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Dear Readers,

Starting in 1980 the GATE **biogas** extension programme was first regarded sceptically and, due to its unorthodox approach, there were doubts about its efficiency. However, those involved in carrying out the project succeeded with patience, persistence and inventiveness in finding ways of using **biogas** installations that were reasonably economical and an appropriate technical solution. These projects have now developed to today's standards and have met with the approval of managing directors and ministers.

Our R+D results, i. e. a number of acceptable dissemination programmes, have even attracted the attention of several regional departments of the Federal Ministery of Economic Cooperation (BMZ) to a project previously supported only by the sectorial department for questions of energy. We are really pleased that parts of the sectorial programme have developed or are going to develop into autonomous projects of the regional departments. The **biogas** project in Burundi may be regarded as an example of this.

We thus reached the end of a phase where various procedures for disseminating **biogas** technology were elaborated and tested in a dialogue with partners from several developing countries. We are now entering the next phase where **biogas** technology will be further disseminated as a result of its application by interested partners and also because of the increasing interest shown by the regionsal departments.

I would recommend all those who want to learn more about **biogas** and our work in this technology sector to read the following pages of this issue of "gate". All those who want to find out more about the R+D activities of GATE should get in touch with us.

Hans-Stephan Peterlowitz

Focus

Mobilization of renewable energy sources in developing countries

The **Biogas** Programme of the Federal Government

by Uwe Lorenzen.

Few events in the last 30 years have resulted in such far-reaching economic upheavals as the end of mineral oil as a dependable and safe source of energy. The price explosion on the oil markets hit the developing countries, with their lack of foreign currency, especially hard, and plunged many nations into financial and economic hardship. An added factor is that wood is the primary source of energy for most developing countries and the increasing rape of the forests has led to a fuelwood crisis of immeasurable proportions. The search for solutions has resulted in cooperation with the developing countries in the field of energy becoming the Iynchpin of German development aid policy.

Conservation of energy, and the exploitation of renewable energy sources, has become the focal point, to which very great importance is attached.

In addition to the development pilot projects undertaken since 1975 the Federal Government, after the World Economic Summits in Bonn and Tokyo in 1978 and 1979 and following he recommendations of the conference on renewable energy in Nairobi in 1981, has introduced projects worldwide in the form of an integrated and coordinated programme set-up. These are known as the

Special Energy Programme (SEP).

No separate budgetary item was created for the Special Energy Programme; i.e., this is not a financing programme. Rather, the nature of the programme is a conceptual one - the Special Energy Programme is financed from a variety of sources.

Test of the Special Energy Programme

The **Biogas** Programme is a separate, technology-oriented sub-programme of the Special Energy Programme. Like the Special Energy Programme, it is a concept-oriented programme and should not be degraded to a financing programme.

Satisfying energy requirements from renewable energy sources, above all by exploiting biomass, is of major importance for all developing countries. Commercial energy sources account for only 25 per cent of total energy consumption in these countries; 75 per cent of the energy used is produced from non-commercial energy sources such as firewood, charcoal, animal and vegetable waste produces, wind and water power, and animal and human muscle power. Two thousand million peopIe continue to rely almost entirely on wood and other traditional fuels. In many developing countries industry satisfies a high proportion of its energy requirements from firewood. In some countries, such as Mali, Burkina Faso, Tanzania, Nepal, Ethiopia, and Haiti, over 90 per cent of all energy needs are satisfied with traditional fuels. In rural regions up to 95 per cent of the energy consumed is provided by these kinds of fuel.

In many developing countries the use of **biogas** is still little known, despite the fact that conditions are more favourable than in the industrialized nations, because the gas is created by bacteria which are sufficiently active at temperatures of over 20°C; and because most of the developing countries are in tropical and subtropical zones they fulfil the necessary climatic requirements for **biogas** technology with unheated plants.

The Special Energy Programme has the following aims: energy conservation and the development and use of renewable energy sources, especially to supply the rural population living outside the urban centres. These aims are also the aims of the **Biogas** Programme.

With a comprehensive coordinated approach the following measures are to be taken in the Special Energy Programme: rational use of energy; identification and localization of renewable energy sources; development, adaptation, and dissemination of systems for economic use of renewable energy sources such as small-scale water power, wind energy, biomass, solar energy, and human and muscle power. Over and above this, the setting up or reinforcement of local counterparts for utilization, production, distribution, and maintenance of the systems; scientific, technical, and administrative training, and the development of regional supply concepts.

Measures to be taken in the **Biogas** Programme:

1. Identification of locations where it is possible to use **biogas**;

2. development, adaptation, and dissemination of **biogas** technology with the aim of economic utilization;

3. setting up or support of local counterparts that can carry out the production, dissemination, and maintenance of the technology and supervise utilization;

4. mobilization of scientific, technical, and organizational knowledge about the use of **biogas**;

5. development of concepts and strategies for decentral supply of **biogas** to the population at suitable

locations.

The **Biogas** Programme is intended to make a practicable contribution to the development policy objectives laid down by the Federal Government, i.e.:

• assuring an appropriate and lasting development;

• strengthening the technological capabilities of the developing countries in the energy sector;

• reducing the dependence of the developing countries on imported sources of energy;

• improving the employment situation;

• raising incomes and living standards, especially in less-developed regions.

Mobilization of local resources

Since the 1970s the energy situation in the developing countries has deteriorated further. Oil prices have temporarily dropped, but the environmental damage caused by consumption of fuelwood has increased dramatically. The development of local energy-producing potential continues to be an urgent task for most developing countries. For a number of them renewable forms of energy, and above all biomass, represent the only energy sources locally available. But it is precisely here that there is a great potential for supplying rural regions. A programme for exploiting renewable energy sources, including the **Biogas** Programme, is in line with national and international discussion on development policy. It helps to reduce the economic and political dependence of the developing countries and to mobilize their own resources. The **Biogas** Programme can make a major contribution towards improving the energy situation in rural areas, conserving natural resources, and meeting basic needs.

Even if, quantitatively speaking, the **Biogas** Programme is only small, and its contribution to resolving the problems of energy supply, balance of payments, environmental damage, and unemployment is correspondingly small, the exploitation of local potential and mobilization of local resources is of such fundamental economic and political importance for the developing countries that the **Biogas** Programme is highly appreciated both nationally and internationally. The **Biogas** Programme is one of the projects in which local potential can be exploited and local resources mobilized successfully in the developing countries, by sector-specific measures and with relatively modest means.

Permanent adaptation and continuing development are required for the **Biogas** Programme concept, i. e., with regard to the technology of the plants, the management-related and overall economic assessment and evaluation of the socioeconomic effectiveness of the **biogas** systems, as well as the work of organizations, institutions, and target groups. The organization and efficiency of the **Biogas** Programme is exemplary as a typical sector programme of German development aid.

Abstract

The **Biogas** Program ist part of the Federal Government's Special Energy Program. The objective of this program is to identify and localize places where the exploitation of **biogas** is feasible, and to develop, adapt and promote this technology. A further objective is to establish and support local counterparts, and to develop concepts and strategies for decentralized supply of **biogas** to the population at appropriate points.

Résumé

Le programme relatif a l'utilisation du biogaz fait partie du programme spécial pour l'utilisation de sources d'énergies renouvables du gouvernement de la République fédérale d'Allemagne. Le but de ce programme réside dans l'identification et la localisation des lieux d'implantation sur lesquels l'utilisation du biogaz est possible, ainsi que le développement, l'adaptation et l'extension de cette technologie. Un autre but de ce programme est de constituer des organismes locaux et de leur apporter le soutien correspondent, de mettre au point des concepts et des stratégies permettant un approvisionnement décentralisé de la population en biogaz sur des sites appropries.

Extracto

El proyecto de **biogas** forma parte de/ programa especial para el aprovechamiento de fuentes de energia renovables del Gobierno Federal. Losfinesde este proyecto consisten en la identificacióny localización delugares, enlos que sea posible el aprovechamiento del **biogas**, asi como el desarrollo, adaptación y popularización de esta tecnología. A estos fines . hay que anadir la creación y ayuda a entidades y organizaciones locales y e/ desarrollo de proyectos y estrategias pare una descentralización del abastecimiento de la problación con **biogas** en emplazemientos apropiados.

Second biogas seminar in Oberreifenberg

by Martin Homola

The second GATE **Biogas** Seminar was held in Oberreifenberg from 26 to 30 August 1985. It was attended by almost all of the GTZ **biogas** experts from Third-World countries, members of the staff at GTZ headquarters, representatives from the BMZ (Federal Ministry for Economic Cooperation), and outside specialists from other institutions and consulting organizations.

The purpose of the seminar was to work out furtherreaching conceptual principles for the introduction and dissemination of **biogas** technology.

The emphasis was on interchange of information and experience, in particular in the following areas:

• refinement of the design of **biogas** plants;

• assessment of operating and overall economics;

• socioeconomic effects and acceptance by target groups;

• analysis and promotion of counterpart institutions.

In addition to "talking shop", the teams of the GATE **Biogas** Extension Service (projects in Burundi, Nicaragua, Tanzania, and the Caribbean), the workers on other GTZ **biogas** projects (Burkina Faso, Ivory Coast, Kenya, Columbia and Thailand), and the external participants took advantage of the opportunity to work out proposals for new concepts and strategies.

A detailed presentation of the projects currently in progress revealed the following picture: so far over 100 **biogas** plants have been built and countless others have been repaired. Additionally, gas-burning appliances adapted to local conditions have been developed and modified. A large number of specialiste (decision-makers, disseminators and artisans) have been trained and qualified. Last but not least, in some projects a start has been made on building up appropriate organization and counterpart structures.

In the total of 14 working groups, a very great deal of work was done; among other things, questions of plant and appliance technology, use of sludge, promotion of local skills, information and training, advisory work and acceptance were covered - and there was some lively debate.

The principal results of the work of the working groups are presented in brief in the following:

• **Biogas** technology has to be regarded as a complete system. As such, it includes target group-oriented identification of the location, the method of production of the substrate, especially in animal husbandry, the technology of the plant itself, the use of the gas, repair and advisory services, and financing procedures.

• The technology of family or respectively small-scale **biogas** plants has been developed into a system capable of being disseminated.

• The plants are economically viable if they can provide the user with a substitute for commercial sources of energy and commercial fertilizers, and if additional energy can be produced with them.

• The provision of light has advantages that cannot always be assessed in terms of money; effects which incidentally were judged to be very important were the improvement in hygiene, the reliability

of the energy supply, and the saving in labour.

• The energy produced is mainly used for cooking and lighting; many of the appliances developed have proved their suitability in practice. The gas produced in large **biogas** plants is distributed profitably.

Although the individual stages of development in the various projects differ widely, because local and infrastructural conditions are often completely different, it was possible to decide on the principal targets of future work:

• Further development or respectively consolidation of self-supporting national and regional dissemination structures, involving local manufacturing, distribution, and maintenance facilities, in particular those of the craft trades;

• Greater involvement of women in the **biogas** programmes (both local and foreign workers), since women represent a special target group in development aid policy, and the running of the plants and utilization of the gas are tasks which very often fall to them;

• The training of local specialists in the areas of planning, construction, and service, to assure continuation of the project in the long term, and thus to encourage independent identification of locations, developmeet, and use of their own sources of **biogas**;

• Intensification of the evaluation of sludge analyses both in the project and accompanying it, since the use of sludge as a fertilizer is of major importance for an economic appraisal of **biogas** plants, and not enough attention has so far been paid to this question in practical project work.

All of the participants agreed that the socioeconomic environment is every bit as important as the technical refinement and adaptation of **biogas** plants.

In Oberreifenberg it was also apparent that an intensification of information interchange in the context of a further training seminar of this kind can be of very considerable importance for the planning and conception of promising sector programmes in Technical Cooperation.

Abstract

Biogas technology must be considered as a complete system. This applies especially to identification of suitable locations, animal husbandry, installation technology, exploitation of the gas, and advisory

and financial arrangements. In future, attention must be paid above all to the further development of self-sufficient national and regional bodies and to the training of local experts in the fields of planning, building and the provision of services.

Résumé

La technologie du biogaz doit être considérée en tant que système général. En particulier en ce qui concerne l'identification des sites, I'élevage d'animaux, la technologie de l'installation, I'utilisation du gaz ainsi que les modalités d'information et de financement. A l'avenir, une attention particulière devra être accordée a l'évolution des structures d'extension nationales et régionales ainsi qu'a la formation sur place d'un personnel qualifie dans le domaine de la planification, de la construction et de la maintenance.

Extracto

La tecnologia del **biogas** debe contemplarse como un sistema global, sobre todo en lo que respecta a la identificación del lugar de ubicación, explotación de ganado, tecnología de las instalaciones, uso y aprovechamiento del gas, asi como formas de asesoramiento y financiación. En el futuro deberá dedicarse especial atención al perfeccionamiento de extructuras de difusión autónomas nacionales y regionales, asi como a la formación y capacitación de expertos locales en los sectores de planificación, construcción y mantenimiento.

Standardization of biogas units

by Alexander Schlusser

About a year ago we began a systematic study of the Arumeru District, which covers 3,000 sq.km. In the Arusha Region, where we work. This district itself can be subdivided Into tour small zones. One of them, known as the Coffee Banana Belt, covers 200 sq.km. and has a population density of 192 inhabitants per sq.km., which Is very high. There Is sufficient water all year round and agriculture is correspondingly Intensive (mainly coffee and bananas); livestock is usually kept inside. The majority of the 7,000 small-farming households have between two and six cows, and often a few pigs, goats, or sheep as well.

The average-sized family here has five to seven members, so that all in all one can speak of ideal conditions as far as **biogas** technology is concerned. As a realistic estimate of the potential, we believe that 700 plants have to be built without any financial assistance. Faced with such a large number we soon realized that we would first need an appropriate marketing strategy if we wanted even to begin to satisfy the demand for this potential market. So we would need many trained artisans familiar enough with construction methods to build a **biogas** unit with just a small subsidy. To negotiate with the customers and advise them we would also need technicians who knew everything about **biogas** technology, and who would assure the required construction quality. Last but not least we would need private contractors who would come in on this technology in order to earn money with it.

The second important point is that standardized units should be used rather than the custom-built models, which are admittedly optimized, but expensive and time-consuming.

However, before we could decide on standard sizes it was necessary to calculate mean values from the economic, ecological, logistical, agronomic, and sociocultural determining parameters. We finally opted for the low-priced dome-type unit in standard sizes of 8 m^3, 12 m^3, and 16 m^3.

What does the term "standardization" cover?

In Tanzania, transport and the procurement of materials are particularly expensive and time-consuming. To obtain a ½" elbow you may spend a whole day chasing around town and then pay about 20 DM. Cement is only available sporadically. So by the time we had built a few units it was clear to us that not only the size of the unit would have to be standardized.

We needed a strategy to get away from every kind of individual consideration, individual supply, and individual building - from the sale of a unit to the connection of the appliances.

On the technical side, this means that today, we only make the pipe system from ¾" pipes and accessories, and according to a precisely defined plan. Piping with the same bore is used for burners and lamps. All stopcocks for burners, lamps, and the unit are identical. In future the burners and lamps are to be made of materials that are readily available locally, e. g., for a lamp: a plate, a pot, a gas supply line of ¾" pipe, som wire, and the glass from a Petromax lamp, which is also available in Tanzania.

An example of standardization on the administrative side: we have worked out a graph from which the technician can read off the appropriate standard size immediately when the relationship of livestock owned to the size of the family and the way the gas is used is known. The materials ret quired can then be calculated immediately from a table. In this way all the building materials can be provided before building work is started.

Finally there is a special form the enables a quite accurate quotation to be prepared for the customer, taking into account any work he may do him self.

How it works in practice

1st step:

Either Chris, or I myself, or a counterpart go to a customer. There are already waiting lists; the basic details (size of the family, number of animals owned) are known. Agreement is reached with the customer on the location of the unit. In the folder we take with us we have the papers mentioned above, from which we can determine the standard size, materials required and the total cost of the unit.

Before building is started the customer makes a down-payment of 40% and before the unit is put into use a further 50%. The remaining 10% is paid when it has been established that the unit works properly.

2nd step:

The technician then tells the artisan which location has been chosen and where everything is. For his part, the artisan has a folder containing the standard drawings and when ail the building materials have been delivered he carries out all the work himself, from tying the plumbline to connecting the lamp and burner.

Ideally, the technician's only job is acceptance testing, i. e., checking the gas-tightness of the pipe system and the unit itself.

Advantages and prospects for the future with standardization

One only becomes aware of the huge advantages of standardization when one plans the practical work in complete conformity with it.

This can be shown by another example. Two of our units cracked immediately after being filled. But

since all the units are similar thanks to standardization, the fault parameters can be analyzed relatively easily using a special matrix. If different degrees of importance are assigned to the individual parameters it is relatively easy to identify the possible causes. This is illustrated in much simplified terms in the following:

We built units of the various standard sizes in both the dry and the rainy season, and filled them immediately after completion. However, only units built in the rainy season cracked. We discovered that the two parameters 'rain' and 'initial filling' play an important role. After a thorough analysis of the cracks we came to the following conclusions: firstly, the initial filling technique would have to be changed, and secondly the design of the units was modified to prevent cracks from extending into the gaslight part.

This is just one example among many. What I want to point out with it is this: if you have standardized units you can develop technically perfected models, that is, you can

• adapt the unit exactly to requirements, from the stable to the gas consumers;

• specify tolerances to the artisan, because you know the units down to the last detail;

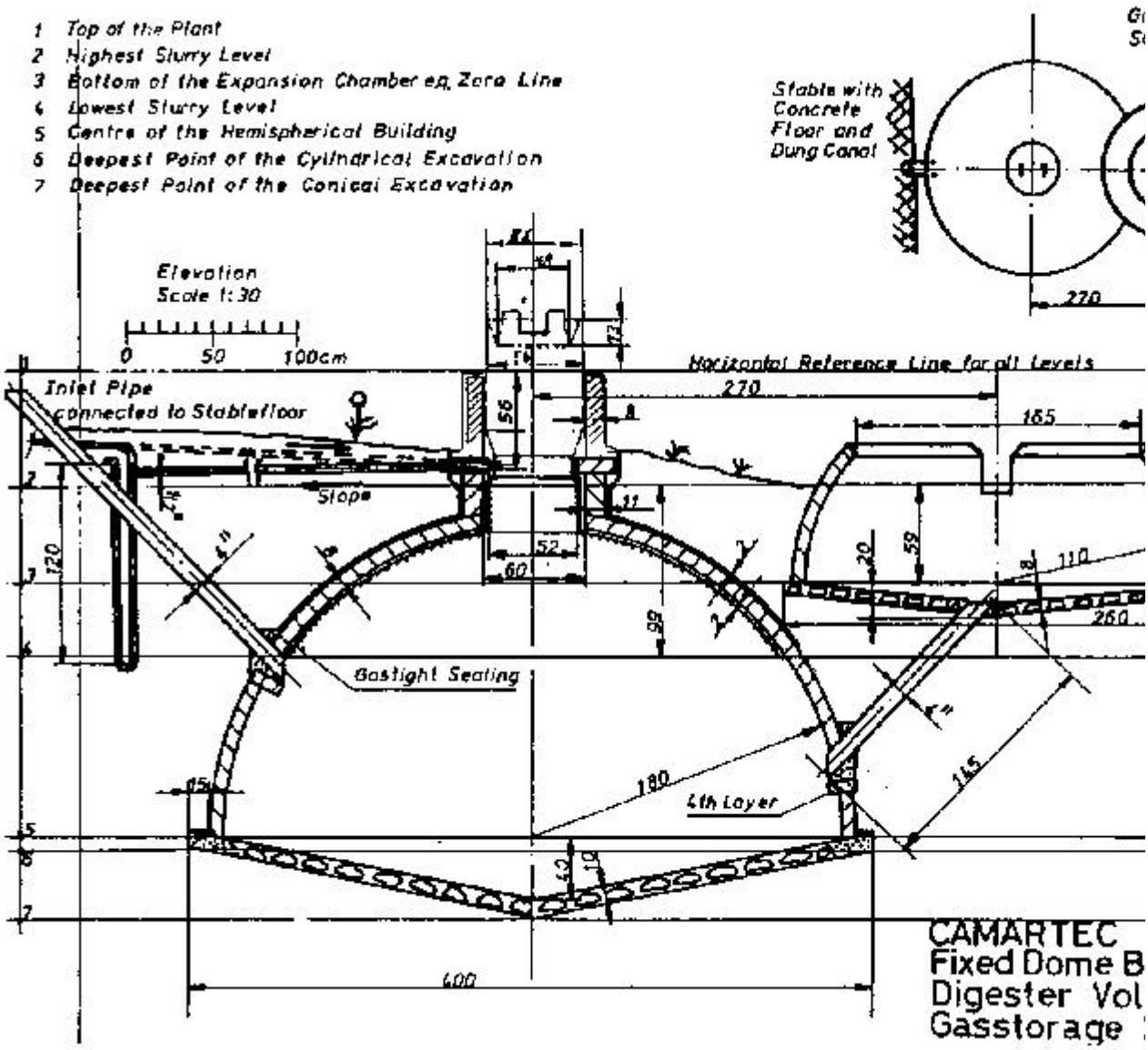
• develop standardized test methods and incorporate corresponding test points in the system;

• make fault-finding checklists (like the ones used for checking cars).

It is only by virtue of standardization that our dissemination strategy- via village artisans and private contractors - can become effective at all. Because the artisans do not have to be so highly qualified and can therefore be trained in a relatively short time. They can act as teachers in training programmes and teach the building method to other artisans. They can carry out servicing and repair work alone and, thanks to standardization, manage with a miminum of spare parts and tools.

And with perfected standards the technology also becomes profitable for private contractors, because calculations and design work are eliminated, supervision and administration are minimized, the transport costs - in fact all costs - can be calculated, and when serving several customers in one region they can be considerably reduced.

Our next article, which deals exclusively with the diffusion of family-sized **biogas** units, describes possible methods of selling standardized units of this kind.



Figure

Abstract

The basic aim of standardizing **biogas** units, which is now normal practice in Tanzania, is to save time and money. However, it a/so involves the training of suitable artisans, the setting-up of a service system, minimization of administrative procedures, and an attempt to interest contractors in building **biogas** units. To this extent, standardization means more than simply providing units of a certain size. And only with standardization is marketing possible on a large scale.

Résumé

Le but de la standardisation des installations au biogaz, telles qu'elles le vent entretemps couramment en Tanzanie, est une économic de temps et d'argent. Ceci dépendant évidemment aussi de la formation d'ouvriers qualifies; de la mise en place d'un selvice d'entretien, de la minimisation des démarches administratives ainsi que de la tentative d'intéresser les entreprises pour la construction d'installations au biogaz.

Dans cette mesure, la standardisation est plus que la simple mise a disposition d'installations de taille donnée. Par ailleurs, seule la standardisation permet un marketing a grande échelle.

Extracto

El objetivo perseguido con la standarización de las plantas de **biogas**, como las instaladas entretanto en gran numero en Tanzania, es, por una parte, el ahorro de tiempo y costes. Pero también esta relacionada con la formación y capacitación de personal adecuado, la organización de una red de servicios, la reducción a un mínimo imprescindible de los procesos y medidas administrativas, asi como despertar el interés de los empresarios en la construcción de estas plantas de **biogas**. En este sentido la standarización es algo mas que la puesta a disposición de plantas de un determinado tamano. Y edemas, la standarización es lo que permite un marketing a gran escala.

The diffusion of familly-size unit biogas plants

by Christopher Kellner

In 1974, a first attempt was made in Tanzania to make **biogas** plants attractive to farmers. This first attempt failed because local conditions were not taken into account, because the plants were faulty in operation and because, last but not least, the technical knowledge required to operate such plants did not exist. Then last year CAMARTEC (Centre for Agricultural Mechanization and Rural Technology) took up the matter once more and is now trying to learn from the mistakes of the past.

For, to aid the breakthrough of **biogas** technology on a wide front, the corresponding basic prerequisites have first to be fulfilled. High density of population, the possibility of indoor stock-keeping all year round (zero-grazing is the key word here), intensive arable farming resulting in the need for manure containing nitrogen and, last but not least, the ability to handle the building materials concrete and brick.

The Tanzanian solution

But to be really successful meant more than just copying what had succeeded in other countries. What was required was a Tanzanian **biogas** plant that would satisfy the requirements of its future users. And this individual Tanzanian solution is the standardized **biogas** plant.

CAMARTEC developed three standardized fixed dome **biogas** plants dimensioned for 8, 12 and 16 cubic metres. The following table shows the material required and the costs involved. Costs which are bound to vary from farmer to farmer are the building costs for the necessary stable as, to keep work to a minimum, the **biogas** plant and the stable are directly linked to one another. It should also be said that the stable must have a concrete floor, for only this will guarantee that the entire faeces-urine mixture will reach the **biogas** plant unadulterated by foreign bodies.

Method of diffusion

In order to interest as many farmers as possible in the construction of a **biogas** plant, and in order to simultaneously train local artisans in the construction of such plants, a course of action that may, at first sight, seem somewhat complicated was chosen. So let me begin by describing it. First of all a survey is conducted to estimate the potential of farms suited to operate a BGP. With the help of a questionnaire the energy situation, the farming system, the availability of digestable material, the availability of water and the financial situation need to be established.

Then, if the results of the investigation show that a demand for BGPs can be expected, the technology will be introduced to the village administration and interested farmers. This will be done either by setting up a small transportable unit which supplies a small amount of gas or by a site visit to an operating BGP.

The third step is then the selection of a suitable site where the first unit of the particular village is installed. The construction is done by two artisans from the village and supervised by CAMARTEC **Biogas** Extension Service who will be conducting job training. Experience has shown that demand follows initial construction.

The farmer who has the required building material already at the premises will get the next plant built by the same artisans. The supervision input can be reduced after each plant. The village artisans are the main suppliers to satisfy the demand. To ease and accelerate for the individual farmer the process of purchasing the requested building material, CAMARTEC is establishing a material supply store.

It also supplies lamps and burners. A step in the future will be also to produce these in the country. The other task of CAMARTEC, within this strategy, is to advise on individual **biogas** problems e. 9. planning, construction, feeding, gas production, gas consumption, use of sludge, and maintenance.

The region of Tanzania in which we gathered our experience has already been described by my colleague Mr. Schlusser in his contribution, and our first findings show that ten percent of the farmers in the Coffee-Banana Belt are seriously interested in a **biogas** plant as well as having the necessary finance at their disposal.

Table: List of Requirements for the Three CAMARTEC Fixed Dome Standard Biogas Plants (BGP).

Item	**Unit small family BGP**	**Standard Digesters medium family BGP**					
			big family BGP				
	8 m³	12 m³	16 m³				
	amount	costs	amount	costs	amount	costs	
	required	required	required				
Bricks 8×11×22	pieces	750	2250	1150	3450	1400	4200
Cement	50 kg bags	10	2000	14	2800	17	3400
Lime	25 kg bags	4	600	6	900	7	1050
Sand stones	kg	2500	1200	4000	1600	5000	2000
Plastic pipe >4"	6 m	1	500	1	500	1	500
Hole to be dug	cbm	20	400	26	520	33	660
Mason	Lump sum	1	1800	1	2500	1	3000
Helper	Lump sum	1	1400	1	1600	1	2000

Other material	400	500	600
Total	10550 TSH	14370 TSH	17410 TSH

1 All prices relate to 2/85

2 The price for sand can differ extremely

3 Other material e.g. kerosene and wax for gaslight sealing, clay for lid sealing, reinforced gas-outlet pipe, handles for lid.

Costs and benefits

Befor I describe why farmers request BGP, I will compare the costs with the benefits. There are many ways to calculate this. The crucial points arise when the benefits are mainly an increase in the quality of life. The traditional cooking fuel (wood) is unlikely to be commercialized yet and the supply of kerosene for lighting is very unreliable to obtain. But calculating the money saved on energy, the investment costs are comparatively high.

However, converting the produced and used amount of gas into commercial energies which finally represent the families' newly achieved standard of living, we come to a break-evenpoint of 3-4 years, including running costs and common interest.

However, the usual customer does not calculate this in advance. I did the same when I decided to buy a refrigerator - I did not consider whether it would save me money; I knew it would cost me money to run - but nevertheless I bought one. It has made my life easier and that makes it important enough to have it. The farmers and especially the farmers' wives who are demanding BGPs, react in a similar way, and arguments that were used for the decision were many.

- The increasing difficulty of getting firewood and kerosene,

- Quick and reliable preparation of small things like tea etc.

- Light in the evening.

We found that the farmers who are interested in obtaining BGPs are innovative and business oriented. This was our experience with the first four farmers who started to convert surplus energy in marketable food products e. 9. they brewed local beer, baked bread or pancakes or roasted their own coffee in order to sell it. It is apparent that the most feasible target group for BGPs are farmers who have more gas than they require, so that the surplus energy can be used for some business activity. The graph on this page shows what preconditions must exist to expect an excessive supply of gas with the various types of standardized plants CAMARTEC recommends.

The fertilizer

The overflowing sludge from the BGP is a very good fertilizer. It is not mentioned among the benefits of the **biogas** technology as it is a problematical material and its advantages are hardly utilized. These advantages can be described as follows.

- In no other stable system but zero-grazing on concrete floors are all the nutrients delivered by the animals collected.

- The overflowing sludge from the digester contains the same amount of nitrogen as the original manure, whereas the common way of storing manure before it is applied to the fields causes big losses of nitrogen.

- Digested manure can be applied to growing plants without any danger of chemical damage. The fertilizer is easily assimilated.

- The fertilizer does not smell and does not attract flies at all.

Nevertheless only the minority of BGP owners utilize this fertilizer in such a way that the advantages are brought to bear. It seems that the disadvantages are major:

- The liquid form of the material makes transportation on wheelbarrows or in buckets difficult.

- The material runs downhill and easily pollutes surface water.

- The fertilizer has its best effects if it is applied to the plant roots, under wet and cloudy conditions, in the stage of intensive plant growth. These preconditions occure on the farm only occasionally, while sludge is produced continuously.

A **biogas** extension programme has to incorporate the discovery of recommendations for practicable fertilizer application methods.

Steps in the future

A **biogas** extension programme which aims in spreading the technology requires a long term strategy. CAMARTEC has started in the Arumeru District and will extend its development activities to other suitable areas. For a success of the programme, the following aspects need further stress. Involvement of private entrepreneurs in plant and accessories construction. Surveys to estimate the potential number of farms suitable for **biogas** plant operation.

• Development of teaching aids for the further training of artisans and technicians.

• Regular training of artisans and technicians.

• Establishment of a maintenance team.

• Expert advice on all fields involved in the technology with the help of appropriate booklets and well equipped advisers.

• Continuous reassessment and improvement of standardized plants.

• Development of prefabricated building materials.

• Development of methods and instruments for the appropriate use of fertilizer.

Abstract

In the Arumeru District in Tanzania the procedure used for dissemination of **biogas** units is that requirements are first determined with a questionnaire. At the same time potential users are familiarized with the technology. They are not left to their own devices when it comes to building the units, either: they are advised by the CAMARTEC **biogas** specialists. Local artisans are also trained in the building of **biogas** units. All these things, plus the use of standardized units, are intended to

help make ? success of the programme. The use of digested sludge as a fertilizer is one thing that has not yet been satisfactorily dealt with in all cases. In future, efforts should be concentrated on the advisory side and on developing accessories.

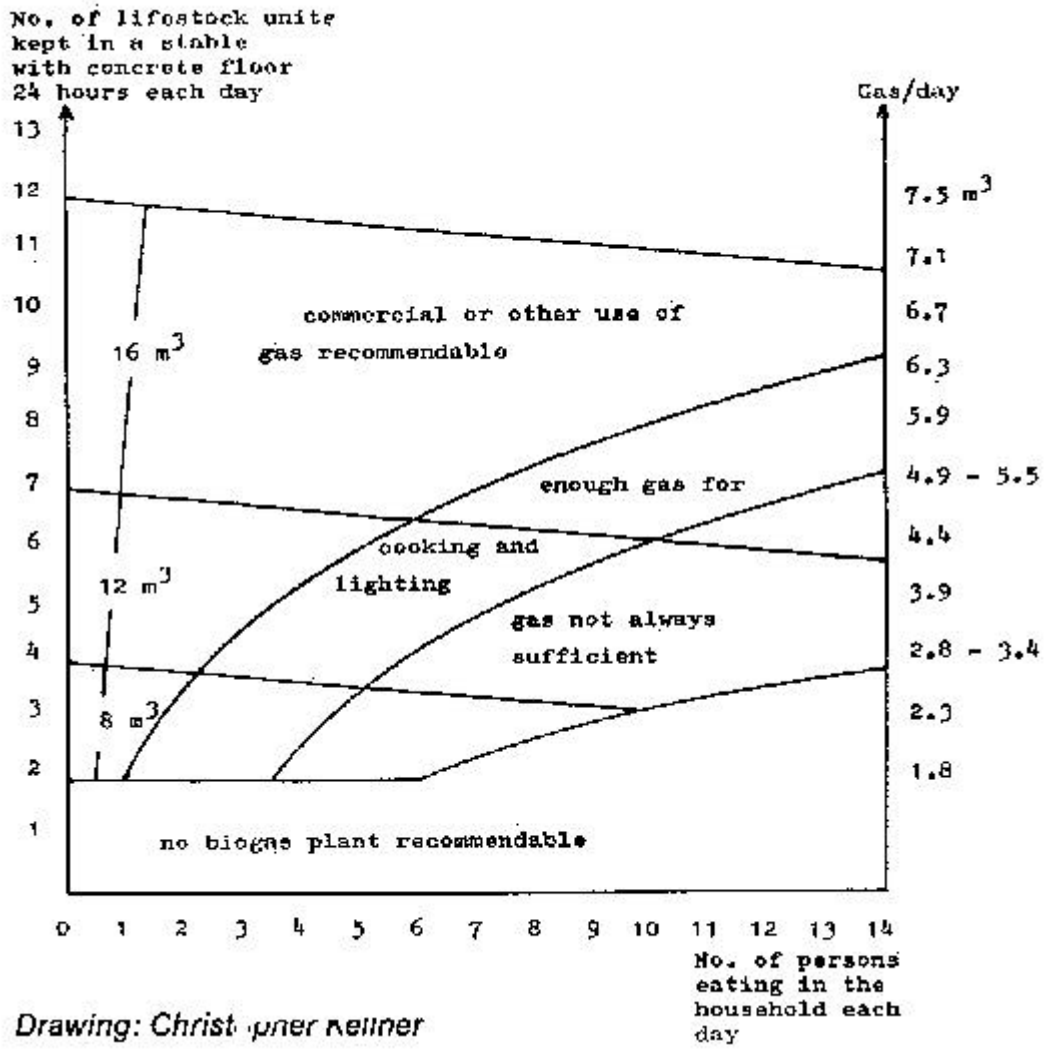
Résumé

Dans le district tanzanien d'Arumeru, on procède a l'extension des installations au biogaz en établissant tout d'abord les besoins grâce a un questionnaire et en familiarisant simultanément les gens avec cette technologie. De même, ils ne vent pas livres a eux-memes lors de la construction, mais conseilles par les experts de CAMARTEC. Des ouvriers vent également formes sur place pour la construction d'installations au biogaz. Tous ces éléments doivent, outre ['utilisation d'installations standardisées, permettre d'aboutir a un succès du programme. L'utilisation du limon organique en tant qu'engrais n'a pas encore été résolue de facon satisfaisante dans tous les cas. A l'avenir, il faudra prêter une attention particulière a l'apports de conseils et a la mise au point d'accessoires.

Extracto

En el Distrito de Arumeru, en Tanzania, antes de instalar una planta de **biogas** se analizan primero las necesidades locales de una planta de estas características con ayuda de un cuestionario de preguntas, y al mismo tiempo se procure familiarizar a los futuros usuarios con esta tecnología. Luego, en la fase de construcción, tampoco se les deja solos, sino que se les asesora a través de los expertos de CAMARTEC. Asimismo los artesanos y pequenos industriales locales son instruidos en el manejo y construcción de las plantas de **biogas**. Todas estas medidas, junto con la standarización de las instalaciones, contribuirán al éxito del proyecto.

Todavía no se ha resuelto satisfactoriamente e/ empleo del cieno de pudrición como fertilizante. En el futuro deberá prestarse especial atención al asesoramiento y la creación de accesorios.



Means for first estimate to attach the appropriate standard unit to the given preconditions. All figures are related to the described unit and the cooking habits of the people in Arumeru District of Tanzania.

Biogas technology and site-oriented agriculture

by Ulrich Hoesle

The aims of site-oriented agriculture under "low external output" conditions are to achieve high and sustained productivity while at the same time conserving or restoring balanced ecosystems, with active participation of the target groups.

From the many different measures that can be taken in the sphere of production technique, the following examples may be mentioned, directly or indirectly related to **biogas** technology: erosion prevention and watershed management; linking of animal husbandry and arable farming; compost and mulching; biological nitrogen fixation (cultivation of leguminous plants); and the use of locally available means of production.

The focal point of interest is the process within the target groups, which must develop from an improvement in decision-making to a sustained improvement of the group's social and economic status when an innovation (such as **biogas** technology) is offered.

This process is decisively influenced by ecology (soil, plants, animals, environment), the economy (market, land, finance, work), and the social sphere (health, education, religion, family, tradition,

state); these are linked to one another by a variety of widely-differing flows of materials (foodstuffs etc.), energy, or money.

When the innovation offered is **biogas** technology, the factors of the system affected by it have to be identified and evaluated, by way of a partial analysis. With regard to production, and also ecological and economic considerations, both gas utilization and sludge utilization must be carefully analyzed to determine whether they might compete with and/ or complement each other.

Because this depends to a very large extent on the specific situation, ranging from the fodder the animals are given to the transport of the material, it is difficult to assess the effects of the sludge; it can only be done at the location in question, by appropriate tests and analyses.

On the basis of examples it can be proved that the fertilizing effect of digested sludge can certainly be inferior to untreated material and that the nitrogen losses during storage may be much higher (Wenzlaff, 1982).

Since the feaces only contain about half of the total quantity of nitrogen, the animal's feaces and urine should be putrefied together if possible.

Although a **biogas** unit can also beregarded as a kind of fertilizer storage facility, subsequent storage of the sludge is often essential. It should therefore be investigated what techniques can be used to prevent further nitrogen losses during storage. One possibility would be a combination of compost and sludge storage. Since most of the nitrogen in the sludge is in dissolved form, drying should be avoided and attention concentrated on possibilities of extracting liquids. This often presents smaller farms, in particular, with unsolvable problems. In addition, a liquid fertilizer with quickly available nutrients should not be turned into the soil before sowing; the seedlings should already have roots if possible.

With regard to the problem of losses during storage, and bearing in mind the combination of measures in site-oriented agriculture mentioned above, it should also be pointed out that the cultivation of leguminous plants offers ways of fixing the nitrogen biologically.

Digested sludge is a nitrogen fertilizer with side-effects. On erosion-prone surfaces these side-effects, such as the improvement of soil structure, for example by increasing the humus content or encouraging soil life, can quickly become more important than the direct fertilizing effects. These long-term effects should not be ignored, either in studies relating to the utilization of sludge, nor in economic appraisals of the **biogas** unit as a whole. The use of digested sludge with its long-term effects, together with the saving in firewood, the reduction in over-grazing by stabling and cultivation of fodder, can make **biogas** units a valuable element in a site-oriented agricultural system.

Abstract

If **biogas** technology is used in site-oriented agriculture it should be borne in mind that it is particularly difficult to assess the effect of the sludge. Above all, the sludge should be removed while it is still liquid to obtain the full fertilizing effect of the nitrogen. Leguminous plants are especially suitable for fixing the quickly available nitrogen. However, the side-effects that can occur when digested sludge is used should always be taken into account.

Résumé

La mise en oeuvre de la technologie du biogaz dans le cadre d'une agriculture adaptée au site implique qu'il faudra tenir compte du fait que les effets du limon organique vent particulièrement difficiles a évaluer. Le limon organique doit surtout être en/eve dans sa phase liquide afin d'obtenir un engraissement maximal par l'azote. Les légumineux vent particulièrement appropries pour obtenir

une fixation de l'azote rapidement disponible. Ce faisant, il faut toujours tenir compte des effets secondaires résultant éventuellement de l'utilisation de limon organique.

Extracto

Si la aplicación prática de la tecnología del **biogas** se realiza en el marco de una explotación agrícola en una ubicación apropiada, deberá tenerse en cuenta, sobre todo, que es difícil analizarlos efectos del cieno de pudrición. Sobre todo deberia esparcirse en su fase liquida, a fin de aprovechar todo el valor fertilizante del nitrógeno. Para la fijación del nitrógeno rápidamente disponible son muy apropiadas las leguminosas. En estas aplicaciones hay que tener siempre en cuenta los efectos secundarios que puede tener el empleo del cieno de pudrición.

Complements and Alternatives to the Biogas Unit

Gas	Sludge
wood from environment (forest)	fallow land mixed cultivation
- planted forest	mulch
- planting of wood	green manure
- living fence	fresh manure
- green manure	compost
petroleum or grass from the market	mineral fertilizer

Fermentation of poultry excrement/rice chaff mixtures

A Report from Nicaragua

by Sofia Bonilla Garcia, Rolf Georg, Reimund Hoffmann and Günter Ullrich

Apart from the village 'Criollo' chickens, that run free in and around houses, poultry keeping is the most widespread form of intensive farming in Nicaragua. It is practiced in the following way: the empty coop is strewn with a 5-10 cm layer of rice husks, and then, according to the size of the coop, occupied by between 500 and 200 young hens of the same age. On average, laying hens remain in the coop for about 13 months, which is not cleaned during this period. In this way, a mixture of poultry excrement and rice chaff results. When laying capacity diminishes, the hens are sold to be slaughtered, more or less all at the same time. The stall is completely cleaned and disinfected. Up to the present, the resulting litter has, as a rule, been thrown away unused.

The authors were confronted with this situation in two schools with adjoining farms, which had asked for support in the construction of **biogas** units. After consultation with both headmasters it was decided to ferment the poultry excrement/rice chaff mixture. Because of the above-mentioned type and amount of biomass, it was decided to build two batch or respectively semi-batch units with a volume of 15 m^3 each.

The initial filling contained 16% dry matter: both digestors produced between 10 and 19 m^3 of good quality **biogas** (with a CO2 content of less than 30%) daily.

By contrast, the short decomposition period of between 45 and 60 days was unsatisfactory, especially as manual emptying with a bucket (1,500 buckets per digestor!) is very time-consuming.

An attempt was therefore made to prolong the decomposition period by increasing the proportion of dry matter to 33%. This attempt failed: gas production did not take place, and the unit evidently remained in an acid phase. It had to be emptied completely and refilled (proportion of dry matter: 13%).

Nevertheless, experiments were carried out in barrel units with varying proportions of dry matter: 8%, 10%, 12%,14%, 20%, 35%. Some results of these experiments are described here in brief:

With a dry matter content of 10% the unit produced 0.18 m^3 of **biogas** per kg of poultry excrement over a period of 24 days. At first, this gas contained 64% methane, increasing to 72% in the third week.

The quality of **biogas** is a direct function of the pH. With a pH in the acid region between 5 and 6, it is well possible that gas production will be very high but that gas quality, on the other hand, will be extremely poor with a methane content of only 20%. With improvement in pH, which came about automatically, gas quality also improved.

At present, one **biogas** unit is continuously being refilled with the poultry excrement/rice chaff mixture, thus slightly increasing the proportion of dry matter. The unit is functioning satisfactorily.

In conclusion, one can say that fermentation of these large amounts of biomass is feasible. Our experience has, however, shown that this is an extremely "sensitive" material and that the operator must always be in a position to interface in the process without too much trouble. On the other hand, this easily available and manageable organic material should not be ignored for fermentation in continuously operating **biogas** units.

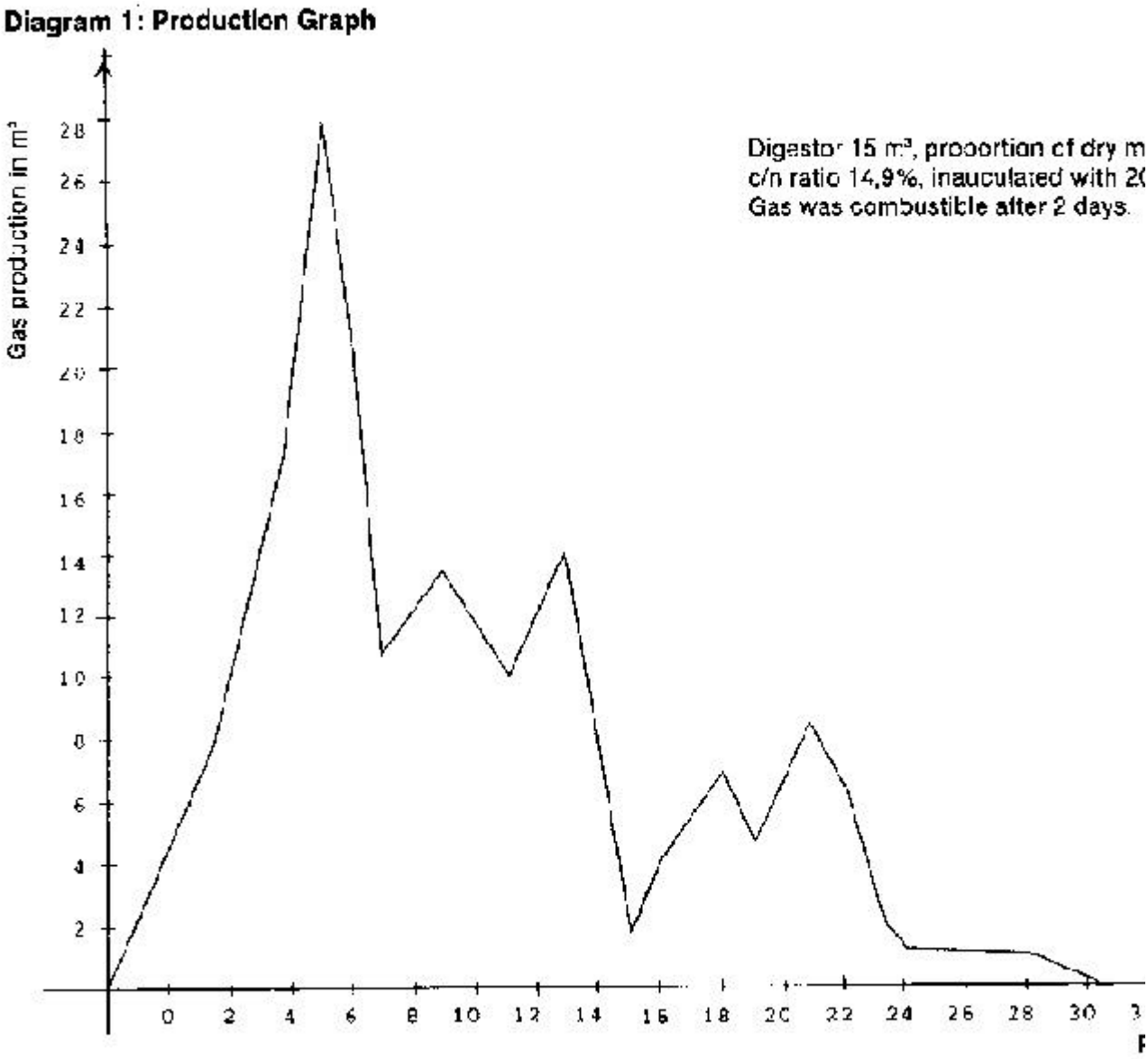


Diagram 1: Production Graph
Gas production in m³
Digestor 15 m³, proportion of dry m
c/n ratio 14,9%, inauculated with 2(
Gas was combustible after 2 days.
28
26
24
22
20
18
16
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12
10
8
6
4
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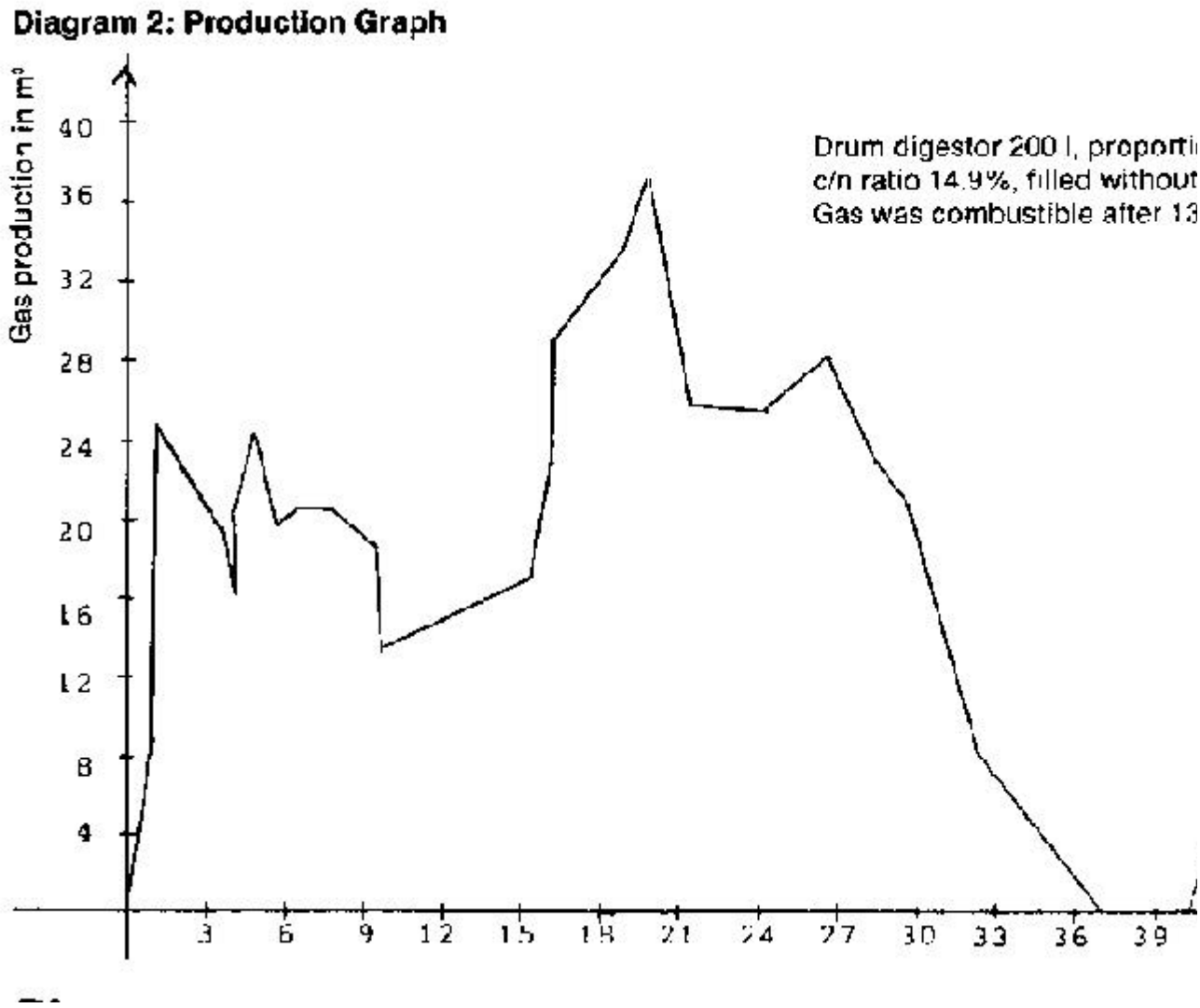
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

Figure



Figure

Biogas storage tanks of plastic sheet

by Gerhard Kopiske and Heinz Eggersglüss

At the "**Biogas** Workshop on Community Plants" in Bremen in May 1984 it became evident that in India in particular, transport and distribution of **biogas** present a problem. A need for portable gas storage tanks was thus identified and a search for new solutions was called for.

The company UTEC GmbH was commissioned by GTZ to collate the technical principles, experience in practice, and results from laboratory investigations into the use of sheet materials; also, to have prototype portable gas storage tanks with a capacity of 1.4 m³ each made, and to have them field-tested in cooperation with the Center of Science for Villages in Wardha. India. These gas bags are so designed that a day's supply of gas can be transported as if in a rucksack. The photo gives an impression of the size and appearance of these gas bags. No results of the field tests are available as yet.

Plastics as a gas storage material

Of the many possible plastics only those are considered which are thus far commonly used for producing sheets and coated fabrics. These are the thermoplastics polyvinyl chloride

(PVC), polyethylene (PER), chlorinated polyethylene (CPE) and the elastomers butyl (IIR), chlorosulphonated polyethylene (CSM), chloroprene rubber (CR) and ethylene-propylene-terpolymer (EPDM).

There is no standard governing the recipes for these plastics. The degree of freedom in the composition and production is so great that the different materials can only be described in general terms.

Long-term behaviour

One major criterion when selecting suitable sheet plastics is their long-term behaviour. The principal influences affecting the materials are atmospheric influences and the actions of chemicals, animals, and micro-organisms.

Of these influences, ultraviolet radiation and ozone loading have the greatest effect. The plastics undergo a chemical change and may become unusable, e. 9., as a result of a slow reduction in their ultimate tensile strength or sudden failure.

The resistance of thermoplastics to temperature is 65-70 °C, that of elastomers 90-120 °C.

In general it may be said that elastomers have better aging and temperature-resistance properties than thermoplastics.

In the application under consideration here, effects of chemicals only occur to a limited extent; resistance to methane, water, and to a limited extent also to hydrogen sulphide and organic acids. These criteria are satisfied by all materials; however, when PVC is used, **biogas**-resistant material should be chosen. This resistance is achieved by using special plasticizers which are not named here for reasons of commercial competition. If standard plasticizers are used the plastic is likely to become brittle after a certain time as a result of plasticizer migration.

Sheet material can be damaged by the actions of animals and micro-organisms. Rodents, in particular, may attack the material and make holes in the rolls. The susceptibility of the materials depends to a great extent on their physical properties, their outer form, the thickness of the material, and the chemical composition. Edges or tabs encourage gnawing, and the same effect results, for example, from the use of certain ingredients in PVC to which rodents seem almost addicted. One of these is red mud plastic (RMP), which has earned the nickname "rat mud plastic" because of its popularity with rodents. RMP is a PVC which has a bauxite extract and old oil as fillers and stabilizers.

If a mechanical stress is added to the above-mentioned effects the long-term durability is considerably reduced. For this reason, when, e.g., sheets are used, the limit load applied to them must be less than 10 per cent of their ultimate tensile stress.

Processing of plastics

Sheeting materials have to be treated very differently in processing than when being repaired. Among the possible methods are bonding, welding, and vulcanizing. The possible applications of these methods for producing and repairing gas bags are shown in the table on page

Risk to health and the environment

Plastics may constitute a danger during production, processing, and disposal, e.g., burning, due to the liberation of constituents.

While the plastic product causes no risk in normal use, a certain risk potential does exist in

production, processing and disposal. Individual constituents, some of which may be liberated by decomposition, are toxic, cancerogenous, or represent a nuisance.

In processing, for example, these include the solvents of the bonding agents; in welding, evaporating ingredients of the plasticizer and vinyls. In disposal, cadmium, lead, and sulphur in the plastics may give rise to problems.

Gas permeability

In all of the materials studied, the gas permeability of the sheeting and coated fabrics is satisfactory, provided the following points are observed when selecting and processing them:

• the coating of coated fabrics must be thick (more than 0.8 mm on PVC); the coating thickness of cheap truck tilts is not sufficient;

• the coating must be protected from damage, because the fabric is very permeable to gases;

• in making the gas bags care must be taken to ensure that no open layers of fabric extend into the gasholding space on one side;

• with sheeting and coated fabrics the joining method used must not weaken or damage the material cross-section.

Since there is a very great increase in gas permeability as the temperature rises, it is advisable to keep the bags in the shade. The daily gas losses calculated for the above-mentioned gas bags are around 0.5-3 per cent of the bag's capacity. For this reason, gas storage bags made of sheeting must always be stored in a well-ventilated place.

Assessment

The various sheeting materials were assessed on the basis of a list of criteria. A subjective appraisal of their behaviour was required in many cases, since the stresses to which they would be subjected in practice could only be simulated.

It was found that with regard to the raw materials, elastomers were superior to the thermoplastics. In particular, the aging and temperature-resistance properties are better. If weight is an important criteria rubberized fabrics (CR, CSM) are preferable to pure sheets; the material strength is also considerably higher when artificial-fiber fabrics are used.

IIR and EPDM sheets are very labour-intensive and expensive to make up into bags. This is also true in respect of vulcanizing of coated fabrics, though in the latter case bonding with two-component cement is also possible.

In view of their lower resistance to aging and temperature, the thermoplastics are regarded as less satisfactory. PVC-coated fabric is the best among them. It can be processed easily and in many different ways and it is relatively cheap. The probable thermal load can be reduced by opting for a light colour and incorporating a shading device in the design. **Biogas**-resistant PVC is available in the FRG, though in other countries recourse will probably have to be made to the standard-quality product.

Because of its poor mechanical properties, PE was found to be unsuitable for the application under study. Bags made of PE tend to require very frequent repair. And this is complicated because simple bonding is not possible.

As a raw mateial CPE exhibits good resistance, but joints which can be subjected to loads cannot be made with it because of its tendency to yield. Gas bags of CPE can only be used completely unpressurized.

Summary

Of the many possible plastics for sheeting and coating fabrics, rubberized fabrics are most suitable for making portable gas bags. Pure rubber sheeting, on the other hand, is considerably heavier and also more laborious to process.

PVC-coated fabric was found to be suitable to a certain extent. Its resistance to aging and **biogas** depends to a great extent on the recipe. PVC can be processed very simply in many different ways.

However, locally, i.e., in the country in question, the criteria are different from those applicable in Europe. Questions of availability, local production, and repair methods are of paramount importance, while the theoretical suitability of a material becomes less significant because there is no choice.

The use of plastic sheeting for making portable gas storage tanks is certainly a suitable and interesting solution to the problem. The technical possibilities are known; the question of social considerations remains unresolved. The field test, which is still in progress, will provide some answers to this, too.

UTEC GmbH will be glad to answer your questions on this topic. In order to complete our documentation we would ask you to send us details of the experience you have gathered, literature, samples of materials, etc. This will be collected and kept in readiness for answering queries.

Address:

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Abstract

The use of plastic foil in the production of transportable gasholders is a very interesting and suitable solution. Field tests with these gas sacks have not yet been concluded, however, so that final results have yet to be published. At this stage, so much can be said: the material must not be too sensitive to ozone and ultraviolet radiation, and must be proof against micro-organisms and rodents. Up to the present, an tested materials have proved to be sufficiently safeguarded against gas permeability. As regards materials, elastomers are to be preferred to thermoplastics.

Résumé

L'utilisation de feuilles synthétiques pour la réalisation de réservoirs a gaz mobiles apparait comme étant une solution intéressante et appropriée. Les séries de tests réalisés sur place avec de tels ballons a gaz ne vent certes pas encore terminées, de sorte que l'on ne dispose pas encore de résultats définitifs. Cependant, on peut déjà dire que les matériaux ne doivent pas être trop sensible a l'ozone et aux rayons ultra-violets et doivent pouvoir résister a l'attaque des micro-organismes et des rongeurs. Il s'est avéré jusqu'a présent que la perméabilité au gaz de tous les matériaux testes est suffisamment assurée. Pour ce qui est des matériaux eux-memes, les élastomères vent supérieurs aux thermoplastes.

Extracto

El empleo de hojas de plástico pare la construcción de depósitos de gas transportables es, desde luego, una solución interesante y apropiada. Las pruebas practicas con estos ,,sacos de gas" no han concluido aun y no se dispone, por lo tanto, todavia de resultados definitivos. No obstante ya se sabe que el material no debe ser demasiado sensible al ozón y a los rayos ultravioletas y debe ser resistente a los microorganismos y los roedores. Hasta el momento ha quedado demostrado que todos los materiales comprobados ofrecen suficientes garantias en cuanto a la permeabilidad a los gases y que los elastómeros y termoplásticos son los materiales mas apropiados.

UK Farmers Support Practical Aid

Famers throughout England and Wales are rallying behind a new scheme that will bring practical agricultural help and know-how to their counterparts in the Third World.

The campaign is being organized by Britain's biggest agricultural organization : the NFU-(National Farmers' Union), in conjunction with Voluntary Services Overseas (VSO), the UK charity which sends people with specific skills to work in the developing world.

Each county in England and Wales has its own localised branch of the NFU, and 14 of these county branches have pledged to support VSO candidates working on two-year agricultural projects in such countries as Kenya, Nepal, Nigeria, Papua New Guinea, Tanzania, Thailand, Tuvalu and Uganda.

These VSO volunteers, all of whom win be working for subsistence wages only, will work in individual communities in local schools and institutes or on projects-funded by aid agencies, with the aim of training colleagues in basic agricultural skills relevant to conditions in the area.

Among the specific areas of agriculture of which they have specialist knowledge are food crop production, seed multiplication, forestry, fisheries, livestock production, ox traction, irrigation and soil conservation, and farm management. (LPS)

Economic and socio-economic evaluation of biogas units from the users' point of view

by Ulrich Stöhr and Uli Werner

The majority of **biogas** units in developing countries are integrated in small and medium-sized agricultural enterprises. The following is intended to help advise farmers with small and medium-sized farms looking for an analysis of the cost/benefit effects of a **biogas** unit appropriate for their farming situation. For this purpose a useful life of 10-15 years for a **biogas** unit is generally assumed.

The analysis which follows, which is intended for unit operators, does not take overall economic effects of **biogas** units into consideration, such as effects on regional development, promotion and diversification of local craft trades, the net effect on employment, the conservation of natural resources, especially by reducing deafforestation and/or sewage, and savings in foreign currency expenditure on imported energy and mineral fertilizer. Seen realistically these secondary effects are only relevant when there is global dissemination, and in most countries this will not be achieved in the forseeable future.

Problems of determining benefit and evaluation at the user-oriented level

It is usually easy to put a figure on the cost of building and operating a **biogas** unit. The capital investment and the costs of spares are mainly money expenses. Operation and maintenance are

primarily a question of working time.

Determining the benefits of a **biogas** unit is more difficult. Apart from clearly quantifiable effects, some of which can also be expressed in terms of money, there are a number of non-quantifiable factors. Economic appraisals based on cash flow only cover some of the factors which are important for unit operators in reaching a decision regarding the investment.

Because on the one hand it is also important to take the effects in the socio-economic and consumer sector into account when evaluating the benefits of **biogas** units, such as smoke-free cooking, increased prestige, or being able to read in the evenings. On the other, the problems of carrying out an economic appraisal on the basis of the flow of payments are all the greater, the less the small farm is integrated in the monetary economy and commercial energy markets.

Therefore, an appraisal of **biogas** technology that takes both business management and socio-economic considerations into account have three levels of evaluation, which are of corresponding importance in advising small and medium farmers. They have to be regarded as analyses which complement each other. The order of their importance and their individual importance may vary depending on the region or locality in question.

1. Monetary economic appraisal

All the outlay/income flows connected with the **biogas** unit as an investment object are taken into account. On the expense side these flows are, in particular, all investment expenses, the costs of spare parts, e.g., for the metal gas dome. Then there are repair and maintenance costs and possibly the costs of raising capital, as well as wage and ancillary wage costs.

On the income side there are:

• cash savings due to the substitution of commercial energy, the net sales proceeds from the production of superfluous energy or respectively the goods produced with it;

• cash savings due to the substitution of mineral fertilizer previously bought, the net sales proceeds from digested sludge fertilizer or respectively the net sales proceeds from increased agricultural yields;

• real income gains from savings in working hours due to the **biogas** unit enabling the users to do paid work or increase the output of marketable produce on their farms.

At the individual economic level the economic appraisal gives the investor an aid in deciding whether the project will bring advantages, or what relative advantages it offers compared to other farm investments. For direct information and advice for small and medium farmers a calculation of the investment amortization time and a simple profitability calculation are likely to be particularly relevant.

The calculation of the amortization time tells the potential unit operator whether he can recover the capital he will have to invest within the technically feasible working life of the unit. Small farmers operating with little personal capital, and in many cases with uncertain economic prospects, are justifiably interested in minimizing the risk, i.e., keeping the amortization time as short as possible. The static profitability calculation gives a rough idea of the likely interest on the invested capital per unit of time. By abiding by certain rules about methods it is also possible to choose the investment alternative - among several - which is likely to be the most favourable.

The two investment calculation methods outlined here, and their results, have the advantage that they can be communicated to the target group relatively easily. This applies especially to static calculation

methods.

However, the **biogas** adviser should check the statements he makes on the basis of static calculations against the complicated dynamic methods, which take the uncertainties of future development into account. This is necessary because payments for **biogas** units extend a relatively long period of time.

2. Working time accounts

Keeping comparative working time accounts, expressed in hours and relating to family members and employees, is especially important for small and medium-scale farmers. This balancing also includes the monetary effects associated with expenditure or respectively savings in working time on the farm.

Additional work caused by the **biogas** unit on the farm and in the household includes:

• the work involved in building the unit;

• continual filling of the unit and collection of the dung;

• transport and removal of the digested sludge;

• the time spent by the operator on repairs and maintenance.

As a rule the biggest saving in working time is in cooking, because it is not necessary to gather and chop wood, cooking times are shorter, and it is no longer necessary to clear out or remove fresh and liquid manure.

It is not only advisable to keep working time accounts for the farm and household because they bring clarity; there are other reasons, too, because in many cases there is no real opportunity locally for the members of the family to do paid work. A further reason is that it does not always lead to additional yields which can be measured in monetary terms, even if the working time thus saved is invested in the farm. However, subsistence production can be increased. It could also happen that an excessive emphasis on the possible reallocation of saved working time, e.g., of women, to other agricultural work, associated with corresponding expectations of a higher yield, would lead to overwork for the women (this has also been found in practice).

3. Non-quantifiable effects

The third level of an analysis for unit operators is that of the numerous secondary effects of the **biogas** unit, which cannot be expressed in terms of money, but which are also hardly or not at all quantifiable.

These include, for example, the fact that the soil structure is generally improved by fertilization with digested sludge, without it being possible to prove this quantitatively. Or that the condition of the livestock improves as a result of improved housing conditions. In the consumer or respectively socio-economic area the benefits are above all in the improved reliability of the energy supply, the prestige value and the convenience of lighting in the evening, as well as in the general improvement in health and hygiene.

On the other hand, a negative factor that can hardly be quantified is the aversion of unit loaders to handling faeces and excrement.

None of the three levels of assessment alone will be decisive in the investment decision for or against a **biogas** unit, or the final assessment of it in everyday use. However, in practice they recur in ail packages of reasons for exploiting **biogas** technology, with varying degrees of importance attached to

them, independent of local conditions. This is also shown by the examples of two family units.

Mascoll's Farm, St. Vincent, Caribbean

Static amortization calculation

The 11 cubic-metre family unit on a 20-acre farm with 4 head of cattle cost the family, who built it themselves, $ EC 2,730 (for materials only). The annual costs of materials for repairs and maintenance amount to about $ EC 200. On the credit side there is an annual saving of $ EC 400 for kerosene and fertilizer. With a static calculation this results in an amortization period of almost 14 years.

Working time accounts

The actual advantage of the unit for the Mascoll family is in the considerable saving in working time for gathering and preparing wood and in shorter cooking times (at least 3 hours a day); altogether, the saving in working time amounts to 120 days a year. This compares with time spent for filling the unit and removal of digested sludge amounting to about 20 minutes a day. Together with the time spent on repairs and maintenance this amounts to about 27 days a year.

If the members of the farm communitiy could reap the full benefit in cash from the considerable net savings in working hours, by doing paid work for average local wages, the amortization time would be considerably reduced, to about 2-½ years.

As benefits of the unit that are not or not yet - quantifiable the Mascoll family mention the reduced smoke nuisance when cooking and the relatively bright light of the **biogas** lamp, as well as the resulting more pleasant evenings. In addition, the family have plans to become advisers and unit builders, and thus to tap new sources of income.

Zakaria Family, Miovaro,

Tanzania

This family cultivates coffee and bananas and owns three cows, two calves, and eight sheep and goats.

Static amortization time

The investment cost of the "turnkey" unit (including gas-utilization apparatus, paving of the stable floor and connection to the **biogas** unit) was 11,000 THS. To this must be added the replacement of the burning-points, necessary every three to four years, costing 400 TSH. The unit supplies cooking energy for a 1 2-headed family; previously, "free" wood was used. The only tangible monetary benefit for the operators is the baking of about 100 flat loaves a week with superfluous **biogas**, and selling them. This is a completely new field of activity for the family, yielding a net profit of approx. 200 TSH a week. The amortization time (static) of the unit is thus about 1¼ years.

Working time accounts

The family statistics are similar to those of the Mascoll family: the net annual saving in working time is also between 90 and 100 days.

Additional beneficial effects of the **biogas** unit in the family's opinion are that the stable floor is kept clean, so that flies are less of a nuisance to both people and animals, and the greater taken of the animals; furthermore, obvious - though not quantified - fertilization successes in the coffee

plantations. And at the same time vegetable fields are being laid out near the **biogas** unit.

These two examples of family **biogas** units make it clear that especially when "freely" cut wood, i.e., wood that costs nothing, is replaced by **biogas** the amortization of the **biogas** unit can hardly be guaranteed during its economic life. Only by turning savings in working time into money (Mascoll) or commercial activities (Zakaria) - on the basis of using superfluous **biogas** - can result in a favourable amortization period for the capital invested in these two cases.

However, both unit operators consider the saving in working time, even without any money income, very important; they usually invest the time saved in their farms. The other non-quantifiable benefits are similarly appreciated.

Abstract

Economic appraisals help users to estimate the value of individual **biogas** units correctly. They are therefore a valuable advisory tool- and can be applied in various ways: as a monetary economic appraisal or, e.g., in the form of working time accounts. In contrast, it is difficult, or completely impossible, to quantify the effects of a **biogas** unit in the area of consumption.

Résumé

Des calculs de rentabilité permettent une évaluation exacte de la valeur de chaque installation au biogaz. Ils vent done un instrument précieux pour l'apport de conseils. Il y a la plusieurs possibilités: d'une part, le calcul de rentabilité monétaire, d'autre part, I'établissement du bilan du temps de travail. Par contre, les répercussions d'une installation au biogaz dans le domaine de la consommation vent difficilement quantifiables, voire pas quantifiables du tout

Extracto

Los cálculos de rentabilidad son una ayuda pare analizar correctamente el valor individual de las instalaciones de una planta de biogás. Constituyen, por lo tanto, un instrumento de asesoramiento muy valioso.

Existen varias posibilidades; por una parte, el calculo de la rentabilidad económica y, por otra, el balance de las horas de trabajo. En cambio, es difícilo, incluso, imposible cuantificar Ias repercusiones de una planta de **biogas** en el sector del consumo.

Catchword

Biogas

The fact that usable gases are produced during anaerobic fermentation of organic matter is not a recent discovery.

Biogas was being produced as early as the 1920s in a number of communal sewage farms in central Europe; but the primary consideration was not so much how to obtain additional energy, but rather the problem of rational and hygienic waste disposal.

The first experiments specifically associated with the production and use of **biogas** were performed at the beginning of the 1950s. Since fossil forms of energy such as natural gas, mineral oil and coal were cheap at that time and the energy supplies of the industrialized nations were centralized, production of **biogas** was obviously uneconomic. Moreover, the climatic conditions for gas production in the countries in the temperate zone are rather unfavourable, as the necessary bacterial activity only begins at about 15°C.

For about 30 years now, simple **biogas** plants have also been built in Third-World countries (in particular India and China).

Not until the middle of the 1970s was **biogas** technology given a new lease of life, due to the sharp rise in energy costs. Since then, a large number of widely differing types of plants have been developed and tested. ranging from electronically controlled and heated large-scale plants to simple small-scale plants for subsistence farmers.

Biogas is a product of the decomposition of organic material by putrefactive bacteria with exclusion of air (anaerobic putrefaction process). The resulting gas is composed of 60-65% methane (CH_4) and 30-35% carbon dioxide (CO_2). The remainder (less than 2%) is made up of nitrogen, hydrogen, and hydrogen sulphide. The water content in the digester must be at least 50%; the reaction is best at pH values of between 6.8 and 7.6.

The methane content, and thus the calorific value, increase with the duration of the putrefaction process. The longer the fermentable material stays in the digester, the more thoroughly it will be putrefied and the more liquid the sludge will be at the end of production.

Basically, any organic material can be decomposed; inorganic solids are unused ballast materials which are not changed by the process of putrefaction. Pig, cattle and poultry excrement (manure), human faeces, agricultural and abattoir waste are suitable. Purely vegetable matter, such as straw etc., first has to be mechanically chopped.

There are various advantages which favour the introduction and refinement of **biogas** technology in Third-World countries in particular:

• **Biogas** is an important renewable source of energy; it can be used decentrally everywhere where organic waste is produced in concentrated form and in appropriate quantities;

• in certain regions, the use of **biogas** technology can make an important contribution to the protection of natural resources and the environment (e.g., by replacing firewood);

• sludge is a high-grade fertilizer which can to some extent replace expensive mineral fertilizer (in particular nitrogen).

It can now be said of **biogas** technology that it is "suitable for dissemination", i. e., in future, in the context of Technical Cooperation, more attention will be paid to questions of motivation, training of artisans, and especially the setting-up and promotion of efficient counterpart institutions.

For many people **biogas** technology still has a negative image ("poor people's technology"); therefore, simple **biogas** plants must become a symbol of social advancement for "poor people" too. As far as the potential user is concerned, the **biogas** plant as an investment has to compete with other desirable products and projects. Hence the first question that arises for him is the question of the economic benefit of the plant. So technical adaptation and increasing perfection of **biogas** plants by the designer are not enough: convincing potential users at the location in question has meanwhile become just as important a task.

Workshop

The Dodoma Stove- Results of a long-term investigation

by Heinz-H. Schneiders

Two years ago the Dodoma Rural Energy Project of the Tanzania National Scientific Research Council initiated a small-scale production of the "Dodoma Stove" and conducted a three-month field test on the cooking performance, savings and acceptance of this charcoal stove, originally designed by UNICEF, In Nairobi. The feedback of the test households was encouraging, so that the continuation of the project seemed viable.

The UTAFITI field test based on 30 Dodoma Stoves revealed that:

• the stoves' cooking performance was generally accepted as good,

• the Dodoma Stove meets exacting demands of the women which are not related to charcoal savings, such as fast cooking, safeness for children, clean handling and durability,

• the stoves' reduced charcoal consumption was considered to be satisfactory, and the amortization time was assessed to be between 3 and 6 months.

Meanwhile, about 600 Dodoma Stoves have been produced and sold in Dodoma without any subsidy, under the quality control of the Dodoma Rural Energy Project and the Workshop of the Small Industries Development Organisation (SIDO), Dodoma. Another 100 Dodoma Stoves were produced and sold under the GATE **Biogas** Team at the Centre for Agricultural Mechanization and Rural Technologies (CAMARTEC), Arusha.

The continuously high demand for the Dodoma Stove during and after the test period indicated that the disadvantages of the stove which have been identified and reported, i.e. its greater weight and its various parts and their handling have been accepted in view of the benefits provided.

In the meantime the first households using the Dodoma Stove have had 18 to 20 months experience - a period after which a traditional charcoal stove is entirely worn out. To conclude the first field test of the Dodoma Stove the Dodoma Rural Energy Project conducted a second field test as a long-term investigation into the practices of cooking on the Dodoma Stove in order to investigate the reasons for a mixed utilization of the Dodoma Stove alongside conventional stoves, determine the extend to which the Dodoma Stove is used and calculate the average charcoal savings per Dodoma Stove sold and to estimate the durability of the Dodoma Stove and its various parts.

The three groups of stove customers

On the basis of the groups of households owning a Dodoma Stove which were identified, three ideal consumer profiles can be outlined as follows: 50 per cent of the households covered use the Dodoma Stove as their main charcoal stove as a full substitute for the conventional stove. If they own a conventional stove (about 20 per cent), they merely use it as an emergency or supplementary stove on occasions when a lot of visitors are present and there is too much food to be prepared on one charcoal stove only. Among the motives for buying a Dodoma Stove the reduced charcoal consumption usually plays a bigger role than the results of the first investigation in 1983 suggest. At least after using the Dodoma Stove for a long time the reduced charcoal consumption is mentioned among the most important advantages. The reported monthly charcoal savings are 50 per cent or more of the previous consumption when using the conventional charcoal stove only. In absolute terms this amounts in small households of four family members to three-quarters of a bag (30 kg) per month and in larger families of 8-10 members to 2 bags (80 kg) per month. By using the Dodoma Stoves these families save an average of on bag (40 kg) per month.

The Dodoma Stove may be said to be a little heavy, to take a little longer to light and smaller pots may move around on the inner charcoal grate while stirring is done. But these problems are generally accepted as genuine characteristics of the new stove and as minor side-effects when compared with

the various and more significant benefits of the Dodoma Stove. The claim of other households that the Dodoma Stove would be slower in cooking the food is repudiated by explaining that the possible delay during lighting is offset later on by the faster cooking. Some households say they sometimes use the conventional stove for lighting the charcoal which they afterwards put into the Dodoma Stove for cooking.

After using the Dodoma Stove for 18 months some parts need to be replaced, e. 9. the upper charcoal grate. The inner grate is likely to last another 6-12 months. The stove body, consisting of the bottom sheet, two walls, door, handles and legs is still in perfect condition and likely to last at least another four years. Mainly relying on the Dodoma Stove to prepare their daily food two or three times a day, this group of stove users is likely to take any effort to keep the Dodoma Stove in operational condition and to replace it immediately if one day it wears out beyond repair.

30-40 per cent of the households owning a Dodoma Stove prefer a mixed utilization of the new stove and one or two traditional stoves. The Dodoma Stove is usually lit about once a day only. The reasons for using both stove types in combintion are manifold. For some households the conventional stove is easier and faster in lighting. In others, only the woman herself understands the handling of the Dodoma Stove while her children are scared or unable to cook on it. Fairly often employees say that they find it difficult to get used to the Dodoma Stove.

Here, problems of the Dodoma Stove are taken more seriously than in the first group. The greater weight of the Dodoma Stove is mentioned frequently along with the cooking pots, which are difficult to hold by hand while stirring is done.

In this group of household wrong handling of the stove can be observed in various forms. Some women got into the habit of always lighting the charcoal on the upper charcoal grate regardless of the pot size used. Others fill the inner chamber of the Dodoma Stove with charcoal right up to the top and then light it. This practice is said to be more convenient since the large amount of charcoal extends the period of cooking which can be accomplished without dirtying the hands through adding smaller amounts during the cooking process. That this convenience is gained at the expense of efficiency is usually understood and accepted.

The general condition of the Dodoma Stoves is still very good. Since the stoves are only used about once every day, hardly any stove needs replacement of grates. If a new Dodoma Stove had to be purchased, this group of households would be 'prepared to pay between 300/= and 400/= TSh.

10-20 per cent of the households possessing a Dodoma Stove report that they use it only very infrequently. For some of these households charcoal is not the main source of energy for cooking. In better-off households gas or electricity is mainly used, charcoal being the source for very long cooking processes only. In poorer households wood is or has become the main source for cooking energy.

Other households do not use the Dodoma Stove because they have failed to understand how to handle it correctly. Initially they tried it out, failed to use it and put it away. Regardless of the reasons for not using the Dodoma Stove, all the households claim that its advantages offset its disadvantages by far and they refuse to part with it even after being offered a full refund of money. They claim it would save about 25-30 per cent of the charcoal needed if utilized. Some even say as much as 50 per cent.

The difficulty some women have in explaining the contradiction between the potential advantages and their failure to translate them into reality by using the stove seems to indicate that in quite a few cases habitual rather than rational aspects direct the course of events.

The condition of the Dodoma Stove after 18 months

In general, the stove check-up confirmed the respondents' assessment in the first questionnaire, that the Dodoma Stove is very durable. Once a Dodoma Stove has been bought, the stove body will hardly be affected by intensive stove utilization and can be used for many years if parts directly exposed to the heat of the charcoal fire are replaced whenever necessary. The stove body consisting of the bottom, two walls, door, handles and legs thus do not deteriorate as for example, the wall of the traditional stove. If the proper material is chosen, the body of the Dodoma Stove forms an imperishable frame accommodating the two wearing parts (grates) which need to be exchanged every two years. A comparison of the higher material requirements and cost of the Dodoma Stove and the conventional stove must take this into account. The higher material inputs (and cost) of the Dodoma Stove are due to the stove body which is likely to last more than the life-span of five traditional stoves. Once this investment to insulate the combustion chamber is made, the maintenance expenditure, e. 9. for replacement of grates after every two years, is far less material-intensive and far cheaper than the replacement of complete conventional stoves every 12 to 18 months.

The average savings per stove sold

The average charcoal savings per Dodoma Stove sold has to be estimated with a view to the stoves that are under-used or not used at all. If all the households buying a Dodoma Stove utilized it fully for all cooking purposes, a monthly saving about 1 bag of charcoal (40 kg) could be achieved. As the above field results show, only 50 per cent of the households covered substitute their conventional stove with the Dodoma Stove. The remaining 50 per cent of the households use the Dodoma Stove either as a charcoal stove among other conventional stoves or utilize it only occasionally. Taking these idle and semi-idle stoves into account the average monthly saving per stove sold drops to 25 or 30 kg of charcoal per month. To allow a security margin it is suggested that the lower figure of 25 kg per stove sold/per month is taken as a basis for further calculations.

Conclusions

The substantial difference between the field efficiency of the Dodoma Stove and its average savings per stove sold suggests a conclusion which is somehow contradictory to the main result of the first field test conducted in 1983.

The three-month investigation revealed that the energy efficiency of an improved charcoal stove is neither a decisive nor an important attribute in the view of the end-user. The stove characteristics with a higher priority than the amount of charcoal consumed were found to be portability, fast cooking, safeness for children and durability. The conclusion that suggests itself is not to concentrate too much on stove efficiency when selling a stove but primarily to pay attention to the womens' preferences, even if this is at the expense of stove efficiency.

The conclusion drawn from the present findings on the acutal savings per stove sold results from the project objective of energy conservation and points into the opposite direction.

Firstly, charcoal saving has a relatively low significance in the womens' priorities concerning a charcoal stove. Energy consciousness can be classified as non-existent or low, and the habitual waste of charcoal is a common feature to be observed in any household regardless of the price paid for energy. There is no reason why these habits should be expected to change when a Dodoma Stove is purchased and used. A continued habitual waste of charcoal therefore offsets part of the potential saving provided by the improved stove.

Secondly, as we have shown above, a remarkable percentage of Dodoma Stoves (50 per cent) are only partly utilized in varying degrees of combination alongside the conventional stoves or used occasionnally. This practice also reduces the stoves' ability to generate charcoal savings on the micro- and macro-level.

Both facts strong indicate that only the most efficient charcoal stove should be mass-produced and distributed, so that in the end some net savings remain. If according to the laboratory test a stove's saving potential is, say, 25 per cent compared with a conventional stove, only 15 per cent or less might remain in the field after allowing for wasteful cooking practices and idle or semi-idle improved stoves.

The saving effects of 600 Dodoma Stoves

If we take the average monthly figure of charcoal savings per Dodoma Stove sold of 25 kg and multiply it by the 600 stoves sold, as a result of this project 15,000 kg of charcoal is being saved every month (equivalent to 380 bags). This amounts to 180 tons of charcoal every year.

Expressed in terms of wood reserves the 600 Dodoma Stoves every month conserve 180 m³ of round wood (12 m³ of round wood are burned to get 1 metric ton of charcoal), amounting to 2,200 m³ of round wood per annum. With an annual increment of 5 m³ wood per ha, an area of 440 ha would be required to obtain this amount of wood fuel from woodlands without causing deforestation. Or, if the clearing of 1 ha of woodland provided 100 m³ of round wood (which is rather a high figure for the shrubland around Dodoma), the 600 Dodoma Stoves prevent the clearing of an area of 22 ha every year.

Taking into account the cost of afforestation measures, the balance is even more impressive.

The expenditure for clearing, ploughing, pitting, planting, watering, tending (twice), including seedlings (TSh. 2/= per tree), insecticides (10 kg/ha) and a 10 per cent transport charge to afforest one hectare are in the Dodoma Region in the region of 15,000/= TSh. This excludes the cost of replanting and long-term measures for assuring the proper growth of the forest. The 600 Dodoma Stoves thus save an annual amount of at least 330,000/= TSh by making the clearing of 22 ha per annum unnecessary. At the same time the production of the 600 Dodoma Stoves only required an amount of 150,000/= TSh which was paid for by the customers (250/= TSh for each stove).

Comparing these figures of 150,000/= TSh for the production of the stoves with their macro-economic effect of avoiding public expenditure of at least 330,000/= TSh each year, the question must be raised as to why only very limited efforts and funds are directed into projects for energy conservation. The fact that each shilling spent on energy conservation through the Dodoma Stove is twice as effective as the shilling spent on afforestation would seem to indicate the necessity for the mass production and free provision of Dodoma Stoves. Economically, it might be wise to do so, but this is not suggested here.

Afforestation measures have multiple objectives such as the improvement of micro-climates, preventing soil erosion, enhancement of nutrient exchange, etc. among which the provision of wood fuel does not necessarily play a vital role. It is therefore not legitimate to contrast directly the high expenditure for afforestation measures with the relatively small financial inputs for conservation measures through improved stoves.

However, if afforestation measures are carried out primarily for the provision of wood fuel, the measures for energy conservation are necessarily more immediate, more effective and more economical.

Firstly, growing one tree to the size necessary to obtain 25 kg of charcoal (the amount saved on average by one Dodoma Stove every month) takes at least five years. By the time this one tree supplies the 0.3 m³ of round wood for charcoal, the Dodoma Stoves itself has saved 5 times 12 trees - equalling 60 such trees. This calculation shows that energy conservation measures are immediatly effective from the first day of utilizing the improved stove. The application of improved stoves does not suffer from the time-lag typical of projects for wood-fuel provision through afforestation. Thus

the energy conservation measures are immediately effective.

Secondly, after an acceptable improved stove has been designed and tested and a local demand has been generated, the charcoal savings are transformed into money savings. These savings (in addition to other benefits) are the economic incentives to utilize the new stove without the necessity of expensive legal measures to assure proper and daily use. Afforestation measures unfortunately do require pressure from outside, be it to motivate individual tree planting or be it in the form of hundreds of watchmen to safeguard afforested plots. The difference between the people's attitudes and their initiative does not come about because afforestation is less beneficial to them. The difference is merely that the utilization of the Dodoma Stove pays off in a shorter time. In this sense conservation measures are more effective.

Thirdly, energy conservation is more economical for a number of reasons. Apart from the figures calculated above, it is important to recall that energy conservation measures are not a seasonal activity. The production and sale of efficient stoves does not depend on the rainy season and its energy conserving results cannot be jeopardized by delayed rains or unfavourable weather conditions. Another vital difference is that the improved stoves are paid for by the enduser if the model is found to be suitable. Being produced locally, they neither demand foreign currency (like the tubes for tree planting) nor public funds on any significant scale.

The figures calculated above are by no means an exaggeration of project results. They are based on accounting for 600 Dodoma Stove only, excluding about 100 Stoves which have been sold by individual artisans without the involvement of the Dodoma Rural Energy Project and they exclude the 100 Dodoma Stoves which have been sold via the GATE **Biogas** Team at CAMARTEC, Arusha.

But these figures clearly indicate that considerable additional funds should be channeled into energy conservation projects in order to boost the national efforts for afforestation by utilizing the saving potential of locally made improved stoves. The annual wood fuel deficit in Tanzania is estimated to be about 20 million m^3 of round wood, implying the clearing of about 200,000 ha of woodland every year. This wide gap between the rising demand for wood fuel of a growing population and the limited afforestation capacities cannot and should not be narrowed by tree planting alone. It makes more sense to support the afforestation efforts by reducing wood-fuel demand at the place where the wood is used - in the kitchens of families and institutions.

A single traction bamboo-cart, specially designed for off-road transport

by Hans-Jörg Hinz

Small scale transport is a basic but mostly unsatisfied need in rural areas of many developing countries. The lack of adequate means of transportation may severely hamper even slight changes in the lifestyle of the rural population. This situation is worst in the mountainous parts of the countries, as normal vehicles need roads, and road construction is an expensive and difficult task possibly leading to additional erosion.

In the Usambaras - a densely-populated tropical mountain area in the Tanga region of Tanzania with low infrastructure (most of the farms Iying off the roads and far from the dwelings) and with a very critical ecological situation (deforestation and erosion) most of the everyday transport is done by carrying the loads on the heads of women and children: firewood, water, crops, market... Grazing cattle are common, but they are just kept for meat and, to a small extent, milk- not for manure or transport.

To raise his standard of living in an ecologically sound way, a subsistence farmer may put his cattle in a cowshed and manure his farm, where some kilometers of contour lines provide protein-rich fodder besides upgrading the soil further. But for this change he has to solve the problem of bringing

another 20 t of fodder and manure per head of cattle and year to and from the distant farm - where his family is already overloaded with their normal transport duties.

One possible solution in this context is the utilization of cattle as draught animals in connection with an appropriate "heavy-duty mountain-cart" fulfilling the following requirements:

• running smoothly and easily balanced on the existing but rugged, steep, and narrow footpaths permitting single traction only,

• not exceeding an overall weight of 250 kg with a payload of 200 kg, 70 kg being the maximum partial load on the back of the animal, and

• allowing production, maintenance, and repair with cheap and locally available materials using only basic tools.

The bamboo-cart, which was designed, built, and tested by the author in cooperation with SECAP/LDP, Lushoto, meets the above requirements.

The design resembles that of a wheelbarrow, the load being placed between the wheels at the back and the drawbars in front. Yielding a low centre of gravity and a narrow wheelbase it places part of the load on the back of the draught animal, the amount depending on the length of the drawbar.

The bamboo poles forming the frame are connected by several layers of strong rubber strips. The elasticity provided by these rubber joints takes torque off the poles. The longitudinal rigidity stems from diagonal sisal strings, stretched into the frame and twisted for tension.

The wooden rim-segments of the two wheels and the oil-soaked wooden bearings pressed into a bamboo-hub are connected by sisal-spokes, the sisal strings also being twisted for tension and soaked with oil to render them waterproof. Wood blocks function as brakes, which are pressed by a simple bamboo lever onto the rubber treads covering the rims.

The spring suspension with the long swing-arms, which connect the axle to the drawbars, serves a multiple purpose:

• it separates the load forces from the traction forces,

• it reduces the peak forces resulting from heavy shocks and

• reduces the forces necessary to keep the cart in balance, and finally

• it hampers heavy overloading, the basket being grounded by 300 kg.

For the sake of the draught animal, the harness should be threefold: a collar for traction, a saddle for the load, and a crupper to prevent the cart from running downhill into the animal - all three parts nicely padded. Reigns are useful for a single driver, as all driving tasks can thus be effected from the back of the cart: steering the animal, operating the brakes, and keeping the cart in balance.

The cart can be used wherever cattle can walk or climb: on slopes, over rocks, through swamps. The soft suspension and the geometry of the sewing-amms make the cart "float" even over quite, large obstacles with rather low resistance and very low toppling forces, one hand sufficing to

secure the balance.

Except for the bearings, the rim-segments, and the axle, where wood and metal saws and drills are

needed, all other construction and repair work can be done with a sharp bushknife, though the use of simple and readymade constructional aids like a wheel-assembler will considerable ease and speed up the process of production.

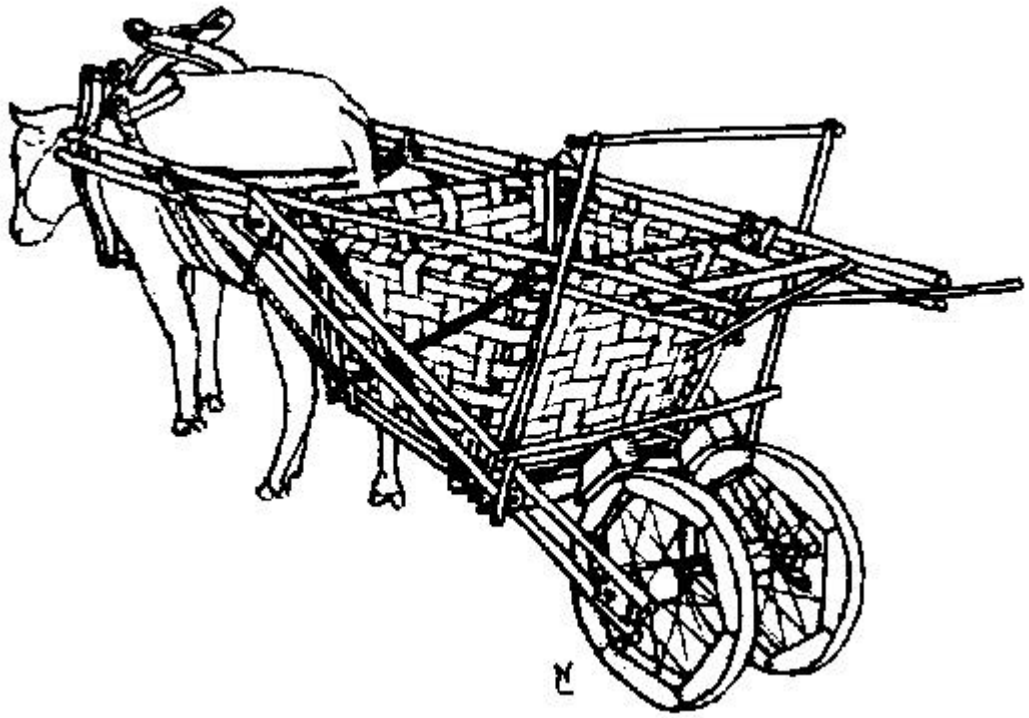
There is only one regular service necessary: the sisal spokes should be kept waterproof - otherwise they could destroy the rims or themselves. During the rainy seasons this should be done with a little oil once in a month, with no regular service during the dry season. All parts of the cart (bearings, rubber joints, basket, etc.) are easily replaced when they are worn out.

The cart can be adapted for all draught animals from donkeys up-ward, as the overall data as well as the design may easily be changed to meet special needs, other changes being related to the use of different materials: sisal poles instead of bamboo, different fibres or wire for the spokes, the rubber joints replaced by twisted string connections, a removable basket made from bamboo-splittings,...

The spring suspension - unusual for a "simple oxcart" - seems justified not only technically but also emotionally: it gives the cart a touch of luxury. Running smoothly is something not even offered by a Land-Rover.

The Bamboo-cart at a Glance

Description (data)		**Tools and materials tools:**	
length	3.5 m	saws, drills (necessary)	rasp, file, plane (optional)
heigth/width	1.0 m	constructional	
wheel base	0.4m	aids (optional):	wheel assembler
wheel diameter	0.6 m	pattern for rim-segments	
basket volume	350 l	boiler for bearings	
payload	200 kg	materials:	bamboo, sisal, rubber, palmband,
drawbarload	70 kg	wood, G.I. waterpipe (1.5 m, ½")	
deadweight	50 kg		



This is what the bamboo-cart looks like.

Cartoon & Reflection

Taboos Make Hygiene Difficult for Women

by Anil Agarwal

As in the energy sector, so in the field of hygiene: women are left out and men make the decisions. Whatever is available by way of water supply and sanitation, for instance, it seems that while the Installation of latrines would be given far more importance if society gave higher priority to women's needs, efforts to introduce scientific practices leading to better family hygiene could easily mean, at least within the existing social framework, more drudgery for women.

The usual official explanation for the neglect of sanitation programmes is that they require changes in deeprooted behavioural factors, which bureaucracies cannot bring about.

But is this all there is to it? Who do these behavioural factors govern most? Was there nobody within the communities benefitting from sanitation programmes interested in toilets? The sociological literature on sanitation behaviour is amazingly small, but whatever exists does show that sanitation programmes where accepted much more by women that men because of the greater need for privacy enforced upon them by society. Undertaking sanitation programmes effectively means asking male decision-makers in the family to establish systems that do not concern them in particular. They can squat whenever and wherever they wish, unlike the women. In many Middle Eastern countries, women defecate on roof tops because of the purdah system. In Bangladesh, scientists reported at a conference on diarrhoeal diseases, men ease themselves according "to their natural requirements" but women only before sunrise or after sunset. In the rural households they surveyed, they found that "when women felt the need for defecation during daytime they had to hold it with difficulty until sunset. Sometimes such women skipped lunch so that they could hold the bowel motion for a longer time. This skipping of lunch occured several times in a month, in the case of most of the women. On occasions when they failed to hold the motion, they defecated hastily in the backyard".

Delhi is no different. Take a train that comes into the city soon after sunrise. There will be thousands

of men out in the field but only a rare woman. "I learnt the feminist aspect of sanitation," remarks a middle-class urban woman from Delhi, "when I went out to a village in eastern Uttar Pradesh. There were no toilet facilities in the village: the land was dry and parched for miles around; and no tree to hide behind. Like the village women, I too had no choice but to hold my urge until dusk."

The half-hearted, liberal attempts that governments and communities have made (read instead "that men have made") to introduce toilets have easily withered away in the face of social taboos. There never was any strong commitment. But it is amazing that all these irrational taboos invariably govern women's behaviour. In parts of East Africa, toilet programmes are said to have failed because a woman who has seen the excrete of a male is not supposed to get married. In South Korea, there was reportedly difficulty in introducing toilets because the daughter-in-law could not squat on the same seat as the father-in-law.

Voluntary groups working in the slums of Bombay are finding that the realities of life have made women particularly anxious to get private toilets. They defecate after sunset and have to look around for isolated spots: just the places that leave them open to rape and molestation. A young Bombay slum girl who has recently risen to become an important beautician of the city but still lives with her family in a slum, frankly told the fashionable Eve's Weekly: "Every morning I control the urge with a great effort and rush to the toilet once I reach the parlour. On holidays I use my friend's bathroom. She lives nearby in a pucca house." The slum performs its morning ablutions on seaside rocks in communal harmony.

What is the lesson of all this? Clearly that all male writers, reporters and analysts of human problems must be made fully aware of and sensitive to women's interests. And women themselves ought to get better organised and assert their technological needs. If that were to happen, many national development priorities could be changed or re-emphasized. Some women argue that it may even be the beginning of a new and more rational world.

"You might just as well stay there– there's just not enough water to go round."

Figure

International scene

Forestry and Rural Energy in Developing Countries

by K. Krishna Prasad

This short essay is concerned with the organization of forestry schemes as a means of providing for the energy needs in rural areas of the developing countries. The arguments developed in the essay are based on three interconnected premises. Firstly, energy policies for rural areas conceived in isolation of development needs are bound to be counter-productive. Secondly, development in rural areas is equivalent to the creation of purchasing power in the population through productive activity. Finally, the service sector in rural areas is organized as part and parcel of each individual family. Thus, water and fuel, two of the basic needs are "gathered" directly by the use of unpaid family labour.

The present essay stems from the contention that neither the national government planning bodies in

developing countries nor the aid agencies are equal to handling a large number of small procjets. In fact these small projects seem essential if renewable energy systems have to play a role in the development of small rural communities. The proposal presented here is an attempt to bridge the global perceptions of a planner/aid-giver and the realities of development project executions.

Conventional approaches to afforestation

It is possible to discern three broad approaches to tackle afforestation in developing countries.

The first approach is to develop plantations of 1,000 hectares or more dedicated to the supply of fuel wood. Several merits commend this approach. It lends itself admirably to a high degree of mechanization and productivity of labour is quite high. It is possible to borrow ideas from successful plantations for supplying raw material for forest based industries like paper and pulp for rayon. In particular by virtue of the size of the undertaking, it is easy to conceive of management systems that can provide adequate technical and managerial expertise for running the enterprise effectively.

However, there is an equal number of disadvantages to the approach. Firstly, such large schemes require considerable initial investments. The management of such schemes are under pressure to produce reasonable returns on investments. Thus the schemes tend to overemphasize the commercial aspects of output and sale. Under such conditions, the first casualty is the need of the poor who can not back their needs by adequate purchasing power. Secondly, mechanization takes the central place in the scheme of things. It places constraints on forestry design, species selection and employment patterns. All these act against the interests of the poor. Finally, such large chunks of land will not be close enough to sizable rural population agglomerations. Thustransport costs of wood in its raw form will become yet another deterrent fo the supply of fuel to the poor. Thus asolution, known to work very well in many circumstances, appears to suffer from serious limitations from the point of view of reaching the rural poor. However, such schemes might be quite effective in supplying char coal for urban/pert-urban areas.

The second approach is that of the so-called agroforestry. The idea is simply to incorporate forestry into present agricultural practices. This is very attractive since trees could be grown in small parcels of land that may be unused and regions of land like boundaries of farms could be extremely effective in producing fuel wood. The main difficulty here lies in persuading the large number of small cultivators to tailor their traditional practices to changing circumstances From all reports that are available now, agricultural extension service in most of the developing countries has not been an unqualified success. It seems that it is unrealistic to expect that a similar service for forestry will produce the results necessary to over come the present fuel wood shortages.

The third approach being actively considered is the community forestry Experience with this approach is very small. It requires dedicated leadership at the individual village level. Such leadership is obviously scarce. If such leadership were available, rural areas would not have been in the present unhappy state. It seems quite improbable that the necessary leadership could be made to emerge in the name of growing fuel wood.

The purpose of the short review is to indicate that the prospects for forestry to meet the growing fuel wood demands of rural poor with the conventional approaches do not sound very encouraging.

An alternative

In this a fourth alternative to the forestry scheme is considered. The scheme attempts to explicitly take into account four important features of the problem.

Forests, like many other renewable energies, are a distributed source of energy. Energy consumption invariably occurs in a highly distributed form. Forests and other renewable energy systems provide an

opportunity to match the magnitude of the production system with the consumption pattern in a spatial sense, consistent with other requirements. Continuity of a scheme can be assured only if it has the prospect of becoming ultimately a viable commercial enterprise.

The scheme, if it has to be viewed sympathically both by the populations and national governments concerned, has to contribute to the development process. One way of ensuring this is to see that the schemes do create employment opportunities in the rural areas.

Success of schemes of this type are contingent upon the availability of continuously improved inputs with time. The two major inputs are technical and managerial expertise.

The concept used here is the franchising system, very much similar to the practice followed in fast food outlets in Western cities. Used in connection with forestry, it could be called the contract farming. However, we prefer to call it franchising because of several other considerations that will become clear later. There are two parties to the system: the franchiser (or better, the franchising company) and the franchisees. The franchising company services a large number of franchisees.

The franchising company is responsible for:

- identifying prospective franchisees;

- providing them with information about proper methods of apportioning land between agriculture and forestry (if the franchisee owns land); if the franchisee does not own enough land, indicates to him possibilities of leasing land;

- providing the franchisees with seeds/seedlings;

- indicating harvesting techniques (if necessary providing them with appropriate tools either on purely a hire basis or hire-purchase basis);

- suggesting sound marketing principles;

- buying a certain amount of produce from the franchisee;

- carrying out research as it is directly applicable to the area of operation of the company:

- providing the appropriate training for the franchisees;

-- making easy credit accessible to the franchisees; etc., etc.

The franchisee is required to:

- put in an initial risk capital;

- hiring wage labour (part of which may be of franchisee/franchisee's family);

- raise, harvest and market the fuel wood (partially on local markets);

- pay a fee for the franchising company for its services; etc., etc.

The above are indicative functions. They obviously can be expected to vary with local situations.

The principal merit of the approach lies in its ability to combine the virtues of smallness of an individual entrepreneur with the muscle of the large which has the ability to attract talent and money

to achieve difficult objectives.

The second constraint has to do with the long maturation period involved with forests. It is true, for example, that a farmer deciding to raise vegetables with windmill irrigation can see the results of his investment and labour in months' time. It is easy to show that such a comparison is invalid if we extend the argument, say, to 10,000 farmers. The thesis here is that such an extension will take an equally long time to mature. It has to be accepted that there is no energy system - be it based on fossils or renewables - that is amenable to quick-fix solutions. One thing can be said in favour of forests: the probability is quite high that every village can have its own forest. The argument above is not to be construed as discrediting windmill technology. It is a plea to consider the problems of energy and development as one that involves large numbers of people.

Another comment in connection with the long maturation of trees is appropriate here. A great deal of forestry expertise lies in growing timber, and not fuel wood. Fuel wood needs to be no more than 2 to 3 cm in diameter and a maximum length of 20 cm. In fact dramatic reductions in wood consumption are feasible with only thin, short sticks of woods used in efficient stoves. Trees catering to this application could be grown in a much denser pack. These will be ready for harvesting in 2 to 3 years' time as against 7 to 10 years of rotation periods for conventional timber trees. In addition if one grows wood sticks, harvesting and processing of wood after harvesting can be done with less exacting technologies. Thus these ideas need to be incorporated into the forestry schemes before arguing about their long maturation periods.

The third constraint concerns the availability of entrepreneurial talent in rural areas. We will look at this constraint from two points of view. Population statistics for the developing countries show that the growth rates of large cities are much higher than is seen for the total country. This is due to migration from rural areas. Most of these rural migrants disappear into the so-called informal sector, working for "own-account" business. Clearly, this could be considered as a proof of the desire on the part of the rural population (at least those who migrate) to involve themselves in entrepreneurial activity. These people do not see any opportunity for carrying out such activities in and around their homes. This leads us to the next view-point: the development view-point. Two important functions of development policy ought to be:

- to provide opportunities for whatever entrepreneurial talent that exists in rural areas to stay there and practise it; and

- to provide for growth, both in quantity and quality, of such talent.

These two will go a long way in assisting in the diversification of employment patterns as well as replacing present disorganized efforts of subsistence living by organized efforts of productive life in rural areas. The point being made here is that while there may be no talent in a village to nun a "modern" business, it is incorrect to assume that there is no talent to run a 10-hectare forest plantation in a village.

The constraints

Any fuel wood scheme intending to serve rural areas faces a number of constraints. These are:

- competition for land and labour between agriculture and forestry;

- long maturation period for forestry;

- lack of entrepreneurial talent in rural areas; and finally the all important question of financing.

These are genuine problems associated with development and are not forestry problems per se as we

will attempt to show below. In what follows, we take two things for granted. The first is that there is no genuine alternative to fuel wood for supplying rural domestic energy from the point of view of cost. Secondly, forests are essential for protecting the environment. We will examine the constraints in the light of these statements.

The competition for land and labour for agriculture and forestry is really a question associated with the productivity of land and labour. If this is so, it seems advantageous to accord priority to agriculture over forestry. Unfortunately it is not clear that improvement in agriculture could be effected at sufficiently rapid rate so that one could afford to ignore the consequence of deforestation on the environment. Therefore there appears to be no way but to carry out the improvements in agriculture and forestry more or less simultaneously. What is required is to apportion the available resources according to presently known empirical evidence. At any rate forests, when coupled with superior stoves, can generate surplus energy which can contribute to the increased productivity from agriculture.

The above line of argument leads to a puzzling question. If forests are so good and entrepreneurial ability exists in rural areas, how come commercial forestry has not come about in extenso, if at all. The reasons for this are complex. In essence there is a vicious circle operating here. The existing private forestry systems do not see any money in fuel wood production. They can not see money since they do not interpret their activity as leading to employment generation. Unless additional employment is generated, there is no overall excess in purchasing power in rural communities. Under these circumstances the poor will have to rely on fuel gathering to meet their energy needs. There probably exist some private forests in many parts of the world; but most of them either cater to fuel needs of urban areas or produce other commercially attractive forest products.

We now turn to the problem of financing of forestry schemes in rural areas. The main issue here is the rather slow rate of return on investments. These are two mitigating factors: firstly a certain amount of investments are already going on; and secondly, environmental arguments could be used to permit increases of these investments. The rate of return on investments argument, as seen by a private investor, is generally invalid for things like energy and development. The assumption made in this essay is that investments on forests and development will pay in the long run. This brings us to the final point. Since the constraints mentioned above act as deterrents for private investment, and since the job needs to be done, there seems to be no alternative to public financing. The difficulty here is two-fold. The first concerns the allocation of scarce public resources. The scope of the present essay is rather limited and we shall not consider this here. We have made a tacit assumption that some public resources are available for energy and forests, in particular. This leads in to the second difficulty - that of marrying the dynamics of the private initiative with the needs of accountability which is characteristic of public financing. In this connection, attempts in the developing countries to set up companies wholly owned by governments, have shown a patchy performance. The protagonists of this system argue that failure of such companies is not due to any inherent fault of the system (there are success stories to back this claim), but due to the incorrect choice of product and technology (for example, steel and fertilizers in India). The detractors point out the inadequacy of corporate talent in the developing countries as the reason for such systems not working up to expectations. The available information is of such a nature that two analysts could arrive at diametrically opposite conclusions depending upon the aim of the analyst. This is not surprising given the diversity of opinion that exists in the whole field of energy and development.

The discussion presented in this section brings out that the evidence taken as a whole needs to be examined in the overall context of development. This context and the requirement of prevention of further environmental degradation have led us to the assertion that the constraints are more imaginary than real.

Finally, a comment seems necessary to justify the use of the franchising system as against the regular forestry service to establish forests in villages. Emphasis on development oriented approach makes

the time scales even larger than those for fuel wood oriented schemes. Given this, it is essential to design systems of implementation that are capable of quickly responding to changing circumstances of the populations concerned and/or changing technologies. It is the present author's belief that a franchising system holds the greatest promise in this regard. A discussion on this issue follows in the next section.

Preliminary steps

We shall sketch in this section some preliminary steps that need to be taken before installing the franchising system. In order to get an appreciation for the franchising system, there is a need to understand the costing of a product and its relation to rural problems.

In general the cost of a product is composed of many elements. In many rural technology evaluations it is faultily assumed that labour and materials are the only two components of the cost. In fact they represent at most a third of the cost. The engineering involved in bringing a product to the manufacturing stage and marketing of the product contribute to the cost. When a product is quite complex, one usually has to account for maintenance costs. Then there is the cost of training. In an advanced economy this and many other services are paid for in the form of a variety of taxes. In an underdeveloped economy, the training item can be quite substantial. Finally, there is the cost of the management. There are two ways of reducing the cost of a product. One is by making large number of a standardized product or by diversifying the product range.

At least to this author, it appears that much of the rhetoric behind "development science" with its slogan of basic needs strategy seems to ignore this point. The rural economies in developing countries are such that the mass produced product, however essential it may be, will not be bought in sufficient numbers simply because of inadequate purchasing power. Thus the mass production unit can not hope to become economical in these circumstances. Thus if an industrial system has to become economical, it has to first create the appropriate climate of purchasing power among the rural population. This can only happen by locating the industrial unit in the village proper. The market in such a case will perforce be small. In addition the productivity of the labour has to increase. Two difficulties arise with the application of these considerations. Firstly, a certain amount of outside technical inputs are necessary and secondly, some marketing outlet is necessary for the excess produce. This is where the franchising company concept is a powerful tool.

The franchising company can be conceived to service a large number of independent village units manufacturing a single product. Because we demand productivity increase and because of geographical constraints (the communication problem of a very widely spread out system can become a limitation), it is wiser for the franchising company to work with a diversified product range. We shall apply these concepts to the forestry problem considered in this essay.

The franchising company in this first place has to operate seed banks and nurseries to service a larger number of franchisees. It has to replace the presently used harvesting tools with more efficient ones (not necessarily power driven). It should suggest methods of postharvest processing of wood mainly drying and cutting into small pieces. The latter job is relatively simple if sticks are raised instead of big logs (as will be the case with conventional forestry practice).

Next, the entrepreneur has to have a surplus from his production system. This surplus can not be generated through bringing more land under forestry because of land scarcity. An important way of generating this surplus is by introducing improved wood stoves. The franchising company can set up again small entrepreneurs in a few places to manufacture these stoves. The forestry franchisees could be used as a sales outlet for the stoves. The employees of the entrepreneur would be potential customers for the stoves. Some form of hire-purchase scheme would probably push the sales of stoves. The franchising company should be responsible for arranging this.

The franchising company has to buy back certain produce from the forestry entrepreneur. The entrepreneur should be made to clearly understand that he should sell part of the produce in the village concerned. The franchising company has to shoulder the responsibility of disposing of the excess produce. One way to do this is convert wood to charcoal, which again could be franchised out.

As can be seen from the above, the franchising company has three products from the start, wood, stoves and charcoal. With time the company could convert itself into a full-fledged rural energy utility company dealing in a diversity of products like:

- wood;

- stoves;

- charcoal:

- charcoal kilns coupled with brick . kilns, dryers (for coffee, tea, tobacco etc.) using the so-called co-generation concept;

- producer gas plants for water pumping, flour milling, running decentralized electricity stations; etc., etc.

Some of these technologies are understood in principle and require much more development work. The company should be on the constant look out for the results of such work.

The franchising company visualized like this is of sufficient size to afford to do a certain amount of engineering work. Managerial and marketing talent could be attracted to work with such a company rather than with a small entrepreneur.

In conclusion, an attempt is made in this essay, to construct an alternative organizational system to carry out forestry and energy projects as one specially suited to rural areas in developing countries.

The First Aymara -Spanish Dictionary

The GTZ project "Bilingual Education at the Elementary Schools in the Peruvian Highlands" has now taken a further step forwards. After several years of socio-linguistic field research as part of the project a dictionary has been produced in the Indian language Aymara. It is called the "Diccionario Aymara Castellano/Arunakan Liwri Aymara - Kastillanu".

With this dictionary the Peruvian variant of Aymara has been recorded for the first time in the history of modern Peru. The Aymaras are the second largest Indio ethnic group in Peru. They live mainly around Lake Titicaca in the Department of Puno.

This project has been in the hands of the GTZ since 1977. The agency provides four consultants who work in bilingual education together with local staff from the Pedagogical Institute of the Peruvian Ministry of Education. Their job is to investigate the mother tongue and culture of school-age children in the Quechua and Aymara areas. The aim of these investigations is to produce and try out teaching materials that are linguistically and culturally adapted to local conditions. The main subjects are Quechua, Aymara, Spanish as a foreign language, arithmetic, general studies and social studies.

The aim of educating the Indio population in their own language and culture, at the same time cautiously and systematically introducing them to the foreign national language and culture, is to enable the individual to keep and to strengthen his own sense of identity.

Second Meeting of Documentalists of SATIS Northern Members

Between 8th and 11th October 1985 the second meeting of documentalists of the Northern members of SATIS took place at GATE in Eschborn. Those who took part were representatives of TOOL (Netherlands), GRET (France), SKAT (Switzerland), A.T.I. (USA) as well as a representative of the SATIS Secretariat (Netherlands).

Apart from the general exchange of experience and discussion about questions of classification and documentation, the participants attended the Frankfurt Book Fair, which was being held at the same time, in order to form an idea as to whether the Fair is a suitable forum for SATIS and its members for disseminating the publications that it produces.

The results of the talks were summarized in recommendations that were submitted to the SATIS General Assembly, which was held at the beginning of December 1985 in New Delhi, India. ~

1st Argentinian Seminar on AT

From 11th-13th April 1986 a seminar on appropriate technology will take place in Buenos Aires, Argentina. The seminar will be organized by the Centro de Estudios sobre Tecnologias Apropiadas de la Argentina (CETAAR), which is a non-governmental organization consisting of several occupational groups.

Two of the topics of the seminar are the dissemination of the AT philosophy in Argentina and the Argentinian experience in the field of appropriate technology.

For further information please contact:

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Argentina.

Documentation

Making the Network Links Closer

Report on the DSE/GATE Conference in Berlin

by Renate Wilke-Launer

A letter from Central America for GATE's Question-and-Answer Service - the person in charge of these matters in Eschborn sent it back over the Atlantic to be dealt with at the Centro Mesoamericano sobre Technologia Apropiada (CEMAT), the GATE partner in Guatemala. "The people who wrote the letter," says Armando Caceres of CEMAT, "didn't know about us beforehand. But now that the Germans have told them that we exist and that we work well, they are pleased to accept our advice. In the meantime, we have been working together successfully for some time."

Using this example Armando Cáceres describes the cooperation partnership between GATE and at present 15 groups in developing countries. This represents an attempt to leave the one-way-street of technological information transfer. In order to exchange previous experience, to make future links even closer and to make the network links even tighter GATE had, in collaboration with the German Foundation for International Development, invited its partners to Berlin. GATE staff members, representatives of their project partners and other guests experienced in the field of AT discussed "Cooperation in the Field of Information and Documentation relating to Appropriate Technology",

which was the topic of the conference.

There are many aspects to AT

Appropriate technology- as little as 10 years ago still dismissed as the creation of inexperienced crackpots-is today accepted throughout the world. Everyone wants it. Institutions to develop and test it are being established, the donor agencies of the developed world are willing to finance AT programmes. However, appropriate technology is not always understood properly. It is not a question of a bit of simple or consciously simplified technology for under-developed people and societies, but a comprehensive attempt at achieving development. Everyone was agreed on that at the Villa Borsig in Berlin, where the conference was held. The development of an easily produced and easily used device does not in itself result in development; it may even have a negative impact on it.

As appropriate technology can only be developed on the spot on the basis of a specific situation, it was not defined in detail at the beginning of the conference. During the course of the discussion it was defined again and again in ever new ways:

• as a holistic attempt to achieve development in order to solve problems with and through the people concerned,

• as the "religion" or "commitment" determining the course of development of people's own work and not the propagation of any particular type of equipment,

• as the attitude towards solving existing and articulated problems,

• as the common endeavours of a community,

• as the technology of liberation.

However different the approach in each case may be, the philosophy of self-determined and self-designed development underlying all these endeavours was shared by all the participants at the conference. Ideas and experience were exchanged and accepted on the basis of the particular context in question, in the knowledge that they are not valid and applicable everywhere. That is why each of the following generalizations requires a local interpretation.

Although development aid planners and administrators in the donor countries and their partners in the Third World use the same words, they nevertheless frequently speak a different language. This begins with the technical-administrative definition of the target group, at present "the poorest of the poor". A number of quantifiable indicators provide information-at the planning table - about who is poor. But the project partners on the spot understand poverty in a more comprehensive, society-related way. They speak of the favoured and the disadvantaged, both of people who are suffering from hunger and those who have lost hope, those who have been disappointed and betrayed by their leaders, of people who are not only poor but also deprived and oppressed. In order to work together with them to improve their living conditions, what is required is not a research report as incorporated in the donor's planning, but a needs assessment on the basis of a practical malady-remedy analysis.

And because it is still not a matter of course, it was emphasized once again at this conference and included in the written recommendations: Women must be taken into consideration at all stages and on all levels of the project. Many projects still fall because this principle is disregarded.

GATE as an intermediary

It is of decisive importance for the success of the project - and this point was included in the seminar recommendations, too - that the recipient community must be organized. This reflects the experience

of the GATE partners that if communities are not organized and do not possess mechanisms for participatory decision-making and the ability to identify and analyse their problems, it is difficult to respond to the genuine needs and aspirations of the communities. The processing of the flow of information can be done better by organized communities. They can also assume greater collective responsibility, and provide checks and balances in the launching, installation, operation and maintenance of projects.

It is the task of GATE's partners to be intermediaries between these organized communities and the donor agencies. They have the central role of acting locally and at the same time of thinking globally. They are responsible for procuring and disseminating information, and also arrange for the council of experts. Calling in preferably local consultants is necessary at certain points. However, what is required are not experts in appropriate technology, but experts in a particular subject who are in a position to apply appropriate technologies. In order to avoid the setbacks resulting from purely technical solutions, the proposals for solutions must be developed and tried out in their social, political and environmental context. A kind of "barefoot" expert is required: neither volunteers who have enthusiasm but lack professionalism nor experts who may be more professional but lack motivation or the perspective of development. One of the participants, Prem Bhai from the Agrindus Institute in India, illustrated this problem with an example: Whilst the electrical engineers spent hours looking through their wiring diagrams trying to trace a fault, the electricians had already smelt out where the fault was and had begun to put it right.

As a rule the intermediary role can only be taken over by non-governmental organizations (NGOs), as the objectives of the projects - social justice and participation - could well result in conflicts with the authorities. However, this does not mean that working together with the government agencies is not possible or meaningful. In some countries the NGOs have been able to occupy and make use of free spaces in the socio-political context. "We must cooperate where we can and resist where we must," was the way Prem Bhai described this selective collaboration.

AT groups cannot be politically neutral. They do not merely aim to help develop the "gaps" and to put right the mistakes of others which, for instance, have come about as a result of large-scale projects. Their work aims much more to be an appropriate reorientation of the entire development process.

Self-reliance is also an objective to be aimed at in the work of these intermediaries. Although they do not understand their work as a charity provided free of charge and try to bring about self-reliant processes of development, in the foreseeable future this cannot be achieved without financing from other agencies. The endeavour, however, is to achieve a diversification of the sources of aid. Furthermore, the NGOs are encouraged in the conference recommendations "to look for additional funds from other sources which are suited to their own conditions, e. 9. generating funds through the commercialization of products, the selling of expertise, and negotiating subsidies or contracts from government agencies. It should be noted, however, that commercialization results in certain problems related to conflicting objectives and attitudes to work, and experience suggests that commercial projects should be organized separately from other development work."

When calculating the projects one must take into account the fact that the calculations for cost effectiveness must be adapted to the project: "A cost-benefit analysis of programmes and projects relating to basic needs and services may not be easily quantifiable in terms of cash flow, income or profits. For example, it may not be easy to present the provision of water pumps to supply the drinking needs of a community in a cash balance-sheet."

Specific ideas

Apart from these considerations of a more fundamental nature, recommendations based on the practical experience of the cooperation partnership were also formulated in Berlin. Thus, the aim

should be to reduce the work involved in management of the project, for example in the statement of accounts. Instead of this, GATE should take a more active part in the projects. "GATE staff and the staff of other donor agencies should have a closer look at the local environment not only for the purpose of evaluation, but also in order to be able to understand better the social mechanics operational in the areas covered, as well as such factors as the environment, the topography and the level of life of the communities. The aim is not only to achieve better and more objective evaluation, but also to be able to communicate to others within their institution or agency their personal experience of the process."

It would also be possible to encourage a more intensive discussion about feedback for the project reports of the GATE partners. As far as financial support is concerned, the recommendations are in favour of increasing the funds for GATE. "GATE should have more funds in order to increase the rate and quality of technology transfer, but too much money in any one project may stifle thought and initiative. The allocation of resources should be assisted by an advisory board which includes cooperation partners. A grouping of smaller potentially valuable projects could result in administrative economies and facilitate worthwhile local initiatives." Such a strategy would not only encourage cooperation and the formation of networks within the various countries, it would also help to decentralize the structures of decision-making and also reduce the problem of "low absorptive capacity", which is so often deplored by the donors. In addition to this, GATE should assist its partners in finding further sources of funds and through public relations work in the media (publishing reports on successful projects, AT Award) endeavouring further to disseminate the idea of Appropriate Technology and to make it a recognized discipline.

Although AT work is local, listening to the people, living and learning with them, it needs at the same time a national, regional and international exchange of information, ideas and networking. This is not an asset in itself, but should be field- and action-oriented. So there is a fundamental difference between a "normal" documentalist and one involved in AT. A working group at the conference described the task of an AT worker as follows: "Besides the normal activities of an information worker, the AT information manager has to consult the potential users direct, he has to translate information into a language that users can understand and has to feed back information, including that gained in his own field-work, into the international AT info network."

A proposal with specific work assignments (e.g. the development of curricula for the training of AT info managers) is to be discussed at the SATIS (Socially Appropriate Technology International Information Services) meeting in New Delhi in December and then submitted by SATIS to UNESCO, who are to be requested to encourage these activities in the context of their programme.

The national, regional and international networks are to assist the exchange of information between the various groups. Apart from the exchange of information, their purpose is to improve communication between the various organizations, to take over coordination tasks in order to avoid doing work twice, to facilitate the implementation of programmes and to help strengthen the AT movement by means of lobbying.

In order to make the network links even closer, the objective - of GATE, too- is to promote programmes of face-to-face interaction (both South-South and North-South) and the exchange of experts between the various groups.

In his article on "Networking" Paul Osborn from Satis attempted to remove the veils from the bureaucratic vocabulary (cf. "gate" 3/85). This is also necessary and meaningful for the other aspect of NGO work - their local activities. A saying from Papua New-Guinea which was quoted during this week of intensive and fruitful exchange of information sums up this part of the discussion:

Go in search of your people,

love them,

learn from them, serve them.

Begin with what they have,

build on what they know.

But of the best leaders,

when their task is accomplished,

the people all remark:

"We have done it ourselves."

Cooperation Partner Programme To Be Extended

Beate Wörner, chief editor of "gate", talked about the results of the Berlin conference to Dr. Peter Baz, Head of Section 211, who is also responsible for the Cooperation Partner Programme.

gate: One of the aims, Dr. Baz, was to obtain an impression of the value of AT solutions to problems within the framework of Technical Cooperation at the present time and, more importantly, in the future. Have you now achieved this aim?

Dr. Baz: I believe that one especially important result of this conference is that the so-called "Hardware Approach", that is to say the employment and supply of machines and equipment is no longer in the foreground. The main objective now is to work out suggestions for AT solutions and to treat the equipment and machines merely as a means to solve the problem concerned within the framework of the suggested solutions. Recently, in particular, the only possible course of action for developing countries has been to look for such AT solutions to their problems, especially in view of the already existing high rate of foreign indebtedness in these countries.

gate: Are you now quite certain of how to proceed, of how to go about solving such problems, or are you still sounding out other possible solution methods?

Dr. Baz: I think that the most important thing at the moment is to make a start disseminating AT solutions of this kind on as decentralized a basis as possible in a large number of places. And the best way to do this is to put on-the-spot organizations in a position to work out such AT solutions on the spot with our support via so-called mediatory organizations or our cooperation partners. This would, at the same time, also mean that thousands of projects or small embryo projects could be run simultaneously in all developing countries.

gate: Dr. Baz, you have just mentioned the key word: cooperation partners. At the Berlin conference you succeeded in gathering all the partner organizations with which you cooperate around the same table. You managed to get them to talk things over among themselves. But what you didn't quite manage to do was to get the representatives of the German institutions which are also active in this field to sit down at the same table. Could this be interpreted as a sign of disinterest on the pea of the German institutions?

Dr. Baz: I don't think it is disinterest but simply the fact that we over here in Germany cannot offer that AT solutions which are necessary to developing countries, that the techniques and processes needed are not available here in Germany. The kind of so-called High-Tech solutions that will be found here in Germany simply cannot be transferred to, let alone financed by or applied in

developing countries. These solutions can only be applied if enough experts, a well-developed infrastructure and the corresponding markets are available. In most developing countries, these three parameters do not exist in the forms necessary for such solutions, and this is probably the reason why few companies, institutions and groups were interested in this conference

gate: One question, Dr. Baz, which people are bound to ask after this meeting in Berlin is what are the next concrete steps to take? Do you wish to continue this type of fairly comprehensive dialogue? Have you given this any thought?

Dr. Baz: During discussions with our partners in Berlin it became abundantly clear that linking up these individual groups into networks is extremely important So the transfer of knowledge between developing countries, too, is a decisive parameter in the improvement of the situation, i. e. towards improving methods of finding solutions to problems. This applies not only to the international but also to the regional plane, which means that the meetings need not always be international - they can be African, Asian or Latin American meetings. We do, however, feel that a meeting with all our partners should also take place approximately every two years.

gate: Dr. Baz, you've already briefly mentioned that the existing problems can only really be solved if even more partners are brought in to cooperate. Does this mean, as far as GATE's work is concerned, that you are trying to extend the number of partnerships you have already established?

Dr. Baz: Over the past five years we have discovered that this is a very efficient way to produce highly-effective problem solutions at relatively low cost. At the present time we are trying to expand this cooperation partner programme from the present 15 to a future 100 cooperation partners, as this is the only possibility to tackle the existing problems in a more extensive and comprehensive way.

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First GATE Film

By documenting one project in detail, this 35-minute film shows how Appropriate Technology simplifies the lives of the women in a village in Mali. It presents the production of shea-butter. GATE has copies of^this film in German, English, French and Spanish. The original German title of the film translates as "The Butter Tree of Zambougou".

A slide show and a publication on the same topic are in preparation.

"We Are Using Very Small Stones. . ."

Cooperation with Governmental and/or Non-governmental Organizations

by Hannah Schreckenbach

It has been known for quite some time that a large number of technical cooperation projects - those that normally result from bilateral consultations and negotiations between the governments of developing countries on the one hand and the governments of donor nations on the other hand - are based on concepts which, when implemented, very often do not reach the large group of rural and urban poor for whom the aid is meant in the first place, if we are to believe the development aid policies which have been formulated by the various donor countries and which are meant to guide the allocation of aid funds.

Apart from this, one also has to look at the kind of "development" which was the aim of many developing countries after they gained their independence, especially those countries which embarked upon industrialization with a high growth rate. The result of this development in many countries (e.g. Nigeria, Ghana, Brazil) was an uneven growth in terms of their internal society with a widening gap between the towns (which represent economic enclaves, elite thinking and where the planning and decision-making takes place) and the rural areas, and within the towns themselves (e. 9. the squatter settlements, slums, shanty towns, favelas of Nairobi, Lagos, Bombay, Rio de Janeiro, Sao Paulo, etc.). This uneven growth is "reflected by the wretchedness and misery of a large proportion of the Third World population compared with the prosperity of isolated sectors" (Samir Amin, Economist, Director of the Strategies for the Future of Afrika programme UNITAC, Dakar, Senegal).

Cooperation with governmental organization in developing countries means for us a long, tedious way of consultations, negotiations and exchanges of notes, before an agreement is signed for the implementation of a programme or project.

When negotiating aid programmes or projects the governments of developing countries normally undertake to contribute towards the implementation of the project by providing the necessary physical infrastructure or part of it (site or buildings, electricity, water, telephones, personnel, etc.) and budgeting for recurrent expenditures, that means the provision of funds for administrative

overheads, etc. Since many developing countries, especially in Africa, entered a phase of prolonged crisis at the beginning of the 1970's (even before the 1973 oil crisis), our GO partners could very often not, or only to a very limited extent, fulfill their commitments according to the bilateral agreements. Therefore, a considerable number of projects were never completed, i.e. the partner has never taken full responsibility for the management and running of the projects including the provision of the necessary funds for all expenditures. The benefit of some projects turned out to be very limited and, in certain cases, their upkeep was a continuous drain on external aid funds.

In addition, a number of critics point out that development assistance in cooperation with governmental organizations more often than not results in financing an undemocratic government against local populations in "a latter-day equivalent of the slave trade" (Patricia Adams and Larry Solomon: In the Name of Progress; Double-day/Energy Probe 1985, Toronto, Canada).

GATE has, since the beginning of its establishment as a division of the Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ), worked together with non-governmental organizations in developing countries. The concept of our cooperation with partner organizations (AT groups, self-help groups, cooperatives, etc.) is part of the Question-and-Answer Service project of GATE. We are using very small stones to build a structure upon the fact that our target groups (the rural and urban poor) can be motivated to participate in the development process. Our NGO partners are taking up the role of a necessary link with the target groups in order to raise their productive capacities through self-help. In this context it is interesting to note that our concept is also accepted by our own government:

"External aid can only really be effective in the long run when it helps to advance this self-help process" (statement by the Federal German Ministry of Economic Cooperation, April 1985).

Only in some cases have GOs of developing countries reacted negatively to our initiative to assist NGOs.

In such instances a cooperation with parastatal organizations may be the answer. In many countries self-help initiatives (women's clubs, cooperatives, farmers associations, etc.) are not only tolerated but actively assisted by governmental organizations. These GOs have realized the importance of involving their people in the planning and decision-making process and of improving the productivity of the people as a basis for self-sustaining economic growth.

The effectiveness of technical and development cooperation can in our opinion only be reached through an increased cooperation with NGOs. There are a number of reasons for this:

• the development involves those who are to benefit from it, it considers their priorities and needs;

• the scale of projects implemented to meet the needs of the target groups is consistent with the availability of their own resources;

• NGOs are the instrument for promoting self-help and as such can guarantee the participation of the target groups in the development process.

A self-help group of women in Zimbabwe making bricks for building latrines.

Changes in Development Policy

In the Sixties and even at the beginning of the Seventies people assumed that growth resulted in development, and so development policy was also based on this assumption. It is an idea that has proved to be false. The Parliamentary Secretary of State for the Federal Minister for Economic Cooperation, Volkmar Köhler, pointed out this trend In "Europa-Archiv" No. 16/1985, before he went into the details of the reorientation and the new proposals for solutions which have developed from this change of approach.

The main features of this reorientation are, according to Köhler, the trend towards projects in agriculture, the health services and education, the political dialogue with the partner countries of the Third World the result of which helps to determine the extent and the programme of the development cooperation. A further feature is that self-help activities and initiatives by the target groups themselves are being encouraged to a greater degree than previously and that the social and cultural conditions of the development country in question are being taken into consideration to a greater extent in the planning and implementation of projects, and that the schemes are being checked for their environmental compatibility.

As Köhler further pointed out, a process of rethinking is necessary in the industrialized and developing countries in order to increase the effectivity of the development aid. For example, the industrialized countries would have to think more intensively about how to prevent their subsidized agricultural surpluses from ousting the rival products of the developing countries from markets in third countries.

The developing countries, for their part, had to realize that, after the period of "nation-building", it was now time to try to bring about the participation of broad classes of the population in the economic and social progress at the cost of the privileged elite, in order to initiate self-reliant development. In the middle of the Eighties one of the main tasks of development policy, cooperation, in Köhler's opinion, is to improve the policy of dialogue.

A self-help group of women in Zimbabwe making bricks for building latrines.

Drawing: Hannah Schreckenbach

Visiting card

Figure

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The German Foundation for International Development was founded in 1959 and charged with the task of fostering relations between the Federal Republic of Germany and other countries on the basis of a mutual exchange of views and experiences in the field of development policy. DSE discharges this statutory function within the framework of Federal German technical assistance aimed at supporting the economic, social, and cultural advancement of developing countries in Africa, Asia, and Latin America.

Over 25 years now, DSE has been conducting programme events in collaboration with national and international partner organizations at home and abroad enabling managerial personnel and specialists from over 100 countries of the Third World to engage in an exchange of views and experiences on problems and aspects of international development or undergo advanced training relevant to their profession.

DSE programme events take the following form:

• conferences, meetings, seminars, symposia, expert consultations, etc. usually of short duration, promoting an exchange of experiences at national and international level;

• training courses for specialists and above all managerial personnel of Third World countries;

• colloquia for German experts who are actively engaged in the field of development policy in one form or another.

Many DSE programme events are linked to bilateral and multilateral development projects, thus facilitating the realization at actual project level of recommendations elaborated at these events. DSE selects the priority areas of its activities on the basis of international coordination.

In accordance with the development concept of the German Federal Government, the areas of priority in DSE's work programme are as follows: improving the planning and organization capability of developing countries in the fields of administration, business and industry, and education; combating unemployment and underemployment; improving the infrastructure in rural areas; promoting the development of work- and environment-oriented education systems; and expanding and diversifying the industrial sector.

DSE coordinates the invitation procedure for its programme events with the governments of its partner countries and with other participating partner organizations at home and abroad.

DSE is an institution under civil law. The Executive Office, the Central Administration, and two programme centres are located in Berlin (West). Four further programme centres are located in Bonn, Bad Honnef, Mannheim, and Feldafing near Munich.

DSE is financed primarily out of Federal Government funds. A number of federal states (in particular Berlin, Baden-Württemberg, Bavaria, and North Rhine-Westphalia) also provide financial support for DSE programme events. DSE is headed by a Board of Trustees composed of representatives of federal ministries and governments of the federal states, management and labour, and political and academic life. The Board of Trustees establishes the guidelines governing DSE activities. The Director General and the Deputy Director General conduct the business of DSE. The interests of DSE in the Bonn area, including contact with ministries, embassies, associations, and organizations, are represented by the Bonn Office. This office also carries responsibility for the DSE magazine "Entwicklung und Zusammenarbeit" and for its English, Spanish, and French editions (D + C).

News from Bonn

Scientific and Technological Cooperation Development Policy

New Technology for the Third World

In the opinion of Dr. Heinz Riesenhuber, the Federal Minister for Research, the use of modern science and technology is absolutely essential to the developing countries in their struggle against - famine and poverty. The best way of making the new technologies accessible to the countries of the Third World was close cooperation and partnership in research and technology.

Cooperation in joint projects by scientists, technicians and entrepreneurs resulted in the training of qualified staff and in their acquiring the knowledge and skills that were required to master new technologies and processes. This was stated by the Federal Minister for Research when recently he explained his conception of the promotion of research and technology for the Third World to representatives of the press.

Aims of the cooperation

For several years the scientific and technological cooperation with developing and in particular with threshold countries has been on the increase. In the last few years the expenditure of the Federal Ministry for Research and Technology for this form of cooperation was more than DM 100 million in

each case. This aid is to be further increased and extended in the context of the new overall conception.

The aim of scientific and technological cooperation with the countries of the Third World is to work out solutions together for solving the problems of the Third World; at the same time to transfer scientific and technical experience and abilities as a means of increasing the development capacities of our partner countries; and thus of creating opportunities for working together with German institutes and firms.

The fields of cooperation range from basic research by way of application-related research and development to field testing in conditions that are close to those found in practice.

Above all, they are characterized by:

• the development of new technologies for use in developing countries. For example, it is a question of methods of production that are environmentally acceptable and that save raw materials.

• the adaptation of existing technologies to the conditions in developing countries. Thus, for instance, solar-operated pumping and refrigerating units are adapted to the operating and maintenance conditions of the Third World.

• the demonstration and trying out of new technologies.

• the exchange of experience and scientists, and training programmes in the context of the project cooperation.

• participation in multilateral activieties, in the North-South dialogue and in the international exchange of experience, for example, by means of international projects, seminars and conferences.

The focal points of the cooperation are:

Environmental research

In the field of environmental research and technology the main emphasis is on the development and adaptation of low-emission technologies for use in the Third World. In cooperation with Egypt an environmentally benign and energy-saving method of manufacturing paper and cellulose from rice straw is being developed which is said to be more economical than the environmentally harmful methods currently in use. In a further project a low-waste galvanizing process developed with BMFT (Federal Ministry for Research and Technology) aid for medium-sized firms is being adapted to the climatic and production-technology conditions in developing countries and tested in a demonstration plant.

In ecological research the emphasis will be on the conservation of ecological systems (e. 9. tropical rain forest, savanna) and of sand usage systems, the investigation of demands on soil and erosion as well as research into suitable big-indicators for the Third World.

Energy research

Energy research and technology range from the fossile and renewable sources of energy to nuclear energy. So far, the emphasis has been on the decentralized supply of energy to rural areas. Examples of cooperation here are the supply of drinking water by means of photovoltaically operated pumps, the irrigation of rice-fields with the help of a wood-consuming gasifier in Indonesia, the supply of solar energy for operating theatre lamps, the refrigeration of medicines and the sterilization of medical equipment in a district hospital in Guinea and the solar drying of raisins in Greece.

In the field of fossile sources of energy the Federal Ministry for Research and Technology is working together with India in the development of pressure-operated fluidized bed firing in order to make use of the coal deposits there. In a German-Chinese project it is a question of the further development and optimization of a mining techniques developed in the Federal Republic (e.g. the freezing shaft technique).

Cooperation in the field of nuclear technology is above all a matter of transferring know-how and training staff. The emphasis here is on safety techniques and quality assurance systems, small reactors and concepts for planning and supplying energy.

Biotechnology

The aim of biotechnological cooperation is to help improve the living conditions in the developing countries in important sectors such as energy, nutrition, agriculture, health and environmental protection. The focal points of the cooperation are: research into and combating tropical diseases (parasitology), obtaining substances for medicines and pesticides from tropical plants, microbial treatment of sewage and waste from raw materials and agricultural processes, cultivating plants and regenerating raw materials, biochemical methods of manufacturing foodstuffs and non-essential foods, the use of biomass to produce energy and process raw materials.

Marine research

In the field of marine research the prerequisites for making use of the resources of the sea are being investigated and in particular the problems of the marine environment are being recorded in collaboration with the coastal countries of the Third World in the context of long-term cooperation. This cooperation concentrates on geo-scientific basic research as a prerequisite for a better understanding of the deposits and climatic development, on marine ecology and environmental protection, on the biology of fishing for carrying out research into and developing new catching techniques and on the investigation of underwater deposits of minerals. In the context of marine technological cooperation a modern freight sailing ship is being developed together with Indonesia for traffic between the islands.

Space research

In space research and technology the emphasis of cooperation is on access to long-range data collection results by means of suitable reception facilities and methods of evaluation as well as on extending and improving communications systems. Fields of application for long-range data collection and satellite communication are charting, estimating crops, forecasting damage and disasters, weather forecasting, observing the environment, prospecting for raw materials as well as the extension and improvement of communications systems for developing rural areas and for the educational television service. At the moment, scientific and technological cooperation is concentrating on the training of experts from partner countries at the German Aerospace Research Establishment, the training of experts and the holding of advanced training seminars together with the German Foundation for International Development and with the United Nations Food and Agriculture Organization, as well as on the evaluation of data provided by satellites.

The business and scientific interest of the German partners is an important propelling force in this cooperation. The development of convincing solutions to problems at one and the same time serves to demonstrate the efficiency of German research and development and improves the conditions for subsequent industrial and financial cooperation.

According to Riesenhuber, the success of the cooperation depends, apart from the quality of the technology, above all on the requirements, ideas and possibilities of the partner countries being taken

into consideration carefully in every individual case. This is guaranteed by working together closely with the Federal Ministry of Economic Cooperation and the agencies active in development policy. These latter have a great deal of experience as the result of many years of cooperation with the partner countries.

By the way, in "gate" we have frequently presented projects that are being carried out in the above context. For example, the solar drying of raisins In Greece (cf. "gate" 4/83), supplying drinking water by means of photovoltaically operated pumps (cf. "gate 2/85) and the supply of solar energy for operating theatre lamps, on which we once again have a report in this issue (see page 52).

Memorandum on German Development Policy

On the occasion of presenting this year's memorandum on German development policy, which is addressed to the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD) In Paris, Volkmar Köhler, the Parliamentary Secretary of State for the Federal Minister for Economic Cooperation, stated that in the dialogue with the developing countries the Federal Government had urged a further improvement of the basic conditions which play a prominent part in development and the effective employment of aid. The Government had therefore increased its endeavours to improve coordination with the recipient countries and with other donors.

The acute state of distress and the economic stagnation in numerous developing countries, particularly in sub-Saharan Africa, but also the successful efforts made in some of these countries and the adaptive policies implemented by them had been a special challenge for German development aid in 1984. The immediate programmes launched in 1984 to combat the current famine in African countries, with a total volume of DM 140 million, had according to Köhler to a large extent been combined with measures for ensuring that the people were able to provide their own food supplies. Short-term measures had been supplemented with structural aid for improving the basis of nutrition.

However, in the long term it would only be possible to increase the production of food by means of improved development of the rural areas and of the infrastructure. Therefore, the Federal Government had raised the percentage of bilateral government promises for promoting rural development from 21 per cent in 1982 to 29 per cent in 1985.

The German development policy was also taking into account the increasing significance of the conservation and protection of the basic natural requirements of life. In all the current projects for development cooperation the impact on the environment was being investigated and steps were being taken to control and eliminate the environmental problems that occurred, Köhler explained. In the meantime, checking environmental compatibility had become a matter of course for new projects.

In the view of the Secretary of State, the absolute poverty in the developing countries could only be combatted lastingly if the people affected had the opportunity to develop their will to help themselves. The Federal Government had therefore encouraged further endeavours to support organizations which promote self-help.

In order to broaden the basis for the development cooperation with the partner countries, the Federal Government had made increased efforts to mobilize medium-sized firms as well as the trades and crafts. The objective of this was to incorporate the private sector of the economy into this cooperation with the Third World in a way that was complementary to public development aid.

According to Köhler, the budget expenditure of the Federal Minister for Economic Cooperation increased in 1984 by 2.5%. This increase in expenditure was linked with trends which were beyond the influence of the Federal Government. Nevertheless, it was just possible to maintain the net amount of the total public development cooperation in 1984 with DM 7,917 billion compared with

DM 8,116 billion in the previous year. Public development cooperation consisted of 0.45 per cent of the gross national product. The Federal Republic of Germany was therefore once again well above the average for all the DAC countries, which is 0.36%.

The next issue of "gate" will be appearing on 17th March 1986. Our "Focus" articles will be looking at environmental problems in Third-World countries.

News from GATE

Rural Crafts and Trades Solar Energy for Hospitals

Promoting Rural Crafts and Trades

by Bernd Schleich.

On 3rd October 1985 a specialist discussion on promoting rural crafts and trades took place at the GTZ headquarters in Eschborn. Responsible for this discussion were GATE and the GTZ Division 17 (Agricultural Engineering, Agroindustries, Technical Equipment Planning). The discussion was planned, prepared and presided over by OEKOTOP GmbH (Berlin).

It should be said in advance that the organizers achieved an important objective merely by holding the workshop: the gathering together of almost ail the specialist departments that promote trades and crafts as part of their specialization within the GTZ. This spectrum ranges from the organizers GATE and Division for Agricultural Engineering via Section 243 (Trades, Small-scale and Medium-scale Industry, Credit System) to the Divisions 12 (Rural Regional Development) and 23 (Vocational Training in Trades).

The OEKOTOP GmbH had provided four speakers who presented their theses on questions of planning.

Integrated promotion of the crafts and trades

First, Dr. Wolfgang Schneider-Barthold (German Institute for Development Policy) developed a model for integrated promotion of the crafts and trades. His central thesis was that one should never promote the trades in isolation, only together with the surrounding factors. This guarantees that promotion is not provided unrelated to the demand and that a general increase in the purchasing power also results in an increased demand for the products of the trades and handicrafts. Dr. Schneider-Barthold named the following as the primary objectives in the promotion of rural trades:

a) the provision of the rural population with goods for their basic requirements and with the means of production, and

b) the creation of jobs and income.

"The promotion of the trades in the sense outlined here is not an isolated discipline. It is part of a comprehensive, integrated development that affects the entire life and work of the target group." (Dr. Schneider-Barthold)

Starting-point: self-help groups

Professor Dr. H.-D. Seibel from the Research Centre for Developing Countries at the University of Cologne then presented his proposals for promoting the trades by means of self-help organizations run by the rural population of developing countries. To him, promotion does not start at the immediate village level and, if at all possible, with the individual craftsman, but with their indigenous

self-help groups which, as a rule, are only found in small rural towns. The most frequently occurring self-help organizations are what may be described as guilds and informal financing institutions (savings and credit cooperatives). According to Professor Dr. Seibel the promotion of rural guilds should be carried out on two levels:

a) the promotion of town guilds in central rural towns, and

b) the affiliation of village craftsmen to town guilds.

Informal financing institutions should be promoted by linking them wherever possible to formal ones (banks) and in this way, for example, increasing the volume of their loans, bringing the sometimes astronomical interest rates down to the national rate and improving the faulty management of finances in general.

The role of women

In her talk on the role of women in the promotion of rural trades, Dr. Ilse Schimpf-Herken (World Peace Service, Berlin) pointed out that every form of expanded production means an additional burden for women.

Even now, women are reaching the limits of their working capacity by carrying out the numerous tasks they already do. The speaker distinguished between ecological and economical causes resulting in additional burdens on women in the Third World. Under the heading ecological causes she subsumed the numerous everyday jobs done by rural women, ranging from looking after children by way of housekeeping to production work in trades and agriculture. The additional economic burden is due to the increase in export cultures. This results in both a greater intensity of work and also a lengthening of the working day. Because the women are forced to resort to distant locations for growing the food they require themselves, it remains dubious - according to Dr. Schimpf-Herken - whether it is in the interests of women to take into account the savings in working time thus gained in trade production. "If there is only a superficial knowledge of the social, cultural and sex-specific conditions, there is a great danger with short-term and inflexible development schemes that the intended promotion of trades and crafts will be directed against the interests of women."

Vocational training

The talks on conceptional questions were concluded with a lecture by the sociologist Bernd Schleich (OEKOTOP GmbH, Berlin) who dealt with the subject of occupational-oriented training projects within the framework of integrated promotion of trades and crafts. Schleich said that vocational training aimed to meet the demand for qualified workers in industry, above all because it was oriented towards advanced technology. The need of trade establishments for workers who were keen on innovation and improvisation and who used their knowledge in the production or repair of goods required to meet the basic needs of the poor masses were to an increasing extent disappearing from the curricula of the vocational training centres in the Third World. Vocational training for the rural trades and crafts should not be oriented towards rigidly defined occupations, but towards flexible and dynamic fields of activity clearly understandable in the context of the trainee's surroundings. It was also urgently necessary to integrate the teaching of commercial and business skills into the training. This would be the only way of ensuring that livelihoods would be created by self-employed craftsmen, as desired, or that trade collectives would be established on a sound basis. The migration of qualified workers from the rural areas to the towns would be prevented. Other promotion measures for rural trades and crafts could thus be assured on the basis of properly qualified workers.

After the talks, the organizers presented examples of GTZ projects for the promotion of rural crafts and trades. In the constructive discussion that followed, which consisted mainly of an exchange of experience, it became clear that in spite of the large amount of positive experience in the field of the

promotion of rural trades which the GTZ can now fall back on, there is still a need to continue this process of discussion. Therefore it was agreed to form a working group for "Promotion of Rural Crafts and Trades". It will be the task of this group to conduct the discussion in such a way that the conceptional considerations and technical experience result in a policy paper on the promotion of rural trades.

Solar Energy for District Hospitals

by Walter Jahn

Electrical power supply has always been a problem in Kissidougou, a district town in Guinea, 600 km east of Conakry. At most, there is power for a few hours in the evening. The fuel supply for diesel generators is also unreliable, apart from the maintenance problems for such generators. Thus the district hospital with 150 beds had to be run almost entirely without any power supply.

During 1984 the hospital was furnished with solar-powered equipment which was considered essential for the hospital. A photovoltaic solar generator with a maximum power output of 770 Watts supplies energy for two operating theatre lamps, one refrigerator (45 litres) and twelve fluorescent lamps of 20 Watts each. A sufficient battery capacity of 350 Ah permits the system to work continuously day and night. It has an emergency. storage unit for 48 hours should there not be enough sunlight for two consecutive days. This photovoltaic system including the equipment costs approximately DM 43,000 (approx. US$ 16,500).

Instrument and dressing sterilizers are essential equipment for the operation unit. For this purpose a solar steam sterilizer (autoclave) was designed using solar vacuum tubes for steam generation. The design is unique and a first prototype was built for the hospital. A solar hot-air instrument sterilizer has also been designed and a prototype built to be tested at the hospital.

This equipment for the Kissidougou hospital and its test run is part of a project which is analysing the energy requirements for hospitals at isolated locations in developing countries and which is looking for ways to use renewable energy sources. A full description of the project was given in "gate" No. 3/83 including some technical details on the newly-developed equipment.

In May 1985 we made a first summary of the experience gained in Kissidougou.

The photovoltaic power generation for light, operating theatre lamps and a refrigerator showed very satisfactory results and the system now ensures a 24-hours' power supply for the operation unit at the hospital. The special low-powered bulbs for the operating theatre lamp with 3 x 15 Watts proved sufficient in lighting strength.

The solar-powered autoclave with high-performance vacuum collectors is regularely used. A kerosene burner can be used should there not be enough sunlight. There is, however, still room for improvement. The distiller which provides the feed water is not efficient and operating the autoclave with several levers requires some experience. These deficiencies resulted in improvements which will be incorporated into the second prototype.

The hot-air sterilizer prototype went through several test runs and reached a temperature of 160°C under good sunlight conditions. The minimum sterlizing temperature should be 140°C. Except for minor improvements necessary for the handling of the sterilizer, the design can be recommended for use. The design is suitable for local manufacturing.

Summary

The overall aim of the project is to provide detailed information for hospital operators and planners

on how to save energy and, where appropriate, how to use renewable energy. This can then be followed by specific programmes and campaigns to implement and disseminate project results and recommendations.

The results of the first part of the project were presented in a study (in German) published in June 1983. This contains an analysis of the energy requirements for hospitals (based on a survey of hospitals in developing countries), a market survey on medical technology and technologies for utilizing renewable energy and identification of new products to be developed in the future.

The aim of the second part of the project was to close the existing gaps by developing solar-powered sterilizers and operating theatre lamps and by concluding an on-site test run.

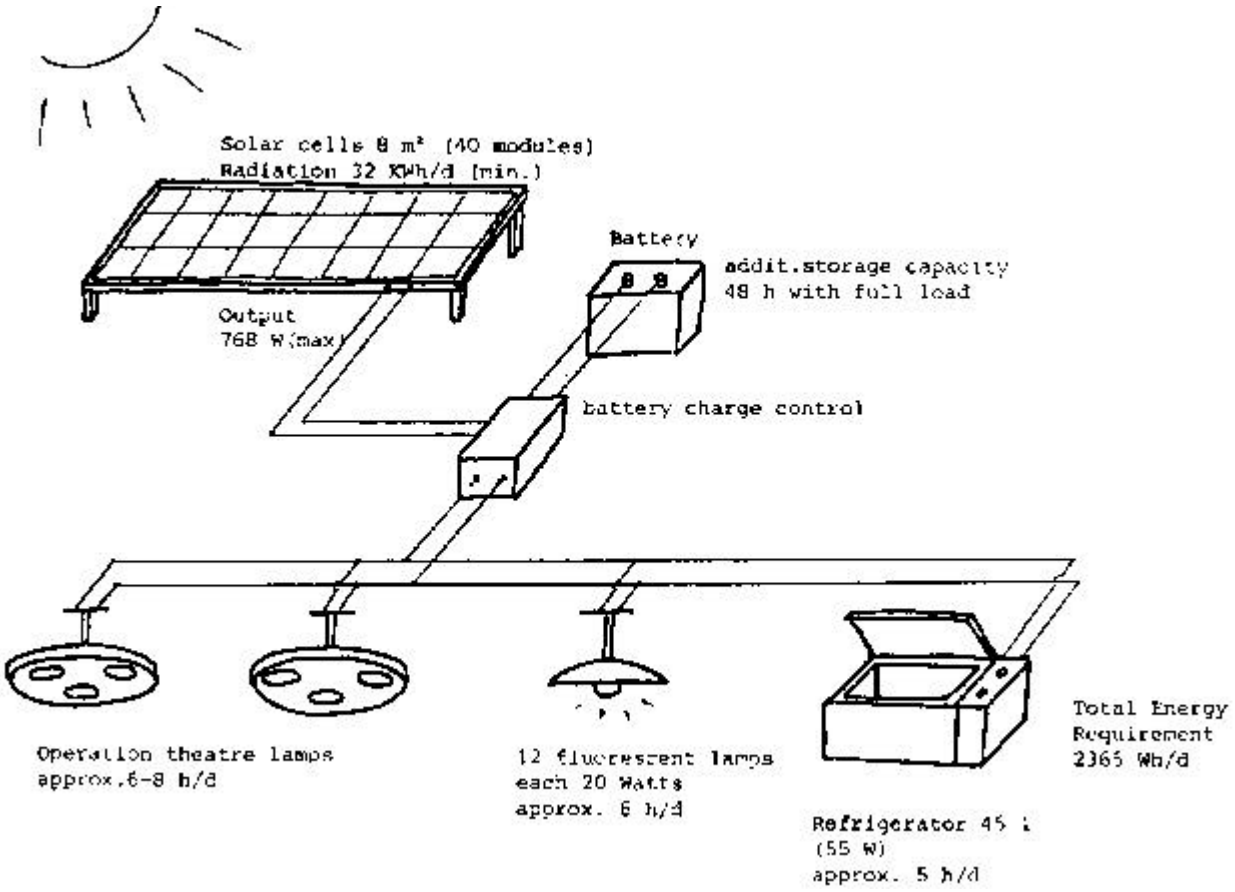
To complete this research project the following steps will be taken:

• Publication of results obtained so far.

• Construction of improved solar autoclaves to be installed and tested in hospitals.

• Analysis of the energy requirements and drafting of a comprehensive plan for several sample hospitals, and furnishing them with the appropriate equipment.

• Publishing of a manual for hospital operators and planners.



Solar Photovoltaic System for Kissidougou Hospital/Guinea

Information Wanted

Natural Pesticides - a Potential Alternative to Chemical Pesticides?

Most of the readers of our quarterly "gate" are - we are quite sure - aware of the high risks and the dangerous side-effects accompanying the ever increasing application of chemical pesticides.

Since the problem was recognized by the experts, many research programmes have been going on in order to reduce the quantities of the dangerous chemical pesticides. For example, the ultra-low-volume spraying technique helps to reduce the quantities applied, a properly managed pest-monitoring system makes it possible to replace automatic, "blind" application by selective use in cases of reported inbalance.

On the other hand, in the industrialized countries of Europe more and more farmers are switching over to methods of biological, natural or organic farming, thus replacing chemical fertilizers and chemical pesticides by natural methods. After several initial years of trials and transition problems, most of them produce roughly the same yields as before the changeover.

As far as plant and stored crop protection is concerned, a huge reservoir of diversified traditional know-how in the field of biological or natural pest control methods is still available worldwide. Here the farmers have much more knowledge than the,scientists. To tap this valuable source of traditional knowledge, to document the most interesting methods and keep it available for others, GATE has started a small research project.

Some examples: In India and other Asian countries the Neem tree (Azadirachta Indica) has been known from ancient times for its pesticidal and repellent properties. Neem cake-left over after oil-pressing - is used in the soil for fertilizing and for controlling nematodes, powder from dried Neem leaves is applied to stored cereals in order to avoid loss through insects.

Brother Morus (Tanzania) wrote in a letter about the application of Marechea seeds (Crotolania ocho-lenca) by African farmers. The seeds-applied in layers between sacks filled with grain - "repel" the harmful insects. This has been demonstrated in many tests. The Marechea plant is also used as green manure, as weed surpressor and fodder for cattle and fish.

The aim of the first stage of GATE's project on natural pest control by plant ingredients is to collect information - in as much detail as possible - on traditional technologies that are still actively in use and to establish contacts and links with persons and institutions engaged in this promising field.

In a second stage, the results of the first phase are to be compared with the scientific data available, checked for their relevance and their transfer potential and tried out under test conditions as close as possible to the target group.

Dear Reader, please write to us (GATE staff member K. Rudolph, for address see p.2), if you know anything about:

• traditional or recently developed methods of biological pest control

• persons or groups active in that field or also, if you are interested in being informed about our preliminary results, which will be available in spring 1986.

We shall be most grateful for any information provided by our "gate" readers.

Appropriate Technology

This book eloquently argues the case for appropriate technology- that is, for capital-saving, labor-intensive technological models geared to the needs and capacities of those who need help most.

Part 1 of the book discusses the basic principles and problems of appropriate technology, while Part 2 describes in detail its practial applications in agriculture, food processing, animal husbandry, village transport, pottery-making, textile-spinning and weaving, tanning, footwear manufacture, cottage industries, public health, energy, and other vitally important areas. Appropriate Technology concentrates on situations and accomplishments in the author's native country, India, but his discussion is applicable to all areas of the world.

Ram Das: "Appropriate Technology. Precepts and Practices". US$ 11.95 per copy plus US $ 1.00 postage and handling. Obtainable from Vantage Press, Inc., 516 West 34th St., New York, N. Y. 10001, USA.

Bookbox

Appropriate Technology **Biogas**

GATE Publications on **Biogas**

Biogas Plants

Simple **biogas** plants have been constructed in Third World Countries for about thirty years. Good and bad solutions are featured side by side without comment in articles and books. The same mistakes are repeated over and over again. This needs not to be the case. The designer of a **biogas** plant must be able to distinguish between valid and invalid solutions. This book is intended to help him in this respect.

Sasse, Ludwig: "**Biogas** Plants. Design and Details of Simple **Biogas** Plants". 1984. 85 pages. English. DM 19.80. ISBN 3-528-02004-0.

German Version

„Die Biogasanlage. Entwurf und Details einfacher Anlagen." 1984. 85 Seiten mit 59 Abb. DM 19,80. ISBN 3-528-02003 -2.

Spanish Version

"La planta de **biogas**. Bosquejo y detalle de plantas sencillas.» 1984. 86 pag. DM19.80.ISBN 3-528-02010-5.

The Purification of **Biogas**

This review attempts to set out the procedures for removing hydrogen sulphide from **biogas**. Only an optimally applied purification agent can ensure a long life for the gas user, particularly engines, and avoid unnecessary repairs and maintenance on the plant equipment.

Muche, Helmut and Harald Zimmermann: "The Purification of **Biogas**". 1985. 34 pages. DM 9.80. ISBN 3-528-02015-6.

German Version

„Reinigung von **Biogas**." 1984.

48 Seiten mit Abb. DM 9,80.

ISBN 3-528-02005-9.

French Version

«Epuration du biogaz.» 1984. 36 p.

DM 9.80. ISBN 3-528-02011-3.

Spanish Version

``La Purificación del **Biogas**.» 1985.

36 peg. DM 9.80.

ISBN 3-528-02020-2.

Further Literature on the Subject of **Biogas**

Biogas Bibliography

Compiled by: Dr. agr. G. Englert, Dr.-lng. R. Kloss, Dipl.-Biol. Elke Heine-Dobbernack. Published by: Zentrale Informations- und Dokumentationsstelle der Bundesforschungsanstalt fur Landwirtschaft, Bundesallee 50, D-3300 Braunschweig (FRG). 483 Seiten. In German only.

Biogas. Una bibliografia mundial

Biogas: una bibliografia mundial. Quito. llCA/OLADE. 1981. 209 pages (IICA: Documentación e Información Agricola; No.108/OLADE: Publicaciones Especiales; No.5)

1. **Biogas** - Bibliografia. I. Organizacion Latinoamericana de Energia-OLADE; II. Titulo; III. Series. ISSN 0301-438X. In Spanish only.

Available from:

Organización Latinoamericana de Energia (OLADE)

10 de Agosto 5133 y Naciones Unidas

Casilla 6413 C.C.I.-Telex 2728 OLADE, ED.

Quito, Ecuador

Instituto Interamericano de Cooperación pare la Agricultura (IICA)

Apartado Postal 55, 2200 Coronado San José, Costa Rica

Biogás. Guia de informações e bibliografia básica.

Biogás: Guia de infommações e bibliografia basica. Volume I. Brasilia 1983.391 pages. In Portugnese only.

Available from:

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Deutsches Zentrum für Entwicklungstechnologien

GATE is not only the name of this quarterly. It also stands for German Appropriate Technology Exchange, founded in 1978 as a special division (Division 21) of the government-owned Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German Agency for Technical Cooperation).

Tasks

GATE is a centre for the dissemination and promotion of appropriate technologies for developing countries.

GATE defines "appropriate technologies" as those which appear particularly apposite in the light of economic, social and cultural criteria. They should contribute to socio-economic development whilst ensuring optimal utilization of resources and minimal detriment to the environment. Depending on the case at hand a traditional, intermediate or highly-developed technology can be the "appropriate" one.

Activities

GATE focusses its work on three key areas

- Technology exchange (Section 211): Collecting, processing and disseminating information on technologies appropriate to the needs of the developing countries;ascertainingthetechnologicalrequirementsofThirdWorldcountries; support in the form of personnel, material and equipment to promote the development and adaptation of technologies for developing countries.

- Research and development (Section 212): Conducting and/or promoting research and development work in appropriate technologies.

- Cooperation in technological development (Section 213): Cooperation in the form of joint projects with relevant institutions in developing countries and in the Federal Republic of Germany.

For several years GATE has been an active supporter of the SATIS network (Socially Appropriate Technology International Information Service) and has entered into cooperation agreements with a number of technology centres in Third World countries. In addition, GATE participates regularly in exhibitions and trade fairs both in the Federal Republic of Germany and abroad.

Service

GATE offers a free information service on appropriate technologies for all public and private development institutions in developing countries. dealing with the development, adaptation. application and introduction of technologies.

N.B.: The more precise your query, the better the answer GATE can give you. At the same time you help us cut down costs. Thank you!

Deutsches Zentrum für Entwicklungstechnologien

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