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ANNEX III

SURVEY OF THE STATE OF APPROPRIATE TECHNOLOGY

IN

EL SALVADOR

Project Number: 519-177
Contract Number: AID-519-183
Location: San Salvador, El Salvador
Date: November, 1978

James S. Monachino
Contractor

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A. Project Description

The principle purpose of this contract was to survey the general state of appropriate technology which exists in El Salvador and offer viable recommendations which could be utilized by the USAID/El Salvador Mission. The bulwork of this investigation was calibrated toward the rural residents and those institutions that interact with them. Fomenters and various program innovators have been identified listing some of their strengths and weakness.

The applied definition of light technology used in this paper can be found in Annex A. This is the official congressional definition issued by Congressman Clarence Long to help eliminate much of the confusion associated with the term.

B. Summary

The Government of El Salvador appears to be maintaining a reserved posture toward any large affirmative movement in the direction of light technology. There are ample examples of innovative A.T. orientated endeavors scattered throughout the country producing viable data that all too often lack a proper conduit. This lack of information dissemination is evident in both national and international agencies. The responsibilities of storage and distribution of different host country programs appear to be in the hands of a precious few, if any at all.

Consequently, any new programs attempting to incorporate socio-economic data dealing with the rural sector must go through a gauntlet of different unintegrated agencies to obtain an accurate infrastructural picture of what is currently being pursued. (Reports 3-5 years old are almost impossible to locate.) There is also a serious deficiency of input from backward linkages to forward planning linkages. For the establishment of any viable A.T. programming this problem must be resolved to insure target support of programs that are locally wanted as well as needed.

The following pages represent a short summation of various organizations that are functioning in El Salvador within the socio-economic parameters of their target groups. Some of the projects described show potential but unfortunately nearly all are operating within the vacuum of their own particular department. Ultimately, the need to improve the productive capacity in non-urban areas that meshes with the agricultural development of El Salvador is self-evident. Through the promotion of small scale indigenous activities coordinated by an integrated agency purview this goal can be started.

C. Recommendation

The following recommendation was developed out of the research efforts of this investigation. It identifies a Salvadorean agency which offers a good potential for USAID Mission assistance and stimulation. The program approach is designed to reach the rural poor of El Salvador utilizing culturally suitable low-cost technology.

Project Title: Low-Cost Rural Improvement Project (Appropriate Technology)

Project Duration and Funding: To be determined at a future date according to agency needs and USAID/El Salvador objectives derived from the formulated project.

Project Proposal: USAID/El Salvador fund a pilot appropriate technology (AT) information/training program whose main objective will be to upgrade technical assistance to the low-income rural residents through viable low-cost alternatives for improvement of their life style.

Project Description: **Program Vehicle** - El Centro Nacional de Capacitación Agropecuaria (CENCAP). This governmental agency is under the Ministry of Agriculture and is a division of Centro Nacional de Tecnología Agropecuaria (CENTA).

Specific Programming Ideas to be Administered by CENCAP

- 1) Formulation of an AT - focused summer camp for the young people who are participating in Club 4C program sponsored by CENTA.
- 2) Production of a daily newspaper series to be written in comic strip form in the language of the target group. It will serve as means of conveying simple ideas dealing with appropriate technology for mass consumption.
- 3) Utilization of a morning radio program to serve as a audio implement for the dissemination of knowledge to the rural sectors.
- 4) Production consideration of two films illustrating alternative living styles that could be incorporated into the lives of the rural resident through better utilization of local resources.
- 5) Investigation and promotion of low-cost farm implements which show potential in improving "campesino" efficiency.

6) Mobile Learning Units: Formation of a self-sufficient resource vehicles which could travel anywhere in the country and provide adequate short term training without the need of any exterior material input. These units could theoretically, give seminars in open fields should constraints be severe and demand high.

7) Explore and apply the use of alternative energy sources to rural areas whenever possible. This includes:

- a) Methane gas
- b) Wind-power
- c) Water-power
- d) Solar-energy

Note: Cross collaboration by CENCAP with other institutions working in their prospective fields of study would prove highly beneficial.

8) Improvement of rural water supplies:

- a) through use of natural filtration units
- b) construction of cisterns
- c) digging of tube wells

9) Formation of training seminars in order to teach rural extension workers and families, low-cost methods of preserving food for home consumption and possible local marketing.

10) Fish meal-utilization of undesirable fish meat. The product would be ground, dried and sold for local consumption as a low cost protein additive for animal feed mixes.

Beneficiaries:

Low-income rural residents with additional input and training being advocated for governmental field workers who would serve as dissemination instruments to the rural poor.

AID Inputs:

Agency reinforcement may be necessary in the following areas:

- 1) Technical Assistance
- 2) Supply of Project Materials
- 3) Propaganda
- 4) Training Programs
- 5) Logistical Support

AID role will be to facilitate CENCAP budgetary constraints on projects deemed worthy of development by both partners in the field of light technology.

II. State of awareness and potential growth of A.T. in low-income rural areas of El Salvador.

A. Housing

"A census in 1975 by the Ministry of Planning and the Bureau of Statistics and Census indicates that the typical home for almost 80% of the rural residents is made of adobe, of one room, with dirt floor and tile roof. All material utilized for housing construction is made by hand from material available locally."* The cost factors on a adobe home vary depending on location and amount of exterior inputs of labor and resources. Estimations of \$300 to \$1,500 have been given for these permanent family structures. The lowest estimate came from a farmer who did almost all the work himself including the making of the adobe bricks** and the highest came from the "Fundación Salvadoreña de Desarrollo de Vivienda Mínima (FSDVM)" with each home containing electricity and running water.

After the initial construction period one or two partitions are erected from bits of wood and cardboard to form a bedroom. Most of the labor is performed by the family but in construction of a home friends sometimes participate in the activities with the knowledge that reciprocal labor needs will be repaired.

Housing is a major problem for many rural residents. The chart on the following page seems to indicate a general governmental concern for urban development with a penury degree of neglect in the non-urban sectors.

The following suggestions will illustrate a few simple ideas that could be incorporated into the adobe home:

1. Utilization of translucent tile in selective areas of the roof to provide lighting during the day time hours for the people working inside. (This tile is made locally in some parts of the country and unknown in other parts).

2. Construction of chimneys to allow passage of smoke created from wood burning stoves.

3. Technical assistance in principle house design for the improvement of structural strength. The FSDVM has had some success in this area with adobe homes.

* Annual Budget Submission FY 1980, El Salvador p. 127

** This home was not equipped with either water or electricity.

4. Various institutions in El Salvador are experimenting with alternative low-cost construction materials for rural homes. The most success to date has been with pumic rock. This information should be disseminated to interested backward linkages.*

5. Construction of adequate sanitary facilities at minimal cost can be promoted if small scale models and seminars were given to local builders. They would collaborate with field agents who would provide leads for prospective customers.

6. Formation of vocational training courses in brick making. There are small commercial implements available that are manually operated and can produce a professionally respectable brick. Selective personnel at cooperative sites who are receiving a high influx of families should consider manufacturing their own bricks to provide employment and low-cost building material for internal consumption. Later, marketing can be expanded to the local community.

B. Communication

1. Role of Printed Material

"Approximately 50% of those over 10 years of age are functionally illiterate; in the rural areas the figure approaches 70%."** The net results of this data indicate a high percentage of rural residents have sub-limited reading and writing skills. Therefore, we can assume that the majority of "campesinos" would have difficulty in reading a book or any complicated text. Through utilization of simple illustrative pictures complete with rural dialog some of these reading barriers can be overcome.

The social structure of each small community contains local leaders. They are not necessarily rich but do have influence among their neighbors. These local leaders can be priests, school-teachers, successful farmers, small town politicians, etc..., who more often than not can comprehend newspaper articles, simple books, magazines, and other types of written material. It is through their eyes that many world issues or town gossip are verified and disseminated by word of mouth.

The most common source of exterior community news comes from the two national daily morning newspapers. They are "La Prensa Gráfica" and "El Diario de Hoy" each having circulations approaching 100,000 copies daily and are distributed throughout most of El Salvador.

The newspaper represents a potential tool for the dissemination of simple ideas of light technology in El Salvador.

* Some of these institutions are: FSDVM, INSAFI, and Centro de Investigaciones Geotécnicas.

** Annual Budget Submission, FY 1980, El Salvador

The suggested approach would be through a daily comic strip which would run Monday through Friday. Topics to be illustrated would include such items as: how to make simple tools, indigenous food recipes, home improvement suggestions, and simple health care practices.

The suggested length of time would be from 6 months to one year. Key terms would be written into the general script of the comic strip to help identify readers and evaluate impact of the instrument. Evaluation of the strip would play an important role in determining what should happen after the elapsed period of time is over.

The success of the program would depend largely on the artist's ability to draw a comprehensible environment the rural resident could identify with and the author's facility to write in the diction of the target group.

2. Potential Role of Radio

There exists a large distribution of radio receivers throughout most of El Salvador rural sectors. Many "campesino" families who do not own a radio have access to one with future aspirations to purchase the unit as soon as economic conditions permit. These radio sets represent a underutilized resource which can occupy an effective role in the dissemination of simple technology and agricultural information. Its main function would be to complement the local agricultural extension service. It would provide basic information on local market prices, preferred planting time of different crops, uses of pesticides, and any other form of pertinent data useful to the farmer. The content of each program would be calibrated to the output of the local extension office.

Successful radio extension programs are being utilized throughout Central America. The most notable examples are:

- a) Title: Radio Math Project
Organization: Ministry of Public Education
Country: Nicaragua
Target Group: Grades 1,2,3, - in selective rural area
Objective: Serve as an additional learning aid to student in the rural area.
Results: "Students study by radio reach significantly higher achievement levels than do students in traditional classrooms." (See annex B)
- b) Title: (Radio Momostenango) The Basic Village Education Project.
Organization: Academy for Educational Development Guatemalan Government.

- Target Group: 900,000 potential audience in rural area of Guatemala.
- Language: "Educational radio programming can effect agricultural practices positively."
- Methodology: The agricultural messages broadcast are developed by agronomist and the production staff at the project's headquarters and production studios in Guatemala City. The primary source of technical information is the Ministry of Agriculture, which reviews and approves each theme used. Farmers, agricultural research institutes, and agencies that supply goods and services to farmers also spot problems and provide data.*

The proposed project could be taped by CENTA's information department which has the facilities and personnel to run a short morning show.** Channel 8 has offered to share their facilities with CENTA before and would conceivably do it again. The suggested target area would be in Morazán sector where some socio-economic data on the populace presently exists and would prove useful at a later date in registering impact of the program. Suggested period of time would be one year.

C. Potable Water

The acquisition of safe sanitary drinking water for many "campesinos" is a drudgery they must endure every day. The situation is compounded in those locations where people have to travel 5 or more kilometers daily to obtain water. This problem becomes particularly salient during the dry season. (The dry season begins in November and ends in May).

In areas that are fortunate enough to be located near running streams pollution can be a dangerous obstacle. It is not uncommon for people to be bathing downstream while upstream others are defecating. Other forms of pollution originate from local coffee processing units, animals, washing of cloths, and industry.

There are a number of actions a "campesino" can take to help relieve some of the serious water problems.

First: (Obvious) If distances are excessive, organize a group petition to ANDA for installation of community spigots in key

* For additional information read "Development Communications Report," April 1978.

** Fidel Tasio is the Director of this department and has expressed an interest in the past of putting together a radio show.

locations.

Second: Examine the possibility of construction of tube-wells for deep water extraction or hand dug well for shallow water.

Third: Consider construction of cisterns made of locally available material as a partial solution to acquisition of sanitary drinking water.

Note: The cooperative "El Tigre" which is located in the Department of Ahuachapán utilizes a large 10,000 gallon iron tank to supply their drinking needs during the dry season.

Dr. Peter Tobia found a cement based cistern being used in the canton "Las Mesas" in the department of San Miguel. It has a simple rain catch attached to the roof of the school that leads into the above ground tank near the building. This unit helps provide usable drinking water to both teachers and students who attend the school.

Fourth: For areas near polluted water supplies the implementation of various natural filter made of local material is suggested.

Caution: Filtration units are effective for various forms of pollution but not all. Therefore, filtrated water should be examined for purity.

Due to the magnitude of the water problems which exist in El Salvador rural areas it is unrealistic to assume that ANDA will be able to reach the total rural populace in the near future. Therefore, promotion and implementation of various self-help efforts should be pursued.

D. Energy

1. Methane-gas

Finding by the USAID Mission in El Salvador has stimulated some interest and publicity in the use of methane gas in rural areas. Under the supervision of Peace Corps Volunteer, Craig Warriner, a working model of a small rural digester was constructed and made functional in a canton called "Las Chinamas", Department of Ahuachapán in September 1978. Future plans include expansion of digester's capacity for incorporation into business venture. (See annex C for more details).

The ramifications of what has been accomplished on this "campesino" farm are:

- a) A small methane-gas digester can be made in El Salvador without the need to import special parts.
- b) Rural residents do not need any type of formal education to learn how to operate and maintain a methane digester.

- c) There is an interest in the rural area in using alternative energy sources provided that they can be pragmatically applied to the cultural and economic background of the target group.
- d) Various Salvadorean institutes are attempting to build models for observational purposes.

Due to the favorable climate conditions which exist in El Salvador for anerobic production and a discernable public interest in the project I would advise continuation of the methane project and examination of an expanded role.

2. Solar

Sunshine represents one of the greatest natural resources available in this country. Current price re-alignment of fossil fuels are making it even more important for industrial use. In the "campo" the utility of the sun has been appreciated for years. The rays of the sun are used to dry grain in the field, beans and coffee on the ground, adobe bricks, fish, cloths, etc..., What is lacking in many cases is refinement of technique. The following examples will illustrate the point.

a) Fish is dried in the open air on the beach or sometimes on platforms. The system works but the end result is not always in the best interest the consumers. Insects, animals, dust, disease, and people often times get mingled with the final product.

Solution: Construction of solar containers that maintain hospitable drying temperatures and keep out unwanted elements. This philosophy is being advocated and tested by CENAP.

b) Seasonal production of fruits and vegetables often facilitate times of feast and famine. During particular months of the year certain fruits and vegetables are abundant and low in price while during other times they remain woefully out of reach of family hands.

Solution: Most fruits and vegetables can be sun dried and utilized for year round consumption. Families need to learn how the food is to be dried and in some cases home recipes to make the final product more tasty.

c) Solar Oven: The lack of firewood in El Salvador is a self-evident problem. Martin Wolterding, a Peace Corps Volunteer working in "El Tamarindo" helped solve the problem by advocating and building a solar oven. The oven is made of completely indigenous material and is used to bake bread.

d) Solar Heater: Heated water for dishes, clothes or bathing is rarely used in the "campo" because many people feel it would be a waste to burn the wood. Peace Corps Volunteer Craig Warriner built

a simple solar heater to raise temperatures for his methane digester but found problems maintaining a full water supply due to family pilfering for bathing and dish washing purposes. The heater was made of locally available material.

e) Fish Meal: In the department of Usulután, Tony Gossman, Peace Corps Volunteer found a local fisherman, who is selling all his trash fish* by grinding it up and laying it out in the sun to dry. Afterward, the material is bagged and sold locally to farmers as a protein additive for livestock. The duration of the indigenous feed is 2 to 3 weeks and sells for about 16 dollars per one hundred pounds.

3. Windmills

Rural populations have been the principal benefactors of wind power throughout the ages. Some of their applications are:

- a) Perform various agricultural tasks such as grinding, sugar cane, or cutting wood.
- b) To lift water for both home and animal consumption.
- c) Irrigation of crops.
- d) Generation of electricity.

There is still evidence of the use of windmills (bombas de aire) along the coast. They are between 20 and 30 years old and have a long reliable history of service for the small cattle farmers.

The advent of electricity to the coastal regions seems to have precipitated the downfall of windmills in El Salvador. Another factor is the limited lifting power that can be generated by these devices. The old "Chicago Airmotor" was the brand name of the wind machine consistently observed along the coast from San Miguel to Usulután. This machine had a lifting power of about 400 gallons of water per hour at a 10 meter depth. The modern day version which is imported from Brazil by Avelar Hnos., S.A. can lift about 700 gallons of water per hour at a 10 meter depth. It is an excellent machine but at a minimum purchase and installation cost of \$2,000 dollars it is way beyond the financial range of the target group.

While there exists an abundance of windmills being sold in Guatemala each year the market for the sale of these units in El Salvador is very poor. This is due to the following reasons:

- a) High purchase cost.
- b) Extensive availability of electricity along the coast.

* Trash Fish: includes all fish and parts of fish such as the head and tail which are generally uneaten and wasted.

- c) Low performance capacity and constant need of a steady wind.

Given a certain set of circumstances windmills such as the "Savonius Rotor Windmill" might prove effective in those rural sites that have; a modest water need, no immediate access to electricity, and water located within ten meters from the surface of the earth.

4. Hydraulic Ram Pumps

The hydraulic ram pump is a simple device which functions principally by the flow of water. It was developed in Europe at the end of the 18th Century and experienced a brief period of popularity before the advent of electricity. Countries that still show some vestiges of the pump are: Japan, part of the United States, and Europe. Likewise, in El Salvador working examples of these pumps can be found primarily in the Sonsonate region. This is due to the varied topography of the land and frequency of small streams. All these factors represent prime conditions for the success of the pump.

The results of the investigation show that:

- a) Increased water demands of small farmers.
- b) High availability of electricity.
- c) High water demands of the pump versus low lifting power of the pump.

All contributed to the demise of the instrument.

Various sites were visited and different pumps were observed in action. It was reported at one time a simple version of this device was manufactured in El Salvador and sold to local customers. All this represents past history and lack of market demands insured the virtual disappearance of the pump today.

Potential: Similar to the windmill, the ram pump has a very selective application zone. Given its modest lifting ability I would not recommend it as a high priority item to be considered for use by small farmers in El Salvador. Estimated cost of these units depending on size are between \$200 and \$3,000 dollars and can be purchased in the United States.

5. Wood (Leña)

The consumption of dead wood for fire is one of the largest energy components in rural living. Most families spend a great deal of time collecting firewood or any other combustible element they can use in the home. Due to rapid population expansion and insufficient reforestation wood is becoming a scarce resource. Other forms of combustible used are: dry husks of plants, corn cobs, dry grass, trash and almost anything else that can burn.

Once the elements are collected they are usually placed in an open air stove that has a simple cover to collect heat inside the stove.

Problem - The stove can produce a great deal of smoke and often remains as an uninvited guest for the whole family causing potential health problem. Also, burning wood cannot be controlled thus causing energy wastes. Cost per "raja"* range from 5-7 cents depending on market demands.

Potential - The first obvious suggestion is that more families be encouraged to plant future wood supplies on land presently being underutilized. Selection of fast growing tree varieties for planting should be encouraged by local extension agents. Another possibility is to recommend a more efficient stove. The "Gana Smokeless Stove" is an effective multipurpose device which can be made of totally indigenous material. This stove is used for both cooking and baking. A small sliding door is used to control the flow of oxygen and consumption of wood.

In conclusion, these few recommendations will not alleviate the wood shortage which is present in El Salvador. Incorporation of alternative energy forms such as solar ovens, solar cookers, and methane digesters may help to lower consumption needs of a rapidly depleting resource.

E. Agriculture

1. Tools

A. Traditional Tools

Nearly 50 percent of the Salvadorean population is involved in agricultural and the projected figure for 1982 is about 46 percent. (See following page for national employment distribution chart.) The two main crops planted by the traditional farmer are maize and sorghum. In order to maintain his crops he needs tools. The agricultural tools used by the farmer portray a very important element in his life. He most work with these implements from 1 to 12 hours a day and depending on how he takes care of them will have a direct result on his work efficiency and physical out-put.

The following list illustrates a few of the main tools used by the traditional farmer:

(i) Machete - A general purpose tool carried frequently by the "campesino". Some of its uses are: cut fire wood, clear land, cut rope, open sacks, cut fruit, harvest sugar cane, etc...

(ii) "Cuma" - Its curved shape and sharp blade make it a favorite among field workers during the weeding season.

* Raja - A piece of firewood which is about 60 centimeters long and 10 centimeters in diameter sold at the local market.

OCCUPATIONAL DISTRIBUTION OF EL SALVADOR

TOTAL EMPLOYMENT	1978 - 95%
	1,353,693

TOTAL EMPLOYMENT	1978 - 5%
	71,247

** Mining, transportation, finance, public administration and personal services.

SOURCE: Ministerio de Planificación y Coordinación del Desarrollo Económico y Social

* 633,119
46.8% - 1978
AGRICULTURE

291,457
21.5% - 1978
** OTHER

232,812
17.2% - 1978
COMMERCIAL

129,010
9.5% - 1978
INDUSTRY

61,880
4.6%
CONSTRUCTION

PUBLIC SERVICES
5,017
0.4% - 1978

The implement is well suited to function in the heavy clay soils where it is chiefly employed.

(iii) Plow - Most farmers use a wooden plow with a metal tip. The metal tip is a recent adaption as improvement over the wooden tip that is still used in the less progressive sectors.

Often times a farmer would prefer to have his land prepared by tractor but is unable to contract one or pay the fee. (The tractor density per 1,000 in El Salvador is 4.2.)

In some instances due to the steepness of the slope and conditions of the land the wooden plow offers the best alternative choice in land preparation because of a heavy erosion factor.

(iv) "Chuzo" - The English translation is planting stick. This tool is used to plant most traditional crops. It usually consist of a wooden stick with a metal point whose main function is to open the soil so that the seed can be deposited by hand and covered by foot.

In some parts of El Salvador soil conditions are so poor that plowing is omitted and planting in this manner is done.

(v) "Carreta" - This two wheel wooden wagon is a very common vehicle in the country side. It is used to transport fertilizer, seed, and all other needs of the poor farmer. The animal drawn wagon is often times responsible for making large ruts in rural roads during the rainy season. Unless the roads are well constructed the net results of these penetrating wooden wheels is unpassable road conditions during peak rainy periods.

(vi) "Yugo" - This is a wooden harness which is fitted around the oxen head in the traditional Spanish style. It has the advantage of permitting the operator to maintain good control over the animal but has the disadvantage of only utilizing the neck muscles of the beast. There is a better harness available which would incorporate a larger portion of the animal's body but cultural barriers would make acceptance almost impossible.

The underlying factor these tools have in common are their easy availability, low purchase cost, and proven adaptability to local conditions.

B. Non-Traditional

There is a growing inventory of non-traditional products slowly reaching their way into the rural zone. The following list will illustrate a few of these elements.

(i) Fertilizer-Consumption - at 155 kg/HA.

El Salvador* is second only to Costa Rica in utilization of this resource throughout all Central America and México. Many of the small landowners have seen the positive effects of this product and are convinced of its value.

(ii) Back Pack Sprayer - While reliable statistics are difficult to find I personally conducted a survey in October 1977 among the Banco de Fomento small farmers. A cross section of Ahuachapán western zone appeared to attend a seminar** on the uses of insecticide and sprayers. The results of that sample showed that only 8% of the members who attended that seminar did not own or have access to a small sprayer. (The farmers were in "grupos solidarios" who have an average land holding of about one hectare).

(iii) Pesticides - The use of chemical control in El Salvador is very common. It has brought with it an increase yield in crops but also unseen danger. Many campesinos do not understand the hazards of the chemicals they are working with. Consequently, use of mask, goggles, and gloves is not wide-spread. The problem stems from the fact that pesticide danger is generally invisible until it finally strikes you. People need to understand the product they are working with even if they cannot read the label.

(iv) Hand Tools - Few tools have been able to permeate the rural market. Special items such as rakes and improved hoes have made some headway in vegetable producing areas but are not well accepted by everyone. The need for different hand tools will expand as soon as new non-traditional crops are planted to perform different work tasks.

(v) Small Grain Bins (SDA 19-73) - This project was requested by CENTA through the AID Extension Specialist. The grant of \$5,000 dollars was made in December of 1972 to replace the original grant made in 1966 by the Salvadorean Commission for the Alliance of Progress.

The project consisted of promoting small metal grain bins for storage of corn, sorghum, and beans on a interest free credit basis through the extension office of MAG.

An estimated 2,200 small grain storage bins have been funded to small farmers since initiation of the project. Also the rotating fund utilized to buy the material has increased from \$5,000 to an estimated \$17,168.00 dollars.***The project is an obvious success. The approach is simple and could conceivably be expanded to

* Information was taken from Agricultural Development Indicators, International Agricultural Development Service 1978.

** There were about 50 groups leaders who were regular customers from the bank that attended.

*** Information was taken from "SDA Review, 1972-1977" by PSC, David B. Quarles, March 1978.

other A.T. oriented projects.

Additional non-traditional tools can be found under the section labeled, Banco de Fomento Agropecuario.

There is a supply of non-traditional tools that are cost efficient in El Salvador. What is lacking is a developed marketing system to demonstrate to the rural residents what is available to them and illustrate how this item can improve the out-put of their farm. Most of the large distributors of small equipment are located in San Salvador with few branch office elsewhere.

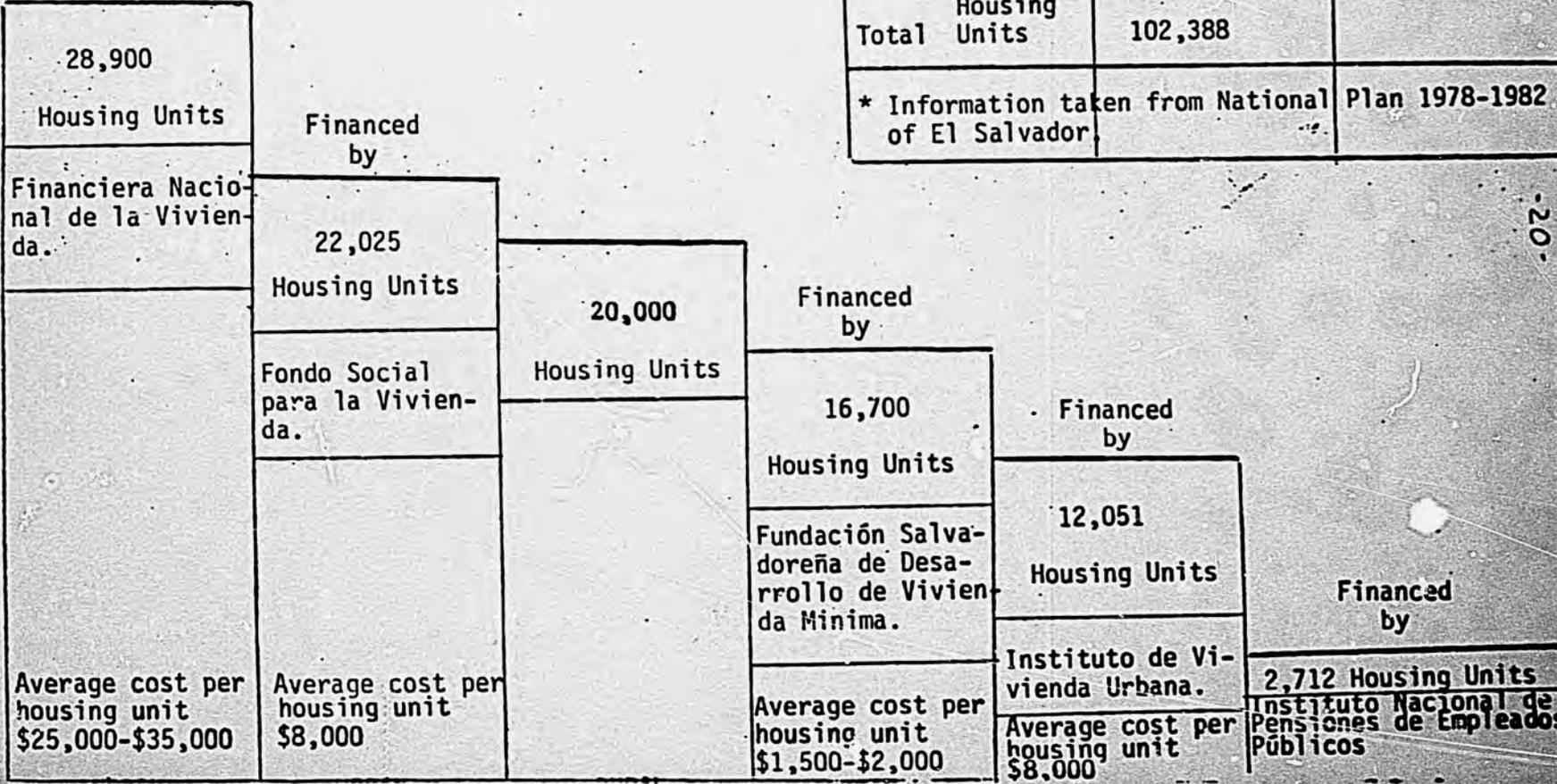
THOUSANDS OF COLONES

HOUSING

Construction of Minimum Level Homes	₡138.0 (\$ 55.0)	12.32%
Construction of Medium Class Housing	₡861.5 (\$344.6)	76.92%
Construction of Marginal Homes	₡ 61.0. (\$ 24.4)	5.44%
Construction of Rural Housing	₡ 60.0 (\$ 24.0)	5.35%
Total	₡1,120.5 (\$ 448.2)	100.00%
Housing Total Units	102,388	
* Information taken from National Plan 1978-1982 of El Salvador		

- 20 -

Financed by



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III. Chief Appropriate Technology Programs Engaged in by Institutional Agencies in El Salvador and Their Effect Upon Rural Populace

A. Educational Institutes

1. National University of El Salvador

a) Physics Department

There is an interest in the utilization of solar energy by Prof. Ethelvina Murillo de Escobar. Her involvement with the Solar Energy Association has also carried into her work at the University.

To date, most of the work done at the University has been theoretical. Some formulas have been written and exchanged with other interested Universities* on an international scale but little practical work has been demonstrated. Prof. Ethelvina cites lack of a central resource center (library) which contains accessible information for students and low budget priorities for project implementation as the chief constraints.

b) Department of Social-Economic Studies

Ing. Rafael Granados Vásquez is a member of the agronomy section of the University. He is currently directing the efforts of one of his student's thesis papers on Bio-gas. The project is recognized by the government as a potentially beneficial endeavor for all. Sr. René Eustaquio Rodríguez from the Ministry of Planning believes the probe will have a positive effect on his country's development.

A small model digester has been constructed and is beginning to produce gas. Craig Warriner, Peace Corps Volunteers, who directed the SDA Las Chinamas project was contacted by the University to expand upon his work but nothing has been put in writing.

2. Instituto Tecnológico Centroamericano (ITCA)

The theory behind this British inspired school is to

* There is some collaboration with UCA and Universidad Autónoma de Puebla in Mexico

produce qualified engineers to perform practical work. The institute is funded by the Ministry of Education and is divided into five departments:

- 1) Department of construction and civil engineering
- 2) Department of electrical engineering
- 3) Department of mechanical engineering
- 4) Department of agricultural engineering
- 5) Department of food sciences

Depending on the courses you choose it will take two to three years to complete training. There are plans on the board for expansion of the present facilities to accommodate triple to present enrollment but Director Dennis Martin is hesitant. He feels a more decentralized approach should be taken and the formation of feeder institutes in Santa Ana and San Miguel considered. Another problem is the uncertainty of the future job market to absorb an inflated amount of engineers.

ITCA Agricultural Engineering Department is administered by Mr. John Sartain. This department has collaborated with various governmental institutions in El Salvador on A.T. projects. Some of the work performed by ITCA includes:

- a) Collaboration in construction of a small proto-type plow design by CENTA Engineering Department.
- b) Cooperation with CENCAP for the promotion of seminars design to teach campesinos who live on cooperatives how to operate and maintain the equipment they have on their farm.
- c) Attempting to design a simple buck-board to be pulled by animal traction for a British International Aid Project.

They will use the implement to produce terraces.

ITCA has demonstrated an interest in appropriate technology projects in El Salvador and represents a viable potential for joint project efforts with other agencies.

3. Universidad José Simeón Cañas (UCA)

The Engineering department at UCA is initiating a new program in the alternative uses of conventional energy sources with a heavy concentration on solar energy. The prime innovator of this action is Mr. Ricardo A. Navarro. He is an avid advocate of applied technology for El Salvador and is also responsible for organizing

the Symposium on Appropriate Technology to underdeveloped countries which will take place in El Salvador from February 19 to 23, 1979 (see annex D for additional details).

The University is attempting to analyze the use of A.T. from both the scientific and social point of impact. Some of the observable projects constructed include:

- a) One solar cooker which was made from a VITA handbook. (Volunteers in Technical Assistance)
- b) One solar oven - It is still in the experimental stages and is made of wood painted black and insulated with the husks of coconuts.
- c) Small Solar Water Heater - made out of wood with plastic panels used to collect the sun's radiation.

Students studying at UCA and who are doing projects on alternative energy sources obtain reference and research material from the following sources:

- a) The University library which is being expanded and developed by Mr. Navarro (Micro filmed material is being gathered from international correspondence around the world.)
- b) CENAP - shares its own resources with the University and allows students from UCA to use there micro-film viewers. (UCA hopes to purchase two viewers of their own before the end of the 1979 class term).
- c) Direct request - This is usually done through written correspondence with various International Institutes that dispense information.

(Annex E lists all other libraries and reference sources available in El Salvador for interested researchers)

UCA is attempting to prepare interested students on different perspectives of appropriate technology which are useful to the growth of El Salvador. They are actively seeking cooperation with other organizations and are interested in participating in A.T. oriented projects. Unfortunately, their main constraints are lack of funds and reserved governmental support.

B. Financial

1. Banco de Fomento Agropecuario (BFA)

The bank has demonstrated an interest in sponsoring A.T. oriented projects. They have participated in various seminars and meetings during the last two years*. The latest one was held in San Salvador. It was presented by ICAITI and CENAP on Light Technology in November 1978.

During the seminar, Fernando Andrés Guerra from the Organization and Methods Department of the bank expressed his position. He stated that the bank has a substantial amount of money to be utilized toward appropriate technology projects and was in the process of reviewing what course of action they can pursue.

Earl Sutherland, who is employed by FAO, works as a technical consultant for the bank livestock department. His position for the incorporation of light technology is very positive and is willing to consider various A.T. prospects.

The following list represents some of the activities the bank is involved in:

a) Dr. Thomas R. Preston from the University of Yucatán is pioneering alternative feed mixtures for cattle. He is presently working in "Nueva Concepción" with Technoserve in designing a feed-mill. The ingredients they will be using are, husks of sugar cane, molasses, urea and rice polishings. The formula will use of 10 percent urea** and the other elements which are simply waste by-products from resources available in this location. Dr. Preston is collaborating with the bank in obtaining simple data for the project and they are keeping a watchful eye on the results of his work.

b) Tropicultor - Is being considered as an implement to aid the small farmer. This multi-purpose unit can be found at both CENTA and cooperative Atiocoyo. Iván Berhmann, Peace Corps Volunteer, who is working at the bank did an economic analysis of this animal drawn instrument and found its best target group to be small farmers who had between 3 to 8 manzanas*** of land in pasture for animal feed. Estimated cost of this unit imported from France with full array of equipment including cutters is about \$1,400 dollars (See Annex F for illustration).

* These meetings were held at the British Club during 1976-1977 for the express purpose of circulating A.T. oriented ideas among the different agencies within El Salvador.

** This element represents the most expensive monetary input.

*** One manzana equals 7,000 square meters.

c) Policultor - This multi-purpose animal drawn implement was designed by a Frenchman as a low cost alternative to the rural farmer. It had a few attachments and showed some potential. The bank considered financing it in 1973 but never did. Estimated cost of the unit was \$120 dollars with cultivator and plow in 1973*. (Additional details will be provided under the section labeled Imacasa).

d) Methane Gas - Earl Sutherland said that the bank was interested in the use of methane-gas as an alternative energy source. A potential farm site was isolated in October of 1978 but no funding has occurred.

e) Small Implements - Occasionally the bank has distributed various small farm implements for exhibition and sale in their regional branches storerooms. Hand operated corn shellers and grain cleaners imported from Mexico are a few of the items they have tried. The results appears to be inconclusive for the moment but the bank represents a large potential in the distribution and financing of various low cost farm tools.

The Bank of Fomento Agropecuario can be considered interested party in the development of low cost technology for the small farmer. Their role in any development program should be emphasized as a financier with excellent rural contacts and limited field extension capabilities.

2. Instituto Salvadoreño de Fomento Industrial (INSAFI)

Carlos Quintanilla Aparicio, department head of the technical assistance section states that INSAFI interest lies in the development of medium to large size business. Emphasis is placed on the need to purchase more expensive and technically sophisticated equipment which would make El Salvador more competitive in the world market, especially in the textile industry.

Testing performed in the area of agro-industry has resulted in a mixed bag. The work accomplished to utilize alcohol as a fuel is no longer being pursued. Some degree of success is being achieved in the construction of press wood panels. These panels would be made of local material and reduce the need of importation. The net benefit would ultimately reduce the price of first class housing.

* See Annex G for pictorial illustration

The financial structure of INSAFI is definitely slanted toward capital intensive production. Loans of under (¢10,000 colones) \$40,000.00 dollars are not even being considered. This organization is primarily urban based and should not be considered for any agriculturally oriented projects designed to aid the poor land owner or small urban shop keeper.

3. Fondo de Garantía y Financiamiento para la Pequeña Empresa (FIGAPE)

This governmental organization is a smaller version of INSAFI. It has three offices located in Santa Ana, San Miguel, and the largest in San Salvador. The people that use FIGAPE's services are urban residents with small industries in crafts, leather goods and textiles. They have little contact with rural residents.

FIGAPE role toward small-scale industry is to provide financing. Loan distributions are between 100 dollars for small incidental needs to 100,000 dollars for larger cooperatives. There is little technical assistance provided by the organization though some efforts are made to aid delinquent accounts.

Lic. Edgar Armando Guzmán of FIGAPE participated in the light technology seminar given by ICAITI and CENAP in November, 1978*. His views of light technology seem to vacillate. He recognizes the need but doesn't see an opening. In the last couple of years there has been a crackdown on the amount of small loans made because of high losses incurred at the inception of the organization. Therefore, any activity that might be considered unorthodox is not encouraged.

FIGAPE may be able to play an ancillary role in the development of an A.T. oriented project. The program would have to be aimed at the small-scale urban industry and provide some vehicle of technical assistance that could complement FIGAPE's constraints.

4. Centro Nacional de Tecnología Agropecuaria (CENTA)

(a) Engineering Department

Ing. Francisco García has been director of this department for about 2 years. He is an agricultural engineer who is interested in the development of low-cost farming implements for the small-scale farmer. In the project "Diseño de Arado de Tracción Animal" (Design of Animal Traction Plow) a field plow

* See annex H for complete list of people and organizations that attended the seminar on light technology in November, 1978.

was designed to improve the farmer's tillage efficiency, be manufactured at local shops, and attached to the traditional plowing stock. The project took one year to develop and is now in the promotion stage. Through the assistance of CENTA's extension offices scattered throughout the country Mr. García hopes to disseminate the Department's Research Work.

Currently, investigation is going on in the development of a low cost solar grain dryer for small landowners, testing of various animal drawn farming implements, and use of bamboo pipes for small-scale irrigation projects.

The largest problem this department has encountered has been lack of funding and personnel. To help alleviate this situation requests for additional personnel and funds were made to CENTA and various other international agencies. The result of this solicitation was a modest increase in both categories. In addition, a technician from Taiwan is expected to join the department in January 1979. Three additional support personnel from the Peace Corps are also being sought.

The engineering department of CENTA is interested in doing adaptative research for the betterment of small-scale farmers.

Ultimately, the impact of this department on national agricultural programs is important but limited*.

C. Agricultural Institutes

1. CENTA

b) Extensión Agropecuaria

The Ministerio de Agricultura y Ganadería (MAG) extension offices which are strategically scattered all over the country have sporadically tested a smorgasbord of small agricultural implements designed to increase the efficiency of the poor land holder. Some of these implements include: backpack sprayers, hand-tools, animal drawn plows, and cultivators. The net results of the work performed have produced little to write about.

The main problem stems from lack of program design and incentive from participating extension agencies to work with the implement under scrutiny. Infrastructural coordination needs to be written into all research investigations or promotion efforts.

* The Engineering Department receives 3 per cent of CENTA's total budgetary allowance.

Proponents of A.T. projects who wish to effectively benefit from MAG's vast resources should take the time to get the project through the whole bureaucratic machinery and see to it that written directives are issued to all people that will be involved in the project. Without a formal approach to the subject, all A.T. oriented attempts will flounder.

c) Centro Nacional de Capacitación Agropecuaria (CENCAP)

The formation of this organization was prompted by a report written for the United Nations in July 1975 by Alvaro Chaparro and Joseph Franco titled, "Informe de la Misión a El Salvador sobre Educación y Capacitación Agropecuaria." The Centro Nacional de Capacitación Agropecuaria was then assigned to work in conjunction with the National School of Agriculture in San Andrés 1976. After one year, CENCAP, changed hands and was annexed by CENTA in 1977 to perform two main objectives:

(i) Help the small farmer in the form of courses and technical assistance.

(ii) Help the technician improve his knowledge of his particular specialty.

Ing. René Francisco Toledo, Director of CENCAP said that they would be receiving a large sum of money in the near future from the World Bank. (They are part of a group of organizations which will receive the loan). The exact amount of money was never clearly specified but plans to build eight separate training centers throughout El Salvador and purchase vehicles to provide logistical field support are on the drawing board.

CENCAP's approach to the training of the rural resident is stratified to incorporate all the institutional advantages they enjoy being under the Ministerio de Agricultura y Ganadería. Some of the projects being handled by CENCAP are:

(i) Collaborating with CENAP in solar fish drying experiments.

(ii) Collaborating with CENAP in distribution of hand operated corn sheller.

(iii) Collaborating with ITCA in providing seminar training to rural personnel who work in cooperatives and need a basic knowledge of mechanics in order to maintain and operate the tractors owned by the cooperative.

The following list represents some of the positive

attributes of CENCAP:

- (i) Excellent infrastructural connections.
- (ii) Programming flexibility (it can be geared to fit both the rural poor directly or field agents that work with them).
- (iii) It is politically stable and well supported.

This organization is recommended as a prime candidate for USAID/El Salvador for promotion of light technology in the rural areas.

d) Club - 4C

The general supervisor of the Club 4C in El Salvador is Armando Morales. His office is stationed in San Andrés in the CENTA complex. The three main objectives of Club 4C are:

- (i) Organize and teach good citizenship to young people in rural areas of both sexes.
- (ii) Teach young people a variety of topics that would be useful for them both in the home and field.
- (iii) Teach young people a system of organization similar to that of cooperatives so that they will learn how to solve their problems in an organized fashion.

This program is directed toward children between the ages of 10 and 20 years. Last year over 208 clubs were organized throughout El Salvador by the Club 4C extension agents. The total membership was 4,160 people who worked in 416 projects collectively and 2,080 at their home.

Recommendations for the Club 4C program are to extend the training season of the members part way through the vacation holiday. This would fall between the months of November and January. The purpose of a prolonged program would be to stimulate formation of a summer camp that would provide comprehensive training to these young people for A.T. oriented projects. They would learn at the camp to eventually inject an improved living style in their home. The facilities located at San Andrés represent a potential camp site which students can receive proper training and quarters.

2. Instituto Salvadoreño de Investigaciones del Café (ISIC)

Nearly all research and support money is geared toward the prevention of the Roya del Café. But after probing it was discovered that some A.T. oriented work is being done by the ISIC department of chemistry under the direction of Dra. Alicia Prim Nunz in the following areas:

a) Experimentation on the extraction of alcohol from coffee pulp. Test to date are inclusive.

b) Utilization of plain glass jars filled with coffee pulp and water for the generation of a small electrical charge. The purpose of this natural battery would be to act as a substitute for commercial batteries presently being purchase for small appliances.

c) Different tests are being performed to examine the usage of coffee pulp as an additive to animal feed. Results have been encouraging and experimentation is still being performed.

d) A model methane digester was built in the laboratory using coffee pulp. The objective was to register the amount of gas it could produce and explore future possibilities for field use.

ISIC is not primarily geared toward helping the poor rural resident. Except for a few interesting projects it offers little potential in the promotion of any A.T. oriented projects.

3. Instituto Regulador de Abastecimientos (IRA)

Jerry Grey, a consultant for the United Nations in New York came to El Salvador in January 1978 to write a report on the use of solar energy. The results of his one week visit produced a study and recommendations on the use of solar energy in El Salvador. One element of these recommendations was that IRA consider using solar energy for the drying of grain. The possible savings outline made the project appear quite favorable.

Consequently, a small group of organizations are investigating the possible construction of a small model solar system which would be useful to IRA. These organizations are: R.G.Y. Asociados S.A. de C.V., UCA, and CEL. Unfortunately, the administration of IRA is no longer considering such a system.

According to Engineering consultant Herold Stryker, IRA

approach to the handling, purchasing, drying, and storage of national grain reserves is capital intense. Equipment purchasing patterns seem to verify his statement. One of the most recent expenditures involves purchase of new electrical scales with digital read out.

There is no recommendation for USAID involvement in relation to this study.

D. Ministry of Planning

Mr. Alirio Bernal Gaitán is the director of the Department of Science and Technology which is located within the Ministry of Planning. Through the collaboration of funds secured from the Organization of American States the first seminar on Science and Technology was held in San Salvador in November of 1977.

The nature of the conference was for the dissemination of knowledge and examination of common problems viewed by all the participants. The subject of appropriate technology was never formally discussed. References were made to the transfer of technology and high unemployment situation but outside the scope of work of this investigation.

Sr. René Eustaquio Rodríguez from the Ministry of Planning outlined the following three goals for the department of science and technology.

1. Formation of quality control for items being manufactured in El Salvador.
2. Encourage the transfer of technology to the Industrial Sector. (Especially in the area of textile manufacturing).
3. Formation of a national advisory board on Science and Technology.

Further discussions with the Ministry of Planning at the Light Technology Seminar seem to indicate that the government is aware of a light technology approach but still reserved on a definite course of action.

E. Centro Nacional de Productividad

There are 50 employees working at CENAP. This organization was founded in 1959 under the Ministry of Economy and now provides technical assistance, training, and information for the business

sector of El Salvador. The main functions of each department are:

1. Department of Technical Assistance - is to increase the production of small industry. The average size business that receives aid is between 5 and 50 people. There are 13 agents working in this department and cover up to 100 firms at the beginning of the year. But the number is quickly reduced by mid-year because of various reasons. The department specializes in textiles, shoes, furniture, and bakeries. They are looking for an additional employee to work in agro-industry.

Problem - Low pay is a serious problem throughout all three departments and often interferes with program continuity.

2. Training Department - Offers a series of business orientated courses to clients that can read and write. From January 1978 till September 1978 a total of 23 courses, 522 participants, and 323 different companies were registered for training programs. Total expenditures were estimated to be about \$25,000 dollars. Program topics include: accounting, marketing, and office administration.

Small fees are charged for these services rendered according to the type of training received. CENAP has a balanced approach to their training program in the respect that they deal with both large and small companies.

This department and institution were not organized to provide training for the rural "campesino".

3. Information Transfer Library - Funds were received from the Organization of American States to develop this section of CENAP. Gustavo Valle received \$6,000 dollars for information resources to be spent on A.T. oriented literature.

This library is used by students, businessmen, governmental agencies, and CENAP technical staff.

The primary organizations that have collaborated with CENAP are FIGAPE, INSAFI, CENCAP, MAG Extension Offices, and both Universities.

Problem - While most of the work which is being performed by the technical staff of CENAP with the small business can be classified as A.T. oriented, there is little interchange between the section officially delegated to work with light technology projects such as hand corn sheller and solar fish dryer and the technical section. Perhaps, this problem will subside after the institution is united together in one building at a future date.

CENAP has received an allocation of funds from the World Bank.

F. International Agencies

1. Banco Interamericano de Desarrollo
(Interamerican Development Bank)

Mr. Francis Peacock has outlined a program orientated to assist the small fisherman of El Salvador in which the bank will be participating.

The main objective of the program will be to increase the harvest and consumption of fish in El Salvador. Project expenditures are estimated at about \$6,735,000 dollars. The course of action is as followed:

a) Establish a special line credit to be used by the small fishermen and cooperatives.

b) Secure the design of an efficient, properly equipped small boat to be made available to the small fishermen obtaining credit. These boats will be about 35 feet in length, operated by diesel engine, have a 2 ton capacity, and 3 to 4 man crew. The target region of harvest will be the coastal shores.

c) Construction of docks to be used by the small fisherman in Acajutla, El Triunfo, and Tamarindo.

d) Repair of installation which exists in La Unión.

e) Installation of a dock and crane in La Libertad for use by small fishermen.

Mr. Peacock is also examining the most appropriate system for the transportation of the fish harvest to the market. He is concerned about the consumer receiving a fresh healthy product. For the coastal fishermen salting, drying, and chilling of fish with ice is being considered. For those people involved in fish ponds it was suggested that a tank could be used to transport the product from pond to market. This tank would have air circulating through it and would operate on much the same principle as they sell live lobster.

2. Organization of American States (OAS)

a) Fundación Salvadoreña de Desarrollo y
Vivienda Mínima (FSDVM)

This organization is funded by OAS and is making

a serious effort to alleviate part of the low cost housing problem. Ing. Manuel Antonio Cañas Lazo is a civil engineer who assists in the supervision and construction of the low cost homes. He also is conducting some experiments with pumic rock as an alternative building resource.

FSDVM homes are designed to meet the needs of urban family with an income between \$60.00 dollars to \$120.00 dollars per month. They have constructed over 1,000 housing units in Santa Ana and have begun work just outside San Miguel on a similar project.

Lots contain 80 sq. meters of land with both electricity and running water. Housing size varies corresponding to purchase price. A typical two room house in Santa Ana costs about \$1,600 dollars for 30 square meters. A less expensive model of 20 sq. meters costs \$1,000 dollars. Prices of homes in the San Miguel project will run a little higher due to inflation*.

While adequate shelter and sanitary facilities are being provided, items such as smokless stoves or solar water heaters for washing clothes, dishes and body can be easily incorporated into overall design at an affordable cost to all.

Manuel Antonio Cañas Lazo stated, at the appropriate technology meeting that was given by CENAP and ICAITI, that close supervision of cultural practices and habits of the personnel you work with are important in the success of any A.T. project. He supervised the construction of adobe homes in Santa Ana and found few problems. Results in San Miguel have been less encouraging because of the different techniques used by the builders in San Miguel. Small marble size holes are now beginning to appear in the walls of these adobe buildings.

The FSDVM should be considered an interested innovator in seeking out efficient methods of solving the large housing problem that exist in El Salvador. Manuel Antonio Cañas Lazo has attended various national seminars and is always looking for new ideas that might be relevant to the program.

b) Technical Assistance

The Organization of American States maintains a small fund which provides technical assistance in the form of financial and to pay salaries and purchase resource material.

* These homes are made of brick

The Director of OAS Mr. Albino Román y Vega stated that the organization has an interest in the promotion of appropriate technology but is not heavily involved at the moment. It was stated that CENAP was receiving monetary support to build up their information section and purchase learning resource material for CENAP. Estimated expenditures are about \$15,000 dollars.

3. Peace Corps

a) Washington, D.C.

There is a strong interest in the Central Office of Peace Corps to promote and disseminate knowledge which is appropriate to the target populace. The idea is not a new one but is simply being rearranged to fit the times. During the Ford administration Peace Corps personnel were specialized. They performed technical services which required a special environment of tools and facilities. The approach has changed.

Under the direction of Sam Brown who was appointed by President Carter, the Peace Corps Volunteers are being brought to foreign countries to perform duties which are closer to the land dealing more with basic human needs rather than technical problems. Consequently, Peace Corps recruiting policy has been revised to capture a well rounded person who is willing to get involved with the people. This is in contrast to two years ago where the main objectives were to help the people but through office or laboratory problem solving.

The result of this philosophy has its strong and weak points. The effect is that Peace Corps is seeking to support programs that are A.T. orientated and is willing to do so in the form of personnel assistance.

b) El Salvador

The Director of Peace Corps, El Salvador is Leticia Díaz. She has taken a positive stance in favor of appropriate technology and is willing to listen to potentially viable projects.

Francisco Rodríguez is Program Manager of Peace Corps, Agricultural Sector. He is currently considering the placement of three Peace Corps Volunteers to be allocated to CENTA, Engineering Department, to assist Francisco García in his field research.

Additional organizations interested in exploring

the possibility of obtaining volunteers for doing work in appropriate technology are Gustavo Valle from CENAP and René Toledo from CENCAP.

The Peace Corps represents a positive force for the promotion of A.T. in El Salvador. Organizations soliciting their services would be aware that they may qualify to receive personnel but must provide program support for all volunteers brought down to assist them.

4. World Bank

The loan officer of the World Bank, Mr. Faillace, stated that a loan had recently been negotiated with El Salvador. The title of the loan was "The Agricultural and Industrial Development Loan to El Salvador". He described the loan as being very comprehensive and said that the vocational training section of the loan included funds that would be allocated to both CENAP and CENCAP (both these agencies sponsor some A.T. oriented programs).

An investigation into the whereabouts of the loan contact prove futile but some general information did turn up. CENAP was to receive funding to relocate into one central building with expanded office space. CENCAP was to receive funds for construction of eight rural extension offices to be located at various strategic points in the country and supplied with support vehicles.

Additional information and exact expenditures going to each organization were unobtainable.

5. German Mission

The Mission has two working sites; the Central Office located in San Salvador and the field site located at Atiocoyo. The group is doing a remarkable job in attempting to blend both high and low power technologies under one roof.

Atiocoyo site is part of an (ISTA) Instituto Salvadoreño de Transformación Agraria project*. Some of the projects currently being examined by the Mission are:

Feed-Mill - A medium size mill is being prepared for operation in January 1979. It will produce feed for the cattle farmers of the cooperative utilizing molasses, corn husks, cotton

* The Atiocoyo site has over 5,000 manzanas of land.

seed, and other locally available material.

The equipment was purchased in Santa Ana and should be able to produce enough feed to serve the internal consumption of the cooperative. The estimated price of a 100 lb. bag of feed will be between 5 and 6 dollars. (A detailed feasibility study was done on the feedmill before construction. The report is precise and would prove interesting to outside parties interested in doing similar work. A copy is available at the German Mission).

Grain Drying (Patio) - There is a section of the project area dedicated to drying grain on concrete patios. The system uses a sliding roof which is moved on a small track to cover the grain each night in case it rains. Problems - High winds can destroy the roof and a large land area is required to dry the grain are limiting factors of this system.

Grain Drying (Machine) - The cooperative dries the bulk to their grain by machine and sells it to IRA. The process enables them to realize a better profit margin. The purchase of two M-150 grain drying units from Santa Ana are planned. These units can dry about 3 tons an hour and have an estimated cost of about \$12,000 dollars each.

This is not a form of low cost technology but in the case of Atiocoyo it may be appropriate to the large drying needs.

Railroad Spur - The cooperative had an old rail spur reconstructed. The idea is proving to be quite economical due to the poor road conditions which exist and the ability of the railroad to provide front door service at bargain rates. Utilization of the rail system is not always the most economical way to transport goods in El Salvador but in this case it is desirable.

Energy - The Atiocoyo site is still without electricity but this problem should be resolved by early 1979. Before the dawn of ISTA the old hacienda apparently used a large water wheel for the generation of its electrical requirements. The wheel which is still visible and can be seen from the main road leading to the German Mission field office. The unit has literally gone to the pigs. It now stands in ruins with wires, insulation, and metal rusting away. A former milk processing plant was also run by the wheel*.

* Interested parties searching for a large water wheel should inspect the one located at Atiocoyo

Tube Well - The Mission dug a tube well to satisfy the potable water needs of the populace. Two wells were dug at a depth of 200 feet. Both wells contain the bacteria E. coli and must to be chemically treated before drunk.

Animal Traction Implements - The Mission has a small selection of animal drawn implements. One is the tropiculture from France plus a few other odds and ends. When questioning personnel about the efficacy of the implements, everyone seemed to feel it wer excellent. Upon examination of the different units which were stacked together one could see few of the tools saw much field action. Also the pieces were not recommended by several employees for initial land preparation. They preferred to use high horse-power tractors.

Small Tractors - There are a few small horsepower tractors situated on the site. Most of the people spoken to seem to feel that the tractors were adequate for a few light jobs but a poor replacement for the larger horse power units. Manfred Graul, a German technician believes there greatest potential lies in the cultivation of vegetable crops in the irrigated sections of the cooperative.

A 14 horse power tractor from China was tried in Atiocoyo but failed to meet the standards expected by the people. (For detailed picture of the German Mission's total approach to the mechanization of Atiocoyo a request should be made for the latest report just completed by the Mission in 1978 titled, "The Mechanization of Atiocoyo").

Ultimately, the Atiocoyo project will probably resolve most of it's problems with capital intensive equipment because of the most availability of credit and pre-planned reliability of machines.

6. Comisión Ejecutiva Hidroeléctrica del Río Lempa (CEL)

All of the work performed at (CEL) represents high power technology geared toward solving national energy needs. The following breakdown illustrates what direction Dr. Alberto Chiquillo Alas, Superintendent of Investigation of Special Projects of CEL would like to pursue in the development of alternative energy sources:

- a) Demonstrate that the use of solar power is an excellent source of energy in the drying of corn.

(Research is geared for large industrial grain drying.) Estimated cost: \$50,000 dollars.

- b) Utilization of coffee pulp for the production of methane gas. Estimated cost: (¢231,500 colones)
- c) Re-utilization of excess water from Ahuachapán geothermal plant for the generation of electricity. Estimated cost: (¢362,900 colones) \$144,000 dollars.

Another subject discussed by Dr. Alberto Chiquillo Alas was utilization of wind power for municipal requirements. Unfortunately, preliminary studies indicate that only a couple of test areas, (Volcán de Santa Ana and Apaneca) might prove applicable to meet required wind velocity demands. Coastal winds were referred to as strong breezes with velocities of about 3 to 4 meters per second. Their potential is only suitable for small farm operations.

The following page gives an illustrative breakdown on just where the budgetary allowance of CEL are being consumed. Special notice should be given to the rural sector listed. As shown they do not represent a major funding sector in relation to CEL's total budgeting program.

Construcción y Equipamiento de la Central Hidroeléctrica San Lorenzo (Ejecución)

74.3
Equipamiento
de la Planta
Geotérmica
Fase III
(Ejecución)

31.9
Construcción
e Instalación
de Líneas de
Transmisión
San Lorenzo
(Factibilidad)

13.1
Construcción
Obras de
Transmisión
y Sub-
Estaciones
Diversas
(Ejecución)

10.2
Electrificación
Rural
(Ejecución)

10.1
Construcción
y Equipamiento
para el control
de Distribución
de la Energía
Eléctrica

9.0
Interconexión
Eléctrica
(Factibilidad)

4.5
Construcción
de Canal
Desague
Planta
Geotérmica
(Ejecución)

Sector
Energía
C.E.L.
Costo
Aproximado
595.3
Millones de Co
Information ta
from the Natio
Plan of El Sal

IV Role of Various Private Enterprises and Organizations Toward A.T. in El Salvador

A. Private Enterprises

1. R.G.Y. Asociados S.A. de C.V.

The report "Sistema de Aprovechamiento de Energía Solar para el Hospital Regional de San Miguel", represents the only major work of an industrial application of solar energy in this country. The promotion of the project has met with some success and plans are now being negotiated for construction of a smaller duplicate unit to be built in San Salvador's new Military Hospital.

Ing. Rodrigo Guerra has installed a small water heating unit in the Presidential Palace and is exploring the possibilities of building water heating units for first class houses. The company is searching for different markets in solar energy. They put together a folder on the energy consumption patterns of El Salvador in B.T.U. The results of that study can be found on the following page.

The market that R.G.Y. Asociados will be trying to entice is the Industrial Sector. Parties interested in examining the prospects of major solar projects in El Salvador should visit this firm.

2. Saquirol, S.A. de C.V.

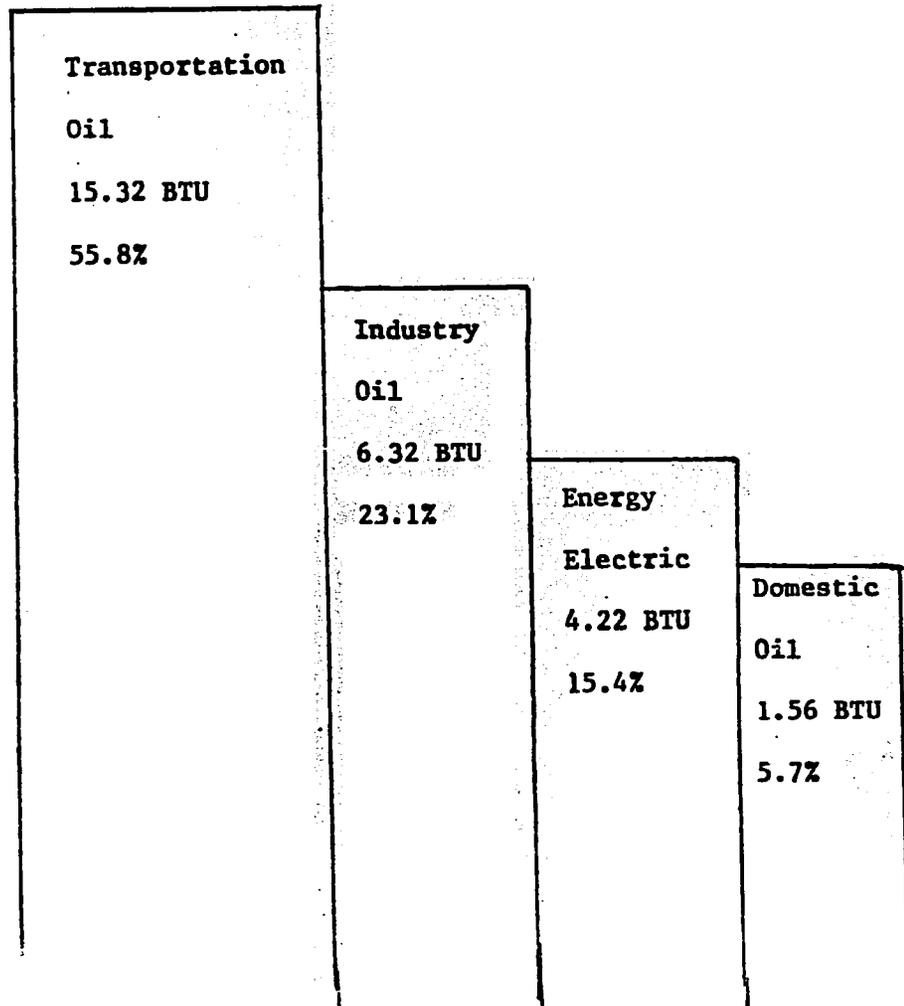
This company sells two small tractors which are imported from a Japanese company named Kubota. The first model is a 12.5 horse-powered Diesel engine which sells for about \$4,000 dollars. The second model is a 25 horse powered engine which sells for about 6,200 dollars. They are sold with a variety of attachments at extra cost. The small discs which are designed to fit the larger tractor are manufactured in El Salvador by Imacasa and sell for about \$1,400 dollars. Average tractor sales are in the neighborhood of 2 units per month.

Both tractors represent practical sources of entry into the mechanized field but unfortunately not for the average small-scale Salvadorean farmer who cultivates grains. Neither of these units can generate enough power to initiate critical land preparation procedures which are vital to production out-put at the beginning of each rainy season in heavy clay soils.

The potential role for the small tractor in El Salvador is with those small-scale farmers who have access to irrigation and are cultivating cash crops such as vegetables. The cultivation of vegetables shows a greater return per ha.* and the utilization of irrigation softens up the land enough to accommodate these lower horsepower tractors.

* See next page for gross return per hectare in more detail.

* BTU x 10² (Trillion of BTU)



**ENERGY CONSUMPTION
OF EL SALVADOR
1977**

**NOTE: Not including fire
wood or sugar cane husks**

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2. Ministerio de Educación
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4. Exxon-Volume Forecast S.A. to 1990

TOTAL ... 27.42 Trillion BTU

AGRICULTURE IN EL SALVADOR - 1978

(Value Listed at 1975 Prices)

Product	National Distribution in Thousands of Hectares	Gross Value of Total Production in Million	Gross Value per Hectare
CORN	230.0	\$ 59.48	\$ 258.61
BEANS	56.0	19.36	345.71
RICE	15.0	9.76	650.66
SORGHUM	132.5	20.64	155.77
SUGAR CANE REFINED SUGAR	40.0	40.28	1,007.00
SUGAR CANE CRUDE SUGAR	8.5	3.68	432.94
COFFEE	206.9	201.6	974.38
COTTON	87.4	85.24	975.28
TABACCO	1.6	8.72	764.91
KENAF	1.0		
HENEQUEN	8.8		
VEGETABLES	4.0	4.48	1,120.00
TUBERS	2.3	2.16	939.13
FRUIT TREES	16.8	13.2	785.60

* Information was provided from the National Plan of El Salvador "Bienestar Para Todos 1978-1982."

3. Imacasa

This company originally began manufacturing machetes for "campesinos" and later expanded into manufacturing shovels, knives, and other assorted hand implements. Situated in Santa Ana the firm is seeking to capture a share of the Central American Market and increase their product line.

Imacasa has just begun building discs of various sizes for both large and small tractors. Rey Roberto Morales, Head of the Agricultural Section believes the new product line being introduced is price competitive and a high quality tool. Steel used to make the implements is imported from Germany, Japan, and a little from United States. Distributors are now being sought throughout Central America. The wholesale price for an 18 piece disc that maintains an 18" inch diameter per unit is about \$2,500 dollars. The recommended retail price around \$3,000 dollars. Should the product line show success, plans to manufacture cultivators and plows for tractors will also be executed.

Imacasa participated in the industry fair held in San Salvador in November 1978 and was able to display their wares for public feedback. One of the implements they had on display was the Policultor. This plow was manufactured by Imacasa in 1973 for Dominique Rousseau. Future plans for this tool are uncertain but the exhibition does demonstrate an expanding interest in the small farmer.

The principle constraint facing companies such as Imacasa is lack of raw materials for in-country production. Mr. Morales stated that everything manufactured at Imacasa is imported right down to the plastic handles on the machetes. Only the labor is from El Salvador. Another factor to consider is governmental tax concessions on imported farm machinery and an underdeveloped marketing system especially in the case of the small farmer.

This company should be considered as an interested collaborator for the construction of simple A.T. oriented equipment in El Salvador.

4. La Casa Castro, S.A.

This firm is one of the largest and most reputable companies in El Salvador. It has been in business for many years serving the needs of various partisan groups including the small farmer.

Ing. Ricardo Armando Bustillo, Director of Technical Department states that many farmers are interested in up-grading their agricultural implements but often lack the knowledge of what exists on the market to achieve their goals. Nearly all the equipment sold at Casa Castro is imported from various countries around the world. The main suppliers are: United States, Brazil, Italy and England. When questioned: "Why import?", Mr. Bustillo declared that the quality of equipment made in El Salvador is inferior to the competition and price difference is low.

The following price break down will give the reader an idea of average cost of small motors in El Salvador.*

<u>TYPE</u>	<u>HORSEPOWER</u>	<u>PRICE</u>	<u>UNITS SOLD 1977</u>	<u>PURPOSE</u>
Diesel	10-150	\$1,400-\$16,000	200	Agro-Industrial
Electric	1/3-5.0 mono phase	40 400	30 30 200	Agr. Milling Building (lifting water)
Electric	5-30	200 11,000	15	Irrigation
Diesel	10-150	1,400 16,000	40	Irrigation

This company use to distribute windmills to small farmers located on the coastal regions but no longer keeps them in stock. The last unit sold by them was over sixteen years ago. It was purchased from Mill Mfg. Company, Beatrice, Nebraska, United States. The reason cited for the decline in sales was that the regions where the windmills show the greatest adaptability also represent the highest proportion of people who have access to electricity.

Other smaller companies mentioned were Sarti and Biollo from San Salvador and San Miguel. They manufacture milling units of 2 HP and 3 HP \$550 and \$700 dollars each. The quality of equipment is acceptable and popular among some small farmers.

Mr. Bustillo believes El Salvador's inability to compete with foreign products stems partly from an underdeveloped marketing system, high cost of raw materials and an insufficient number of technically skilled and experienced personnel. Rectification of this situation will take time and many companies like Casa Castro do not like to gamble on distributing untested quality equipment to their customers.

5. Maquinaria Agrícola

This company specializes in small scale equipment for the rural farmer. Located across the street from a large bus terminal which handles a great deal of traffic going to the western end of the country they are well situated to reach that portion of the rural population that visit San Salvador by bus.

All the tools sold by Maquinaria Agrícola are imported from México, Brazil and Guatemala. The price range differs on the type and size implement you buy. The following list represents some of the products sold.

* Figures were given as estimates from Ricardo Armando Bustillo from Casa Castro, S.A.

- a) Coffee Sheller (Pulperos de Café) manual, \$330 dollars with production capacity of 700 to 800 pounds per hour.
- b) Silage Cutter (Desgranadoras de Maíz) manual, \$300 dollars with production capacity of 700 to 100 pounds per hour.
- c) Corn Sheller (Desgranadoras de Maíz) manual, \$300 dollars with production capacity of 700 to 1000 pounds per hour.
- d) Hand Pump (Bomba de Agua) manual, \$100 dollars with lifting capacity of 10 gallons per hour.
- e) Feed Concentrate Mixers (Mezcladoras) \$150 dollars plus small motor which must be purchased separately, Production Capacity is about 500 pounds per hour.

While all the products listed above are imported from foreign countries they are durable and easy to repair. In most cases no special parts need to be imported and local repair could be performed. Future plans of Maquinaria Agrícola are to open a branch office in San Miguel to help attract more business from the eastern section of the country. Even though this company sells primarily to the low income farmers their marketing system is not aggressive. Poor rural residents do not like to venture into large cities because of the different environment and high cost. Therefore, they never receive exposure to tools that might improve the efficiency of their farm operation. Ultimately, weak product distribution has hindered sales as much as low purchasing power of many small-scale landowners.

6. Avelar Hnos., S.A. de C.V.

This Company is located in San Salvador and imports most of its small machinery from a Brazilian Company named Fortuna. Some of the products they handle are: corn huskers that are run by motor or tractor; wagon frames that are pulled by tractor; small animal traction plows and cultivators; easy-to-install water tanks for cattle and windmills.

This distributor is the only one I was able to locate that is still actively trying to sell windmills. The advertised lifting potential is 1,200 to 4,00 liters per hour at a depth up to 90 meters. Cost including installation will run \$2,000 dollars and up.

Mr. Eduardo Montes Dania states that the sales market for the windmill in El Salvador has been very poor compared to Guatemala where the same product is selling well along the coast. Upon closer examination we find that many of the coastal regions of Guatemala are still without electrical power and therefor searching for a power source.

Avelar Hnos., S.A. de C.V.; Maquinaria Agrícola Salvadoreña and Resortesa* all have a full line of equipment which could conceivably improve the efficiency and profitability of the small farmer. What they are lacking viable promotion vehicles to penetrate the rural wall.

The beverage companies have established a penetrating distribution system. Sales of soda or beers can be found even in the most remote portions of the country. Problems facing an entrepreneur in El Salvador can overcome but grass root exposure and availability of the product must be achieved to effectively sell to low-income rural residents.

B. Private Organizations

1. Asociación de Energía Solar de El Salvador AESES

The organization is composed of a variety of professional and non-professional members who meet periodically to discuss the role of solar energy in El Salvador. Group meetings are usually held at the Asociación Salvadoreña de Ingenieros y Arquitectos (ASIA) every other Thursday. Membership is placed at about 50 but not everyone is active in the association.

Ethelvina Murillo de Escobar is Director of the Association. A copy of one of the association's projects can be found in Annex H. It is being performed in conjunction with Dr. Rafael Baquero Parra from the "Universidad Autónoma Puebla, Mexico." The amount of progress achieved in relation to this plan has been little due to budgetary limitations.

Additional difficulties encountered by the group is the location of adequate material, Ethelvina Murillo de Escobar claims that lack of funding to purchase information and project material has greatly hampered the group effort. Some of the more prominent members of the association included; Mr. Ricardo A. Navarro from UCA; Dr. Alberto Chiquillo from CEL; Rodrigo E. Guerra y Guerra, from R.G.Y. Asociados S.A. de C.V. and Julio Rodríguez Barrera from UCA.

It appears that interest in solar energy association swings like a pendulum. Dr. Alberto Chiquillo stated that he was a member but has not gone to a meeting in months. Unless the organization can start generating some solid, visible projects, interest will most likely continue to fall. Perhaps, the Appropriate Technology Symposium might serve as an excellent springboard in generating additional momentum for the group.

AESES should be considered as a fomenter in the promotion of both high and low cost solar technology in El Salvador.

*Resortesa is a company that is located in San Salvador and distributes tools for the small scale farmer.

2. Technoserve, Inc

This non-profit International Organization provides selective technical consultation to various groups or cooperatives operating in El Salvador. The Director is Enrique Cristi and has a crew of about ten professional performing various tasks.

One of the more successful programs stimulated by Technoserve is a feed mill they initiated at a cooperative in Sensuntepeque. This mill can produce about two tons of bagged feed a day using locally available materials for a profit to the cooperative and saving to the buyer.

Donald O. Kieether is an Agricultural Engineer from International Rice Research Institute in the Philippines. He has visited Technoserve Inc. three consecutive years in an effort to provide technical assistance and dissemination of agricultural implements design by IRRI. The results of this collaboration has been the purchase of one rice thrasher from IRRI in the Philippines and operational difficulties in performance of the unit.

Due to vegetative difference between highland rice in El Salvador and lowland rice planted in the Philippines the maximum efficiency of the IRRI rice thrasher may never be realized. This unit can be viewed at Nueva Concepción at the Cooperative Acasycal. Technoserve is A.T. orientated but tends to be very particular about the organizations it assists.

3. Instituto Interamericano de Ciencias Agrícolas de la OEA (IICA)

Preliminary questioning of the local branch Director in El Salvador, Mr. Flavio Lazo, indicate that this organization is not directly involved in any appropriate technology operations. The type of information IICA has available is slanted toward socio-economic data of the small farmer and the environment he lives in. A project being advocated by IICA, El Salvador is to try and increase the use of legumes especially in the eastern part of the country. Gandul is being recommended to CENTA by IICA technician in hopes of rebuilding the soil.

IICA has performed some projects for various institutes in El Salvador. They should be considered for work designated to register impact of agriculturally oriented programs dealing with appropriate technology.

4. Instituto Centroamericano de Investigaciones y Tecnología (ICAITI)

Background: ICAITI was founded in 1955 to provide technological services to the five Central American Republics. It is located in Guatemala and is operating in facilities donated and maintained by the Guatemalan Government since 1957.

ICAITI is divided into eight departments. They are as followed:

- a) Applied Research
- b) Technical Industrial Services
- c) Standards
- d) Applied Geology
- e) Analysis
- f) Science and Technology (PTT)
- g) Documentation and Information
- h) Technical Publications

Organizational Facilities: The institution consist of 6485 square meters of land where a staff of 135 people are employed. This number includes 64 professionals.

Working Facilities of ICAITI are:

- a) An Organic Chemistry Laboratory
- b) An Inorganic Chemistry Laboratory
- c) A Leather Technology Laboratory
- d) A Laboratory and pulps and paper pilot plant
- e) A Laboratory and textile pilot plant
- f) A Food Technological Laboratory
- g) An Industrial Microbiology Laboratory
- h) A Special Analysis Laboratory equipped with an atomic absorption spectrophometer a mass spectrophometer and various gas chromoscopes.

* ICAITI Definition of Small and Medium Firms:

Small Firms: 30 or less employees

assets \$200,000 dollars

Medium Firms: 30 to 99 employees

assets \$200,000 - \$999,999 dollars

*Definition can be found in ROCAP project paper #596-0066 titled, Transfer of Technology, Oct. 1978

The suggested employee/capital ratio is indicative of a capital intensive system beyond the scope of appropriate technology given in this paper. While ICAITI definition does allow maneuverability, shifts from high to low power technology can be complex.

Future Plans: They intend to hire two additional field representatives for Honduras and Nicaragua (currently there are only three for the five Central American Countries).

Develop a businesslike strategy in order to transform the PTT division of ICAITI into a fund raising sector. Estimated total income to reach \$35,000 dollars per month.

ICAITI in El Salvador: The field agent is Jaime González. Every month he spends three weeks in El Salvador* and one week in Nicaragua. Recent activity in El Salvador includes a furniture specialist who performed a general assistance contract for \$6,000 dollars. There are plans being made to give a seminar to rural farmers on simple milk processing techniques in conjunction with CENCAP and CENAP in early 1979.

Elfas C. Hill was brought down to help direct a national appropriate technology seminars* in November of 1978 with CENAP. He stated that ICAITI has six full time employees working in conjunction with the entire spectrum of specialized laboratories and personnel for the promotion of A.T. in Central America.

Conclusion: ICAITI laboratory facilities and specialized approaches to problem solving indicate that they are a capital intensive organization attempting to provide technical services throughout Central America. There appears to be an interest in developing a section of the organization for A.T. oriented projects but this would be incongruent with self-sufficiency goals unless outside funding was incorporated to help defer cost to the small-scale benefactor. AID should consider ICAITI as a possible training vehicle for national field agents who would disseminate the knowledge to needy backward linkages.

5. Asociación Salvadoreña de Industriales (ASI)

Dr. Victor Manuel Cuellar Ortiz is the Technical Director of the organization. The objectives of ASI are:

* He is provided with office space by Asociación Salvadoreña de Industriales

**See Annex I for list of names and organizations that participated in the seminar.

- a) Foment and protect the industrial production of El Salvador.
- b) Protect the interest of industry of El Salvador in general by particularly the interest of its members.
- c) Attempt to improve the quality of goods manufactured in El Salvador.
- d) Foment and establish new industries for El Salvador.
- e) Cooperate with industry to help facilitate development of exportation of manufactured goods.
- f) Participate in National and International exhibitions to increase knowledge of Salvadoran goods.
- g) Collaborate with Industrial Training Centers to help promote a stable population of skilled labor that will be the future workers of different industries.

The members who participate in this organization are some of the largest and best organized companies in this country. They are not involved in any A.T. oriented projects and are interested in capital intensive systems that could improve their production and quality of good. They have solicited the service of ICAITI but only on a few occasions due to the high fees charged for personnel consultation. The organization preferred by many members was the one located in Washington, D.C. which consisted of retired businessmen who come down for short consultation.

ASI is a functionally efficient organization which is interested primarily in high powered technology. They should not be considered an appropriate organization for the promotion of light technology projects.

ANNEX I

COMMITTEE ON
APPROPRIATIONS
CHAIRMAN:
SUBCOMMITTEE ON
FOREIGN OPERATIONS
MEMBER:
SUBCOMMITTEE ON
INTERIOR
MILITARY CONSTRUCTION

AMERICA
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House of Representatives
Washington, D.C. 20515

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(202) 512-1000
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February 15, 1978

Office of Representative Clarence D. Long

DEFINITION OF LIGHT CAPITAL TECHNOLOGY

Although a number of amendments have been enacted into law requiring emphasis on "light capital technology" in foreign aid programs, there is still a great deal of confusion over what the term "light capital technology" means.

- Light capital technology should not be regarded as "primitive," "low," "unsophisticated," or "obsolete" technology. Rather it is technology economical of capital. Producing a light capital technology that works, is culturally congenial, and is economic can require ingenious design and careful field testing.
- Light capital technology should not be regarded as synonymous with inefficiency or high cost. On the contrary, if done appropriately, it should represent the least-cost solution by combining factors of production according to their relative scarcities; economizing on capital wherever capital is scarce and expensive and labor abundant and cheap.
- Labor intensiveness is a necessary condition by which to define light capital technology, but it is not a sufficient condition, since even primitive or labor wasting technologies are labor intensive.
- Light capital is not defined by dividing the total cost of a project by some total of beneficiaries, especially where it is difficult to identify these beneficiaries and to measure their individual benefits. It is defined by a small amount of capital investment per worker using the capital, and preferably by small projects that can be managed by small entrepreneurs.

A useful approximation of light capital technology is \$100 per worker employed. The \$100 figure is intended to be an order of magnitude, rather than a precise figure. A few light capital technologies will be more costly than

\$100, but many others can be found that will be much cheaper --a one shot seeder in Honduras for \$20; a family grain storage bin in El Salvador for less than \$60. Any cost appreciably larger than \$100 per worker tends to soak up so much capital in helping a relatively small number that no capital would be left to help the great majority. Even a cost of \$100 per worker would mean that \$100 billion would be required to finance the employment and increased production of the world's one billion working poor - a far larger sum of money than would be available for economic development even over a number of years. Therefore, any standard on an order of magnitude greater than \$100 per worker deprives us of any hope of reaching a significant proportion of the world's poor.

Of course, if a technology costing in the thousands of dollars per worker--such as a wheat thresher I saw in El Salvador--should turn out to be spectacularly productive it should be given consideration, but the burden of proof should be against any technology requiring such an infusion of capital, if for no other reason than because too much capital used in one place is going to mean less capital at another place. Even at \$100 or less, most of the cost of economic development will have to be borne by finding ways for poor countries to produce their own capital from their own reserves of underutilized labor time or by finding ways of accumulating money savings through cooperative savings and lending institutions.

-Light capital technology does not necessarily mean the displacement of large scale infrastructure projects. Light capital technologies can be developed in the rural areas or inserted into the interstices of urban sectors of poor countries simultaneously with capital-intensive infrastructural development, especially if the latter are designed to complement the light capital development (e.g., irrigation and rural roads), but so much attention has been given to infrastructural projects, that it would seem possible, for a while at least, to shift the emphasis to light capital technology.

LONG AMENDMENTS IN THE FIELD OF LIGHT CAPITAL TECHNOLOGY

DATE ENACTED

AMENDMENT

May 31, 1976

Amendment to the Inter-American Development Bank Authorization Act requiring the U.S. Executive Director to propose that light capital technologies "be accepted as major facets of the Bank's development strategy."
(PL 94-302)

<u>DATE ENACTED</u>	<u>AMENDMENT</u>
August 17, 1977	<u>Amendment</u> requiring that the U.S. place "important" emphasis on light capital technologies in preparing for and participating in the U.N. Conference on Science and Technology. (PL 95-105)
October 3, 1977	<u>Amendment</u> to the International Financial Institutions Authorization Act Requiring the U.S. to "promote the development and and utilization of light capital technologies" through the international financial institutions. (PL 95-118)
July 26, 1977	<u>Amendment</u> to the Interior and Related Agencies Appropriation Act for FY 1978 providing \$3 million for ERDA (Energy Research and Development Administration; now a part of the Department of Energy) program in light capital or appropriate energy technologies. This program is for domestic U.S. projects but should develop some technologies that will be applicable to developing countries. (PL 95-74)

DEVELOPMENT
COMMUNICATION
REPORTSEPTEMBER 1978
No. 24

The Guatemalan Basic Village Education Project (Ed. note: see DCR issue 22) has shown that careful programming can win the attention of a large rural audience and foster changes in agricultural practices as well. By providing accurate agricultural information precisely tuned to the timing of the crop cycle, the BVE programmers maximize the chance that the farmers will try the practices recommended. The audiences are organized in part of the project, but high learning gains and high levels of innovation adoption have also typified some of the open audiences.

The first three cases demonstrate that radio can be used to promote good health, sound nutrition, and agricultural productivity. They show too that radio attracts a wide audience and gets messages across even to an unorganized audience. Two of the cases show that it can affect behavior changes as well. Since all these changes have been wrought at low cost, this evidence suggests that most countries could use radio as a national resource to pursue important development goals.

The last example, that of a radio campaign, reveals another dimension of radio's potential and shows that broadcast does indeed mean broad cast. The Tanzanian campaign, Man Is Health, mobilized over 2,000,000 adults in 1973, and its success testifies to radio's potential for reaching large audiences. Campaign costs in Tanzania have been modest and could be relatively low elsewhere, though the careful planning and control critical to the success of this campaign may be difficult to achieve in some countries.

Systematic review shows that radio's potential in development communication is for the most part untapped. Political, infrastructural, and some technological constraints upon its use cannot be ignored, but neither can its enormous promise.

■ Dean T. Jamison, Development Economics Department of the World Bank, and Emile G. McNany, Stanford University's Institute for Communication Research

(This article is based upon research supported by the World Bank and published in *Radio for Education and Development*, 1978, by Sage Publications, Inc., of Beverly Hills and London. Views expressed are those of the authors and not

Using Radio For
Classroom Instruction

In 1973 the Development Services Bureau of USAID initiated an experimental project to test the feasibility of providing direct instruction in mathematics to children in primary-school classrooms by radio. Most prior applications used radio lessons as an auxiliary to mainline teaching, to provide enrichment or supplementary practice. What USAID wanted to know was whether the medium could be used to carry the full burden of instruction and whether such a use could improve the achievement levels of students at a cost developing countries could bear. The Radio Math Project, which is run in collaboration with Nicaragua's Ministry of Public Education, is nearing the end of its research phase and the results have provided an answer to USAID's question.

Since the project's goal is to improve the quality of mathematics instruction, evaluations have focused on achievement-test scores. The results — which can be generalized because both radio classes and control classes were selected at random — show that in Grades 1, 2, and 3, students studying by radio reach significantly higher achievement levels than do students in traditional classrooms. For example, the mean post-test score for radio students in grade 1 was 55, compared with 34 for control students. Two groups of second-grade radio students were studied, those who had used the Radio Math Program for one year and those who had used it for two (in first and in second grade). The mean post-test scores were 74.2 for control students, 78.6 for students with one year of radio classes, 85.6 for students with two years of radio classes. A similar progression was found for Grade 3: mean test scores for control, one-year, and two-year groups were, respectively, 56.0, 67.4, and 73.0.

How were these positive results achieved? One key is assuming complete responsibility for all mathematics instruction of the children — taking the radio lessons. The project staff puts together the daily lessons (each of which has two parts — a half-hour radio broadcast plus a set of post-broadcast activities) that the children use in the schools during their regular mathematics periods. The teacher supervises the class during the broadcast lesson and also conducts supplementary activities during the remainder of the mathematics period; these activities are based on suggestions provided in a teacher's guide prepared and distributed by the project staff.

The content of the lessons is taken from the official syllabus of the Nicaraguan Ministry of Public Education, the same syllabus that guides the activities of teachers in traditional classrooms. Thus, despite the pedagogical differences between the traditional style of instruction and the radio-based instruction, lesson content is essentially the same and the focus differs only slightly.

cast portions of the lessons, stress falls on active learner participation; an average of five student responses per minute is elicited during the radio broadcast. These responses may be oral, written, or physical. Mathematical concepts, arithmetic skills, and problem-solving abilities are all taught in a direct, down-to-earth style that children can understand and appreciate. Lecturing and the use of technical vocabulary are held to a minimum, and songs, jokes, riddles, stories, and games are interspersed among the mathematical segments. The quick pace of the broadcast, the keen interest of the children, and the careful sequential development of mathematical concepts and skills have prompted some to characterize the programs as a cross between Sesame Street and programmed instruction.

A program that both captivates its audience and effectively teaches a subject as difficult as mathematics does not come about by chance. It must be developed according to a well-thought-out system of program design — the essence of which is feedback. Although a detailed annual plan is elaborated before the lessons are written, this plan is altered throughout the year in conformance with performance data culled from classroom observations and weekly tests. Evaluation is an integral part of production, and lessons reflect the implications of observational and test data from previously broadcast lessons.

Designing and administering tests and observing scattered rural classes on a daily basis require a large staff. Consequently, the curriculum development process is quite expensive. However, production outlays represent a one-time cost (taped programs are usable for years), and a great effort has been made to keep long-term operating costs down. No textbooks are required; each child has a small, inexpensive notebook, in addition to which seeds, bottle tops, and stones — free and abundant materials all — are used. The teacher's guide, like the taped programs, is reusable. In addition, radio receivers are shared (lessons for different grades are broadcast at different times, so a communal radio receiver can be passed from one classroom to the next during a musical interlude provided specifically for this purpose). In short, the high initial cost of curriculum development may be spread over hundreds of thousands of students to keep yearly operating costs low.

By paying careful attention to economics, as well as to educational and human considerations, the staff of the Radio Math Project has brought Nicaraguan children an educational system that is both of the highest quality and well within the budgetary reach of the poorest of countries. The success of the program can be attributed to the style of lesson and to the care with which curriculum, material and instructional dialogue is developed — ingredients that can be transferred to other countries and to other subject matters.

■ Barbara Searle, Institute for Mathematical Studies in the Social Sciences, Sta

"Total dependency on conventional fuels especially in rural areas is likely to become, if not already, a serious handicap for those persons who must rely upon the exorbitant high costs of fossil fuels or the disastrous consequences of deforestation. However, by producing energy from local resources it is possible to be partially freed from these external sources of increasingly expensive fuel supplies."

Craig J. Warriner
Peace Corp Volunteer
February 1978

This statement was written in conclusion to an initial report concerning my experiments with Methane Gas here in El Salvador. At the time this article was written I had not received sufficient results to judge whether the production of energy from local resources could be achieved. As of this writing, the recipient of my experiment is realizing a 30% reduction of firewood expenditure while obtaining benefits of greater than 2 hours cooking time and variable hours of lighting. How have such results been achieved? Simply by utilizing the organic wastes of 1 mature cow and a system of airtight containers referred to as "Methane Digesters."

Methane digestion is a process in which fresh cowdung, or any other animal feces (horses, pigs, poultry, camels or yaks), is first diluted with water and fermented by the bacterium "methanogenes". This action results in the production of 90% of its potential gas within a period of four weeks. After initial production, the gas leaves the digester through a system of tubes and continues onto a determined container for the purpose of storage. From these storage tanks the gas can be fed directly into stoves, refrigerators, lamps, engines or any such appliance or utility that is capable of using natural gas.

The results I have obtained have been greater than I had originally expected. From the daily use of approximately 10 pounds of fresh cow manure, we are realizing the net results of nearly 16 Ft.³ of gas per day, and sometimes greater due to fluctuations of the surrounding temperatures. (It should be noted here that the average adult cow can produce more than 30 pounds of manure daily. However, the need for "fresh" manure is an important part of methane digestion and since the

ows from this project are not confined, the manure must be gathered daily from the fields. Therefore, only the portion not in contact with the ground can be used, as inorganic material such as stones and dirt do not digest within the unit and eventually cause functional difficulties). From the point of production, the daily gas is stored in a simple system of large truck inertubes connected with adjoining "T" valves. From these tubes the gas runs directly through a line into the kitchen. Here we have converted a typical "tropigas" propane stove for the use of methane. The end result is a 3 burner stove burning at an efficiency level equal to that of propane or butane. The flame remains stable and blue throughout the duration of use.

A second benefit of methane is a system of lighting produced by a "Coleman" type kerosene lamp connected to the methane storage tanks. These lamps provide a continuous source of illumination for the household. The light, although not as bright as that of an electric lightbulb, is sufficient for the simple needs of the farmer but can be improved by either drying the gas through sawdust, or enriching the gas by passing it first through an airtight container containing some form of volital liquid, like kerosene. In this manner the methane produces a higher intensity light nearly equal to that of electricity.

The third major benefit from this "homestead" type digester is the residual effluent that is produced after the anaerobic process is completed. This effluent, in the form of liquid fertilizer, has often been said to be the profit margin of methane digestion. Although this project is producing only 3.5 gallons of effluent daily, it has been sufficient to obtain remarkable results. Periodically this effluent was spread over a controlled area of 8 rows of maturing corn, and tended by the farmer under normal growing procedures. The results of this experiment were a larger and more healthystock of corn in comparison to these surrounding areas that had not been "fed" with the methane residual. Similiar results were experienced with cucumbers, tomatoes and several orange trees, all of which presented a substantial increase in production and quality of the product.

After nearly 6 months of developing this project, many cultural as well as physical changes have come about. When I set out to do this project my original goals were to provide an adequate fuel for cooking, apart from the conventional sources found here in Latin America, i.e. firewood. Through the process of methane I was searching for a way to offer the people an alternative to smoke filled homes, intense eye-irritation, and unsanitary cooking methods. In hopes of alleviating the burden

of often futile hours of wood collection due to rapid deforestation, my drive has enabled me to fulfill not only these goals but other less obvious ones such as a simple cost free method of home lighting as well as an endless supply of valuable fertilizers. Apart from the physical advantages of methane digestion, this experiment has presented to the people the possibility for utilizing other sources of alternative energy. Through this project I have introduced, as well, a simple low cost method of water heating by direct use of the sun. Not only are we using the benefits of this solar water heater to assist in methane production, but such advantages as bathing and the washing of clothes and dishes have been achieved through this secondary project.

Upon arrival to Las Chinamas, the majority of the community looked upon me as a "tonto" or a "bobo" as I went about my day collecting manure and depositing it into our somewhat strange looking digester. Today those same people look upon this project as an alternative to that increasingly scarce commodity, firewood. I do not feel that methane digestion is the ultimate key to the world's fast approaching energy shortage. However, by opening our eyes to the things around us, and by realizing that Nature has provided us with those "keys" to minimize our dependency with fossil fuels, maybe we as human beings can survive yet a little longer, still to enjoy the beauty of the setting sun and the wonders of nature around us.

JUSTIFICATIONS

The "Universidad Centroamericana José Simeón Cañas", conscious of the fundamental role played by Engineering in the Socio-Economic development of a country, has resolved to sponsor the Second International Symposium of Engineering, to be held at the University from the 19th. to the 23rd. of February 1978.

The decision to organize this event has evolved from a strongly felt need for a profound analysis of the technical and social problems involved in the application of technology in underdeveloped countries. For this reason the central theme of the Second International Symposium of Engineering has been designated:

TECHNOLOGY APPROPRIATE TO UNDERDEVELOPED COUNTRIES

OBJECTIVES

- 1) To study the technical aspects related to technology utilization in underdeveloped countries.
- 2) To promote the use of those technologies which have been created in developed countries, yet are usable in underdeveloped areas.
- 3) To promote the formation of a native technology appropriate to the socio-economic conditions of underdeveloped countries.
- 4) To look for solutions to technical, ecological and social problems arising from the application of technologies appropriate to developed countries, without critical judgement, to underdeveloped areas.
- 5) To analyze the technical, economic, social, political and psychological barriers to research on, encouragement of, and utilization of, labor intensive technology.

PAPERS REQUESTED:

The Symposium welcomes papers on any technical or social problem related to possible applications of native or transferred technologies in underdeveloped areas. Some possible areas are:

CONVENTIONAL AND NON CONVENTIONAL SOURCES OF ENERGY.
COLLECTION PRESERVATION AND SUPPLY OF WATER
TECHNOLOGY DEVELOPED IN AND FOR UNDERDEVELOPED AREAS.
MAN-TECHNOLOGY INTERACTIONS.
ENVIRONMENT — TECHNOLOGY INTERACTIONS.
SOCIAL AND ETHICAL ASPECTS OF ENGINEERING.
DEVELOPMENT OF SOCIALLY CONSCIOUS ENGINEERS.

SANITARY TECHNOLOGY.
POLLUTION.
TRANSFER OF TECHNOLOGY.
COMPUTER APPLICATIONS.
FOOD TECHNOLOGY, ...
INDUSTRIAL TECHNOLOGY.
TRANSPORTATION.

FORMAT

An abstract of less than 300 words should be submitted by October 1st, 1978. Two copies of the final paper should be sent by December 10 1978. Manuscripts written in Spanish, Portuguese, English, German, Italian or French are acceptable. The manuscript should be no more than 25 pages (8½ by 11"); drawings, graphs, tables, etc., can be included in the text or at the end. References must be placed at the end of the work.

PARTICIPANTS

This Symposium is intended to be of interest to Engineers, Scientists, Technical and non-technical people concerned with technical and social problems involved with technology utilization in underdeveloped areas. The registration fee is as follows:

Participant U.S. \$ 30 (Paid Prior December 10, 1978)
Student U.S. \$ 12 (Paid Prior December 10, 1978)

After December 10, a 20% charge will be added.

Make Check Payable to: SEGUNDO SIMPOSIO DE INGENIERIA

MORE INFORMATION

Please contact:

Ing. Ricardo A. Navarro
Coordinador General del Segundo Simposio de Ingeniería.
Universidad José Simeón Cañas
Apto. (01) 168
San Salvador, El Salvador, C. A.
Phone: 24-0011 Cable: UCASAL



Segundo Simposio de Ingeniería

Tecnología Apropriada para Países Subdesarrollados

Febrero 19-23, 1979.

LIST # 1 OF PAPERS TO BE PRESENTED AT THE INTERNATIONAL SYMPOSIUM OF ENGINEERING:

- 1- Industrial Technology - Carlos A. Becerra, Ecuador.
- 2- Interacción Tecnología Ambiente. - Ramón Blanco Fernández; Carlos Roméu Hedwed, España.
- 3- Ingeniería Solar para el desarrollo rural en Latinoamérica - Jorge M. Huacuz V., México.
- 4- Transferencia de Tecnología-Creación de Tecnología en países subdesarrollados - Juan E. Joffré, Bolivia.
- 5- The Potential of Direct Filtration for Water Treatment in underdeveloped countries - Paul H. King, U.S.A.
- 6- Conversion of Organic Waste and Urban refuse to produce substitute Natural Gas - Donald L. Klass, U.S.A.
- 7- Utilización del Poliestireno expandible en la producción de modelos para fundición - Carlos A. López, Colombia.
- 8- Biomass Fueled Producer Gas Generators for Agriculture, Light industry and Villages - Harry W. Parker, U.S.A.
- 9- Current Trends in Engineering Education in the USA, and implications for Latin America - George Pincus; Frank Tiller, U.S.A.
- 10- Development of a Novel Solar Heating and Air Conditioning - William F. Rush, U.S.A.
- 11- Appropriate Technology for Water and Waste Water Treatment in Developing Countries - George H. Reid, U.S.A.
- 12- Estimation of Electrical Energy cost for Solar Thermal Electric Power System in Japan - Tatsuo Tani, Japan.
- 13- Transportation - James I. Taylor, U.S.A.
- 14- Mecanización de la Agricultura en zonas de Ladera - Ernesto Valencia C., Colombia.
- 15- Química de alimentos producción, Procesamiento y Conservación de Alimentos - Oscar Aragón Valdez, Nicaragua.
- 16- Criteria for industrialization among selected nations - T.G. Gonen, U.S.A.; A.S. Eltouny, Saudi Arabia.
- 17- Técnicas Educativas - Phillip H. Osborne, U.S.A.
- 18- Producción, Procesamiento y Preservación de Alimentos - Mrs. Phillip H. Osborne, U.S.A.
- 19- Determination of how urban land use should be organized to reduce travel (Energy) and the cost of Services.- John Dickey; Erick Chetwynd Ron Sharpe; Erick Teicholz, U.S.A.
- 20- Processing woody residues for use in ruminant rations.- Harry W. Parker, U.S.A.
- 21- Energy for Appropriate Technology Farming Systems in the humid Tropics. Ray H. Jewardene, Nigeria.

**LIST # 2 OF PAPERS TO BE PRESENTED AT THE INTERNATIONAL SYMPOSIUM OF EN-
GINEERING;**

- 22- Applications of castor Oil-based elastomers and plastics:
Simultaneous interpreting Network mode of Synthesis - L.H. Sperling,
U.S.A.
- 23- Agricultura integrada mediante el uso de residuos orgánicos para la
producción de Energía fertilizantes y peces en estanques - Samuel Bern,
Panamá.
- 24- Transferecia de Tecnología-Enlaces industriales - Sara Isabel López
Barrios, Nicaragua.
- 25- Tecnología apropiada para incrementar la habilidad de empresarios - Hay
J. ne Weiss, U.S.A.
- 26- Transportation and developing countries - Peter R. Stopher, U.S.A.
- 27- Conflictos que se derivan de los diversos usos de las zonas costeras, y
de las políticas y tecnologías desarrolladas para dichos usos - Francisco
J. Palacio, USA.
- 28- Mobility, Transportation, and economic development in rural areas in de
veloping countries: Perspectives from Tanzania.- Gerrit Vander Wees,
Holanda.
- 29- Choice of Appropriate technology in developing countries: Experiences
in transport and road improvement in Tanzania - Gerrit Vander Wees, Ho-
landa.
- 30- Engineering Protein Extraction from green plants - H. D. Bruhn, U.S.A.
- 31- La problemática Tecnológica Latinoamericana y sus implicaciones en el
desarrollo de una Ingeniería Nacional - Edgar Paredes, Miguel Génova,
Lois Alvaray, Jorge Giordany, Venezuela.
- 32- Environment Technology Interaction - Gerald J.L. Griffin, United Kin -
dom.
- 33- Brickwork as a material of Construction for underdeveloped countries -
F. Sawko, England.
- 34- Appropriate sanitation for Urban Areas and villages in Developing Coun
tries: John Pickford, United Kindom.
- 35- Fruticultura - Fernando Medel, Chile.
- 36- Construction of Self Help Wells - Richard G. Koegel, U.S.A.
- 37- Fuel cell Technology and Underdeveloped countries - Randal Antonio Go
ffe, U.S.A.
- 38- A study of Appropriate Mechanical Technologies in small farms in se -
lected Latin American Countries - Rex L. Clark, J. M. Patrick, U.S.A.
- 39- Energy Technology and Social Structure - Bent Sørensen, Dinamarca.
- 40- Therole of Meteorology in developing countries - A. I. Scarr, Great
Britain.

ANNEX E**CURSO "TALLER METODOS SEMIAUTOMATIZADOS DE MANEJO DE DOCUMENTOS"**

<u>NOMBRE</u>	<u>INSTITUCION</u>	<u>DIRECCION PARTICULAR</u>
MYRIAN ORELLANA AMADOR	Instituto Tecnológico de San Salvador	Av. Fernal #24 Políg.H.C.Satélite
ALICIA MELGAR	Ministerio de Agricultura y Ganadería	16 Av. Nte. #07, Ciudad.-
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MYRNA DE PORTILLO	Biblioteca Ministerio de Planificación y Coordinación del Desarrollo Económico y Social.	Final Av. Irazú #6 Col. Costa Rica 2. Tel. 22-9015
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MARINA FLORES DE DIAZ	Biblioteca Central, Universidad de El Salvador	Col. San Mateo Caracas Polígono H No.24
XIMENA TIZNADO R.	Biblioteca Nacional	2a. Av. Sur 535
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JOSEFINA CASTRO DE ROQUE	Biblioteca UCA	Col.Costa Rica, C.Liberia 123
ABELINA DE CLAROS	Universidad Centroamericana "José Simeón Cañas"	Col.Buenos Aires #2 Av.4 de mayo 118
LUCY ARRABE PINAR	Sección Cultural Embajada Argentina 17 C.P.617	Centro Urbano Amatepec Edif.55 Apartamento 24.
ROBERTO BERCIANO	Comisión Ejecutiva Hidroeléctrica del Río Lempa	Col. Matamoros 3 Pto Las Colinas #503

EDGAR A. PEREZ PORJA

Biblioteca Central ISSS

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Universidad de El Salvador

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JUDITH LOVATO DE GARCIA

Dirección Gral.Nac.Naturales Renovables Cantón El Matizano

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ANA ISABEL M. DE CARRERA

Ministerio de Trabajo y Prev.Social 2a.Av.Nte. 428

C.Santa Cruz #17 Santa Ana

JUAN ANTONIO FLORES

CENTA - San Andrés

Col.El Quetzal, Pje."A" 63
Quezaltepeque.

ALFREDO LOZANO

Compañía Salvadoreña de Café 6a.Av.S.y 2a.C.O.

C.Urbano Atlacat, Pje.Gua:
18.

MARIA DEL CARMEN DE SALGADO

ISIC - Final 1a. Av.Nte. Santa Tecla

Col.Guadalupe Pje.23 #12
Soyapango.

MARTHA C. DE RIVAS

INSAFI

Calle Rubén Darfo 628

Jardines Cuscatlán
Av. L.A. # KE

ROBERTO MAGARA

Universidad de El Salvador

Col. Zacamil #1 Apart.#12

GLADYS DE NAZARIO

Universidad de El Salvador

Calle Nueva #2 casa 10, Esc

HELEN G. DE DEL CID

Edif.306 No.21 C.Urbano
José Simón Cañas, Mejican

Première machine au Monde qui réconcilie l'AMI DE LA TERRE AVEC LE TRAVAIL



* **AU PAKISTANI**

RANA MAQSUD IQBAL KHAN et son frère hersent leur champ

se promenant et bavardant en même temps...

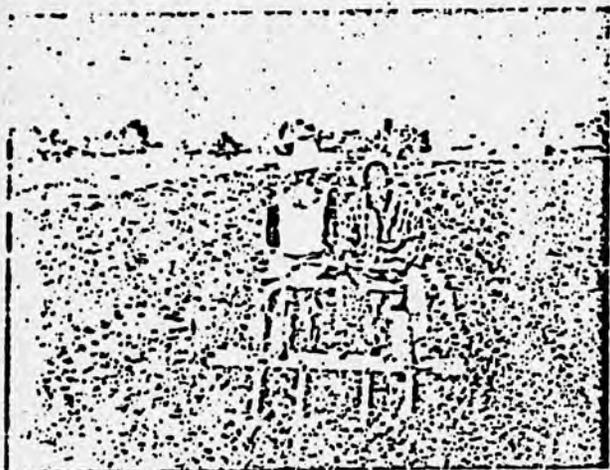
* **EN INDOIE**

Sri RAMLOU sème 4 hectares de maïs par jour, son assistant surveille assis les semoirs...



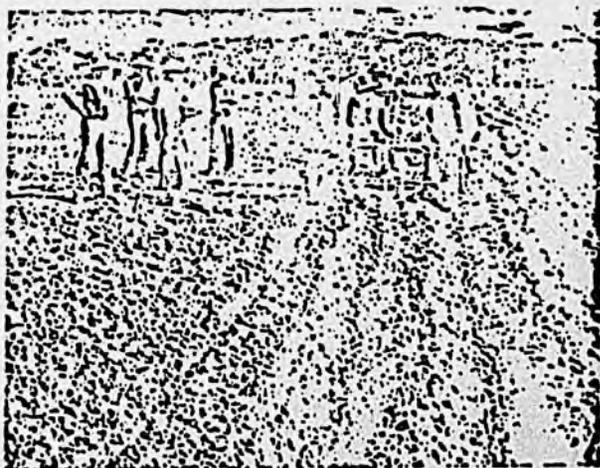
* **AU SÉNÉGAL**

Le dénommé DIAGNE bine sans fatigue ses arachides...



* **AU SALVADOR**

L'ingénieur J. MADRIZ essaie le billonneur devant les agronomes d'ATIOCOYO...

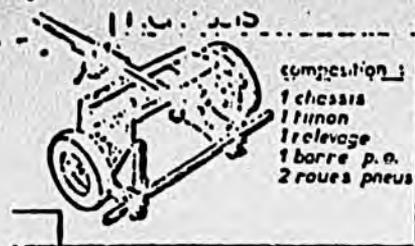


... et ainsi de suite, du labour à la récolte...



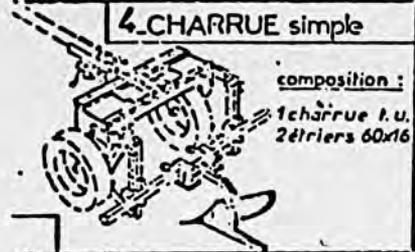
c'est une création de Jean NOUË





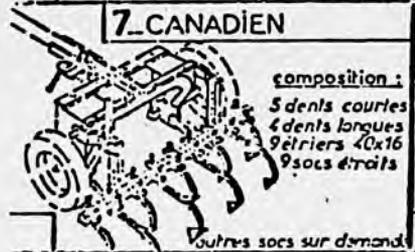
composition :
 1 chassa
 1 lunon
 1 relevage
 1 barre p.o.
 2 roues pneus

4. CHARRUE simple



composition :
 1 charrue t.u.
 2 étriers 60x16

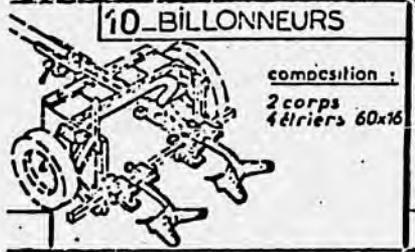
7. CANADIEN



composition :
 5 dents courtes
 4 dents longues
 9 étriers 40x16
 9 socs étroits

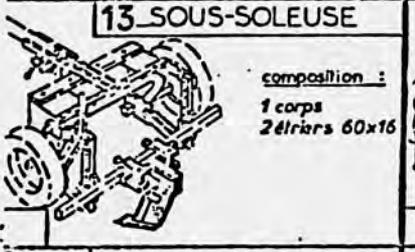
autres socs sur demand

10. BILLONNEURS



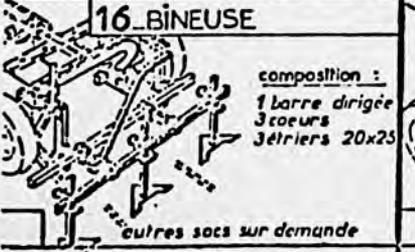
composition :
 2 corps
 4 étriers 60x16

13. SOUS-SOLEUSE



composition :
 1 corps
 2 étriers 60x16

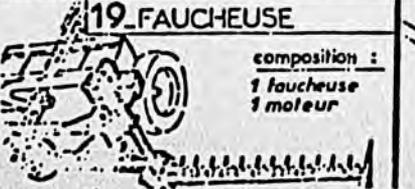
16. BINEUSE



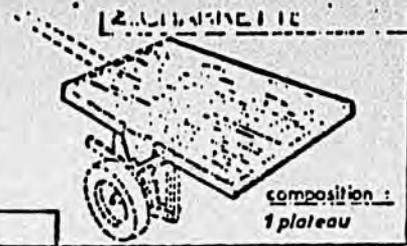
composition :
 1 barre dirigée
 3 coeurs
 3 étriers 20x25

autres socs sur demande

19. FAUCHEUSE

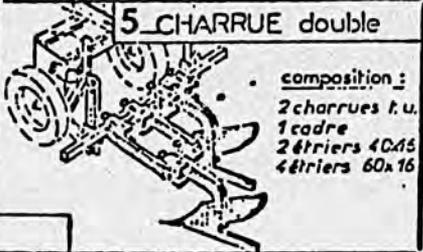


composition :
 1 faucheuse
 1 moteur



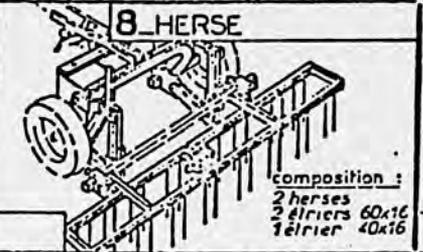
composition :
 1 plateau

5. CHARRUE double



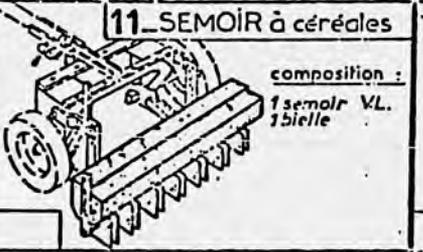
composition :
 2 charrues t.u.
 1 cadre
 2 étriers 40x16
 4 étriers 60x16

8. HERSE



composition :
 2 herse
 2 étriers 60x16
 1 étrier 40x16

11. SEMOIR à céréales



composition :
 1 semoir VL.
 1 bielle

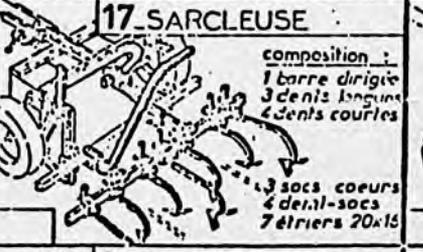
14. FERTILISEUR volée



composition :
 1 caisse
 1 bielle

utilisable avec 7.8.9.10.11.16.17

17. SARCLEUSE

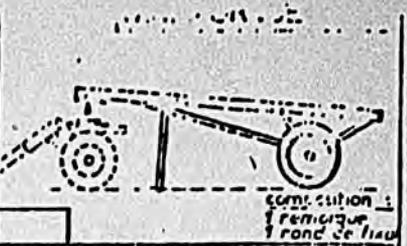


composition :
 1 barre dirigée
 3 dents longues
 4 dents courtes
 3 socs coeurs
 4 dent-socs
 7 étriers 20x16

20. PULVÉRISATEUR

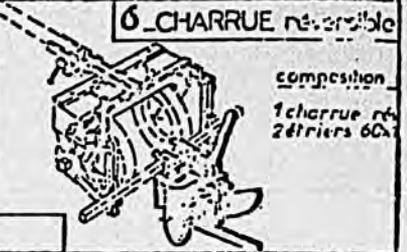


composition :
 1 bac (cuve)



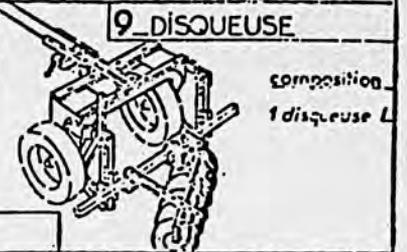
composition :
 1 renvoi
 1 rond de liaison

6. CHARRUE réversible



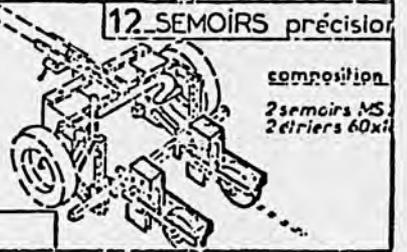
composition :
 1 charrue r.v.
 2 étriers 60x16

9. DISQUEUSE



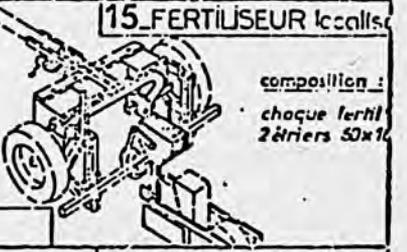
composition :
 1 disqueuse L

12. SEMOIRS précisior



composition :
 2 semoirs MS
 2 étriers 60x16

15. FERTILISEUR localis



composition :
 chaque fertil
 2 étriers 50x16

18. ARRACHEUSE



composition :
 2 étriers 60x16
 1 élançon
 1 soc pointu
 1 soc droit

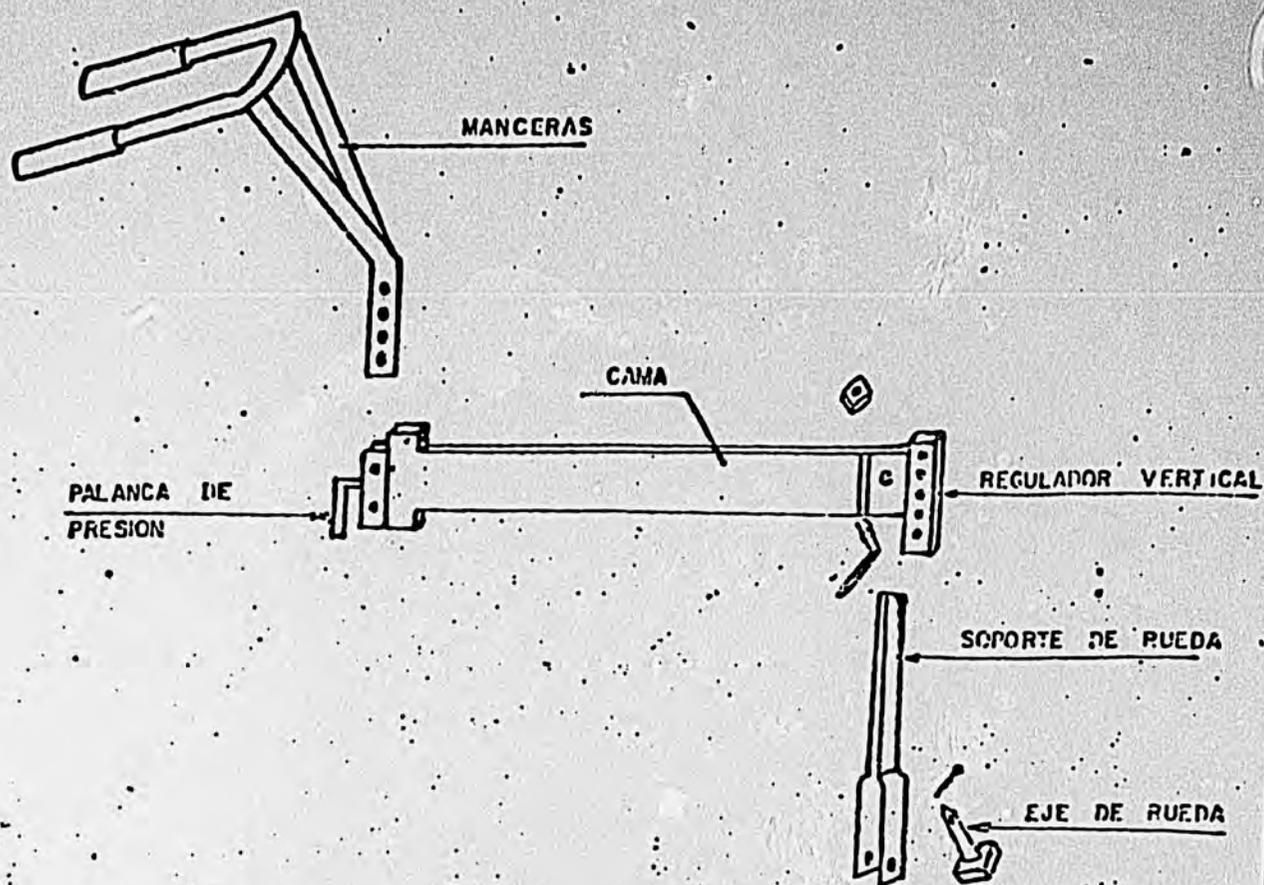
barre dirigée sur demande

21. DIVERS

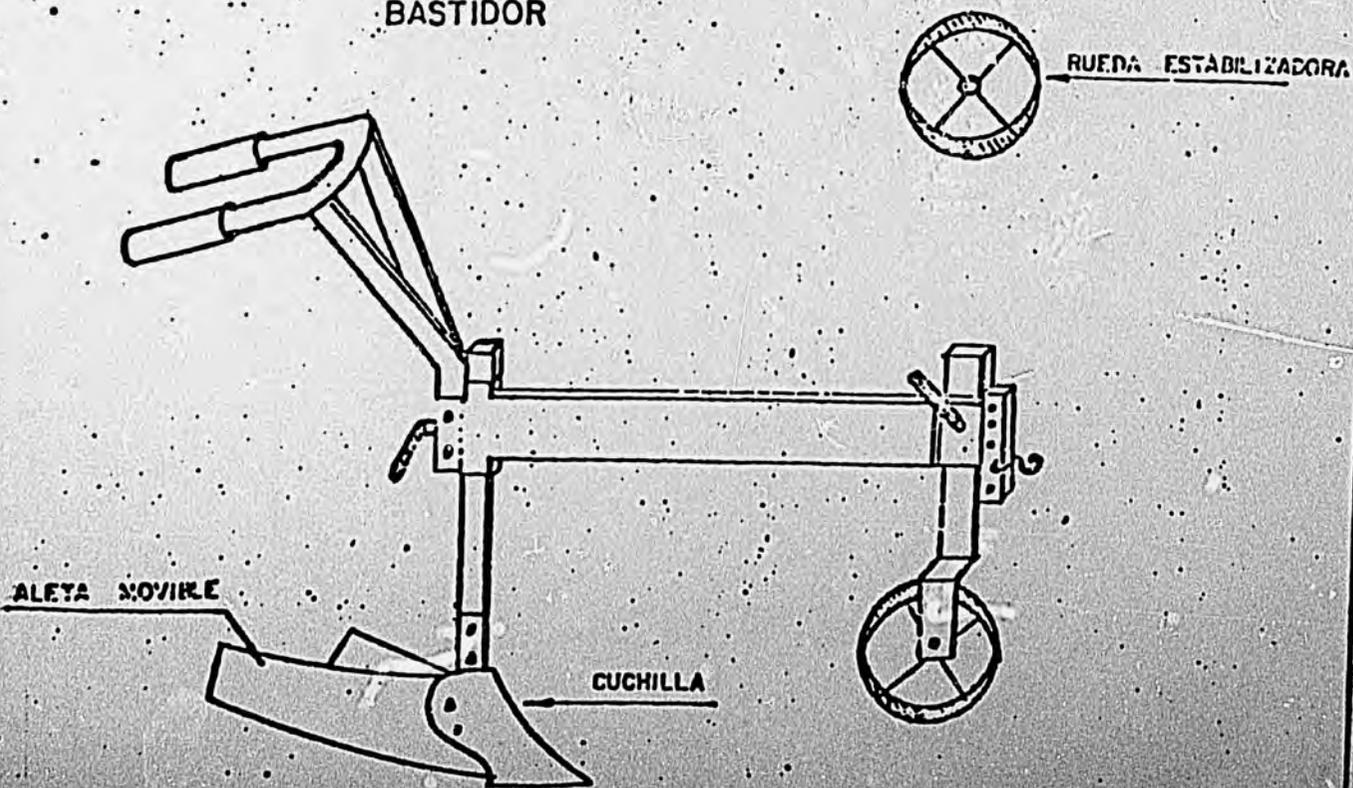
roue chassis
 limonière
 fauteuril
 socs hor. ralloys vert
 socs de bethèves
 tonneuse à disques
 veleuse
 socs rayonneurs
 socs queue
 socs à dents rigides

EL POLICULTOR IMACASA

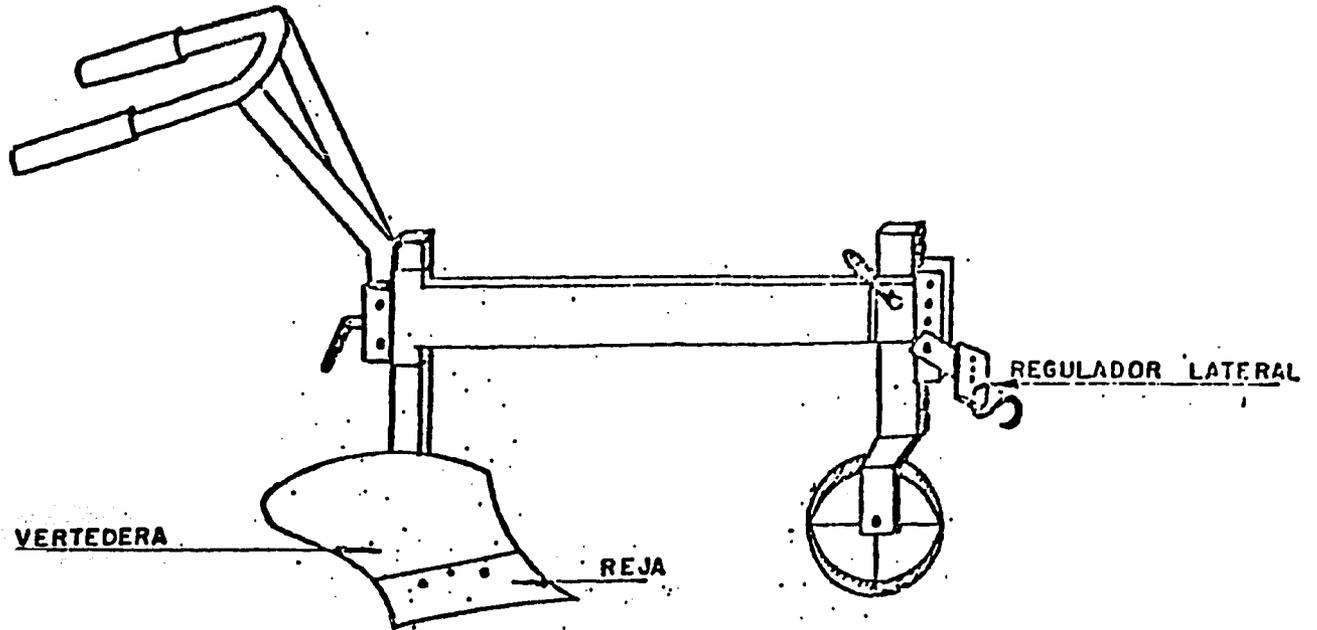
ANNEX G



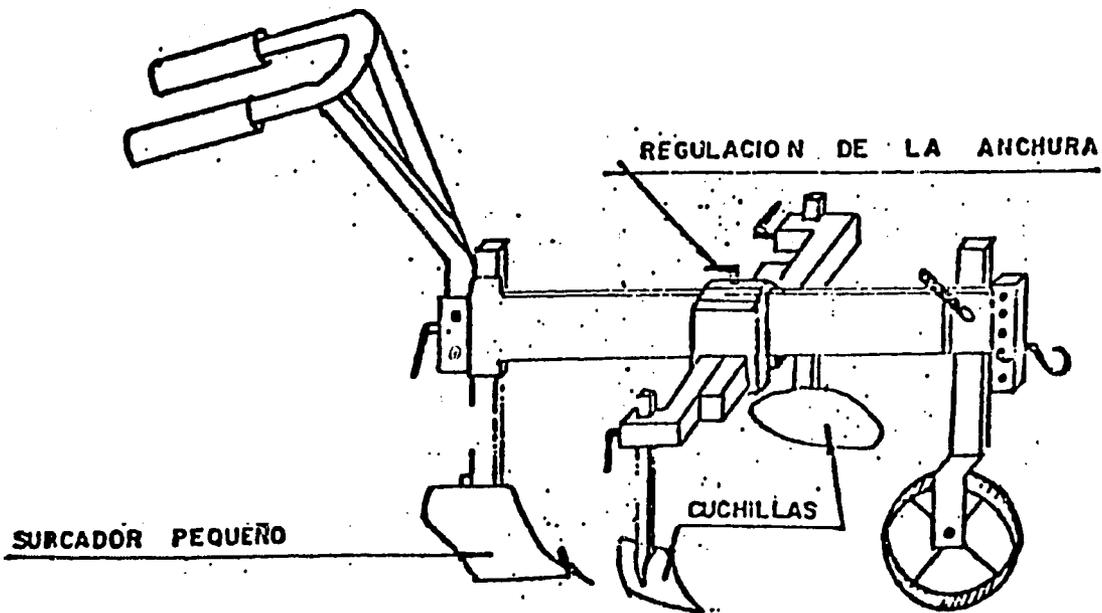
BASTIDOR



EL POLICULTOR IMACASA



ARADO



APORCADORA

PARTICIPANTES EN EL SEMINARIO SOBRE TECNOLOGIA DE BAJO COSTO

ICAITI - CENAP

<u>NOMBRE</u>	<u>INSTITUCION</u>
1. Ing. Manuel Antonio Cañas Lazol.	F U N D A S A L
2. Lic. René García Monge	INSAFOCOOP
3. Lic. Edgar Armando Guzmán	F I G A P E
4. Sr. Julio Rodríguez Barrera	U C A
5. Ing. Leonel E. Preza Quezada	Bcc. Central de Reserva
6. Ec. Erick Francisco Castillo	Minist. Agricultura y Gandería
7. Sr. Fernando Andrés Guerra H.	Bco. de Fomento Agropecuario*
8. Sr. Gilberto Cabezas Castillo	FENAPES
9. Sr. Rosalío Tóchez Zavaleta	FENAPES
10. Sr. James Monachino	A I D
11. Ing. Carlos Eduardo Martínez	CENAP
12. Sr. Carlos Ed. Sandoval Barton	CENAP
13. Sr. Gustavo Adolfo Valle	CENAP
14. Sr. Mauricio Herrera Coello	CENAP
15. Sr. Jesús Cáceres	FUNPROCOOP
16. Sr. José Eduardo Velasco	CENCAP
17. Sr. Fco. Tomás Orellana	Proyecto Pesquero, MAG
18. Ing. Romeo Edgar López S.	CENTA
19. Lic. Monge Ayala	Alcaldía Municipal
20. Lic. Rogelio Arturo Castro	I S T A
21. Sr. René Eustaquio Rodríguez	M I P L A N
25. Lic. Alexander Vásquez	A C O D E S
26. Sr. Luis Armando Mejía	Recursos Naturales, MAG
27. ING, José Alberto Peña	Direc. Gral. de Salud

Marzo 17 de 1978

1. Título del Proyecto:

CELIDAS SOLARES TIPO BARRERA DE SCHOTTKY.

2. Países Participantes:

MEXICO Y EL SALVADOR

3. Duración:

CUATRO AROS.

4. Instituciones Ejecutantes y Funcionarios Responsables:

CENTRO DE INVESTIGACION DEL IPN
DEPARTAMENTO DE FISICA
RESPONSABLE: DR. FELICIANO SANCHEZ SINENCIO

UNIVERSIDAD AUTONOMA DE PUEBLA
INSTITUTO DE CIENCIAS
RESPONSABLE: DR. RAFAEL BAQUERO PARRA

UNIVERSIDAD DE EL SALVADOR
FACULTAD DE CIENCIAS Y HUMANIDADES
DEPARTAMENTO DE FISICA
RESPONSABLE: M. en C. ETHELVINA MORILLO DE ESCOBAR

5. Naturaleza del Problema que genera el Proyecto:

El problema mundial de energéticos asociado al aumento creciente del costo de los combustibles usados actualmente y al agotamiento a corto plazo de los mismos requiere del estudio de la viabilidad del uso terrestre de celdas solares. Las celdas solares de silicio obtenibles en el mercado y de uso común en satélites artificiales son demasiado costosas y de uso prohibitivo en la mayoría de las necesidades energéticas terrestres.

6. Objetivo del Proyecto:

El objetivo central de este proyecto es el de investigar y desarrollar celdas solares más económicas que las actuales.

7. Metas Específicas

Se pretende crear celdas solares que usen barreras de potencial tipo Schottky. Se experimentará con interfaces semiconductor-electrolito y semiconductor-metal. En los experimentos preliminares se usaran muestras semiconductoras obtenidas de lingotes monocristalinos o policristalinos. Posteriormente se intentará el uso de películas delgadas semiconductoras policris-

talinas o amorfas. Finalmente se estudiará la vida media de las celdas y la viabilidad económica de las mismas.

8. Beneficios del Proyecto:

Los usuarios potenciales de los resultados del presente proyecto son los consumidores de energía eléctrica. Se tendrá una mejor definición sobre usuarios cuando el estudio económico de este proyecto este terminado.

9. Metodología de la Operación del Proyecto:

Los Dres. Rafael Baquero y Jesús Reyes, que actualmente trabajan en el Instituto de Ciencias de la Universidad Autónoma de Puebla, obtuvieron su grado de Doctor en Física en el Centro de Investigación del IPN. Durante 1978 obtendrán el grado de Doctor en Física los estudiantes de este Centro, Elías López Cruz y Carlos Vázquez López, quienes se incorporarán de inmediato al Instituto de Ciencias de la Universidad de Puebla. La M. en C. Ethelvina Morillo de Escobar, Profesora de la Universidad de El Salvador, ha colaborado en repetidas ocasiones con el grupo de Investigación en Física del Estado Sólido del Centro de Investigación del IPN, en calidad de profesor visitante. El estudiante de este Departamento, Orlando Zelaya, obtendrá este año el grado de Maestro en Ciencias y se incorporará de inmediato a la planta de profesores de la Universidad de El Salvador.

El grupo de Investigación en Física del Estado Sólido del CIEA ha estado trabajando en la caracterización de interfaces entre sólidos y sólidos y electrolitos durante los últimos ocho años (se anexan reprints). En los últimos dos años se ha estado trabajando específicamente en la caracterización de celdas solares, habiéndose obtenido la primera celda solar reportada en la literatura científica que funciona eficientemente basada en la barrera de Schottky que aparece en la interface semiconductor-electrolito. Actualmente este Departamento dispone de las más modernas técnicas para el estudio de la composición atómica y estructura de interfaces. Estas técnicas son la espectroscopía Auger y SIMS. Estas técnicas son indispensables para el desarrollo de celdas solares.

Los detalles de la metodología están expuestos en los reprints anexos. Es conveniente enfatizar que por la relación estrecha que existe entre los investigadores participantes en este proyecto, todos ellos están familiarizados con esas técnicas y metodologías necesarias para el buen funcionamiento del proyecto.

Mediante su participación en este proyecto, los grupos mencionados esperan acelerar la obtención de resultados en problemas que atacados separadamente tomarían más tiempo.

10. Acciones o Actividades Propuestas:

El Instituto de Ciencias de la Universidad de Puebla y el Departamento de Física de la Universidad de El Salvador disponen del equipo necesario para las mediciones preliminares que sobre propiedades de celdas solares son necesarias para este proyecto. Además de estas mediciones, durante el primer año del proyecto, las instituciones mencionadas instalarán sus laboratorios de preparación de muestras y usarán los equipos de caracterización de superficies e interfaces de este Departamento.

La instalación de los laboratorios que se requieren se iniciará a partir de la aprobación de este proyecto.

Se planean estancias cortas (entre uno y tres meses) de investigadores de un grupo en la sede del otro, así como asistencia a congresos internacionales de la especialidad de conversión fotovoltaica de energía solar.

A fin de dar una atención exclusiva a este proyecto se planea la contratación de dos investigadores a nivel postdoctoral.

11. Insumos requeridos:

Grupo de Investigación en Física del Estado Sólido del CIEA

Salarios de dos investigadores a nivel postdoctoral	US\$31.200.00
Viajes y estancias en la sede de los otros grupos y asistencia a congresos internacionales	US\$ 2.400.00
Investigadores visitantes	US\$ 1.000.00
Muestras y material de consumo	<u>US\$ 1.400.00</u>
sub-total	US\$36.000.00

Instituto de Ciencias de la Universidad Autónoma de Puebla

Equipo (una evaporadora de materiales al alto vacío)	US\$15.000.00
Viajes y estancias en la sede de los otros grupos	<u>US\$ 1.000.00</u>
sub-total	US\$16.000.00

Departamento de Física de la Universidad de El Salvador

Viajes y estancias en la sede de los otros grupos	US\$ 2,000.00
Equipo (monocromadores en la región ultravioleta, visible e infrarroja)	US\$ 6,000.00
	<hr/>
Sub-total	US\$ 8,000.00
	<hr/>
TOTAL ANUAL	<u>US\$60,000.00</u>

12. Financiamiento Proyectado

El Departamento de Física del CIEA, el Instituto de Ciencias de la Universidad Autónoma de Puebla y el Departamento de Física de la Universidad de El Salvador contribuirán con su infraestructura científica y técnica que incluye el salario de los investigadores participantes (con excepción de las posiciones post-doctorales mencionadas arriba), los servicios técnicos de apoyo, los servicios secretariales y los servicios de biblioteca y computación. Las tres Instituciones apoyarán el proyecto a través de los equipos experimentales existentes en ellas.

13. Presupuesto:

Año 1979

CIEA: Pagos mensuales de US\$ 3.000.00 (DOLARES)
UAP: Un pago anual de US\$16.000.00 (DOLARES)
UES: Un pago anual de U US 8.000.00 (DOLARES)

Para los años 1980, 1981 y 1982, los calendarios de pago se entregarán cuatro meses antes de los ejercicios anuales correspondientes.

14. Coordinación interna del Proyecto.

La coordinación de la investigación científica será hecha por el responsable del proyecto en el CIEA. Cada uno de los responsables de grupo tendrá a su cargo la distribución del apoyo económico que le corresponde.

15. Cooperación con otros programas:

NINGUNA

16. Se anexan currícula de los responsables.

ANNEX II

Topic: Energy

Subject: Solar Energy

Contact

Organization: R.G.Y. Asociados S.A. DE C.V.
Presidente, Rodrigo E. Guerra,
21 Av. Nte. #1334, Tel. 25-34 26

Proposal: Investigate the current status of the San Miguel solar heating unit in the new regional Hospital

Results: The report "Sistema de aprovechamiento de energía solar para el Hospital regional de San Miguel", represents the only major functioning model of an industrial application of solar energy in this country. The project has met with some success and construction is going on at the new military Hospital in San Salvador to build a slightly smaller duplicate unit.

Ing. Rodrigo Guerra has installed a small water heating unit in the Presidential Palace and is exploring the possibilities of building water heating units for first class houses. The company is looking for different markets in solar energy. They put together a folder on "Breves consideraciones sobre el consumo global de energía en El Salvador - 1977". The report is short but interesting with data supplied by both private and government sources.

It converts El Salvador total energy consumption into BTU. The results are:

1. Transporte (petróleo)	15.32 trillones BTU (55.8% total energy demands)
2. Industria (petróleo)	6.32 trillones BTU (23.1% total energy demands)
3. Doméstico (petróleo)	1.56 trillones BTU (5.7% total energy demands)
4. Energía Eléctrica (CEL)	4.22 trillones BTU (15.4% total energy demands)

The market that R.G.Y. asociados will be trying to entice is the Industrial section. They represent the best possible entry point into the field given the degree of solar technology available and industrial energy requirements.

Topic: Land

Subject: Land Development

Contact

Organization: ISTA, Lic. Francisco González Chávez
Department of Planification, Tel. 25-72 74

Purpose: To determine the degree of awareness that exists in ISTA
in the utilization of light technology

Results: The primary meeting resulted in a short discussion on what
is light technology in El Salvador. After which time a
short resumé of ISTA and its main function was presented.
The point was emphasized that ISTA is a new organization in
an evolutionary position. Their policies are still being
examined decided.

An appointment is being set up to send some of the ISTA po-
lity makers to Las Chinamas to view the SDA funded methane
project. A prepared folder has already been sent to Lic.
González Chávez describing the methane project along with
additional international bibliographic material on appro-
priate technology.

The objective of the Las Chinamas visit will be to promote
an awareness of the way alternative technology could be
incorporated into ISTA planning machinery. Currently,
there is little if any activity along these lines being
done at ISTA.

Topic: Energy

Contact

Organization: Peace Corps, El Salvador, Tel. 26-36 82
Craig Warriner, Peace Corps Volunteer
Site - Las Chinamas

Subject: Use of Methane Gas

Purpose of

Visit: Explore present status of SDA 3.9-77 project and
examine future potential

Results:

Mr. Warriner's last report to AID best summarizes the goals of his project and the results he has achieved. The 110 gallon digester (it is made of two oil barrels welded together) uses about ten pounds of fresh cow manure daily for a net production of 18 feet³ of gas per day, depending on outside temperatures. The gas has been hooked up to a propane gas burner and provides about two hours of cooking time per day with additional gas left over for use for night time lighting. (A coleman lamp has also been hooked up to the digester.)

The waste from the digester has been used a fertilizer and proved to be an excellent source of nitrogen. The corn that received the organic waste grew noticeably larger than the untreated corn.

Total costs of the SDA project number 3.9-77 ran about \$330.00 dollars. This price can be lowered by up to 50% if any degree of mass production takes place. But even at \$165.00 you still have to consider purchase price of propane stove and lantern, plus time spent in gathering the dung if animals are not penned up. This expenditure represents a very large initial investment which may place the whole project out of the target group aimed at.

Recommendations for the Las Chinamas project are to consider additional funding of the project into the suggested business of a pupusería. It is the next step necessary for promotion of the idea. This technique was also used in Ecuador by AID and Peace Corps in May 1976, "Araque Methane Gas Project".

(A bakery was planned for construction.)

Topic: Energy

Subject: Bio-gas/compost plants

Location: San Salvador, Santa Ana

Contact

Organization: Mayor of San Salvador Ing. Hugo Guerra - He is a Civil Engineer and has an interest in Bio-gas utilization

Proposal: Inquire what happen to the compost pilot-plant that was constructed in the mid 70's for the cities of San Salvador and Santa Ana

Project: Report on project potential and present status

Comment: Higher fertilizer, organized public information program, and improved extension assistance may augment program success where deficiency once existed

Results: Inquiry as to what happened to the pilot plants that were constructed for San Salvador and Santa Ana resulted in little satisfaction. The major admitted not having prior knowledge to the project and expressed doubt as to whether anything could be produced from the city files.

Ing. Guerra did visit the SDA methane project in Las Chinamas and felt the need to develop a more organized approach to the utilization of that resource. He has solicited information on the use of municipal sewage waste for conversion into methane gas. The system he prefers is done by "Battelle". They proposed doing a study on the utilization of sewage waste for conversion into methane gas, fertilizer and addition ingredients for supplemental building material. The reason why he chose the "Battelle" approach was explained by their international reputation, unbiased system of investigation, and ability to help facilitate transfer of technology to assisting Salvadorean counterparts.

The mayor would like to get the project started around the first of the new year. (Salvadorean mayors serve a two year term, and a January development program would be politically beneficial.) Other projects being explored by the major is the use of solar water heaters for home consumption. They are very expensive to build and can be constructed from local material. Collaboration is going on for construction of a more sophisticated unit to be placed in on the central markets in San Salvador with Ing. Navarro from the Catholic University.

Topic: Energy

Subject: Non-traditional energy sources in El Salvador

Contact

Organization: Comisión Ejecutiva Hidroeléctrica (CEL)
9a. Calle Poniente 950
San Salvador, El Salvador, C.A.
Tel. 22-08 55

Individual: Dr. Alberto Chiquillo Alas, Superintendent of Investigation and Special Projects

Purpose of Visit:

Investigate current activity being conducted at CEL in the field of Non-traditional energy sources in El Salvador

Results:

The following projects were listed by CEL for future financing:

- A) Determine the amount of energy being consumed and project energy demand for the next 20 years. After a viable statistic is reached establish possible alternative energy sources. Estimated cost ₡517,500.
- B) Educate the populace on how to use available energy to the optimum potential. Estimated cost ₡250,000.
- C) Demonstrate that the use of solar power is an excellent source of energy in the drying of corn. (Research is geared for large industrial grain drying.) Estimated cost ₡125,000.
- D) Utilization of coffee pulp for the production of methane gas. Estimated cost ₡231,500.
- E) Re-utilization of excess water from the Ahuachapán geothermal plant for the generation of electricity. Estimated cost ₡362,900.

The use of wind mills was also discussed as an alternative energy possibility. Unfortunately, preliminary studies indicate that only a couple of test areas (volcán de Santa Ana and Apaneca) might prove applicable to generate the needed wind velocity in order to meet municipal demands.

Coastal winds were referred as strong breezes (Estimated velocities of 3 to 4 meters per second) and is sufficient enough to meet CEL requirements. It was suggested that the force would be strong enough to lift water a short distance for small farm irrigation.

Comment:

Dr. Chiquillo cited the lack of usable meteorological data as their biggest problem. Negotiations are going on between CEL and El Salvador meteorological section but they were classified as going slowly.

Topic: Energy

Subject: Alcohol Production for Fuel

Organization: INSAFI (Instituto Salvadoreño de Fomento Industrial)
(Dept. Ramas Industriales) Carlos Quintanilla Aparicio,
Jefe Departamento Asistencia Técnica, Tel. 22-08 81

Location: San Salvador, El Salvador

Proposal: That there be a investigation of the current work going on at INSAFI. Probe the work that has been done and explore the possibility of A.I.D. involvement should the project look fruitful and controlled.

Comment: In a State Department Airgram sent June 16, 1978 it was stated that INSAFI preliminary findings indicate that producing alcohol for fuel is economically feasible. Three different types of distillery pilots have been constructed.

Result: It was stated that INSAFI had done some experimenting in the utilization of alcohol as fuel but lost interest in the project due to excessive costs. When questioned further about who was in charge of the investigation and for an opportunity to review some of the results, nothing could be produced. The man who was conducting the testing left INSAFI and his boss was out of country, in Brazil.

The interview proceeded to demonstrate that INSAFI interest lies in development of medium to large size business. Emphasis was placed on the need to purchase more expensive and technically sophisticated equipment which would make El Salvador more competitive on the world market especially in the textile industry.

Currently there is a lot of testing being done in the manufacturing of a type of press wood for use in home construction. These panels would be made of local material and reduce the need for importation. The net effect would ultimately reduce the price of first class housing if successful.

Research sources and reference material are gathered from:

- A. The University library which is being expanded and developed by Ing. Navarro. (micro-filmed material is being utilized and very low rates from international contacts.)
- B. CENAP - Which share its own resources with the University and also allows students from UCA to use their micro-film viewers. (UCA hopes to purchase two viewers of their own before the end of the 1979 school year.)
- C. Direct request - This is usually done through written correspondence with various international institutes for information.

Mr. Ricardo Navarro is an Industrial Engineer with an additional major in Political Science. He received his Master's at Purdue University and is very active outside the Catholic University.

Topic: Education

Contact

Organization: Instituto Tecnológico Centroamericano
Director, Dennis F. Martin
Santa Tecla, Tel. 28-06 19

Subject: Investigate Institute's sentiments on the use of light
Technology in El Salvador.

Results: The theory behind the British-inspired school is to produce qualified engineers to perform practical work. The school is run by the Ministry of Education who provides funding for its operation. It is divided into five departments.

1. Departamento de Ingeniería Civil y Construcción
2. Departamento de Ingeniería Eléctrica
3. Departamento de Ingeniería Mecánica
4. Departamento de Ingeniería Agrícola
5. Departamento de Ciencias (Food Science)

Depending on the courses you chose it will take two to three years to complete training at this school. There are plans on the board for expansion of the present facilities to accommodate triple the present enrollment but Director, Dennis Martin, is hesitant. He feels a more decentralized approach should be taken and the formation of feeder institutes in Santa Ana and San Miguel considered. Another problem is the uncertainty of the future job market to absorb an inflated amount of engineers.

Mr. Martin (founding director of ITCA but now here in El Salvador on temporary duty from the Central Headquarter in Mexico) has also found under utilization of laboratory equipment and class space to be high. Recommendations are being drawn up to help rectify this situation. Part of the reason cited for the problem was a very strong budget and loose examination of necessary expenditures.

ITCA is collaborating with CENTA, Engineering Department in the building of agricultural proto-types and maintains an arsenal of small tools brought in from England waiting to leave the shop. They have expressed an interest in appropriate technology in El Salvador and have a tremendous potential in joint project efforts with other agencies.

Topic: Marketing Trends

Contact

Organization: University of Rhode Island
Kingston, Rhode Island
Department of Resource Economics
Michael Shank, Tel. (401) 792-1471

Subject: Local patterns of fish consumption in El Salvador

Comment: The following information was provided by Mike Shank, a former Peace Corps Volunteer, who has been studying the public fish market since he was a volunteer. He is now working on his thesis paper for his Master's and has been down to El Salvador several times gathering additional data.

Results: (Short summation of Michael Shank investigation)

"On a general basis, I have come up with the following general theory on the public fish market in El Salvador. This has developed out of 1) discussion with biologists and economists at the D.G.R.N.R., 2) discussions with retailers, wholesalers and transporters in the market system, 3) fishermen, and 4) a lot of time and experience watching and trying to get a hold on this.

It can loosely be described as a two-stage model, with long-run supply generally remaining stable. In my report I am hoping to be able to prove this. There are biological and fishing effort changes with seasons, but I feel they basically cancel each other out over the long-run and supply remains steady throughout the new year, given short-run supply shortages and surpluses. During the wet season there are more fish in the sea, but when the storms and rain come the fish go deeper and the amount of time men can go fishing (effort) is less.

During the dry season there is an increase in effort due to favorable weather and an additional motive for the fishermen in that the price he gets is better. There is however, a reduction in the resource stock.

I feel (and hope to prove) that there is a shift in demand that comes about in the following manner. Beginning in late October employment and income are on the rise and continue to improve due to the coffee, sugar cane and cotton harvests. This goes on through March or so. The economy,

at least in the poor sector improves and the desire and ability to purchase a lot of goods, including fish is up. This demand is reflected in a higher price for fish during this period and it peaks during the cuaresma, or Lenten season. The week to ten days before Easter Sunday is when retail fish prices are at their highest. This additional increase in price is credited to the traditional religious tradition of eating fish during Lent. (I might add that during the lenten season, a tremendous demand increase in dried fish also occurs.)

After Semana Santa, prices drop back to their pre-Semana Santa level and subsequently to the rainy season level.

My study on price/volume of the retailers in all the city markets was carried out the four weeks before and the four weeks after Semana Santa. The buy and sell prices and volumes by FISA species of the retailers were gathered through a sampling program on a daily basis over a nine week period. I have a preliminary methodology report going through a final draft stage and will send it to you upon completion if you want."

Topic: Information Service

Subject: Dissemination of Information in El Salvador

Contact

Organization: (IICA) Instituto Interamericano de Ciencias Agrícolas de la OEA. Ing. Flavio Lazos, Tel. 23- 25 61

Proposal: Examine branch office of IICA in El Salvador and report on its future projections and present capabilities.

Project: Review IICA operation in El Salvador and make recommendations to USAID Mission.

Comment: There is a need for a viable dissemination service in El Salvador. IICA is certainly worth the effort of investigating.

Results: Preliminary questioning shows that there is no work being done directly in the field of appropriate technology. Some of the individuals at IICA were unacquainted with the term asking for clarification of its meaning.

What they do have is some socio-economic data on the small farmer and the environment they live in. A project being advocated by IICA, El Salvador is to try and increase the use of legumes. Gondul is being recommended to CENTA by IICA technician in hopes of rebuilding the soil.

IICA has performed some projects for various institutes in El Salvador, including CENTA. They should be considered for work designated to register impact of agriculturally-oriented programs dealing with appropriate technology.

Topic: Information Center

Contact

Organization: CENCAP, Director, Ing. René Francisco Toledo
Tel. 25-5238, Centro Nacional de Capacitación
Agropecuaria

Subject: Dissemination Service

Purpose

of Visit: Examine facilities and determine main objective of the Center.

Results:

The formation of this organization was precipitated by a report written for the United Nations in July 1975 by Alvaro Chaparro and Dr. Joseph Franco titled, "Informe de la Misión a El Salvador sobre Educación y Capacitación Agropecuaria". The Centro Nacional de Capacitación Agropecuaria was then assigned to work in conjunction with the National School of Agriculture in San Andrés, 1976. After one year CENCAP change hands and was annexed by CENTA in 1977 to perform two main objectives:

- A) Help the small farmer in the form of courses and technical assistance.
- B) Help the technician improve his knowledge of his particular speciality.

Ing. Toledo stated that CENCAP would be receiving a large sum of money in the near future from the World Bank. (They are part of a group of organizations that will receive the loan.) The exact amount of money was never clearly specified but plans to build eleven separate CENCAP centers throughout El Salvador and purchase vehicles to provide logistical field support are being considered. A stratified approach to help the small landowner is being advocated. Claims were made of knowledge and connections throughout the whole family of agricultural institutions that exists in El Salvador. But upon closer examination it would appear that CENCAP is still a very new organization and was unable to tell me the head of the Engineering Department of CENTA or any of the work that has been done there to date. A more precise judgement will be made upon receiving additional written data of what CENCAP had done and how much money they will receive from the World Bank Loan.

Topic: Agricultural Extension

Subject: Development of Small Agricultural Implements for Campesinos

Contact

Organization: CENTA, Department of Engineering
Ing. Francisco García

Project: Examine what type of program would be developed by the Engineering Department of CENTA if more manpower and funding were made available to it in the future.

Comment: Francisco García is a competent Agricultural Engineer who heads the Engineering Department. He has only a skeleton crew under him and has been highly frustrated at his inability to receive funds or source manpower.

Results: The Agricultural Engineering Department is prescribing a more intense approach to assist the small landowner. Under the direction of Ing. García Investigation and completion of a project titled "Diseño de Arado de Tracción Animal" was performed. The plow design can be manufactured at local shops and made to fit the traditional wooden plow frame used by the "campesino". The implement has been tested and is now entering the promotion and dissemination stage of development.

A more accurate conception of the Engineering Departments goals can be found in "Programación del Departamento de Ingeniería Agrícola de CENTA para su Reestructuración y Funcionamiento", by Francisco García, July 1977. The objective of the report is to secure additional funding (Engineer Department receives about 2-3% of CENTA Total Budget) and manpower to promote a more comprehensive program in the investigation of small farm irrigation systems with possible utilization of non-traditional piping systems; improvement of indigenous farm equipment, and exploration of various soil maintenance program using available resources.

The personnel problem of the Department can be temporarily alleviated by importation of qualified agro-technicians. The Taiwan Mission has promised to send an engineer to assist Ing. García in January 1979.

Topic: Private Industry

Subject: Production of back-pack sprayers in El Salvador

Contact

Organization: Edgar Owens, A. t. International, Washington, D.C.
IMACASA, Santa Ana - Telephone 41-3035

Proposal: Investigate the possibility of the in-country production of a small and efficient back-pack sprayer.

Project: Probe operating companies in El Salvador and inquire if there is any interest in producing this type of agricultural equipment. Secure preliminary framework for transfer of technology to a Salvadorean company that can demonstrate a serious financial commitment to the idea.

Comment: The proposed sprayer was designed in Africa for 3rd-world farmers. Its main advantage is its ability to maximize the amount of chemicals used by producing a very fine mist to cover a large surface area of plants.

The sprayer comes highly recommended from both (VITA) Volunteers in Technical Assistance and A.T. International.

Problem: Water used in the instrument must be relatively pure in order to maintain free nozzle flow.

Results: The company that sells this sprayer is named Micron West Inc. The president, Mr. Michael A. Wenner, has passed through El Salvador and spoken to Mr. Earl Sutherland from the Banco de Fomento. The firm is just beginning to develop its promotion strategy for Latin America and plans to spend most of its time developing the big market areas. A few test sprayers are available in El Salvador. The U. S. company address is:

Micron West Inc.
8582 Katy Freeway
Suite 200
Houston, Texas 77024

Topic: Food Storage

Contact

Organization: IRA, Engineering Consultant, Herold Styker,
Project Department, San Salvador, Tel. 26-1011

Subject: Grain Storage

Purpose: To investigate the use of solar energy in drying grain.

Results: Mr. Styker stated that at the present time there was little if any activity going on in the use of solar energy to dry grain. On the contrary, interest seems to be moving toward more capital intensive systems of grain drying and storing.

The windfall infusion of grants or low interest loans seem partly to blame for the more capital intense approach. It is unearned money put into the system by an outside force which has to be spent within a specified time period. Consequently, underutilization of expensive equipment is not uncommon or excessive loss of time due to unavailability of spare parts and qualified mechanics.

The suggestion was made by Mr. Styker that if IRA adopted a third premium level for the purchase of dried grain from the farmer, the savings incurred by IRA could be substantial. The main problem stems from the fact that many farmers dry the grain in unacceptable surroundings. It is a problem that could be overcome if the farmer was told what to do and given a viable alternative to his present practice.

Topic: Use of small Agricultural Implements in El Salvador

Contact

Organization: Technoserve, Inc., El Salvador
Director, Ing. Enrique Cristi
Calle La Reforma N° 213
San Salvador, El Salvador
Tel. 23-4369 - 23-0069

Subject: Investigation of rice thresher, animal feed mill, and designs of a two wheel tractor for in-country production in El Salvador.

Report: Rice Thresher - Design by IRRI, this project began in 1976 and has met with considerable delay and adaptative trouble.

Donald O. Kuether is an agricultural engineer from IRRI and has visited Technoserve, El Salvador three consecutive years in an effort to provide some technical assistance and dissemination of other agricultural implements design by IRRI. His presence has provided some redesigning of the original rice thresher imported from the Phillipines. It is hoped that the thresher will be operational for the up-coming rice harvest in October - November of 1978 and threshing at its recommended levels of production. (Before redesigning, the thresher was producing at only 30% of suggested capacity.)

Gerald L. Schmaedick, Regional Director of Technoserve in Latin America stated that the cost for the unit was around \$1,500.00 (including shipping and handling from Phillipines) and that when the thresher arrived in December 1977, no instructions were provided for assembly of the unit.

The rice thresher is located at Nueva Concepción at the Cooperative ACASYCAL.

Comment:

Due to vegetative differences between high land rice in El Salvador and low land rice planted in the Phillipines the maximum efficiency of the IRRI rice thresher may never be realized thus making it economically unsuitable to the needs of this country, even if in-country production were initiated.

Topic: Housing

Subject: Formation of Model Home in the Campo

Contact

Organization: Fundación Salvadoreña de Desarrollo y Vivienda
Mínima (FSDVM) Ing. Manuel Antonio Cañas Lazo,
Tel. 22-5333

Proposal: Demonstration homes be constructed at pre-selected locations throughout the campo in order to illustrate optimum use of available resources for promotion of a healthier and more comfortable living style.

Project: Homes would be constructed at strategic locations incorporating Salvadorean design into a more sanitary and hospitable habitat. AID would fund construction of demonstration material, FSDVM would provide design and instruction, and the cooperating campesinos the labor.

Comment: Readily comprehensible benefits are essential for program success. If a campesino can examine the advantages of an improved housing design constructed from locally available materials chances of model imitation would be enhanced.

Result: The construction of low cost housing designed to meet the needs of people with incomes between ¢150.00 to ¢300.00 colones per month has already begun.

The FSDVM has constructed over 1,000 housing units in Santa Ana and has begun work at San Miguel on a similar project. Each lot contains 80 sq. meters of land with both electricity and running water. House sizes vary corresponding to purchase price. A typical two room house in Santa Ana costs about ¢4,000 for 30 sq. meters. A less expensive model of 20 sq. meters costs ¢2,300.00. Prices of the homes in the San Miguel project will run a little higher due to inflation.

While adequate shelter is being constructed by the FSDVM and financed, there is no other features included with the house. Utilization of solar heaters for washing clothes, dishes, and body can be designed for incorporation in these homes. Additional costs would be light (depending on capacity of the unit) and serve as a beneficial model for other nearby communities.

Topic: Drinking Water

Contact

Organization: Martin Wolterding, Peace Corps Volunteer and Vision Mundial, International, Lic. Pablo A. Goddard, Director, Tel. 26-0615

Subject: Construction of water line for a small rural town.

Background: El Tamarindo is a small rural town (population 2,000) situated in the eastern part of the country on a small peninsula with no available drinking water. The Salvadoran government has been petitioned three separate times by the town within the last 5 years. The latest request, made to the Public Health Sector of the government, produced an inspector who came out of San Salvador to visit the site and make recommendations. The results of his survey showed that water could be brought into the town from a nearby spring situated across the peninsula but in 3-5 more years. The main reason cited was due to lack of money.

Monetary

Action: The average family earns an income between 5 to 6 colones a day. The town has raised \$2,000 dollars and pledges "mano de obra" to seek completion of the pipeline.

Visión Mundial (religious organization) has pledged \$14,000 dollars for construction of a pipeline and Peace Corps Volunteer Martin Wolterding is trying to put together the program.

Legal

Status:

The spring is located about 3 kilometers from the town. It is situated on a finca owned by Doña Emma Ceballos. She has consented to give the town free water rights for use of the spring. The legal papers are being drawn up now.

Immediate

Needs:

The present situation calls for a survey to be taken by an engineer to examine the possibilities of a water project and give an estimate on anticipated cost.

Once the technical feasibility of the project is established work plans can be started as soon as funding permits.

Topic: Water

Subject: Use of Hydraulic Ram Pumps in El Salvador

Contact: Small private farm situated outside of Sonsonate in the Cantón, San Ramón, another site was located about 5 kilometers from San Ramón on the river Barranca.

Purpose of Visit: To investigate the use of hydraulic ram pumps by small farmers.

Results: The first site visited on the Río Barranca was located about one mile off the main road (dirt) and was accessible only by foot along the border of a dug out irrigation canal. Upon arrival the pump appeared to be functional situated along the base of the river in about 18 inches of mud. The pipe extending out of the pump was about 1 inch in diameter and did not appear to be suitable for any large irrigation.

The second site was located in the Cantón San Ramón. The owner of this small finca had about 3 or 4 pumps scattered throughout his property in key locations. (the pumps are thought to be over 50 years old.) The farmer stated that he felt the pumps were efficient moving small quantities of water but expressed doubts about any large scale irrigation with the units. The Salvadorean Health Department had also visited his site to view the potential of using the ram pump for lifting drinking water.

Comment: There are various locations throughout the department of Sonsonate that are using ram pumps in small scale projects. The potential of this pump represents a good investment to a small land owner with modest water needs. (such as a water supply for himself, animals, and a garden.) Unfortunately, there is only a limited number of possible beneficiaries for this pump due to its large quantitative use of water and geographic functional demands.

It was reported that some simple ram pumps have been manufactured in El Salvador but are now practical non-existent due to low demand.