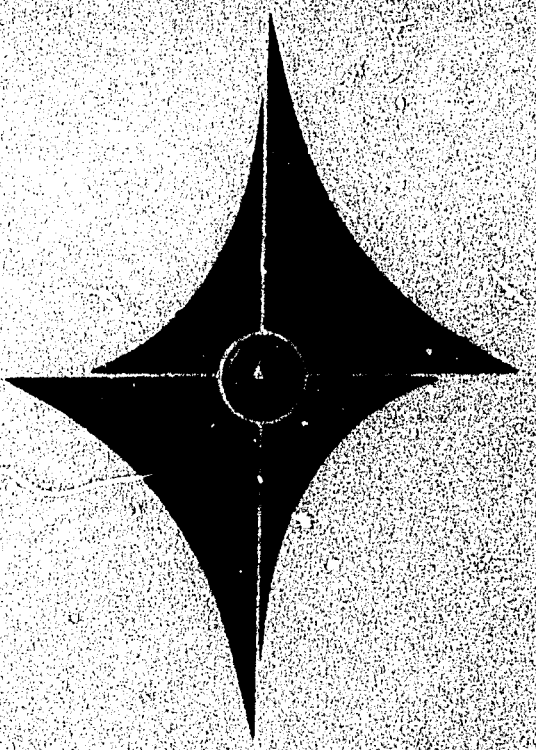

SOLAR ENERGY LABORATORY

College of Engineering

University of Florida

Gainesville

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES

A Cooperative Agreement between US AID and the University of Florida

Semi-Annual Report

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A Cooperative Agreement (AID/DSAN-CA-0188) between the United States Agency for International Development and the University of Florida took effect on September 1, 1979. This agreement established the Training in Alternative Energy Technologies program and specified the relationship of AID and the University in meeting the objectives of the program. Contained within the documentation were a number of program elements detailing contractual responsibilities of both parties.

Commencing with the clarification of contractual responsibilities, the Solar Energy and Energy Conversion Laboratory (SEECL) began the process of organizing the program. The goal of this organization was to secure staff, develop procedures to find and select participants, and to produce course material for the first training session. In accordance with affirmative action guidelines, the University implemented a review procedure through which a number of applications were received and screened so the most qualified personnel could be assembled to operate the program, with the leadership of Dr. E.A. Farber (SEECL Director) providing the overall direction.

Once the University had completed the review process, AID was consulted concerning the appointment of key personnel. AID project management reviewed those submissions and concurred with the University's selections. Appointed to the professional staff were: Dr. Roberto Pagano --- Technical Director; George Shipp --- Program Administrator; Dr. Anil Rajvanshi and Leonard Laketek --- Instructors. Resumes are found in Appendix 1.

Support staff of three technicians, a staff assistant, two secretaries, and an information specialist were hired soon after the agreement became affective. Additional program personnel assistance will be supplied by faculty and staff of SEECL.

Once staffing had been established, the College of Engineering (the host organization for the Solar Energy Laboratory) created an accounting mechanism by which the program's financial transactions could be handled. Two separate accounts were provided so that staff would be able to maintain accurate data on funds for participant expenditures; e.g. travel, housing, and stipend payments. This two account system also separates the operational funds so that budgetary items specifically earmarked for the participants are not mixed with those budget items required for daily program operation.

AID contracting officer Mort Darvin was contacted regarding limitations on expenditures. Several written communications were exchanged to present information on program needs and AID's position in funding those needs. Jim Brunson of the College of Engineering provided a written justification to Mort Darvin detailing the various needs. Approval was granted for acquisition of a number of major items. See Appendix 2. These items are being used to supplement and enhance the shop and laboratory equipment already on hand at the SEECL.

FACILITY DEVELOPMENT

As the accounting and staffing activities progressed, the University designated one of its off-campus facilities as the facility to house this program. The Training, Research, and Education in Environmental Occupations (TREEO) building was selected to serve the needs of the program; including office space, classrooms, workshop, laboratory, and reading room areas.

To enhance this facility so that it could be used to meet the objective of the program, the University modified portions of the main shop area and dedicated this space entirely for this effort. Several pieces of equipment were also acquired so the participants could perform their experiments and develop projects without leaving TREEO. See Appendix 3.

Other University facilities are being used in this program to provide each participant with a number of resources and opportunities. Special arrangements have been made to allow participants to use the North Florida Regional Data Center. Proper identification has been provided to each participant to allow them to use the various libraries and to check-out materials. Shop, laboratory, and research facilities of the College of Engineering are available to the program so that a number of special projects might be undertaken. One such example is the use of the Solar Calorimeter at the Energy Research and Education Park. This device can be used by the participants to measure solar properties of materials.

SELECTION OF PARTICIPANTS

As the program staff was assembling, members of the SEECL staff were developing information and preliminary criteria for selecting the first training class. Basic information was provided by the administrative staff from AID's Stony Brook program. With April 16, 1980 set as the first day of the inaugural session, the time schedule for preparing nomination and application material was extremely limited.

Based upon contract requirements, program staff developed an information brochure which described the intent of the training activities, program objectives, and details covering AID's support to participants. The University submitted a draft of the brochure to AID for approval. Approval for format and content was received in the latter part of November. Simultaneously with this approval, AID issued telegraphic communications to its missions encouraging them to nominate candidates for the first session.

Nomination and application packages were sent to Washington in early December. AID's pouch mail system was utilized in transmitting and distributing the information materials to the various AID missions. The University was also contacting a number of friends and pursuing nominations through these resources.

By January, a number of nomination and application packages had been returned to the University. By the close of the designated period for acceptance of applications, the training staff had received 80 nominations. Upon careful review of the potential students, a preliminary group was selected. This group was comprised of the first choice and stand-by candidates. The names of these people were forwarded to Washington, and AID granted approval for issuing invitations to all persons on the list. By mid-February, 33 invitations were issued.

As acceptance to invitations came into the program, office staff immediately began to process paperwork for visa and travel arrangements. Additional instructional material was also forwarded to each person accepting the invitation. This material described their personal needs during the 15 week stay in the United States. As flight schedules were finalized, telegraphic communications were used to inform each person of his travel itinerary. The attached list found in Appendix 4 provides the name and pertinent details on the 31 people accepting AID sponsorship to attend the first session.

COURSE OUTLINE

While administrative activities were progressing the technical staff began assembling the course material. A variety of topics were examined to determine their relevance to the program objectives.

As materials were accepted and rejected a number of University faculty and staff screened the proposed course materials. Once a basic outline had been developed, AID project management was consulted. Comments made at a February 28, 1980 meeting were then incorporated into the next phase of course development.

Using the approved basic outline, the technical staff began to contact persons outside the University of Florida seeking their assistance. These potential guest lecturers were consulted in their particular areas of expertise so that diversified ideas would be reflected in the program content. Many of these people are scheduled to present guest lectures, thereby providing a direct contact between the expert and the participants. See Appendix 5. The technical staff has worked to insure that the guest lecturers are placed within the program in such a way as to maintain over-all continuity of material.

Once the input sources had been thoroughly evaluated and considered, technical personnel developed the final course outline. This outline can be found in Appendix 6.

APPENDIX 1

ERICH A. FARBER

Dr. Erich A. Farber received the major part of his education in Europe as well as a BS in ME and a MS in ME from the University of Missouri in 1943 and 1946 respectivel and a Ph.D. from the University of Iowa in 1949.

Serving in the Armed Forces he received a Battle Field Commission, Purple Hearts, the Silver Star and other decorations.

He has pioneered in the fields of heat transfer, fluid flow and energy conversion. He has built the Solar Energy Laboratory at the University of Florida into one with international reputation and has lead a team in fundamental research for NASA on Liquid Rocket Propellant Characteristics, which influenced some of our largest rocket designs.

Dr. Farber has over 400 publications, has co-authored 6 books, and received many honors, among them a Citation from the Air Force for his work in Solar Energy Conversion; the Worcester Reed Warner gold metal for "Outstanding Contributions to the Permanent Literature of Engineering;" the Missouri Honor Award, a Gold Metal and Citation for "Distinguished Service in Engineering;" is listed in the Engineers' Joint Council "Engineers of Distinction;" in "Outstanding Floridians;" Who is Who in America, Who is Who in the World; World Who is Who in Science; Leaders in America Science; American Men of Science, etc.

He received a number of Scholarship Awards, developed the "Boiling Curve" in heat transfer, which is quoted in all books on heat transfer, developed a method of heat transfer surface treatment which is referred to in the literature as "Farberizing." He was awarded the Wisconsin ASEE Technical Paper Award and Best Teacher Award.

He has been invited by many foreign governments, at their expense, to visit and consult with them. He also is consultant to many industries and U.S. Government Agencies, including Governmental Advisory Committees. He has been made a Fellow in the American Society of Mechanical Engineers.

Dr. Farber was a member of the NSF/NASA Solar Energy Panel which prepared a report, "Solar Energy as a National Energy Resource." He is a member of the "Solar Energy Working Group" established by the Federal Government for U.S. - U.S.S.R. Cooperative efforts in Solar Energy, and he has been appointed by Governor Askew to the Florida Energy Committee. In 1973 he received the Florida Blue Key Distinguished Faculty Award, in 1974 the College of Engineering Outstanding Service Award. In 1975 he was appointed by Governor Askew to a task force to work on Florida's energy problems. In 1976, Dr. Farber was asked to serve on the U.S. - India cooperative solar energy program. Since 1976 Dr. Farber has acted, by request of the State Department, as advisor on energy problems to such countries as the Phillipines, Peru, Morocco, etc. and has helped to establish energy centers in these countries.

In 1977, he was honored by a resolution of the Alabama Conservancy for his "Exceptional Contributions to Solar Energy Toward a Solution of the Global Problems of Failing Energy Sources, Increasing Pollution and Exponential Escalation of Energy Costs." He received the Crosby Field Award from the American Society of Heating, Refrigeration and Air-Conditioning Engineers for the Best Technical Paper and the Best Paper of 1976, and he was invited by the Austrian Government to give the Science Lecture in Vienna on the Austrian National Holiday, October 26, 1977. He received a citation and certificate of recognition from NASA for his invention and development of fluidic gas analyzers. He was also named "Distinguished Lecturer" in 1977 by the University of Florida. He received a Citation from NASA for his contributions to the Space Program, and was inducted as a Charter Member into the "Solar Hall of Fame" established during the Bicentennial. For the last two years he has been selected "Frontiers of the Mind" Lecturer. 1979, appointed "Distinguished Service Professor."

Roberto Pagano

Dr. Pagano holds a Bachelor and Master degree in Physics from the University of Cape Town, South Africa and a Master and a Doctorate in Engineering from the University of Florida. Dr. Pagano joined the TAET program in November 1979 after a number of years in the Division of Energy, Resources and the Environment of the MITRE Corporation, Washington Operations.

Dr. Pagano's technical background includes extensive experience in both industrial and university laboratories. He has conducted research mainly in the areas of inorganic chemistry, heat transfer, differential thermal analysis and nuclear instrumentation. He has worked for several years in the nuclear power industry, where his experience encompasses the areas of core physics of both gas-cooled and water-cooled reactors, shielding, reactor kinetics and control systems, preoperational field testing, test data acquisition and the training of reactor operating personnel. During the past several years, he has contributed to a number of interdisciplinary studies dealing with energy developments and their economic and environmental implications. These include studies related to the siting of energy facilities, control and monitoring of airborne and liquid effluents from steam-electric power plants, disposal of high level radioactive wastes,and the ecological impacts associated with energy developments.

RESUME

George W. Shipp, Assistant in Engineering
Solar Energy & Energy Conversion Laboratory, University of Florida

Personal Record

Date of Birth: [redacted]
Marital Status: Married

Education & Training

1971, University of Florida, BSBR
1977, Grantsmanship Center

Societies and Organizations

Pi Kappa Phi Fraternity
Florida Public Relations Association
Southern Public Relations Federation
Florida High School Activities Association

Work Experience

1975 - date College of Engineering (Sub-Faculty)
Program Administrator/Public Relations Coordinator
Solar Energy & Energy Conversion Laboratory

1973 - 1975 Office of Comptroller, State of Florida
Information Specialist

1972 - 1973 Institute of Food and Agricultural Sciences
Production Assistant

1971 - 1972 Church of The Nazarene
Production Assistant

Awards

1974 Government Award, by National Consumer Information Council

1975 Full Color Award, Southern Public Relations Federation

Publications

1975 "Plan So Your Money Makes It" Florida Department of Banking

1976 "Solar Research at the University of Florida" Florida Academy of Sciences

1976 "The State of Solar in Florida" Feb., 1976 Solar Engineering

1977 "Development of an Absorber Coating Based on the Electromagnetic Wave Energy Conversion Theory" ERDA Flat Plate Workshop

1977 "Twenty Years of Solar Living" for Chilton Company

1978 "Is Solar Making an Impact?" Feb., 1978, Consulting Engineering

BIODATA

ANIL K. RAJVANSHI

Personal Record

Date of Birth: [redacted]
Citizenship: Indian

Education

Indian Institute of Technology, Kanpur, India, B Tech (1972), M Tech (1974), University of Florida, Gainesville, Ph.D., (1979).

Professional Experience

Nov 1979 to Present: Instructor in the Center for Training in Alternative Energy Technologies

June 1979 to Nov 1979: Adjunct Post-Doctoral Fellow
Department of Mechanical Engineering, University of Florida, Gainesville

Memberships and Awards

International Solar Energy Society, American Association of Advancement of Science, Solar Lobby.
Government of India National Scholarship; AAAS invitee to a panel discussion on "Relevance of American Graduate Program for Foreign Students".

Fields of Interest

Solar distillation, Energy conversion, Energy policy for developing countries, Energy transduction in biological systems.

Publications - 10; a selected list is given below

Rajvanshi, A.K.,(co-author) "Effect of Dropwise Condensation on Solar Glass Properties", Solar Energy, Vol. 19, No. 4, 1977.

Rajvanshi, A.K., "Decentralized Technologies for Power", Lead article published in Indian Express, January 20, 1978.

Rajvanshi, A.K., et al, "Effect of Dye on Solar Distillation; Analysis and Experimental Evaluation", International Solar Energy Society Congress - Atlanta, Georgia, U.S.A.; May 28 - June 2, 1979.

Rajvanshi, A.K., Large Scale Desalination of Sea Water Using Solar Energy", Solar Energy (in press).

Herbert A. Ingley

Department Affiliation & Academic Rank:	Assistant Professor, Mechanical Engineering Department, University of Florida.
Degrees:	1967, University of Florida, BSChE 1969, University of Florida, MSME* 1971, University of Florida, Ph.D., ME *Minors in Environmental Engineering
Fields of Specialization:	Air pollution technology, solar heating and cooling of residences, low temperature solar air conditioning, selective coatings for solar collectors, energy considerations & air quality for laboratory animal facilities & acoustica evaluation of laboratory animal faciliti
Recent Publications:	"University of Florida Solar Research Residence Solar Heating and Cooling Applications," Flat Plate Collector Workshop, Orlando, FL, March 1977.
"The Importance of Design Parameters for Successful Manufacture of Flat Plate Collectors," Flat Plate Collector Workshop, Orlando, FL, March 1977.	"Performance Computer Modeling of Flat Plate Solar Collectors," Flat Plate Collector Workshop, Orlando, FL, March 1977.
"Theoretical Analysis and Design: A Solar Powered Ammonia/Water Absorption Air Conditioning System," American Section ISES Annual Meeting, Orlando, FL, June 1977.	"The University of Florida Solar House," 14th Space Congress, Cocoa Beach, FL, April 1977. "Residential Cooling - Here, There, Today and Tomorrow," to be presented at the International Conference on Energy Use Management, Tuscon, Arizona, October 1977.

Leonard E. Laketek

He received his B.S. and M.S. in physics from the University of Florida. His Ph.D. course work was also completed here.

From February 1980 until Present he has been an Instructor at the University of Florida for the T.A.E.T. program, reporting to the Director, Dr. E.A. Farber.

From June 1972 through February 1980 he was a Senior Systems Analyst for the U.S. Navy, where he reported to the Project Director concerning design test, and evaluation of advance U.S. Navy weapon systems and test facilities. In addition, he was the Senior Technical Consultant and Liaison to the Admiralty Underwater Weapons Establishment, Portsmouth, England, concerning U.K. weapons system design and evaluation.

From September 1969 through June 1970 he was a Resident Advisor at the University of Florida Division of Housing.

From June 1968 through September 1969 he was a Senior Test Engineer for North American Rockwell. Here he did prelaunch tests for the Apollo Saturn V.

APPENDIX 2

Training in Alternative Energy Technologies

A Report on OCO Needs

The development of the Training in Alternative Energy Technology program follows the proposed activities found in the university's unsolicited proposal to US AID. Within the framework of this narrative and the subsequent cooperative agreement between the University of Florida and AID, the expenditure of funds is required. Those expenditures being considered in this report fall under the catagory of Operating Capital Outlay (OCO).

This report details several major needs, contains technical justifications, and compares various cost factors.

Item (A) Word Processing System

Justification:

The university's proposal called for a formal training program which involved the preparation of training and laboratory manuals. Instructors will be preparing classroom materials covering the following subjects such as:

1. solar properties of materials;
2. design of flat plate collectors;
3. domestic hot water;
4. refrigeration;
5. crop drying;
6. greenhouses;
7. high temperature systems;
8. cooking;
9. pumps;
10. engines;
11. water purification;

12. generation of electricity;

13. wind energy;

14. hydropower;

15. methane generation;

16. development of liquid fuels (alcohol);

17. wood and silviculture.

Since these topics will constitute textual materials, instructors will be spending many hours drafting information.

The equipment will be needed to:

a. prepare rough drafts;

b. re-drafting of narrative changes;

c. preparation of final copies;

d. draft transcript of guest lectures;

e. prepare daily instructional materials;

f. prepare laboratory/workshop manuals;

g. stored mailing list of key program contacts;

h. prepare AID weekly, monthly, and contractually obligated reports.

This equipment will be in use 100% of the time for the training program.

System Selection:

As in all purchases by the Solar Group, we seek to acquire equipment that will do the job required at the most favorable price. We also consider the availability of service, supplies, and support assistance provided by the supplier. Using this criteria, we selected a Lanier "No Problem" System to use in our word processing needs.

Lanier was selected because:

a. maintains low cost warranty package;

b. guarantee three hour service assistance;

c. provides hardware updates;

d. maintains a local training program;

e. provides new information on equipment use.

The only other system that approaches comparability to the Lanier is IBM. Their comparability is strictly from a service factor. Beyond that, IBM has no operator training program or hardware update.

Cost Factors:

As an outright purchase, the Lanier system will cost $17,000. On a lease agreement the system will cost approximately $400 per month. The IBM system costs exceed $20,000 for purchase and the monthly lease figure is approximately $450.

Item (B) Copier System

Justification:

The university's proposal called for an evaluation of existing materials to determine the potential use of information. Since much of the information contains charts, tables, etc. that can be reprinted, copies of this material could then be given to each participant.

The copier will be used to:

a. provide copies of charts, tables, etc. to participants;

b. provide handout material from guest lecturer;

c. provide copies of participants work for evaluation;

d. reduce 18 x 18 inch system designs to report format;

e. maintain copies of administrative materials,

f. maintain financial reports;

g. provide copies of various contractual reports to AID.

The equipment will be used 100% of the time for the training program.

System Selection:

When considering a copier system to meet the needs previously noted, a number of systems were considered. The following criteria was used to judge all systems:

1. portable;
2. use of letterhead or other bond paper;
3. ability to provide reductions;
4. 10,000 copies per month.

IBM, Savin, and Xerox were examined. The Xerox 3109 is the only system that could meet these needs and provide quality copies at a reasonable cost.

Cost Factor:

For IBM to meet criteria 2 and 3, we would have seen a purchase price in excess of $20,000. The Xerox system could be purchased for

$9,000 or be leased for $375 per month; which for the term of the contract, equals the purchase price.

Item (C) Laboratory and Shop Equipment

Justification:

According to the university's proposal, each participant will be expected to design, build, and test small scale conversion equipment having application to their country. In addition, the participants will be field testing equipment and systems at a variety of locations.

To accommodate the trainees in fulfilling the hands-on objectives of the program, a variety of small and large pieces of equipment, tools, and instrumentation is needed. The university has made available several sophisticated data systems that will be used in selected laboratory exercises. In addition, the university's shops will be used to assist in preparing major demonstrations. However, participants are required to do many things on an individual or team basis and therefore need access to some equipment which might otherwise be available within the university.

In order to provide five to seven teams with equipment, some duplication of purchases will be required. This allows, however, each an opportunity to take an active part in each experiment and laboratory exercise. Also, by having the facilities available at the training site, participants can perform extra experimentation during break periods.

Some field data will also be required, and existing equipment could not be used to meet this need without disrupting projects that have been on-going for a number of years.

The new facilities will be used 100% for the project.

Equipment Selection:

A number of university personnel are providing input into the variety of laboratory and shop equipment needed. Selections will be based on cost, durability and the ability to serve the needs of the program.

Cost Factors:

Since the selection process has not been completed, there is no individual cost breakdown. However, the budgeted amount for this effort falls within the $30,000 range. In comparison the university's existing equipment being used by the participants will approach $100,000.

APPENDIX 3

List of Equipment to be Purchased

Qty.	Name of Item	Catalog No.	Price ($)	Company's Name
1	Solar Photoraltaic Pump (If possible can be asked as a donation)	-----	$1,200.00	Solar Electric International 7315 Wisconsin Ave. Washington D.C. 20014
1	Portable refrigerator (Thermoelectric unit)	-----	$134.00 + $7.00 for handling	Koolatron Ind. Ltd. 56 Harvester Ave., Batavia, N.Y. 14020
4	Shadow Plotter	-----	$3.00 each	The Sun Path Indicator E.A.R.S., Box 545 La Veta, Colorado 81055
1	Air Meter (W131) (free conv. measurements)	Scientific Inst. Catalog 1078 p.63	$185.00	Weather Measure Corporation P.O. Box 41257 Sacramento, Ca. 95841
2	Wind Meter (W1) (hand held)	Scientific Inst. Catalog 1078 p.66	$10.00 each	same as above
1	Sling Psychrometer (HM10)	Sc. Inst. Cat. p.99	$38.00	same as above
1	Slide Rule (HM12)	Sc. Inst. Cat. p.99	$4.00	same as above
1	Hygrothermograph (H311s)	Sc. Inst. Cat. p.192	$330.00	same as above
1 pkg	Charts (C311-W-HF)	Sc. Inst. Cat. p.192	$9.00 / pkg	same as above
1	Sunshine Duration Recorder (R431)	Sc. Inst. Cat. p.153	$595.00	same as above
1 pkg	Charts (C431-C)	Sc. Inst. Cat. p.153	$57.00	same as above
1	D & S Emissometer Model AE	-----	$675.00	Devices & Services Company 3501 - A Milton, Dallas, Texas 75205

List of Equipment to be Purchased

Qty.	Name of Item	Catalog No.	Price ($)	Company's Name
1	Scaling Digital Voltmeter	-----	$315.00	Devices & Services Company 3501 - A Milton, Dallas, Texas 75205
1	Ice Point References Model TRC	Omege 1979 p.H-13	$595.00	Omega Engineering Inc.
5	Fast Temp. Thermometer Probes Model T-250F	Omega 1979 p.C-9	$69.50 each	same as above
15	20 Point Terminal	Omega 1979 BS20 p.F-5	$7.00 each (ask for discount)	same as above
5 pkg	Constantan Lug	Omega TLCO-20 p.F-5	$7.50/pkg	same as above
10 pkg	Copper Lug	Omega TLCP-20 p.F-5	$7.50/pkg	same as above
1	Low Temp. Circulator Bath (-15°C - 150°C)	C/P 1268-00 p.13	$695.00	Cole - Palmer Inst. Co.
1	Chemcadet Tr pH Meter	C/P 5982-20 p.238	$125.00	same as above
1	Epoxy Body Probe	5992-20 p.238	$28.00	same as above
1	Heavy Duty Balance	1048-01	$415.00	same as above
1	Solar Radiometer (hand held)	636-6 p.3	$195.00	Science Associates Inc. 230 Nassau St. Box 230
1	Recording Wind System (vane and recorder)	1036 AC p.15	$880.00	Sierra-Misco, Inc.
1	Mechanical Pyranograph	R401S p.152	$530.00	Weather Measure Corp. Sacramento, Ca.

List of Equipment to be Purchased

Qty.	Name of Item	Catalog No.	Price ($)	Company's Name
1	Eppley PSP with Schott WG7 Glass Hemispheres	-----	$1,090.00	Eppley Labs, Inc. 12 Sheffield Ave., New Port, R.I.
1	Eppley Normal Incidence Pyrheliometer	NIP	$1,000.00	same as above
1	Eppley Solar Tracker	ST1	$840.00	same as above
3	Portable Solar Meter	Model 776	$54.60 each with $6.50 for case	Dodge Products Box 19781 Houston, Texas 77024
1	2 Pen Recorder	Model 196	$2,100.00 (approx.)	Honeywell
2	24 Point Recorders	Model 112	$2,000.00 each	Honeywell
2	30 Point Recorders	Specdomax 250	$3,000.00 each	Leeds & Northrup

APPENDIX 4

Participants - TAET program 4/16/80 - 7/25/80
updated 5/12/80

Bangladesh

Ms. Afiya Mahtab

Khairul Islam

Belize

Douglas Smith

Bolivia

Ricardo Maldonado

Jaime Rolando S. Guerra-Fernandois

Dominican Republic

Gil Manuel Canario Estrella

Arturo Emilio Urena Pena

Ms. Violeta Morrobel

Ecuador

Lenin Ubidia Guerra

Franklin Jacinto Carrasco Guaricela

Egypt

Atared Assaad

Haiti

Ms. Carole M. Louis

India

Geethaguru, V.

S.K. Sharma

Indonesia

Ignatius Suwardjaka Sudjana

Jamaica

Hugh Sandford

Jordan

Awad Fakhoury

Rizeq Ta'ani

Kenya

Patrick M. Nyoike

Nigeria

*NON-AID
Cornelius Ezekwe

Philippines

Antonio A. Santos

Emmanuel D. Bello

Portugal

José António Mesquita Penaforte E Costa

Rwanda

Charles Ntakirutinka

Prosper Mpawenayo

Sudan

Nasreldin El Hakeem

Ahmed Abasaeed

Thailand

Krissanapong Kirtikara

Nikorn Mangkorntong

Vidhurn Hongsumalya

Tunisia

Ms. Akissa Bahri

APPENDIX 5

Guest Lecturers for Training in Alternative Energy Technologies Program

First Session - 16 April to 25 July 1980

Dr. Robert Nathans State University of New York at Stony Brook	"Energy and Other Development Crises"
Dr. Richard S. Greeley The MITRE Corporation	"Global Energy Resources"
Dr. George E. Bowes University of Florida	"Photosynthesis and Productivity -- Biomass as a Source of Energy"
Dr. C.G. Justus Georgia Institute of Technology	"Wind Energy"
Dr. John S. Gladwell Idaho Water Resources Institute	"Hydropower -- An Examination of an Alternative Source of Energy"
James H. Anderson J. Hilbert Anderson, Inc.	"Geothermal and Ocean Thermal Energy and the Recovery of Waste Heat"
Dr. Thomas A. Lawand Brace Research Institute	"Appropriate Technology and Renewable Energy Development"
Dr. Joseph J. Loferski Brown University	"Photovoltaics -- An Overview of Developments and Applications"
James F. Lowry Booz Allen and Hamilton, Inc.	"Energy Conservation"
Mr. David Etherton ARIBA, New York	"Solar Architecture"
Dr. David Pimentel Cornell University	"Energy Use in the Food System"
Dr. Gene Shove University of Illinois	"Solar Crop Drying and Food Preservation"
Dr. O.K. Burros CH2M Hill Inc.	"Water Desalination and Management"
Dr. William T. Beale Sunpower, Inc.	"Mechanical Power from Alternative Sources of Energy"
Dr. Robert E. Inman Solar Energy Research Institute	"Fuels from Biomass"
Dr. John T. Pfeffer University of Illinois	"Biological Conversion of Biomass to Methane"

Edward S. Lipinsky Battelle Columbus Laboratories	"Production and Utilization of Ethanol as Fuel"
Dr. A.G. Alexander University of Puerto Rico	"Grasses as Renewable Sources of Energy"
Dr. Klaus Steinbeck University of Georgia	"Forest Biomass as a Source of Energy"
Dr. Thai K. Van University of Florida	"Aquatic Biomass as a Source of Energy"
U.S. Department of Energy	"Industrial Applications of Alternative Energy Technologies"
World Bank	"Data Base on World Energy"
Dr. Seymour Baron Burns and Roe	"Economic Aspects of Alternative Energy Systems"
World Bank	"Financing Energy Projects"
Dr. Vaclav Smil University of Manitoba	"Energy Flows in the Developing World"
Dr. Gabor Strasser Strasser Associates	"Transfer of Alternative Energy Technologies"
U.S. Department of Energy	"Small Scale Energy Technologies in the U.S."
Dr. David C. Dunham Columbia University	"Sociological Aspects of Introduction of Alternative Technologies in Developing Countries"
USAID/VITA	"Rural Energy Systems"
U.S. Department of Energy	"Research and Development in Alternative Energy Technologies"

APPENDIX 6

TRAINING IN ALTERNATIVE ENERGY TECHNOLOGIES
SESSION: 16 APRIL THROUGH 25 JULY 1980

DATE

WEEK 1

Mon 4/14 Registration
Day 1

Tue 4/15 Registration
Day 2

Wed 4/16 Morning
Day 3

TREEO CENTER
Welcome
University of Florida and State of Florida Officials

Objectives of the Training in Alternative Energy Technologies (TAET) program
Mr. Alan B. Jacobs
US Agency for International Development

Overview of the TAET program
Dr. E.A. Farber
University of Florida

Coffee Break

Orientation
TAET Program Staff
General information on the University of Florida and Gainesville, Florida

Lunch 12 - 1:30 p.m.

Afternoon

TOUR OF CAMPUS

Reitz Union, Mechanical Engineering Building, Libraries, Northeast Regional Data Processing Center, Insititute of Food and Agricultural Sciences, College of Architecture, Florida State Museum, Campus Shops and Bookstores

Thur 4/17 Morning
Day 4

INTRODUCTORY SESSION

Course content and schedule, lectures, labs, seminars, field trips, individual and group projects, considerations underlying the design of the training program.
Participants introduce themselves and give a brief talk on their backgrounds and on the energy situation in their countries

Thur 4/17 Afternoon
Day 4

SEMINAR

Alternative Energy Technologies in Perspective
Dr. E.A. Farber
University of Florida

An overview of the global energy crisis, solar energy as a means of meeting man's future needs for energy, a historical note on the research conducted over the past 25 years at the University of Florida on the conversion of solar energy to other forms of energy, examples of the application of solar energy throughout the world.

Fri 4/18 All Day
Day 5

FIELD TRIP

Tour of the University of Florida's Energy Research and Education Park and solar installations in the Gainesville area

Energy park: 3 solar houses, single wide and double wide mobile homes, 6 mobile home envelopes, instrumentation building and data acquisition system, solar calorimeter, solar collector test stands meteorological data center and solar exhibit

Gainesville: Solar air heaters at the Agriculture Engineering station, solar hot water system at the married student housing, solar space and water heating at the Federal Credit Union, water heating as a commercial laundry, water heating at a moderate income housing complex, water heating at a small apartment building, heating and cooling system at the airport

WEEK 2

AVAILABILITY OF ALTERNATIVE SOURCES OF ENERGY (2 WEEKS)

Mon 4/21
Day 6

Morning

SEMINAR

Energy and Other Development Crises
Dr. Robert Nathans
Institute for Energy Research
State University of New York at Stony Brook

Afternoon

LECTURE

Solar Radiation

The sun as a source of energy; output of the sun; temperature of the sun; nature of solar spectrum; % energy in visible, ultraviolet and infrared range; energy of photons; leaf's color

Tue 4/22

Morning

LECTURE

Solar Radiation (continued)

Calculation of solar constant from T_{sun} and output; sunspots; variability of solar constant with sunspots and seasons; change of earth's orbit around sun for different months; % change in solar constant to produce ice age; northern and southern hemisphere's weather; southern hemisphere severe summer and winter

Afternoon

LAB

Solar Measurements

Demonstration of solar radiation measuring instruments; silicon cells, pyranometer, sunshine duration recorder, wind measurement recorders, meteorological variables measuring instruments, recorders

Wed 4/23
Day 8

Morning

LECTURE

Solar Radiation

Effect of various meteorological conditions on solar radiation; industrial atmosphere, fog, various clouds; the change in solar spectrum with these conditions; relationship between solar time, local time and standard time; various solar radiation measuring instruments, calibration of these instruments

Wed 4/23 Afternoon
Day 8

SEMINAR

Global Energy Resources
Dr. Richard S. Greeley
The MITRE Corporation

World-wide resources of fossil fuels; nuclear energy, renewable energy resources, traditional patterns of energy consumption, energy and the gross national product, projected energy needs, available options in meeting the energy crisis

Thur 4/24 Morning
Day 9

LECTURE

Solar Radiation (concluded)

Hourly variation of solar radiation; altitude and azimuth angles, sun path diagrams; % of direct and diffuse radiation for various environmental conditions; amount of solar radiation falling on horizontal surface, normal surface, NV, SV, EV and WV surfaces for various seasons and for northern and southern hemisphere

Afternoon

LAB

Solar Measurements

Demonstration of solar simulator measurement of q_T by homemade instrument (black plate with T/C attached) and comparison with pyranometer; comparison of solar radiation obtained for various instruments

Fri 4/25 All Day
Day 10

FIELD TRIP

Visit of the US Department of Agriculture's solar crop drying facilities near Tifton, Georgia

WEEK 3

Mon 4/28
Day 11

Morning

LECTURE/SEMINAR

Photosynthesis and Productivity -- Biomass as a Source of Energy
Dr. George E. Bowes, Department of Botany
Institute of Food and Agricultural Sciences
University of Florida

Basic mechanism of photosynthesis; production of biomass; efficiency of biomass production; energy plantation; growth analysis of energy plantation; energy input in production of biomass; possible fuel forms obtainable from various biomass

Afternoon

LAB

Solar and Meteorological Measurements

Measurement of wind velocity with simple handheld anemometer; comparison with calibrated anemometer; humidity measurements; carry over of Day 9 experiments

Tue 4/29
Day 12

All Day

LECTURE/SEMINAR

Wind Energy
Dr. C.G. Justus
Georgia Institute of Technology

The availability of wind energy in different parts of the world, wind as a very localized phenomenon, wind turbine designs, conversion of wind energy to electrical and mechanical energy, energy storage systems, economics of wind energy, application of wind energy with emphasis on the developing countries and village level technologies

Wed 4/30
Day 13

Morning

LAB

Properties of Materials

Demonstration of emissometer; emissivity measurement of various paints; solar absorptance measurement using the calibrated black plate with T/C

Wed 4/30
Day 13

Afternoon

LECTURE/SEMINAR

Hydropower -- An Examination of an Alternative Source of Energy
Dr. John S. Gladwell
Idaho Water Resources Research Institute

Hydropower in the context of the global energy crisis, low-head hydro potential with emphasis on the developing countries, low-head turbine technology, experience with mini- and micro-hydro systems, basic technical considerations, hydroelectric development and irrigation systems, economics of small scale hydro projects, environmental aspects of hydro developments

Thur 5/1
Day 14

All Day

LECTURE/SEMINAR

Geothermal and Ocean Thermal Energy and the Recovery of Waste Heat
J. Hilbert Anderson
J. Hilbert Anderson, Inc.

World-wide geothermal and ocean thermal resources, types of geothermal resources, exploration and assessment, production and conversion, state of technology for low grade heat applications, economics of low grade heat systems, potential areas of application with emphasis on the developing countries

HARNESSING OF RENEWABLE SOURCES OF ENERGY (4 WEEKS)

Fri 5/2
Day 15

Morning

LECTURE

Principles of Heat Transfer

Basic principles of conduction (steady and unsteady state); data on conductivities of various substances; free and forced convection; values of film coefficients; solution of simple heat transfer problems (nails in a board; water flowing through pipes)

Afternoon

LAB

Properties of Materials

Transmittance (τ) vs θ for glass; for 1, 2, 3 pieces of glass; reflectivities (r) vs θ for these glasses; same measurements for plastic

WEEK 4

Mon 5/5
Day 16

Morning

LECTURE

Principles of Heat Transfer

Thermal radiation, emissivity, absorptivity and reflectivity; Planck's Black Body Radiation Law; combined mode of heat transfer (h_{c+r}); data on absorptivities and emissivities of various surfaces; overall heat transfer coefficient; U factors

Afternoon

LAB

Calculation of Overall Heat Transfer Coefficient for Glass Windows Mechanical Engineering Building

Demonstration of hot box - cold box in the Mechanical Engineering Department; presentation of data to
a) do the energy balance on the window
b) calculate over all heat transfer coefficient

Tue 5/6
Day 17

Morning

LECTURE

Principles of Fluid Flow and Properties of Materials

Pipe flow; flow in series and parallel; transmittance properties of various fenestration materials (τ vs λ); selective coatings; temperature dependence of emissivity; solar absorptance of various paints and materials

Afternoon

LAB

Demonstration of Solar Calorimeter at Energy Park

Presentation of data to calculate solar heat gain through the fenestration

Wed 5/7
Day 18

Morning

LECTURE

Flat Plate Solar Collectors

General configuration of solar collector; pan type; various tube configurations; discussion on good design attributes; good contact

Wed 5/7
Day 18

between plate and tubes; distance between glass and plate, tube size, tube spacing, thickness of insulation; weep holes, angle of collector; efficiency of collector; min m to prevent boiling at 1 atm and at different pressure; outgassing, corrosion, scaling in collectors; pressure drop in tubes; temperature profile of plate; performance, collector, test interpretation

Afternoon

LAB

Demonstration of Construction of a Home Made
Flat Plate Solar Collector

Insulation thickness, plate size; how are tubes soldered to plate; gaskets holding glass; plate should not be touching the collector frame; weep holes; connecting pipes from collector to header

Thur 5/8
Day 19

Morning

LECTURE

Solar -- Flat Plate Collector

Basic principles of a thermosiphon system; calculation of velocity; temperature profile of tank for 1 day; effect of height (bottom of tank from the top of the collector) on velocity; forced convection system; calculation of boiling point as a function of collector height over storage tank; freeze protection; series and parallel configuration of collectors

Afternoon

LAB

Thermosyphon Experiments of Small Systems

Calculation of amount of energy collected by the system; measurement of temperature of tank after 1 hour duration; measurement of temperature of glass and back panel of the collector; measurement of solar radiation incident

Fri 5/9
Day 20

All Day

SEMINAR

Appropriate Technology and Renewable Energy Development
Dr. Thomas A. Lawand
Brace Research Institute
McGill University

Sat 5/10 SEMINAR (continued)

WEEK 5

Mon 5/12
Day 21

Morning

LECTURE

Solar Collectors

Controls on water heaters; clock, single sensor, differential controls; break even point for solar water heating; evacuated tubes collectors; advantages and disadvantages; other types of collectors like pipes in sand; calculation of temperature of water in such a system; collectors for medium temperature (200°F) process heat application (low concentrating)

Afternoon

LAB

Collector Tests

Experiments on thermosiphon continued; comparison of heat gain between various configuration of collectors (box type); pipes in sand; measurement of temperature of sand at various depths; temperature of water in and temperature of water out

Tue 5/13
Day 22

Morning

LECTURE

Flat Plate Collectors

Different configurations of air collector; discussion on utilizing of air collectors for solar drying and space heating only; calculation for U of Fl plate collector T_{out}, T_{in} (temperature of air; 1/3 plate uncovered and 2/3 covered); discussion on bench top air collector

Afternoon

LAB

Bench Top Air Collector

Measurement of solar radiation falling on the collector (measured by black plate with T/C and mechanical pyranograph); measurement of $T_{plastic}$; T_{bottom} and air flow rate (by hand held anemometer); measurement of T_{inlet} and T_{outlet} at different air velocities

Wed 5/14
Day 23

Morning

LECTURE

Solar Ponds

History of solar pond development; natural occurences; basic characteristic of density gradient pond; density and temperature profiles; different methods of heat extraction; problems in heat extraction; LLL shallow pond; nonconvective solar ponds; dye pond; cost of a pond as compared to that of collector

Afternoon

LAB

Solar Pond

1) Experiment on dye pond; measurement of T_{layers}, T_{lower}, $T_{inlet\ (water)}$ and $T_{outlet\ (water)}$; m_{water} calculation of the η of the pond;
2) Experiment on density gradient pond; T_{layers}, T_{bottom} ($T_{outlet/water}$, $T_{inlet/water}$)

Thur 5/15
Day 24

All Day

FIELD TRIP

Visit of a solar equipment manufacturing plant near Hampton, Florida

Fri 5/16
Day 25

All Day

FIELD TRIP (continued)

WEEK 6

Mon 5/19
Day 26

Morning

LECTURE

Concentrating Collectors

Introduction to concentrating collectors; they concentrate only direct radiation, high temperature applications; maximum possible temperature available ($T_c \leq T_{sun}$); single axis and double axis tracking concentrators; flux distribution of fixed vs tracking concentrator; various configurations of concentrators; compound parabolic concentrators (CPC); calculation of temperature of target irridiated by spherical concentrators; reflective surfaces

Afternoon

LAB

Experiments on Concentrators

Maximum temperature obtained on a target by fresnel lens; flux distribution on a target - tracking the sun; tracking it every 15 minutes - not tracking it at all; temperature outlet and inlet of water in the pipe at the focus of a parabolic cylindrical concentrator

Tue 5/20
Day 27

Morning

LECTURE

Concentrating Collectors

Liquid lenses; heat transfer calculations for target temperature; metallurgical applications; effect of wind loading on the concentrators; how to make a simple concentrator (concrete mold); high temperature fluids and their properties; vegetable oils; cost of some of these liquids; central receiver systems; crystal growing; water extraction

Afternoon

LAB

Continuation of the concentrators testing

Wed 5/21
Day 28

Morning

LECTURE

Storage of Thermal Energy

Types of storage - thermal, photochemical; low temperature (100 - 160°F); medium temperature storage (200 - 400°F); high temperature

Wed 5/21
Day 28

storage (> 400°F); storage in water, rocks, phase change material; calculation of Btu/ft^3 for these 3 systems; advantages and disadvantages of these systems; various phase change materials; encapsulation problems; cost; properties of vegetable oils (ρ, μ, Cp, k) for medium temperature storage; oxidation of these oils; dissociation of gases ($SO_3 \rightarrow SO_2 + \frac{1}{2}O_2$) for storage at high temperature; various problems; materials and concentration of energy; photochemical storage; dyes, photosynthesis; etc.

Afternoon

LAB

Thermal storage demonstration

Storage in rocks; measurement of T_{in}, T_{out} of air; pressure drop; calculation of storage; temperature distribution; efficiency; storage in thermal heat rods; η of storage in these rods; charging and discharging time

Thur 5/22
Day 29

All Day

FIELD TRIP

Solar installations near Jacksonville, Florida
Brewery, Naval Air Station

Fri 5/23
Day 30

All Day

LECTURE/SEMINAR

Photovoltaics
Dr. J. Loferski
Brown University

Basic principles of p-n junction; silicon cells, GaAs and other cells; efficiency of these cells, cost; output of these cells; problems and advantages of solar cells; present technology potential applications in developing countries

WEEK 7

Mon 5/26 MEMORIAL DAY - HOLIDAY
Day 31

Tue 5/27 Morning
Day 32

LECTURE

Research on Silicon Cells at the University of Florida
Dr. F.A. Lindholm and Dr. J.G. Fossum
University of Florida

Discussion of innovative techniques used in production of high solar cells

Afternoon

Visit to Silicon Cell Research Lab at the University of Florida

Wed 5/28 Morning
Day 35

LAB

Photovoltaics Experiments

Demonstration of photovoltaic pump; calculation of short circuit current J's; calculation of open circuit voltage; V_{OC} at various orientations of the panel (tracking the sun, fixed orientation); efficiency of the pump; comparison of power output under solar simulator and actual conditions

Afternoon

SEMINAR

Energy Conservation

Potential areas of energy conservation in developing countries; cooking stove; industrial processes

Thur 5/29 All Day
Day 34

LAB

Monitoring of previous experiments and individual work - day for the work in library

Fri 5/30 Morning
Day 35

LAB

Monitoring of ongoing experiments and individual work

Fri 5/30
Day 35

Afternoon

SEMINAR

Appropriate Technologies

Definition of appropriate technology; any technology suited to a certain section of society is appropriate; emphasis on local materials and resources; some AT experiments in different parts of the world; strengths and weakness of such experiments; social ramifications of introduction of AT

WEEK 8

APPLICATIONS OF ALTERNATIVE ENERGY TECHNOLOGIES (5 WEEKS)

Mon 6/2
Day 36

Morning

LECTURE

Domestic Thermal Energy Loads

Hot water requirements for family; calculation of heating load of a residence or a building; development of U values for different structural materials; design conditions for heat load calculations; average conditions; calculations of cooling loads for buildings; degree days; comfort zones

Afternoon

LAB

Demonstration of thermal energy loads of various buildings and structures - Energy Park

Tue 6/3
Day 37

Morning

LECTURE

Domestic Thermal Energy Loads

Different insulations and structural materials; R values; air change; ventilation needs; infiltration tests; different fenestration materials; sizing of solar energy heating system; collector area, flow distribution (parallel or series circuits), pressure drop, pump size, size of the storage tank

Afternoon

LAB

Demonstration of solar cooking experiments

Temperature vs time of the water in a pot when in focus of a 4' diameter parabolic dish; time for the wate. to boil for non tracking dish; same process for umbrella type cooker; temperature vs time curve for flat plate solar cooker (crockpot); temperature measurement of crockpot; η of the collector and calculation of η of the whole system

Wed 6/4
Day 38

Morning

LECTURE

Domestic Thermal Energy Loads

Various distribution systems for heating of the house, (free convection boards, heat exchanger and blower), air system, sizing of collectors, storage tank (rocks), pressure drop in rock bed, blower sizes, movable insulation homes

Wed 6/4
Day 38

Afternoon

LECTURE/SEMINAR

Solar Architecture
Mr. David Etherton, ARIBA
United Nations

Overview of present architectural practices in solar houses; "passive" systems for heating (Trombe walls, mass of the walls), shading by trees, various materials available in developing countries (mud, straw, etc) for building structures - need for incorporation of them in sound solar architectural design

Thur 6/5
Day 39

Morning

LECTURE/SEMINAR

Solar Architecture (continued)

Historical evolution of various architectural structures in developing countries for various climates; humid climate - more air flow; hot and dry climate - thick walls, some underground structures; also evaporative cooling (Persian towers, termite mounds); need for sensible modern architectural practice to assimilate these evolutionary designs and provide viable alternatives to developing countries with the local materials available

Afternoon

LAB

Demonstration of Heat Storage Wall and Continuation of Other Ongoing Experiments

Measurement of T_{house}, $T_{outside}$, T_{sides}, T_{glass} air flow vs time through the gap between glass and "wall"; measurement of $T_{beer\ cans}$; Experiment to be done with simulator on and off to simulate day and night conditions; Effect of gap width (between glass and "wall") and T_{house}; Change of wall from beer cans to heat rods (Thermol 81)

Fri 6/6
Day 40

All Day

FIELD TRIP

Visit of St. Petersburg Times Building in Clearwater, Florida

WEEK 9

Mon 6/9
Day 41

Morning

LECTURE

Refrigeration and Air Conditioning

Need for refrigeration; temperature and time of spoilage of various food products (data from ASHRAE); conductivity, C_p, respiration; basic refrigeration cycle; 3 methods of using S.E. for refrigeration; most useful and viable - flat plate collector and designing low temperature refrigeration system; emphasis on NS_3/H_2O systems vs $H_2O/LiBr$; basic components of intermittent and continuous NH_3-H_2O system

Afternoon

LAB

Demonstration of Ice-Making Machine and Servel Refrigerator

Identification of various parts of these devices and demonstration of how they work

Tue 6/10
Day 42

Morning

LECTURE

Refrigeration and Air Conditioning

Design of 1 ton NH_3-H_2O refrigeration system; calculations of x, p, T, h, m of various states in a NH_3-H_2O absorption system; calculations for various evaporator temperatures; for 1 ton NH_3-H_2O system, design of the whole unit; sizing of heat exchangers, pumps and cooling water flow rates for continuous machine; heat exchangers for intermittent machine

Afternoon

LAB

Demonstration of a Thermoelectric Cooler

Measurement of temperature of cooler as a function of time; power used and COP

Wed 6/11
Day 43

Morning

LECTURE

Refrigeration and Air Conditioning

Calculation of collector area, COP of the system for either a/c or refrigeration; other absorption system combinations (Zeolites, NH_3-H_2O-NaSCn, etc); organic Rankine cycle systems; evaporative cooling; cooling of houses using well water, sizing of heat exchanger and pump for such a system

Wed 6/11 Afternoon
Day 43

SEMINAR

Energy Use in the Food System
David Pimentel
Cornell University

Need for calculating energy use in agriculture in developing countries; identification of processes with low efficiency; methodology of calculating energy in various agricultural processes; for developing countries muscle power, wood, etc. is also taken into account; calculation of output/input ratios for various food products; identification of processes which can be modified in the food chain to yield high output/input ratios

Thur 6/12 Morning
Day 44

LECTURE

Crop Drying, Greenhouses, Food Preservation

Need for crop drying; moisture contents of various crops for storage; feasibility of storage - cum - dryer; deep basin vs shallow basin crop drying; temperature and mass flow rate of air needed; moisture vs time curve for various collector cum crop storage systems; fungus growth; possible ways of eliminating it; USDA experiment of using small amount of NH_3 on corn for fungus removal; village level crop dryers; use of bicycle or wind mill to blow air; present US technology in crop drying; drop drying and preservation an alternative to refrigeration

Afternoon

Demonstration of Agricultural Engineering
Work in Crop Drying and Food Preservation

Various models of solar drying; temperature outlet and inlet for various collectors; analysis of data gathered in various projects

Fri 6/13 Morning
Day 45

LECTURE

Solar Distillation

History of solar distillation; problem of good potable water in developing countries; one easy way of getting over this problem is solar distillation; shallow and deep basin solar stills; angle of the glass; calculation of the area of the glass from condensation and reflection point of view; h_{evap} vs T_s; temperature of water vs time; output vs time; effect of dyes and other additives on output;

Fri 6/13
Day 45

various environmental variables and their effects on output of still; batch process and continuous process; flushing time of still; palatability of water; small and large scale solar distillation projects; desert project (MSF); use of flat plate collectors; heat pipes

Afternoon

LAB

Solar Stills

Calculation of $\dot{m}$ vs time; temperature of water (shallow basin unit), temperature of glass; h_{evap}, energy balance on glass; lbs/ft^2

WEEK 10

Mon 6/16
Day 46

Morning

SEMINAR

Water Desalination and Management
Dr. O.K. Burros
CH2M Hill Southeast, Inc.

Existing desalination plants all over the world (an overview); use of various processes (MSF, RO, ED, VTE, Solar etc); temperature (wherever applicable); type of power input to these plants; present status of technologies and research and development being done in different institutions around USA

Afternoon

SEMINAR

Energy Development and Public Health

Overview of advantages and disadvantages of energy development to human health; pollution of environment by development of coal energy; potential environmental impact of large scale hydroelectric projects; hazard to ozone from too much use of fluorocarbons; health development by use of distilled water, better irrigation and with the availability of energy - the general standard of living

Tue 6/17
Day 47

Morning

LECTURE

Mechanical Energy

Areas of potential application of mechanical energy in developing countries; water pumping, RO desalination, grain thrashing, small electricity generating power systems; present technology based on expansion of gas (heat engine); need for development of low temperature engine; Rankine cycle (steam and organic); choice of working fluids; various configuration - reciprocating engines, turbines; Stirling cycle and engines - advantage of being multi fuel and no other working fluid (only air) required; shape memory alloys engine

Afternoon

SEMINAR

Mechanical Power from Alternative Sources of Energy
Dr. W.T. Beale
Sunpower Inc., Ohio

Historical survey of stirling engines; basic development of stirling engines - various designs and sizes; small scale power packs to generate mechanical power from solar or other fuels

Wed 6/18
Day 48

Morning

LECTURE

Mechanical Energy

Gravity wheel characteristics; some design considerations on gravity wheel; various other potential concepts of generating mechanical power - fluidyne pump, phase change cycle device, mechano chemical devices; the cost of all these devices as compared to diesel engines and future costs

Afternoon

SEMINAR

Small Scale Technologies US DOE

Status of small scale technologies in US; an idea catching up in US also; debate between big and small scale technologies; more decentralized extremely important for developing countries; more labor oriented technologies

Thur 6/19
Day 49

Morning

Carry Over Material From 6/18 Lecture on Mechanical Energy

Afternoon

LAB

Stirling and Other Engines

Demonstration of solar powered and wood burning stirling engine; measurement of $T_{cylinder}$, power output; amount of wood burned; efficiency of the engine; demonstration of Freon engine (V-2); temperature of Freon vapor; condensing temperature; power output; amount of Freon evaporated; P-T characteristic of Freon vapor; n of the whole system

Fri 6/20
Day 50

Morning

LAB

Pumps and Engines

Demonstration of fluidyne pump; gravity wheel; measurement of rpm of gravity wheel under simulator and actual conditions; calculation of torque developed by gravity wheel. Rest of the time is for individual projects

Afternoon

SEMINAR

Solar Thermal Central Receiver Power Plant

WEEK 11

Mon 6/23
Day 51

Morning

LECTURE/SEMINAR

Fuels from Biomass
Dr. Robert E. Inman
Solar Energy Research Institute

An assessment of biomass as a source of energy, development of means to enhance future supplies of biomass, overview of combustion and conversion technologies

Afternoon

LAB

Visit of the Production Facility at the University of Florida

Tue 6/24
Day 52

Morning

LECTURE/SEMINAR

Aquatic Biomass
Dr. Thai K. Van
Institute of Food and Agricultural Sciences
University of Florida

Afternoon

LAB

Individual/Group Projects

Wed 6/25
Day 53

Morning

LECTURE/SEMINAR

Production and Utilization of Ethanol as Fuel
Edward S. Lipinsky
Battelle Columbus Laboratories

An evaluation of crops and wastes as sources of fuel ethanol, conversion processes, energy budgets, improved agricultural and manufacturing processes, end uses, economic considerations

Afternoon

LAB

Solar Distillation of Alcohol

Thur 6/26 Day 54 — All Day

FIELD TRIP

Biogas Plant in Bartow, Florida

Fri 6/27 Day 55 — Two Days

FIELD TRIP

Solar heating and air conditioning system at Disneyworld, Orlando, Florida

Sat 6/28 — FIELD TRIP (continued)

WEEK 12

Mon 6/30
Day 56

Morning

LECTURE/SEMINAR

Production of Sugarcane and Tropical Grasses as
Renewable Sources of Energy
Dr. A.G. Alexander
University of Puerto Rico

The agronomic and economic feasibility of year-round production of sugarcane and napier grass as tropical forages, intensive production of alternate tropical grasses as sources of biomass, production targets, solar drying

Afternoon

LECTURE/SEMINAR

Production and Utilization of Methanol as Fuel

Tue 7/1
Day 57

Morning

LECTURE/SEMINAR

Forest Biomass as a Source of Energy
Dr. Klaus Steinbeck
University of Georgia

Forest management and utilization, forest residues, biomass production on plantations, short rotation forestry, mixed cultures, developing improved strains

LECTURE/SEMINAR

Energy from Wood -- Combustion Pyrolisis and Conversion Technologies

Wed 7/2
Day 58

Morning

LECTURE/SEMINAR

Biological Conversion of Biomass to Methane
Dr. John T. Pfeffer
University of Illinois

Feasibility of generating methane from organic refuse, sewage, crop residues, animal wastes and crops grown specifically for the production of energy

Thur 7/3
Day 59

Morning

LECTURE/SEMINAR

Hydrogen as Fuel

Thur 7/3 Day 59	Afternoon
	LAB
	Individual/Group Projects
Fri 7/4 Day 60	HOLIDAY

WEEK 13

SOCIOECONOMIC ASPECTS

Mon 7/7
Day 61

Morning

LECTURE/SEMINAR

Global Energy Data Base World Bank

Tue 7/8
Day 62

Morning

LECTURE/SEMINAR

Economic Aspects of Alternative Energy Systems

Afternoon

LAB

Individual/Group Projects

Wed 7/9
Day 63

Morning

LECTURE/SEMINAR

Industrial Applications of Alternative Energy Technology
US Department of Energy

Afternoon

LAB

Individual/Group Projects

Thur 7/10
Day 64

Morning:

LECTURE/SEMINAR

Energy Flows in the Developing World
Dr. Vaclav Smil
University of Manitoba

Fri 7/11
Day 65

All Day

FIELD TRIP

WEEK 14

Mon 7/14
Day 66

Morning

Presentation of Individual/Group Projects

Afternoon

SEMINAR/DISCUSSION

Transfer of Appropriate Technology
Mr. G. Strasser
Strasser Associates
Vienna, Virginia (tentative)

A round table discussion conducted to arrive at a set of criteria to be applied in determining whether a particular energy technology is appropriate given a set of conditions prevailing in a developing country

Tue 7/15
Day 67

Morning

Presentation of Individual/Group Projects

Afternoon

LECTURE/SEMINAR

Financing Energy Projects in Developing Countries
World Bank

General aspects of financing in the developing countries, foreign exchange financing, capital markets, investments in energy systems, World Bank financing, escalating oil prices and associated phenomena, financial implications of the increasing cost of energy

Wed 7/16
Day 68

Morning

Presentation of Individual/Group Projects

Afternoon

LECTURE/SEMINAR

Sociological Aspects of Introduction of Alternative Technologies in Developing Countries
David C. Dunham
Columbia University

Thur 7/17
Day 69

Morning

Presentation of Individual/Group Projects

Thur 7/17 Afternoon
Day 69

LECTURE/SEMINAR

Rural Energy Systems
USAID/VITA

Fri 7/18 All Day
Day 70

FIELD TRIP

WEEK 15

ALTERNATIVE ENERGY TECHNOLOGIES IN THE FUTURE

Mon 7/21
Day 71

Morning

Presentation of Individual/Group Projects

Afternoon

SEMINAR

Research and Development in Alternative Energy Technologies in the United States
US Department of Energy

Tue 7/22
Day 72

All Day

Presentation of Individual/Group Projects

Wed 7/23
Day 73

Morning

Presentation of Individual/Group Projects

Afternoon

SEMINAR

Alternative Energy Technologies in the Future
Dr. E.A. Farber
University of Florida

Thur 7/24
Day 74

All Day

Engineers Fair

Fri 7/25
Day 75

All Day

Engineers Fair