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ENERGY CONSERVATION MEASURES AND ALTERNATIVE ENERGY RESOURCES.

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OVERVIEW

This presentation is only a brief description of a few of the topics which were addressed during the training in alternative energy technologies(TAET) program and incorporation of the technologies with regard to their resources and application in Somalia. The opinions expressed in the presentation are those of the author, and should not be attributed to the TAET. (This presentation was supplemented by slide show of photos obtained from field trips during the seminar.)

The U.S. Agency for International Development (USAID), sponsoring a program with the cooperation of the University of Florida for the training of multiple participants from the third world countries at the U.F. Gainesville in the alternative energy technologies. The TAET program provides training in both technical principles of the alternative energy technologies and the socio-economic aspects of selection and implementation. Through systematic presentation and analysis of the scientific, technical, economic, and social aspects of the technologies of the alternative sources of energy, the program participants were provided with training in the procedures involved in

1) Assessing the potential of each source of energy within a broad perspective of energy needs and uses at a national level,

2) Selecting appropriate technological options to meet specific needs, and

3) Implementing alternative energy programs.

The TAET curriculum was designed to meet the following specific objectives.

1. To acquaint the participants with the alternative energy technologies.

2. To provide the participants with sufficient knowledge to asses the renewable energy resources.

3. To provide technical know-how and knowledge to select among technological options and to identify their most appropriate applications.

There were altogether nine sessions conducted the past five years. The 9th session (I participated in this session) being the last session of this kind of program. The program focused mainly on, solar energy, wind energy, biomass, and micropower. There were also such diverse important topics covered like, improved fuel conserving cookstoves, geothermal, and OTEC (ocean thermal energy conversion.) The program consisted of lectures, seminars, system demonstrations, laboratory work, and field trips, all selected to explain the theory, illustrate the practice and demonstrate the alternative energy technologies.

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INTRODUCTION

The world has experienced or undergone a stress for the last decade of oil price rise. Rapidly rising oil price have resulted in rapid adjustment of consumption practices in the idustrialised nations. Conservation and substitution have been accomplished on a scale, as a result, oil prices are temporarily stablising, except insignificant price rise in some coutries due to the Gulf war. For developing countries, the effect of rising oil prices was desasterous in various ways, mainly (1) their uncertain economies were overwhelmed by the cost of their modest oil needs to the extent that most are deep in debt to the oil suppliers, and investment in idustrialisation and agricultural development has absolutely disappeared, and (2) substitution of traditional fuels for petrolium has increased the serious deforestation problems, hence the rise in price of traditional fuels, like fuelwood and charcoal. The rural poor are worst affected by the higher prices of the traditional fuels. They are forced to turn to substitute fuels and burn crop residues which would be better left on the land as fertilizers. At the same time renewable energy resources are not well assessed, implimented or diffused among the people most dependent on them.

The problem now facing the developing coutries is to reverse this critical situation, in other words to recognize the importance of the role energy plays in development. It is essential that developing countries should intensify their efforts to identify, asses, and utilize the full range of their indigenous sources of energy. Governments seldom recognize the importance of these technologies, but not surprisingly, the majority of the oil-importing developing countries are vigorously searching recently, for ways to reduce their dependence on imported petrolium. The sources of energy available to the developing countries include those that are known as the alternative sources of energy; energy from biomass, hydropower, solar energy, wind power and, etc. These alternative and renewable sources of energy have the potential to supply significant amount of energy to the developing countries. This does'nt mean it would substitute the conventional energy systems but will give substantial contribution to the country's energy needs and create selfreliance. More-over these technologies are particularly effective in increasing agricultural productivity, in helping to lessen the pace of deforestation, and in improving the lif() of rural poor.

It is convincing to say or state that the developing countries have to utilize the alternative energy resources for the development of their nations, but the hardship lies in assesing, selecting, and implimenting these technologies where they are appropriate. For each of these technologies, the technical, economic, social, and cultural factors affecting their introduction and diffusion have to be considered.

BIOMASS

Biomass production for fuel has been practiced for thousands of years. It is only recently that population increases have made the regeneration of woody plants in agricultural areas impossible and the day to day increase of forest cutdown for timber and charcoal production, in general inefficient use of the forest resources has led in some countries in serious deforestration problemes. There are several ways which can help restore forestry. In the long term reforstation is the solution, but the magnitude of reforestation needed is enormous.

two examples:

> To supply 30 million sahelians in the year 2000, 3 to 6 million hectares will have to be planted which involves planting an average 150,000 to 300,000 hectares of forest anually up to the end of the century. (Ibid)

> In order to meet demands for fuel wood..., Nepal will require about 1.3 million hectares of plantation by the end of the century. To provide this, a national reforestation program has been recomended under which 32,000 hectares of village woodlot would be planted anually in the hills and 20,000 hectares in the terain over the next twenty years. (evans, Ianto)

Reforestation programs have been started in many countries but forests are being cut down much faster than they are being planted. This is to point out that while reforestation program is being implemented side by side other ways, (short term) of reducing the cut down of trees should be introduced.

FUEL CONSERVING IMPROVED STOVES

Most of the forests cut down in the developing countries end under cooking pots. "It is estimated that total fire wood consumption in the sahel is at least 16 million cu.m/year (or 12 million tons) corresponding to 0.6 cu.m. per person per year!! (club du sahel). This indicates sahel is approaching a point where it will be almost impossible to stop deforestation. Improved cookstoves can play a great role in lessening the rate of deforestation. VITA Somalia is implementing and diffusing improved stoves in Somalia, which is on the stage of dissimination. Apart from the objective indicated above introducing improved stoves can promote the socioeconomic status of a community. (improve domestic environment, reduce tiresome labor, save money, and give women time for other productive activities.) Stove building may create new jobs and potential for local innovation.

CONSTRAINTS:

-Most goverment organizations and non government organizations do not recognize the importance of improved stove technolugy as an element of comprehensive planning, hence difficulty in implementing the program.

-Most people (esp. in urban areas) do not feel the fuelwood crisis and do not recognize the aim of stove project. Also there is a tendency of people to stick to their old way of life, hence the difficulty in deffusing new ideas among the people.

-Higher cost of the improved stoves hinder wide suread adaption.

-The difficulty in compromising the science involved in the design parameters of more efficient stoves and the design preferred by the users.

-Most people do not consider this a technology having potential benifit for the nation, as well as for communities and individuals. They believe it is women's concern.

-The complete reliance on expatriates on assesment of socio-economic aspects and technical aspects.

-The difficulty in producing stoves according to design.

-Alienation of the program from other relavant energy conservation measures.

RECOMMENDATIONS:

-The Somali government should accept cookstoves and must include in its integrated rural development programes. For large scale dissimination, a government role is essential, whether by direct financing or by indirect programmes of public education and motivation, but leave the commercial aspect of stove dissimination to the private sector.

-Active extention should be introduced for the dissimination of the stoves. This cannot be done without the help of government and non-government organization.

-The public should be educated on deforestation and the different measures that can prevent deforestation. A carriculum should include this in schools.

- make every effort to lower the price of imuroved stoves and convince people why the improved stoves are higher in price.

-Implement a relevant program side by side with the introduction and dissimination of stoves such as planting trees, or incorporate the NWP with other organizations' energy program.

-Make design parameters that satisfy cooking conditions without affecting the efficiency perceived. Explain to the producer and

user why those parameters have to be there.

-Non-governmental organizations play a very important role in the introduction and initiation of stove projects, but above all in training local staff, so they can carry out the job, when expatriate term ends.

-Produce templates for the artisans and make good quality controll.

My experience in this aspect from the training is tremendous and vital to the NWP. It gave me an indepth knowledge on the theoretical aspect of heat transfer and combustion and the practical optimum design parameters of efficient stoves.

Biogass

Biogass generation is another source of energy that can play important role in reducing deforestation in particular and in general lessen dependence on imported fuel.

Biogas is produced by the anaerobic digestion of biomass material. Animal waste, when fermented by methane forming bacteria in the absence of air, will produce over a period of a month 30 - 50 litres of gas per kilogram of dung. The gas, which is predominantly methane, can be used for heating, lighting, cooking and for operating modified internal combustion engines. Though the digestion process is complex the materials used for this technology is simple and uses local materials. Biogas generators can be constructed communally or on individual family basis. Though single family units are not deemed economical, community biogas projects are attractive (China and India), if there is plentiful and reliable source of substrate (preferably animal dung).

Another important aspect of biogas technology is the sludge (residue) obtained from the digester as fertilizer which is competent with the commercial fertilizer, because methane generation conserves the nutrient elements needed for crop production. We (the participants) did an experiment regarding this during our training. Three groups of tomatoes, carrots and peas were planted in three different raws. One raw was fed with commercial fertilizer, the second raw with residue from an experimental digester unit and the third was left without any fertilizer. The two groups which were fertilized showed the same growth rate, which was far better than the unfertilized group. Still further advantage of biogas technology is, the sludge lacking its original odor, solves sanitation problems and lessens insect breeding. Animal wastes can also be used to grow algae for animal feed, simaltaneously generating methane.

Somalia is a country of livestock, but the main problem in utilizing this resource is the nomadic nature of the people, who are moving from place to place with their animals. However, biogas technology is a technology that can be ventured in the Juba and Shebelle regions where people are settled partly farming and part livestock raising.

IMPROVED KILNS AND GASIFIERS:

In many countries, particularly arid ones, where trees are scarce, there exists a sophisticated and efficient system which has characteristics of contract relationships among charcoal producers, trasporters and consumers, providing employment and income to many people at the expense of the countries diminishing forest resources. This system has proved difficult to alter even when charcoal has to be transported for hundreds of kilometers. Some countries have banned the production of charcoal to prevent the consequence of charcoal production. This didn't solve the problem. Some of the ways of reducing charcoal use have been mentioned above, but since charcoal production is done by using traditional pit or mound methods, improved charcoal kilns should be introduced to reduce the ammount of wood needed to make a certain amount of charcoal. Also introduction of briquetting and plantation of woodlot for charcoal producttion can improve this worst situattion. Kilns should be developed for firing clay products using waste oil from our oil-fired thermal and diesel electric generators, garages, and other sources available. This can substitute the large ammount of wood used for firing clay products or else dision and introduce efficient wood burning kilns.

Gassification is a process by which carbon monoxide and carbon dioxide are formed, by the reaction of oxgen in the air with the carbon in the fire, when a stream of air passes through a bed of red-hot burning wood. If conditions are adjusted and regulated suitably, the proportion of carbon monoxide can be made sufficiently high that the gas can be used as a fuel source in internal combustion engines or directly as heat source. Gasification can be applied to manay uses. The "gasifier" can be used to power stationary engines for irrigation or electricity generation, or/and can be made compact and portable to operate a car, truck, tractor, or boat engine. The technology is simple and uses local materials and can fill an important need as a substitute for imported fuel to run motorized equipments. This technology is being pursued by the industrialized coutries as a power for small farms. In developing coutries the ecological unbalance that might result sould be consiuered and avoided in the introduction of this technology. Also the technology would be labour intensive if machinery is not available for chipping the wood for the gasifier.

ALCOHOL FUELS.

Many countries are now undertaking pilot projects to produce ethanol as a substitute for gasoline. If used wisely, ethenol can provide farm power and where land permits, can raise income in rural areas through local production of fermentation substrates as cash crops. Ethanol requires a cheap and plentiful supply of substrates such as sugarcane, cassava, cerial grains and/or resedues from another plants or factories like molasses from beer factories and bagasse from sugar factories. However increase in demand of ethenol is likely to increase the price of sunstrates.

SOLAR ENERGY

solar energy is a free inexhaustable energy from the sun. There are so many practical applications of solar energy. Some of the

applications are solar water heating systems, solar space cooling and heating, photovoltaics, solar thermal electric systems, solar refregeration systems, solar drying, etc. Utilisation of solar energy is not free, but very expensive, in a sense that most of these systems use very sophisticated divices and need a lot of investments. Solar water heating has been very attractive and economically feasible lately.

Photovoltaic systems (up to 5 kw) are being very popular in the developing countries, the main attractive applications being solar water pumps and medicine preservation using photvoltaic systems. Somalia due to its location enjoys a tremendous sunshine all year round, so the potential of solar energy is not in dispute. The problem is ways of harnessing this energy is expensive. In the case of the photvoltaic systems, cost is dropping due to droping cost of manufactured cells which is the biggest portion of the system cost. If we look back at the history of terrestrial P.V. cells, decade ago the cost per peak watt was $40-50 while today the cost per peak watt is $7 or less. In remote villages where there is no conventional power supply and where fuel inconsistency (which is totally imported) makes it impossible to supply diesel to the diesel generator, photovoltaic system will be the bet application especially for life saving (medicine preservation). If pumping water and medicine preservation is followed by rural electrification it would be a step forward to upgrade the standard of living of the rural population. Encapsulation of P.V. cells using local materials and skills and a case study on cost evaluation of solar electric powered house was made by our group during the 9th session of TAST. A pilot project for P.V system was recommended (by Mohamed Hassan, et al.) Most governments of the developing countries can undertake this project.

WIND ENERGY

Wind energy is caused globally by the differential heating of the earth's surface due to the earth's rotation. Wind motion is generated locally by the difference in heat capacity between adjacent bodies of water and land masses. Hence, wind energy is the kinetic form of solar thermal energy input to the atmosphere and the ground. The cost effectiveness of wind energy conversion systems (WECS) mainly depends on the availability (duration and intesity) of the wind resource, system power performance, and the comparative cost of alternate energy sources.

Somalia owing to its location in the Indian monsonic area (between 12N and 2S) and according to some studies so far done has a quite regular resource of wind energy. Water pumping wind-mills are the cheaper water pumping solution and the more profitable exploitation of the wind energy, also the low density of wind energy availble matches the water demand of people and livestock.

Inorder to define a project for reasonable water pumping wind energy exploitation, three general and related knowledges are essential (1) the deep and ground water territorial availability (2) the wind energy distribution (3) the water demand distribution. After investigating these parameters the cost effectiveness of the system in relation to other sources of energy for pumping water should be considered.

HYDRO POWER

The uses of energy from water are about the same as those from wind and mechanical power for electric generation. Water power turbines attached to generators are used to generate electricity. A very simple and cheap water wheels can be used to drive simple mechanical devices such as saws, grinding machines or systems of gears and pulleys. Hydropower is so far the cheapest source of electricity not only in the developing countries but also in the industrialized countries. But mini hydro plants have proved cost effective in the developing countries. Using water power be it an artificial canal or a river requires: (1) A constant and steady flow of water and, (2) sufficient "head" (this can be artificially created) to run the turbine and match the power out put required.

Somalia having two rivers Juba (perennial) and Shebelle (flows about 7-10 months a year) has the potential of mini hydro power. Stream power, a technology to harness the kenetic energy of flowing water in rivers has been tested in somalia by ERDWS in Bur-Dhubo Jubba river. The results are encouraging. UNDP is studying a Lossibility of installing several mini hydro plants in the Shabelle, one in Bala'd, a francis turbine of 1500 KWe has been proposed.

The existing river water controll gates and barrages in Jenale, Falkeroy and Kurtun-Warrey have heads of 2-4m, which could accommodate small hydropower units. The integration of hydropower in these plans will be cheap, since major civil works exist. However, end use matching and opportunity cost need be studied and environmetal impacts considered, before a reasonable justification.

CONCLUSION

Developing countries use considerable amount of energy, but generally much less than industrialized nations. Within the developing countries them-selves there is desparity in energy use and demand. Somalia is one of the countries with low energy demand. Somalia's national economy being dominated by livestock and to some extent agriculture is in need of water supply as the main energy requirement. To meet this and all the other diverse energy demands, we have to utilize differnt sources of energy. Since the spalating price and scarsity of oil is making impossible the use of conventional systems, the resources of renewable energy should be exploited. However the energy demand as well as the abundance of the renewable energy sources should never justify an irrational and wasteful program of energy exploitation.

It often happens that in the developing countries exploitation of the alternative energy sources is approached without adequate knowledge of the energy distribution, inaccurate knowledge of the national resources and with lack of commitment. To avoid these setbacks and strengthen the exploitation of the Alternative energy resources in Somalia, the following points should be considered.

- Activate and restructure the institutional position of the National Alternative Energy Committee in broader aspect on this

field.

- Organize under the committee all data and researches so far done, to avoid repetetions in collecting data and resource assesments.

- determination of the target population's need and resources, with policies based on the data obtained from NAED inorder to identify, evaluate and select strategies for development of a particular technology. Opportunity cost should be incorporated in the study.

- Experimentation should be done with technologies viable, on pilot-level under actual field condition before diffusion or dessimination and replicaton. Consequences on introduction of certain techology should be consiuered so as not to worsen the environmental condition, but incorporate benefits other than energy in the plan. For example development of marketable skills and products, or improved environment and health.

- Encourage the private sector to be involved in the transfer of these technologies for example by commercialization of the technologies, (local production)

- Make effort on the increase of education in this field in particular and conservation measures in general and enhance extension services.

- Support non-government organizations promoting or ready to promote renewable energy projects.

- encourage community involvement in the planning, implementation, and management of local energy projects. Train local people in the field so they can carry out these tasks and great selfreliance.

- Encourage, organize and give credit to individuals or groups invloved in this field.

- Cooperation and communication with other countries and international organizations to update informations on relevant exprience. The community should have access to reliable and unbiased information and technical assistance on the renewable energy technologies.

- systematic end-use matching should be adopted to make the selection of technologies harmonize with the country's development goals and program objectives. The socio-cultural impact should also be considered.

These factors are equally important in organizing the assessment of the national resources of energy and implementation of energy projects, hence the organization and management of the efforts appear to be more critical than the precise nature of these technologies.