-blowing techniques for the manufacture of scientific glassware. (1)

Publications.

A list of over 300 titles is available; this includes academic articles and conference papers, as well as research reports and technical memoranda. Technical reports on all the products and processes developed at FIIRO are available, their price varying according to content and length. FIIRO also publishes a quarterly 'Technical Information Bulletin for industry', 4pp each issue, giving brief background and information about a product or process recently developed at the Institute.

92. INSTITUTE FOR AGRICULTURAL RESEARCH

Ahmadu Bello University,
Samaru,
PMB 1044,
Zaria,
Nigeria.

Programme.

IAR has sections dealing with different aspects of agricultural research: agronomy, weed-science, pathology, entomology, engineering, soil-science and economics.

Two sections are particularly engaged in the development of appropriate agricultural technologies. The Weed Science section has developed an ox-drawn tool for 'reduced tillage' cultivation of the traditional 1 metre ridges used in savannah agriculture. As an alternative to energy-expensive, erosion-promoting deep ploughing and soil inversion, the straddle-row weeder is designed to straddle existing ridges; it weeds the sides of the ridges and prepares them in sweep fashion as a seed-bed. Combined with some application of post-emergent herbicides, this tool cuts cultivation times and thereby increases the potential area cultivated. Straddle-row weeders are now under limited manufacture in a commercial workshop.

The Engineering Section has several programmes. The largest is a testing programme for threshing machinery, in which all available manual and motor powered small threshers suitable for local crops are tested, and the best models recommended to the extension authorities. Another programme is the development of ultra-low volume spraying equipment. IAR has developed a sprayer that

operates on a peristaltic principle, which can accurately control the droplet size and volume of spray applied. Called the 'ground-metered shrouded disc' it is mounted on a single-wheeled frame for manual operation.

The section is also making a collection of the wide variety of traditional hand-tools used in West Africa, as they represent a development of appropriate agricultural technology often absent in modern designs. The collection is undergoing ergonomic and agronomic appraisal. (2)

Publications.

Numerous, including extension 'Bulletins', 'Guides', 'Flipcharts', 'Posters', 'Leaflets'; 'Test Reports', 10-20pp, in booklet form; a full list is available.

93. INTERNATIONAL INSTITUTE FOR TROPICAL AGRICULTURE (IITA)

Agricultural Engineering Sub-programme,
PMB 5320,
Ibadan,
Nigeria.

Programme.

IITA is the international institute concerned with research for the humid tropics. It is part of the International Research Programme of CGIAR (Consultative Group on International Agricultural Research). Most of the Institute's programme is in plant-breeding, pathology and agronomy for the crops of the humid tropics.

The Agricultural Engineering Sub-programme is responsible for experiments on agricultural machinery for cultivation and processing, but has latterly focussed its attention on the perfection of a 'Zero-Tillage' system of land preparation for the humid tropics. This system was inspired by the constraint imposed on cultivation in the humid tropics by the high labour demands for weeding and by the soil erosion caused by traditional manual and deep ploughing cultivation. The recent availability of ultra low-volume herbicide application technology (the Micron sprayer) has made Zero-Tillage a practical proposition. Consequently IITA have perfected a design of rotary injection planter which will plant food crop seeds through the mulch residue left by herbicides. A manual model is now being manufactured in Nigeria. A design that can be attached to a tool-bar powered by a 2-wheel tractor has also been developed and this is being incorporated into a 2 wheel-tractor package for Zero Tillage by a British manufacturer. (2)

Publications.

'Rotary Injection Planter', plans are available from IITA; a description of this planter appears in 'Appropriate Technology' (London), Vol.6, No.4, February 1980.

94. NIGERIAN STORED PRODUCTS RESEARCH INSTITUTE

PMB 12543,
Lagos,
Nigeria.

Programme.

This Institute has done research and extension work on improved maize cribs, on the use of insecticides, and on other storage problems. Work on wood-fired crop dryers found that temperature control was a serious problem. The Institute plans to develop low-cost solar crop dryers. (1)

Publications.

'Advisory leaflets' on 'Storing your own produce', on maize; yam tubers; dried yams; cassava; and gari.

95. PROJECTS DEVELOPMENT INSTITUTE (PRODA)

3 Independence Layout,
P. O. Box 609,
Enugu,
Nigeria.

Programme.

PRODA (formerly the Project Development Agency) is a government organisation, charged with industrial research and production - its role as a manufacturer was not originally intended, but local entrepreneurs were unwilling to take up some projects so PRODA did them itself. PRODA has a staff of about 200.

Its work is based on the philosophy that 'Technology acquisition is a surer path than technology transfer because it depends more on the effort of the party seeking the technology than on the willingness of the party transferring technology'.

With a machine acquired from ITDG, London, PRODA manufactures egg-cartons, at a rate of 60-100/hour, from waste paper of all types. The same machine makes ceiling boards from similar materials.

240-egg incubators, run on gas or kerosene, have been developed and are now being manufactured to order.

Hand-made and machine-extruded bricks are manufactured by PRODA, special shapes and fire-bricks being hand-moulded. 4.2 million bricks are produced each year; they are dried naturally in an open shed, and firing is done in specially-designed clamps for building bricks, and in coal kilns for fire-bricks. Other factories have been established, utilising local clays, the suitability of which was ascertained by PRODA. The Institute has a pottery plant, making glazed pottery from locally-made glaze. Some colours, especially ferruginous ones, are made by PRODA itself. Ceramic bodies of the composite type have recently been developed; these are suitable for tableware and sanitaryware.

A glass-blowing unit trains glass-blowers and also supplies laboratory glassware to secondary schools and colleges. Various sizes of glass tubes are imported from which the specialised glass is fabricated. Some other school science equipment is also made from local materials, such as metre bridges, potentiometers and pulleys.

Machinery for processing cassava into gari has been developed and proved, and two commercial companies have bought the PRODA machines. The cassava is peeled in a large drum in which dozens of small mesh barrels are also packed; it is then grated, pressed and fried using locally generated gas. A small-scale gari oven developed by the Institute has been installed in many parts of Nigeria, this being a smokeless oven using coal or wood as fuel.

Projects which are at the prototype testing stage include industrial adhesives made from waste rubber (old tyres mainly); the production of school chalk from clay rather than from gypsum, by two different processes; a coating compound for welding electrodes; a kerosene burner for bread-ovens or steam-raising; two types of solar dryer for grains, one portable and small, the other a large induced-draft model for granaries; also, a kerosene-heated natural draft grain dryer; a machine for large-scale cracking of palm kernels, now under trial, and a process for extracting palm-oil using super-heated steam at high pressure. Air-blowers developed at PRODA are used in PRODA gari-processing equipment, and further work on the mechanical efficiency of these is under way. A simple but effective washing machine, suitable for hospitals or other large institutions, and an experimental rice par-boiler are currently under development.

PRODA has developed particular skills in machine design, and in casting of all types of iron and non-ferrous components. There is a training scheme for foundry hands, and the machine shop manufactures crucial spare-parts for imported machines. The Institute offers advice to public and private industrialists, and carries out analysis and testing of, for example, clays and other geological samples. PRODA 'gladly welcomes exchange of ideas and visits, and a wholesome cooperation in the development of appropriate technology'. (2)

96. RELEVANT TECHNOLOGY TRAINING WORKSHOPS

Malam Kure Street,
Genta,
PMB 2174,
Jos,
Plateau State,
Nigeria.

Programme.

These workshops (of which there are 6) are an attempt to combine practical training with self-supporting production for young people with only primary education (some of them disabled). Training, especially in metal work but also in working with wood, pottery etc, is given by artisans and by former trainees, and the products made and the tools used are mostly relevant technologies, in the sense that they are labour-intensive and use locally-available materials and local skills. There are currently 230 trainees, producing a very wide range of goods, notably hospital equipment, wheelchairs of various designs, school desks, toys, and some agricultural processing equipment. The object is to enable the trainees to set themselves up as self-employed artisans who have both the skills and the adaptability to devise their own 'appropriate' solutions to local technical problems. Soft loans are available for this purpose.

A somewhat similar project is the Intermediate Technology Workshop, P.O. Box 401, Zaria, Kaduna State. In the past they have developed designs of hospital equipment. Presently their programme is training of electricians and blacksmiths. (1)

Publications.

'Relevant Technology: a new strategy for development', a booklet with 124 photographs (no text) showing the course of this project and some of its products; available from the Bernard van Leer Foundation, Koninginnegracht 52, P.O. Box 85905, 2508 CP, The Hague, Netherlands.

97. APPROPRIATE TECHNOLOGY DEVELOPMENT UNIT

P. O. Box 793,
Lae,
Papua New Guinea.

Programme.

The ATDU is a joint project of South Pacific Appropriate Technology Foundation and of the University of Technology, Lae. Started in 1977, it now has 14 employees, and is partially funded by the government. As well as utilising the technical skills of the university community in solving problems, the Unit is committed to directing the interests of staff and students towards the needs of rural PNG.

The ATDU has been investigating small-scale hydro-electric power, and has installed one unit and plans more for the immediate future. The units are both high and low voltage. The ATDU is developing low-cost parts which can be locally fabricated.

A low-cost hydraulic ram pump has been developed, utilising local materials such as pipe fittings; ferro-cement water tanks have been fabricated. ATDU is in the process of setting up a small-scale casting workshop where small items such as bucket wheels for the micro-hydro plants, and spares for water pumps, can be manufactured.

ATDU has also done some work on biogas, charcoal manufacture, bee-keeping, gardening and machinery-testing. (1)

Publications.

See entry for South Pacific Appropriate Technology Foundation.

98. LIKLIK BUK INFORMATION CENTRE

P. O. Box 1920,
Lae,
Papua New Guinea.

Programme.

This project is funded by the Melanesian Council of Churches, and is closely associated with the Appropriate Technology Development Unit. The Centre provides information about AT and rural development, and has a small library.

The Centre's main work is the publication 'Liklik Buk', which is a comprehensive handbook/catalogue on rural development. Articles on crops, livestock, fertilisers, simple technology designs and

processes, health, are accompanied by lists of useful books and organisations. An English edition was published in 1977 and a Melanesian Pidgin edition should be coming out in 1980. The layout of the book is notable for its use of cartoons, graphics and different type-faces. (1)

Publications.

'Liklik Buk', see above, 274pp, £4.50; available from Liklik Buk Information Centre, Box 1920, Lae, PNG; from VITA, 3706 Rhode Island Avenue, Mt. Rainier, Md 20822, USA; and from Third World Publications, 151 Stratford Road, Birmingham, England.

99. SOUTH PACIFIC APPROPRIATE TECHNOLOGY FOUNDATION (SPATF)

P. O. Box 6937,
Boroko,
Papua New Guinea.

Programme.

SPATF is a non-profit organisation which grew out of the Office of Village Development of the PNG Government. It has 23 employees, with administration costs paid by the government and project funds coming from various sources. It provides some funds for other PNG organisations, paying the salaries of the Liklik Buk librarian and of two ATDU engineers and providing the capital for Village Equipment Suppliers (see below).

SPATF has a library, catalogued on a system common to SPATF and the Liklik Buk library, and it answers about 300 technical enquiries each year from its collection of some 2000 publications on AT and rural development. It has printed and distributed 1500-2000 copies of each technical instruction booklet (see Publications).

AT Demonstration Workshops (14 in 1979) are organised by SPATF workers throughout the country, giving practical demonstrations at youth conventions, women's meetings and the like. Starting in 1980, SPATF hopes to have fully mobile demonstration teams in each of the four regions of PNG and its surrounding islands. As a result of SPATF's involvement with women's groups, a slide-tape show entitled 'Women & Technology in PNG' has been prepared.

SPATF helps to finance very small projects which would otherwise be too small to be eligible for normal funding agencies; 25 such projects were funded in 1979, getting an average of about $400 each. Such seed money can help to get grass-roots projects off the ground, though SPATF finds it difficult to get people to plan their projects thoroughly. Projects have included a crocodile farm, knitting centre and village water supply.

SPATF has set up a trading arm, Village Equipment Suppliers, which imports or sponsors the local manufacture of equipment to meet the needs of village development - its sales of quality, low-cost tools and other equipment came to over $15,000 in November 1979 alone.

Testing of equipment imported by VES or developed locally will take place at Bomana Rural Workshops, which is expected to open early in 1980. Bomana is the site of a YMCA Integrated Agricultural Project, and the rural workshops are planned to complement this project, by developing and testing village technologies 'in situ' with local skills, rather than in an urban laboratory with skilled engineers. A ferro-cement 'igloo' has been constructed at the site to house the manager.

An urban workshop has been opened at Hanuatek, where existing small-scale industries have been reorganised, and a branch of VES has been opened. There are 31 workshop units, and SPATF has opened a sewing machine repair shop and a small carpentry store.

SPATF plans to extend its activities to the South Pacific region, now that its work in PNG is more organized. It is worth drawing attention to the fact that an essential component of this work is a sound administrative system, to coordinate the manifold activities and to make them mesh in with each other; the staff at SPATF have paid considerable attention to this, and to ensuring continuity by training local staff. (1)

Publications.

In Papua New Guinea, free; in Asia, Latin America, Africa and the Caribbean, $US2.50 each by surface mail, (except Report 2 and Yumi Kirapim, which are free); payment by International Postal Reply Coupons, bankdrafts or money order; in Australia, Europe and North America, $US5.00 each, by surface mail (except Report 2 and Yumi Kirapim, which are free), payment by International money order or bank draft only. Payment must be included with order. Some publications are available in Pidgin and in Motu, as well as in English.

'A blacksmith's bellow', description and drawings for construction;

'A drum oven', description and drawings for construction;

'Basic sewing machine repair', description and drawings for construction;

'Report 1 - April 1978', and 'Report 2 - March 1979';

'Tradition-linked technology', report of 1978 National Women's Workshop on Appropriate Technology;

'Yumi Kirapim', quarterly, mailed to over 4000 subscribers, 12-16pp, discussion and drawings of a particular topic each issue, plus news of SPATF and other AT in PNG; each issue now in 3 languages, one column/language.

Under preparation or planned are manuals on 'A village workshop', 'Ferrocement water tanks', 'Ferrocement House', 'Installation of a hydraulic ram pump' (new edition), 'A drum oven' (new edition), 'A blacksmith's forge, anvil and charcoal-making'.

100. WAU ECOLOGY INSTITUTE

Box 77,
Wau,
Papua New Guinea.

Programme.

This Institute, as well as doing research, is providing a practical alternative to the shifting cultivation which threatens the PNG rainforests. It has combined every known sound land-management technique into a single system of intensive gardening, using coffee-pulp compost, legumes and casuarina trees on a contour-mounded hill-side. Pest-control is by natural methods. Soil fertility and results are being analysed, and an extension programme is under way. (1)

101. ADVISORY SERVICES IN TECHNOLOGY, RESEARCH & DEVELOPMENT (ASTRAD)

Faculty of Engineering,
Fourah Bay College,
University of Sierra Leone,
Freetown,
Sierra Leone.

Programme.

ASTRAD was set up in 1973 to bring together engineers, in the University and from outside, to investigate appropriate technologies, and to provide consultancy services to Sierra Leone industry and government. ASTRAD provided the core of what has now become the National Association for Appropriate Technology.

Most of ASTRAD's current work is research and testing of prototypes mainly in the fields of energy, palm-nut processing, and building materials. Recognising that the cost of most solar water heaters is high, attention has been focussed on the use of locally available cheap materials with the required thermal properties, and on the manufacturing techniques required for each design. The objective is to recommend for large-scale production designs appropriate to local conditions. A Brace-type solar steam cooker has been built and is being tested, and is now being compared to another design. A project just starting will investigate simple solar crop-dryers using natural convection.

Another crop-dryer, a prototype of which is under construction, operates on solar power or on burning sawdust, the latter being a back-up when there is not enough sunshine.

The use of sawdust as a fuel has also been tested in a fish-dryer. An oven using this fuel is being designed, while general studies concerning sawdust's burning rate and other characteristics continue. Analysis of charcoal burning appliances has been carried out, and work on improving their thermal efficiency is under way.

Other forms of energy being investigated are lignite, bush-wood, coconut shells, and rice husks, and a new project will explore the possibility of mini-hydroelectric generation - a suitable site is now being looked for.

Over the past few years various prototype palm-oil presses have been developed and tested, the latest of which meets several of the requirements, being small, light and equipped with a small boiler which greatly increases the palm-oil output. Rural development extension workers will be involved in field trials of 26 models of this design. A prototype palm-kernel cracker, using centrifugal force, has been developed.

A new project is the development of spinning and weaving machines, aiming to identify possible improvements in the traditional systems.

There is no cement limestone in Sierra Leone, so the binding properties of local materials and wastes are being studied. Particular attention has been given to lateritic rocks, and to the manufacture of lateritic cement by burning under controlled conditions. The pozzolanic properties of industrial wastes and agricultural materials such as crop shells have been studied. A systematic review of the widely used 'sandcrete' blocks is also under way, as is a study of clay deposits, for clay is used as a building material in Sierra Leone. The strength of various types of timber has been studied. (2)

102. DEPARTMENT OF AGRICULTURAL ENGINEERING

Njala University College,
Njala,
PMB Freetown,
Sierra Leone.

Programme.

During the last few years, the Department has been engaged on the design and development of appropraite technologies for crop production, processing and preservation.

Designed and manufactured on a limited scale are: hand tools, seeders, rice threshers and winnowers, decorticators and block-making machines. Under intensive study is the potential for greater use of ox-draught in Sierra Leone and the design of implements appropriate to the local Ndama oxen. In this project the Department is working together with the Intensive Agricultural Development Programme in the north of Sierra Leone.

Students in the Department are assigned development projects and some recent ones have been: low-cost crop dryers, methane generators, inclined-plane palm-nut cracking, solar drying and paddy parboiling. (2)

103. SMALL FARM EQUIPMENT UNIT

Tikonko Agricultural Extension Centre,
P. O. Box 142,
Bo,
Sierra Leone.

Programme.

The Tikonko Centre concentrates on the production of swamp rice by small farmers, providing extension advice, management help, forming credit unions, breeding varieties etc. The Equipment Unit, which is located at Bo, develops and manufactures equipment needed by such farmers; it also produces some general tools and works to special order.

The Unit manufactures a pedal-operated rice-thresher, having a bicycle chain running over 3 sprockets to provide the power and wire hoops on a wooden drum as the threshing mechanism. 25 of these were sold in 1978-79, at a price of c.$US130 each. It can be operated by one man, but is most efficient with three, when it can thresh 30-40 bushels of rice per day.

The Unit manufactures a rice-winnower, with a treadle-operated fan, an oil-drum as the main drum, and the frame of galvanised pipe; it also makes a cassava grater, the grating wheel of which is solid wood with a galvanised tin covering punched with serrated holes; and it produces a wheelbarrow of all-wood construction.

Other products manufactured for sale at the Unit include a pre-cleaner, seed-dresser, jab-planter, push-pull hoe, hand maize-sheller, a blacksmith's blower, and a pulley for wells. A steady sale of hand-tools, mainly hoes and cutlasses, is kept deliberately small to avoid competition with a local commercial manufacturer. Total sales of the Unit in 1978-79 came to about $US12,000.

The Unit has developed and is now testing various water pumps, a coconut grater and a groundnut decorticator, and is planning to develop a rice huller. (1)

Publications.

Catalogue and price-list.

104. TECHNONET ASIA

International Development Research Centre,
Tanglin P. O. Box 160,
Singapore.

Programme.

Technonet is a network of 14 organisations in 11 countries of the Asian-Pacific region, which cooperate through Technonet in training of industrial extension workers, and in the exchange of information about technologies suitable for small and medium industries. Among the 12 industries identified as priorities are food-processing, wood-based industries, and agricultural waste utilisation. Hundreds of industrial problems have been successfully handled by extension officers trained under Technonet; for example the design and manufacture of a special mechanical knife for splitting bamboo for use in handicrafts, and the identification of the correct staining medium for a particular wood used in the manufacture of trays.

Each organisation has a Technical Information Service, and through Technonet these are increasingly utilising information available in each other's data-banks, and from outside sources. The experience could be valuable in setting up similar networks of information exchange. (1)

Publications.

Many reports and case-studies, including 'Directory of national sources of information for small-scale industries', by the University of the Philippines Institute for Small-Scale Industries;

'The development of small and cottage industries in Sri Lanka & India', report of a study team;

'Starters Kit: a guide to setting up a technical information service unit';

'Technonet Asia newsletter', 6 issues per year, 20pp, free.

105. IRRIRI COMMUNITY DEVELOPMENT PROJECT

Box 42,
Gizo,
Kolombangera,
Western Solomons,
Solomon Islands.

Programme.

This is a village cooperative, formed by a religious group, which has developed a system of intensive agriculture in place of the traditional slash-and-burn pattern. The project makes its own compost fertiliser/mulch by shredding all green wastes and jungle vines; this mulch prevents erosion and maintains soil moisture and temperature, while careful crop rotation is also followed, and insecticides made from chillies and garlic are used.

Irriri's plans include a small hydro-electric plant using a nearby waterfall, and the production of fuel-alcohol from cassava for use in outboard motors. (2)

106. APPROPRIATE TECHNOLOGY GROUP

c/o Chemical Industries (Colombo) Ltd.,
P. O. Box 352,
Colombo 1,
Sri Lanka.

Programme.

The ATG was started in 1975, but has become much more active in the past two years; a full-time project manager was appointed in November 1978.

In cooperation with TOOL, a prototype solar ice-making unit was built and tested. It produced cold water but not ice. The design has now been changed in the light of the test-results, and a second prototype is being built.

Also with TOOL and other Dutch workers, a project to collect and assess traditional 'ayurvedic' medicines was started in 1977, and is continuing. Samples have been analysed at the University of Utrecht, and ATG is now awaiting funding for further development of this project to extract the effective drugs from traditional medicinal herbs.

ITIS, of Britain, is helping ATG with 3 projects. A hand-operated cart-wheel-driven power-source for turning a carpenter's lathe has been built as a prototype, tested in 2 villages by local craftsmen, and the manufacturer is now awaiting the carftsmen's suggestions before building a production model. A pedal-operated wood-carving machine is being manufactured, using a double-decker bus speedometer cable as a flexible drive. And a hand-operated machine for the extraction of fibre from sisal leaves has been tested as a prototype. The first model was based on a sugar cane crusher frame, and was not satisfactory, but the roller-mounting and platen are now being adapted.

Three types of bicycle trailer are under development, one prototype having been completed. ATG is also going to assemble and test the 'Oxtrike' experimental tricycle.

Projects on an ITDG windmill and on biogas are presently in abeyance, while a project to encourage the cultivation of manioc (cassava) for use as an animal feed is held up for lack of funds. (1)

107. SARVODAYA DEVELOPMENT EDUCATION INSTITUTE

77 de Soysa Road,
Moratuwa,
Sri Lanka.

Programme.

Sarvodaya is a large community development organisation, relying on voluntary workers and active in many rural areas of Sri Lanka. Its Rural Technical Services has been building and testing the effectiveness of various 'appropriate' technologies for some years now, and the regular programme of Sarvodaya is itself made up of projects which are small-scale and which use existing skills and local materials.

In the energy field, different windmills are being used for water-pumping. A prototype Cretan mill, mainly wooden, with 8 sails made by local fishermen, was constructed in 1978 at an agricultural institute. Based on this model, a standard design has been drawn up and one model of this is now working at a Sarvodaya farm. The diameter is 6 metres, height 10 metres, it has a steel crankshaft with bearings, a 2-4" pump with wooden pistons and PVC rings and a 30 cm. stroke. Output is 1.3 litre/second from an 8 metre lift and a wind of 4 metres/second, while the cost is about £250. Two metal windmills have been built, designed to irrigate 2 acres and to produce two crops per year. Output is 1.7 litres/second in a 4 metre/second wind, the windmill being 10 metres high and with a diameter of 4 metres. It costs about £600 including the pump.

30 hand-pumps have been installed in village water supply schemes, costing about £20 each. The frame is of steel, with a bolt as the bearing, while the pump is of PVC pipe and the piston of wood with PVC rings. At 40 strokes/minute, a 4" piston pump produces 17 litres/minute from a depth of 7 metres; from a depth of 14 metres 12.5 litres/minute are lifted with a 3" piston.

2 Biogas plants based on a Nepalese design have been built and tested, one of them at a dairy, which is producing gas sufficient for 8 people. A Chinese model has been built recently for testing, and 3 more biogas plants are planned for 1980.

A prototype solar still has been successfully tested at Karaitivu; 9½ litres of potable water are now being distilled each day from a 3 square metre still made from cement, glass, timber and galvanised iron sheet. Solar power will be used in a new project to develop a solar pump, to be started this year; another new project is a bullock-driven pump.

A large, 45 cubic metre water storage tank made of ferro-cement is under construction, in an effort to find a cheaper alternative to masonry tanks.

25 smokeless stoves have been constructed, and there is now a survey under way to assess their social impact. 15 models of another version have been built, based on the Lorena stove developed in Guatemala. They are made of clay, sand and ant-hill laterite, with binders such as cow-dung, ash and rice-hulls. Sarvodaya has found that the efficient use of the new stove, rather than its construction, is the main problem in its successful adoption.

With technical assistance from ITIS, of Britain, the production of coconut-fibre-reinforced cement roofing sheets has been started. These sheets are cheaper than asbestos ones, and the project requires little capital. Ridge tiles, irrigation channels and heavy-duty tables are also being produced.

Sarvodaya has three soap-producing units, making soap from coconut oil, caustic soda and citronella. The soap tends to be too soft, however, and at present is more expensive than mass-produced equivalents.

Sarvodaya also has 4 machine shops and many small smithies, producing agricultural tools, wheelbarrows, handpumps, household utensils etc. The movement is interested in improving the quality of steel tools made at village level; it is also seeking cheap ways to preserve wood in a wet tropical climate, designs of non-diesel pumps which can lift 10,000 gallons/day from 25-30 feet, and designs of large kitchen stoves which utilise wood or agricultural wastes. (1)

Publications.

Mostly in Sinhala or Tamil.

108. NATIONAL INDUSTRIAL DEVELOPMENT CORPORATION

Tractor Project,
P. O. Box 450,
Manzini,
Swaziland.

Programme.

The 'Tinkabi' tractor has been under development since 1968, and has been tested and re-designed so that full-scale production of the current model will begin early in 1980. To date 520 units have been produced and marketed in 16 countries. It is planned that total production, in Swaziland and in other African countries under licence, should reach 35,000 by the mid 1980s.

The tractor is a 4-wheel machine with a rear-mounted engine and a trailer in front of the driver. It has a 16 HP diesel, air-cooled engine, uses hydrostatic transmission, and can be fitted with a full range of implements for agricultural use (plough, planter, cultivator, ridger, harrow, sprayer etc), as well as being used as a stationary engine for pumping, sawing etc. It carries up to 1000kg loads. Its current price in Swaziland is about 60% of that of imported tractors. All parts other than engine, transmission, wheels and tyres are made in Swaziland.

Publicity material and technical specifications are available. (1)

109. ARUSHA APPROPRIATE TECHNOLOGY PROJECT (AATP)

P. O. Box 764,
Arusha,
Tanzania.

Programme.

AATP was started in 1976, and now has a staff of about 25. It has a small workshop, offices and library, and a demonstration/testing site. It will be integrated into the government's Small Industries Development Organisation in 1981.

AATP is notable for the attention it pays to identifying the technical needs and capacities of rural communities, and to carefully planned communication and extension of the technologies developed. One of its most successful projects has been the development of a hand-pump; the villagers of Majengo decided that this was their priority, they participated in the design and testing so that the construction, operation and maintenance of the pump was within the capacity of the village craftsmen, and a specially formed cooperative in the village now produces, for sale, the 'Majengo Water Pump'. This can deliver about 5 gallons/minute from 60 feet, requires no welding, and incorporates inlet or exhaust valves from scrap engines for the valve poppets. A simple testing rig for these pumps has been built.

Another cooperative, Ujuzi Leo, was set up to manufacture windmills, but after manufacturing 15 production has now stopped, and the design is being changed. This project suffers from a lack of data about wind conditions in Tanzania, and the windmill is forever being strengthened to withstand 'the most improbable situations'; there is also the problem of the users needing to be properly trained. An electric generator, utilising a bicycle wheel and two auto dynamos, has been developed and tested, but technical problems remain and this project has a low priority as there is not a proven demand for it.

Cinva rams are being successfully manufactured and sold in large numbers, and the techniques of soil cement housing construction are being taught to extension workers and villagers. Once an optimum design is arrived at a construction manual for the ram will be prepared. AATP has cooperated closely with the Building Research Unit on low-cost housing; the Unit has developed an effective way of casting 4 concrete corner pillars in situ.

Six biogas plants have been made and a further 12 were on order in mid-1979; AATP has concentrated on cutting the cost of the plants, and their design utilises old oil drums, packed in a pit in the ground. Several designs of methane lamp have been developed and tested.

AATP has developed a half ton ox-cart which is now being commercially manufactured by a small business, at a price 60% of that

charged for the other locally available model. This interest in rural transport also prompted work on a trailer designed for use with a bicycle, but also adaptable for a donkey, motor-bike or hand pulling. Problems with lateral stress on the narrow bicycle rims are being tackled; a special feature of this trailer is that the hitch can be shifted to the side so that it can easily be pulled on the two-rutted roads which abound around Arusha. AATP is also involved in the ITDG Oxtrike programme.

Other AATP work includes improved stoves (a local woman has started manufacturing a modified Dutch cooking stove), ferro-cement water jars, ferro-cement latrine slabs, sanitary well-seals, a fluoride filter made from animal bone char, and some work on sisal fibre cement. A 'Fresnel lens' solar cooker, being a series of concentric angled rings of polished aluminium sheets, is on display at the centre in Arusha, and is being tested and the design improved; solar distillation is now being investigated.

AATP had 1174 recorded visitors in 1978-79; although AATP will try to meet the demand for information and exposure tours, it plans in future to place its emphasis on people living and working in Tanzania as opposed to those coming from abroad. (1)

110. KILACHA PRODUCTION & TRAINING CENTRE

P. O. Box 21,
Himo,
Tanzania.

Programme.

This Centre has developed and is now manufacturing for sale a kerosene-heated incubator for poultry. The incubators are of different sizes, having a capacity of from 100 to 1000 eggs and a very simple thermostat mechanism maintains the temperature. Other simple machinery for poultry farms is also manufactured at the Centre. (2)

111. SMALL INDUSTRIES DEVELOPMENT ORGANISATION

P. O. Box 2476,
Dar es Salaam,
Tanzania.

Programme.

SIDO was established in 1973, and is charged with all aspects of developing small industries in Tanzania. It devises plans, builds industrial estates, gives credit, trains, markets products, and has extension workers in small towns and villages.

SIDO's work includes development of bricks and tiles, lime and lime pozzolana cement, ceramics, glass, spinning and weaving, crop processing, fish drying, brush-making with coir fibre, soap-making, and handicrafts.

Prototypes of a Persian wheel, tractor plough, biogas plant and solar water heater have been developed, and an effective soil-cement brick-making machine is manufactured under SIDO auspices. SIDO has also experimented with a cupola foundry. (3)

112. TANZANIA AGRICULTURAL MACHINERY TESTING UNIT (TAMTU)

P. O. Box 1389,
Arusha,
Tanzania.

Programme.

TAMTU was set up in 1955, and is responsible for testing local and imported equipment, and recommending on its adoption in Tanzania. It also designs needed machinery, and builds and tests prototypes, as well as carrying out demonstrations of ox-drawn equipment in villages.

TAMTU itself, and six Rural Craft Workshops which are small, regional manufacturers of TAMTU's designs, manufacture some implements, notably ox-drawn carts, but small quantities of 2-furrow ploughs, planters, inter-row cultivators, ridgers and harrows are also made for sale. (2)

113. UYOLE AGRICULTURAL CENTRE

P. O. Box 400,
Mbeya,
Tanzania.

Programme.

The Agricultural Engineering programme at Uyole has developed an ox-drawn wooden tool-bar, to which implements can be fitted, including specially-designed ones for the 'minimum tillage' research programme. These include direct drilling, planting and sub-weeding using hoe and sweep. A universal cultivator tine, rather than different tines for different activities, has been designed and fitted to the tool-bar. The tool-bar is still under test. (2)

114. CARIBBEAN INDUSTRIAL RESEARCH INSTITUTE

Tunapuna Post Office,
Trinidad.

Programme.

This Institute is partially funded by UNIDO, and is effectively a national institute of Trinidad & Tobago, although it does work throughout the Caribbean region. Most of its work is done on contract, and the permission of project sponsors is required before certain information can be released, but its Technical Information Service can respond to requests, and is very well-equipped. A nominal fee is charged for assistance to small industries in Trinidad & Tobago.

Work done at the Institute has included the distillation of essential oils, the development of a small-scale huller for pigeon peas, of a device for husking coconuts, low-cost radio transceivers suitable for isolated rural sites. The Institute has special expertise in fermentation, alternative low-cost food packaging, and electronics. (2)

115. FACULTY OF NATURAL SCIENCES

University of the West Indies,
St. Augustine,
Trinidad.

Programme.

Staff of the departments of chemistry, physics and crop science have worked on solar energy for some years now. A solar still has proceeded through 6 designs over the past ten years, and about 20 of the latest models are still operating, producing 10 or 20 litres of distilled water per day from 6' by 4' or 8' by 6' collectors. The principal lesson of this development has been that simpler, more reliable but less efficient units are very much cheaper than the most efficient designs.

In 1973 a natural convection solar crop dryer was developed and tested, but was found to be ineffective in the rainy season; a two-stage dryer has now been produced, using a polythene covered wire-mesh dryer in the first stage and a double-glazed rock-bed natural convection dryer in the second. This has been successfully tested with a wide variety of crops, by two small farmers, and commercial production should be viable.

Three solar water heaters, with 48 sq.ft. collectors and a 75 gallon capacity, have been installed in private homes in Trinidad and in Barbados. At current prices of bottled gas and electricity they are not viable in Trinidad.

Current research is on a high-temperature solar collector, using diesel oil as the heat-transfer fluid, and distillation of fuel alcohol from sugar cane will be attempted with this energy source when the design is perfected. (1)

116. LOW-COST FARM EQUIPMENT PROJECT

P. O. Box 280,
Soroti,
Uganda.

Programme.

This project is funded jointly by the Ministry of Agriculture and UNDP, with UNIDO providing technical assistance. At present its output is limited, due to conditions in the country after the war, but it plans to develop and test, as well as manufacture in quantity, all types of ox-drawn and hand-operated equipment, as well as spares for cotton gins, coffee processing machinery and other machines. (2)

117. SAMOA METHODIST LAND DEVELOPMENT

P. O. Box 497,
Apia,
Western Samoa.

Programme.

Founded in 1973 to develop over 1000 acres of land owned by the Methodist church, this project now has a thriving 235 acre farm with 160 head of cattle on up-graded pasture land, and banana, coconut and cocoa plantations. The project aims to utilise appropriate technologies to develop processing industry; women, who initiated the dairy operations, play a particularly prominent role.

A solar dryer is used to dry bananas, breadfruit and pawpaw, while a special solar copra dryer, set on old railway lines, processes this coconut product. A nutrition education programme is accompanied by the production of snacks for school children - these come from a village texturiser, and are made of ground wheat, ground rice, breadfruit and dried coconut. (2)

118. FARM MACHINERY RESEARCH UNIT

Magoye Regional Research Station,
P. O. Box 11,
Magoye,
Zambia.

Programme.

This Unit of the government tests agricultural machinery and recommends whether or not it is suitable for use in Zambia. The Unit no longer trains artisans, nor does it at present do any R&D work on agricultural equipment. Reports and designs of some of the equipment developed at Magoye in the past are available from ITDG Publications, London.

Over the past three years the Unit has tested and reported on the following items:- ox-drawn ploughs, a cultivator and a ridger, all made by Northlands, Zambia; an ox-drawn plough, a cultivator, a ridger and a hand-operated maize-sheller, made by Cossul, India; an ox-drawn harrow (diamond and zigzag) made by Walker, Zambia; and four models of ox-drawn plough and an ox-drawn cultivator made in India.

The Unit has also evaluated five models of tractor - a 16HP Tinkabi from Swaziland; a 26.5HP Swaraj and 16.5HP Eicher, both from India; a 25HP Tractorexport T25 A1 from the USSR; and a 25HP Massey Ferguson 210 from the UK.

The Unit has cooperated closely with Northlands Engineering, a local company which is now manufacturing the first Zambia-made ploughs and other ox-drawn equipment. The Unit's suggestions for improvements to equipment are also communicated to overseas manufacturers whose machinery has been tested. The typical tractor test requires about 420 hours of performance, with records of all relevant criteria being kept.

Items currently being tested include the following:- groundnut shellers (Indian and local); a Zambian planter, and an Indian hand-jab planter (Kirloscar); two Zambian groundnut lifters; an Ariana tool-bar from France and a local tool-bar; various hoes and axes; and a South African knapsack sprayer.

A 21HP Goldoni tractor, a 30HP Bouyer tractor, and a 33HP Yanmar tractor, are also being tested this year. (1)

Publications.

Copies of test reports could, subject to availability, be supplied to bona fide enquirers, provided postage was paid for. A typical tractor test-report is about 15 pages, a report on an ox-drawn implement usually one page.

119. TECHNOLOGY DEVELOPMENT & ADVISORY UNIT (TDAU)

University of Zambia,
P. O. Box 2379,
Lusaka,
Zambia.

Programme.
TDAU was set up in 1975, to develop local design and manufacture of equipment and to link the expertise of university staff and students to the public and private sectors.

Projects completed have included a soil-cement brick-making machine; an inter-row cultivator; cyclone groundnut sheller; hydraulic pump; solar water heater; and the production of low-cost science teaching equipment. A cashew nut processing plant was developed by TDAU and after succesful tests it is now being redesigned for large-scale production.

A borehole drilling machine was built out of scrap materials, and is now also being redesigned. A cord pump is being tested, so far successfully, and five different types of maize sheller are under test by farmers in two villages. A Banki water turbine is being installed, and windmills are being tested. Others in the University are working on the development of a windmill specially designed for pumping water, a solar cooker, a biogas generator and a charcoal stove. (1)

STOP PRESS

ZIMBABWE

APPROPRIATE TECHNOLOGY COMMITTEE

c/o School of Agriculture,
University of Zimbabwe,
P. O. Box MP 167,
Mount Pleasant,
Salisbury,
Zimbabwe.

Programme.
The ATC provides a contact point for those wishing to find out about AT work in Zimbabwe. In recent years Zimbabwe has developed several small-scale technologies using local materials, including work on a version of the Tinkabi tractor. Other equipment being developed includes an ox-drawn ripper, and improved ox-drawn ploughs. Small shellers and winnowers are manufactured commercially, and there are several methane digesters and solar dryers under test in various parts of the country. A Solar Energy Society has recently been formed. (2)

120. AFRICAN REGIONAL CENTRE FOR TRANSFER, ADAPTATION AND DEVELOPMENT OF TECHNOLOGY

2 Roume Avenue,
Dakar,
Senegal.

Programme.

This Centre has recently been established under the auspices of the Economic Commission for Africa. Its objectives are to coordinate the transfer of technology within Africa. Its major concentration will be on the appropriateness of proposed technology transfers, and on the terms and conditions of such transfers. (2)

121. APPROPRIATE TECHNOLOGY FOR HEALTH PROGRAMME

World Health Organisation,
1211 Geneva 27,
Switzerland.

Programme.

The ATH programme started in 1976, and has now assembled a large library on low-cost, simple medical equipment. It acts mainly as a source of information, answering or referring technical enquiries, and publishing the ATH Newsletter (see below). Other programmes of WHO include rural water supply, sanitation, medicinal herbs, etc. (1)

Publications.

'Appropriate Technology for health directory', 2nd edition, 1978, free; 328 organisations in 75 countries, with brief information about their work, address, and index;

'ATH Newsletter', once or twice per year, free; short descriptions of equipment from people actually using it in the field, requests for information, bibliographies;

WHO also publishes many reports, guides etc, some of which are free.

122. A.T. INTERNATIONAL

1709 N. Street, N.W.,
Washington,
DC 20036,
U.S.A.

Programme.

AT International started work in mid-1978, and is funded by the US government 'to promote the development and dissemination of technologies appropriate for developing countries'. It has become an important source of funding for many AT groups. It is particularly interested in technologies which can be applied by local entrepreneurs, to whom ATI provides financial and technical support. (3)

123. COMMONWEALTH SECRETARIAT

Marlborough House,
Pall Mall,
London SW1Y 5HX,
England.

Programme.

The Food Production & Rural Development Division has organised two meetings on rural technology, one in Tanzania in 1977 and one in The Gambia in 1979. These meetings have brought together both policy-makers and practicioners from the regions, and included demonstrations of machines and implements brought in from countries of the region.

The Division has since sponsored visits to particular projects by interested individuals from African countries, and with ITIS/ITDG has arranged for samples of equipment to be shipped for testing to countries in the regions.

A workshop on 'Appropriate Tillage' was held in Nigeria in 1979, and a survey of rural technologies in the South Pacific is under way, preparatory to a meeting to be held there in 1981.

Two meetings on post-harvest losses have been organised and their proceedings published. A workshop on the Management of Irrigation was held in India in 1978, and one on Agricultural Project Management in Sri Lanka in 1979.

The Commonwealth Science Council has organised the Caribbean Alternative Energy Programme, which includes projects on biogas, the use of bagasse as a fuel, solar crop-drying, pumping, and

heating of greenhouses, solar stills for schools, and an evaluation of windpower in Barbados. These projects are in various stages of development. A similar programme is now being organised in Africa.

The CSC also organised meetings on rural technology in Asia and the South Pacific, out of which has come a project for the management of water hyacinth and its possible utilisation as biogas feed, fodder and fertiliser. Another Caribbean programme is investigating the utilisation of natural products such as algae, medicinal plants, forest products and agricultural wastes, while workshops on the transfer of science information have been held in Belize and Jamaica. (1)

Publications.

Proceedings of the meetings referred to above, plus:
'Common poultry diseases: diagnosis and control', 1979, £1.00;
'Beekeeping in rural development', 1979, £2.50;
'Report of the Regional Appropriate Technology Coordinators Meeting', Lusaka, 1979, free;
'Training for agricultural development: a directory of resources in the Commonwealth', £3.00;
'Report of the 1st regional grain storage conservation seminar, Lusaka, 1978', free;
'Report of a seminar on alternative energy resources and their potential for rural development', Sri Lanka, 1976, free;
'Report of a seminar on new energy technologies', Guyana, 1978, free;
'Report of the project group meeting on alternative energy resources', Barbados, 1977, in three volumes, free;
'Communication techniques in science and technology', Tanzania, 1976, free;
'Science communication in the Caribbean', Guyana, 1977, free;
'Commonwealth regional rural technology programme', Bangladesh, 1978;
'Report of a Caribbean meeting on utilisation of natural products', Guyana, 1978, free.

124. FOOD & AGRICULTURE ORGANISATION (FAO)

Via delle Terme di Caracalla,
00100 Rome,
Italy.

Programme.

FAO's work covers the whole spectrum of agricultural development and food production, processing, storage etc, and it publishes hundreds of useful books, reports, technical papers, manuals on specific aspects of such development, e.g. on the design of

agricultural machinery workshops, a directory of agricultural engineering institutions around the world, a practical guide to rice parboiling.

The part of FAO most closely concerned with appropraite technology work is the Agricultural Services Division, and within it the Agricultural Engineering Service. (1)

Publications.

Full list available from Chief, Reference and Documentary Information Section, FAO, Rome.

125. GROUPE DE RECHERCHES ET ECHANGES TECHNOLOGIQUES (GRET)

34 rue Dumont d'Urville,
75116 Paris,
France.

Programme.

GRET is a non-profit organisation, with a comprehensive information centre and a wide range of publications on appropriate technology. It is the main centre for such information in the French language, and is thus a useful contact for technological developments in francophone countries. GRET answers technical enquiries, from its own resources or by referral; and it also assists developing countries with consultancy services, advice, research and with identifying technical experts. (2)

Publications.

2-4 page 'fiches', i.e. brief description and drawings of a particular technology, with instructions on how to obtain further information, and details of its current adoption and use; some fiches describe organisations or other AT topics; about 100 of these fiches are published each year. All are in French, some in Spanish.

126. OECD DEVELOPMENT CENTRE

94 rue Chardon-Lagache,
75016 Paris,
France.

Programme.

The OECD Development Centre carries out research on all aspects of development, and has done a number of studies of appropriate technology. It also collects and disseminates information and documentation on development. Current research includes work on food self-sufficiency, on the management of technological knowledge, and on the 'shadow valuation' of technology. (1)

Publications.

List available; some distributors in Commonwealth countries; some regular OECD publications are available free.
'Appropriate Technology Directory', 364pp, 1979, £11.00;
'Appropriate Technology: problems and promises', by Nicolas Jequier, 344pp, 1976, £5.60;
'Appropriate Technology Developments in the United States and their relevance to the 3rd world', 163pp, 1979, available on request.

127. TOOL

Mauritskade 61a,
Amsterdam 1092 AD,
Netherlands.

Programme.

TOOL is a cooperative, composed of 8 groups with several hundred members; it has a permanent staff of 22, and is funded mainly from the Netherlands government aid programme.

The cornerstone of TOOL's work is the technical enquiry service, which receives some 3000 requests annually on all aspects of appropriate technology. These are either answered from the existing documentation, or referred to specialist members of one of the groups. TOOL organises its own research on problems which require investigation, and recent projects have included a solar ice-maker, a simple fish-net machine, wood-burning stoves and crop-graders. TOOL has been involved with the evaluation of windpumps on irrigation schemes in India, and with the development of ferro-cement items, water pumps and water storage, biogas, crop-drying and transport in Indonesia.

TOOL has been coordinating the development of SATIS, the Socially Appropriate Technology Information System; this is a standardised information system, designed to enable organisations participating in the scheme to store, retrieve and exchange information about technologies, people and resources. (1)

Publications.

'Wind and Sun Compendium', once or twice per year; information about applied research on solar and wind water-pumps; free to a restricted circulation;
Various documents on SATIS (see above);
Various construction manuals, catalogues etc on appropriate technologies, including uses of bamboo, biogas, wind-pumps, wind-generators, shallow wells, salawe pump, etc; list available.

128. UNITED NATIONS CHILDREN'S FUND (UNICEF)

United Nations,
New York,
U.S.A.

Programme.

UNICEF's programmes include small-scale food processing and storage, hand-dug wells and simple water pumps, and the provision of cheap health care. The Food Engineering and Technology Section tries to ensure that technologies used in UNICEF's programmes are appropriate to the communities being served. (1)

Publications.

UNICEF publishes numerous manuals etc on sanitation, health, water, and other topics of rural development; they are available free from regional offices.

129. UNITED NATIONS ENVIRONMENT PROGRAMME (UNEP)

P. O. Box 30552,
Nairobi,
Kenya.

Programme.

UNEP has been organising meetings to discuss a 'conceptual framework' and a 'methodology for selecting' 'environmentally-sound and appropriate technologies'. The proceedings of these meetings are to be published. UNEP plans to set up a network of institutionally-based pilot projects, one object of which is to promote, design and test such technologies.

One part of UNEP's programme is INFOTERRA, a network of national organisations which exchange information about the environment and about appropriate technologies. INFOTERRA was partly responsible for the preparation of the UNEP Directory (see below). (1)

Publications.

'Directory of institutions and individuals active in environmentally-sound and appropriate technologies', 1979, 152pp, price unknown; (published by Pergamon Press, England, for UNEP); this lists some 2000 institutions and individuals, with brief details of their work, address and the source of information about them;

'Environmentally-sound and appropriate technology', UNEP Report No.3 of 1979, 102pp, a review of what all the various UN agencies are doing in this field, price unknown;

'Technology, development & the environment: a re-appraisal', by A. K. N. Reddy, 1979, 52pp, price unknown.

130. UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION (UNIDO)

Lerchenfelder Strasse 1,
A-1070 Vienna,
Austria.

Programme.

UNIDO operates an Industrial and Technological Information Bank on 20 sectors of industry including agricultural machinery and agro-industries, and also answers inquiries about industrial products and processes. It runs a computerised data base, INDIS. It has funds available for providing technical assistance to small industries in developing countries, but not for capital investment. (1)

Publications.

Several series, all available from UNIDO Newsletter, P.O.Box 300, A-1400 Vienna, Austria; most are free to people in developing countries; list available;
'Monographs on Appropriate Industrial Technology' on the following topics:-
"Energy for rural use", "Textiles", "Low cost transport for rural areas", "Food storage and processing", "Sugar", "Oils and fats", "Drugs and pharmaceuticals", "Light industries and rural workshops", "Construction and building materials", "Paper products and small pulp mills";
'Guides to sources of information' about the following industries (among others):-
"Meat processing", "Leather and leather goods", "Vegetable oil processing", "Agricultural implements and machinery", "Building boards from wood and other fibrous materials", "Animal feed", "Coffee, cocoa, tea and spices", "Non-conventional sources of energy", "Woodworking machinery", "Bioconversion of agricultural wastes", "Utilisation of agricultural residues for the production of paper, pulp and panels";
'Technologies from developing countries';
'Technology for solar energy utilisation'; and numerous reports and studies.

131. VOLUNTEERS IN TECHNICAL ASSISTANCE (VITA)

3706 Rhode Island Avenue,
Mt. Rainier,
Maryland 20822,
U.S.A.

Programme.

VITA is a private, non-profit organisation and is one of the world's major sources of information about rural technologies. Its Documentation Centre holds over 40,000 documents, and VITA provides copies of relevant material to enquirers. It can also draw on its thousands of US-based volunteers to solve technical or management problems in development countries. In 1978 it received some 1500 requests for technical assistance and 2500 general enquiries, and distributed over 30,000 publications. (2)

Publications.

Numerous; list is available; a selection is given below. Payment in US$ whenever possible, or bank drafts, international money orders or postal orders, or UNESCO coupons; make payable to VITA Publication Service; non-US$ payments, add 5% service

charge; postage, add 15% to all orders for seamail; for air-mail, add 40% for N. and S. America and Europe, add 80% for other parts of the world;
'VITA News', 3 or 4 issues per year; price by ability to pay;
'Village Technology Handbook', 350pp, 1970, $8.95;
'Appropriate Technology Sourcebook', (by Volunteers in Asia), 1977, 305pp, $4.50;
'The Lorena owner-built stoves (mud-build)', 1979, 80pp, $4.00;
'Small Farm Grain Storage', 1976, Volume 1: Preparing grain for storage, $4.00; Volume 2: Enemies of stored grain, $4.00; Volume 3: Storage, $4.00; or $9.95 for set of three;
'Village texturizer', 1977, 70pp, $3.95;
'Raising rabbits', 1977, 90pp, $2.95;
'Post harvest grain loss assessment methods', 1978, 144pp, $8.95;
'Smoking fish in a cardboard smokehouse', 1976, 12pp, $1.25;
'How to salt fish', 1966, 10pp, $1.25;
'Fresh produce handling and distribution', 1968, 10pp, $1.25;
'Groundnut (peanut) huller', 1977, 10pp, $1.25;
'Freshwater fish pond culture and management', 1976, 200pp, $6.50;
'How to perform an agricultural experiment', 1971, 30pp, $2.95;
'Forest farming', 1976, 200pp, $8.95;
'Winnower', 1976, 35pp, $2.95;
'Low cost development of small water power sites', 1967, 50pp, $2.95;
'Solar cooker construction manual', 1967, 25pp, $2.25;
'Low cost windmill for developing nations', 1970, 45pp, $2.95;
'Design manual for water wheels', 1975, 80pp, $4.50;
'Handpumps for village wells', 1975, 15pp, $1.95;
'Evaluation of solar cookers', 1962, 72pp, $5.95;
'Using water resources', 1977, 160pp, $5.50;
'Savonius rotor construction', 1977, 54pp, $3.25;
'Small Michell (Banki) turbine: a construction manual', 1979, 55pp, $4.25;
'Helical sail windmill', 1979, 40pp, $3.95;
'Overshot water-wheel: design and construction manual', 1979, 50pp, $3.95;
'Wood conserving stoves: two stove designs and construction techniques', 1979, 25pp, $3.25;
'Three cubic-metre biogas plant: a construction manual', 1979, 25pp, $3.25;
'Hydraulic ram pump for tropical climates', 1979, 45pp, $3.95;
'Solar water heater', 1979, 15pp, $2.25;
'Solar still', 1979, 20pp, $2.95;
'Making charcoal: the retort method', 1979, 16pp, $2.25;
'Solar grain dryer', 1979, 32pp, $3.25;
'The dynapod: a pedal-power unit', 1979, 35pp, $3.95;
'Animal-driven chain pump', 1979, 25pp, $2.95;
'The Arusha windmill: a construction manual', 1977, 58pp, $3.00;
'Construction manual for a Cretan windmill', 1978, 60pp, $5.95;
'Making building blocks with the cinva-ram block press', 1966, 30pp, $1.95;
'Small scale manufacture of burned building brick', 1968, 24pp, $2.25;
'Simple furniture design', 1976, 18pp, $1.25;

'How to get waterproofing substances from plants', 1973, 15pp, $2.25;
'Design guide for light aircraft airport', 1970, 50pp, $2.95;
'Construction and maintenance of water wells', 1969, 170pp, $6.50;
'Workshop practice: a manual for engineering instructors', 1977, 75pp, $3.25;
'The planning, installation and maintenance of low-voltage rural electrification systems and subsystems', 1976, 152pp, $5.95;
'Reforestation in arid lands', 1977, 250pp, $6.50;
'Single-entry bookkeeping system for small-scale manufacturing business', 1977, 55pp, $3.25;
'Handloom construction: a practical guide for the non-expert', 1979, 200pp, $6.95.
'Technical Bulletins', mostly 5-10pp, on a wide range of technologies; mostly $1.00 or $2.00.

INDEX OF EQUIPMENT AND PROCESSES

(Numbers refer to entries, not to pages)

INDEX OF ORGANISATIONS

INDEX OF ABBREVIATIONS AND ACRONYMS

Published by
Food Production & Rural Development Division
The Commonwealth Secretariat

May be purchased from
Commonwealth Secretariat Publications
Marlborough House
London SWIY 5HX

ISBN 085092 179 1